ENCYCLOPEDIA of video games

The Culture, Technology, and Art of Gaming

Volume 1

Mark J. P. Wolf, Editor

Encyclopedia of Video Games

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Encyclopedia of Video Games

The Culture, Technology, and Art of Gaming

VOLUME ONE

Mark J. P. Wolf, Editor

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Foreword

I guess a book about video games needs a foreword about the context of the business at the beginning, and I guess that I am the guy who should write it.

I got my start on a late night at the Merrill Engineering Building at the University of Utah, where I was studying engineering. There were big computers connected to video screens, and whenever that happens someone uses them to play games. The game I saw was *Spacewar!* written by Steve Russell from MIT. I was hooked. For the whole next two years, we programmed more than 20 games for play on the system, spending hours from midnight to 5 A.M. every weekend. We did everything from a little car racing game to fox and geese, from a very bad football game to tennis and hockey.

The piece of the puzzle that made me unique among the thousands of students who played the game was that I was working summers at an amusement park. It was called Lagoon, and it was a half-hour drive north from Salt Lake City. I had become the games manager that year and knew the economics of the amusement business and made the connection immediately. If this game could be put in one of the arcades at the park, it would make money. Further analysis said that the computers were too costly to be paid for 25 cents at a time.

Fast forward a few years. I had graduated, moved to California, and was working at Ampex as an Associate Electrical Engineer. I was playing Go with a programmer working at the Stanford Artificial Intelligence lab at Stanford, and he asked me if I wanted to come up and play *Spacewar!* I was hooked again. But this time I was in a position where I could act on my interest. I saw an ad for a Data General Nova Computer for $5,000. The cost looked like it could work.

My office mate was Ted Dabney, and I asked him if he wanted to join my company and give this a try. He said yes, and we were off to the races.

The problem was that computer displays were vector graphic units modified from radar displays and cost about $30,000 at that time. What was needed was a cheap monitor. A TV could be purchased for about $100 at the time, and I decided that a digital interface was the right approach.

The design work started, and although we had not purchased the computer yet, we got all the technical specs and began the design. The computer was mind-numbingly slow. A TV wants data at 3 megabits per second. The computer had a clock speed of 800 Khz. We had to do many tricks to get the information to match. When we would run out of time, we would make the interface do more stuff in hardware.

Our epiphany came when we decided that we could do it all in hardware and not buy the computer at all. It was a big day. We got a blip on the screen in two weeks and turned it into a rocket ship in a month. We got a licensing deal with a local company called Nutting Associates that had been making a trivia coin-operated game, and in six months we had the game ready to ship. It was a wild ride. *Computer Space* was a modest success selling about 3,000 units. It was limited to locations around college campuses. It made a lot of money with a sophisticated customer base but did horribly in the bar with normal folks. Probably the best thing it did was convince us that we could go out on our own. We got some contracts for games, hired Al Alcorn, and made a business of video games.

Did we think the game business would get to be worth billions of dollars? Perhaps we all knew it would get big but were so busy making games and dealing with competition that there was actually little time for that type of speculation. The video game industry was born.

Nolan Bushnell
January 23, 2011

Acknowledgments

This project has allowed me to meet people from all over the world who are writing about video games, and I have learned a great deal while putting these volumes together. So I would first like to thank all the contributors, Frederick Luis Aldama, Jessica Aldred, Aubrey Anable, Kara Lynn Andersen, Thomas H. Apperley, Dominic Arsenault, Ben Aslinger, Barry Atkins, Ralph H. Baer, Andrew Baerg, Jason Scott Begy, Alexis Blanchet, Ian Bogost, Nis Bojin, Maude Bonenfant, Aaron D. Boothroyd, Kelly Boudreau, P. Konrad Budziszewski, Nolan Bushnell, Mark Butler, Brett Camper, Daniel Cermak-Sassenrath, Karen Collins, Mia Consalvo, Patrick Crogan, Suzanne de Castell, Mario De Govia, Joseph C. DiPietro, Simon Dor, Judith Dormans, Jon-Paul C. Dyson, Trevor Elkington, Anna Everett, Richard E. Ferdig, Simon Ferrari, Alberto Flores del Río, Eelke Folmer, Gonzalo Frasca, Manuel Garin, Ben Gill, Harrison Gish, Eitan Glinert, Marty Goldberg, Racquel M. Gonzales, Louis-Martin Guay, Stephan Günzel, Christopher Hanson, Mark Hayse, Leonard Herman, Jennifer Jenson, Jesper Juul, Radwan Kasmiya, Wesley Kirinya, Carly A. Kocurek, Kyle Kontour, Lars Konzack, Julian Raul Kücklich, Nicolle Lamerichs, Michael Liebe, Henry Lowood, Vincent Mauger, Frans Mäyrä, Greg McLemore, Souvik Mukherjee, Sheila C. Murphy, David Nelson, Benjamin Wai-ming Ng, Michael Nitsche, Rolf F. Nohr, David O'Grady, John Reid Perkins-Buzo, Bernard Perron, Martin Picard, Rachel F. Pickett, Diana Pozo, William B. A. Robinson, Guillaume Roux-Girard, TreaAndrea M. Russworm, Taiyoung Ryu, Kevin Schut, Bobby Schweizer, Tim Skelly, Grant Tavinor, Carl Therrien, Michael Thomasson, Staci Tucker, Ethan Tussey, Patrik Vacek, Curt Vendel, Rachel Wagner, Matthew Weise, Karin Wenz, Zach Whalen, Markus Wiemker, Hanna E. Wirman, and Bryan-Mitchell Young. I would also like to thank Kristi Ward, George Butler, and John Wagner at ABC-CLIO/Greenwood Press for their help and participation, and Melanie Swalwell and David Winter for their help on various entries. At home, I am thankful for the patience and support from my wife, Diane, and my sons, Michael, Christian, and Francis, who allowed me the time to work on this encyclopedia. And, as always, thanks be to God.

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Introduction

The year 2012 marks the 50th anniversary of video games, if one measures their existence from the completion of *Spacewar!* (1962), considered by many to be the first real video game, a claim that, naturally, involves defining the video game itself (see "first" video game). In its first half century, the video game went from being a technological trick created by hackers to an electronic novelty to a popular toy, American pastime, and media industry, and, more recently, to a social networking tool and object of academic study. The uses of video games have likewise expanded from mere entertainment to a tool for communication, education, physical exercise, job training, psychological experimentation, therapy, and more. When one considers their many uses, the great variety of games and game technologies, and the wide variety of scholarly approaches to studying them (ranging from media studies to art history and computer science, philosophy and psychology, education and economics, anthropology and politics, and so on), the time seems right for a comprehensive encyclopedia of video games written from a scholarly perspective.

With more than 300 entries on a variety of topics, the *Encyclopedia of Video Games* features the work of 97 contributors from six continents whose countries of origin include Australia, Canada, China, the Czech Republic, Denmark, England, Finland, France, Germany, India, Kenya, the Netherlands, Spain, Syria, the United States, and Uruguay. As a result, more of the world could be covered here than I was able to cover as editor of *The Video Game Explosion: A History of Video Games from PONG to PlayStation and Beyond* (2007), and there are entries on video games in Africa, India, Latin America, the Middle East, and New Zealand, places that are hardly touched upon in North American video game scholarship, despite their rapidly growing video game industries. Some regions have also been combined or divided according to shared historical circumstances, for example, the separate entries for "Europe (Central and Eastern)" and "Europe (Western)."

Likewise, something should be said about the terminology used throughout this encyclopedia. Because of the nature of the coverage needed in this encyclopedia, "video games" is used here in a very broad and inclusive sense and is the broadest of terms referring to the games discussed here. "Computer games" is slightly narrower; it is reserved for games that use home computers (or mainframe computers) but not those found in dedicated console systems, even when those systems can arguably be said to contain a computer (generally speaking, the machines that play "computer games" are those that can perform other computer functions apart from games). The terms "electronic games" and "digital games," which are even broader in scope than "video games," are not used because they include many games that do not utilize an imaging device and that may have little or no visual displays. A similar problem arises with "handheld games," which seems only to indicate the portable nature of the hardware used; those handheld games considered here are only those that would also qualify as "video games" because of the use of some imaging technology. The term is also typically used for devices for which the primary purpose is that of game playing, whereas games on other portable devices such as cell phone games are usually referred to as "mobile games." Thus, in many cases, there is a great overlap in terminology, which, more than anything else indicates shared technological or practical commonalities and a specific focus of attention rather than an exclusive group of games.

Some overlap is inevitable in the entries as well. For example, there are separate entries for "controllers" and "peripherals" because not all peripherals are controllers (for example, 3-D glasses or external CD-ROM drives) and, likewise, not all controllers are peripherals (for example, the buttons, joysticks, and trackballs built into arcade game cabinets). And "joysticks," although a subset of "controllers," is also deserving of a separate entry, because their own historical development is long and varied enough to warrant individual attention and because part of their history lies outside of their use as a video game controller. Two other terms are potentially ambiguous; as used here, "3-D" graphics refers to stereoscopic imagery resulting in an illusion of depth, whereas "three-dimensional" graphics refers to graphics that include perspective views and that are computed through the rendering of points, lines, and planes within a mathematically three-dimensional space.

Throughout the encyclopedia, terms that are also cross-references to other entries appear in boldface on their first mention within an entry, alerting readers to related topics that are also covered. Most entries also include a Further Reading section, listing a few sources that may be of interest as well as any works cited in the entry. Along with books and periodicals, websites have been included in these lists because there is today a wealth of material that can only be found on-line. The Guide to Related Topics helps readers trace broad themes and ideas across the entries, and a detailed subject index provides ready access to information in the entries.

Finally, this encyclopedia could have easily been many times the size it is; limiting it to only two volumes was perhaps the most difficult task in compiling it. The conceptual division of material, the selection of which entries would be included, and the relative sizes of those entries, was, of course, difficult to determine, and I have tried to achieve as much balance as possible. Although there are entries on well-known topics that one would expect, such as "Atari," "Nintendo," and "*PONG*," there are also lesser-known topics such as "crash of 1977," "*Quraish*," "suicide battery," and "Zeebo"; other entries are included with their usefulness to a scholarly audience in mind, such as "dual in-line parallel (DIP) switches," the settings of which can affect game content (and thus game analysis); "game genealogies"; "silent film"; and "*Sony vs. Bleem*," an important court case for video game scholarship that involves the fair use of screenshot imagery. Other entries provide in-depth history and little-known information for familiar subjects (for example, the "joysticks" entry).

In an era of on-line encyclopedias, it is not enough merely to cover persons, places, and things, so we have also included entries that are thematic or theoretical in nature and attempt to cover video games' form, content, and multiple contexts, be they social, cultural, industrial, or technological. Browsing is perhaps one of the most common ways that people experience reference works, and this has been kept in mind during the compilation and design of this encyclopedia. At more than a third of a million words, it is one of the largest academic projects I have been involved with, and I hope that readers will find as much pleasure in browsing it as I have had as its editor.

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Guide to Related Topics

Associations and Institutions

Digital Games Research Association (DiGRA)
Digital Games Research Center (DIGAREC)
Entertainment and Leisure Software Publishers Association (ELSPA)
Entertainment Software Association (ESA)
Entertainment Software Rating Board (ESRB)
Game Developers Conference (GDC)
Gamers Outreach Foundation
International Arcade Museum (IAM)
International Center for the History of Electronic Games (ICHEG)
International Game Developers Association (IGDA)
Killer List of Video Games (KLOV)
Midwest Gaming Classic (MGC)
Pan European Game Information (PEGI) system
Twin Galaxies
Videotopia
Vintage Arcade Preservation Society (VAPS)
World Cyber Games

Business and Industry

careers
City of Mesquite vs. Aladdin's Castle, Inc.
crash of 1977
crash of 1983
industry
merchandising
packaging
patent #2,455,992
piracy in China
Sony vs. Bleem

Companies

3DO Interactive Multiplayer
Activision
Atari
Bally
Capcom
Cinematronics
Coleco
Cyan Worlds

Electronic Arts (EA)
id Software
Infocom
Maxis Software
MicroProse
Midway Games
Namco
Nintendo
SEGA
Sierra Entertainment
SNK (Shin Nihon Kikaku) Playmore
Sony Corporation
Treasure Co. Ltd.
Vectorbeam
Williams

Games

Adventure
Animal Crossing series
BattleZone
Bioshock series
Computer Space
Dance Dance Revolution (DDR)
Defender
Doom
FarmVille
Galaxy Game
Grand Theft Auto series
I, Robot
Legend of Zelda series
Mario series
Metal Gear series
Metroid series
Mortal Kombat
Myst
Pac-Man
PONG
Portal
*Q*bert*
Quraish
Riven
Sim series
Space Invaders
Spacewar!
StarCraft
Street Fighter II
Tetris
Ultima series
World of Warcraft (WOW)

Other Media

board games
comics
Computer Games Magazine
electromechanical games
film
hip-hop
journalism
Play Meter magazine
RePlay magazine
silent film
television

People

Arakawa, Minoru
Baer, Ralph H.
Bushnell, Nolan
Caillois, Roger
Crawford, Chris
Garriott, Richard

Hawkins, Trip
Huizinga, Johan
Kojima, Hideo
Meier, Sid
Molyneux, Peter
Spector, Warren
Wright, Will
Yokoi, Gunpei

Regions

Africa
Australia
Canada
China
Europe (Central and Eastern)
Europe (Western)
France
Germany
Hong Kong
India
Japan
Latin America
Middle East
New Zealand
South Korea
Spain
United States of America (USA)

Systems

Atari 5200
Atari Jaguar
Atari 7800 ProSystem
Atari VCS 2600
ColecoVision
Fairchild/Zircon Channel F
GCE/Milton Bradley Vectrex
Magnavox Odyssey
Mattel Intellivision
Microsoft Xbox
Microsoft Xbox 360
NEC PC-Engine/Turbografx-16
Neo•Geo
Nintendo 64
Nintendo DS
Nintendo Entertainment System (NES)/Nintendo Famicom
Nintendo Game Boy
Nintendo GameCube
Nintendo Virtual Boy
Nintendo Wii
SEGA CD/Mega-CD
SEGA Dreamcast
SEGA Genesis/SEGA Mega Drive
SEGA Master System/SEGA Mark III
SEGA Saturn
Sony PlayStation
Sony PlayStation 2
Sony PlayStation 3
Super Nintendo Entertainment System (SNES)/Super Famicom
Zeebo

Technology

3-D hardware
artificial intelligence (AI)
audio (dynamic, interactive, and adaptive)
augmented reality
bulletin board systems (BBSs)
cartridges

CD-ROM-based games
checkpoints
CVC Gameline Master Module
DECO cassette system
dual in-line parallel (DIP) switches
Easter eggs
electromechanical games
emulators
game design
game engines
game modifications
generations of technology
gestural interfaces
graphics
hacking
help function
interface
JAMMA standard
joysticks
motion capture/motion control
Multiple Arcade Machine Emulator (MAME)
multi-user domains (MUDs)
peripherals
platforms
resolution
save function
scrolling
sound technology
suicide battery
vector games
XNA

Theoretical Concerns

abstraction
accessibility
adaptation
addiction
advertising
apocalypse
arcades
art
art, video games as
audio (adaptive, dynamic, and interactive)
avatars
"beating" a game
biomechanics
censorship
cheating
civic engagement
co-creativity
cognition
collecting of video games
controllers
cooperative gameplay
cut-scenes
death and resurrection
deludic play
education (general)
education (job training)
education (religious)
emotion
environmentalism
fandom
"first" video game
game, definition of
game design
game genealogies
game guides
game manuals
game modifications
game writing
games, philosophical critique of
gender
gestural interfaces
graphics
health (mental)

health (physical)
help function
history of video games
idea for home video games
immersion
interface
language
Latinos and video games
ludology
machinima
magic circle
maps
military use of games
morality and ethics
narrative
navigation (spatial)
navigation (temporal)
non-player characters (NPCs)
performance
phenomenology
play
procedural rhetoric
psychodynamics
psychological research on video games
race
reading video game imagery
Reception Theory
replay and repetition
representations of video games in Hollywood cinema
retrogaming
ritual
rules
save function
sound
space (narrative)
space (visual)
speedruns
spirituality
subcreation
time
unit operations
video game studies
violence
virtual reality (VR)
visual literacy
walkthroughs
war
world (of a video game)
World War II in video games
z-axis depth

Types of Games

adventure games
advergames
arcade games
ball-and-paddle games
board games
casual games
CD-ROM-based games
computer games
console-based games
DVD and Blu-ray Disc games
electromechanical games
experimental games
fighting games
girls' games
god games
handheld games
HDTV games
homebrew games
interactive movies
laserdisc games
mainframe games
massively multiplayer on-line role-playing games (MMORPGs)
minigames

mobile games
on-line games
persistent games
pervasive games
racing games
rhythm and dance games
role-playing games (RPGs)
serious games
shareware games
shooting games
simulation games
sports games
stealth games
strategy games
survival horror games
ubiquitous games
unlockable games
vector games
web-based games

A

abstraction

Video games emerged at a time when abstract **art** was in vogue, although the abstraction found in early games was typically the result of technical limitations rather than deliberate artistic choice. As technology improved, designers strove for greater representational ability in game **graphics**; as a result, the possibilities offered by abstraction are usually neglected, and its potential remains largely unexplored.

Video games require abstract imagery to be read in a new way. Because video games are simultaneously *imagery* and *events*, games' elements can be abstract in both *appearance* and *behavior*. Players must learn to identify the different elements seen on-screen and understand how they function and behave, which includes distinguishing between the player-controlled characters, computer-controlled characters, objects that can be manipulated and used, and static background imagery. Knowing the role and function of each game element, where they begin and end, and how they affect the player-character is crucial to learning a game. As these elements grow more abstract, however, so can the game's objectives, as both the **interface** and gameplay grow less intuitive. Thus, another reason for making game elements representational is the default assumptions and diegetic structures that accompany them and make both the interface and gameplay more transparent and intuitive.

In early video games, player-controlled characters were often function-based; instead of an anthropomorphic character, the player was represented on-screen by a graphic of a tool or vehicle that the player controlled, including spaceships, tanks, planes, cars, or even a simple rectangular "paddle." Such characters represented rigid objects for which a minimum of animation was needed, because they tended to move in straight lines or turn in place, whereas characters with moving arms and legs required more animation and computing power. Later characters were humanoid, but still minimalist figures barely recognizable as such. The simple, abstracted graphics aided player identification in that they were generic figures lacking specific detail; anyone could identify with them, because markers indicating such things as **gender**, **race**, and age were not present. Some player-characters were as simple as a square, a ball, or even a kind of spark, as in the **arcade game** *Qix* (1981). Other arcade games using abstract designs include ***Pac-Man*** (1980), *Tempest* (1981), ***Q*bert*** (1982), *Quantum* (1982), *Marble Madness* (1984), and ***Tetris*** (1988), and several of these games were successful enough to inspire sequels. The graphics of early home video games in the 1970s and 1980s were also limited by technology; on the **Atari VCS 2600**, for example, the

Cartridge box images compared to the rather abstract graphics of the actual game screens. (Mark J. P. Wolf)

background graphics making up the playing field could only be drawn on the left half of the screen and were then duplicated on the right half, either as a **repetition** or a mirror image of the left side, accounting for much of the horizontal symmetry found in the early **Atari** games.

As computer hardware advanced, graphics capabilities improved, and gameplay and graphics grew more representational, as video games strove to imitate media such as **film**, **television**, and **comics**. Representational game graphics provide a way to visually benchmark a system's graphics technology, and this is used to sell games (although simpler graphics are occasionally used to produce a retro feel). Relatively few abstract games were produced after the 1980s, but abstraction found a use within game graphics, particularly the texture-mapping used in three-dimensional polygonal graphics—for example, the patterns and designs appearing as surface textures found on objects and settings. Texture maps display patterns such as rust, cracks, grain, splatter, corrosion, and wear—subject matter often explored in abstract art. It is through the application of these abstract texture maps that video game imagery achieves heightened realism and greater representational ability.

Finally, even the most representational games will always, to some degree, be an abstraction of the things or situations they are trying to represent or simulate. As the player's mind completes or imagines game details, he or she is engaged and involved more in the game. Simplified versions of situations found in video games may even allow players to feel a greater sense of order and understanding than they find in their own lives. Abstract games may not be learned as intuitively as representational games, yet abstraction need not imply simplicity. Complexity may even help bring about a rebirth of the abstract game.

Abstraction's role in video games has ranged from perceptual abstraction to conceptual abstraction, but it appears to be both a necessary and inevitable part of the video game playing experience. Rather than try to avoid or sublimate abstraction, **game design** can usefully incorporate abstraction, resulting in new gaming experiences and game conventions. Just as computer simulations and mathematical visualization have taken graphic design in directions other than photorealistic representation, abstraction can expand and explore the great potential that the video game medium has to offer.

Mark J. P. Wolf

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accessibility

Within the field of human-computer interaction, game accessibility refers to the accessibility of video games and is considered a subfield of computer accessibility, which studies how software and computers can be made accessible to users with various types of impairments. The way we interact with software is increasingly modeled after how we interact with the physical **world**, as such interaction is most natural to us (Yuan, Folmer, and Harris, 2010). However, the emergence of immersive technologies with three-dimensional **graphics** such as video games and virtual worlds, as well as more intuitive forms of interaction, such as the use of motion sensing, have only raised new barriers for users with disabilities (Yuan, Folmer, and Harris, 2010; Popcap Games, 2008). For example, video games and virtual worlds often lack any textual representations that can be read by a screen reader or tactile display. Games usually require a degree of control that goes beyond what can be feasibly provided with assistive technology such as an eye tracker or a switch **controller** (Sporka, Kurniawan, Mahmud, and Slavik, 2006).

With rising numbers of people interested in playing video games and video games increasingly being used for purposes other than entertainment, such as **education**, rehabilitation, or **health**, game accessibility has become an emerging field of research, especially as players with disabilities could most benefit from the opportunities video games offer. One study (Yuan, Folmer, and Harris, 2010) estimates that 2% of the U.S. population is unable to play a game at all because of an impairment, and 9% can play games but suffer from a reduced gaming experience. Because games are increasingly used as education tools, there may be a legal obligation to make them accessible, as Section 508 of the Rehabilitation Act mandates that schools and universities that rely on federal funding must make their electronic and information technologies accessible (U.S. Government, 1998).

Barriers to Access

According to Yuan, Folmer, and Harris (2010), video game accessibility problems can be a categorized into three categories: not being able to receive feedback from the game due to a sensory impairment (examples include not being able to hear dialogue between game characters or **audio** cues, such as an explosion, because of a hearing impairment or being unable to see or distinguish visual feedback due to a visual impairment, such as colorblindness); not being able to provide input using a conventional input device due to a motor impairment (for example, users who rely on using switch controller or eye trackers to interact with games may find it difficult or impossible to play games that require large amounts of input); and not being able to understand how to **play** the game or what input to provide because of a **cognitive** impairment (for example, real-time **strategy games** require a lot of micromanagement, which may be too difficult to understand or to perform for someone with a learning impairment).

Accessible Game Categories

Since 2000, small companies and independent game developers have developed numerous games that seek to accommodate the abilities of players with the most severe impairments, which has led to the definition of the following accessible game categories: audio games, one-switch games, and universally accessible games.

Audio games are specifically for gamers who are blind. These games can be played without visual feedback and instead use audio-based techniques such as audio cues or synthetic speech. The website audiogames.net provides a comprehensive overview of audio games.

One-switch games can be played with a single button and accommodate the abilities of users with severe motor impairments. The website oneswitch.org.uk provides a comprehensive overview of all one-switch games.

Universally accessible games offer multiple **interfaces** to support different impairments. An overview of universally accessible games can be found at http://www.ics.forth.gr/hci/ua-games/index.html. These games are not only great examples of accessible games but may also drive innovation in **game design**. For example, the game *Strange Attractors* at http://www.ominousdev.com/games.htm was originally developed for a one-switch game design competition, but its gameplay was so compelling and innovative that it became successful outside the accessible gaming realm.

Strategies for Improving Accessibility

There have been two attempts at composing a set of game accessibility guidelines similar to the Web Content Accessibility Guidelines (see http://www.w3.org/tr/wcag10). The **International Game Developers Association (IGDA)** Special Interest Group on Game Accessibility proposed 19 accessibility guidelines in 2004, which were derived from a survey of 20 accessible games (Bierre et al., 2004). The majority of the games surveyed include games for the visually impaired, and several support motor or hearing impaired gamers. The Norwegian Medialt organization published a set of 34 game accessibility guidelines on their website (Tollefson, 2006), based on the 19 IGDA game accessibility SIG guidelines as well as their own set of guidelines. Based on the three aforementioned different types of accessibility barriers, Yuan, Fomer, and Harris (2010) have divided higher-level accessibility strategies into three categories: sensory impairment, motor impairment, and cognitive impairment.

Sensory impairment strategies include the enhancement of stimuli (for example, high contrast color schemes, increased font size, colorblind-friendly color schemes, and zoom options) and the replacement of stimuli (for example, subtitles or closed captioning, audio cues, sonification [the modulation of no-speech audio], speech output, and haptic cues).

Motor impairment strategies include the replacement of input (for example, support voice or brain control) or the reduction of input (for example, the removal or automation of inputs).

Cognitive impairment strategies include the reduction of stimuli (for example, the limiting of the number of game objects, or the simplification of the storyline), the reduction of time constraints (for example, the slowing down of the game), and the reduction of input (for example, the removal or automation of inputs that need to be provided).

Eelke Folmer

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Activision

Activision, Inc. is an American video game development and publishing company, and the first third-party video game developer in **history**. Before it was founded on

October 1, 1979, game development had been the exclusive domain of game **console** manufacturers.

The company was formed by four **Atari** programmers: David Crane, Robert Whitehead, Alan Miller, and Larry Kaplan. Under the management of Atari executive Ray Kassar (who saw games as mere products rather than as **artistic** expression and held programmers in notoriously low esteem), game creators at Atari did not receive **design** credit or royalties. Crane, Whitehead, Miller, and Kaplan—who, according to a 1978 internal memo, together accounted for 60% of Atari's game sale profits—decided that the only feasible way to gain creative freedom, as well as proper recognition and financial compensation for their work was to leave Atari and start their own business. Lacking managerial experience, they enlisted the help of James Levy, a music-industry veteran, who joined them as Activision's president and chief executive officer.

The four programmers' dissatisfaction with the treatment they received at Atari, along with Levy's background in the music business, strongly informed the way the company treated programmers. Not only was the designer's name placed on the game **cartridge** and **packaging** (initially on the back of the box; later, prominently, on the front), but also their picture, signature, and a short biography were featured in the instruction **manual**, along with personal gameplay tips.

Activision initiated the practice of placing game screenshots on the back of the retail box. It also instituted the first "achievement" program, wherein players could earn a commemorative sew-on patch for beating a specific score or time challenge in a given game.

Atari launched a number of lawsuits against the fledgling company, claiming, among other things, copyright and patent infringement. Activision won or settled every suit. Following the success of their **Atari VCS 2600** titles (including *Freeway* [1981], *Kaboom!* [1981], *Pitfall!* [1982], and *River Raid* [1982]), Activision proceeded to expand their catalog with releases for the **ColecoVision** and **Intellivision** systems, as well as for the **Atari 5200** and the Atari 400/800 line of home computers. However, having suffered heavy financial losses in the wake of the video game industry **crash of 1983**, the company abandoned the home console market in 1984, focusing for the next few years on home computers. In the same year, Alan Miller and Robert Whitehead left Activision to form their own company, Accolade.

In 1986, Activision acquired **Infocom**, the developer of text-based **adventure games**. (Due to several questionable management decisions and steadily declining profits, Infocom would be shut down three years later.) Soon after, David Crane left the company, largely because of disagreements with newly appointed CEO Bruce Davis, whose management style was reminiscent of Kassar's. With Crane's departure, Activision lost the last of its founding fathers (Larry Kaplan had left in 1982 to take the position of vice president at Atari).

In 1988, the company decided to branch out into business and productivity software, changing the corporate name to Mediagenic, although games continued to be released under the Activision label. The diversification strategy was not successful, and Mediagenic filed for bankruptcy in 1992. Extensively reorganized, the company returned to its original name and focused exclusively on **console-based games** and **computer games**.

Over the following years, Activision expanded dynamically, acquiring a number of game companies, including Raven Software, Neversoft, Infinity Ward, and Bizarre Creations, as well as publisher Red Octane. In 2008, it merged with French developer Vivendi Games. The resulting entity, Activision Blizzard, is currently the world's largest independent game publisher.

P. Konrad Budziszewski

adaptation

Distinguishing adaptation from **simulation** is essential to understanding the video game adaptation's expanded position in the entertainment **industry**. Although all video games are simulation on some level, whether based on preexisting sports or games or on imagined experiences like battling dragons or waging **space** warfare, video game adaptations specifically work from source material that originated in another medium, most commonly **film**, **television**, or print media such as novels or **comics**. In doing so, video game adaptations confront specific practical, cultural, and **artistic** challenges. Although adaptations have been part of the video game industry since its early origins, more recent, widespread conglomeration in the entertainment industry has brought a rapid rise in the number of adaptations published annually (Elkington, 2008, p. 217). Similarly, video games are increasingly the inspiration for film, television, and novels, all part of a general trend toward what media theorist Henry Jenkins and others have termed "media convergence." Technological innovation makes media an ever-increasing part of our daily life. At the same time, media production is increasingly housed under unified corporate umbrellas such as Time Warner or Viacom. Consequently, media conglomerates look to maximize or synergize content across multiple commercial and technological **platforms** in the hope of lessening risk and increasing profit (Jenkins, 2006, pp. 17–18).

With the rapid expansion of the video game industry over the past two decades, it follows that the entertainment industry would capitalize upon this popularity. However, the commercial and creative failure of games such as Atari's *E.T.: The Extra-Terrestrial* (1982) did little to bolster the public perception of video game adaptations. Notorious as one of the largest critical and commercial failures in the history of video games and as a harbinger of the industry **crash of 1983** (Kent, 2001, p. 239), *E.T.* also became a symbol of what was wrong with video games based on movies. Video game adaptations quickly gained a reputation for low-quality, blatant commercialism. Although video game adaptations have increased their share of industry space year-upon-year and are now de rigueur for any blockbuster film or television series, the public impression has been that they are quickly produced at the expense of quality to seize short-term profits. This suspicion is borne out by critics' review scores, where video game adaptations consistently score lower on average than nonadaptations (Elkington, 2008, p. 217). However, the challenges in adapting a television or film property into interactive form go beyond simple cost-cutting. Conflicts in development processes, the fact that a large percentage of adaptations are based on children's franchises and don't appeal to adult critics, and a pervasive skepticism toward adaptations in general all affect the success of any adaptation released (Elkington, 2008, pp. 223–225). Exceptions do occur, such as Vivendi's *The Chronicles of Riddick: Escape from Butcher Bay* (2004), but they are usually presented as the exception to the rule.

Similarly, movies and television series based on video games also generally receive poor critical reception. Early examples such as the films *Super* ***Mario*** *Bros.* (1993) or *Street Fighter* (1994) often cut or alter characters and plot points at the expense of the source material or by necessity provide history and motivation for video game characters that originally had none, such as the animated series based on Namco's **Pac-Man** game franchise. Created by Hanna-Barbera and running from 1982 to 1984, the series expanded on the scant characterization offered in the game by exploring his marriage to Mrs. Pac-Man, giving him pets, detailing his life in Pac-Land, and introducing new adversaries. Although necessary to create a **narrative** universe, these types of changes to known and accepted characters run the risk of alienating the original fan-base that the adaptations are aimed at, omitting key details and being perceived as taking liberties with the source material. It is a challenge that faces any adaptation from one medium to another. At the same time, the disparity in financial stakes between a major motion picture and a major video game release, as well as the difference in economic scale between the film and television industries on one side and the video game industry on the other, creates an imbalance in influence, such that the video game originators often have difficulty maintaining creative control over their product (Elkington, 2008, p. 218). The initial fanfare and subsequent shelving of Peter Jackson's *Halo* film adaptation suggests that even the appeal of one of the most commercially successful video game franchises in history is no guarantee of influence within the film industry. The imbalance of power between the two industries was clear enough that in 2005, Douglas Lowenstein, then head of the **Entertainment Software Association**, acknowledged the disparity between industries and saw fit to devote his remarks at that year's E3 Expo to what it would take "for the game industry to be as big or bigger than the film industry at some point in the future" (Lowenstein, 2005).

Although film and television adaptations both to and from video games occupy the largest segment of the adaptation trend, there has been a simultaneous expansion in games adapted from print media, most commonly from **comic books** and graphic novels such as 2K's *The Darkness* (2007) or from the popular DC and Marvel comic universes. Novel and comic series based in the ***World of Warcraft*** and *Halo* universes likewise expand on ideas and characters originating in video games in a form that can be enjoyed away from the computer console.

The rapid growth of adaptation into or based on video games finds its roots in the conglomeration of entertainment and communication companies. With corporations like Sony, Time Warner, and Viacom holding interests in film, television, publishing, and video games, it is perhaps natural that the flow of ideas becomes less focused upon a given medium and instead revolves around the franchise itself. As Jenkins writes, "more and more, storytelling has become the art of **world** building. . . . The world is bigger than the film, bigger even than the franchise. . . . World-making follows its own market logic" (Jenkins, 2006, p. 114). Jenkins points to projects such as *The Matrix* games, movies, and graphic novelizations, the cluster of products released around Peter Jackson's *Lord of the Rings* movies, and other cross-platform or "transmedia" development as proof that the central intellectual property (IP) is now more important than any one product within that cycle. As such, entertainment conglomerates increasingly plan centrally around the IP, looking to cross-pollinate within their own corporation or outward to other production partners. Although the products of media convergence expand beyond more straightforward categorization as adaptation, the rate and presence of cross-media productions seems likely to continue to increase as long as the entertainment industry sees value and advantage in adapting central franchises into numerous forms and genres. ***See also*** industry; merchandising; subcreation.

Trevor Elkington

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addiction

The term "addiction" is used in medicine, psychology, and psychiatry to characterize a compulsion or excessive dependence on something. The term is often used to describe or diagnose overdependence on such things as gambling, drugs, or alcohol. Medically, the American Academy of Pain Medicine, the American Pain Society, and the American Society of Addiction Medicine define addiction as "a primary, chronic, neurobiologic disease, with genetic, psychosocial, and environmental factors influencing its development and manifestations. It is characterized by behaviors that include one or more of the following: impaired control over drug use, compulsive use, continued use despite harm, and craving" (http://www.painmed.org, 2009). Psychologically, although the term was used in earlier versions, the current version of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV-TR) does not use the term addiction. Instead, it refers to "substance dependence" or "control disorders."

Parents, educators, government officials, and researchers have seemingly always been interested in the amount of time that children and adults spend with media such as **television**, computers, and video games. However, people began referring to *computer addiction* or *video game addiction* because of stories of excessive and compulsive gameplay. In one case, a **Chinese** man died after playing **on-line games** continuously for 15 straight days; in a second case, two American 10-month-old twins drowned when their father left them in a bathtub so that he could go play a video game. An organization called Online Gamers Anonymous was even created after the founder's son committed suicide while playing an on-line game.

Because of the recency of the terminology, relatively little research exists regarding whether excessive video game play is a disorder, how many people it affects, the exact causes of the addiction, or how to treat it. Research has provided evidence that some gamers show classic signs of addiction (Grüsser, Thalemann, and Griffiths, 2007; Young, 2009). Those symptoms include lying about game use, becoming preoccupied with gaming, losing interest in other activities, withdrawal from others, and the use of gaming as a psychological escape (Leung, 2004). Researchers also argue that diagnoses and detection of these symptoms can be difficult because of society's increased use of computer technologies in daily life.

Video game addiction or dependence is a very real problem as evidenced by recent research findings and news reports. New surveys are currently being developed to further explore and understand video game addiction, and, as of 2010, the American Psychiatric Association is also considering video game addiction as a mental disorder for their upcoming 5th edition of the DSM. However, there is also evidence that video game **play** can be beneficial for **health**, **education**, training, and business (Ferdig, 2009). At the very least, games, particularly on-line, multiplayer games, provide enjoyment through increased social relationships (Klimmt, Schmid, and Orthmann, 2009). Therefore, caution should be exercised in reading and understanding media coverage related to video game addiction.

Richard E. Ferdig

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Adventure

Written by Warren Robinett, *Adventure* (1979) for the **Atari VCS 2600** was the first graphical **adventure game**, and one which can be credited with a number of other firsts. Based on the all-text game *Adventure* (1976) by Will Crowther and Don Woods, Robinett's *Adventure* was the first game to feature multiple screens that cut one to the next as the player moved from room to room, imitating the linked locations of a text adventure game (and using only 4 kilobytes of memory). Conservation of screen direction was used to continue the action (that is, when the player's character exited one screen on the right, it reappeared on the left side of the next screen), making *Adventure* the first to use cinematic conventions to orient the player in the game's diegetic **world**. The game's world consisted of 30 interconnected screens linked in a manner that could not be **mapped** onto a two-dimensional plane. The rooms included two labyrinths and three castles—the Golden Castle, White Castle, and Black Castle—each of which had a portcullis that could be open or closed, and castle interiors represented by other screens.

Not only did *Adventure* have navigable **space**, it was also the first graphical game to feature significant off-screen events that the player would discover after they had happened; the Black Bat that flew screen to screen could pick up and drop objects even when they were off-screen, which in turn affected the game for the player and could even result in a loss of the game. The Black Bat was also the first computer-controlled character to have more than one behavioral state (agitated and not agitated). The game's three dragons, Yorgle (the yellow dragon), Grundle (the green dragon), and Rhindle (the red dragon), were the first identically shaped characters whose algorithmic behavior differed; each had different duties guarding different objects, and each had a different level of aggression. *Adventure* was also the first game to feature graphical, portable objects on-screen (as opposed to being located in an inventory) that a player-character could pick up, use, and drop, and that could be carried by a computer-controlled character as well (the Black Bat). These objects included a key for each castle, a sword, a chalice, a magnet, and a bridge that would allow the player-character to pass through walls and that was needed to access several disjoint regions within the game.

Adventure was also the first game in which a player found an **Easter egg** (a hidden feature waiting to be found); because programmers did not receive credit for their games, Robinett put a **graphic** of his name in a secret room that players would not easily discover by accident; thus the game also became the first to feature a screen credit for its programmer. *Adventure* sold well and was a popular game, and in several online polls, it was voted the best **cartridge** for the 2600, despite the fact that it was among the earliest cartridges to appear.

Mark J. P. Wolf

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adventure games

Games of the adventure genre differ from other games in that they are set in a game **world** usually made up of multiple connected rooms, locations, or screens, which the player can freely explore in nonlinear fashion. The games also typically involve an objective that is more complex than simply catching, shooting, capturing, or escaping, although completion of the objective can involve several or all of these. Objectives usually must be completed in several steps, for example, finding keys and unlocking doors to other areas to retrieve objects needed elsewhere in the game. Characters are usually able to carry objects, such as weapons, keys, tools, and so on. Settings often evoke a particular historical time period and place, such as the Middle Ages or Arthurian England, or are thematically related to content-based genres such as science fiction, fantasy, or espionage. Although most **massively multiplayer online role-playing games (MMORPGs)** would qualify as adventure games, they are usually considered a separate genre unto themselves because of all the player interaction that makes them very different from single-player adventure games.

Many adventure games, although they have some kind of monsters, villains, or other characters opposed to the player's character, often do not have an antagonist in the classic sense. The world of the game itself takes on that role, as players attempt to learn its geography and the navigation of it; gain access to its hidden, closed, and locked areas; and discover how to use the various objects and devices within it. Exploration, **navigation**, accessing restricted areas and tool usage are found in many other genres, but in the adventure genre they occupy a central position and are often the subgoals necessary to the achievement of the main objective; the discovery of how such subgoals contribute to the overall objective is itself also a part of the experience and essence of the adventure game.

History of the Genre

Adventure games began in the mid-1970s when Willie Crowther, a computer programmer, combined his interest in cave exploration and mapping, the **role-playing game** *Dungeons & Dragons*, and his background in programming to produce what would come to be known as the first **computer game** in the adventure genre, *Colossal Cave Adventure* (1975), which would be developed further by Don Woods into *Adventure* (1976). The all-text game consisted of descriptions of a series of connected rooms through which a player moved by typing responses such as "n" for "north" or "d" for "down." The player also needed several objects, like keys or a lamp, during the game. Such games came to be known as text adventures, or interactive fiction, and the company **Infocom** was known for producing them.

After playing Crowther and Woods's *Adventure* at Stanford, **Atari** programmer Warren Robinett decided that it could work as a video game and took on the challenge of translating such a game into a 4096-byte Atari **cartridge**, a task that Robinett's boss at Atari thought was impossible. Various problems that had to be solved included how to represent rooms and their connectedness; usable objects that could be carried around, picked up, and dropped; and autonomous creatures that could be encountered during gameplay. ***Adventure*** (1979) became the first graphical adventure game and featured 30 interconnected screens that used the cinematic convention of cutting from one to the next rather than **scrolling**, making it the first video game to use multiple screens. The game also had disjoint regions that the player could only access with the use of certain tools (the keys to open castle gates, the bridge to pass into walled areas), as well as off-screen actions the player could encounter later (for example, the bat could pick up and drop objects while the player was elsewhere). Other adventure games for the **Atari VCS 2600** followed, including *Superman* (1979), *Haunted House* (1981), *Raiders of the Lost Ark* (1981), *Venture* (1982), *E.T.: The Extra-Terrestrial* (1982), *Krull* (1983), *Dark Chambers* (1988), and the *Swordquest* series of games. *Dragonstomper* (1982) was an adventure game that was also an early role-playing game.

Adventure games also appeared on home computers, which could provide more memory for games. Richard **Garriott**'s ***Ultima*** (1980) was the first home computer game to feature scrolling in both horizontal and vertical directions, resulting in a large playing field of which only a portion was seen at once. *Ultima*'s four-way scrolling screen technique, using tiled **graphics** that were added or removed from the edges of the screen as it scrolled, was developed by Garriott with his friend Ken Arnold, who was one of the programmers that developed the computer game *Rogue* the same year (*Rogue* was another adventure game with a graphical display made of ASCII characters; for example, the player's character was represented by an "@" that could be moved around the screen).

Beginning with Roberta Williams's *Mystery House* (1980), text adventure games also began to include graphics, which acted as illustrations for the game's text. These illustrations were more detailed than the typical graphical adventure games of the time, but they were for the most part only images with which players could not directly interact. These images did introduce a first-person perspective into the games, which helped to engage the player more and compensate for the lack of a graphical user **interface**.

Advances in graphics display standards also made better-quality graphics possible. Before 1984, the CGA (Color Graphics Adaptor) standard, which allowed image resolutions of 320 by 200 pixels with a four-color palette (or 620 by 200 with a two-color palette), was used by DOS computers for graphic displays. Such harsh graphical restrictions made representational imagery difficult, and it was not until the 1984 release of the EGA (Enhanced Graphics Adaptor) standard, which allowed image resolutions of 640 by 350 with 16 supported colors from a 64-color palette, that images began to dominate the screen in what were still mainly text-based adventure games. In 1987 graphics improved again when the VGA (Video Graphics Array) standard appeared with images of 640 by 480 pixels and a 256-color palette. Later, SVGA (Super VGA) would increase image resolution to 800 by 600 pixels.

During the 1980s, and especially after the appearance of the graphical user interface, home computer adventure games began to add features originally found in **console-based games**, making them less like the early all-text adventures. Roberta Williams's *King's Quest* (1984) introduced the idea of an animated character that walked over the background graphics, and *King's Quest III: To Heir Is Human* (1986) had a clock on the titlebar, with events occurring at specific times, adding an element of time pressure to the game. ICOM Simulations, Inc.'s *Déjà Vu 1: A Nightmare Comes True* (1985) had an inventory box, similar to video games like *Raiders of the Lost Ark* (1981) for the Atari 2600. It was also one of the earliest home computer games to use a mouse and cursor, giving it point-and-click capability similar to home video games using **joysticks** with firing buttons, although it used pointing-and-clicking mainly for selecting objects from an inventory window or choices from a menu, rather than **avatar** control or spatial **navigation**. Despite these advances, however, the images used in many of these games were still more or less illustrations of what was essentially text-based interaction.

A more user-friendly and graphically oriented interface came in 1987 with the introduction of the SCUMM (Script Creation Utility for *Maniac Mansion*) **game engine** written by Ron Gilbert and Aric Wilmunder of Lucasfilm Games (now LucasArts), used (and named) for the game *Maniac Mansion* (1987). LucasFilm Games would go on to use versions of the SCUMM engine for their games into the 1990s. Although characters could be directed by clicking in the "Animation Window," the interface did not allow direct avatar control, as was found in even the earliest home video games, but it did provide, along with **cut-scenes**, on-screen action that the earlier graphically illustrated games lacked. After the release of the **Nintendo Entertainment System (NES)** in 1985, home video game systems had improved to the point where home computer games could be ported to them, resulting in the cross-**platform** release of many home computer adventure titles. Likewise, more adventure titles were originating in home console systems, such as the ***Legend of Zelda* series**, which first appeared in 1986.

After 1987, an increasing number of **CD-ROM-based games** were released, beginning with *The Manhole* (1987), and the greater amount of memory available encouraged the use of better graphics, better **sound**, and even integrated video clips. Advances in computer animation meant more photorealistic graphics, and full-motion video (FMV) began appearing in games, beginning with Trilobyte's spring 1993 release, *The 7th Guest*, which was over a gigabyte in size (because of its video clips) and the first CD-ROM game to require two discs.

In September 1993, **Cyan**'s ***Myst*** was released, which would surpass *The 7th Guest* as the best-selling game of all time.

Myst gave new twists to familiar ideas, innovating and developing existing traditions, conventions, and graphics of the adventure genre, especially in regard to creating an integrated and seamless experience for the player. Like *Maniac Mansion*, the player's character can't die in *Myst*, keeping players from being ejected from the game before they want to leave. Graphically, *Myst* was designed to keep players as much within the game's world as possible. *Myst* would eliminate almost all informational graphics, with almost everything integrated directly into the game's world itself. *Myst* was followed by ***Riven*** (1997) and several more sequels.

The success of *Myst* renewed interest in the adventure genre, leading to a wide range of CD-ROM-based adventure games, including *Ray Bradbury's The Martian Chronicles* (1995), *Frankenstein through the Eyes of the Monster* (1995), *AMBER: Journeys Beyond* (1996), *Bad Mojo* (1996), *Gord@k* (1996), *Lighthouse: The Dark Being* (1996), *Noir: A Shadowy Thriller* (1996), *Obsidian* (1996), *Of Light and Darkness* (1996), *Rama* (1996), *Timelapse* (1996), *Titanic: Adventure Out of Time* (1996), *Safecracker* (1997), *Treasure Hunter* (1997), *Weird: Truth Is Stranger than Fiction* (1997), the *Rhem* series, the *Riddle of the Sphinx* series, the *Schizm* series, the *Shivers* series, and the *Syberia* series. Other games and games series, like the ***Grand Theft Auto* series**, could also be considered adventure games even though they are often not billed as such.

Finally, alongside single-player games, MMORPGs took the adventure genre in a new direction, with large, **persistent** (24 hours a day, 7 days a week) worlds that featured hundreds of thousands of players within them. As descendents of the multiplayer on-line text adventure games from the mid-1980s (such as the 16-player *Sceptre of Goth* [1983]), these games offer an experience so different from single-player adventure games that they arguably constitute their own genre; nonetheless, they are an extension and development of the worlds developed in the single-player adventure games whose history is described in this entry. Many single-player games have also incorporated elements from other genres and influenced the design of their game worlds. Such overlapping has blurred the boundaries of the adventure genre, but exploration, **navigation**, and tool use will always remain at the heart of the adventure genre.

Mark J. P. Wolf

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advergames

Coined in 2000 by Andrew Giallourakis, the term "advergames" refers to video games that are used as a venue for **advertising**. The practice of advergaming, however, has been around for decades. Even when games' **graphics** were relatively **abstract**, companies produced games to advertise their products. Although some games include product placement or company logos (for example, *Pole Position* [1982] used in-game roadside signs to advertise real companies) such games are generally not considered advergames, especially when advertising was not the main purpose for the games' creation. Advergames are often produced by the company doing the advertising or are at least initiated by them if a third-party developer is involved in the production. Early advergames include three made for the **Atari VCS 2600**: *Kool-Aid Man* (1983) (also made for the **Mattel Intellivision**), Purina's *Chase the Chuck Wagon* (1983), and *Pepsi Invaders* (1983), which was commissioned by Coca-Cola for a sales convention and featured letters spelling "PEPSI" arranged like **space invaders** that the player shot at. Because of their relative rarity, all three **cartridges** are sought after by game collectors.

Advergaming grew into big business during the late 1980s and 1990s, as more companies began developing games. The companies most interested in advergaming tended to be those marketing food and drink for a younger crowd; snack food and soda companies such as 7-Up, Coca-Cola, Cheetos, and Pepsi and fast-food restaurant chains such as Burger King, McDonald's, and Domino's Pizza. This trend continued into the 2000s, as games were produced promoting Chex, Cap'n Crunch, Doritos, and Skittles. Car manufacturers including BMW, Toyota, and Volvo also produced advergames. Some of these games, like the ones for cereals, came **packaged** with the product as an extra incentive to purchase, whereas others required the customer to mail in for them or buy them for a relatively low price compared with retail prices for other games.

After the appearance of **web-based games**, advergames also began appearing on-line, usually with links to companies' websites. This allows games to be more closely connected with the company, and the user with company information, and allows the games to spread digitally without additional cost, resulting in what companies hope will become viral marketing. These advances and advantages have helped advergames grow into a multi-billion-dollar business, and the greater availability of game creation tools makes them an affordable advertising venue for a wider range of businesses. Services like the Massive Network can even place ads into video games that are connected on-line through the use of software development kits that place advertising images on in-game billboards, posters, and other surfaces and can change these ads over time.

Because of their close connection with a product and the positive feeling that advertisers want users to feel in relation to their products, most advergames are **casual games** that are neither too complicated nor taxing to play. By delivering a gaming experience, the user also receives something in return for his or her time spent with the advertisement, thus making advergames a way to actively involve the audience in the advertising process.

Mark J. P. Wolf

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advertising

The relationship of advertising to video games is complex and varied: video games have been produced as advertisements; are commonly marketed through print and **television** advertisements, as well as other forms of product placement; and have been placed within video games, both enhancing and connecting games to the **world** outside of the game and bringing the nongame world deeper into the social and cultural sphere of video games. More than a simple marketing tool, advertising is a pervasive part of contemporary culture, and its role in video games testifies to advertising's inescapable ubiquity.

Historically, early home video game systems were advertised in newspapers and magazines, often in ads directed to an adult male audience that typically might be found in the bars and taverns where **arcade games** were located. Although not strictly an advertisement, the appearance of **Atari**'s ***PONG*** product line in the Sears catalogue, which sold everything from tools to car parts to clothing and soft home goods, was indicative of the movement of the games industry into the home itself, as leisure item for home electronic enthusiasts and for general family fun.

Marketing kits and early promotional materials also advertised and instructed gamers on how to imagine their new products—as a site for family togetherness or **educational** fun, as evidenced in the early Atari catalogues. Some companies chose to promote games and systems with celebrity spokespeople, including Kareem Abdul-Jabbar (*Basketball* [1978] by Atari), William Shatner (Commodore Vic-20), and George Plimpton (**Mattel Intellivision**). Specialty publications geared toward the gamer market are another key advertising site for both game systems and software. *Nintendo Power* magazine (and the **Nintendo** telephone hotline) lent the Nintendo brand an aura of authenticity and illustrated the scope and scale of its products for its fans. In 1989, Universal Pictures released the feature film *The Wizard*, which follows a young gamer to a Nintendo gaming tournament, highlighting both the **Super Nintendo Entertainment System (SNES)** and its catalogue along the way, functioning as a "program-length commercial" for Nintendo and its titles.

Since the early 1980s, advertising elements have crept into video games themselves, sometimes lending authenticity to a game world, other times disrupting its virtual coherency. Meanwhile, the popular Madden franchise of games has recently been criticized for its incorporation of pop-up advertisements in *Madden NFL 10* (2009). Appearing frequently before a play in this football title, such pop-up ads can actually disrupt a gamer's pleasure and concentration even though these advertisements mimic television broadcasts of sports and their use of infotainment strategies like pop-up advertisements. For instance, in the **racing game** *Pole Position* (1982), advertisements for products such as Canon and Pepsi were incorporated as billboards posted alongside the race course, making the game's simulation more authentically like that of a real Formula One race. And, of course, games often feature simulated advertisements, from billboards to radio spots (as in ***Grand Theft Auto III*** [2001]), echoing just how much advertising has become central to everyday life. In-game advertising has become a key aspect of many **sports games**, where advertising on arena and stadium spaces also lends to the realism of the game itself. The **Electronic Arts (EA)** game *Battlefield 2142* (2006) notified its audience that EA and advertising partner IGA Worldwide would monitor and update in-game advertisements via Internet tracking software installed as part of the game. This system, referred to as "adware" or "spyware," allows for regular in-game updates to advertising but also raises many privacy questions for gamers. Although controversial at first, now many on-line **console-based games** allow for advertisements to be updated regularly, creating new commercial content for variety within the game. Many games have been partnered with brands from other companies, such as *SEGA's Crazy Taxi* (1999) and Kentucky Fried Chicken or the cobranding of *Enter the Matrix* (2003) and Sprite, the former of which is itself a very long, playable transmedia advertisement for the film *The Matrix Reloaded* (2003). Indeed, today one even sees political advertisements in games such as *Burnout Paradise* (2008), which ran ads for then-presidential candidate Barack Obama alongside paid spots for JL Audio, Burger King, and Gillette. This marked the first time a political campaign had purchased in-game advertising.

These developments of in-game advertising have led to the emergence of **advergames**, games made explicitly *as* advertising materials, such as the Burger King **Microsoft XBox** titles *PocketBike Racer* (2006), *Big Bumpin'* (2006), and *Sneak King* (2006). Like other advergames, these titles incorporated the advertised brand into the game's own logic, or what Ian Bogost has called a game's "**procedural rhetoric**": concepts that become part of a game's code and ethos (Bogost, 2007). Some game-advertiser collaborations take the interactive component of gaming even farther, as in the "/pizza" command in *EverQuest II* (2004), which allowed gamers to order Domino's pizza from within the game world itself and have it delivered to their homes. Whether advertising is outside of a game, part of the fabric of the game world, or incorporated into collaborative branded partnerships, it is thoroughly integrated into video gaming, and innovations in video game advertising will surely keep pace with the industry as it continues to develop and grow.

Sheila C. Murphy

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Africa

Many Africans have been playing video games since their childhood. Some of the most popular consoles in the early 1990s were the **SEGA Mega Drive**, **Nintendo Entertainment System (NES)**, and **Super Nintendo Entertainment System (SNES)**, followed by the **Sony PlayStation** in the late 1990s. The most popular games in the early 1990s were ports of ***Mario*** *Bros.* (1983), *Super Mario Bros.* (1985), ***The Legend of Zelda*** (1986), and *Sonic the Hedgehog* (1991). Foreign game companies are starting to take an interest in the African market (for example, international game developer Ubisoft has an office in Casablanca, Morocco), and more recently, there have been games created in the West that are set in Africa, such as *Pamoja Mtaani* (2008) developed by Warner Brothers Studios in the **United States**. The game is about educating the youth on HIV and AIDS and is in Swahili (the native language spoken in Kenya; the game's name translates as "Together in the Hood").

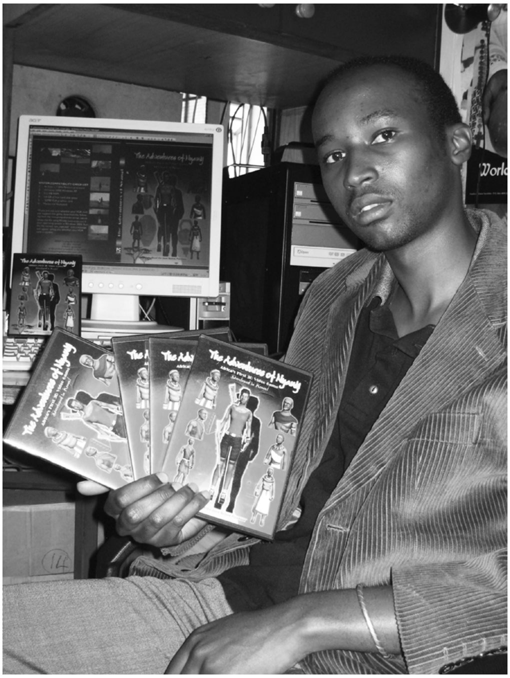
Indigenous video game development started emerging around 2004 to 2006, particularly in the home computer and mobile computing sectors. Countries where video game development is taking root include South Africa, Kenya, and Ghana.

South Africa has a website dedicated to video game development, www.sagamedev .co.za. Small game development studios are emerging in South Africa and are usually linked to an animation company or a company in the entertainment **industry**. The development of **mobile games** has also begun. South African game companies include Luma Arcade, the makers of *Mini#37* (2007) and *The Harvest* (2010) as well as mobile games and **advergames**, and Open-Reset Studios, the makers of *Bounty Arms* (2010).

Ghana does not yet have a video game development community, but one game designer, Eyram Tawia, whose background is in the writing of **comics**, has made a three-dimensional home **computer game** titled *Sword of Sygos* (2005), based on Greek mythology.

Kenya, similar to Ghana, also does not yet have a video game development community, although there are people interested in the field. I am the first Kenyan to develop a commercial video game with three-dimensional **graphics**, and I am the first African to develop a commercial video game with three-dimensional graphics from scratch—that is, developing all the **game engines** besides the rendering engine (OpenGL/Direct X).

The first video game I developed is called *Adventures of Nyangi* (2007). It took me two years of research and two years of full-time development (more information about it is available from www.sinc-studios.com). I finished the game in 2006 and began selling it in 2007. I sold the game to determine whether there is a market for games I would develop in future. I received a lot of interest in the game. The game was not as complete as I wanted, and therefore I began developing another version of the game; however, I did not complete that version.



Wesley Kirinya and his computer game, *Adventures of Nyangi* (2007). (Wesley Kirinya)

I founded Sinc Studios when I was about to complete *Adventures of Nyangi* (2007). There are few game developers in Africa, so it was basically a one-man army. My vision was to develop a full game company. Although I never realized this dream with Sinc Studios, I'm working on it now at my new company, Leti Games.

There were other game development studios in Africa before Sinc Studios, but they were all very small (for example, Eyram Tawia's company in Ghana, which was called BlackSoft Developers, no longer exists). However, Sinc Studios was unique in that I envisioned creating games from the ground up unless there were compelling reasons to use premade game engines, as is the case with the other game development companies that existed. I believed that by understanding the underlying mechanics at all stages of development, Sinc Studios would be in a position to create innovative games.

Sinc Studios was fully funded by me. At a later stage, I gave up some shares for funding. However, the game we planned to develop never took off, and we decided to close the company. This is also the time when I decided to venture into B2B-type software development.

I got to meet Eyram on a blog about the game I had developed. We kept in touch and finally met in 2008. We also met a businessman and game enthusiast who had developed a mobile game, and we all agreed to start a full-time video game development company. We founded the company, Leti Games, in April 2009. So far we have developed one commercial game for the iPhone titled *iWarrior* (2009), and *Kijiji* (2009), a mobile phone port of *iWarrior*. We have ported the game to some mobile phones; however, as of April 2012, we have not released them yet.

Most of the video games that will be developed from Africa will be on mobile and web **platforms**. Cutting-edge home computer and console games are expensive to develop and require expertise that is not available in Africa.

Wesley Kirinya

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AI

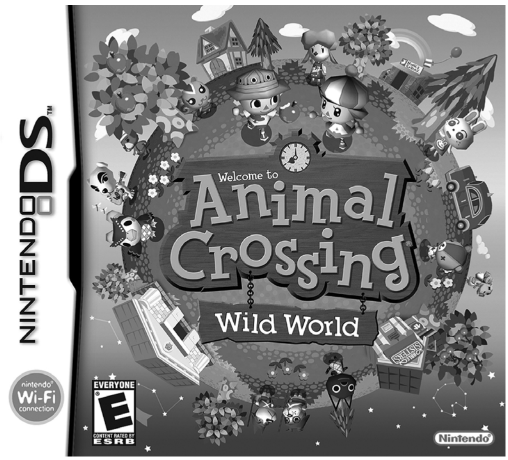
See artificial intelligence

Animal Crossing series

The *Animal Crossing* series games are video games from **Nintendo**. As of 2012, the series included *Animal Crossing*, the 2002 **Nintendo GameCube** title (the Japanese version, *Dōbutsu no Mori*, was released in 2001 for the **Nintendo 64**); *Animal Crossing-e*, a series of Nintendo e-Reader cards for the **Game Boy** Advance; *Animal Crossing: Wild World* (2005) for the **Nintendo DS**; *Dōbutsu no Mori*, the 2006 film based on the game series and directed by Jōjin Shimura (exhibited only in **Japan**); and *Animal Crossing: City Folk* (2008) for the **Nintendo Wii**. A fourth game is currently in development for Nintendo's 3DS **handheld game** system.

The *Animal Crossing* games are social networking games that emphasize interactions between **non-player-characters (NPCs)** and other players. There is also a strong emphasis on collecting and purchasing numerous game items. The games are set in a town of animal characters. The player is a human character that moves into town and interacts with the NPCs. There are anthropomorphic dogs, cats, eagles, tigers, octopuses, and more that move in and out of the village. If the player does not interact with a particular character, it will eventually become dissatisfied with living in the village and move away. Game activities include catching fish and insects, collecting shells, pulling weeds, planting flowers and trees in the village, digging up fossils, talking to neighbors, buying and selling furniture and other items, and participating in seasonal events. Although there are a number of suggested goals in the game, players are not required to complete any of them.

When the player begins a new *Animal Crossing* game, he or she needs a place to stay in the village. The local merchant, Tom Nook, offers to loan the player the money needed to purchase a house. Because the player begins the game with no money, this means taking on mortgage debt. Tom Nook loans the player the necessary money but insists the player work in his store to begin paying off the debt. This period of servitude is used to introduce the player to the game world and characters. After it is



Animal Crossing: Wild World (2005) for the Nintendo DS. (PRNewsFoto/Nintendo) completed, much of the debt still remains, but Nook allows the player to pay it back slowly (or even not at all). In addition to sending letters and talking to the other characters, the player is often asked to perform certain tasks, such as returning a borrowed item or catching a certain kind of fish or insect. Upon completion of the task, the player receives a gift of bells (the name of the in-game currency), stationery, clothing, or furniture. The player is also invited to donate items to the village museum, called the Farway Museum, and participate in a number of holiday celebrations, festivals, and other events. The variety of items in the game is surprisingly vast, and the kind of player to whom this game appeals is one who enjoys finding new clothing designs or new kinds of furniture. There is no way to win the *Animal Crossing* games, and thus the game is potentially never-ending.

One of the game activities is to catch and collect the myriad insects, fossils, fish, and paintings available in the game. These items can be donated to the town museum, sold to Tom Nook, or used to decorate the player's house. The curator of the Farway Museum is an owl named Blathers. The museum has four wings devoted to displaying fish, insects, fossils, and paintings, which players can peruse and interact with as they gradually fill out the displays. Completing the museum makes the town more attractive to visitors. Although the Farway Museum only accepts a limited number of objects, players can furnish and decorate their house with any of the thousands of items available in each *Animal Crossing* game. Each player has a house that can be expanded to have several different rooms. The player can choose the carpet and wallpaper for each room and install furniture, pictures of the other characters, and a myriad of other items. There is an organization called the Happy Room Academy (HRA) that judges the player's arrangement of furniture and assigns the furniture layout a certain number of points (from 0 to 100,000). After achieving a house design of 70,000 points, the HRA gives the player a "House Model," and on reaching 100,000 points, a "Manor Model." These are miniature models of town locations given as a reward for winning competitions or completing special tasks. The HRA encourages matching items by color or **design**, but there are also "luck" items like the "**Mario** Trophy" that bring the player good luck during game events when displayed in the player's house. Additionally, by arranging items according to a simplified feng shui philosophy, the player will earn more points from the HRA and have better luck obtaining bells and other items.

The games are rated "E" for everyone and are suitable for all ages. The only skill requirement is an elementary school–level reading ability, but the games are notable for their appeal to teens and adults as well. *Animal Crossing* games operate in real time, meaning that not only does an hour of game time take an hour of real time to **play**, but time continues to pass in the game world even when the game is turned off, and the seasons change accordingly.

One of the defining characteristics of the *Animal Crossing* games is their emphasis on social interactions between players and game characters. Ian Bogost has noted that "like ***The Sims*** (**Maxis**, 2000), *Animal Crossing*'s primary metaphors are social interaction and household customization"

(Bogost, 2004, p. 10). The games are often categorized as social **simulation games** as a result. Nintendo promoted the series as "communication games" because much of the gameplay consists of talking or writing letters to the characters in the game. For Bogost, the *Animal Crossing* games are also an example of an "asynchronous multiplay" game, in which multiple players participate in the same game but not at the same time. The game world continues to change even while a particular player is not playing. The multiplay aspect of *Animal Crossing* is optional but strongly encouraged in the game. For example, the NPCs will often complain about wanting to meet new people if the same player's character is consistently the only one they interact with. If a particular player has not used *Animal Crossing* for a while, the NPCs will ask about them by name to any players who do continue to play.

Jesper Juul also observes that the social relations between players is one of the unique features of the series, "although only one player can play the game at a time, it allows members of a family (for example) to play at different times but then to send messages and gifts to each other, which are received the next time a recipient plays" (Juul, p. 123). Juul discusses the short **Korean** animation *Animal Crossing Is Tragic* (http://loliel.egloos.com/2023210) as an example of a meaningful **emotional** experience catalyzed by the *Animal Crossing* game. This short cartoon tells the story of how the narrator introduced his mother to *Animal Crossing* because she was largely housebound as a result of illness. The mother spends hours playing the game and locating items she can mail to her son's character through the *Animal Crossing* post office. After the mother dies, the narrator returns to *Animal Crossing* to find his character's mailbox full of letters and gifts from her. As Juul has observed, this system of messaging and gift giving in the *Animal Crossing* games means that much of the meaning is derived from the context of the players' lives. Because individuals play the game at different times, it means the mother in this example can send messages to her son "from beyond the grave, so to speak" (Juul, p. 124). This gives the messages an emotional resonance that is dependent on the specific circumstances of the players' lives.

The *Animal Crossing* games each have active fan communities where players interact with each other, trade game secrets, exchange passwords to visit each other's towns, make new friends, and discuss issues related to the game. Many of these fan communities are based around websites such as *Animal Crossing Ahead* and *Animal Crossing Community.*

Features of the original *Animal Crossing* include the ability to put a second data card in the GameCube, allowing the character to visit the towns of friends. Players with a Game Boy Advance and GBA cable can visit Animal Island and obtain fruit, items, and clothing not available otherwise. One of the in-game items is a **Nintendo Entertainment System (NES)**. With the in-game NES, the player can find and play old NES games such as *Donkey Kong* (1981), *Balloon Fight* (1984), and more. The e-Reader scanner can be hooked up to the Game Boy Advance. The series of *Animal Crossing* e-Reader cards provides access to even more unique items.

In *Animal Crossing: Wild World*, the wifi capabilities of the Nintendo DS allowed Nintendo to expand the communication elements in the game. In *Wild World*, players can visit other villages from anywhere in the world by setting up wifi access and getting an invite code from a friend. The game includes some new locations such as The Roost (a coffee shop in the basement of the Farway Museum) and the Observatory. The game features even more collectible items and furniture than the previous version.

Animal Crossing: City Folk added a city location. The player can now take a bus from the village to the city, which has shops with more expensive items available for sale, a beauty salon, an auction house, a fortuneteller, the Happy Room Academy main office, and a theatre. The player character can get a makeover to look like his or her Wii Mii. Using the Wii Speak microphone allows players in different locations to chat with each other live while playing the game.

Kara Lynn Andersen

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apocalypse

Many of today's **violent** video games exhibit remarkable structural similarities to ancient Jewish and Christian apocalypses. Both video games and apocalypses are types of imagined otherworldly journeys, often with an interest in portraying events of the end times. Indeed, we can readily view video games as the most poignant site for contemporary renegotiation of the genre of apocalypse.

In 1979, specialists in the Society of Biblical Literature produced for the first time a definition of apocalypse, composed to set the stage for analysis of dozens of ancient Jewish and Christian texts, most of which did not make it into the Bible but were clearly important for communities living around the turn of the first millennium and suffering under Roman oppression. The definition marks an "apocalypse" as a type of **narrative** revealed by God, mediated by an otherworldly being, received by a human recipient, disclosing "a transcendent reality that is both temporal, insofar as it envisages eschatological salvation, and spatial, insofar as it involves another, supernatural world." That is, apocalypses involve supernatural figures that guide the human through the otherworldly journey, and they are often preoccupied with defeat of enemies in a cataclysmic judgment.

For example, in the noncanonical Jewish apocalypse *The Book of the Watchers* (probably second century BC), a seer goes on a journey through the heavens and the regions of future punishment and acquires heavenly knowledge through questions asked of an otherworldly mediator. Enoch sees "the stars and the lightnings" speeding by as "the winds in the vision caused me to fly and lifted me upward, and bore me into heaven" where he sees "a wall which is built of crystals and surrounded by tongues of fire" and "a tesselated floor (made) of crystals." On the ceiling, he sees "fiery cherubim" (1 Enoch 14). Later, he sees the gruesome punishment awaiting those who oppose God's will—a deep abyss of searing flame and torture.

Like apocalypses, video games invite players into a "**world**" accessible only through a video game **platform**. In video games, an "otherworldly mediator" often guides the player through tutorials, offers helpful hints at crucial moments, and helps the player achieve his or her goals in the game; for example, Link in the ***Zelda* series** and Cortana in the *Halo* series. Games even exhibit the characteristic dualisms of apocalypses in their frequent representation of the player-protagonist in a battle against fierce and deadly opponents with ultimate consequences. Apparently recognizing the rich potential of ancient apocalypses for video games, Ignition Entertainment is currently working on a video game based precisely on the otherworldly journeys of Enoch in *The Book of Watchers*.

Apocalypses and video games also both exhibit a form of what Ian Bogost calls "**procedural rhetoric**," those "processes [that] define the way things work: the methods, techniques, and logics that drive the operation of systems" (Bogost, 2007, p. 3). In Jewish and Christian apocalypses, God is the "programmer" and his "logics" are understood through apocalypses, which provide an ideological template for how to understand life on earth under Roman rule. The procedural rhetoric of apocalypses encourages readers to wait for God's imminent intervention in human life and his victorious and likely violent destruction of their enemies. The passivity encouraged for ancient hearers of apocalypse is one of the most marked differences between these ancient stories and today's games. The occasional Jewish or Christian apocalypse does depict human beings enacting judgment, but more typically, it is *God*, not humans, who is in control of salvation and will intervene to end his people's suffering at the hands of their enemies. In other words, if there is a final showdown with weapons and huge explosions, it will be God pulling the trigger, not us.

In video games, by contrast, agency is situated squarely with the player, who may rely on guides for assistance but ultimately enacts salvation by himself or herself, often in dramatically violent form. We see this contemporary shift even in *Left Behind: Eternal Forces* (2006), the Christian-produced **computer game**. Despite its assumption of God as in charge of the unfolding end of the world, in *Left Behind*, it is up to *humans alone* to enact his charge on earth. The same human-powered messianic impulse is evident in almost all first-person **shooting games**, perhaps because in many video games there is no overarching divine power. Instead, the player is a singular messianic figure called on to save the world.

What can we make of this important difference? Ancient apocalypses were probably not read as games and thus had a lot more ideological teeth. By depicting the cosmos as subject to God's rules and shaped by God's own predetermined design, apocalypses can be viewed as the *ultimate* game, shaped by the *ultimate* procedural rhetoric. This means that for these Jews and Christians, there was only one "world" to save—our own—and God is the hero holding the gun. In today's video games, we are more likely to see ourselves as imagined gods in control of our own fate. We are also more likely to see the "world" that we save in virtual **space** as of no real consequence to our daily lives. For most secularized game-players today, neither the imagined apocalyptic spaces of antiquity nor the virtual spaces of video games have any necessary bearing on our offline lives, which are markedly less certain, less fated, and less scripted.

Rachel Wagner

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Arakawa, Minoru (1946–)

Minoru Arakawa, the second son of a millionaire family, was born in Kyoto, **Japan**, on September 3, 1946. He founded **Nintendo** of America (NOA) in 1980 and served as CEO through 2002. His father was a textile wholesaler, and the total real estate of his father's family and his mother's family combined was up to about one-fifth of the downtown district in Kyoto. He graduated from the Architecture Department of Kyoto University in 1969 and attended graduate school at the same university. After that, he attended graduate school at the Massachusetts Institute of Technology School of Architecture. In 1972, he joined the Marubeni Corporation and was assigned to the overseas construction and development department. On Christmas 1972, he met Yoko Yamauchi at a family party and later married her. She was the daughter of Yamauchi Hiroshi, the CEO of Nintendo at that time. In 1977, he moved to Vancouver, **Canada**, with his family for a condominium construction project and was very successful with the project. Upon returning to Kyoto in 1980, Yamauchi Hiroshi offered him the CEO position at NOA, and he accepted the chance to test his ability with a big challenge. After resigning from Marubeni Corporation, he founded NOA in New York.

Minoru Arakawa, founder of Nintendo of America, lounges on a chair modeled after Nintendo's Mario in 1993. (Alan Levenson/Time Life Pictures/Getty Images)

In December 1980, Arakawa started his first enterprise at NOA, the importation of *Radar Scope* (1979), an early arcade game from Nintendo, although not their first. On the basis of the successful results of user testing, he ordered 3,000 units from headquarters. This resulted in a big failure, however, and 2,000 units went back into inventory. With an overstock of *Radar Scope* occupying the warehouse, Arakawa decided to use the game's ROM and convert it into another game, but the main development team in Kyoto didn't have time to make the game. This task was finally assigned to a new employee, Miyamoto Shigeru, and the game he developed became *Donkey Kong* (1981). *Donkey Kong* was an enormous success and sold about 60,000 units, with sales amounting to about $100 million. The following year, Arakawa moved the NOA office to Seattle.

In 1985, Arakawa introduced the **Nintendo Entertainment System (NES)** in the **United States** and sold 30 million units by 1990. Also, in 1989, he succeeded in obtaining the rights for ***Tetris*** (1985) and bundled it with every **Nintendo Game Boy**, selling more than 33 million units. On January 7, 2002, Arakawa resigned from the position of CEO of NOA and founded a mobile content provider called Blue Lava Wireless and sold it to JAMDAT Mobile. In 2006, he founded the Tetris Online Company with Henk Rogers and Alexey Pajitnov, the creator of *Tetris*.

Taiyoung Ryu

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arcade games

Arcades and arcade games existed long before video games appeared. Pinball games and other **electromechanical games** used motors, switches, relays, and lights to create fast-action coin-operated games for players. Some came in upright wooden cabinets with their control panels below a viewscreen, a design that arcade video games would emulate. Because of all their moving parts, electromechanical games often broke down, frustrating arcade operators and reducing profits. The **industry** was looking for a way to make more reliable games.

Companies like Gottlieb, **Bally**, **Williams**, **Midway**, **SEGA**, and Allied Leisure all made electromechanical games before joining the video game **industry**. One such company, Nutting Associates, had an employee, Nolan **Bushnell**, who suggested making an arcade game from the mainframe game ***Spacewar!*** (1962). The result was ***Computer Space*** (1971), which appeared in both one- and two-player versions. The game was electronic instead of electromechanical, but its controls were more complex than other games of its day, and it did not do well. Bushnell left Nutting to start **Atari**, and his next game was ***PONG*** (1972), a table-tennis game similar to that of the **Magnavox Odyssey**. *PONG* was successful and helped launch arcade video games, which soon became the main kind of game found in arcades. For the majority of the public, arcade video games were their first exposure to video games and to computer technology itself. Arcade video games set the standards and established many of the conventions used in later games, for a long time leading the way as a benchmark.

An Expanding Industry

PONG's success encouraged other companies to produce games, and in 1973 more than two dozen arcade video games appeared, many of which were imitations of *PONG*, and even Atari came out with more versions of *PONG*. Magnavox sued Atari for copying its game, and the companies settled out of court. Atari also innovated two new game forms in 1973: a maze game, *Gotcha*, and a space **racing game**, *Space Race*, which was licensed to Midway under the name *Asteroid*. Other games of the year included Chicago Coin's *TV Pin Game*, the first video pinball game; Nutting Associates' **shooting game**, *Missile Radar*; and a code-breaking game, *Watergate Caper*.

Ball-and-paddle games continued to appear through the mid-1970s, and other **sports games** were adapted into arcade games. In 1974 alone, there were adaptations of volleyball (*Rebound* and *Spike*), basketball (PMC's *Basketball*, Taito's *Basketball*, and Midway's *TV Basketball*), soccer (*TV Goalee*), duck hunting (Atari's *Qwak!*, which featured a light gun), and racing (Atari's *Gran Trak 10*, which featured a steering wheel and was one of the first games to use a form of read-only memory [ROM]). The use of ROM in games such as *Tank!* (1974) allowed improvements in **graphics** that in turn gave games more variety, moving them away from the simple blocks or lines that were used to represent everything on the screen. One ball-and-paddle game, Exidy's *TV Pinball* (1975) advertised in its flyer that the "GAME PLAYS ITSELF to attract attention when not in use"; this came to be known as an "attract mode" and was commonly used in arcade games by the 1980s.

In the mid-1970s, driving and racing games became popular, and at least a dozen of them were released, including Exidy's *Death Race* (1976), the first video game to become controversial due to its use of **violence**. Many of these games had steering wheel **interfaces**, some had foot pedals, and two-player games featured two sets of **controllers**. Two single-player games, Midway's *Racer* and Atari's *Hi-Way*, both had seats for the player to sit on while playing to simulate the experience of driving, and Kee Games's eight-player *Indy 800* had a steering wheel and two pedals for each player, all arranged in a square with the screen in the middle. Some motorcycle driving games, such as Atari's *Stunt Cycle* (1976) and Digital Games Incorporated's *Heavy Traffic* (1976), had handlebars instead of steering wheels. One motorcycle game, SEGA's *Fonz* (1976), had handlebars that vibrated during collisions, an early example of haptic feedback in a video game. Most of the other arcade games of the mid-1970s were sports-related, including billiards, skiing, pinball, baseball, football, bowling, boxing, and shooting games, some of which had either mounted or tethered guns that players used as part of the interface.

Besides new interfaces, other technological advances appeared in the mid- to late 1970s. Ramtek's *Trivia* (1976) stored 2,000 questions on an eight-track audiotape, allowing operators to change the tape and load new questions, an idea that would later be revisited by the **DECO cassette system** in the 1980s. Kee Games's *Super Bug* (1977), a driving game, had a Volkswagen Bug that stayed on-screen while the background moved behind it, in all four directions (up, down, left, right), making it very likely the first video game to feature **scrolling**. Another advance that appeared in 1977 was the new type of graphics used by **vector games**, which produced its imagery using line segments rather than raster graphics; for example, **Cinematronics**' *Starhawk* (1978), Atari's *Asteroids* (1979), and Vectorbeam's *Warrior* (1979). More games were using color graphics, and **Namco**'s *Galaxian* (1979) was the first game to have all of its graphics in true RGB color.

The 1970s ended with two hit games that ushered in the golden age of arcade video games. ***Space Invaders*** (1978) was made by Taito and licensed to Bally/Midway for release in the **United States**, and it was so popular in **Japan** that it caused a shortage in 100-yen coins. Another game that originated in Japan, *Puck-Man* (1979), was renamed and released as ***Pac-Man*** (1980) and became one of the biggest moneymakers in the arcade; *Pac-Man* and another hit game, ***Defender*** (1980), would each go on to take in more than a billion dollars in revenue. The same year saw the release of Atari's ***BattleZone*** (1980), the first arcade game in which the environment was produced with true three-dimensional computation, and Cinematronics's *Rip Off* (1980), a game with **cooperative gameplay** in which players had to work together rather than against each other.

By the start of the 1980s, the video game had replaced pinball as the dominant game of the arcade, and in 1981 ***Play Meter* magazine** estimated that there were 24,000 full arcades, 400,000 street locations, and 1.5 million arcade video games in operation. Arcade video games also innovated several forms of cabinet designs. Although most came in the upright, standalone cabinet pioneered by earlier arcade games, some sports games came in the "cocktail" style cabinet, which set the screen facing upward in a small table that players sat around and on which players could place their drinks. Driving and racing games sometimes came in "ride-on" consoles that the player sat on while playing, and Exidy's *Star Fire* (1979) was the first game to have an enclosed cockpit (although an upright version was also released), and it was also the first game to feature a high-score table with players' initials.

The boom continued into the next two years, which saw the release of *Tempest* (1981), *Qix* (1981), *Frogger* (1981), *Centipede* (1981; the first arcade video game designed by a woman), *Robotron 2084* (1982), *Dig Dug* (1982), *Pole Position* (1982), *Zaxxon* (1982), and **Nintendo**'s first successful arcade game, *Donkey Kong* (1981). But starting in 1982, many games were released that were sequels, such as *Baby Pac-Man*, *Pac-Man Plus*, *Super Pac-Man*, *Donkey Kong Jr.*, *Missile Command 2*, *Frenzy* (a sequel to *Berzerk*), and *Millipede* (a sequel to *Centipede*), suggesting that the industry was relying more and more on past successes, and beginning to stagnate. By the end of 1982, arcade profits were dropping, distributors of arcade games were overstocked, and the great video game industry **crash of 1983** soon brought an end to arcade video games' golden age.

Struggling to Compete

Although the number of arcades had peaked at about 10,000 arcades in 1982 (Wolf, 2007, p. 105), more than 2,000 of them would close in 1983 as the crash worsened. One attempt to rejuvenate the industry was **laserdisc games**, such as *Dragon's Lair* (1983), which brought full-motion video (FMV) into arcade games but with reduced interaction as a result. Laserdisc games were far more expensive to produce than other games, and in the end they failed to live up to the hype and expectations. Another technical advance introduced to the arcade was filled-polygon three-dimensional graphics, in which objects were solid and colored, unlike the wireframe graphics of vector games, where objects were defined as a series of outlines. Atari's ***I, Robot*** (1983) was the first arcade game to feature such graphics, but the level of computing power available resulted in a rather simplified and abstract setting, in which a robot moved around a blocky three-dimensional structure, changing the color of the surface it passed over. The game failed commercially, and filled-polygon graphics would not return until the late 1980s, when more computing power was available.

Unlike the period of 1978 to 1982, which saw the release of many games now considered classics, the rest of the 1980s saw far fewer arcade games of note. Nintendo's *Mario Bros.* (1983) and *Super Mario Bros.* (1985) started its ***Mario* series** of games, and Atari's *Crystal Castles* (1983), *Star Wars* (1983), and ***Tetris*** (1988) were popular, as well as Gottlieb's ***Q*bert*** (1983). Also, Atari Games' *Gauntlet* (1985) had an interactive environment that multiple players could experience simultaneously. But many games were sequels hoping to cash in on their predecessors' successes, including *Discs of Tron* (1983), *Donkey Kong 3* (1983), *Pole Position II* (1983), *Galaga 3* (1984), *Dig Dug II* (1985), *Pitfall II: The Lost Caverns* (1985), *Return of the Invaders* (1985), and more *Pac-Man* sequels including *Jr. Pac-Man* (1983), *Pac & Pal* (1983), *Pac-Man & Chomp Chomp* (1983), *Professor Pac-Man* (1983), and *Pac-Land* (1984).

As players tired of games, income fell, and replacing arcade games was expensive and cumbersome. Systems came into use that allowed arcade operators to change games, much as home game cartridges allowed many different games to be played by the same system. Data East's DECO Cassette System, introduced in 1981, used magnetic tape cassettes with game programs on them, although in the end the tapes were not as reliable or durable as operators had hoped. Nintendo's "Vs. System" (also known as the UniSystem [single-player games] or DualSystem [for two-player head-to-head games]) was a version of the **Nintendo Entertainment System (NES)** with some additional arcade game hardware; home games were starting to catch up to arcade games as new **generations of technology** emerged. Other companies also developed their own arcade game systems, including Atari Games's Atari System 1 in 1986, **Capcom**'s CP System 1 in 1988, **SNK**'s **Neo•Geo** MVS in 1989, and **SEGA**'s Mega Tech System in 1989. These interchangeable systems also changed the look of arcade games. Because a variety of different games would use the same cabinet, the cabinets were often bland and lacked the colorful artwork that appeared on dedicated cabinets.

An industry-wide standard for interchangeable hardware also came into use. With Nintendo's rise, Japan became a center of video game production, and in 1982 the Japanese Arcade Machine Manufacturers' Association (JAMMA) was begun. Around 1985, JAMMA introduced a wiring standard for arcade machines, known as the JAMMA conversion class, which became the standard used in Japan as well as many American game companies. All games using the **JAMMA standard** could be converted from one to the other by changing the printed circuit boards inside. As the interchangeability of the games made piracy more of a threat, some companies, including SEGA and Capcom, used what are now called "**suicide batteries**," which supplied power to a small amount of RAM that held a decryption key needed to decode the program code in the game's ROM. When a battery died, the RAM was erased, and without the decryption key, the game could no longer run.

By the early 1990s, it was clear that the industry would probably not return to the heights of its glory days before the crash. Like the 1980s, the 1990s saw a large number of sequels, variants, and series games produced. Certain genres flourished, including vertically-oriented shooting games, fighting games (like the ***Street Fighter*** series, ***Mortal Kombat*** series, and *Tekken* series), puzzle games (many of which were ***Tetris*** clones), and mahjong games, which were popular in Japan. Home video games were starting to provide vigorous competition, and, to stay ahead of them, arcade games would have to provide things that home games could not, such as cockpit games that the player sat in or hydraulic systems that moved and shook players as they played, like those of *After Burner* (1987) and *After Burner II* (1987). The number of three- and four-player games increased dramatically, some six-player games were produced, like SEGA's *Hard Dunk* (1994), Atari Games' *T-Mek* (1994), Konami's *X-MEN* (1992), Namco's *Galaxian 3* (1990), and *Attack of the Zolgear* (1994); and racing games such as Namco's *Final Lap 2* (1991), SEGA's *Daytona USA* (1994), and *Manx TT Superbike Twin* (1995) could accommodate up to eight players when the cabinets were networked together. One game, *Daytona USA 2: Power Edition* (1999), could network up to 40 players.

Specialized interfaces also continued to add to the gameplay experience, like the sit-in car seats, steering wheels, and motorcycle handlebars in driving and racing games. Namco's *Driver's Eyes* (1990) had a panoramic image spread over three video monitors extending into the player's peripheral vision, and *Lucky & Wild* (1993), a two-player cooperative game, combined interfaces and had a steering wheel, foot pedal, and two mounted guns. Games simulated a variety of vehicles, including planes (*Landing Gear* [1995] and *Airline Pilots* [1999]), an excavator (*Power Shovel Simulator* [1999]), a motorboat (*Powerboat Racing* [1998]), a train (*Densha De Go! 2* [1999]), a pedaling bicycle (*Prop Cycle* [1996]), a hang glider (*Hang Pilot* [1997]), water scooters (*Aqua Jet* [1996] and *Wave Runner* [1996]), and even a horse (*Final Furlong* [1997]). Players stood on a moving interface in games that simulated skateboarding (*Top Skater* [1997]), snowboarding (*Alpine Surfer* [1996]), and skiing (*Alpine Racer* [1995], *Alpine Racer 2* [1997], and *Ski Champ* [1998]). Sports games sometimes included game balls in their interfaces, for sports such as soccer (*Football Power* [1999] and *Kick It!* [1997]), bowling (*Family Bowl* [1998]), and billiards (*Super Strike* [1990] and *Slick Shot* [1990]). Other sports had specialized interface devices like boxing gloves (*Sonic Blast Man* [1990]), a robotic arm (*Arm Champ* [1988] and *Arm Champ II* [1992]), or a fishing rod (*Angler King* [1990], *Sport Fishing* [1994], *Sport Fishing 2* [1995], *Get Bass* [1998], and *SEGA Marine Fishing* [1999]).

New interface devices could even start new genres, such as **rhythm and dance games** in which players coordinate their movements to music; Konami produced so many that they had a separate division, Benami games, to produce them. These games' interface devices included miniature drumsets (*Drumscape* [1990] and the *DrumMania* series), pianos and DJ turntables (the *Beatmania* series), guitars (*Guitar Jam* [1999] and the *GuitarFreaks* series), and a pressure-sensitive dance floor (Konami's ***Dance Dance Revolution*** [1998], 16 versions of which appeared from 1998 to 2006). Two **virtual reality** games with head-mounted displays appeared; *Dactyl Nightmare* (1992) and *Virtual Combat* (1993). But while the 1990s saw some innovative hardware, it was changes in software, particularly game graphics, where home **console-based games** were catching up and raising players' expectations, which would have to be met if the arcade was to continue.

True three-dimensional graphics began appearing with more regularity in the early 1990s, when sufficient computing power finally became available, and they were used typically in racing games (such as *Driver's Edge* [1994] and *Ridge Racer 2* [1994]) and **fighting games** (like *Virtua Striker* [1994], *Soul Edge* [1995], and the *Tekken* series). But competition with home game systems continued, and the mid-1990s release of the **Sony PlayStation**, the **SEGA Saturn**, and the **Nintendo 64** helped to narrow the gap even further. As more powerful home consoles appeared, arcade games would decline even more in popularity.

The Decline of the Arcade

Just as video games displaced pinball games in the 1970s and early 1980s, video games were starting to become displaced by redemption games during the 1990s, as operators began to believe that they would be more profitable. Redemption games involved some sort of skill (like Skee-ball) and paid out in tokens or tickets that players could redeem for prizes (hence the name "redemption"). Redemption games typically had shorter play times than video games and were more family-friendly because they did not have the reputation for being violent that many video games had. Just as there were a few hybrid pinball/video games, there were hybrids combining video games and redemption games, including *Golly! Ghost!* (1991), *Bonk's Adventure* (1994), *Frantic Fred* (1998), and *Mallet Madness* (1999). Like the interfaces discussed earlier, these games, with their payouts, provided an experience that home games could not.

As the old style of arcade declined, the arcade changed into game centers, video game lounges, and "location-based entertainment" centers that also offered dining and socializing. During the 1990s, Namco opened a chain of Cyberstation Amusement Zones and produced game theatres that were small rooms in which a team of six people sat playing a game with large images projected on the walls by over a dozen projectors. In 1997, several well-known media companies opened chains of location-based entertainment centers, including Disney, Sony, Viacom, and SEGA, whose GameWorks was a joint venture with DreamWorks and Universal Studios. In Japan as well, the 1990s saw arcades being transformed into family-oriented *amyuuzumento sentaa* (amusement centers), trying to avoid the seedy image that arcades sometimes had.

Although few arcades remained in the early 21st century, the games themselves enjoyed a comeback as **collectibles** and nostalgia. Collectors bought old games, and in 1990 they started the **Video Arcade Preservation Society (VAPS)**. A number of resources such as the **Killer List of Videogames (KLOV)** offered game information. Several museums have featured arcade games in exhibitions, making them available to players, and **emulators** like **MAME (Multiple Arcade Machine Emulator)** try to digitally recreate the games on personal computers. Arcade games continue to influence the video game industry that they began and introduced to the public, paving the way for all the other branches of the industry to come.

Mark J. P. Wolf

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arcades

Arcades are commercial venues that feature coin-operated devices such as video games, pinball machines and other **electromechanical games**, and merchandiser and redemption games. Contemporary arcades consist of rows or clusters of these devices. Electronic **arcade games** are usually housed in colorful cabinets that may include a screen, **controllers**, and coin or paper currency slots. The existence of arcades dates to the late 19th century when such venues were established in European and North American cities to exhibit and profit from new inventions such as the phonograph, mutoscope, and kinetoscope. The **history** of arcades is characterized by several boom and bust cycles. The popularity of pinball machines revived the arcade business in the 1930s and 1940s, and arcades saw a revival again in the 1970s with the emergence of electronic games, particularly video games.

Amusement arcades are not synonymous with the shopping arcades that also emerged during the 19th century, but their histories overlap in significant ways. The shopping arcades that were built in **Europe** and the **United States** during the early decades of the 19th century were, in form and content, the product of industrialization. The arcades, enclosed passageways between buildings, used new glass and iron construction and were lined with plate-glass store windows that artfully displayed the latest mass-produced consumer goods. The store windows in the arcades often featured automatons and other novelties to cash in on the rage for all things mechanical. Similarly, merchants used new musical recording and early cinematic devices to attract customers. Arcades merged mechanical spectacle with the spectacle of consumption. By the end of the 19th century, as department stores began replacing arcade merchants, the passageways were increasingly used exclusively for the exhibition of the new mechanical inventions.

At the beginning of the 20th century, stand-alone businesses featuring coin-operated phonographs, film-showing devices like the mutoscope, coin-operated bagatelle machines, and early pinball games, became successful in and out of the shopping arcades. By 1905, companies such as the

Sergeant George Camblair plays a pinball machine at the post exchange in Fort Belvoir, Virginia, in September of 1942, the same year that Mayor Fiorello Henry LaGuardia banned pinball in New York City. (Library of Congress)

Automatic Vaudeville Company operated dozens of such penny arcades in the major cities of the Northeastern United States. These arcades, however, went into decline when film exhibition moved away from single-viewer coin-operated devices to projection on a screen in front of an audience in a theater.

In the 1930s, during the Depression, arcades reemerged as venues for low-cost entertainment featuring electric coin-operated pinball machines. The game *Ballyhoo*, invented by Raymond Maloney, kicked off the craze. Maloney went on to create the **Bally** Manufacturing Company in Chicago, which became a major video game manufacturer. The success of pinball parlors was dampened a bit in the postwar era after pinball machines were outlawed as gambling devices in some jurisdictions in the United States. Most famously, New York City Mayor Fiorello Henry LaGuardia banned pinball in the city in 1942. The ban lasted until 1976.

During the 1970s and 1980s, arcades were integral to the emergence of video game culture. The first arcade video game was ***Computer Space*** (1971), a coin-operated version of the **mainframe game** ***Spacewar!*** (1962), developed by Nolan **Bushnell** for Nutting Associates. Shortly after its release, Bushnell founded the company **Atari** and released ***PONG*** (1972), an arcade version of an electronic tennis game. Companies such as **Midway Games**, Atari, **SEGA**, **Coleco**, and Bally distributed coin-operated video games to bars, restaurants, and arcades. The popularity of the games led to a boom in the arcade business. The game manufacturers themselves backed many arcades. For example, Bushnell started the chain Chuck E. Cheese's Pizza Time Theatre in 1977 to combine arcade games with a sit down dinner and animatronic show. Chains such as Time Out, Aladdin's Castle, Cyberstation, SpacePort, Diamond Jim's, and Pocket Change operated thousands of arcades. Many of these chains were or currently are owned by the Japanese gaming company **Namco** Ltd.

Although home gaming systems entered the market in 1972, the quarter-fueled arcade games remained the only places where many people could afford to experience the medium. Arcades had other advantages over the home gaming systems of the 1970s and 1980s as well. They offered a constantly updated supply of state-of-the-art games, a social setting that allowed for multiplayer games played with strangers, and video game tournaments. Arcades catered to throngs of teenagers, especially boys, who gathered in them to try out the newest games and who used arcades as social spaces away from parents and teachers. In the United States, the venues were closely identified with suburban shopping malls, a type of development that was expanding during the same period and can be seen as the 20th-century version of the urban shopping arcade.

Video games in arcades continue the tradition of games on carnival midways, peep shows in penny arcades at the beginning of the 20th century, and pinball parlors in the 1930s. As such, they have been subject to similar debates about the moral character of their proprietors and patrons and about the appropriateness of such amusements for segments of the population that are deemed "impressionable" (historically, children, women, the working class, minorities, and immigrants). In the 1970s, the low lighting favored by many arcades contributed to similar concerns that they were not safe places for adolescents. Fearing the **violence** of video games, some suggested that arcades might have negative effects on teens and attract criminals. Others worried that the popularity of arcades and their proximity to schools would lead to truancy. Arcade owners changed the lighting and hired security guards to assuage these fears and to keep their adolescent patrons, but the stigma never fully receded. A home gaming market oversaturated with subpar games combined with improved and more affordable personal computers led to the industry-wide **crash of 1983**. More than 2,000 arcades closed that year alone. By the mid-1980s, the emergence of more sophisticated home gaming systems, such as the **Nintendo Entertainment System (NES)**, revived the home video game market, but arcades continued to languish throughout the 1980s and 1990s.

The history of video game arcades has been slightly different in **Asia** where the popularity of arcades remained fairly consistent throughout the 1970s, 1980s, and 1990s despite shifts in the global gaming industry away from arcade games and toward home gaming systems. Since 2000, however, arcades in Asia have been losing

SEGA's *Gunblade NY: Special Air Assault Force* (1995) (on the left), along with other arcade machines of the 1990s. (Jjspring/Dreamstime.com)

business to **on-line game** centers, which offer players computers and Internet access for popular **massively multiplayer on-line role-playing games (MMORPGs)**.

Currently, arcades in North America are not usually stand-alone businesses but rather a side attraction in a larger entertainment complex. In the United States, arcades can be found in the lobbies of large movie theaters, in shopping malls and casinos, and as part of "family entertainment centers" alongside go-kart racing and miniature golf. However, arcades continue to maintain relevance in global video game culture by offering elaborate **interfaces** for gameplay. Game cabinets designed like cockpits for flight **simulation games**, multiple screens, and controllers shaped like motorcycles that players ride in **racing games**, for example, provide immersive gaming experiences that are unique to arcades.

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art

The association between art and video games goes back almost to the beginning of the **history of video games**. Even though the **industry** arose from the conjuncture of military-industrial research and a blossoming **hacker** culture, programmers and early designers with aesthetic sensibilities took part in the early evolution of the medium, which shifted from a simple curiosity or computing experimentation to a specific design practice aimed to create singular interactive experiences. As demonstrated by the title of his famous book *The Art of Computer Game Design* (1982)—the first book of its kind—**Chris Crawford** was one of the earliest game designers to claim artistic means for video games and to insist that computer game design was an art form. From then on, debates about whether video games are art have been consistently reappearing in journalistic, practitioner, and scholarly discourses (see also **art, video games as**).

Notwithstanding this debate, many instances of art can be found in video game contents and forms. Paintings have influenced many game designers to create styles and aesthetic experiences different from the commonly known photorealistic simulations or caricatured and stereotyped stories that we find in most video games. For example, game designer Tetsuya Mizuguchi claimed that he was influenced by the Russian painter Wassily Kandinsky for the creation of the unusual **abstract** style in the game *Rez* (2001), a kind of hallucinogenic and kinetic **shooting game** surrounded by techno music that evolves according to the input of the player. The same can be said for the game *Echochrome* (2008), a puzzle game designed in accordance with the optical illusions of Escher's graphic art.

Other visual art styles have also influenced some designers to create beautiful and singular aesthetic experiences. **Capcom**'s *Okami* (2006) is a masterful action-adventure game strongly influenced by the art of Japanese calligraphy, but also by *ukiyo-e*, a woodblock prints style of painting mostly popular during the Edo period (1608–1868). Many other video games were influenced by Japanese traditional and modern visual art, such as games from the Japanese companies Atlus (*Shin Megami Tensei* series [1987–2009], *Baroque* [2008], *Eternal Poison* [2008]) or Vanillaware (*Odin Sphere* [2007], *GrimGrimoire* [2007], *Muramasa: The Demon Blade* [2009]), the latter specializing in two-dimensional sprite-based **game design**.

Even artists themselves have designed distinctive video games, such as the experimental artist Toshio Iwai, who created the **Nintendo DS** game *Electroplankton* (2005), a kind of music generator in which the graphics (mostly wave motions) help to generate new age music as the player touches the screen with a stylus. This interactive musical happening is arguably more a work of art than a video game. Such software is better categorized in the genre of *art games*, which are mostly works of art made by artists from a **game engine**, or those intended to be experienced as an artistic (and ludic) interactive encounter.

A strong community of artists has devoted their artistic practice to the creation of such artwork, including JODI, Cory Arcangel, Brody Condon, Anne-Marie Schleiner, Julian Oliver, and Eddo Stern. Many websites exhibit and analyze this art, the best-known ones being artificial .dk, selectparks.net, and rhizome.org. Reversing the relationship, video games can be used as the theme or the subject of art, an activity named *game art* (which is art inspired by game culture), as many game art exhibitions have taken place in museums and art galleries since the early 2000s. Thus, art and games have had a long-lasting relationship since the end of the 20th century, one that continues to grow and flourish.

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art, video games as

That the question is still asked as to whether video games can be art demonstrates the comparative youth of video games to other media such as **film**, **television**, photography, and so on, which were themselves the subject of debates as to their status as **art** when they were in their youth. Although the video game continues to develop and mature, its potential has already been made manifest enough for its status as an art form to be secured alongside older media that have proven themselves over the years.

By a very broad definition, “art” is a deliberate arrangement of elements that calls forth **emotions** and refers to human experience. But which emotions and experiences enhance the artistic value of a work depend on the way “art” is more narrowly defined, and by the end of 20th century, the scope of the term had widened enormously. The work of artists such as Marcel Duchamp, Andy Warhol, and Jeff Koons helped erode the dividing lines between high art and low art, commercial versus noncommercial work, and elitist versus popular tastes, making it difficult to find consensus as to how exactly “art” should be defined. It may be more useful, then, to consider the ways in which video games can become art, and the possibilities for artistic expression within them. Taking their cues from other media forms, video games can be considered as graphic art, as **time**-based art, as **narrative** art, and as interactive art.

Like other graphical media, video games contain a visual element that has run the gamut from minimalist **abstraction** to photorealistic representational imagery, and every conceivable graphical style can be adapted into video game imagery. Many games tend to gravitate toward certain themes and iconography (such as conflict and weaponry), incarnating established conventions more often than not, rather than seeking innovation. Such narrowness of vision is often the result of fiscally conservative companies afraid of taking risks, especially considering the increasing cost of game production and marketing. But a growing variety of authoring tools continue to open up **game design** to artists and individuals not bound by commercial concerns, and over time even industrial game development has broadened its stylistic scope and vision, as games like ***Riven*** (1997), *Rez* (2002), and *Echochrome* (2008) can attest.

Innovative **graphics** and artistic sensibility are most often found in the **experimental games** of independent developers and artists sojourning from other media, like Bill Viola and Mark Essen. And just as Roy Lichtenstein used comic book imagery as the subject of his art, video game imagery is likewise becoming the subject of art. Some artists are even using video game systems to produce art, like Julian Oliver's *ioq3apaint*, a drawing program using modified software bots and exploiting the z-buffer in *Quake III: Arena* (1999). The video game has already begun to find its way into the art world as subject matter, art form, and authoring tool, and it will continue to hybridize forms as digital convergence reconfigures traditional notions of art practice boundaries.

Like music, dance, theater, film, radio, and television, video games are also a time-based form of media that involves duration and change. Stasis, movement, transition, transformation, repetition, anticipation, interruption, and closure are some of the devices through which time-based art achieves its effects and retains audience engagement, and video games employ them all, using them in new ways unique to video games. The audiovisual nature of video games also allows them to include the material of other arts within them, such as music and full-motion video (FMV). Again, it should be noted that the video game's potential in the area of time-based art is still far from being realized because only a small number of games, such as *Blinx: The Time Sweeper* (2002), *Braid* (2008), and *The Misadventures of P. B. Winterbottom* (2010), actively foreground the temporal possibilities available to game designers.

Time-based art, by demanding an audience's ongoing attention for a definite duration, controls the pace of its revelation. Music, film, theater, dance, and so on, all withhold and release the experiences contained within them, drawing the audience into rhythms and building expectations, and then using these to reveal whatever point or idea they may have to make. Likewise, video games employ the same formal strategies and can achieve similar effects, although most games use them more for entertainment than contemplative purposes.

Video games can also become narrative art. As abstract games like ***Tetris*** (1985) and *Qix* (1981) have shown, video games need not involve any narrative content at all, but many games do contain at least a rudimentary narrative, which provides some context to a game's action. Although video games have not developed far enough that their narratives have the depth and insight of great literature, the narrative potential of the video game stands out as a rich vein waiting to be mined. Interactivity need not destroy a narrative's certainty and linearity, and even if multiple endings are available, they are all designed by the author who also determines how and when they will appear and what actions will lead to them. In many cases, player control is something of an illusion arising from apparent free will choices that are actually often either quite limited or have a minimal effect on the game's preordained narrative. In *Riven* (1997), for example, details making up the game's narrative and backstory are scattered throughout the world the game takes place in, and even in the very design of the **world** itself. Yet although the order in which the player encounters these details may vary, as well as the rate or degree to which they are able to reconstruct the backstory, the story itself does not change. There are multiple endings, but a single ending is privileged as clearly the desirable or "right" one that provides the most narrative closure (as is the case in many games). Player choice, then, is more about how the player encounters the story, not the rewriting of the story.

Even when there are multiple endings with no single ending favored by the author or the way a story is structured, or when a game is clearly open-ended in structure, this in itself is not enough to deny a work the status of art. Ambiguity has always been a part of art, and interactive fiction—also known as hypertext fiction and represented by works such as *afternoon, a story* (1990) by Michael Joyce or *Victory Garden* (1992) by Stuart Moulthrop—also involved user interactivity, ambiguity, and multiple endings but are still considered by many to be literature or art. Video games can provide the same kinds of experiences, and with audiovisual material added. In any form of narrative art, it is the narrative itself that is the greatest factor in determining the work's artistic value, and video games are certainly capable of containing narrative art, even though the potential for it still remains largely unrealized. Even stronger than the video game's capacity for narrative, however, is its capacity for interactivity, which is an essential element of it, whereas narrative is not.

In the 1960s, interactive art became a part of the American and European art worlds. Interactive art could involve electronic installations using video images or **sounds** based on the viewer's involvement or immersive walk-in installations and responsive environments that changed because of a viewer's actions or presence. The period of the 1960s and 1970s saw a great deal of experimentation in which art and technology was combined in collaborations that were constantly in search of new experiences. Electronic music, light shows, "happenings," artworks using live monitor images, and new computer technology provided the means through which interactive art debuted in museums. Some works, such as Myron Krueger's *VIDEOPLACE* (1970), were very much like video games in their design and playful forms of interaction. By the 1980s, when home computer technology appeared that artists could use without needing to collaborate with technicians, video games were widespread and already a part of the cultural landscape. As more artists began to incorporate computers into their artwork, video games and gamelike situations came with them.

Today, video games represent the pinnacle of interactive technology, and the interactive experiences they engender range from casual leisure entertainment to contemplative reflection and experimentation. The very **definition of "video game"** has itself been broadened by the fluid use of digital technology, specifically computer-generated imagery directed in real time by user control, to include productions in the areas of **virtual reality** and **augmented reality**, as well as proprietary inventions specific to individual art installations. From generative **game modifications** to video game performance art to mixed media installations, video games are being integrated into the art world, and stand-alone games are also being accepted as a form of interactive art.

Video games have found acceptance with younger generations of artists who grew up with them and who keep up with technological change and are more aware of the range of their capabilities. Video games provide another tool for artists that, like paint, film, or clay, can be used to create art or be used for other purposes that fall short of being called art. Whether they attain the status of art depends not on their own intrinsic material natures but on those who use them to wield, shape, and construct artwork that incarnates their ideas in material form.

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artificial intelligence (AI)

Artificial Intelligence (AI) in video games refers to algorithms that govern the behavior of computer-controlled agents designed to create meaningful interactions between the system and a human player. (This is a separate and distinct definition from AI seen outside of video games, and such as that used in computer science.) The most common form of video game AI is the control of computerized opponents who are designed to compete with the human player in a manner mimicking human behavior.

History

The first video games did not feature any form of AI; all action in the game was a direct result of human input. Early titles such as ***Spacewar!*** (1962) and ***PONG*** (1972) were entirely controlled by user actions and featured no computer agents, thus requiring two people to play.

In the 1970s, the first single-player games with enemy agents were created. These agents followed stored behavior patterns that dictated their movement and actions. Some of the more advanced agents would partially base their behavior on player actions. A noteworthy example of this behavior was the four ghosts in ***Pac-Man*** (1980). When pursuing Pac-Man, each of the ghosts obeyed a different rule set, with three of the ghosts basing their movement decisions on the player's location. This led to a complex cat-and-mouse maze chase and a sense of enemy personality.

Two of the main roadblocks to powerful video game AI are limited processing power and computer memory. As both improve, developers can create more complex and robust AI implementations. In 1997, a chess-playing computer, IBM's Deep Blue, bested a reigning world chess champion for the first time when it defeated Garry Kasparov in a highly publicized set of six games.

In recent years, increasingly sophisticated AIs have been developed to compete with and challenge players. The majority of modern video games feature AI in some shape or form: **fighting games** and **racing games** feature AI opponents with variable ability levels; platform games and puzzle games often feature enemy and boss AIs with set patterns; and real-time **strategy games** and **sports games** feature a large number of computer-controlled agents, each of which has its own goals and abilities.

Common Problems Solved with AI

The following are some of the problems typically tackled by video game AI. Many games feature agents that address multiple issues simultaneously.

Turn-based opponents: these types of AI agents are often employed in video game **adaptations** of **board games**. On each turn, agents strive to increase their chance of success while minimizing their opponent's based on some internal heuristic. Because of the nature of their implementation, AIs tend to fare much better at games with a smaller set of finite states. Relatively strong programs have been written to play Chess and Checkers, but currently there are no strong programs for playing Go, which has a much larger set of possible game states.

Path-finding: in movement-centered games, path-finding is frequently a critical aspect of AI implementation. Agents must **navigate** terrain in an attempt to find the shortest, fastest, or cheapest path from one point to another. Some games, such as *Desktop Tower Defense* (2007), feature path-finding as a core game mechanic.

Personality: a critical aspect of game AI is whether the agent feels like a person (as opposed to a computer system) to the user. Good AIs frequently take suboptimal actions, behave in a manner that is more focused on enriching the player experience rather than the AI's chance of "winning," or avoid actions that will result in "stupid" behavior. Well-implemented AIs can exhibit individual personalities that seem different from one to the next. A noteworthy example of an AI personality is the AI Director in *Left 4 Dead* (2008), which modifies enemy spawning to create a tense atmosphere and keep the gameplay exciting.

Learning: learning algorithms can change an agent's future behavior based on past events. *Nintendogs* (2005) used learning algorithms to dictate the behavior of the player's pet and had the benefit that AI mistakes added to personality, making the pet seem more realistic. Games with **motion controls** or camera controls can also use learning algorithms to calibrate the system and adjust their control schemes based on player movement. As games get more advanced, it is likely that these techniques will be used increasingly to implement a growing array of agents.

Implementation and "Cheats"

Some of the more basic and well-known techniques used to implement AIs are min-max algorithms for choosing actions, A* (known as "A-star") and Dijkstra's algorithm for path-finding, and neural networks and genetic algorithms for learning. Often

AIs will be given a set of goals to pursue that determines their actions, and changing the preference of the AI to pick a given goal can lead to perceived personality.

A common development practice is to "**cheat**" and give an agent information that wouldn't be readily available to a human opponent to circumvent difficult design and implementation challenges. For instance, an AI opponent that has trouble tracking a human player through a large branching maze might simply be "told" where the player is at all times. Conversely, it may be necessary to "dumb down" an AI opponent to make its behavior feel more realistic. An agent can likely execute attacks with perfect timing or aim a weapon with perfect precision, and introducing some amount of error makes the agent seem more human.

Eitan Glinert

Asia

See China; Hong Kong; India; Japan; South Korea

Atari

Atari Inc. is a company that played a pivotal role in the development of nearly all aspects of the video game **industry**. During the 1970s and early 1980s, **platforms** and games designed at Atari contributed to the growth of the **arcade** and home console markets, with a dedicated consumer base emerging around the success of early **arcade games** such as ***PONG*** (1972) and home consoles such as the **Atari VCS 2600**. Atari games broke sales records and fundamentally influenced the future of **game design**. Early Atari games established video game genres still prominent today, and competitors readily adapted successful Atari titles, minimally altering gameplay and releasing these games as their own. The engineers who created and managed Atari are today considered the pioneers of the video game industry, and the design principles they established are still evident in the contemporary game industry. For example, Atari released multiple iterations of popular games and adapted successful properties across platforms, an early precursor to the creation of multiplatform franchises commonplace today. Atari's business practices also presaged the ways in which the contemporary video game industry functions in relation to other media industries such as the **film** industry, because the games Atari produced created a revenue stream that rivaled Hollywood's, and several Atari titles were video game **adaptations** of popular films and early examples of multimedia synergy. In terms of platform design and game development, Atari provided a foundation on which a successful video game industry—and culture—could emerge, even if Atari's own practices sometimes destabilized the very industry it helped establish.

Nolan **Bushnell** and Ted Dabney initially founded Syzygy, each providing an investment of $250 in November 1970 to develop ***Computer Space*** (1970), an adaptation of ***Spacewar!*** (1962). They licensed the game to Nutting Associates in 1971, and both Bushnell and Dabney went to work for Nutting to facilitate the manufacture of the game. They left Nutting in March 1972, and with royalties from *Computer Space* and a contract for a driving game from **Bally/Midway**, Bushnell and Dabney started a new company in a rented thousand-square-foot building in Santa Clara, California. They incorporated Atari on June 27, 1972, and hired engineering student Al Alcorn as a game designer, whom they had worked with at Ampex Corporation, a Northern California engineering company. (Much of Atari's early staff was recruited from within Ampex, where Bushnell had also worked as an engineer.) Other notable employees from Atari's early years include Steve Bristow, Atari's future vice president of engineering; Steve Mayer and Larry Emmons, who ran a consulting firm (owned by Atari) that served as a company retreat in Grass Valley, California; and Steve Wozniak and Steve Jobs, who designed *Breakout* (1976) and would release the Apple II in 1977. Later Bushnell hired his next-door neighbor Joe Keenan, who was the marketing manager for a local time-sharing company. Keenan became president of both Atari and Kee Games (the latter a company that Atari wholly owned and created in 1974 to get around exclusive distribution contracts). At the time, the design of arcade games was an individual process, and Atari's engineers overcame complex hardware and software limitations to create games that were both strikingly unique and addictively **replayable**.

Al Alcorn's *PONG*, Atari's first arcade game and the first commercially successful video game, was released in September 1972 as a prototype at Andy Capp's Tavern in Sunnyvale, California. Bushnell attempted to give *PONG* to both Bally and Midway to manufacture and distribute, in satisfaction of their design contract; when they hesitated, he instead decided that Atari would itself manufacture *PONG*'s arcade cabinet, given the prototype's success (the profits of an individual *PONG* cabinet were approximately $200 a week in 1972, whereas other coin-operated machines netted between $40 and $50). Bushnell's decision importantly positioned Atari as a company that both produced and manufactured its own games and game hardware; third-party manufacturers were unnecessary in Atari's early business model.

PONG's success led to a patent lawsuit with Magnavox based on the patents Ralph **Baer** filed while working at Sanders Associates. Although many ping-pong games had been programmed on the PDP-1 in the 1960s, Magnavox asserted that *PONG* was exceptionally similar to the electronic ping-pong game Baer had produced for the **Magnavox Odyssey** earlier that same year. Bushnell had attended an Odyssey demonstration at a Burlingame, California, trade show on May 24, 1972, and later stated that he was reminded of the simple nature of the electronic ping-pong genre, assigning the game's design to Alcorn (who had just started at Atari) as a training exercise. Alcorn and Bushnell added many improvements that made *PONG* a success and differentiated the game from its contemporaries. The litigation against Atari on the grounds of patent infringement resulted in an advantageous out-of-court settlement in which Atari gained a paid-up license for less than the cost of litigation. Because numerous game developers used Atari's technology following *PONG*'s success (Dabney and Bushnell had their own patents on the more sophisticated digital side slip technology, which allowed for high-resolution graphics), these companies had to pay large royalties.

Although Atari would release several versions of *PONG* that altered gameplay only slightly, numerous other Atari arcade releases positioned the company as a source of originality in game design. An increasingly competitive marketplace grew from Atari's initial achievements, with other companies frequently adapting or simply rebranding successful Atari titles as their own games. Bushnell's response to such competition was to produce games that were recognizably unique, differing wholly in both concept and design from previous Atari successes. Early notable Atari arcade games include *Space Race* (1973), the early maze game *Gotcha* (1973), the **racing game** *Gran Trak 10* (1974), Steve Bristow and Lyle Rains's *Tank* (1974), Steve Jobs and Steve Wozniak's *Breakout* (1976), Lyle Rains and Ed Logg's *Asteroids* (1979), *Lunar Lander* (1979), Ed Rotberg's ***BattleZone*** (1980), Logg and Dona Bailey's *Centipede* (1981), and Dave Theurer's *Missile Command* (1980) and *Tempest* (1981).

Finding initial success in the coin-operated arcade, Atari became the only company involved in all three branches of the video game industry, producing both home console systems and home computers in addition to designing and manufacturing arcade games and cabinets. Atari successfully marketed a *Home PONG* system through Sears in 1975, but increasing competition in the home video game marketplace necessitated a platform that could play more than just one game. The Atari VCS 2600, released in October 1977, greatly influenced the growth of the home console market and, along with other home consoles such as the **Fairchild/Zircon Channel F** and the Coleco Telestar (both from 1976), established the private space of the home as an appropriate place to play video games. The VCS allowed players to interchange games stored on individual **cartridges** and interact with them primarily through a single-button **joystick**. The VCS surpassed the Channel F's sales in 1977, contributing to Atari's $75 million revenue that year. As the VCS's popularity grew, so did Atari's returns, reaching $2 billion by 1980. Upon its release in 1977, the VCS had nine titles, including *Combat* (an adaptation of Atari's arcade hit *Tank!* [1973]); the **shooting game** *Air-Sea Battle*; and the racing game *Indy 500*. Later notable VCS titles Atari produced include Warren Robinett's ***Adventure*** (1979), the home console port of ***Space Invaders*** (arcade version, 1978; home version, 1980), Howard Scott Warshaw's *Yar's Revenge* (1981), Tod Frye's port of *Pac-Man* (arcade version, 1980; home version, 1982), and Warshaw's infamous **adaptation** of Steven Spielberg's *E.T.: The Extra-Terrestrial* (1982). After the VCS's introduction, work began immediately on faster 8-bit machines that featured keyboards instead of **joysticks** and included a version of the Microsoft BASIC programming language, Atari BASIC. These computers were released as the Atari 400 and Atari 800 in 1979, and Atari would continue to develop personal computers into the 1990s, including the Atari ST series originally released in 1985. The VCS's popularity also allowed Atari to design and manufacture more technically advanced dedicated gaming consoles, such as the **Atari 5200**, released in 1982.

During Atari's early years, the company's success led to changes in ownership and management. In 1976, Bushnell sold Atari to Steve Ross's entertainment conglomerate Warner Communications for $28 million to secure funding for the VCS's production. Bushnell remained as chief executive officer until 1978, when disputes between Bushnell and Warner executives led to Bushnell being dismissed over strong disagreements of the future direction of Atari, including the development of the 2600's successor, the strategy for Atari's pinball division, and plans to manufacture all the software for Atari's personal computers in-house, a strategy intended to freeze out third-party developers. Warner's Ray Kassar became CEO, and administrative changes led to personnel changes as well. The perceived lack of recognition Kassar's Atari paid to its game designers led Atari programmers David Crane, Alan Miller, and Bob Whitehead to join venture capitalist Jim Levy in founding third-party developer **Activision** in 1979, which would go on to produce influential VCS titles such as *Barnstorming* (1982), *Grand Prix* (1982), and *Pitfall!* (1982).

After the video game industry **crash of 1983**, blamed partially on the excessive production of poorly designed games epitomized by Atari's own *E.T.: The Extra-Terrestrial* (1982), Atari was split into two companies: Atari Games Inc., which received ownership rights to Atari's arcade games, and Atari Corporation, which controlled Atari's consumer electronics division. Atari Corporation would release the **Atari 7800 ProSystem** in 1986, the handheld **Atari Lynx** in 1989, and the 64-bit **Atari Jaguar** home console in 1993. The Lynx and Jaguar's lack of success resulted in Atari Corporation's sale to hard disk manufacturer JTS Inc. in 1996, and then to the toy company Hasbro in 1998. In 2001, software developer Infogrames purchased Hasbro Interactive, rebranding its North American distribution arm Atari Inc. In March 2008, Infogrames began purchasing all remaining public shares of Atari Inc., a process completed in October of that same year, making Atari Inc. a wholly owned, privately held subsidiary of Infogrames. In May 2009, Infogrames Entertainment officially changed its corporate name to Atari SA, reflecting a brand unity between the company and its subsidiaries. In April 2010, Nolan Bushnell joined Atari SA's board of directors, returning to a managerial position in the company he had created almost four decades before. Although Atari today differs drastically from the company Bushnell and Dabney incorporated in 1972, the games and platforms Atari produced are understood as fundamental to the development of video game culture and history. Ported to more advanced systems, early Atari games are repackaged and resold today in the form of classic collections and anthologies, such as Digital Eclipse's *Atari Anthology* (2004) released for the **Microsoft Xbox** and **Sony PlayStation 2**.

Historians and theorists have written extensively on Atari, discussing its role within the video game industry's development and analyzing the technical and representational influence Atari's consoles and games have had on contemporary games and game culture. Scott Cohen's *Zap! The Rise and Fall of Atari* (1984) provides a comprehensive discussion of the mitigating factors that led to Atari's success and decline, whereas Steven L. Kent's *The Ultimate History of Video Games* (2001) offers significant insight into the intentions and practices of several important Atari designers, including illuminating excerpts from interviews Kent conducted with Nolan Bushnell and Al Alcorn. Nick Montfort and Ian Bogost's *Racing the Beam: The Atari Video Computer System* (2009) presents a design history of individual VCS titles and productively theorizes the interrelationship between platform technology, game design, game aesthetics, interactivity, and game culture.

Harrison Gish

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Atari 2600

See Atari VCS 2600

Atari 5200

The Atari 5200 (also known as the Atari 5200 SuperSystem) was a second generation (see **generations of technology**) game console released by **Atari**, Inc. in November 1982. The system was developed as a replacement for the aging **Atari VCS 2600** platform, its name chosen to suggest that it was twice as powerful as its predecessor.

The hardware design was based on and very similar to (but not compatible with) that of Atari's 400/800 line of 8-bit home computers. At the heart of the system was a custom 6502C CPU (based on the popular MOS Technology 6502 chip), operating at the speed of 1.79 MHz. The 5200 had 16 KB of random access memory (RAM), and was capable of addressing up to 32 KB of read-only memory (ROM). It featured four semi-independent sound channels and could display 256 colors at the maximum screen resolution of 320 × 192 pixels. Software was distributed on **cartridges**.

The original design sported four **controller** ports, as well as an innovative automatic RF switchbox: the power supply plugged into the switchbox, rather than directly into the console, and the TV was automatically switched from antenna to game input upon system power-up. Both features were soon eliminated in an effort to reduce manufacturing costs. The 1983 redesign included only two controller ports and replaced the automatic switchbox with a conventional manual one.

The iconic Atari CX-40 digital 8-way **joystick** was replaced with a new controller, featuring a fully analog stick, a numerical keypad, as well as start, reset, and pause buttons. Although the stick was capable of full 360-degree movement and precise positioning, it was marred by a critical design flaw. Rather than a metal spring, a cheap rubber boot was used to hold it in neutral position. As a result, the controller would not self-center properly (or, after extended use, at all), which often translated into a frustrating gameplay experience, especially with titles requiring precise four-way input.

The 5200 was not commercially successful. Because the sales of the 2600 were still fairly strong, Atari was not willing to commit exclusively to the new **platform**. Consequently, throughout its short life span, the system was competing for development resources with its older sibling. In addition, many of the initial games were mere cosmetic updates of existing 2600 titles and did not fully utilize the capabilities of the new hardware. Because the 5200 was not backwards-compatible, 2600 owners had little incentive to upgrade. A VCS Cartridge Adaptor was eventually released in 1983 but not before **Coleco** released a similar device for the **ColecoVision**.

Perhaps the greatest contributing factor in the 5200's failure, however, was competition from 8-bit home computers, including Atari's own 400/800 line. In December 1982, a $50 rebate from Atari brought the retail price of the 400 series computers to under $200. Combined with access to an extensive library of entertainment, educational, and productivity software, this gave the home computers considerable advantage over a $250 dedicated game machine, especially in the wake of the video game **crash of 1983**. The system was discontinued in 1984.

P. Konrad Budziszewski

Atari Jaguar

After its rise and fall during the golden age of gaming, Atari attempted a comeback with the Atari Jaguar, the company's entry into the more advanced games industry of 1993. However, that hoped-for success never came to fruition, when fate intervened.

The Atari Jaguar seemed off to a solid start. A large number of developers were initially impressed with the hardware, and many signed up to develop titles or offered popular intellectual properties and licenses to Atari. The hardware was far superior to its 16-bit predecessors, and consumers were anxious for the next generation of video game systems. The cartridge-based machine was well priced at only $249.99. Atari had secured a strong partnership with IBM, which was to make the console's hardware, bringing game console manufacturing back to the **United States** for the first time in decades.

Technologically, the Atari Jaguar used several processors, a rather revolutionary idea at the time. Although now a common design practice in game hardware, an architecture of multiple processors proved difficult for game developers of the early 1990s. The unit housed five processors that resided within three chips, two of which were proprietary and named after the popular MGM cartoon cat and mouse, Tom and Jerry. Tom featured a 32-bit **graphics** processor, a 64-bit object processor, and a 64-bit Blitter graphics chip, and Jerry paired **sound** and input/output, and also included a digital signal processor.

The Jaguar also included the 16-bit Motorola 68000 co-processor that was popular at the time and previously used in Atari's own ST line of computers. The inclusion of this chip, already familiar to developers, helped them make the transition to more complex architecture; however, it turned out to be a crutch instead, because several developers chose to use only that particular chip. As a result, many developers did not take advantage of the full power of the hardware, thus allowing for subpar games to be released or ported to the console. This was a trend that would haunt Atari and ultimately prevent the Jaguar's success in the marketplace.

Although the Jaguar was a 64-bit reduced instruction set computing (RISC)-based processor at its core, the use of several chips with different specs also allowed the market to question the true nature of the insides of the Jaguar. The competing game systems of the time were primarily 16-bit machines, so Atari essentially skipped the 32-bit stage and moved directly to the 64-bit level. The company even tried to capitalize on this with its "Do the Math" slogan, implying that their 64-bit system had more under the hood than their 16-bit and 32-bit competitors.

The Atari Jaguar premiered in a handful of cities, including New York and San Francisco, in late November of 1993 and reached the remainder of the United States and foreign markets the following year. The unit was packaged with the game *Cybermorph* (1993), which received favorable reviews from most of the press at the time. However, only a few games, all of subpar quality, trickled out during the remainder of 1994 and proved to be a case of too little, too late for Atari.

The Atari Jaguar did have moments of glory. *Alien vs. Predator* (1994) was a huge success showcasing the system's capabilities. In addition, the Jaguar premiered the *Iron Soldier* (1994) series and Ubisoft's immensely popular *Rayman* (1995) franchise, still admired today.

In mid-September of 1995, Atari released a double-speed **CD-ROM peripheral** for the Atari Jaguar for an additional $199.99. It sat atop the console and was attached to the Jaguar unit through the **cartridge** slot. It could play games requiring storage of up to 790 megabytes of data, more than the usual CD-ROM formats. The unit could also play audio CDs and CD-G format discs. The unit was packaged with *Blue Lightning CD* (1995), a sequel to the popular Atari Lynx game of the same name from 1989; *Vid Grid* (1995); a demo of ***Myst*** (1993); and an audio CD soundtrack for *Tempest 2000* (1994).

The unit also included the Virtual Light Machine (VLM) built directly into the unit. The VLM displayed a variety of visual effects based on input from an audio CD and was programmed by the well-known programmer Jeff Minter, who also programmed *Tempest 2000*, the remake of Atari's arcade game *Tempest* (1981). If the device had been offered back in 1993, when it was originally supposed to be released, it might have been more successful. However, after it launched six days behind the **Sony PlayStation**, time was running out for the Atari Jaguar.

Several other add-on peripheral devices were also released for the Jaguar. A networking device known as the JagLink allowed multiple players to compete against one another from more than one Jaguar unit. The Memory Track cartridge allowed the Jaguar CD to save game progress, preferences, and high scores.

Other revolutionary projects were announced for the Jaguar but never reached production: a PC card, developed by Sigma Designs, that would have allowed PC owners to play Jaguar games on their home computer; an MPEG video cartridge that would allow full-motion video playback; and a voice modem that would allow players to speak to each other while playing from different locations. The most promising and biggest disappointment of the shelved peripherals, however, was the VR headset. It was being developed in conjunction with the VR coin-op company Virtuality and had really excited the market. The headset was to feature infrared head-tracking capabilities, but in the end, it became another case of Atari vaporware.

COJAG, short for "Coin-Op Jaguar," was a modified Jaguar chipset system used briefly in the arcade industry. A handful of titles were being developed for the system, but only the lightgun games *Area 51* (1995) and *Maximum Force* (1997) ever reached operators.

The Jaguar was on the market at the same time as the **SEGA Genesis**, the **Super Nintendo Entertainment System (SNES)**, and the **3DO Interactive Multiplayer**. The **SEGA Saturn** was looming around the corner and Sony was about to unleash the juggernaut that was the PlayStation. With fierce competition and a minimal operating budget compared to their competitors, Atari simply could not compete. The Jaguar was Atari's final console release and left the market with a whimper in 1996. Later, when the Atari name and assets were bought by Hasbro, the Jaguar was declared an open system, allowing **homebrew games** for the system to be developed.

Michael Thomasson

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Atari 7800 ProSystem

Atari's third **cartridge**-based **console** was the Atari 7800 ProSystem, released in 1986. It was developed to replace the failed **Atari 5200** console and revive Atari's popularity from the glory days of the **Atari VCS 2600**. Although the console was almost identical region to region, the European model came packaged with joypad-style **controllers** in place of the traditional **joystick** controllers seen elsewhere.

The Atari 7800 ProSystem was known during development as the Atari 3600 and later the Atari CX-9000 Video Computer System. Atari's marketing division later renamed the unit the Atari 7800. The name was derived from the fact that it was fully backward compatible with the Atari 2600 model and had Atari 5200-quality graphics. The sum of those two numbers equals 7800, and "ProSystem" was used to imply that the unit was compatible with Atari Pro-Line accessories. The physical housing for the Atari 7800 was actually an altered case used for the Japanese Atari 2600, the Atari 2800.

The Atari 7800 was also the first Atari product not developed internally. General Computer Corporation (GCC), an arcade coin-op game manufacturer, actually designed the console for Atari. As a result, the system featured many arcade coin-op like qualities, such as the ability to move a large number of sprites on-screen simultaneously and a 256-color palette. The custom-made **graphics** chip, known as Maria, could display more graphic sprites and colors than any game system that preceded it (Forster, 2005).

The system had also been designed to be fully upgradeable to a functional home computer, complete with options for a keyboard, disk drive, and printer. The original batch of 7800 consoles featured a port for future expansion with other devices, including a laserdisc player. This port was removed from the unit as a cost-cutting measure following the debut launch.

The system was set to release in 1984 but was shelved when the financially troubled Warner Communications sold off Atari, Inc. Due to the **crash of 1983**, the home video game market was in a state of collapse, while the home computer field was beginning to take hold and looked to become the future.

Jack Tramiel, the founder of Commodore Computers who had been encouraged to leave his own company due to internal disagreements, bought Atari from Warner to exact revenge. The former Atari computer rival then began selling Atari brand computers to try and take market share from his previous company, Commodore. Atari projects that were not associated with the computer line were abandoned to wither and die on the vine. This included the Atari 7800 console and most of the ProLine accessories such as the much-anticipated battery-backed RAM "Hi-Score" cartridge.

In 1986, when the Atari line of computers was struggling, **Nintendo** released its popular **Nintendo Entertainment System (NES)** nationwide in North America to much fanfare (after a successful release in New York in October 1985). Taking note, the Tramiel family-governed Atari resurrected the Warner Atari 7800 project and finally released the Atari 7800 in 1986 for the value price of only $140. Two years beyond its original debut date, what was once cutting-edge technology became "old hat" when released several years later. The console was initially meant to compete against the **ColecoVision**, but because of the lengthy delay in reaching store shelves, it found itself competing primarily with the NES and the **SEGA Master System**. To a lesser extent, it even found itself contending with Atari's own Atari XE in 1987.

Tramiel's halfhearted approach to promoting and caring for the Atari 7800 brand contributed to the system's poor showing. With little support from Atari, third parties, or consumers, the 7800 never reached its full potential. Most of the ProLine accessories were cancelled, and just under five dozen 7800 titles made it to store shelves. Atari officially retired the Atari 7800 on the first day of 1992.

Michael Thomasson

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Atari VCS 2600

The **Atari** Video Computer System, or VCS, was the first wildly popular video game **console**. Available from 1977 through 1991, the VCS holds the record for being

The Atari VCS 2600 home console system, along with game cartridges and paddle controllers. (Science & Society Picture Library/Getty Images)

the longest commercially available video game console. The VCS was designed in early 1976 as a replacement for Atari's line of dedicated consoles because consumers were more apt to purchase additional games for one programmable system, as opposed to buying multiple dedicated systems.

The VCS was simplicity itself because the software did most of the work. The heart of the system, which contained 128 bytes of internal RAM, was a 6507 processor that ran at a mere 1 MHz. The console had been designed to play *PONG* and *Tank!*-type games that only required 2 Kb of code. However, the designers built the VCS so it could play games that had up to 4 Kb of code, although they never expected programs to get that large.

Atari released the $199 VCS in October 1977. The console was sold with paddle and **joystick controllers**, as well as a *Combat* **cartridge** that featured several variations of Atari's hit **arcade** game *Tank!* (1974), along with biplane and jet plane games. Eight additional cartridges were available optionally including home versions of popular Atari arcade games such as ***PONG*** (1972) and *Surround* (1978).

At first the VCS didn't sell in quantities needed to sustain it. Even after releasing a VCS version of the arcade hit *Breakout* (1976) in 1978, along with *Codebreaker* and *Hunt & Score*, a pair of games that incorporated keyboard controllers, the console didn't stir much interest. Instead, it was the importation of a new arcade game that sealed the VCS's fate. In 1978, ***Space Invaders*** invaded arcades around the world. Atari executives quickly realized that having *Space Invaders* available on the VCS would be a major marketing coup. In a move without precedent, Atari licensed the home rights for *Space Invaders* and released a VCS version in January 1980. Suddenly everyone had to own a VCS just so they could play *Space Invaders* at home. Atari grossed $415 million that year—more than twice that of the previous year. Atari soon licensed other arcade hits such as ***Defender*** (1980) and *Berserk* (1980) and began releasing more VCS versions of its own arcade titles such as *Missile Command* (1980).

The 4-Kb limit was challenged when Atari gave Tod Frye the task of designing a VCS adaptation of Atari's arcade hit *Asteroids* (1979). Frye realized early on that he couldn't create a faithful rendition of the game within the confines of the allotted 4 Kb. He opted to use "bank-switching," a method that tricked the VCS into processing games that contained more than 4 Kb of code.

Bank-switching involved dividing memory into disjointed sections or banks. Although all of the banks were available to the program, only one could be accessed at a time. In the case of the VCS, an instruction within the first 4-Kb bank branched to an address in the second 4-Kb bank, where processing continued. The branch to the second bank of 4 Kb was transparent to the CPU. In effect, this allowed the VCS to process games that were larger than 4 Kb. Before long, 8-Kb and even 16-Kb games became the norm for the VCS.

Ultimately, Atari programmers became resentful that their creations earned Atari hundreds of millions of dollars while they were treated as mere employees who weren't even entitled to royalties. In addition, Atari kept its designers anonymous, fearing that competitors might lure them away. One programmer, Warren Robinett, did something about the anonymity. Robinett programmed undocumented moves into his game ***Adventure*** (1979), which caused his name to flash on the screen. When a 12-year-old Utah boy found the hidden name, it was too late for Atari to correct the code.

Four other Atari programmers weren't satisfied with hiding their names in games. David Crane, Ed Miller, Bob Whitehead, and Larry Kaplan teamed up with an ex-record company executive named Jim Levy and formed **Activision**, the first company to develop third-party software for video game consoles, specifically the VCS. Activision games featured innovative graphics and were generally considered fun to play. The name and photo of the game's designer was displayed on the instruction manual. Before long, Activision's programmers had the notoriety of rock stars.

Activision's success led to the formation of many other third-party software developers. Even companies like Quaker Oats entered the software arena, an area that they had no expertise or business being in. By 1983, there were more than three dozen companies offering software for the VCS (renamed the 2600 after its model number). Hundreds of games were available but most of them were poorly designed and offered little play value. Even Atari managed to release inferior games. Consumers purchased its 2600 rendition of *Pac-Man* (1980; Atari 2600 version, 1981) although the game bore little resemblance to the arcade mega-hit that it derived from. Atari was so certain that its 2600 games would sell in droves that it produced more copies of *E.T.: The Extra-Terrestrial* (1982) than there were 2600s.

The 2600's popularity inevitably made it a magnet for add-on **peripherals**. The year 1983 introduced the **CVC Gameline Master Module**, a modem that plugged into the cartridge slot and was an early instance of downloaded video games. Starpath's Supercharger also plugged into the cartridge slot but had games loaded into them from inexpensive cassette tapes. Amiga's "Joyboard" was a stand-on controller that was sold with a skiing game, *Mogul Maniac* (1983). Several companies, including Atari, planned computer upgrades for the 2600, but the video game **crash of 1983** ended those plans.

In 1984, Atari was sold to Jack Tramiel, who had no interest in selling video games. However, in 1986, following Nintendo's success with the **Nintendo Entertainment System (NES)**, Atari released the $50 2600jr, a newly designed unit much smaller than the standard 2600. Atari claimed the console was targeted for lower-income households, as an alternative to the newer, higher-priced systems. The 2600jr was packaged with only a single joystick and one game cartridge. New software was also developed, but Atari couldn't lure customers away from the NES. In 1988, Atari began selling the games by direct mail only. Atari finally ceased manufacturing the 2600 in 1991 but the news hardly made headlines.

Since then, Atari 2600 games from Atari, Activision, and Imagic have appeared in their original state for play on home computers, current game consoles, and **handheld game** systems. The games have also been included in devices that plug directly into television sets. Atari itself released its own unit in 2004, called the Flashback, a direct-to-video console that resembled the **Atari 7800** and had 20 games from the 1980s built-in. A year later Atari went full-circle when it released the Flashback 2, a device that resembled the original VCS from 1977. This unit had 40 built-in 2600 games, including several homebrews, and came complete with joystick controllers that looked like the original ones from 1977. And although it wasn't advertised, the Flashback 2 also accepted the original game cartridges, although one had to be knowledgeable in electronics to access the hidden cartridge port. Atari sold nearly one million Flashback 2 units, proving that the interest in the 2600 had not abated.

While the old games are still being played on new systems, new **homebrew games** are still being developed and sold for the original system by hobbyists just for the challenge of it. In July 2010, Ed Fries, a former head of Microsoft Game Studios, designed *Halo 2600*, which was released at Classic Gaming Expo. This 2600 approach to the classic **Microsoft Xbox** game continues to prove that there's continuing life in the decades-old system.

Leonard Herman

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Atari Video Computer System

See Atari VCS 2600

audio (dynamic, interactive, and adaptive)

Video game **sound** can be broadly separated into dynamic and nondynamic sound, with nondynamic sound referring to those sounds that are fixed and linear, as is the case in cinematic sequences in games, with which the player has no direct interaction. Dynamic audio, on the other hand, refers to the fact that, like the game itself, the audio is constantly changing in response to game parameters and the player. Dynamic audio can be separated into interactive and adaptive audio.

Interactive audio refers to sound events directly triggered by the player and therefore affected by the player's input device (**controller**, **joystick**, and so on). The player's input actions nearly always affect the soundscape of a game in an interactive fashion, from adding simple footsteps when the player moves a character on-screen, to shooting sounds upon pressing a fire button, to triggering cross-fades based on the player's directional choices. For instance, if a player runs toward an enemy in a game while firing a weapon, the shots, footsteps, and other sound effects may all be triggered directly by the player and are directly influenced by the timing of the player's input. Players may also encounter a "trigger point" in the visual **space** of the game, whereby through their character's movement on-screen, they may change the music or ambient cues from one of relative peace to an "enemy cue" or from one specific location to another (land to water, for instance). The player can typically run back and forth across the trigger point, retriggering the cue. Players therefore have control over these sound events in the game in terms of the timings of their playback, although the game engine usually controls the rules for playback (which sounds are associated with which events).

Adaptive audio events, on the other hand, are unaffected by the player's direct actions, although they are inevitably influenced by the indirect actions of the player. Adaptive audio events are system-generated and cued by the game's engine on the basis of in-game parameters and are therefore rarely immediately repeatable. These parameters may include the general locations (as in place, e.g., "the city") or time of day (e.g., "night," based on system clocks), scripted or unscripted events (the player may need to gather certain objects before a particular character will react in a specific way, for example), difficulty level, timing, player properties (skills, health, endurance), "camera" angle, and so on. An example of adaptive audio is a change in music, ambience, and sound effects as the timer in a **game engine** switches the scene from daytime to night-time based on the system clock. In the **Nintendo** game *The* ***Legend of Zelda****: Phantom Compass* (2006), for instance, there are pieces of mail (with associated audio cues) that only arrive after a day has passed on the system's date calendar. Although the player may exit the game, change the **Nintendo DS** calendar, and then reload the game to force these changes, these changes are intended as indirect (adaptive) actions. Like interactive audio events, these adaptive audio sound events are also generated in runtime by the game's scripts, but the actual timing of these events can be set by timers to execute at variable timings.

Apart from **cut-scenes**, which are fixed in a linear fashion, these degrees of dynamic activity in a game are sometimes fluid. For instance, in the Kokiri Forest from the **adventure game** *The Legend of Zelda: Ocarina of Time* (1998), during the first portion of the game we are continuously in daytime mode as we get trained in gameplay, and the Kokiri Forest theme playing throughout does not change except at those points when a player enters a building or encounters an enemy. Although interactive, it is not adaptive at this point. After we complete our first major task and arrive at the next portion of the game (there are no distinct "levels" in this game), we then experience the passing of time and can return to the forest. Now, if we return at night, the music has faded out to silence. At dawn, it will return to the main theme: the theme has now become adaptive. In other words, a cue that is interactive or adaptive at one point in the game does not necessarily remain so throughout the entire game. Moreover, there is an inherent interactivity in much of adaptive audio because there is an implied action that the sound may attempt to instigate (for example, "time is running out—hurry up!").

The use of interactive and adaptive audio highlights the function of much game sound as feedback-driven (or feedforward). The sound can serve informational purposes such as "you have taken an action" (feedback—such as jumping sounds when the player presses a button), "you need to take an action" (feedforward—such as an enemy is approaching, pull out your sword), "you are taking an action" (status information such as invincibility modes), and "you are here" (navigation information regarding where the player is, either in the game matrix or [virtual] three-dimensional space, as well as contextual and intertextual information).

Moreover, the nature of interactivity as a series of often repetitive tasks (pushing a button many times, for instance) has meant that interactive audio has struggled with heavy repetition, meaning that the sounds can become annoying or boring over time. This has spurred on game sound designers to incorporate variable playback into interactive audio systems, so that a sound may be selected from a series of options or even synthesized in real time.

Karen Collins

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augmented reality

Unlike **virtual reality**, which replaces what a person sees with computer-generated imagery, augmented reality overlays data and **graphics** over a live or mediated view of the physical world, combining the physical and virtual within the same user viewpoint. The data displayed usually is interactively connected with the view of the physical world, so that it tracks it and reacts to it automatically in real time, changing as it changes, relating physical spaces and virtual spaces to each other. Applied to video games, augmented reality can connect the **world** of the video game with the physical world as if one were overlaid over the other. Such games can make use of mobile computing technology, global positioning satellite tracking systems, cameras, projectors, and other recognition technology to combine game space and physical **space**.

Perhaps the simplest and most common type of game to use augmented reality involves pointing a camera and a projector at the same space. The camera, coupled with a motion detector, finds the outlines of people moving in front of the screen and projects them onto the screen, along with computer-controlled characters or events that allow the audience to interact in real time with what appears on the screen. Other technologies include head-mounted displays that allow the user to see the physical world while also overlaying it with computer graphics. Julian Oliver's *levelHead* (2007) combines computer-generated imagery with live-action video imagery in real-time, resulting in cubes the player manipulates that appear to have computer-generated interiors inside them. Some augmented reality games have already appeared for **mobile gaming** devices (such as an iPhone, iPod, or iPad), including A Different Game's *Ghostwire* (2008) or Simbiotics's *Sky Siege* (2009), which position game elements virtually in the space around the player, who must turn around and use the mobile device as a window to see what is occurring in the game. Another game, XMG's *Pandemica* (2009) allows four players to player together, shooting at virtual aliens positioned around them. Ogmento, a company started in 2009, is devoted exclusively to the production of augmented reality games.

As pattern recognition and motion detection software grow more sophisticated, augmented reality games will become more available, and new game systems with built-in cameras or **peripherals** such as the Nintendo DSi, the PlayStation Move, and Kinect for the **Microsoft Xbox 360** now allow for home video games to use augmented reality technology. ***See also*** pervasive games.

Mark J. P. Wolf

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Australia

According to Brand (2007), 79% of Australian households have a device to play video games. The average age of the Australian gamer is 28 years old, and 41% of gamers are female. Video gaming is widely regarded to be a social activity; particularly within families, with two-thirds of those surveyed living in households with other game players; 56% of players usually played with others in the same room, and 28% played with others on-line. In 2006, the Australian games market was worth AUD $925 million, and Australians purchased almost 12.5 million units of game software that year.

The most recent in-depth analysis of the Australian video games **industry** (Insight Economics, 2006) states that it earns AUD $110 million per annum and employs more than 1,300 permanent staff across more than 40 game studios (Hill, 2006). At this time, the majority (46%) of the Australian video games industry was based in Melbourne. The industry is well established but not immune to the global financial climate; the precarious existence of the local industry is exemplified by the financial difficulties faced by prominent independent companies Auran Development (the developers of the *Trainz* series) in 2007 and Krome Studios (the developers of *Ty the Tasmanian Tyger* series) in 2010, which forced them to cut considerable amounts of staff, and the closure of the Australian office of the multinational developers Pandemic Studios (where *Mercenaries 2: Playground of Destruction* [2008] was developed) in 2009, approximately two years after their purchase by **Electronic Arts**. Furthermore, the development of games based on original intellectual property (IP) in Australia is uncommon; although 85% of companies in Australia do develop their own IP (Insight Economics, 2006), 90% of the industry's output are based on licensed products (Hill, 2006).

The Australian market has also struggled with the regulation of video games. The key problem has been the lack of adult ratings for video games, the highest possible rating allowed being a MA15+, meaning many games rated R in the **United States** cannot be released without changes on the Australian market. Key examples are Valve's *Left 4 Dead 2* (2009), which was released only in a cut version; Rockstar North's *Manhunt* (2003), which was withdrawn from the market completely; and Rockstar North's *Grand Theft Auto: San Andreas* (2004), which was briefly taken off the shelves in the wake of the "hot coffee" scandal. Bethesda Studios declared a global delay on the release of *Fallout 3* (2008) while they resolved issues that would prevent the game's uncut release in Australia. The game was accepted for distribution and sale after all references to the drug morphine were removed. Although this issue has become contentious in local and national government, in 2012 it appeared likely that the system would be reformed in the near future.

Thomas H. Apperley

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avatars

The word "avatar" comes from the Sanskrit word *Avatãra* meaning "descent," referring specifically to the descent of a deity in human, superhuman, or animal form into the mortal realm. It is traditionally used in Hinduism to refer to the bodily incarnation of a heavenly soul (deity or god) on Earth. Early appropriations of the word *avatar* in digital culture can be found in various forms including in Origin Systems's ***Ultima*** *IV: Quest of the Avatar* (1985), LucasFilm's on-line virtual world *Habitat* (1986), as well as Neal Stephenson's science fiction novel *Snow Crash* (1992).

The word "avatar" in contemporary digital culture refers to a digital character controlled by the player or user within a digitally mediated environment. In on-line spaces such as chat rooms, message boards, discussion forums, and social networking sites, avatars are often two-dimensional images that are coupled with the user's on-line name or pseudonym, which are used to represent the user. Depending on the site, users may select an image from a database or upload their own photos.

In a video game, an avatar is a two- or three-dimensional visual representation bearing the aesthetic style found within the context of each particular game **world**. An avatar is also sometimes synonymous with the term "player-character," which literally means the character that the player "**plays**" or controls within the video game world. Although the word "avatar" can sometimes be extended to mean all the characters within a game world that are not playable by the player, these are more often referred to as "**non-player characters (NPCs)**."

The degree to which a player can customize an avatar varies depending on the specific video game title and genre. Some video games, such as those of ***The Sims* series** allow players almost full creative freedom to create their avatars by selecting from a wide range of characteristics such as **gender**, hair color and style, eye color and shape, body type, clothing, personality traits, and career trajectory. In **massively multiplayer on-line role-playing games (MMORPGs)** such as *EverQuest* (1999) and ***World of Warcraft*** (2004), players have a more limited range of freedom to create their avatars before beginning the game. Players must first select a gender, race, and class, as well as other aesthetic characteristics such as hairstyle and color, eye color, and other defining characteristics such as tattoos or skin tone. Players may further customize their avatars during game play as they work toward leveling their character as new armor and trinkets are acquired and adorned; players may dye the color of their armor, and hairstyles can be changed in the game. With the constant development of technology, avatars are becoming increasingly customizable, further increasing the potential for player identification with the avatar on the screen.

However, many video games offer the player minimal to no customization options depending on the genre and title. In some games, the player's only choice is to play either a preexisting male or female character, although a game's **narrative** may change depending on the gender of the avatar the player opts to play. Single-player games often have more rigid boundaries in regard to character creation and development generally because of a more structured narrative and controlled path of gameplay. For example, in the game *Splinter Cell* (2002), the player may only play the avatar of central protagonist, Sam Fischer. The player cannot alter Fischer's appearance in any way before or during gameplay but there is the potential for statistical enhancement through the acquisition of equipment later in the game.

It has been widely argued that avatars have the potential to influence player identity, in both positive and negative ways, through avatar **design**, customization, and gameplay (Blinka, 2008; Cassell and Jenkins, 2000; Cleland, 2008; Dill and Thill, 2007; Kolko, 1999; Merola and Peña, 2010; Nakumara, 2002). If an avatar is said to be the representation of the player in the game world, questions arise as to whether the visual representations provided by game designers of both male and female avatars are too unrealistic, often falling into the category of hypersexualized images of women and hypermasculinized images of male heroes, although others may argue that most video games are meant to be forms of entertainment, enabling the player to experience a fantasy and fiction through their avatars. In either case, the player has the ability to create and play with multiple identities through video game avatars.

Kelly Boudreau

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B

Baer, Ralph H. (1922–)

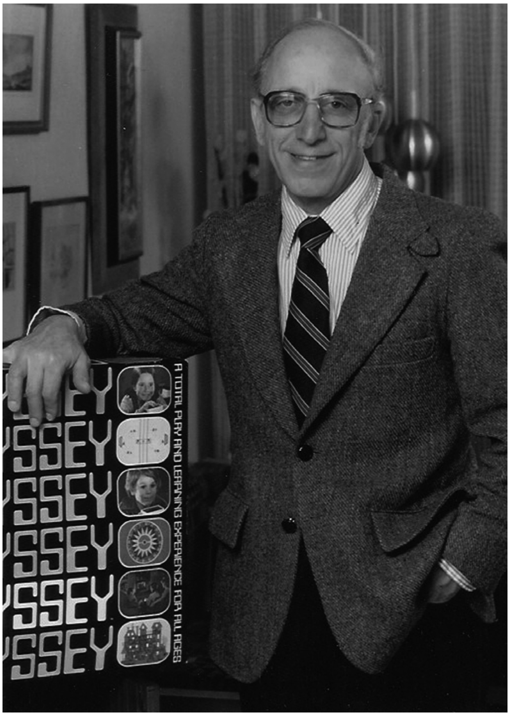
Sometimes described as the "Father of the Home Video Game **Industry**," Ralph H. Baer is an engineer and inventor who developed the first home video game **console** system, the **Magnavox Odyssey**, as well as a host of other toys and inventions in consumer electronics, for which he holds more than 150 patents (including patent #3,728,480, "Television Gaming and Training Apparatus," which became the basis of the home video game industry). By conceiving of the **television** set as a display device that could be used for electronic games, he is responsible for bringing video games into the home and making them an affordable commercial product that could be purchased by the average consumer.

Baer was born in **Germany** and came to the **United States** with his family in 1938 and two years later graduated from the National Radio Institute. In 1943, he served in World War II, during which he was stationed in England and **France**. After the war, he earned a degree in the new field of television engineering in 1948. Over the next seven years, he worked as an engineer at Wappler, Inc. (1949–1950), senior engineer at Loral Electronics (1951–1952), and as chief engineer and vice president for engineering at Transitron, Inc. (1952–1956). There he developed and put into production large numbers of radar test equipment and radio communications systems.

In 1956, he came to Sanders Associates in Nashua, New Hampshire, where he would remain until his retirement from the company in 1987. Baer was a division manager supervising up to 500 engineers, technicians, and support people working on the development of countermeasure systems and space-related hardware, giving him the means to pursue new ideas. Baer describes his situation as follows:

> Along the way I wandered off the straight and narrow into interactive video areas that initially had nothing at all to do with the normal work going on in my division at Sanders. The invention of videogames in 1966, the concept of using TV sets for something other than watching network fare, came first; building the early feasibility models came next. The activity started as a skunk works operation but it didn't stay that way for long. (Baer, 2005, p. 3)

Baer's experiments resulted in a series of seven prototypes of which the "Brown Box" was the seventh. These prototypes were developed during part-time work involving Bill Harrison, the technician who actually built the models; Bill Rusch, who provided engineering support and ideas; and Baer, who supervised the activity. After two years, in mid-1967, Sanders applied for patents on Baer's invention. Baer's team also made overlays to be used on the TV screen and a light gun that could



Ralph H. Baer, inventor of the Magnavox Odyssey and the father of home video games. (Ralph H. Baer)

be used for **shooting games**. In 1971, a licensing agreement was signed between Sanders Associates and the television set manufacturer Magnavox, and a year later the Brown Box technology was developed into the Magnavox Odyssey, which became an international success. A version of Baer's light gun was made for the Odyssey and became the first video game **peripheral**. Other video game accessories such as a golf ball atop a **joystick** for playing putting games and additional accessories were developed during that period but were not pursued by Magnavox. A series of Odyssey consoles also followed, with new systems appearing every year until 1978; in the end, Magnavox had produced and sold around 1.7 million Odyssey units (Baer, 2005, p. 133). Video game technology developed by Baer was also licensed to other companies in the industry, and over the years, the money brought in from those licenses and from lawsuits against patent infringers alone would amount to more than $100 million (roughly four times as much in 2010 dollars) for Magnavox, Sanders, and their lawyers (Baer, 2005, p. 88).

Starting in 1975, Baer began to devote his time and talents to electronic toys and games other than video games. Along with Howard J. Morrison, he developed Milton Bradley's *Simon* game (1978), one of the most popular electronic games of the late 1970s and 1980s and still in current production, although in much advanced form. Baer also introduced the management of **Coleco** to the possibilities of developing low-cost video game consoles based on General Instruments's AY-3-8500 single-chip game system, which powered millions of low-end console games in the period from 1975 through 1978, both in the United States and overseas. The result was Coleco's Telstar system in 1976, and Baer also participated in the development of subsequent models in the Telstar line, including the Telstar Arcade of 1977, the first home system to feature a built-in steering wheel **controller**. Other inventions that Baer worked on for Coleco included a TV Alarm Clock and a TV Weather Station, both of which involved displaying numbers and text on-screen, superimposed over a broadcast television signal. He also worked on ways to use audiotape players with video games to give them better sound quality and a video game system that could control a videodisc player, which also led to Interactive Video Training Systems for the military. In 1985, Baer worked with **Bally/Midway**, who licensed Baer's invention, which involved a video camera built into an arcade game that allowed the player's face to be digitized, stored, and used in the game on the head of a game character.

After his retirement from Sanders in 1987, Baer remained active in the video game and interactive video fields through his own business, R. H. Baer Consultants. In 2000, along with his longtime friend and colleague Bob Pelovitz, Baer licensed Hasbro/Tonka to produce the *Talkin' Tools* series of toys using his technology. Baer has donated his technical papers to the Smithsonian Institution and has also replicated several of the early game systems from 1966 through 1969 for museum displays. In his book, *Videogames: In the Beginning* (2005), Baer recounts his experiences and inventions, supplementing his text with numerous scans of documents, schematics, and product photographs and flyers.

Although he is best known for his pioneering efforts in video games, Baer's wide range of technological accomplishments spans seven decades. Some of Baer's other firsts include an audiotape player controlled by a video game (in 1973); real-time extraction of data from video (in 1974); a programmable and remotely controllable record player (in 1977); the ability to draw symbols on-screen interactively during video game play (in 1980); the first patent for video game instant replay (in 1981); talking greeting cards (in 1982); a hand puppet used as a video game controller (in 1983); an interactive VCR game with real-time branching to multiple screens (in 1984); a doll that could look at text and read it out loud (in 1987); a recordable talking doormat (in 1992); interactive, recordable talking books (in 1993); a talking picture frame (in 1996); a talking speedometer for bicycles (1998); and other toys and consumer electronics. Baer has also received many awards for his pioneering work, including the National Medal of Technology in 2006 and the IEEE Masaru Ibuka Consumer Electronics Award in 2008. He was inducted into the National Inventors Hall of Fame in 2010 and as of 2012 was still active, running R. H. Baer Consultants from his website, RalphBaer.com. ***See also*** idea for home video games.

Mark J. P. Wolf and Leonard Herman

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ball-and-paddle games

The genre of video games sometimes referred to as ball-and-paddle games are those in which a "ball" (usually represented by a small white square) is bounced back and forth against the player's "paddle" (usually represented by a white rectangle) on the side of the screen. Two of the earliest and most famous examples of ball-and-paddle games include the first home **console** system, the **Magnavox Odyssey**, and the **arcade game** ***PONG*** (1972), the first game produced by **Atari**.

The main importance of ball-and-paddle games to video game history is the way they introduced video games to a mass audience around the **world** and for a while were synonymous with "video games" itself. Although they were preceded by several types of **mainframe games**, such games were not the first to break through to a mass audience for several reasons: they were more complex to play, whereas ball-and-paddle games were very simple and easy to learn; they required expensive hardware and software, whereas the earliest ball-and-paddle games used much less technology and did not even require software (*PONG*, for example, was an assembly of 80 logic chips [Winter, 2011]); and they were patterned after the existing activity of table tennis, making the game conceptually easy to understand (which was necessary, because no video game conventions had yet been established).

After the release of the Magnavox Odyssey and *PONG* in 1972, an increasing number of companies began releasing ball-and-paddle games, including licensed as well as bootleg versions of *PONG*. A variety of games developed, all based on the concept of bouncing the ball off paddles. Some games had multiple paddles controlled by the player, arranged vertically or horizontally on the screen, and because of these different arrangements, the games were referred to as a variety of different sports, including baseball, basketball, football, hockey, soccer, volleyball, and so on, with some games bearing little or no resemblance to their physical counterparts. Some variations allowed doubles play and four players, and some had computer-controlled players. Some also began to move in other directions, like *Breakout* (1976), in which a ball and paddle was used to destroy a wall of bricks.

The success of the earliest commercial ball-and-paddle games, and the novelty of video games in general, brought about a flood of imitators after 1973, as well as several more models and variations from Magnavox and Atari as well. Ball-and-paddle games were also the first to reach many countries and areas around the world, including **Asia**, **Europe**, **Australia**, **Latin America**, and the **Middle East**. Importation also provided a way for companies established in other areas to enter the video game market; for example, Nintendo's first video game venture was the importation of the Magnavox Odyssey into **Japan** in 1974.

For the 1975 release of the home version of *PONG*, engineers at Atari integrated all the circuitry necessary for the game on a single chip. Chips containing more circuitry became common after the invention of Large-Scale Integration (LSI) chips, and their mass production by General Instruments in 1976—particularly the AY-3-8500 chip, which had all the components for a ball-and-paddle game on it—made games cheap to make. Due to the chip, dozens of companies joined the competition, flooding the market and resulting in a record-breaking year for video game sales as the **industry** flourished.

Another system released in 1976, the Fairchild Channel F, introduced the idea of interchangeable game **cartridges**, unlike the dedicated and unchangeable systems of most ball-and-paddle games. The following year, the Atari VCS 2600 would be released, and as the public realized cartridge-based systems were the future of the industry, interest in dedicated systems waned just as more companies were entering the ball-and-paddle game market, bringing about the **crash of 1977**. After that, consoles of the second **generation of technology** became dominant, and after 1978 ball-and-paddle games had died out almost entirely, leaving only old machines in arcades for some time after that. Today, ball-and-paddle games are a part of **retrogaming** and may appear as **minigames** within larger games, functioning as nostalgic artifacts recalling the birth of video games as an industry.

Mark J. P. Wolf

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Bally

The Bally Manufacturing Corporation was established in Chicago in 1932 as a daughter company of Lion Manufacturing. Named after its first pinball game, *Ballyhoo*, the company produced games and amusement devices and by the end of the decade had expanded into gambling equipment and vending machines. In 1963, following the financial failure of Lion Manufacturing, Bally was bought out by investors and went on to dominate the slot machine market. It introduced the world's first electromechanical slot machine in 1964. In 1969, the company acquired **Midway Manufacturing**, the maker of mechanical and, beginning in 1973, electronic **arcade games**. With a number of successful titles—including licenses to Taito's ***Space Invaders*** (1978) and **Namco**'s *Galaxian* (1979), ***Pac-Man*** (1980), and *Galaga* (1981)—Midway was Bally's primary source of revenue throughout the 1970s and early 1980s.

In the late 1970s, the company briefly ventured into the home **console** business with the **cartridge**-based Bally Professional Arcade. First announced in 1977 (and originally named the Bally Home Library Computer), the system was not released until the following year. The hardware, designed by the Midway division, was based on Midway's **arcade** machines of the time, with a Zilog Z80 CPU, operating at 1.79 MHz, 4 KB of Random Access Memory, and 8 KB of Read-Only Memory. The system could simultaneously display up to 8 colors from a 256-color palette, at the maximum resolution of 160 × 102 pixels, and was capable of producing four-channel sound. Retailing for $299, the Professional Arcade sold poorly, largely because of bad marketing decisions (the system was only available from computer stores) and technical problems (it was prone to overheating and malfunctions).

After Bally decided to withdraw from the consumer market, the license to the system was sold to Astrovision, who rereleased it in 1981 as the Bally Computer System and, beginning in 1982, as the Astrocade. The console was discontinued in 1984, with the company's bankruptcy following the video game **industry crash of 1983**.

In 1981, Bally's pinball division merged with **Midway**. Under the Bally/Midway name the company developed and released such titles as *Tron* (1982), *Spy Hunter* (1983), and *Rampage* (1986). Throughout the early 1980s, Bally expanded aggressively, acquiring the Six Flags amusement park chain, the Health and Tennis Corporation of America, as well as a number of hotels and casinos. However, the company soon ran into financial problems and was forced to sell off a number of divisions, including Bally/Midway, which was purchased in 1988 by WMS Industries (see **Williams**).

Following restructuring and management changes in the late 1980s and early 1990s, Bally Manufacturing split into two independent entities. Bally Entertainment Corporation, focused on the operation of fitness centers and casinos, went on to become Park Place Entertainment, then Caesar's Entertainment. In 2005, it was bought out and dissolved by Harrah's Entertainment. Bally Gaming International, a casino equipment manufacturer, merged with Alliance Gaming Corporation in 1992. In 2006, the company changed its name to Bally Technologies, Inc.

Meanwhile, Williams-Bally-Midway continued releasing arcade games under the Bally/Midway name until 1991, when Midway absorbed Williams's game development division and dropped Bally from the name. Bally brand pinball tables were manufactured until 1999, when Midway, by then an independent company, decided to leave the pinball business.

P. Konrad Budziszewski

BattleZone

Released by **Atari** in fall of 1980, *BattleZone* was the first **arcade game** to use a first-person perspective with an environment produced with true three-dimensional computation. Designed and written primarily by Ed Rotberg and Morgan Hoff, *BattleZone* simulates tank combat on a barren landscape and uses the **vector graphics** technology developed at Atari by Howard Delman. Although previous games viewed gameplay from a third-person perspective, such as similarly-themed *Tank!* (1974) from Kee Games (a company owned by Atari) and the **mainframe game** *Panther* (1975), *BattleZone* provided a perspective from within the tank that the player controls. In the game, the player is pitted against other tanks, as well as occasional flying saucers and guided missiles; he or she may use three-dimensional stationary geometric objects for cover within the game to shield the tank from enemy fire. Both the stationary objects and enemy vehicles in the game are composed of wireframe models that depict the outline of diegetic objects.

Like *Tank!*, *BattleZone* uses two **joysticks** for control of the player's tank and firing of its weapons. Original versions of *BattleZone* **arcade** cabinets used a periscope-like viewfinder through which the player controls the game, much like the one employed in **Midway**'s submarine game *Sea Wolf* (1976) or the earlier **electromechanical game** *Periscope* (1966) by **SEGA**. Although it did not appear in later versions of the game, this scope enhanced the game's first-person perspective by restricting peripheral vision and narrowing the player's vision to the game's events. The player's point-of-view is thus placed within the diegetic game world by both the first-person perspective and by the physical design of the arcade cabinet. Along with ***Defender*** (1980), *BattleZone* pioneered the use of a radar scope depicting off-screen **space** and events in diagrammatic form as an overhead view. This forced players to simultaneously consider events that are visible on-screen as well as those occurring off-screen and only reported by the radar scope (for instance, players must consider the movement of other tanks which may be maneuvering behind the player's tank), enhancing the impression of a virtual space surrounding the player.

Although the game space of *BattleZone* appears to the player to be contained by a mountainous horizon that includes an erupting volcano, player movement is not restricted to a bounded space within the three-dimensional game **world** (that is, players may move in a single direction and never reach a boundary). *BattleZone* is an example of the use of vector graphics in an arcade game, most notably following the first vector-based arcade games, **Vectorbeam**'s *Space War* (1977) and **Cinematronics**'s *Space Wars* (1977), as well as the success of Atari's own *Asteroids* (1979). Although the game's monitor was black and white, a sectioned screen overlay tinted the graphics red at the top fifth of the screen for the radar, score, and other data, whereas the remainder of the screen, used for first-person perspective viewpoint, was tinted green.

Military consultants for the **United States** Army asked Atari to develop a military simulator based on the *BattleZone* game for the Bradley Infantry Fighting Vehicle (IFV). Although members of the development team objected, the simulator (known as *Army BattleZone* or the *Bradley Trainer*) was made, with a number of changes to *BattleZone*, including a new control yoke based on the Bradley IFV. This yoke was used in the later Atari game *Star Wars* (1983), which also features the use of vector graphics and first-person perspective. The legacy of *BattleZone* is evident in contemporary video games, from its popularization of first-person perspective to ports of the game to a number of home systems. Most notably, **Activision** released an updated version of *BattleZone* in 1998 for home computers that significantly expanded gameplay elements and added real-time strategy elements, whereas a 2008 version by Stainless Studios for **Xbox** Live remains closer to the original game, with added features such as multiplayer capability.

Christopher Hanson

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BBSs

See bulletin board systems (BBSs)

“beating” a game

A player can be said to have “beaten” a video game when he or she has achieved mastery over the game narratively, technically, or even on the level of the game’s source code. In contrast to “winning,” in which a player prevails over another player or **non-player character** in a single contest, “beating” a game implies that the player has mastered some aspect of a particular video game completely. Goals that players often work toward to “beat” video games include the completion of a prescribed **narrative**, sometimes in the fastest possible **time**; collecting all of a set of objects or earning a complete set of “achievements”; earning the highest “level” for a player character or on a player network; becoming the most respected or feared personality in a multiplayer game **world**; or even successfully playing *against* the fabric of the game, exploiting all of its “glitches” and “**cheats**” or finding other innovative ways to gain power over the game’s mechanics.

Hidden features, known as “**Easter eggs**,” and other rewards often await players who replay a game with the goal of complete mastery over all of the game’s possibilities. Mark J. P. Wolf writes of how the inclusion of these hidden choices shifts players’ focus away from the completion of an in-game objective (winning) and toward playing “to explore the game’s world and how the game functions” (Wolf, 2006, p. 82).

Paul Budra characterizes the first-person **shooting game** as having particularly “obvious and urgent” goals compared with other game genres. He describes the linearity and narrative reward structure of such games as *Wolfenstein 3D* (1992) and *Doom* (1993) as linking the action of shooting with the production of meaning and writes, “Ideological coherence emerges from digital carnage. The player kills to gain knowledge and, more importantly, certainty, a most rare and precious commodity in the postmodern world” (Budra, 2004, pp. 4–10).

“Beating” the Computer

Some players use the phrase “beating the game” in reference to reaching the end of a game’s technical capacities. In the case of **arcade games** designed to be never-ending, such as ***Pac-Man*** (1980) or *Donkey Kong* (1981), extremely skilled gamers can sometimes reach a “kill screen” where the game’s programming fails, and the game glitches or crashes to such an extent that further gameplay is impossible.

In **narrative** games, exhausting the game’s capacities is often simultaneous with the completion of a narrative. Marie-Laure

Ryan makes a distinction between narrative games and playable stories, writing that "in a narrative game, the player plays to win, to beat the game, and story is mostly a lure into the game world. . . . In a playable story there is no winning or losing: the purpose of the player is not to beat the game, but to observe the evolution of the storyworld" (Ryan, 2009, p. 46). Quantic Dream's *Heavy Rain* (2010) offers different endings depending on a player's actions within the game. Although no single ending constitutes beating *Heavy Rain*, the game gives "achievements" to players who experience different narrative events. Thus, a player may feel as if he or she has beaten *Heavy Rain* when every one of the game's narrative possibilities is exhausted and each "ending" and significant narrative event has been achieved.

Many games feature narrative or visual rewards for successful players in the form of images or **cut-scenes**. An early example of these rewards occurs in *Pac-Man* (1980); after the completion of certain levels, players are shown one of three "intermissions," short narrative animations. ***Metroid*** (1986) offers different endings depending on how quickly players complete the game, with the main character, Samus, removing more of her space suit for faster completion. Because the "best" ending to *Metroid* features Samus waving at the player in a revealing leotard, "beating" *Metroid* could have sexual connotations.

The practice of **speedrunning** builds on *Metroid*'s time-based reward system. The most obvious goal of speedrunning is to complete an entire video game in the shortest possible time. However, the fact that speedrunners often exploit obscure elements of a game's code to finish so quickly suggests that another goal of the practice is to play well-known games in unusual and even virtuosic ways. Although some players showcase their ability to use the original interface for a game to perform a speedrun, "tool-assisted" speedruns use **emulators** to slow down or speed up a game or even to analyze the game on the level of source code. Seb Franklin writes that speedrunning "exposes the abstract functions that underpin the seemingly linear map and sets of objectives that make up major or 'conventional' gaming experiences" (Franklin, 2009, p. 173). In this sense, speedrunners play against the fabric of the game, "beating" the game's code to achieve unconventional outcomes.

"Beating" Other Players

Players' differing gameplay priorities can result in conflict in multiplayer gaming environments. Richard Bartle offers an early model of four types of players in **multi-user domains (MUDs)** that he terms "hearts, clubs, diamonds [and] spades" (Bartle, 1996). Hearts value socializing; clubs attempt to kill other players; spades "dig around for information," attempting to master all aspects of the game's geography and mechanics; and diamonds seek treasure, items, and achievements.

The practice of "griefing," in which players in **massively multiplayer on-line role-playing games (MMORPGs)** intentionally disrupt other players' gaming, is one method in which gamers "beat" other players in a game world. Chek Yang Foo and Elina M. I. Kovisto, in an interview-based study of so-called grief play, suggest that some players may believe they have been intentionally "griefed" by other players when those other players' actions were in fact unintentional. Foo and Kovisto also introduce the related term "greed play," in which players attempt to benefit regardless of whether they do so at the expense of other players. As in "ninja looting" in which players steal items earned by other players, and "kill stealing" in which players participate in killing a mob of enemies to receive some of the "rightful" benefits of the players who started the battle, "the actor will do anything to win; he follows the operational rules of a game, but violates the *spirit* of the game and its implicit rules" (Foo and Kovisto, 2004, p. 249).

On-line gaming networks such as **PlayStation** Network (PSN) and Xbox Live allow gamers to compete against each other through both multiplayer and single-player games. Systems of points or levels visible to other gamers on the network allow gamers to compare statistics about their gaming performance. Achievement-oriented gamers on the PlayStation Network have complained that the PSN trophy system is inadequate for competition against other gamers compared with the "gamerscore" and "achievements" offered on Xbox Live (Chubb, 2010). However, IGN contributor Greg Miller argues that PS3 trophies are more fun to collect because the PSN's abstract "levels" "grade on a curve" compared to Xbox Live's mathematical "gamerscore" (Miller, 2009).

Diana Pozo

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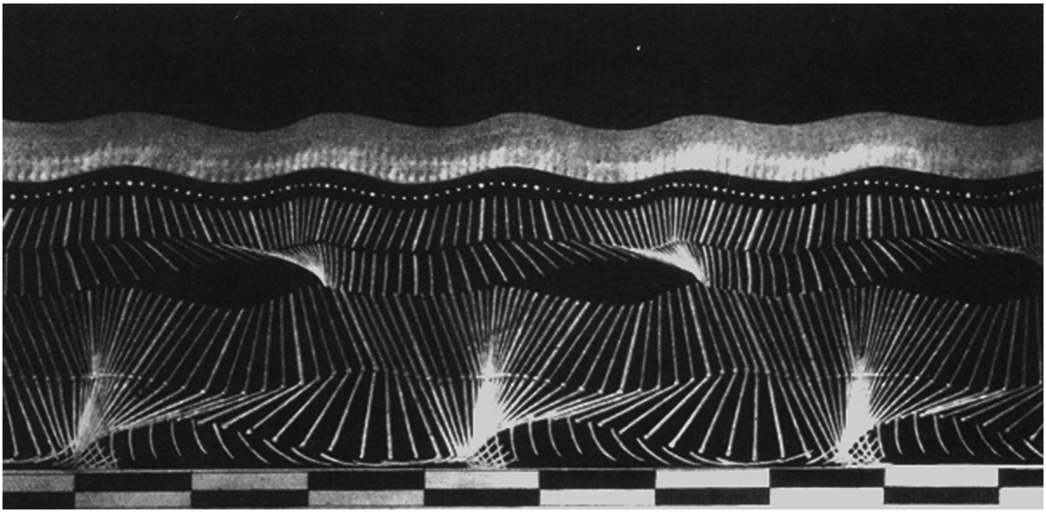
biomechanics

Biomechanics is the application of principles derived from physics to living organisms. As the term suggests, biomechanics combines the disciplines of biology and mechanics—or the physics of various phenomena, such as inertia and gravity—to explain and predict how many physiological processes work, from blood circulation to animal locomotion. As bioengineering professor Y. C. Fung notes, "For an organism, biomechanics helps us to understand its normal function, predict changes due to alterations, and propose methods of artificial intervention" (Fung, 1993, p. 1). Biomechanics is concerned with describing organisms under a variety of conditions, whether at rest or in motion, and the forces such organisms may exert or sustain. Many of the principles applied in biomechanics—and the mathematics that formulate them—are derived from Newtonian physics, such as the laws of thermodynamics and motion, as well as equations for fluid dynamics. With respect to video gaming, biomechanics influences the design of physical **interfaces**, such as the keyboard, mouse, gamepad, and a variety of motion- or touch-sensitive **controllers**, which allow for interaction between player movements and on-screen images.

Although the term "biomechanics" did not emerge until the 1970s, the principle of drawing affinities between the properties of physical processes and living organisms can be traced back to Aristotle's studies of animals. However, it was a contemporary of Galileo, Giovanni Alfonso Borelli (1608–1679), who demonstrated the applicability of mechanics to biological study and is today considered the father of biomechanics (the American Society of Biomechanics annually grants a Borelli Award for leading work in the field). Borelli's *On the Movement of Animals* (*De Motu Animalium,* 1680) illustrates how mathematics related to levers could accurately describe the implications of various loads on the human spine, as well as provide mechanical models for muscular contractions, the beating heart, and intestinal motility. Today, biomechanics is closely aligned with kinesiology, the study of human movement, although biomechanical principles and applications can be found in a variety of disciplines related to the human body, such as medicine, sports, ergonomics and human factors, and performance and other visual **arts**.

Biomechanics and the Moving Image

The history of the moving image is intertwined with the study of biomechanics, which spurred developments in photography and **film** in the 19th century. A wager on the biomechanics of a horse's gallop—whether one of its hooves is always touching the ground—compelled photographic pioneer Eadweard Muybridge (1830–1904) to improve the speed of photographic exposure. In 1877, Muybridge successfully captured a single image of a horse in motion, revealing that all of its hooves leave the ground midstride. The following year, Muybridge created a multicamera setup that could photograph the complete cycle of a horse's gait through a series of sequential images. Muybridge's advances sparked technical, popular, and artistic imagination, and his motion studies and technological developments attained wide influence (including depictions of movement among older visual arts, such as Marcel Duchamp's painting *Nude Descending a Staircase, No. 2* [1912]). However, critics contend that Muybridge's multicamera setup and unscientific methods lacked the precision and consistency required for serious biomechanical study. Physiologist Etienne-Jules Marey (1830–1904) arguably addressed many of



Marey's motion studies, much like motion-capture work in film and video games today, effaced external appearance to reveal the internal, biomechanical characteristics of bodies in motion. (Etienne-Jules Marey/UC Berkeley)

these concerns with his more scientifically rigorous approach to recording movement. In 1882, Marey developed the chronophotographic gun, which shot 12 frames a second at precise intervals through a single lens—a key development for analyzing real-time motion from a fixed vantage point. Marey later developed the "double-use camera," which took high-speed pictures and could expose them on either a fixed plate or on celluloid film to create moving images. Paradoxically for Marey, photography's surfeit of visual information obscured the biomechanical functionality he intended to study; as a countermeasure, he dressed figures completely in black and set them against similarly dark backgrounds, outlining in white only the key joints and limbs he wished to record on film. Ultimately, the efforts of Muybridge, Marey, and others to study movement through space and time yielded cameras and projectors useful for both scientific and artistic purposes. In the 20th century, film would become a product of scientific modernism and a record of its key concerns—specifically, a fascination with the moving human form in a variety of industrial, personal, and recreational contexts.

Biomechanics and Video Games

Within computer and electronic culture, biomechanical considerations can be identified in two areas: in the **space** of the screen, where fidelity of character movement to a real-world counterpart or to viewer experience of such movement may be essential; and in the interface itself, with which the player or user manipulates digital objects via biomechanical input. Contemporary **motion-capture** techniques—for computer modeling, film special effects, and video game animation—are reminiscent of Marey's efforts to isolate the function of movement within the body's form. In the modern version, the movements of live actors (such as professional athletes) are recorded digitally as points, creating a biomechanical frame that can be composited with the animated or photo-real likeness of the figure. Video game interactivity takes such recreations a step further, as simulated, game **world** mechanics (such as gravity and collision detection) and biomechanics (such as character movement) are combined with the real-world biomechanics of the player. Most computer and video game interfaces or controllers (such as keyboard, mouse, **joystick**, gamepad, etc.) are designed to translate movements of the finger, hand, and wrist (such as pressing a button or pulling a lever) into an on-screen result.

In the 21st century, biomechanical considerations have expanded with the proliferation of **gestural interfaces**, devices that mobilize more of the body's biomechanical ability for input and often evoke movements used in other settings. The introduction of the **Nintendo Wii** in 2006 began a trend in game and interface design that paired well-known games, such as tennis, golf, and boxing, with motion-sensitive controllers (such as Nintendo's Wiimote, Sony's Move, and Microsoft's Kinect) to bring the sensation of swinging, chipping, punching, and other activities to video gaming. Apple's iPhone, which debuted in 2007, has similarly changed the interface landscape for mobile media devices, as the screen itself is responsive to touch, orientation, and movement. Although such interfaces are relatively new to home **consoles** and mobile media devices, the **arcade** market has long developed one-off or game-specific interfaces exploring various types of bodily movement; one notable example that traversed the arcade/home divide is ***Dance Dance Revolution*** (1998), which features a pressure-sensitive pad for players to coordinate elaborate dance movements with musical and visual cues.

Professionals from various fields continue to explore the implications of increased biomechanical input on various theoretical concepts, on utility and efficiency, and on the body and its **health**. *The New England Journal of Medicine* has noted an increase in what it calls "Wii-itis," or injuries sustained to muscles and joints by overuse of gestural interfaces, although carpal-tunnel syndrome remains the most diagnosed interface-related injury due to the prevalence of the keyboard and mouse. Personal trainers and rehabilitation experts are evaluating the substitution of biomechanically expansive interfaces for other forms of exercise, and designers are questioning whether the use of accelerometers, touch-sensitive screens, and other motion-enabling technologies are truly good design or simply mere novelty. For video game scholars, the emergence of new interfaces and their biomechanical consequences generate compelling research questions about the nature of interactivity and the experience of video game **play**.

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BioShock series

The *BioShock* series is a franchise of first-person **shooting games** including *BioShock* (2007), *BioShock 2* (2010), and *BioShock Infinite* (2013). *System Shock 2* (1999) shares gameplay and **narrative** elements with *BioShock* and is an important progenitor of the series. *BioShock* was developed by Irrational Games (at the time named 2k Boston) led by game designer Ken Levine. It was originally released on the **Microsoft Xbox 360** and Windows. A version for the **Sony PlayStation 3** followed in 2008. The game received extensive critical praise, particularly for its **emotional** and intellectual approach. It was among the best-selling games of 2007.

The level-based gameplay of *BioShock* combines traditional first-person shooter gunplay and physical powers such as electricity and fire-based attacks that players are able to mix to achieve unique effects. Both weapons and powers are upgradable, adding an aspect of role-playing to the game. *BioShock* is set in Rapture, an underwater city built by the business magnate Andrew Ryan. Rapture is significant both for its art deco architecture and sophisticated art design, and for drawing on philosophical ideas expressed in Ayn Rand's *Atlas Shrugged*.

Set in 1960, the story begins with the protagonist Jack surviving an air crash in the Atlantic and using a bathysphere to enter the city of Rapture. Exploring Rapture, Jack encounters various "Splicers" who are the former inhabitants of Rapture now physically and mentally disfigured by their use of genetic modification technology. Jack is guided through a number of tasks by a man named Atlas, with whom he communicates through a radio. Jack also hears messages from Andrew Ryan warning him to curtail his hostile activities and explaining the politics of Rapture.

Jack has frequent encounters with the Little Sisters and Big Daddies. The Little Sisters are little girls designed for the purpose of extracting ADAM from the bodies of Splicers, a substance that Jack needs to upgrade his own abilities. The Big Daddies are the protectors of the Little Sisters, although they become a threat only if the player initiates combat. Having defeated a Big Daddy, Jack is free to "harvest" or "save" the accompanying Little Sister. The game has three possible endings, differing in content and emotional tone, that depend on how the player chooses to deal with the Little Sisters.

BioShock is famous for a narrative twist. Eventually Jack learns that Atlas is actually Frank Fontaine, Ryan's competitor for the control of Rapture. Furthermore, Jack is Ryan's illegitimate son, genetically modified and conditioned to respond to the use of the phrase "Would you kindly." This phrase is revealed as the means through which Jack has been manipulated to do

Atlas/Fontaine's bidding in the earlier parts of the game. In a final defiant act, Ryan employs the phrase to have Jack kill him with a golf club. The remainder of the game is spent taking revenge on Fontaine with the aid of the Little Sisters.

BioShock was followed by a sequel in 2010, developed by 2k Marin and released on the **Microsoft Xbox 360**, Windows, and PlayStation 3. *BioShock 2*, in which the player takes on the role of a Big Daddy, further explores the fall of Rapture and introduces the Big Sisters.

In 2010, Irrational Games announced *BioShock Infinite* for a projected 2012 release. The game is set in the early 20th century against a political backdrop of American exceptionalism within a city in the sky named Colombia.

Grant Tavinor

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Blu-Ray Disc games

See DVD and Blu-ray Disc games

board games

Board games extend back into ancient times and have been found buried in Egyptian tombs. They generally consist of some small physical playing field or surface (the "board") with pieces that players move from one position to another, usually in competition to complete some goal, such as getting to some location first, the capture of other player's pieces, or the completion of some strategic configuration, all according to some set of **rules** that players agree to follow. Many aspects of board games appear in video games as well, including the idea of a playing field, **avatars**, rules, goals, turn-taking, win-lose conditions, points and scoring, the importance of relative positioning, and more. Several board game companies like Milton Bradley and Parker Brothers also produced video games and occasionally even game **consoles** (like the **GCE/Milton Bradley Vectrex**).

The most common link between board games and video games are video game **adaptations** of board games, like those produced for public domain games like chess, checkers, and Go, or copyrighted games like *Monopoly* or *Scrabble*. Computer chess programs have even been used as a means of benchmarking computer performance (the first chess-playing computer program was written in 1950). Early examples of commercial adaptations of board games include the **Atari VCS 2600** games *Video Chess* (1979), *Othello* (1980), and *Video Checkers* (1980).

Board games and video games have often influenced each other's **designs**. First, there are hybrid games, video games that were combined with board game materials in some way. The first home video game system, the **Magnavox Odyssey**, used board game supplies along with some of its games, including dice, poker chips, paper money, and score sheets. Three games for the Philips Videopac video game system, *Conquest* *of the World* (1982), *Quest for the Rings* (1982), and *The Great Wall Street Fortune Hunt* (1982), all involved on-screen video game **play** as well as a game board with movers, combining video game play and board game play. Second, some video games are designed like board games, even though they are not adaptations of existing board games; for example, the arcade game *Ataxx* (1990), the home **computer game** *Hexxagōn* (1993), or *Mario Party* (1998). Finally, several board games were based on video games, including ***Pac-Man*** *Game* (1982), *Super Xevious* (1985), *Myst: The Puzzling New Board Game Adventure* (1998), and ***StarCraft****: The Board Game* (2007).

A number of board games have used video as an element of the game, first on videotape and later on **DVD**, such as the *Clue DVD Game* (2006) or *The Lord of the Rings DVD Trivial Pursuit* (2004). Despite the use of interactive video, these games would not be considered video games by most definitions because the player's pieces move around on the physical board rather than on-screen.

Mark J. P. Wolf

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bulletin board systems (BBSs)

Computerized bulletin board systems, or BBSs, appeared in the 1970s and were online services where one or multiple users could connect and exchange information, such as a software, electronic mail, and messages on public message boards. The term "bulletin board system" is a reference to traditional cork-and-pin bulletin boards found in public **spaces**, where people can post announcements and news. Originally, BBS users utilized a terminal program to log in over a phone line using a modem. By the 1990s, some BBSs allowed access via Telnet or packet-switched networks, such as the Internet. In many ways, the BBS was the first form of on-line community for many users.

The first significant computerized bulletin board system was called the Community Memory Project, which started in 1973 and used hardwired terminals in neighborhoods in Berkeley, California (Rossman, 1975). The first public dial-up computerized BBS, known as CBBS, went on-line February 16, 1978, in Chicago, Illinois, and was developed by Ward Christensen and Randy Suess, who began preliminary work on the system during the Great Chicago Blizzard of 1978 (Lee, 2005).

Most BBSs were operated free of charge by computer hobbyists, known as "system operators" or "sysops." Because BBSs were often operated out of homes, access was not always available because the technology was sometimes unreliable. Some BBSs, mostly file exchange or business services, charged subscription fees for use. Phone lines were used for **access**, and thus early BBSs were mostly local ventures, because dialing outside calling areas incurred long-distance charges. Given that most users lived in close proximity to one another, "BBS Meets" or "Get Togethers" where users gathered to meet face-to-face, were common. BBSs were generally operated by hobbyists, and thus it was common for discussions on the early boards to revolve around topics popular among technophiles.

As BBSs gained in popularity, a number of special interest boards began to emerge. Boards were available for most every hobby and interest, including politics, religion, personals, music, and alternative lifestyles. In addition, some BBSs carried themes, reflected in their names and on their welcome screens. Common themes included castles, dungeons, spaceships, pirate ships, sanatoriums, and circuses. Some "elite" or "warez" boards exclusively offered pirated software and required membership in order to exclude law enforcement ("lamers"). Despite these efforts, some of the BBSs providing illegal content were cracked down on. On July 12, 1985, The Private Sector BBS, the official BBS of the gray hat hacker quarterly magazine *2600*, was raided by the Middlesex County (New Jersey) Sheriff's Office in conjunction with a credit card fraud investigation. A BBS in Boardman, Ohio, Rusty n Edie's, was raided by the FBI in January of 1993 for software piracy and later sued by *Playboy* magazine for copyright infringement. In 1996, the sysop of a BBS in Flint, Michigan, was charged with distributing child pornography.

BBSs were most popular from the late 1970s to the mid-1990s. The introduction of faster modems in the 1980s, 1200-baud modems versus the 110- and 300-baud modems in use during the late 1970s, led to an increase in popularity. The World Wide Web gradually began replacing BBSs in the mid-1990s, when BBS usage reached its peak, but BBSing remains popular today in different parts of the world. A number of print publications sprang up around BBSs in the early 1990s, including *Boardwatch*, *BBS Magazine*, and *Chips 'n Bits Magazine*, and publications devoted to computer hobbyists often listed BBSs.

The early bulletin board systems ran on microcomputers and customized **homebrew** software. However, by the early 1980s, BBS software was available for the home computer systems produced by Apple, **Atari**, and IBM. By the mid-1980s, a number of popular BBSs were running on the Commodore 64 and Commodore Amiga models. MS-DOS remained the most popular operating system until the introduction of the World Wide Web in the mid-1990s. Most BBSs were generally text-based, displayed using ASCII or ANSI, principally due to the limited bandwidth available through dial-up modems over analog land lines. Early use of custom character sets, such as ATASCII for Atari or PETSCII for Commodore, resulted in compatibility issues. By the late 1980s and into the 1990s, most BBSs began to employ ANSI art to incorporate graphics and color into their interface. Experimentation with ANSI art led to a BBS subculture of ANSI **graphic** artists.

One legacy spawned by early BBS computer hacker subculture was the slang known as leet or "l33t," which comes from the word "elite," referencing the membership-only BBSs frequented by hackers in the early 1980s. l33t (or 1337) is unique in its substitution of other characters to represent letters in a word. Once exclusive to hackers, l33t has since entered mainstream culture. Versions of l33t are still used today by gamers and some web communities. N00bs, or newcomers, to on-line gaming are challenged to learn the l33t speak frequently used by gaming veterans. One could argue that a version of l33t is used by most everyone today who text messages or tweets.

Before popular use of packet-switched networks, BBSs with multiple phone lines offered chat rooms and on-line games where users could interact in real time. In the 1980s, door games, both single-player and multi-player, drew early on-line gamers. Bulletin board system "doors" allowed users to communicate with external programs, such as games, so games offered through BBSs were referred to as "Door Games." Some of first versions of these closely resembled **board games**. Players would submit their moves to the sysop or Gamemaster, and their moves were updated and posted daily or several times daily. Door games evolved, and soon many allowed for automation by the computer. Many BBSs with multiple phone lines, for simultaneous log-ins, offered ASCII text-based games which allowed users to compete or interact with one other in virtual environments. Some popular 1980s door games include *Trade Wars* (1984; a possible precursor to *EVE Online* [2003]), *Usurper* (1985), *Space Empire Elite* (1987), *LoRD* (*Legend of the Red Dragon,* 1989), and *The Pit* (1989).

Staci Tucker

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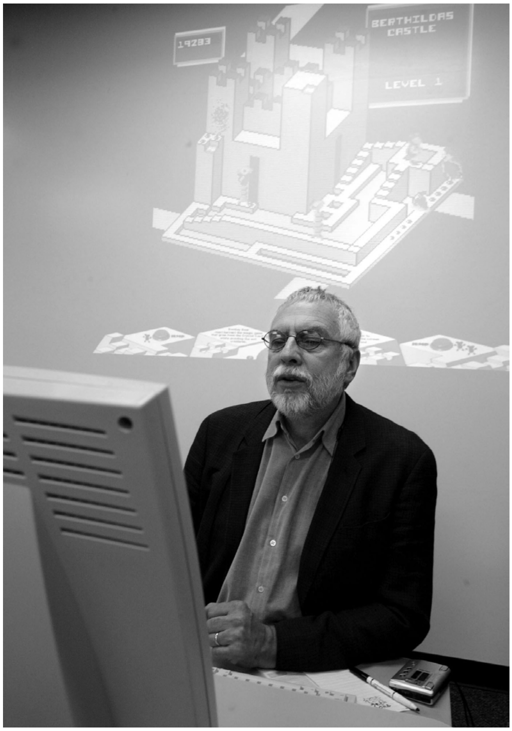
Bushnell, Nolan (1943–)

Sometimes described as the "Father of the **Arcade** Video Game **Industry**," Nolan Bushnell was born in 1943 and raised in Utah, where he took over his father's concrete business at 15 when the elder Bushnell passed away. While in high school, Bushnell also began working at an amusement park in Farmington, Utah, running **electromechanical** midway games. He studied electrical engineering at the University of Utah, one of four educational institutions in the **United States** that possessed a Digital Equipment Corporation PDP-1 mainframe computer. During this time, hundreds of games were programmed using the display and the PDP-1 power including a pinball game, hockey game, and a ping-pong game. On another PDP-1 at the Massachusetts Institute for Technology (MIT), the computer game ***Spacewar!*** (1962) was developed by students and was considered the best game, and the program circulated to the other schools with a PDP-1. While at the University of Utah, Bushnell became an avid fan of *Spacewar!* and later created the first mass-produced commercial coin-operated video game ***Computer Space*** (1971). *Computer Space*, which was largely based on *Spacewar!*, was developed by Syzygy Engineering, a company founded by Bushnell and Ted Dabney in 1969. Bushnell and Syzygy sold the rights to *Computer Space* to mechanical coin-operated game company Nutting Associates (founded by Bill and Dave Nutting), who ultimately released only 3,000 units of the game (2,200 single-player units and 800 two-player units). Bushnell attributed the lack of success of *Computer Space* to be partly due to the complexity of the game's instructions and its gameplay mechanics.



Nolan Bushnell plays the game *Crystal Castles* (1983), which can be seen overhead, at the University of Utah on April 12, 2002. (AP photo/Steve C. Wilson)

Bushnell and Dabney formed **Atari**, Inc. in June 1972 (Dabney left the company in 1973), where Bushnell oversaw the creation of Al Alcorn's ***PONG*** (1972) after being reminded of the tennis games played in college on the PDP-1 computer when he saw a demonstration of a table tennis game prototype for the **Magnavox Odyssey**. After negotiating with both **Bally** and **Midway** to release the game, Bushnell instead decided that Atari should produce *PONG* as the company's first coin-operated **arcade game**. Following the commercial disappointment of the comparatively complex *Computer Space*, *PONG* instead demonstrated simple gameplay and concise accompanying instructions: "Avoid missing ball for high score." *PONG* proved to be an immediate success, prompting Atari to release several improved variants of the arcade game in subsequent years. Soon after founding Atari, Bushnell also surreptitiously cofounded Kee Games with neighbor and friend Joseph Keenan. Bushnell actively sought exclusivity contracts with regional distributors for Atari, which legally required distributors to purchase only Atari games. Kee Games was conceived as a way to sign exclusivity contracts with secondary distributors, effectively rebranding and selling Atari games with only minor cosmetic changes. One of Kee's first original games, *Tank!* (1973), proved so successful that it single-handedly rescued Atari from a financial crisis and prompted the merging of Kee Games with Atari in December 1974, with Keenan as the new president of the company and Bushnell as its chairman.

Bushnell's work at Atari increasingly shifted away from engineering projects to overseeing the corporation, and he pushed the company to expand beyond its coin-operated games. Faced with competition from similar arcade games that were undermining the initially lucrative *PONG*, Bushnell supported several of Atari engineers' proposed development of a home version of the game by transferring the complex design of *PONG* onto a single chip. Demonstrations of this home iteration of *PONG*, which could be connected to **television** sets, took place at the 1975 New York City Toy Fair but piqued little interest among toy retailers. Bushnell eventually signed an exclusive deal with retail chain Sears, Roebuck, and Co. to produce 150,000 *Home PONG* units to be sold at Sears stores during the 1975 holiday season, securing capital from friend Donald Valentine to finance the production of the units for Sears.

After the exclusivity deal with Sears expired, Atari produced and sold its own version of *Home PONG*, and Bushnell spurred development of the **Atari Video Computer System** (VCS, later renamed the Atari 2600), a home **console** that would use interchangeable game **cartridges** rather than have dedicated (and thus limited) games. To secure sufficient capital for the launch of the VCS, Bushnell sold Atari to Warner Communications in November 1976 for $28 million. Bushnell's next venture would be a restaurant chain. The first Chuck E. Cheese had been developed in Atari research and opened in the fall of 1976. After the sale of Atari, Warner did not understand the value of a captive arcade chain and sold it to Bushnell. Chuck E. Cheese's Pizza Time Theatre sought to create a family-friendly venue for video games to compete with existing video arcades, which had been negatively portrayed in the media, and to secure a stable commercial space for Atari's products. While working on a follow-up system to the Atari VCS, Bushnell was forced to leave Atari by Warner executives in 1978 following escalating disagreements about pricing of the VCS and the next generation of machines. During negotiations for the acquisition of Atari, Warner insisted that Bushnell agree to a noncompete clause that would prevent him from working in video game development for seven years; this agreement would remain in effect until 1983.

In 1982, Bushnell left the day-to-day management of Chuck E. Cheese to a restaurant veteran who changed the formula, which caused the restaurants to begin to lose money. Bushnell tried to step back in but was rebuffed by the board, and he resigned in 1983. The following year, Chuck E. Cheese declared bankruptcy and was purchased by rival chain Showbiz Pizza Place.

Following his departure from Atari, Bushnell also started Catalyst Technologies, the first high-tech incubator, which provided technical services and startup capital to small high-tech businesses. During this time, Catalyst funded and formed 14 companies and had positive exits in all but three, which is considered a very good record for early stage companies. The companies included Compower, the developer of the switching power supply (sold to Boshert at a profit); Etak, the first automobile navigation system for cars (sold to News Corp. at a profit); ByVideo, who had the first on-line shopping system (sold at a profit); Axlon Toys and Games (sold to Hasbro at a profit); Timbertech, which ran computer summer camps (sold at a loss); I'Ro, cosmetic test systems (sold at a loss); Androbot, a personal robotics company (sold at a loss); Cumma, programmable game vending (sold at a profit); Magnum Microwave, simple high-speed communications (sold at a profit); Octus, unique call control (taken public); KadabraScope, which produced digital animation (sold to Lucasfilm); Digivision, video display chips (sold at a profit); CompShop, a chain of computer retailers (sold at a profit); and EnerOp, an electronic communication technology company (sold at a profit).

Bushnell has founded or served on advisory boards to dozens of game and technology companies, and in 2000 he launched uWink, a business which develops and incorporates touch-screen technologies and games into restaurant **spaces**, including its own company-owned uWink Bistros. Bushnell has been inducted into the Video Games Hall of Fame and the Consumer Electronics Association Hall of Fame and continues to work in technology, game, and media development. In April 2010, Bushnell was invited to serve on the Board of Directors of Atari, bringing the iconic figure back to help guide the future of the revolutionary company he cofounded.

Christopher Hanson

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C

Caillois, Roger (1913–1978)

Roger Caillois was a French essayist, poet, literary critic, sociologist, anthropologist, and philosopher. He was a member of the Surrealist movement (1932–1934), co-initiator of the Collège de Sociologie in 1938, founder of the journal *Lettres Françaises* in 1941, appointed as a senior official of the United Nations Educational, Scientific, and Cultural Organization (UNESCO) in 1948, founder in 1953 of UNESCO's journal *Diogène*, and elected to the *Académie Française* in 1971. Through his various works, Callois has investigated the powers of imagination, poetry, the fantastic, the sacred, and natural science. He is an important figure in game studies because of his book *Man, Play, and Games* (1961; the French edition has an often-forgotten subtitle, *Les jeux et les hommes: Le masque et le vertige* [*Mask and Vertigo*] [1958]). Following the appendix of the second edition of *Man and the Sacred* (1950) titled "Play and the Sacred," in which Caillois criticizes Johan **Huizinga**'s "mentally stimulating" *Homo Ludens: A Study of the Play-Element in Culture* (1938), Caillois's major contributions are twofold.

On the one hand, because he finds Huizinga's definition of **play** "at the same time too broad and too narrow," Caillois begins *Man, Play, and Games* by reconsidering the aforementioned definition and giving his own detailed explanation (that will also, in turn, be used and criticized by future theoreticians). For Caillois, play is an activity which is essentially:

1. *Free*: playing is not obligatory; if it were, it would at once lose its attractive and joyous quality as diversion;
2. *Separate*: circumscribed within limits of **space** and **time**, defined and fixed in advance;
3. *Uncertain*: the course of play cannot be determined, nor the result attained beforehand, and some latitude for innovations is left to the player's initiative;
4. *Unproductive*: creating neither goods, nor wealth, nor new elements of any kind; and, except for the exchange of property among the players, ending in a situation identical to that prevailing at the beginning of the game;
5. *Rule-governed*: under conventions that suspend ordinary laws, and for the moment establish new legislation, which alone counts;
6. *Make-believe*: accompanied by a special awareness of a second reality or of a free unreality, as against real life. (Caillois, 1961, pp. 9–10)

Those qualities are intended to define "the nature and the largest common denominator of all games." They are "purely formal" and "do not prejudge the content of the games."

On the other hand, Caillois considers Huizinga's study as an inquiry "of the spirit that rules certain kinds of games—those which are competitive." However, for Caillois, there is a multitude and infinite variety of games that possess many characteristics. *Man, Play, and Games* therefore comes up with a classification as complete and systematic as possible. Caillois distinguishes four fundamental categories of games: *agôn*, *alea*, *mimicry*, and *ilinx*. The first kind includes all games in which there is always a "question of rivalry," which has for an essential principle the search for equality; *agôn* is the Greek word for competition. For Caillois, "the point of the game is for each player to have his superiority on a given area recognized." This is akin to Huizinga's claim that the agonal dimension is central to any social activity. Chess, contests, and sports in general are examples of *agôn*. The second category consists of games that are based on chance; *alea* is the Latin name for the game of dice. It "signifies and reveals the favor of destiny." Success does not depend on the player; gambling and lotteries are examples of *alea*. The third category refers to games in which the role of simulation and make-believe is predominant; "mimicry" is the English name for mimetism. The player temporarily enters a "closed, conventional, and, in certain respects, imaginary universe." He or she can dress up, wear a mask, or play a role. In other words, the player accepts "an illusion (indeed this last word means nothing less than beginning a game; *in-lusio*)." Children's imitation, as well as theater and spectacle in general, are examples of mimicry. The fourth category consists of games based on the search for vertigo; *ilinx* is the Greek word for "whirlpool." These games consist of an attempt to destroy for a moment the stability of perception and create a kind of voluptuous panic. Swinging, horseback riding, skiing, and tightrope walking are examples of *ilinx*. For Caillois, what makes this classification rational remains the player's psychological attitude in front of and within a game:

> the desire to win by one's merit in regulation competition (*agôn*), the submission to one's will in favor of anxious and passive anticipation of where the wheel will stop (*alea*), the desire to assume a strange personality (*mimicry*), and, finally, the pursuit of vertigo (*ilinx*). In *agôn*, the player relies only upon himself and his utmost efforts; in *alea*, he counts on everything except himself, submitting to the powers that elude him; in *mimicry*, he imagines that he is someone else, and he invents an imaginary universe; in *ilinx*, he gratifies the desire to temporarily destroy his body equilibrium, escape the tyranny of his ordinary perception, and provoke the abdication of conscience. (Caillois, 1961, p. 44)

According to Caillois, the four categories still do not fully cover the universe of games. Within each category, games "can be placed on a continuum between two poles: the *paidia* and the *ludus*." The *paidia* is "an almost indivisible principle, common to diversion, turbulence, free improvisation, and carefree gaiety is dominant. It manifests a kind of uncontrolled fantasy." The *ludus* is "a growing tendency to bind it [this *paidia*] with arbitrary, imperative, and purposely tedious conventions, to oppose it still more by ceaselessly practicing the most embarrassing chicanery upon it, in order to make it more uncertain of attaining its desired effect" (Caillois, 1961, p. 13).

Although the two poles give more precision to the classification, Caillois proposes an expanded theory of games by showing the various relationships between his four categories. The combinations competition-vertigo and chance-simulation cannot be associated because one needs to stay in control to be able to compete and because one needs to decide consciously to make believe; competition-simulation and chance-vertigo are contingent insofar as the player of games of chance is seized by some sort of vertigo and because games of competition are also a spectacle. There are, then, two fundamental relationships: competition-chance (because games can't exist without rules) and simulation-vertigo (which also presumes a world without rules in which the player constantly improvises).

As Caillois discusses the possible corruption of play, the social function of play, and, following Huizinga, a sociology derived from games, he particularly shows the interdependence of games and culture and tries to diagnose a "civilization in terms of the games that are especially popular there." Broadly, primitive societies are "ruled equally by masks and possession, i.e., by *mimicry* and *ilinx*," because orderly societies have "fixes and hierarchical privileges in which *agôn* and *alea*, i.e., merit and heredity seem to be the chief complementary elements of the game of living." However, "since *mimicry* and *ilinx* are always tempting man," they are found in the modern world in the form of carnival, amusement park, circus, tightrope, and, of course, video games.

Bernard Perron

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Canada

From the beginning of the video game **industry** to the North American industry **crash of 1983**, Canadian players bought American products from **Atari**, Mattel, and **Coleco**, and everything played in the country was made by Canada's southern neighbor. The history of Canadian video game production began in 1983 with a game called *Evolution*, which was created by two Vancouver teenagers, Don Mattrick and Jeff Sember, who designed a player experience tracing the natural evolution from the first life forms to the appearance of the human race. Published by Sydney Development Corporation for PCs, the game sold more than 400,000 copies. Proud of their success, the two creators founded a company in British Columbia called Distinctive Software in the 1980s, with 60 employees, a size unheard of at that time. That same year in Ottawa, Ontario, Rick Banks and Paul Butler of Artech Digital Entertainment Studio created *B.C.'s Quest for Tires* (1983) a game in which the caveman player-character must rescue his girlfriend who is kidnapped by a dinosaur. The next year the sequel, *Grog's Revenge* (1984) was released.

In 1991, **Electronic Arts (EA)** bought Distinctive Software and rebranded the studio EA Canada. The industry grew significantly when employees left the company to begin third-party studios such as Radical Entertainment (*Prototype* [2009]), Relic Entertainment (*Company of Heroes* (2006]), Barking Dog (now Rockstar Vancouver), and Black Box Games (acquired by EA in 2002). These acquisitions by EA in the 1990s and the 2000s would create the biggest production capacity in Vancouver and subsequently in Canada and in the world. Among their base of operations are EA Montreal and EA Edmonton, also known as Bioware.

Before becoming a subsidiary of Eletronic Arts, Bioware was formed in 1995 in Edmonton, Alberta, by Ray Muzyka, Greg Zeschuk, and Augustine Yip. Specializing in **role-playing games (RPGs)** for the PC market, Bioware became one of the most praised companies in the Western world in the early 2000s. Their success with the *Baldur's Gate* and *Neverwinter Nights* franchises and games including *Knights of the Old Republic* (2003) and *Mass Effect* (2007) are among the most celebrated RPGs in the world and have become a reference point for many creators.

While EA's Vancouver Studio is the largest center of production in Canada, the second largest, more than 2,900 miles away, is Montreal with the presence of EA, Eidos, Warner Bros., and especially Ubisoft. In 1997, the Quebec government, with a lot of subsidies, convinced the French company to open a big studio in the province. After a slow start, Ubisoft Montreal became, less than five years later, the second biggest studio in the country and one of the most productive in the world. Thanks to franchises like *Splinter Cell* and *Prince of Persia* (and *Prince of Persia: The Sands of Time* [2003] in particular) the studio acquired both revenues and credibility. Since then, Ubisoft Montreal has grown to more than 2,500 employees to become one of most important studios in the world.

Canadian video game history is not limited to its production capacity and its titles. Technological innovation and creative savvy play a role in this explosion as well; in 2005, Syd Bolton opened the Personal Computer Museum in Brantford, Ontario, to document and to conserve the history and the present state of the video game industry in the world and especially in Canada. As of late 2010, more than 3,000 software pieces are exhibited in the museum, a number which will only increase as the industry continues to prosper in Canada.

Louis-Martin Guay

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Capcom

Capcom is a **Japanese** video game developer and publisher with significant franchises in both the home **console-based games** market and **arcade games**. It was officially founded in 1983 to take over Osaka-based Sambi Co.'s internal sales department. The company's series helped establish (and continue to dominate) a number of major genres: run-and-gun **shooting games** (the *Mega Man* series), hack-and-slash games (the *Devil May Cry* series), **fighting games** (the *Street Fighter* series), and **survival horror games** (the *Resident Evil* series). Capcom is primarily known as a purveyor of highly skill-based video games that appeal to "hardcore" gamers.

Despite a focus on shooting games for the company's first titles in 1984 and 1985, Capcom quickly established a number of run-and-gun franchises that spawned decades of sequels. The arcade game *Ghosts 'n Goblins* (1985) maintains notoriety as one of the most difficult games of all time. It follows a knight, Arthur, who collects armor power-ups and alternate weapons to battle the undead on a quest to save a princess. Arthur dies after two hits or when a fairly short timer reaches zero. Capcom's *Mega Man* (1987), for the **Nintendo Entertainment System (NES)**, ushered in the conventions of nonlinear level selection and selectable weapon modes derived from completed boss battles.

As a third-party developer, Capcom was instrumental in the success of the **Super Nintendo Entertainment System (SNES)**. The console release of ***Street Fighter II*** (1991), an SNES exclusive and first third-party hit, sold more than 2 million copies, and with an estimated 60,000 arcade machines sold worldwide, *Street Fighter II* also reinvigorated **U.S. arcades** (Kent, 2001, p. 446). Designed by Capcom's own Yoshiki Okamoto, *Street Fighter II*'s keys to success were its skill-based "secret" moves and wide selection of playable characters, each with their own strengths, weaknesses, styles, and movesets (Donovan, 2010, p. 221). The *Street Fighter* franchise also standardized the six-button **controller** layout used in most contemporary fighting games. Iterated on and graphically retouched countless times, *Street Fighter II* remains a staple of competitive gaming.

Today, Capcom titles continue to fuel the growing professional fighting game community. At the 2010 Evolution Championship Series (EVO), the largest and longest-running fighting game event in the world, four out of the six featured tournaments were for Capcom games: *Super Street Fighter IV* (2010), *Tatsunoko vs. Capcom* (2008), *Super Street Fighter II HD Remix* (2008), and *Marvel vs. Capcom 2* (2000). Capcom also supports professional gaming through funding, **advertising**, and broadcasting partnerships.

In the mid-1990s, Capcom's *Resident Evil* franchise successfully translated the cinematic tropes of the Romero-style zombie **film** into low-polygon **resolution** three-dimensional **graphics** (Donovan, 2010, p. 275). The game reveled in moody atmosphere, awkward camera angles, limited ammunition, and surprise attacks from slow-moving but inexorable enemies. Capcom again shifted the direction of the horror genre in 2005, when *Resident Evil 4* introduced a more action-oriented approach to zombie survival, with a focus on faster enemies and crowd dynamics, leading the way for popular titles such as Capcom's own *Dead Rising* (2006) and Valve's *Left 4 Dead* (2008) (Donovan, 2010, p. 277). Despite justified criticism of its portrayal of African people as violent savages, *Resident*

Evil 5 (2009) became the best-selling game of the franchise.

Simon Ferrari

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careers

Video game **industry** careers are often situated along one of several tracks, including the roles of **game designer**, software programmer, **artist**, animator, quality assurance tester, marketing specialist, and producer. Companies that produce game consoles also use hardware engineers for the design and manufacture of video game systems.

Game designers are responsible for creating a game's fictional scenario, as well as for establishing the **rules**, mechanics, and tuning and adjusting these rule systems to optimize gameplay. In **strategy games**, for example, a game designer might be responsible for designing the basic layout of **maps** for the game's **world**, setting and adjusting the values and attributes for each game element, and establishing the relationships between elements. After creating the main aspects of game play mechanics, designers focus on building levels, writing the game's backstory, and balancing aspects of gameplay. Some designers specialize in specific aspects of a game's design; for instance, several level designers may work under a lead designer, with each building the layouts and maps of different parts of a game.

Software programmers often come from a computer science background and are responsible for the construction of the software frameworks and **game engines** upon which games run. The design and implementation of such software systems is often divided among programmers, who are often broken up into teams based around specific elements of the game; for instance, one or more programmers may be tasked with the building of the three-dimensional **graphics** engine for a game, while others may focus on the software code that handles the network and multiplayer capabilities of a game. Programmers also build the software tools used by other people involved in the production of the game. For instance, programmers may design the map-building and scripting tools that are used by the designers to construct the rudimentary elements of the game.

Artists design the visual and aural aspects of the game, crafting the appearance of characters and other elements in the game. After the basic gameplay mechanics, map layouts, and game elements have been established by the game's designers, artists will shape a game's aesthetic appearance. Artists conceive of the appearance and tone of a game, such as creating conceptual sketches of characters and levels for the game and will shape elements such as lighting and **sound** effects. Animators draw and design character movement and other aspects of motion in the game using both traditional and digital techniques to create frame-by-frame relationships for movement. Animators also employ **motion-capture** systems to record digitally the movement of people or other objects to translate the data into realistic motion animations within the game.

Game testers, also known as quality assurance (QA) testers, are tasked with verifying game functionality, checking for software bugs and gameplay balance, and ensuring the proper behavior of game features. QA plays a key role in the development of games to ensure that the games work as designed and are enjoyable experiences for the player. Some game companies will outsource QA work to other companies that specialize in software testing.

Marketing and public relations specialists help promote games and the companies that produce them, working with websites, magazines, **television** shows, and other media outlets by using **advertising** and other means to garner the attention of game players and the game press.

Game producers manage the creation of games, coordinating the schedules of the different people and teams described above to help them work together to produce the game. Given the large numbers of people and enormous budgets required to make a game (particularly more visually complex ones), producers are necessary help to organize and coordinate a game's development.

Hardware engineers are more common at companies that produce video game **arcade** or **console** hardware, such as **Nintendo**, **Namco**, **Sony**, or Microsoft, and are typically trained in electronics and circuit design. Engineers design the physical aspects of video game systems, including the specifications for the console's processors, **controllers**, and **interfaces** such as game pads, and highly specialized components such as graphics chips.

At smaller companies, the responsibilities of multiple positions may be shared by several individuals; for instance, a programmer may also function as the game's producer and artist. At larger companies that are producing multiple games simultaneously, groups of individuals may be assigned to work as a "team" for one game or for one specific aspect of the development of multiple games (for example, a larger company may use a testing/QA department that is responsible for bug checking for all of the company's games in development rather than just one).

Professional experience in game development is often valued when game companies are hiring, but specialized skills for the many specific jobs are equally important. For instance, artists and animators often have creative experience and training, and game producers and marketers may have a managerial and business background. An increasing number of colleges, universities, and other educational programs offer game design and development courses and degrees.

Careers in video games also extend beyond the production and marketing of games, and several other professions involve direct work with video games. Game reviewers and critics assess the quality and value of specific game titles, and video game **journalists** cover the game industry for magazines, newspapers, television, and digital publications. Scholars in media studies and

video game studies research the **history**, theory, and social and cultural aspects of video game production, and some also teach courses at colleges and universities. A relatively small number of professional game players also earn income and sponsorship for playing video games competitively, working with organizations such as Major League Gaming and the Canadian-based Pro Gaming League.

Christopher Hanson

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cartridges

A cartridge is a sealed box that contains a read-only memory (ROM) chip, usually consisting of the data of only one game (or set of variations on a game) designed for a specific **console**. One part of the box contains a connector, which has to be connected in the circuits of the corresponding console through a slot. When the cartridge is inserted in this slot, the console can be powered on, and the game is ready to be played.

In 1974, Alpex Computer Corporation patented the main principle of game cartridges: data stored on ROM chips, allowing players to switch easily from one game to another. Their home console system, the **Fairchild Channel F**, released in 1976, was the first to introduce real cartridges. The **Magnavox Odyssey**, released in 1972, already employed a similar mechanism; a user had to physically change a plastic part of the console to play a chosen game. However, technically, every game was already embedded in the Odyssey: the cartridge only contained wires to connect existing circuits, thus selecting which properties were needed to play the game. Instead of being embedded in the cartridge as read-only memory, the game was generated by properties already programmed in the console circuits.

All consoles in the first half of the 1970s were "dedicated" consoles, which means they offered a small number of playable games, directly hardwired into their circuitry. With the introduction of cartridges, customers would no longer have to buy a new console for each new game they wanted to play; they could buy new games in cartridge form and play them on the same console system. Although cartridges were all initially read-only, some **Nintendo Entertainment System (NES)** cartridges, using a new technology, could write basic data such as game states. Even though Alpex Computer Corporation undertook legal actions to receive monetary compensation following the proliferation of their patented mechanism, cartridges became a standard in the industry and remained the principal home video game format for approximately 20 years.

The introduction of cartridges had a major impact on the industry. Cartridges allowed the production of games by third-party developers: they could develop games on an existing system instead of creating their own, reducing the cost of the game itself and minimizing the risk of a commercial failure. The **Atari VCS 2600** console took advantage of this third-party contribution with its large number of games available, but it ultimately led to the video game **industry crash of 1983**; too many bad games glutted the market. When Nintendo introduced the NES, they still allowed third-party developers to release games for their console, but they maintained a tighter control over licensing than **Atari** had.

Cartridges would soon be replaced by **CD-ROM** technology. The first CD-ROM drive for a home console system was NEC's CD-ROM drive for the **NEC PC-Engine/Turbografx-16** released in 1989, and the first home computer game to appear on CD-ROM was **Cyan**'s *The Manhole* (1987). The late 1980s and early 1990s were a period of coexistence of both formats: the **SEGA CD** and the **3DO Interactive Multiplayer** consoles used CD-ROMs, whereas the **Super Nintendo Entertainment System (SNES)** and **SEGA Mega Drive** were cartridge-based systems.

Nintendo still used cartridges for its **Nintendo 64** released in 1996, although this would be the last major home console to do so. At the time, even though the CD-ROM seemed to be the next generation support medium—carrying approximately 320 times more data—cartridges had technological advantages that couldn't be ignored. First, CD-ROM games were slowed by a loading time in between gaming sequences, whereas cartridges were significantly faster than discs and games were ready to play as soon as they were plugged into the console. Cartridges were designed to work with only one system, which raised the cost of each unit produced but allowed the Nintendo 64 to be protected from the piracy problem that the **Sony PlayStation** console was experiencing. Furthermore, because the cartridge is directly connected to the internal wires, cartridge-based consoles do not use internal memory to load data, reducing the cost of the machine itself. Additional hardware elements could be added that way to adapt to specific demands of a game: for example, *Star Fox* (Nintendo EAD and Argonaut Software, 1993), for the SNES, included a co-processor in the cartridge to support three-dimensional **graphics**. The invention of the cartridge separated game and console development in the industry, leading to an increase in game offerings. It also made user-friendly game-switching hardware a widespread phenomenon that is still the main game selection system today with home consoles.

Simon Dor

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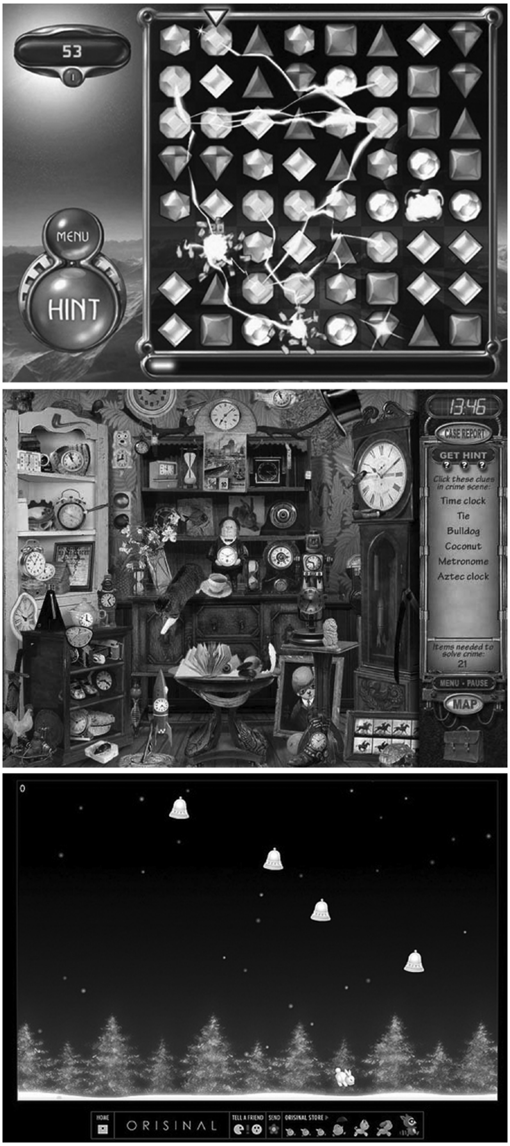
casual games

There are several ways to approach and define what casual games are and what they do, though none of them are definitive. Typically, the prime characteristic of casual games is that they are considered easy, making them thereby suitable as a "casual pastime," rather than for long and immersive gameplay experiences. However, many classic **board games** and puzzle games are also generally categorized under casual games, and these games can be rather difficult and complex at more advanced levels of **play**. According to a popular maxim, casual games are "easy to learn, difficult to master." Thus, not all games that are considered casual necessarily lead to play styles that are casual or laid back. Consequently, it is important to differentiate between casual games, people who prefer to play these games, and the play style involved.

The concept of casual games was originally intended for marketing purposes, and these games continue to be a growing business area. The IGDA White Paper on Casual Games labels them as "games for the rest of us" and states that casual games are typically designed and marketed in a neutral, inclusive manner, hopefully attracting people of all ages and genders. Some casual game providers have claimed that the majority of their customers are female; a customer survey published by PopCap Games, one of the leading developers and publishers of casual games, claimed in 2006 that "76% of casual game players are female, with an average age of 48." Yet in so-called hardcore gamers' discussion forums, it is easy to find antipathy toward casual games. Rather than being completely gender and age neutral, casual games have a distinctive aesthetics and stimulate the growth of a game culture specific to them. Their common emphasis on



Bejeweled 2 (PopCap Games, 2004) [top], *Mystery Case Files: Huntsville* (Big Fish Games, 2005) [center], and *Winterbells* (Orisinal, 2008) [bottom]. (Frans Mäyrä)

"cuteness" and easy **accessibility** stands in clear opposition to the complexity and dark, often violent themes that dominate the form and dynamics of popular "hard-core" genres like first-person **shooting games**, for example. The popular perception of casual games and video games in general, however, continues to change.

The history of casual games is as long as the history of games itself. Many classic games (such as mahjong, card games like solitaire, or board games of the "three-in-a-row" variety) are currently considered casual games. The powerful expansion of the digital casual games market is nevertheless a rather recent phenomenon. Early examples of casual games include the version of Solitaire shipped with Windows operating systems, but it was the expansion of the World Wide Web and broadband connectivity that opened up the space for mass-market casual games to emerge. Several key companies opened their on-line casual game services around the turn of the century: Pogo.com in 1998, PopCap Games in 2000, and Big Fish Games in 2002. Their revenue and distribution models started diversifying the games **industry**, providing new opportunities for casual games. According to the IGDA's 2008 White Paper, six popular casual game business models currently exist: (1) Try and Buy Downloadable Games, (2) **Advergames**, (3) Ad-supported **Web Games**, (4) **Console** Downloads, (5) Skill Games, and (6) Microtransaction Supported Games. In terms of playable content, the genres of casual games provided through these channels are similar; for example, various puzzle games are popular in all these categories.

On-line distribution models have also provided access for independent, small-scale games, such as those found at "Orisinal: Morning Sunshine," a website of original Flash games by Ferry Halim. The field of casual games can also provide room for experimentation. For example, some successful student game projects were later revised and released as commercial video games, such as *Flow* (2006) by Jenova Chen and Nicholas Clark. Since a new generation of video game consoles (the **Microsoft Xbox 360**, **Sony PlayStation 3**, and **Nintendo Wii**) were introduced with Internet connectivity and built-in on-line marketplaces, the development and distribution of casual games to video game consoles has started to grow. This has particularly stimulated the rise of casual-style **sports games**. Also, the introduction of games into smartphones and social networking sites such as Facebook has accelerated the growth of casual and social games. Meanwhile, there is still room for innovation in the traditional web-based domain of casual games, as proved by the "Mystery Case Files" series introduced by Big Fish Games in 2005, which adapts traditions of puzzle and **adventure games** into a novel form of crime-themed "hidden object" games.

Frans Mäyrä

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Cathode-Ray Tube Amusement Device

See patent #2,455,992

CD-ROM-based games

Throughout the history of video games, developers have used a variety of disc-based storage to distribute content to their audience: magnetic floppy discs, laserdiscs, and other types of digital optical media. The CD-ROM made one of the biggest impacts on the video game industry. On a CD-ROM, data is encrypted in binary code and read by a laser diode, providing around 650 to 700 Mb of storage. While the CD-ROM format shares its core technical principle with DVDs (used by the **Microsoft Xbox** and **Sony PlayStation 2**) and with other dedicated formats (such as the **SEGA Dreamcast**'s GD-ROM and the **Nintendo GameCube** optical disc), this entry will focus solely on the integration of CD-ROM technology and its influence on game design and development.

Compact Disc Systems

When it became the most common video game distribution format in the mid-1990s, the compact disc was already a standard in the music industry. In 1980, Sony and Philips agreed upon the specifications of the audio CD format, an agreement known as the "red book" standard, which was followed in 1985 by a "yellow book" specifying the data structure of CD-ROM technology. In 1986, a single 12-cm-diameter disc could hold 550 megabytes.

In 1988, NEC was the first company to bring CD technology to the console world by releasing a peripheral for the **NEC PC-Engine/Turbografx-16** gaming system. **SEGA** followed in 1992 with its **SEGA CD** add-on for the **SEGA Genesis/SEGA Mega Drive**. These extensions had to rely on the original console's display and processing abilities and featured a 1x drive that could transfer data at a rate of 150 Kb per second. In 1989, Fujitsu released the FM Towns computer in **Japan**, which was built with cutting-edge PC technology to realize the ambitions of its much-touted CD-ROM drive. Back in the **United States**, the Software Publishing Association (including Microsoft, Dell, and Creative Labs) was working on a standard dedicated to multimedia applications and games. In 1990, the association established the Multimedia PC (MPC) format, a configuration guideline for PC CD-ROM users. Finally, the Commodore CDTV and Philips CD-I (both released in 1991) introduced another type of CD-based system—positioned between home computers and game **consoles**—designed to bring a larger array of multimedia applications to the home.

In 1991, NEC released the first console with a built-in CD-ROM drive; the PC

Engine Duo was essentially a redesigned PC Engine with the CD and RAM expansions. NEC would soon follow with its Turbo Duo in 1992, a new design for a system essentially equivalent to the Turbografx-CD with the latest system card. The MPC formats were reevaluated in 1993, the same year the 3DO Company and Commodore launched their CD-based consoles. Featuring a 2x CD-ROM drive, the **3DO Interactive Multiplayer** and the Amiga CD32 could be upgraded to read Video CDs. With the U.S. release of the **SEGA Saturn** and the **Sony PlayStation** in 1995, developers now had the technical means to integrate good quality full-motion video (FMV) in their CD games: 2x transfer rate, sufficient working/video memory, and **graphical** processors that could display thousands of colors. At the same time, these systems were among the first to hardwire real-time three-dimensional manipulation. Notwithstanding the relative abilities and lacks of all the CD systems mentioned earlier, it is interesting to note that FMV games appeared on most of the systems.

Extended Games, Extended Play

From the perspective of game developers, the additional storage space was the most significant aspect of CD-ROM technology. This increase was a mixed blessing, however; although greater storage capacities opened new possibilities for the interactive experience, it also pushed developers to produce more content and contributed to the significant rise of production costs.

To take advantage of the new opportunities offered by the CD format, many developers decided to add content around familiar gameplay experiences. The "extended game" was marketed with the promise of extra material, the novelty of which attracted much attention at the time. The addition of CD-quality musical pieces "around" the game **world** were popular because audio tracks could be read directly from the CD as the player progressed through the levels. Memorable examples include *Loom* (1991) and *Lords of Thunder* (1993). CD-ROM technology also became an incentive to include animated **cut-scenes** between gameplay segments. Japanese **role-playing games (RPGs)** made extensive use of this feature, with many early examples on the PC-Engine CD system (such as *Far East of Eden* [1989] and *Ys* [1989]). Games were also "extended" with the addition of extra levels not seen in the **cartridge** edition (like *The Terminator* [1993] and *Zool* [1993]).

In some genres, the rich assets afforded by the CD format could be integrated more intricately into the gameplay, for example, "talkie" revised editions of popular **adventure games** with digitized voices, like *King's Quest V* (1992) or *Indiana Jones and the Fate of Atlantis* (1993), in which the queries or other conversations selected by the player were fully acted out. A breakthrough CD-ROM title, Trilobyte's *The 7th Guest* (1993), became the best-selling CD-ROM game, only to be beaten months later by the seminal adventure game ***Myst*** (1993). The latter expanded on the graphical adventure formula with thousands of unique prerendered game screens, helping it avoid the visual repetition that plagued other games with first-person exploration. The CD-ROM format became the ideal outlet for the creation of game worlds "saturated" with detail.

With digitized audio and FMV, game developers now had the technical means to pursue the ideal of **interactive movies**. Games such as *Under a Killing Moon* (1994), *The Beast Within: A Gabriel Knight Mystery* (1995), and *Ripper* (1996) relied on conversation sequences with live-action characters to a great extent. The fascination with FMV sequences integrated into gameplay mechanics spread far beyond the graphic adventure enclave. American Laser Games brought their arcade laserdisc titles to home gaming systems (such as the home versions *Mad Dog McCree* [1993] and *Crime Patrol* [1994]) and many other live-action or CGI shooters were produced (such as *Surgical Strike* [1993] and *Rebel Assault* [1993]). The most unlikely genre to undergo FMV treatment was undoubtedly the **fighting game**. In *Supreme Warrior* (1994) and *Prize Fighter* (1994), live-action sequences depict street fights and boxing as seen through the eyes of the protagonist.

In the global production landscape, action games were outnumbered, and few acquired critical or popular recognition. This failure can partially be explained by a gameplay discrepancy between FMV CD-ROM games and contemporary prime examples in any given genre. As the **industry** began its transition toward three-dimensional visuals that were rendered in real time and could change point-of-view easily, the worlds depicted by FMV appeared fixed and rigid even compared with most two-dimensional games of the time. Ultimately, these worlds were not only saturated with detail but also with authorship; through their prerendered nature, the creators exerted much more control over the interactive encounter.

Carl Therrien

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censorship

Like books, magazines, **film**, **comics**, music, and **television** before them, video games became the focus of censorship and regulation efforts. Governments around the world have passed laws that restrict access, prohibit content, or even ban certain video games. Every year a growing number of countries establish censorship rules, classification systems, and ratings agencies with the ambitious aim of regulating games on a wide variety of **platforms**. Censorship, as the strongest form of regulation, generally means the intervention from superordinate authorities (mostly state institutions) in the creative work of an individual or a group. This intervention aims to protect the public through the control of access to content that is not conformable with the dominant norms and values or is actually harmful to society. In this sense, censorship assumes that all individuals, not just children, are vulnerable and need protection from offensive material. For this reason, most democratic societies have founded state- or **industry**-controlled rating agencies that evaluate possible dangerous media content, content that might negatively affect the development of children and adolescents or endanger their ability to become moral and ethical individuals.

Ordinarily, regulating bodies look for subject matter that seems to be indecent, for example, pornography or excessive **violence**, criminal behavior, drug abuse, or hate speech. All these efforts set out to stop the creation of offensive material, to demand changes, to classify and categorize, or to prohibit or restrict the circulation of certain media products.

Forms of Censorship, Regulation, and Classification

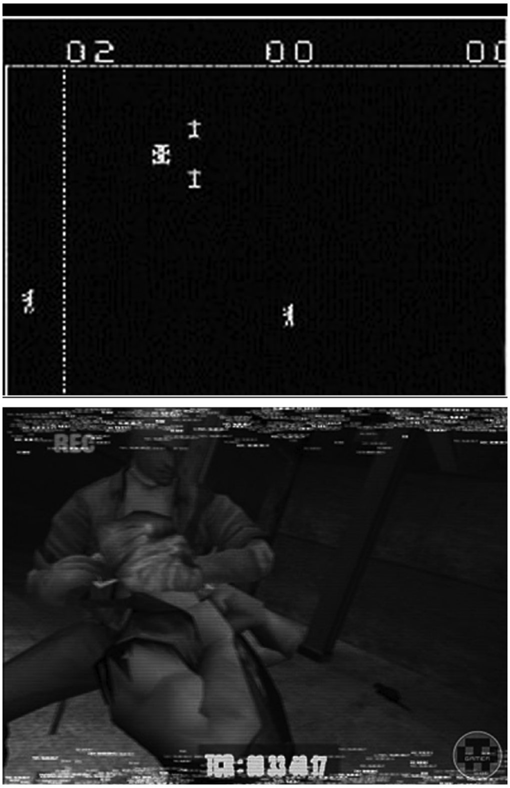
It is useful to distinguish among different kinds of censorship, regulation, and classification. The first distinction is between pre-, post-, and self-censorship. Precensorship is censorship in which each media artifact needs to be screened by a state-controlled board before publication. The board decides whether the respective work may be made public and, if so, under what conditions. Possible requirements are cuts, modifications of the content, or distribution restrictions (regulations that state which people or age groups may access the respective media). Postcensorship is the most common in Western democracies, meaning that the media product will be reviewed after its release, at which time the board will decide on access or age restrictions, modifications, or banning. For example, in **Germany**, if a game contains certain forms of sexual material (such as child pornography) or symbols of anticonstitutional organizations such as swastikas, the district court can mandate confiscation (Liesching, 2010, p. 15). As a result, access to this material is restricted (Rubin, 2010, p. 925). The third form of regulation is self-censorship, in which game designers and producers modify their games themselves (before or after release) because they hope to avoid problems with the law or to get a “better” (usually meaning lower) age rating.

The second distinction is between private-regulated and state-controlled classification agencies. For example, the **Entertainment Software Rating Board (ESRB)** in the **United States** is run by the industry, whereas the censorship system in the People’s Republic of **China** is controlled by the state. In Germany, both systems are combined; the Unterhaltungssoftware Selbstkontrolle (USK) is, on one hand, financed and organized though the gaming industry, but, on the other hand, it remains controlled by the Permanent Representative of the Supreme Youth Authorities of the Federal States.

The third distinction is between rating systems that are mandatory, voluntary, or legally binding only under certain conditions. For example, in **Australia** it is statutory for publishers to rate their games by the Australian Classification Board (ACB), and sales of games rated MA15+ to people under the age of 15 is not allowed. Conversely, in most countries using the **Pan European Game Information (PEGI)** system, it is not obligatory for publishers to submit games to the PEGI rating agency before they sell them in the PEGI region. In addition, retailers cannot be held accountable afterward if the product is not appropriate for a certain age group. However, in some countries such as **New Zealand**, games must be classified when they contain potentially harmful subject matter or if they are probably only suitable for older juveniles or adults.

The Rise of Video Game Censorship

The public debate about video game censorship began with Exidy's **arcade game** *Death Race* (1976). The goal of the movie-inspired game was to run down "gremlins" (originally called "pedestrians") that were fleeing from the vehicle. As the player hit them, they would scream and be replaced by tombstones, which the player avoided to prevent vehicle damage. Another controversial game, which changed the focus of the discussion from violent to sexual content, was Mystique's *Custer's Revenge* (1982) for the **Atari VCS 2600**, in which the Custer player-character's goal was to rape a Native American woman.



Exidy's arcade game *Death Race* (1976) [top] and Rockstar Games's *Manhunt* (2003) [bottom] for the PlayStation 2. (Markus Wiemkar)

The climax of the debate was reached in 1992 when three games hit the market: ***Mortal Kombat***, which showed brutal martial arts action; the **shooting game** *Lethal Enforcers* (1992); and the full-motion video game *Night Trap* (1992), which gave the player a voyeuristic look into a slumber party. The public cried out for regulation, and, following some political debates in 1994, the Entertainment Software Rating Board was established. Subsequently, most major markets introduced their own content rating systems soon afterward.

These early games showed what type of content induced discussions or constituted claims for censorship. All regulation bodies share concern for the (excessively) realistic depiction of violence and torture, sexual activities and nudity, racism and discrimination, the offending of religious beliefs, the insulting of national cultural values or territorial sovereignty, obscene or profane language, and the portrayal of gambling, drug use, or criminal behavior. Most censors believe that this content can stimulate aggressive or antisocial behavior, harm the personal development of younger people, or desensitize individuals. To protect the youth and sometimes also adults from these effects, the industry and the state answered with classification systems that are, in the majority of cases, based on a combination of age classes and content descriptors, which indicate game elements that may trigger a certain rating or may be of interest to parents. However, the foundations for these evaluations can be very different, ranging from industry checklists, video summaries of possibly debatable content, or the reviews of **play**-testers.

Ratings Systems

As noted earlier, in the United States and **Canada**, the market is regulated by the industry-controlled ESRB. Although this system is strictly voluntary, nearly all video games that are published in the United States are submitted for a rating, because most retail stores do not support the sale of unrated video games, and no major **console** manufacturer has licensed an adults-only "AO" game for their system or published a game without a ESRB rating. An exception arose with ***Grand Theft Auto: San Andreas*** (2004), when the "M"-rated ("mature") game got an "AO" labeling after the discovery of a sexual mini-game called the "Hot Coffee Mod." The publisher later fully removed the sexual interactive content to get the previous "M" rating again.

Similar to the ESRB, the industry-controlled PEGI system uses five age categories and only eight content descriptors (the ERSB uses more than 30). The usage of PEGI is also voluntary and likewise based on a code of conduct to which every publisher using the system is contractually committed. The system replaced many national age-rating systems in 2003 and is, as of early 2011, accepted by 32 countries, which is remarkable considering the cultural diversity and varying norms of member states. For example, Greece is very concerned about gambling, so when PEGI began, games with gambling were given ratings for a mature audience. Germany also has its own system, the USK, because protection of the youth is demanded by the German constitution; consequently, publishers and retailers are legally bound to ensure that children and adolescents are not harmed in their development. Many German publishers also modify their games using strategies such as reducing the amount of gruesome content, changing the red color of blood to green or blue, or converting human victims or opponents to nonhuman (like zombies or space aliens).

The most important rating agencies in **Asia** are the Japanese Computer Entertainment Rating Organization (CERO), the Chinese General Administration of Press and Publication (GAPP), and the **South Korean** Game Rating Board (GRB). In **Japan**, there are hardly any obligations to get a classification before publication or real restrictions for the retailer, with the exception of so-called "Z" games. For these adult titles, a review process through the government is mandatory, selling is only allowed in separate salesrooms, and an age verification process is necessary. Another exception is erotic games, called Erogē in Japan. They are regulated by specialized industry organizations like the Ethics Organization of Computer Software (EOCS) or the Contents Soft Association (CSA). Normally Erogē titles are only published in Japan, but the game *RapeLay* (2006) was also sold over Amazon.com, which started a heated debate in game-rating politics around the world on the controversial "stalking and raping" theme.

In **China**, the General Administration of Press and Publication uses an obligatory checklist to test whether a game is violating basic principles of the Chinese constitution; threatening their national unity, sovereignty, or territorial integrity; divulging state secrets; threatening state security; damaging the nation's glory; disturbing the social order, or infringing others' legitimate rights. Additionally, the Ministry of Culture (MoC) requires that game companies develop techniques to limit the playing time of minors to prevent **addiction**. The South Korean system resembles the Chinese one insofar as every game developer and distributor must have their games rated before publication. In particular, titles can be banned from the market if they focus on the conflict between South and North Korea (like *Tom Clancy's Ghost Recon 2* [2004] or the game *Mercenaries: Playground of Destruction* [2005]).

Australia is also an interesting case, because the highest age category is "MA 15+" (not suitable for people under 15), which means that it is currently the only country without an age class for games aimed at an adult audience. Officially, the Australian Classification Board (ACB) does not censor material by ordering cuts or changes, but they are able to effectively regulate media by refusing classification and making this kind of media illegal for hire, exhibition, or importation to Australia.

Finally, The Independent Game Rating System (TIGRS) is noteworthy, because it is a free, self-rating system for developers and publishers of games that are available over the Internet who want to voluntarily educate players about potentially objectionable content.

Criticism of Game Regulation

Video game censorship and regulation is often criticized for some underlying assumptions: first and foremost, for the implicit assumption that digital (not analog) games, due to their inherent interactivity, have a stronger influence on users than other media products (Olson, 2010, p. 2). For instance, stimulating aggressive behavior or inhibiting empathic **emotions** are highlighted, whereas possible positive effects such as the improvement of spatial or process reasoning are ignored or marginalized.

Another criticism revolves around the confusing variety of rating regulations and the impact of the industry on the evaluations. For video game companies, there is the problem that a unified, international ratings system is absent, making it is necessary to submit an international title to different rating agencies with various requirements. Additionally, in some nations there is no legal certainty to prevent the banning of an already published game, so that a publisher risks losing investments. On the other hand, critics believe that game companies have too much influence on rating decisions—for example, that a big publisher obtains a "teen" rating for a rather mature title by fraud. This point is often supported by the argument that the industry frequently markets "adult" games to teenagers; for example, through advertisements in youth magazines or respective television shows (Rubin, 2009, p. 929).

But most of the time, both sides agree that there should be more consumer awareness of rating systems and that the retailers of games should be forcibly pressured to enforce age restrictions.

Finally, there is criticism of the rating process itself. First and foremost, the methods used to get a review for a game are denounced. For example, is it sufficiently trustworthy to rely (only) on an industry questionnaire or the screening of a video edit of possibly objectionable parts of a game without actually playing the game itself (Rubin, 2009, p. 928)? Another critical point is that many raters focus too much on the (graphic) realism and amount of violence in a game and often neglect the importance of specific gameplay aspects; many censors do not consider whether the displayed aggression is justified, whether the gameplay also allows nonviolent actions or solutions, whether gruesomeness is rewarded, or if the game **controller** alters the feeling of the game. For instance, some critics mentioned the play experience of *Manhunt 2* (2007) was more immersive on the **Nintendo Wii** (the Wii remote is used to act out executions) compared with other platforms (Casamassina, 2007).

Describing the first *Manhunt* (2003), Jose Zagal wrote,

> *Manhunt*'s player-based (rather than character-based) moral dilemma is made all the more intense through the use of a USB headset. Playing the game using the headset allows the player to use his voice to distract enemies in the game. It also allows the player to hear the Director's instructions directly via the earpiece. Both elements narrow the distance between the player and the grotesque world of *Manhunt*. The microphone does this by allowing a more direct form of agency while the headset heightens the tension by channeling the Director's wishes and desires directly to your ear. In this way, the Director assumes the role of the "evil conscience." As a player, you hear him inside your head. His voice goads, taunts, and cheers you on when you cave in to his desires. There is nothing more sickening and disturbing than hearing the Director cackle maniacally as Cash murders a gang member. As expected, the Director derives more pleasure from the more gruesome executions. (Zagal, 2009, p. 5)

This leads to an argument about the accuracy or objectiveness of the game ratings, the underlying logic of the rating criteria, and the selection of the people who are responsible for the evaluation of games. For example, whether raters with different norms and values judge differently or whether experienced players adjudicate unlike the layman (Rubin, 2009, p. 927). Finally, it is hoped that in the future, the positive effects of playing games will also be part of rating decisions and that the **artistic** value of games will be more recognized.

Markus Wiemker

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Channel F

See Fairchild/Zircon Channel F

cheating

Most video game players define cheating in a game as anything that gives the player an unfair advantage. Beyond that, however, there is great disparity on what different players and different game designers and publishers consider cheating. However, there are some commonalities across definitions and practices, and there are several common reasons why people cheat in video games.

One type of cheat is the use of information external to a video game, commonly found in **walkthroughs**, strategy guides (which are mainly illustrated walkthroughs), hints and tips found in official game magazines and websites as well as on players' websites and blogs, and information gleaned from asking other players. Most of these types of cheats are considered legal and acceptable by the game **industry**, and indeed many game publishers sponsor the creation of official strategy **guides** for their games and release hints and tips to magazines and popular gaming sites.

Another type of cheat is one that alters the code of a video game and can include cheat codes, **hacks**, bots, and other technical changes. Examples of cheat codes include codes entered via keyboard or **controller** that allow the player such things as unlimited lives or money or access to levels further along in the game. Perhaps the best known "cheat" in video games is the Konami Code (up, up, down, down, left, right, left, right, B, A), which allowed players of many Konami games (such as *Contra* [1987], the *Castlevania* series, and some ***Dance Dance Revolution*** titles) to unlock various game elements or hidden secrets. More controversial cheats include software programs that attempt to intercept, access, and alter game code in multiplayer **online games**. Such cheats include aimbots (which allow the player to aim with perfect accuracy) and wall hacks (allowing the player to see through walls).

A more recent form of cheating that has garnered international attention is the practice of "gold farming" in **massively multiplayer on-line role-playing games (MMORPGs)** such as *Final Fantasy XI* (2002), ***World of Warcraft*** (2004), and *The Lord of the Rings Online: Shadows of Angmar* (2007). Essentially, companies in countries such as **China** will set up shop and hire workers to play a game such as *World of Warcraft* to gather resources and in-game currency (usually termed "gold"). The shops then sell this gold (usually via a broker such as the International Game Exchange) to players globally. This practice violates most MMORPG terms of service, yet many players engage in the practice. Many MMORPG developers actively work to identify and then ban gold farmers from their games. Some, such as Sony Online, have created specific servers for their games (such as for *Everquest II* [2004]) where the purchase and sale of virtual goods for real cash is allowed and, perhaps more important, controlled by the game company itself.

No matter the form of cheating, there are several common reasons that players will cheat in a game. The first is that players become stuck and are unable to progress further in a game. This could be due to the difficulty level of the game being too high for the player or a poorly designed game with unclear options of how players should proceed. For most players, this is the predominant form of cheating, because without some resort to a walkthrough, FAQ, or cheat code, they would be unable to progress in the game. The second reason for cheating is to fast-forward through various parts of a game. Players will use codes to get to the end of a game or skip levels because they have grown bored with the game's content but wish to see how the game ends. Likewise, in the case of gold-farming, players who buy gold are fast-forwarding their experience, so they may gain access to more powerful equipment or advanced areas before the game designers had dictated they should be able to do so. The third reason for cheating is that players wish to "play God" and obtain all items, money, or actions within a game simply to have fun. The final reason for cheating, which only applies in multiplayer games, is to harass other players and get ahead relative to them. For this type of cheating, having every advantage possible is the central reason for doing so, although causing other players to fall behind or ruining their gaming experience can be part of the experience. These are the main reasons that players currently cheat in single-player, multiplayer, on-line, and off-line video games.

Current industry responses to cheating are varied and evolving. Most game developers do not care if players cheat in single-player games because they feel the player is the only person affected in such instances. Actually many companies encourage cheating in single-player games through the use of walkthroughs, strategy guides, and cheat codes. Releasing such artifacts can extend play of a game that players might have grown tired of as they explore new options. The sale of guides can also help bring in revenue for developers, although most players now rely on free FAQs and walkthroughs found on-line, at sites such as gamefaqs.com. In multiplayer games, however, developers take a harder line against cheating because it can potentially ruin the experience of many more players, who do not cheat. Companies such as Even Balance have created software such as PunkBuster that can detect cheating in games such as *America's Army* (2002) and the *Call of Duty* series. Finally, companies such as *World of Warcraft* developer Blizzard have taken an active role in banning thousands of accounts suspected of cheating in their games to minimize the activity.

While companies often take a hard line on particular actions they deem cheating, players are often more varied in what they consider acceptable and unacceptable forms of play. For some players, "camping" in a particular spot in a first-person **shooting game** might qualify as cheating, whereas for others it is a strategic **play** style. Likewise, some players consider that using a walkthrough, even in a single-player game, is a form of cheating, even if they ultimately consult one. Although developers can patrol for and decrease certain forms of cheating, players will find endless new ways to cheat and will endlessly debate what exactly constitutes cheating in a video game.

Mia Consalvo

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checkpoints

Checkpoints in video games are used to mark a player's passage through a game, generally allowing the player to resume **play** from the previous checkpoint. Often associated with **save functionality** in a video game, a checkpoint often operates as a predetermined point within a game such as the completion of a game's level or similar milestone. After a player passes through a checkpoint, the next time he or she plays the game, play will resume from this checkpoint; however, its presence is not always readily apparent, and checkpoints may be entirely invisible within a game as the player passes through them. Checkpoints are used in differing modes, dependent on the type of game and the play mechanics used in a particular game.

Among the first and perhaps clearest examples of the use of checkpoints in video games can be seen in the use of game levels in **arcade games**. **Nintendo**'s *Donkey Kong* (1981), for example, features several sequential game screens through which the player must progress. After a player completes the first screen, he or she then moves to the second level of play; the start of this second level serves as a checkpoint, for if the player is unsuccessful in completing the second level, he or she will start again at the beginning of the second level instead of the first level.

Arcade **racing games** may incorporate checkpoints as a particular point on a game's race course, rewarding the player with more **time** to play the game. Games such as SEGA's *Out Run* (1986) provide a player with a set amount of playing time in each playing session, which counts down during play. If the player successfully reaches subsequent checkpoints on the racing course, the playing time is extended, allowing the player to play longer and attempt to reach the next checkpoint. Successful play of *Out Run* and similar games, then, requires successful completion of a series of checkpoints.

Dragon's Lair (1983) employs another mode of checkpoints; the game consists of a series of hand-drawn animated sequences that are stored on a **laserdisc**. It requires players to input basic movements with a **joystick** and button at predetermined moments during the animations. A game of *Dragon's Lair* appears much like a cartoon, with portions of the screen in a scene flashing to prompt the player's movement of the joystick to control "Dirk the Daring," the player's **avatar**. For example, the left side of the screen will flash if the cartoon character is threatened by an enemy, indicating the player should move the joystick left to successfully avoid the danger. The game presents these animated sequences as a series of scenes, and players are penalized if they move incorrectly in a given scene of the game. These scenes are also checkpoints, because the game will generally restart the player at the beginning of a given scene each time until he successfully completes the sequence and moves to the next scene and checkpoint.

As games for home **console-based games** have grown increasingly complex and require considerably more time than arcade games to complete, checkpoints often play a more central and incremental role in more recent games. **Activision**'s *Call of Duty 2* (2005) is a first-person **shooting game** that requires the player to navigate complex and chaotic maps of prescripted events during **World War II** battles. Each level of the game has a series of invisible checkpoints, from which players will restart if they unsuccessfully maneuver and die, greatly reducing the difficulty of the game by not requiring the player to start a given level over. Other first-person games and games of other genres employ a similar checkpoint system or one linked to an automatic save function ("auto-save") in which a player's progress is regularly saved at a series of checkpoints. This and other uses of checkpoints can greatly reduce the player's need to repeat sections of a game and minimize player frustration and thus can make video games more pleasurable experiences.

Christopher Hanson

China

Video gaming is an integral part of youth consumption and cultural **industry** in China, which is now one of the largest and fastest growing game markets in the **world**. Although China is not a new market and its **history of video games** can be traced to the 1980s, gaming in China is far from being mature and is characterized and influenced by **piracy** and state control.

China is a superpower of game piracy, being the world's largest supplier, consumer, and exporter of game piracy. Game piracy has two main forms: game software piracy and digital piracy. Game software piracy refers to the making of pirated game **CD-ROMs** or **cartridges** without acquiring the copyrights. Pirated software is sold about 20 times cheaper than its licensed counterpart; a **Nintendo Wii** or **Microsoft Xbox 360** game is now sold as cheap as $3 RMB ($0.44 USD) in China. Digital piracy is the downloading of free games from unlicensed game websites. From the 1980s to the early 2000s, pirated game software had been the main form of game piracy. In the past several years, the rise of digital piracy has caused the decline of game software piracy. From day one to the present, the entire game market in China has been dominated by piracy. Most players have never purchased any licensed software. As a result, game manufacturers in **Japan** and the **United States** have basically given up on the Chinese market. The prevalence of piracy is one of the key factors for the booming of on-line games in China. Because home **console-based games**, home **computer games**, and **handheld games** cannot generate much revenue due to piracy, **on-line games**, which are piracy-free by nature, have become the only area that both Chinese and overseas game manufacturers focus on developing and marketing. Internet cafés and home computers are the most important means for on-line gaming. Internet cafés are extremely popular among students and young people for their affordability and interactivity.

China has very tight control over gaming, and all imported games are subject to state **censorship**. Many are banned because of problems in content (such as sex, **violence**, bad taste, discrimination, and unwanted social behavior) and ideology (such as defaming the image of the Chinese troops, distorting history, and undermining China's sovereignty and territorial integrity). For example, *Hearts of Iron* (2002), a war game about World War II, was banned because it depicts Tibet and Manchuria as independent nations and Taiwan as a Japanese colony. Although the background of the game is historically accurate, the Chinese authority accused it of "distorting history and damaging China's sovereignty and territorial integrity" (Egenfeldt-Nielsen, 2008, p. 140). Sometimes even the importation of game hardware can be blocked by Chinese authorities on the grounds that its technology can be misused. All these measures are meant not only to control the cultural activities and thinking of the people but also to protect China's domestic market from foreign games. Censorship has served as a kind of trade barrier. It usually takes a long time for an imported game to go through the screening. When an imported game is finally approved and is ready to launch in China, its pirated software is usually everywhere in the market. Many imported games are required to have their content edited as a condition for approval. This is a time-consuming and costly exercise. To make it worse, players do not like the edited version, and thus they turn to the unedited pirated version. While censoring and restricting imported games, the Chinese authority promotes domestically made games to protect the Chinese market. China used to import on-line games, and in particular Korean games occupied the lion's share of the Chinese market in the early

2000s. Nowadays, playing Chinese on-line games has become the mainstream form of game consumption in China, and the market share of imported games in China has been declining.

Piracy and state control of gaming in China have created a strong sense of disagreement and frustration among game manufacturers in Japan and the United States. If China does not make progress in cracking down on piracy and opening its market, international game trade friction will intensify and China will not be accepted as a full member of the global gaming community.

The development of gaming in China has been incredibly fast but somewhat unbalanced. The problem of piracy has forced game manufacturers to develop nothing but on-line games. The Chinese government is sending confusing messages to the game industry. It has set the development of the Chinese game industry as a state policy but has very tight control over game content. As a result, Chinese games are criticized for lack of originality and thus are less successful when exported. On-line game centers are subject to frequent state surveillance, criticism, and crackdown. The social image of gaming remains somewhat negative. The problem of the social acceptance of gaming will definitely have an adverse effect on game culture in China. ***See also*** Hong Kong; piracy in China.

Benjamin Wai-ming Ng

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cinematics

See cut-scenes

Cinematronics

From the mid-1970s to the late 1980s, Cinematronics presented an alternative to the ubiquitous bitmapped **graphics** that had dominated video games since the arrival of ***PONG*** (1972). Over time, the **resolution** of video game graphics moved ahead by incorporating smaller and smaller pixels, eventually becoming equal to the resolution of broadcast **television** and, in **time**, beyond that. However, in the 1970s and 1980s, video games were unable to offer anything but images made of noticeably large blocks of light. Cinematronics changed that by replacing pixels with smoothly moving lines of light called vector graphics.

In 1975, in the desert of the El Cajon Valley near San Diego, California, Jim Pierce, Dennis Parte, and Garry Garrison came together to became the founding owners of Cinematronics Inc. This particular grouping was soon replaced by Pierce, "Papa" Tom Stroud, and Stroud's sons Tommy and

Dave. The latter two were responsible for sales, and their father was an experienced veteran of the coin-operated amusement business. Cinematronics's first game for sale was *Flipper Ball* (1976). Like many Cinematronics games to come, it was a "kit" game, purchased and assembled by Cinematronics rather than having been created within the company. Their next game was *Embargo* (1977), the first original Cinematronics game. It was created by Rob Shaver, a Cinematronics technician who left the nascent game industry shortly after *Embargo* to work for Motorola as a software engineer. His game was clever, simple, and, most important, it made money for Cinematronics.

In 1976, with a license from the Massachusetts Institute of Technology to produce a commercial version of the laboratory game ***Spacewar!*** (1962), Larry Rosenthal, recent graduate of MIT, began looking for a manufacturer to build and sell his **vector game** *Space Wars* (1977). He was turned down by nearly every video game manufacturer he approached, largely because he was asking for an unheard of remuneration of 50% of revenues on every game sold. However, one company desperate enough to make that agreement was Cinematronics. The collaboration was a huge success for both parties, but even though very happy with their share of revenues from *Space Wars*, Pierce and Stroud were not happy with their arrangement with Rosenthal. In turn, Rosenthal felt that he was not receiving the remuneration he felt he deserved. One night, Rosenthal and Cinematronics sales representative Bill Cravens removed all of the software and hardware Cinematronics used to create vector-based games. Fortunately for Cinematronics, an observant technician kept duplicate documentation that allowed the plundered company to continue on. With these, the Cinematronics technical team created custom **sound** boards, software tools, game **controllers**, and upgrades to Rosenthal's original hardware, making it possible to once again create new games for Cinematronics. The first of the post-Rosenthal titles was the two-player **shooting game** *Starhawk* (1977), designed and programmed by Tim Skelly. Visually inspired by the trench sequence from *Star Wars* (1977), it sported a somewhat postmodern touch. If not destroyed soon enough, a spaceship attacked the digits of the player's score. *Starhawk*'s sales were strong enough to keep the company alive, and Skelly soon followed up with *Sundance* (1979), an oddity that challenged its players to capture sparkling balls of light. It had a vertical screen and a **dual in-line parallel (DIP) switch** that could be set to display **Japanese** rather than English, the only game that Cinematronics ever made with a feature of that kind.

In 1978, rather than compete head-to-head with Rosenthal's new company, **Vectorbeam**, Cinematronics chose to purchase the company outright. Based on the two companies' production schedules, Vectorbeam's nearly finished game *Tail Gunner* (1979) was manufactured at Cinematronics and, shortly after, *Warrior* (1979) was released as a Vectorbeam title, though it had been created at Cinematronics. The company did well during the late 1970s and early 1980s, partly because of its programming and design team of game developer Tim Skelly and technician Scott Boden, who would soon become a game designer in his own right. Additional games from the pair included *Rip-Off* (1980), *Star Castle* (1980), *Armor Attack* (1980), *Boxing Bugs* (1981), and *Solar Quest* (1981). Some projects never made it into production, like *Boxing Bugs* (1981), which Boden began as a castle defense style of vector game but was turned into a "cute" game at the request of management.

About that time, Skelly was recruited by the game company **SEGA**, which was looking for experienced vector game talent. His leaving prompted a lawsuit against him by Cinematronics, which was soon dismissed in court. From that time on, with the exception of engineer and programmer Rob Patton's vector game *War of the Worlds* (1982), there would never again be a "home-grown" game sold under the name Cinematronics. However, this is not to say that the company ceased to build and sell video games; Cinematronics merely changed strategies. After *Solar Quest*, owners Jim Pierce and "Papa" Tom Stroud returned to their past, once again purchasing the rights to manufacture and sell games conceived by outside vendors. Because of economic factors, the company was often struggling; Cinematronics may have had no choice but to give up designing original titles. Or, at best, as in the case of the laserdisc games *Dragon's Lair* (1983) and *Space Ace* (1984), they became manufacturing partners with other companies; no small achievement for Cinematronics. The fad for **laserdisc games** was short-lived, but the revenue from those two games kept the company on its feet.

Cinematronics managed to stay alive through 1988, purchasing kits for whatever games it could afford. These included *Freeze* (1982), *Zzyzzyxx* (1982), *Jack the Giant Killer* (1982), *Brix* (1983), *Hovercraft* (1983), *World Series Baseball* (1984), *Express Delivery* (1984), *Cerberus* (1985), *Mayhem 2002* (1985), *World Series—The Season* (1985), *Power Play* (1985), *Danger Zone* (1986), *Red Line Racer* (1986), *Double Play: Super Baseball Home Run Derby* (1987), *Baseball the Season II* (1987), and the last title to be sold by Cinematronics, *Alley Master* (1988). Although many of these games were generic with anonymous authors, it is important to remember that each of these games was conceived by technicians, **game designers**, and developers who spent their time and imagination creating pastimes that would be, for many or few, fun.

Tim Skelly

City of Mesquite vs. Aladdin's Castle, Inc.

City of Mesquite vs. Aladdin's Castle, Inc. is a 1982 U.S. Supreme Court Case regarding the access of minors to coin-operated **arcade games**. The City of Mesquite had implemented a licensing ordinance governing coin-operated amusement establishments. Under section 6 of this ordinance, the chief of police was required to assess whether a license applicant had any "connections with criminal elements." The advice of the chief of police along with that of the chief building inspector and the city planner would affect the city manager's decision regarding whether to grant a license. Denied applicants could appeal to the city council, but if the license was denied under the advice of the chief of police, the applicant would have to demonstrate good character. Under section 5 of the ordinance, no one under the age of 17 was allowed to operate an amusement device unless accompanied by a parent or guardian.

In April 1976, the City of Mesquite exempted Aladdin's Castle, Inc. from section 6 of the ordinance as long as children under age 7 were not permitted to operate coin-operated machines without a parent or guardian. Aladdin's Castle then entered into a long-term lease with the local shopping mall and began making arrangements to open an **arcade**. In August, the city manager refused the company's application for a license because the chief of police had stated that the parent corporation had connections with criminal elements.

Aladdin's Castle sued in Federal District Court, seeking an injunction against enforcement of the ordinance. The District Court upheld section 5 but ruled that section 6 was unconstitutionally vague. Ultimately, the Supreme Court ruled that both sections 5 and 6 were unconstitutional, basing its decision on the First and Fourteenth Amendments of the U.S. Constitution as well as the Texas Constitution. The Supreme Court ruled that neither part of the ordinance met the rational basis test. Further, the Supreme Court ruled that section 5 violated the right to freedom of association and freedom of speech and the due process clause of the Fourteenth Amendment. With regard to section 6, the Supreme Court ruled that the ordinance violated the due process clause of the Fourteenth Amendment.

The U.S. Supreme Court's ruling in this case was a significant victory for operators who had struggled against city ordinances in many communities. The guarantee of access to machines for young gamers also had significant implications for manufacturers and operators who saw youths as key customers. The ruling in *City of Mesquite v. Aladdin's Castle* curtailed efforts to limit youth access to coin-operated machines and weakened efforts to restrict the licensing of arcades and related businesses.

Challenges to youth access to games have persisted, particularly with regard to **violent** games. In subsequent court cases, including Video Software Dealers Association, *Entertainment Software Association v. Schwarzenegger et al.*, courts have upheld the guarantee of youth access to games and have ruled that video games are protected as free speech. To date, the only age-based limitations on game access are the quasi-legal limitations instituted through the **Entertainment Software Rating Board (ESRB)**. ***See also*** arcade games; censorship.

Carly A. Kocurek

civic engagement

Civic engagement can relate to video gaming in several ways. First, engagement with in-game communities is an essential part of some games; in other games, helping practices are an essential part of the game. In both cases, games can be designed to foster civic practices. Second, gamers may form communities within certain games or around certain gaming practices and become involved in civic activities in this way. Third, gamers may use gaming toward specific civic-minded goals, such as fund-raising for nonprofit organizations or specific causes, or use a game as a medium for protest.

In the first case, games may cultivate in-game civic engagement. Games structured to encourage or demand civic engagement may require players to form communities, develop community guidelines, and engage in civic practices such as community problem solving and assisting other community members. A game can encourage specific desirable behaviors or invite thought about issues of community importance. Marsha Kinder's *Runaways* is an **experimental game** meant to encourage players to explore categories of personal, cultural, and historical identity and what these categories might mean. **Educational games**, in addition to teaching topic-specific knowledge in geography, **history**, or math, may also deliberately model civic practices.

Diverse games, however, include helping other players as an imperative (see **cooperative gameplay**). The study "The Civic Potential of Video Games," released in 2008 by the Civic Engagement Research Group at Mills College, suggests that youth who play games in which they engage in civic behaviors are more likely to make civic and political commitments such as volunteering, participating in protests, fund-raising, and having an active interest in politics. The type of game does not negate this effect; for example, the game *Halo: Combat Evolved* (2001) is held out as an example of a game which models helping practices.

In the second category of civic engagement, related to the formation of in-game communities or game-related communities, players can directly shape the gaming community in which they participate through simple civically oriented actions such as helping other players or forming groups of like-minded players. Community-oriented games predated video gaming and some similar elements are evident in **role-playing games (RPGs)** and team-based games. The development of **multi-user domains (MUDs)** precipitated the formation of similar social structures within video game environments. **Massively multiplayer online role-playing games (MMOPRGs)** such as *Ultima Online* (1997) and ***World of Warcraft*** (2004) serve as some of the most famous examples. Events such as community meetings, festivals, protests, and even funerals have become part of MMOPRGs.

Communities of gamers may also develop outside of in-game activity. Many game companies actively encourage the development of these types of communities by supporting message boards or other online community spaces that enable players to communicate outside of games. Publications or websites may also serve as a home base for a specific subset of the gaming community. For example, WomenGamers.com covers issues of importance to women gamers and game developers. Most of the content at the site is contributed by community members who perform the labor of producing content as volunteer contributors; the site also works to offer scholarships for women interested in pursuing game development as a career and offers forums that enable members to connect with staff and each other. Other networks of gamers, like the long-running **Twin Galaxies**, help organize tournaments and maintain high scores. Again, much of the labor behind the organization is performed on a volunteer basis by community members.

Third and finally, games may be used to address specific community or social issues. Gamers and **artists** have used video games as a site of protest for issues related to the games' subject or intervened in gameplay practices. For example, Anne-Marie Schleiner developed *Velvet-Strike* (2002) as a response to *Counter-Strike* (1999), a first-person **shooting game** she enjoyed playing. *Velvet-Strike* is a protest modification to *Counter-Strike* that allows players to alter the game by placing antiwar graffiti skins on the walls, ceilings, and floors of the game. Schleiner also developed a list of "recipes" outlining tactics protestors could use to alter gameplay by playing against the game's assumed antagonists. Another protest begun in March 2006 by Joceph DeLappe addressed the **United States** Army recruiting game, *America's Army* (2002). Under the user name "dead-in-iraq," DeLappe would log into the on-line game and type in the name, rank, and date of death of service persons killed in the Iraq conflict, continuing this action until he was killed in-game, and then resuming when he was reincarnated.

Organizations of gamers and game companies have also engaged in civic actions such as volunteer work and fund-raising, including through gaming-related efforts such as gaming marathons. Child's Play Charity, which provides games, toys, and books for patients in children's hospitals worldwide, describes itself as "a community-based charity grown and nurtured from the game culture and **industry**" and uses the tagline "Gamers give back." Launched in 2003, Child's Play has donated millions of dollars worth of items, many of them paid for through the fund-raising efforts and donations of gamers.

Game marathons usually rely on individual organizers and are not officially affiliated with the relevant game companies; marathoners may collaborate directly with the organization for which they are raising funds. Marathons have raised funds for a variety of nonprofits including Big Brothers, Big Sisters, the American Diabetes Association, and others. Games played have included ***Super Mario Bros.*** (1985), ***Metroid*** (1986), ***The Legend of Zelda*** (1987), and *Mega Man* (1987), which is reflective of a tendency to marathon using long-running game franchises with a large audience. Also noteworthy is the Desert Bus for Hope marathon, which uses the unreleased **SEGA minigame** *Desert Bus*, in which the objective is to drive a bus in real time from Tucson to Las Vegas. ***See also*** game modifications; reception theory.

Carly A. Kocurek

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co-creativity

Co-creativity is a term used to refer to player practices that go beyond the **playing** of a video game and result in new productions such as **game modifications**, skins (see "game modifications"), or **machinima** videos. Co-creativity is a way to understand the ways in which the creation of a game is often shared between the actual paid game developers and the players of a game. This results in a particular co-creative relationship between the player and the developers.

The term "co-creativity" was introduced to **video game studies** by John Banks in 2002 and further elaborated by Sue Morris (2003) and Dovey and Kennedy (2006). It acknowledges the players' influence on professional game development and suggests that players' productions and knowledge can be used in the **design** of new games or embedded in existing games. For instance, game developers can integrate player-made modifications into their products or simply develop their games based on the discussions of player communities. Players' work can also be considered as a source for innovation and **experimentation** for official game development because the **industry** itself is constrained by marketing, **censorship**, and financial considerations, whereas players, such as modders, are free to test and try out new innovative aspects of games. Players' involvement in beta testing, then, is a more formal mode of co-creativity.

In many cases, such co-creativity also adds to the monetary value of a game as a retail product. Thus, the concept of "playbour" has been introduced to cover the free player labor that contributes to the profits of game companies (Kücklich, 2005). Co-creativity is a controversial topic because it is usually only the developers who gain economic benefit from the collaboration, although players acquire peer recognition, skills, more enjoyable play, and other such immaterial benefits from it.

Although some forms of co-creativity feed ideas directly into commercial game development, other forms can largely remain within the player communities. These practices may inform or help in gameplay (for example, **walkthroughs** and on-line databases such as Thottbot) or work as separate productions (such as machinima stories). These can be considered co-creativity because the gameplay experiences of other players are meaningfully altered through the use such aids.

What kind of co-creativity players participate in depends not only on their individual interests and skills but also on the genre and type of game. Some games offer readymade tools for co-creative contribution, such as on-line discussion forums or modification tools. Some types of games integrate aspects of co-creativity into the game itself, thus blurring the line between actual gameplay and co-creativity. For instance, *The Sims 3* (2009) includes the possibility of sharing characters, items, and **worlds** with other players. Players' contributions and innovations thus help in further developing the game that future players will play. A number of **casual games** that are played on social software websites such as Facebook are more extreme in their flexibility in regard to players' innovation. ***FarmVille*** (2009), for instance, remained in beta mode nearly two years and is constantly developed according to new requests and ideas from players.

Co-creativity is an umbrella term for a variety of practices that are also approached from the points of view of **fandom**, **hacking**, and the tactical use of games.

Accordingly, the various forms of player productivity are described as *fan art*, *mod arts*, and *tactical arts*. Other synonymous and overlapping terms are *custom-content* and *user-generated content* that are primarily used by the industry. Furthermore, the idea of "prosumers" (Toffler, 1980) refers to this merging of producer and consumer roles in terms of creativity and innovation.

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cognition

Much ink has been spilled deliberating over whether video games make you more or less intelligent. The mainstream media tend to lean more toward the former and science more toward the latter. Some scientific research, for instance, tells us that video game **play** actually increases our ability to focus, training us to ignore distracting tasks with the main one constantly in sight (Gackenbach, 2006). Other scientific research argues that video game play can increase motor coordination and perceptual speed reaction skills, **spatial** visualization capacity, even reflective decision making (Greene, 2003; Greenfield and Cocking, 1996). As much as video game players would love to have science prove that they're becoming smarter, it is still far from conclusive; the mind's response to the environment remains too complex for science to declare any kind of direct correlation.

What we do know for certain is that playing video games activates all variety of cognitive processes: from causal and counterfactual reasoning to meta-cognitive reflection, spatial visualization, memory function, and language capacity. Along with the activation of the corresponding neural network centers, there is a more general triggering of our emotional and cognitive systems in the making and playing of video games.

The Neurobiology of Video Game Play

The constant stream of sensory stimulation and information (**sound** and image primarily) is first processed by our **emotion** system, or what biologists call the "limbic system," which includes the hypothalamus and amygdala. When marauding zombies try to get you in *Resident Evil* (1996), rabid mutants gnash at you in *Left 4 Dead 2* (2009), or monsters crawl after you in spacecraft cavities in *Dead Space* (2009), they activate our limbic system, our fight-or-flight response mechanism. We experience the reflex emotion of fear and the adrenaline kicks in. However, our brains are equipped with a conceptual filtering capacity; *grosso modo*, it is a prefrontal cortex response that allows us to distinguish between the real and unreal, or between fiction and nonfiction events. So when those monsters attack, the sensory stimulus is prefiltered as fiction by the emotion system, then resolutely distinguished as such by our reason system, or the executive cortex that includes the orbitofrontal, prefrontal, anterior cingulate, and motor cortex, for instance. The executive brain sets in stone, so to speak, this evaluation of the monster as unreal. All the while, another monster has jumped out at you that you must destroy, triggering once again the emotion system with its respective reflex emotion, its prefiltering of real versus unreal, and its signaling of the executive brain for confirmation.

The emotion and executive brain trigger an appropriate body response, and the body reaction in turn can intensify the emotion experienced. The well-seasoned video game player seamlessly toggles the **controller** to control the character movements *as if* they were the player's own. When playing a **survival horror game** like *Dead Space,* we react with surprise, shock, and horror and move our character's body to survive, but always in an *as if way*—as if the flesh-eating monsters were real yet *knowing* all the while that they are fictional.

Although the executive system reaffirms what has already been processed by the emotion system, a residual fight-or-flight reflex emotion remains in the latter system; the executive system is not all-powerful, in this sense. It does not erase the initial reflex emotion already experienced, and game players would not want it to. Players get not only that adrenaline rush but also that wash of "feel-good" neuropeptides such as oxytocine and dopamine.

There are important nuances that differently inflect the way people cognitively and emotionally experience video games. First, the more one plays video games, the more the executive system is prepped and primed to override the emotion system. Without emotion reflex and reward, there's little reason to play again, or at all. Hence, designers are constantly working to create games with cognitive challenges and emotional rewards; they are striving to up the ante on what has come before. Second, from the day we are born, our reason system or executive brain grows in conjunction with an already fairly developed emotion or "limbic" system. In other words, if a young child had the motor skills to play a horror **shooting game**, given the underdeveloped reason system and the overdeveloped emotion system, there would not be the kind of emotion override that a teen player would have. The child would most likely be scared in a nonpleasurable way (Subrahmanyam et al., 2000).

Cognitive Mechanisms at Work in Video Game Play and Design

Like all humans, video game players have developed brains within a natural and social world. From the day we are born, we begin growing our capacity for causal, counterfactual, and probabilistic thinking, doing, and behaving in the **world**. In our constant interaction with the natural (organic and inorganic) and social (people and institutions) world we imagine and work through in our minds possible and probabilistic outcomes to actions and actually do the work to modify our environments and/or our expectations. As we modify our natural, personal, and social environs, we also get to know our own abilities better.

All this results from the healthy growing of our causality mechanism (in which we learn that A leads to B, then to C, and so on) and our counterfactual process (whereby we learn that *if* I do A, I will achieve B and not C or D). Namely, these capacities allow for the following: *if* A produces or is the cause of B, we can formulate a hypothesis that A might (as a possibility) *cause* C. Or, conversely, we can move from effect toward the cause: maybe the cause of C is A.

Because we grow in this capacity to formulate or perceive relations of causality, we therefore also automatically possess the capacity to perceive and formulate counterfactual hypotheses, arguments, and thoughts generally. We also grow and sharpen our capacity to create **maps**—of the human (social) and physical (natural) world—and by doing so, we learn to create new maps within the chain that allow us to consider new possibilities and formulate plans with probabilistic outcomes for what our situation will be in the world in the future.

These cognitive mapping mechanisms (comprising causality, counterfactuality and probabilistic reasoning) feed all our story-making activities, including the making of counterfactual characters and places in video games. These innate mapping capacities grow in ways that express themselves in the making and playing of video games.

When we play (or design) video games, we exercise the same cognitive mechanisms (causal, counterfactual, natural, and social mappings) already at work in young children who playfully invent storyworlds populated with imaginary companions and characters. When we follow the logic that a video game blueprint sets out for us, we exercise these causal, counterfactual, and probabilistic processes—and to specific ends: to experience fear, shock, or horror while playing and to feel happy, satisfied, and elated in the win.

Video games are a particular expression of our everyday causal and counterfactual mechanisms that we use to map our physical and social worlds. Playable and **non-player characters (NPCs)**, like the imaginary companions of childhood, present us with ways that we might be and act—or that others might be and act. Of course, different games present different opportunities to exercise our causal and counterfactual mapping capacities. Some might demand more that we exercise our mapping of the natural world (as in *Call of Duty* [2003]). Others might demand that we use these mechanisms in the mapping of a social world, as in many **massively multiplayer on-line role-playing games (MMORPGs)**.

When we play video games, we do so within a real-life safe zone. It is within this safety zone that our emotion and executive system can work together in ways that allow us to feel all sorts of emotion—even relish in the attack of a horde of zombie invaders. We can do so because our brain knows that it is safe to do so. If there were real zombies *really* attacking, the exercise of our causal and counterfactual mapping would not be enjoyable, as it is in the guarded and controlled and purposeful play of video games.

Video games are not entirely like childhood storyworld play. Each game has its respective algorithmic constraints that put a limit on who we can be and how we can act. Even if the game's boundaries and levels seem limitless, we are *following* the **design** of another person during our play.

The causal and counterfactual mechanisms that allow us to plan, think, and act in new ways are also the ones that game designers use to create new and innovative video game blueprints that vitally engage the player's causal and counterfactual mechanisms. Game designers can do so because these mechanisms help grow in all of us the sophisticated meta-representational system of language, including the so-called language of computer programming. These basic cognitive processes, then, one way or another are at work in the neuromechanical auditory and visual design of video games.

Video game designers are constantly imagining events and minds of invented characters who use causal and counterfactual mechanisms in their own encounters with the natural and social world. Designers are therefore not only using these basic cognitive mechanisms to imagine and create the video game blueprints, they are also seeking ways in which the characters in the video game worlds are themselves using these capacities one way or another. Moreover, they are doing this with the game player in mind: the game designers are anticipating what the player will feel and think when *playing* characters that feel and think. Video games rely on the player's *doing* (purposefully directed movement and action-oriented gestures) to intensify the brain's immersion in the designers' counterfactual blueprint, and this triggers the cognitive and emotive payoff.

Specific Expressions of Our Cognitive Mechanisms

MMORPGs require that players exercise causal, counterfactual, and probabilistic thinking by creating new versions of themselves, and this can take place at any time of day and alongside characters played by gamers all over the world. For instance, as a flesh-and-blood English-speaking Anglo-American male player, one could choose to be a patois-speaking African American female character. MMORPGs are worlds with recognizable natural laws—you can't walk through a wall, for instance—and the emphasis is on the social; the player constantly exercises cognitive mechanisms to map social situations and encounters with constantly shifting codes of conduct (as in games such as ***Ultima Online*** [1997], *EverQuest* [1999], *Dark Age of Camelot* [2001], *Final Fantasy XI* [2002], *Star Wars Galaxies* [2003], and *Prius Online* [2008]).

Puzzle games are designed to trigger our causal and counterfactual mechanisms as expressed in puzzle-solving and algorithmic computation. *Professor Layton and the Curious Village* (2007) as well as *Professor Layton and the Diabolical Box* (2009) are visually appealing (Japanese Ghibli art) and have a basic story (a romance set in Victorian England), but the main purpose is for the player to exercise puzzle-solving cognitive mechanisms. The **strategy game** also belongs to this category, albeit it is puzzle-solving put to building and managing entire worlds (as in ***SimCity*** [1989], and *Civilization* [1991], *Spore* [2008], and *Dawn of Discovery* [2009]). **Role-playing**

games (RPGs) lean heavily on the use of our counterfactual mechanism. In an RPG, players build up their virtual characters through the accumulation and selection of equipment and skills. Shooting games require that we exercise more of our causal basic mechanisms (and our perceptual and motor cortex) as we learn that killing A will lead to B, to C, then to the end of the game.

The design and playing of video games emphasizes more or less the different ways we use our causal and counterfactual thinking to map our natural and social world. And although video games are becoming more and more realistic, they still do not give the absolute total picture and are not a mirror held up to reality; the player still has to fill in the gaps in the counterfactual play.

Video game playing is not imagining in **abstract**; it is an imagining directed by the designers' programmed algorithms. This is the crucial difference to the counterfactual play of children. When a child hops along on a broomstick, this intensifies his or her imagining of the broomstick to be a horse. Although the imagining of the broomstick to be a horse is culturally conditioned by what the child knows and the child's experiences, it doesn't force the child to follow predetermined **rules** and options, whereas video games do require rules to be followed. Even when they are hugely varied and where the options (forking paths) are seemingly infinite, ultimately these are contained by the algorithm—those boundaries fixed by the creators of the game. Immersion in a video game often requires a constant use of induction, deduction, and abduction (educated guesswork) precisely because the game player has to make decisions according to options predetermined by the game. Many video games require a constant use of our causal, counterfactual, and probabalistic cognitive faculties to determine their rules and goals; other video games have their rules and goals laid out in the game manual and can be learned before they are played. However, in all cases, the player's imagination is necessary to fill whatever gaps are left and to enjoy a game's fictionality. ***See also*** emotion; reading video game imagery.

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Coleco

Coleco Industries, Inc., was an American manufacturer of toys and consumer electronics. Established in 1932 under the name Connecticut Leather Company, it initially specialized in leather and leather supplies before branching into plastics in 1956. In 1961, the company withdrew from the leather business and, by the late 1960s, became a leading manufacturer of above-ground swimming pools.

Coleco entered the video game business in 1976 with the Telstar line of game **consoles**. Fourteen models were produced within the next two years, most of them ***PONG*** (1972) clones based on the General Instrument AY-3-8500 chip or its derivatives. Of note is the Telstar Arcade (1978), the only programmable, **cartridge**-based unit in the series. The distinctive triangular console could play **shooting games**, driving games, and *PONG*-type games, each side of the casing accommodating a dedicated **controller** (a light gun, a driving wheel and a gearshift, and paddles, respectively). Four cartridges were released containing 14 games.

With its extensive product line, Coleco incurred $30 million in losses when the video game market crashed because of oversaturation with dedicated consoles (see **crash of 1977**). The company decided to withdraw temporarily from the home console business and instead shifted its focus to LED-based **handheld game** units (such as the *Electronic Quarterback* or the *Head to Head* series of two-player sports games) and tabletop versions of **arcade games** (including *Galaxian* [1979], ***Pac-Man*** [1980], and *Donkey Kong* [1981]).

Coleco returned to the home console market in 1982, with the release of an 8-bit programmable console, the **ColecoVision**. It also began releasing games for the **Atari VCS 2600** and the **Mattel Intellivision**, primarily conversions of popular arcade titles, such as *Donkey Kong* and *Zaxxon* (1982). In the same year, the company unveiled Expansion Module #1, which made the ColecoVision compatible with the extensive library of VCS cartridges, and the Coleco Gemini—a full VCS clone.

With the sales of the ColecoVision slowing down in mid-1983, Coleco focused on promoting its upcoming ADAM home computer. Introduced to the market in late 1983, the ADAM was available as a stand-alone system or a ColecoVision expansion module. Included in the price were a tape drive, printer, full-stroke keyboard, and built-in word processor. Although it was initially considered to be a highly promising product, the ADAM's future was sealed by design flaws and technical problems. The computer did not perform well in the market, and many of the units were returned because of malfunctions. The ADAM's failure severely weakened the company, which posted losses of $79.8 million for fiscal 1984. The computer was discontinued in early 1985, having sold an estimated 250,000 units (Lewis, 1985).

Despite the success of its Cabbage Patch Kids doll line, Coleco did not recover from its financial troubles. With debts of $540.3 million dollars, the company filed for bankruptcy in July 1988. Most of its assets were acquired the following year by Hasbro, Inc.

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ColecoVision

The Connecticut Leather Company was started in 1932 by Russian immigrant Maurice Greenberg. Greenberg originally supplied provisions to shoe repair shops and within a decade expanded his business to selling leather craft kits featuring famous characters such as Mickey Mouse. During the 1950s, the company entered into the plastic pool **industry**, and as it moved away from leather goods into other products, it decided to abbreviate the company’s name by taking the first two letters from each word in the original name to form the name by which it came to be known: CO-LE-CO.

By 1962, Coleco had become the world’s largest above-ground pool manufacturer and became a publicly traded company. The company transformed again when Coleco bought Canadian Eagle Toys and entered the toy business.

Coleco had much success with Eagle Toys’ tabletop game *Rod Hockey* (1968) and as a result decided to pursue more entertainment games. Seeing the success of **Atari**’s coin-op ***PONG*** (1972) and the home version of *PONG* in 1975, Coleco Industries, Inc. released a $50 home version of their own, the Telstar Arcade in 1976. This unit completely sold out, and Coleco moved forward with several successful LED sports **handheld games** such as the Coleco *Head to Head Football* (1980) and Coleco *Head to Head Baseball* (1982).

Coleco watched the success of the **cartridge**-based home **console** systems released by Atari and Mattel, and followed suit by releasing the ColecoVision in August of 1982, exactly 50 years after opening its doors. The unit sold for $175 and was packaged with the popular game *Donkey Kong* (arcade version, 1981, home version 1982). Just under half a million consoles sold during the ColecoVision’s launch, and in less than three years Coleco would sell more than six million units.

The ColecoVision was part of the second **generation** of video game systems, meaning that their game program cartridges had 32 Kb of working memory. This increased memory over their adversaries, which used 2-Kb and 16-Kb chips, allowed Coleco to produce better **graphics** and **sound** than its competitors. Coleco had successfully filled the gap in the market by offering hardware that, as their box slogan boldly stated, “Plays like the real **arcade game**.”

Atari was releasing arcade game titles for their home system by porting their own arcade games and through exclusive licensing agreements with other coin-op manufacturers such as **Namco**. As a result, Coleco partnered with other coin-op manufacturers such as Konami, **SEGA**, **Nintendo**, and Universal to port their game software to the ColecoVision console.

The ColecoVision used the Z8A central processing unit, the same CPU used in many coin-ops, the MSX, SEGA hardware, and several home computers of the time. This turned out to be a blessing concerning development by third-party publishers because games originally developed for other hardware could be quickly and easily ported to the ColecoVision.

Coleco made two **controller peripherals** for the ColecoVision: the roller controller, a trackball device similar to the kind used in the **arcades**, and a deluxe controller set referred to as the Super Action Controllers. Unique in design, each controller resembled the hilt of a sword, with the action buttons hidden behind the knuckle guard. This unique design allowed for privacy and shielded competing players from watching what button was pressed, a particularly useful tactic when choosing a pitch in *Super Action Baseball* (1983). A spinner dial, yet to be duplicated by another console controller, allowed for variable speed and quick changes in direction.

The ColecoVision also had a built-in expansion port crafted directly into the console housing, a first for a video game console. While several different modules had been planned, only three distinct modules were released. The first expansion module allowed the ColecoVision to play cartridges made for the **Atari VCS 2600**. The ability for one system to play games designed for another console was a first for the game industry. It also prompted a legal battle with competitor Atari. The second module was a steering wheel that included a gas pedal to play driving games such as the popular arcade game conversion *Turbo* (arcade game, 1981; Coleco's home version, 1982).

The third module transformed the ColecoVision into a full-fledged computer, known as the ADAM, complete with a keyboard, cassette drive, and a daisy-wheel printer. Coleco was becoming a dominant force in the video game arena when, eighteen months after launch, the American video game market collapsed in the **crash of 1983**. The ADAM was to be Coleco's solution and savior. Unfortunately for Coleco, the ADAM got off to a rocky start and never recovered. ADAM was plagued by a list of technical problems, the launch was delayed several times, and only 95,000 units, as opposed to the 500,000 predicted, ever made it to consumers.

Following the disastrous release of ADAM in 1983, Coleco retreated from the video game market in 1984. Saved by the overnight success of the Cabbage Patch Kids, Coleco remained in business until the fad had passed, leaving Coleco overexpanded and unprepared. Hasbro bought the Coleco name in 1987, and the rights to the Cabbage Patch Kids now ironically belong to Mattel, Coleco's one-time video game rival and manufacturer of the **Mattel Intellivision**.

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collecting of video games

Collecting video games is very different from many traditional collecting hobbies. Books tell a single story; baseball cards feature a photo coupled with a few statistics to read; salt and pepper shakers simply store and distribute spice. Few collecting hobbies, however, offer the depth of interaction as do video games. A single video game can be played for hours, and certain genres such as **role-playing games (RPG)**, can be played for months with little or no duplication of events. Even classic games, with fewer screens and levels, are never the same game twice. Because most video games feature adjustable skill levels or multiple game playing options, nearly anyone of any age can partake in the hobby.

Hardback book collectors search for first editions and printings by famous authors, and sports card collectors hunt for "rookie" cards, but collectors of video games do not share such challenges. For example, early video games by prominent programmers such as Richard **Garriott** and Shigeru Miyamoto do not command a higher value. Popular games had larger and multiple production runs to meet demand, are more plentiful, and usually the most affordable. Most games are available for a fraction of their original retail price, meaning there is great value and fun to be found with little expenditure to start collecting.

Many collectible items become fragile over time, but early video game hardware and software have proven to be very stable and durable. In fact, older video game equipment will survive most modern-day video game gear because most were solid-state in design and contained no moving parts. The more modern the video game equipment, the more susceptible it is to failure due to mechanical problems, including technologies such as CD-ROM drives, motorized doors, liquid coolant, rubber belts, laser technology, and so on.

A particular sought-after game can be elusive. For some, the hunt becomes a game in itself. There are the obvious venues such as flea markets, pawn shops, and local video game vendors such as GameStop. Popular on-line destinations include Good Deal Games (GoodDealGames.com), Digital Press (www.DigitPress.com), J2 Games (J2games.com), and eBay (ebay.com). There are also numerous video game conventions and swap meets around the country and the **world**, such as the Midwest Classic, NWCE, Video Game Summit, and Too Many Games. Perhaps the most popular among them is the Classic Gaming Expo, usually held in Las Vegas.

For most collectors, the criteria that determine a game's value are completeness, scarcity, and condition. A single change concerning any of these factors can have a dramatic effect on a game's worth and collectability. Many consumers discard game **packaging**. As a result, video games present with their original boxes and paperwork, including any promotional paperwork originally packaged within the box (such as catalogs and registration cards) usually sell for more than double that of a "loose" **cartridge**. In some cases, the packaging is more valuable than the actual game itself; for example, the *Stadium Events* (1987) packaging alone sold for more than $10,000.

Games with lower production runs are more difficult to locate, and that can often drive the price up. Cartridges such as *Combat* (1977) for the **Atari VCS 2600** and *Sonic the Hedgehog* (1991) for the **SEGA Genesis** are very common because they were packaged with their respective consoles, resulting in a lower value as they are obtainable with little effort.

Grading the condition of a game and its accompanying items has no set formula. Labels that are pristine are far more desired than torn labels or labels with marker writing. Boxes that are not crushed or bent, those which contain bright vibrant colors rather than those faded by the sun while sitting in a rental store's window, or those that are not otherwise damaged command more respect. Unopened games in their original factory packaging are very sought after in most cases. Furthermore, cartridges with clean integrated circuits (the part of a game that plugs into the console) or CD-ROMs that are scratch-free improve the odds of the game playing correctly as well as being cosmetically desirable.

In some cases, game genre can affect value and collectability. **Sports games** that are published year after year, such as games in the John Madden football franchise, rarely retain even a minute portion of their initial retail value. Story-driven games such as role-playing games (RPGs) often cause an **emotional** response with players and collectors and as a result can be more desirable. Nostalgia can also be a motivating factor. Individual collectors may have a stronger appreciation for a certain generation of games, perhaps those from their own childhood.

Some collectors collect by system, organizing their games by console release and attempting to obtain every game released for a particular system. Some systems offer a greater challenge than others; for instance, collecting games for the **Atari 7800 Prosystem** is rather easy because it had a relatively small library of about five dozen games, all of which are fairly plentiful and easy to locate. Collecting for the Atari VCS 2600, however, is a massive undertaking with hundreds of different games having been released by multiple publishers, in various quantities, through different distribution chains, in multiple international markets with a variety of label and packaging variations. Other popular collecting options include collecting games by a particular publisher or of a favorite series, producer, artist, or genre.

A collector's physical location can also pose challenges. Most games are released within the North American and **Japanese** markets, but there are exclusive game titles released to select regions such as the United Kingdom or Brazil. Games sold in markets other than their original ones are referred to as import games and usually cost more abroad than in their native country.

Even domestically, finding a game in a particular region can be difficult. When the home video game **industry** began, there was no real distribution system in place; thus, many titles were easier to obtain in certain markets. For instance, **Bally** Astrocade games were manufactured in Columbus, Ohio, and were easier to acquire in the Midwest region.

Certain rare cartridges have fetched hefty prices, proving that video game collecting can be an investment. In the early 1990s, **Nintendo** staged several gaming tournaments, and perhaps the most popular was the 30-city North American Powerfest Tour that allowed Nintendo fans to prove their skills using the specially designed *Nintendo World Championship* (1990) cartridge. The top 90 finalists were awarded a gray edition of the cartridge, and *Nintendo Power Magazine* also awarded an additional 26 *World Championship* cartridges in a contest.

These cartridges were gold in color, similar to ***The Legend of Zelda*** (1986) cartridges common in circulation, and only a dozen have surfaced since 1990. Although most of the gold carts have sold for around $6,000 each, one sold to collector J. J. Hendricks for $17,500 in 2009. Another rare tournament cartridge, *Nintendo Campus Challenge* (1991) purchased by Rob Walters in 2006 for $21,100, is believed to be the only surviving copy because Nintendo often destroyed such material after the completion of a tournament.

In January 2001, a factory-sealed copy of *Stadium Events* (1987) sold for $22,806. The game was originally released in limited quantities (approximately 2000) by Bandai before being recalled to be republished by Nintendo for use with the Power Pad peripheral and relabeled as *World Class Track Meet* (1988). In January 2011, a sealed copy of *Stadium Events* (1987) was successfully sold to another bidder for $22,800. The highest recorded price ever paid for a single video game was $31,600, on April 10, 2010, for the only known copy of *Air Raid* (1982) for the Atari VCS 2600, which included a box.

Some games are released with the collector in mind. Known as Limited Editions (LE) or Collector Editions (CE), these special versions are manufactured in smaller quantities than the usual regular release and include bonus materials such as audio soundtracks, art books, and figurines and contain development material such as "making of" videos. Collector editions are often presented in special packaging such as a designer metal tin, often required to house the extra content.

Some collectors collect video game accessories in addition to video game hardware and software. Special **controllers** such as driving wheels, light guns, track balls, fishing rods, and musical instruments like those used with *Guitar Hero* (2005) are also collectable. Supportive **peripherals** such as memory cards, rumble packs, face plates, expansion memory, and link cables can also be added to any collection. Even a non-functioning apparatus such as the SEGA Genesis SEGA Channel Adapter or other obsolete equipment may be collected for completeness's sake. Many collectors also collect video game memorabilia. Tie-ins are numerous, encompassing items such as toys, promotional materials, retail displays, original art, and more, including the popular Super **Mario** bed sheets from the late 1980s.

Many enterprising individuals make their own **homebrew games** for obsolete systems no longer supported by the original console manufacturers. These games are also collectable and can be especially difficult to locate because they are usually manufactured in very limited quantities, normally less than a hundred copies per title. They are also not sold via retail establishments and are usually only available on-line from the original designers, from hobbyist websites such as Atari Age (Atari Age.com) and Good Deal Game's Homebrew Heaven (GoodDealGames.com), or at small retro-gaming trade shows such as the Classic Gaming Expo. Often homebrew games sold at a particular convention sell out almost immediately and are only available for a few hours.

The number of games that a consumer purchases for a select gaming console varies from individual to individual, but sales statistics show that most patrons usually purchase less than 10 titles per console. A serious game collector, however, amasses very large collections in the thousands. In addition to private collections, there are also professional and publically collected works, including archives and museums. The world's first permanent video game exhibition, *Computerspiele*, opened in Berlin, **Germany**, in 1997. The International Video Game Hall of Fame and Museum collects video game coin-op machines, and **Videotopia** is a mobile exhibition that has been in such notable museums as the Franklin Institute and features both coin-op arcade games and home console video games. One of the more impressive collections is owned by the **International Center for the History of Electronic Games (ICHEG)** at the Strong National Museum of **Play**, which currently houses more than 8,000 video game items and is constantly expanding.

There are on-line organizations as well; the **Video Arcade Preservation Society (VAPS)** has thousands of volunteer members who compile locations of vintage amusement hardware encompassing more than 70 countries, and the **Killer List of Videogames (KLOV)** offers a database for coin-operated video games. Good Deal Games (GoodDealGames.com) and Digital Press (www.digitpress.com) compose and publish release lists of available software for more than 60 gaming consoles and also serve as gathering places for collectors to meet each another. Print resources, which include value pricing in addition to various other information that may be beneficial to collectors, include the *Digital Press Collector's Guide* and *Video Game Trader Magazine*. ***See also*** CD-ROM-based games.

Michael Thomasson

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comics

Much like other media forms such as **television** and feature **films**, a significant number of video games have been adapted from comic books and strips. Several of the earliest video game adaptations from comics include the **Atari VCS 2600** games *Superman* (1979) and *Spider-Man* (1982). Adaptations from comic strips for the Atari 2600 are also to be found, including *Snoopy and the Red Baron* (1983), based on the *Peanuts* character, and *Flash Gordon* (1983), which was released after the 1980 film of the same name. Comic strip-inspired *Popeye* (1983) also followed a motion picture adaptation and was released on the Atari 2600, the **Mattel Intellivision**, the **ColecoVision**, and several other **platforms**.

Adaptations from **European** comics include *Obelix* (1983), based on the character from the French *Asterix* comics, and *Smurf: Escape from Gargamel's Castle* (1982) for the ColecoVision and the Atari 2600, as well as the educational game *Smurfs Save the Day* (1983) for the Atari 2600, were inspired by Belgian comics. In the **United States**, Marvel Comics characters Spider-Man and the X-Men and DC Comics characters Batman and Superman have been among the comic book properties to be adapted most frequently to video games. In **Japan**, video game adaptations of manga (Japanese comic books) characters are perhaps even more common, including games based on popular series such as Takao Saito's *Golgo 13* and Akira Toiyama's *Dragon Ball*.

Comic book adaptations of video games can also be found but are far less prevalent than games based on comic books. In 1982, DC comics created several mini comic books, including the series *Atari Force*, for inclusion with the packaging for games for the Atari 2600. The stories of these DC mini comic books were focused on the particular games with which they were included, such as ***Defender*** (Atari 2600 version, 1981) and *Galaxian* (Atari 2600 version, 1983), and DC also produced a stand-alone version of the *Atari Force* comic from 1982 to 1986. Japanese publisher JICC created several manga books based on Origin's ***Ultima* series** of **role-playing games (RPGs)**, starting with *The Terror of Exodus* (1988) adapted from the *Ultima III: Exodus* (1983) when the game was ported to the **Nintendo Entertainment System (NES)**. Valiant Comics published a series of comics under the *Nintendo Comics System* name from 1990 to 1991, including titles based on the ***Mario* series** and ***The Legend of Zelda* series**. Archie Comics began publishing *Sonic the Hedgehog* in 1993, which remains in publication, and Top Cow published *Tomb Raider* from 1997 until 2005. Perhaps the most successful case of adaptation to comic books and other media is **Nintendo**'s *Pokémon* series, which was first released as a pair of video games for the **Nintendo Game Boy** in 1996 and has been successfully adapted to a number of media forms, including manga, animé (Japanese animation), feature films, and toys.

Several video games adopt comic book–like aesthetics or game play mechanics, including Distinctive Software's *Accolade's Comics* (1987) and **SEGA**'s *Comix Zone* (1996), both of which employ comic book panels, and **Capcom**'s *Viewtiful Joe* (2003), which was also adapted to an animé series in Japan. Ubisoft's *XIII* (2003) is a first-person **shooting game** adapted from the Belgian comic book series of the same name that uses a cel-shaded graphical style, comic book panels, and speech and **sound** effect bubbles. Other games, such as *Max Payne* (2002), employ comic book aesthetics for the purposes of establishing a game's backstory and advancing the **narrative** between game levels.

Christopher Hanson

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computer games

The term "computer games" is sometimes used synonymously with "video games," but not all early video games used a microprocessor, which is usually implied by the term "computer." Likewise, not all games using a computer are "video games" because some of them do not involve video or **graphics**; for example, the **board game** *Stop Thief* (1979) has a handheld computer that makes sounds that relate to game play on the board; therefore, the game could be considered a computer game but not a video game. Often, "computer games" is used to refer more specifically to home computer games, which differ from **arcade games** and home **console-based games** in that they are designed to be played on a computer, which was typically not designed with game-playing in mind, as opposed to video games for dedicated systems.

Early Development

The earliest computer games were **mainframe games**, which were written and played during the 1960s on the large mainframe computers found at universities and large corporations. As home computers began appearing in the 1970s, games were created for them as well. Home computer games differed from arcade games in several ways. Whereas arcade games tried to bring in more income by being typically fast-paced and ending quickly (unless the player had enough skill to prolong the game), home computer games were purchased by the player and could be more leisurely and contemplative in nature. Games taking many hours to play that were not financially feasible in the arcade were welcome as home computer games, and certain game genres, including text-based games, **adventure games**, puzzle games, **role-playing games (RPGs)**, **simulation games**, and **adaptations** of games like chess and checkers, mainly appeared on home computers, where players could spend hours playing them. Although early home computers did not have the computing power found in arcade games, home computer games also differed from early home console-based games in that they could record data and allow games to be paused and **saved**. Computer disks contained more memory than the typical **cartridges** of the early era, allowing games to be larger and more complex. Home computer games also served to provide motivation for the sales of many early home computers, offering a way for people to play video games at home, and many even allowed players to experiment with writing their own games, which encouraged the startup of more home computer game companies.

Growing Competition

During the 1980s, home computer systems and their games improved as technology advanced, and home computer games, along with home console games, became the main competition for arcade games, which had to stay a step ahead of home games' capabilities if they were to survive. Arcade machines and home video game consoles were both dedicated systems designed for the playing of video games, which gave them an advantage over home computers that were multipurpose machines. As home computers developed, however, they would acquire various technologies for purposes other than video games, which would later be put to use for video games, and allow games to do things they could not do on dedicated machines of the time.

First, modems provided connectivity through phone lines that allowed home computers to dial up to **bulletin board systems (BBSs)** and **multi-user domains (MUDs)**, as well as early networked games and **on-line games** for multiple players, like *Scepter of Goth* (1983). Although home consoles were quick to follow up, with the appearance of Mattel's PlayCable Service in 1981 and the **CVC Gameline Master Module** in 1983 (a cartridge for the **Atari VCS 2600** that allowed games to be downloaded into it from a modem), home consoles with on-line connectivity would not be the norm for some time. Home computers would also be the main source of access for the playing of **massively multiplayer on-line role-playing games (MMORPGs)** in the latter half of the 1990s and into the 2000s, and home console systems would again take a while to catch up, with the **SEGA Dreamcast**, released in 1998 in **Japan** and 1999 in **North America**, being the first home console system to include a built-in modem through which MMORPGs could be played.

Home computers also continued to lead the way in storage media, incorporating **CD-ROM** drives and supporting the first CD-ROM games, like **Cyan**'s *The Manhole* (1987), often cited as the first game to appear on CD-ROM. Home console systems caught up a year later, with the **NEC PC-Engine/Turbografx-16**'s CD-ROM peripheral appearing in 1988, and over the next decade, the CD-ROM would replace cartridges as the standard storage medium used by console systems. Likewise, popular games such as ***Myst*** (1993) would encourage the purchase of CD-ROM drives for home computers.

Converging Technologies

As arcade games declined during the 1990s, home console games and home computer games became the main competitors in the computer game **industry**; home consoles would continue to take on functions of home computers, and games would be released on both home computer and home console platforms. By the beginning of the 2000s, commercial computer technology was keeping pace with home console video game technology, with the latter staying only a step ahead due to its design as a dedicated system, although many console systems could also play CDs and **DVDs** and go on-line, while sharing a number of other functions with personal computers.

At present, then, little distinction remains between "computer games" and other types of video games because they now all use computers in some form; the only question is whether a computer system was designed with gaming as its main purpose and marketed as a video game system. With video games available on almost every kind of personal computing device, one could argue that the term "computer games" has finally come to encompass all contemporary "video games."

In game scholarship, the term "computer games" is used more often in **Europe**, probably because most Europeans first encountered video games on home computers or home console systems, as opposed to in arcades, where many in North America first encountered them. In North America, such games were referred to as "video arcade games" to distinguish them from other kinds of arcade games, and were later shortened to "video games" to be inclusive of home games. The term has remained the main one in use since then.

Mark J. P. Wolf

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Computer Games Magazine

Computer Games Magazine, published in print from 1988 until 2007, was a monthly periodical dedicated to both reviewing games available on personal computers and providing **industry** news related to their production. In addition to game criticism and industrial reporting, *Computer Games Magazine* also had interviews with game **designers**, featured articles written by those active within game development communities, and reports from games conferences and trade shows. *Computer Games Magazine*'s long-standing focus specifically on personal **computer games** differentiates the publication from periodicals that discuss video games available for dedicated **console** systems as well as personal computers. As *Computer Games Magazine*'s original editor in chief Brian Walker noted in a press release issued in 1991, 90% of the periodical's focus at the time was on MS-DOS games, and the other 10% of reporting focused on games for such **platforms** as the Commodore Amiga and the Atari ST.

In print for 19 years, *Computer Games Magazine* is the second longest running magazine dedicated to personal computer games following *Computer Gaming World*, which began publishing in 1981. *Computer Games Magazine* was originally published as *Games International* in Great Britain. The name reflects the magazine's international scope; for example, the second issue features Walker reporting on the Essen Games Fair held in **Germany** on October 27–30, 1988, in addition to reports focusing on British games and gaming events. Before Walker's sale of the magazine's publishing rights in 1991, the editor in chief changed the name to *Strategy Plus*, denoting the magazine's increasingly specific focus on **strategy games**. At this time, the magazine's layout was divided into large sections dedicated to broad generic categories, progressing from strategy games to **adventure games** to **sports games**, and finally to **simulation games**.

In 1991, Yale and Tina Brozen acquired the magazine from Walker. Owners and operators of a mom-and-pop computer retailer and on-line software distributor named Chips & Bits, located in Vermont, the Brozens continued to distribute the publication to 240,000 subscribers worldwide after renaming the magazine *Computer Games: Strategy Plus*. Acquiring Chips & Bits in 1999, Florida-based publisher TheGlobe.com again retitled the periodical as *Computer Games Magazine*, the fourth and final iteration of the print publication. Reflecting the magazine's corporate ownership, later issues focused not only on multiple game genres but also on games available for dedicated gaming consoles, moving the magazine's focus away from the rigid definition of computer games as only those games available on personal computers.

In March 2006, Jayson Dubin, *Computer Games Magazine*'s president, announced the forthcoming publication of *Massive Magazine*, an offshoot publication dedicated specifically to **massively multiplayer on-line role-playing games (MMORPGs)**, with the first issue to be published on September 19, 2006. Citing both the increasing popularity of such games as ***World of Warcraft*** (2004) and the dedication of MMORPG players to the virtual **worlds** they inhabit, Dubin perceived a growing demand for a publication dedicated to MMORPGs. While both *Computer Games Magazine* and *Massive* released print issues in 2006 and early 2007, a California state lawsuit filed against publisher TheGlobe.com concerning spam messages distributed to MySpace subscribers led to the cancellation of both magazines' print publications as TheGlobe.com's finances were depleted. An attempt to transition into an on-line distribution model and establish a comprehensive archive of *Computer Games Magazine* past issues through the website www.cgonline.com is still in progress.

Harrison Gish

Computer Space

Computer Space was the world's first commercially sold video game and, as such, marks the beginning of the video game **industry**. Although video games had been created in the lab and university settings before, and the coin-operated mini-computer driven ***Galaxy Game*** (1971) on the Stanford University campus preceded it by two months, *Computer Space* was the first widely available stand-alone release.

Created by Nolan **Bushnell** and Ted Dabney, *Computer Space* used no CPU, RAM, or ROM and instead was based on "74" series TTL logic and a low-cost General Electric black-and-white television set. Bushnell brought the idea to Nutting Associates, a Mountain View, California, **arcade game** manufacturer for production, and it was released in November 1971. *Computer Space* was inspired by the game ***Spacewar!*** (1962) developed by Steve Russell, J. Martin Graetz, and Wayne Witaenem on a DEC PDP-1 computer at the Massachusetts Institute of Technology (MIT). Before its release, Nutting Associates even referred to the project internally as the "SW" or "*Spacewar!*" project.

In *Computer Space*, a player controls a rocket ship using buttons for thrust, rotation, and weapons fire. Enemy flying saucers shoot at the player, and the player shoots back. Each hit scores one point. Upon reaching 15 points, the next hit returns the score back to zero. Points are displayed via one onscreen character, the numbers 0 through 9, and custom characters for 10 through 15. A game lasts for 99 seconds, although at the end of the time period, if a player's score exceeds the enemy's score, the player receives another 99 seconds. This bonus feature can be repeated indefinitely. A two-player version of the game was released in which **joysticks** were added to the control panel.

The games were placed in custom-designed curved fiberglass cabinets to attract attention. Initially a single-player version was released and was available in red, blue, and yellow. Additionally, one white unit was made for exhibition. A two-player version was later released in green cabinets. Only 1,500 single-player models and as few as 350 green two-player units were produced. At least 80 to 150 of the single player models and 30 to 50 of the two-player models have survived. The **International Arcade Museum** holds the three earliest produced surviving units, including the only white one made by the factory.

Computer Space was not a commercial success, likely due to its unfamiliar theme and learning curve. Nolan Bushnell is reported to have said after the fact, "It was a little too complicated for the guy with the beer in the bar." Still, it attracted some attention, and at least one company released a clone of it (For-Play's *Star Trek* [1972]). *Computer Space* appeared prominently in the film *Soylent Green* (1973) and in an **arcade** scene in the film *Jaws* (1975). Bushnell believed both in his own ability and in the commercial viability of coin-operated video games. To develop another release for Nutting, he wanted an equity interest in the company. Bill Nutting turned him down and Bushnell and Ted Dabney left to form a new company, **Atari**. Atari's first release was the coin-operated game ***PONG*** (1972), which in turn was inspired by (and attracted lawyers representing) the tennis game from Ralph **Baer**'s **Magnavox Odyssey**. Atari's *PONG* was very successful, causing the general public to often incorrectly identify it as the first arcade video game release.

Computer Space can be seen at Penny Arcadia exhibitions of the International Arcade Museum in Los Angeles, California, at the Computer History Museum in Mountain View, California, occasionally at California Extreme (a classic coin-op arcade convention held each summer in Santa Clara, California), and at the homes of a number of classic video game collectors throughout the world.

Greg McLemore

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"Computer Space" Web page at The International Arcade Museum website, available at http://www.arcade-museum.com/C/Computer_Space.html.

console-based games

As opposed to personal **computer games**, **mobile games**, or **arcade games**, console-based gaming requires the use of a dedicated device that displays its output through an external monitor, most typically a **television** screen. The first video gaming console was the **Magnavox Odyssey**, originally conceived by inventor Ralph **Baer** as a prototype—then known as the Brown Box—in 1968 before its commercial release in 1972. An analog device with games that were hardwired into the console itself, the Odyssey also lacked **sound** output and displayed only black-and-white **graphics**, although Magnavox packaged the console with a number of vivid plastic covers that could be placed over the screen to emulate the effect of color. Although the **arcade** scene would remain at the forefront of the gaming industry for some years,

The Magnavox Odyssey, created by Ralph H. Baer and released in 1972, was the first home video game console. (Evan-Amos)

Magnavox had succeeded in popularizing the idea of a device that allowed games to be played on a television set at home.

The Odyssey was the first of a **generation** of dedicated consoles, most of which played variations of **ball-and-paddle games** similar to **Atari**'s pioneering arcade classic ***PONG*** (1972), which was also made available for the home market as *Home PONG* (1975) under Sears's Tele-Games brand. The proliferation of *PONG*-like home game consoles was made possible by General Instruments's AY-3-8500 chip, which contained all the elements needed for a game on a single chip. The flood of consoles resulting from the chip's popularity led to the **crash of 1977** and the end of the first generation of console technology.

From Dedicated Systems to Cartridge-based Systems

In 1976, Fairchild Semiconductor's **Fairchild Channel F** introduced the video game **cartridge** to the public and with it the concept of interchangeable games that would become a hallmark of future consoles. Although only a small number of titles were released for the Channel F, mostly developed by Fairchild itself, the device was more successful than RCA's Studio II, a device already obsolete by the time of its launch in early 1977. A hybrid machine of sorts, the Studio II played cartridge-based games along with a number built into the console itself. Like Magnavox's console, the Studio II output only black-and-white video and was guaranteed an early grave by the release of Atari's technologically superior **Atari VCS** (later renamed the 2600) in October 1977.

The Atari VCS expanded on Atari's earlier efforts to market *Home PONG* and introduced the plug-in cartridge format to a mass audience. For the first time, a home console could reproduce a reasonable facsimile of a gamer's favorite arcade titles—their graphical superiority compared to home consoles, provided much of the appeal of the arcade scene—and the success of the device was buoyed by the release of home ports of other popular arcade titles such as *Missile Command* (1980) and Atari's *Tank!* (1973) (which inspired *Combat* [1977]). Alongside arcade ports were many original games such as **Activision**'s *Pitfall* (1982) and Atari's ***Adventure*** (1979), the first graphical **adventure game**. One of the most popular cartridges, which boosted overall sales of the system, was the 1980 port of ***Space Invaders*** (1978), the first licensed home video game release. Licensing well-known games, however, proved to be a double-edged sword when Atari's home version of **Namco**'s wildly popular ***Pac-Man*** (1980; Atari 2600 version, 1982) was widely criticized for bearing little resemblance to the arcade original. The cartridge, along with Atari's *E.T.: The Extra-Terrestrial* (rushed to release in 1982 to capitalize on the popularity of the film of the same name), was returned to stores in vast quantities by disappointed buyers. These releases were typical of a glut of low-quality, and often third-party, games that weakened interest in video games and contributed to the industry-wide **crash of 1983**.

Intervening years had seen the release of the Magnavox Odyssey² (1978), the **Mattel Intellivision** (1979), and Coleco's **ColecoVision** (1982), devices that enjoyed modest success before the crash dealt a devastating blow to consumer confidence in the fledgling console industry. The Odyssey² proved popular in the **European** market, but its success in **North America** was limited by its inferior graphical capability compared with the Atari 2600 and its lack of third-party software support. (Only two developers besides Magnavox—Parker Brothers and Imagic—released games for the console.) The Intellivision, on the other hand, was technically superior to the 2600 but was undermined in the marketplace by Mattel's failure to deliver the Keyboard Component—a highly touted **peripheral** that would convert the Intellivision into a functional home computer—into the hands of consumers, a controversy that prompted the Federal Trade Commission to investigate Mattel for false advertising and fraud. Lastly, the ColecoVision boasted an impressive library of games (especially following the release of a peripheral that took advantage of a legal loophole and allowed the console to play 2600 games) and superior technical specifications but faced an uphill struggle when it launched shortly before the 2600's software glut crashed the North American console industry. All of these consoles, however, fared better than RDI Video Systems's Halcyon, a **laserdisc**-based console released in 1984 that saw the release of just two games before bankrupting its parent company. Not even the release of Atari's update to the 2600, the **Atari 5200**, in 1982 could prevent a recession that, ironically, only Atari managed to weather.

An Industry Revived

The fortunes of the video game console in North America would not begin to recover until the October 1985 release of the **Nintendo Entertainment System (NES)**, which had been released in **Japan** in 1983 as the **Nintendo Famicom** (a portmanteau of "family computer"). Although ports of **Nintendo**'s arcade hit *Donkey Kong* (1981) had proven popular on the 2600, Intellivision, and ColecoVision in 1982, Nintendo's decision to enter the console business was viewed with skepticism in an American market still reeling from the crash of 1983. Nintendo, however, had an ace up its sleeve: designer Shigeru Miyamoto, who followed his successful *Donkey Kong* and ***Mario Bros.*** (1983) with *Super Mario Bros.* (1985). This progression saw the games' mustachioed hero scaling a construction site to save his girlfriend from a rampaging ape, clearing a sewer of vermin and, finally, traversing the Mushroom Kingdom to rescue its princess from a fire-breathing turtle named Bowser. *Super Mario Bros.* proved immensely popular and inspired innumerable other action-platform titles for the NES, among them Konami's *Castlevania* (1986) and **Capcom**'s *Mega Man* (1987), both of which would in turn spawn myriad sequels on the NES and subsequent consoles. The action-platform game would come to be the dominant genre on gaming consoles over the course of the next decade, taking advantage of the speed of dedicated gaming consoles in comparison to contemporary home computers, where slower-paced adventure games prevailed. The NES also saw its own share of cerebral gaming in Miyamoto's ***The Legend of Zelda*** (1986)—the first cartridge to feature a built-in battery that allowed game progress to be saved even after the NES was turned off—in which protagonist Link embarked on an epic fantasy quest that introduced many players to the concept of an expansive, consistent game **world** ripe for exploration. In addition to Miyamoto's games, Nintendo released beloved action titles such as *Kid Icarus* (1987) and ***Metroid*** (1986) for the NES, the latter of which introduced gaming's first notable female protagonist, bounty hunter Samus Aran, and helped establish a stable of beloved characters that Nintendo would continue to draw on throughout the life spans of subsequent consoles. *Zelda* and *Metroid* would both see sequels on the company's handheld gaming device, the **Nintendo Game Boy**, which launched in 1989 and would remain incredibly popular over the course of the next decade.

Although the massive success of the NES single-handedly reignited Western interest in video games, it also allowed Nintendo to ink exclusivity deals with numerous third-party developers, severely limiting the libraries of competing consoles such as the **SEGA Master System** (released in Japan in 1985 as the **SEGA Mark III**) and the **Atari 7800 Prosystem**, both released in 1986. Although the 7800 gained some measure of popularity thanks both to its backward compatibility with almost all 2600 games and a selection of popular arcade conversions that included Atari's own *Centipede* (1980, arcade version; 1987, 7800 version), **Bally/Midway**'s *Rampage* (1986, arcade version; 1988, 7800 version) and Midway's *Ms. Pac-Man* (1981, arcade version; 1987, 7800 version), **SEGA** would have to wait until the next generation of machines before it established itself as a major player in the console market in North America, although the master system proved popular internationally. That generation arguably began in 1987 with the Japanese launch of the **NEC PC-Engine TurboGrafx-16** (a North American release would follow in 1989). As its name suggests, the TurboGrafx-16 boasted 16-bit video processors that represented a marked improvement over graphical capabilities of the 8-bit processors utilized by the NES and its competitors. The core CPU of the TurboGrafx-16, however, was still 8-bit, making the console something of a stepping stone between the 8-bit and 16-bit generations of consoles.

It was SEGA who took the next step into the 16-bit era with the **SEGA Mega Drive** (1988, released in North America in 1989 under the name **SEGA Genesis**). Early in their new console's life, SEGA released several popular **fighting games**—notably *Altered Beast* (1988) and *Golden Axe* (1989)—before demonstrating the processing speed of its machine by debuting a new mascot in 1991's *Sonic the Hedgehog*, whose titular protagonist traversed a series of platform levels with blinding speed and a determined smirk that set him apart from Nintendo's wide-eyed Mario. The game was followed by *Sonic the Hedgehog 2* in 1992 and twin sequels *Sonic the Hedgehog 3* and *Sonic and Knuckles* in 1994, a period during which SEGA also released another popular action title, *Ecco the Dolphin*

(1992). SEGA also released numerous popular **role-playing games (RPGs)** for the Genesis, among them the *Shining Force* series (beginning in 1992) and the continuation of the *Phantasy Star* series from 1989's *Phantasy Star II* through two further sequels in 1990 and 1993.

In 1990, Nintendo followed the success of the NES with the release of its successor, the **Super Famicon** (**Super Nintendo Entertainment System [SNES]** in North America, where it launched almost a year later), a 16-bit console that could compete on an even footing with the TurboGrafx-16 and the Genesis. Building on the triumphs of the original NES, the SNES's **controller** doubled the number of buttons on the now-iconic NES gamepad to four and added two additional triggers to the "shoulders" of the controller, setting a precedent that would be followed by many subsequent input devices. Nintendo also ensured that the console's launch was accompanied by a Mario title, *Super Mario World* (1990), along with *F-Zero* (1990), a high-speed futuristic **racing game** that exhibited the console's ability to simulate three-dimensional graphics. Using a technique known as Mode 7 rendering, the console used two-dimensional graphics to create the illusion of three-dimensional movement, years in advance of the true polygonal three-dimensional rendering that would be ushered in by the next console generation. This technique would be used in many of the SNES's most beloved titles, among them *The Legend of Zelda: A Link to the Past* (1991) and *Super Mario Kart* (1992), and would also surface in many of Square's popular role-playing games (RPGs) for the console, including their flagship *Final Fantasy* series (which saw three titles released on the system: *IV* in 1991, *V* in 1992, and *VI* in 1994), *Chrono Trigger* (1995), and *Super Mario RPG: Legend of the Seven Stars* (1996), a collaboration with Nintendo late in the console's life. Other popular releases of the SNES era included *Super Metroid* (1994), released the same year as the first entry in Rare's popular *Donkey Kong Country* series, which granted Mario's original foe a platform title of his own. In addition to Mario-style platform games and RPGs, one-on-one fighting games proved extremely popular on both the SNES and the Genesis, most notably Capcom's smash arcade hit ***Street Fighter II*** (1991). (The first of several home versions of the game, *Street Fighter II: The World Warrior*, was released in 1992. At the time *Street Fighter* and its ilk were also dominating the arcade scene, inspiring intense competition among players that drove sales of fighting games on home consoles.) The release of another popular arcade conversion, Midway's ***Mortal Kombat*** (1992, arcade version; 1993, SNES version) drew attention to Nintendo's family-friendly approach to the video game business. The plentiful blood of the notoriously **violent** original was changed to sweat in the sanitized SNES port, which, unlike the Genesis version of the game, featured no code to unlock the full gore of the arcade version. Poor sales of *Mortal Kombat* on the SNES caused Nintendo to redact this approach with the release of *Mortal Kombat II* (1993) on the console in 1995.

The Rise of Three-Dimensional Graphics

Like the transition from 8-bit to 16-bit consoles, the leap to a new generation of devices capable of displaying polygonal three-dimensional graphics left a number of casualties in its wake. Atari attempted to reestablish itself as a console manufacturer with the 1993 release of the Atari Jaguar, but it (much like Panasonic's **3DO Interactive Multiplayer**, released the same year) was doomed by a lack of third-party developer support. SEGA's 1994 successor to the Genesis, the **SEGA Saturn**, was undone instead by the arrival of a new player in the console market that year: the **Sony PlayStation**, which like the Saturn took advantage of the high data capacity and inexpensive manufacturing process afforded by the CD-ROM format. Although the Saturn boasted some beloved titles, including SEGA's own *Nights into Dreams* (1996) and *Panzer Dragoon Saga* (1998), unfavorable comparisons to the PlayStation as well as Sony's decision to undercut the Saturn's retail price ensured that the console never found a solid footing in the marketplace.

The PlayStation, which entered the Japanese marketplace in 1994 (with an American release the following year) would revolutionize the general public's perception of video gaming. Unlike the dominant Nintendo and SEGA consoles of the late 1980s and early 1990s, the PlayStation lacked a child-friendly mascot. (Admittedly, the titular character of *Naughty Dog*'s Crash Bandicoot [1996] was seen to fulfill that role in an unofficial capacity until 2000, when Sony's role as the series' publisher came to an end.) Rather, games like Sony Computer Entertainment's (SCE) futuristic racing game, *WipEout* (1995), UEP Systems' *Cool Boarders* (1996), and Activision's *Tony Hawk's Pro Skater* (1999) ensured the console's association with the nascent rave and extreme sports subcultures prominent in the young adult demographic that would come to dominate video gaming for the next decade. Car culture was also well represented by Namco's arcade port *Ridge Racer* (1995) and Sony's own *Gran Turismo* (1997), developed by Kazumori Yamauchi's Polyphony Digital, which was by far the most comprehensive driving simulation on a console. During the same period, ambitiously cinematic titles such as Square's role-playing epic *Final Fantasy VII* (1997) and Konami and director **Hideo Kojima**'s "Tactical Espionage Action" game ***Metal Gear** Solid* (1998) took advantage of the storage capacity of CD-ROMs via full-motion video (FMV) sequences that adopted Hollywood conventions of storytelling and framing, resulting in a more immersive **narrative** experience than had previously been possible on consoles. Konami also released a RPG-influenced update to its venerable *Castlevania* series in *Symphony of the Night* (1997) and **survival horror game** *Silent Hill* (1999) that, along with Capcom's *Resident Evil* series (beginning in 1996 and continuing through two sequels in 1998 and 1999) popularized the horror genre among console gamers. Meanwhile, Namco's *Tekken* (1994, arcade version; 1995, PlayStation version) and its sequels established a major new three-dimensional fighting franchise, and Sony's *DualShock*, a 1998 update to the original PlayStation controller that added vibration feedback and twin analog sticks, became an iconic piece of hardware, the design of which endured as a consistent part of the PlayStation line.

The analog stick was a design element borrowed from the PlayStation's most notable competitor, the **Nintendo 64**, an idiosyncratic console released in 1996.

Unlike Sony and SEGA, Nintendo chose to ignore the onset of the CD-ROM format, instead making the controversial decision to continue releasing games on expensive plastic cartridges. More popular with children than with the young adult market courted by Sony, early titles like *Super Mario 64* (1996) and *Mario Kart 64* (1996) played to the strengths of the cartridge format by featuring cartoon-inspired graphics emphasizing bright colors and limited texturing. The former also established the template for the three-dimensional platform game in much the same ways that *Super Mario Bros.* did the two-dimensional platform game 11 years earlier. Nintendo's long-standing relationship with Rare yielded similar character-based action titles such as *Banjo Kazooie* (1998) and *Donkey Kong 64* (1999), as well as titles aimed at an older audience. Most notable among these were *Goldeneye 007* (1997) and its spiritual successor *Perfect Dark* (2000), games that made first-person **shooting games** a viable proposition on consoles when previously the genre had been associated primarily with home computers because the mouse-and-keyboard controls allowed for greater aiming precision, and their on-line capabilities provided a multiplayer experience that wouldn't exist on consoles for several years. Aiding in this endeavor were the 64's four built-in controller ports, allowing for shootouts between up to four players to take place on a single screen. Also taking advantage of the console's multiplayer capabilities was HAL Laboratory's *Super Smash Bros.* (1999), a title that exploited Nintendo's extensive stable of iconic characters, from Mario to Link to *Pokémon*'s Pikachu, by pitting them against each other in fevered free-for-all battles. Link himself received two adventures on the console—*Ocarina of Time* (1998) and *Majora's Mask* (2000)—the former an acclaimed three-dimensional reimagining of its hero's eternal battle against his nemesis Ganondorf, the latter the first in a number of stylistic deviations for the series in which players experienced a perpetual three-day cycle that could only be broken by solving the game's myriad challenges.

It was into this race between Sony and Nintendo that SEGA attempted to reestablish itself in the console market with the late 1998 release of the **SEGA Dreamcast**. Despite being the first console to feature a modem and boasting beloved launch titles like *Sonic Adventure* (1998) and Namco's *Soul Calibur* (1998, arcade version; 1999, Dreamcast version), the Dreamcast struggled to find a wide audience and SEGA announced the end of support for the console a little over a year after its 1999 North American launch. The device drew praise from hardcore gamers for its rich library of fighting games, notably *Soul Calibur* along with a host of Capcom efforts including *Power Stone* (1999), *Marvel vs. Capcom 2* (2000), and *Resident Evil: Code Veronica* (2000). (During this period, the technical capabilities of consoles caught up to those of arcade games and the enhanced home ports of arcade titles available on home devices contributed to the death of the arcade scene in North America.) However, SEGA's own highly anticipated adventure title *Shenmue* (2000) divided critics, and despite the release of *Shenmue II* (2001), creator Yu Suzuki's planned trilogy has remained unresolved.

New Challenges and Generations

The early demise of the Dreamcast is often attributed to the high level of consumer anticipation for the **Sony PlayStation 2**, released in early 2000 in Japan and six months later in North America. Utilizing the **DVD** format, the PlayStation 2 built on the successes of Sony's first console by quickly amassing a library of prominent games—including Konami's ***Metal Gear*** *Solid 2: Sons of Liberty* (2001, with *Metal Gear Solid 3: Snake Eater* following in 2004) and Square's *Final Fantasy X* (2001)—that continued to adapt cinematic conventions to gaming. The console also saw the release of influential titles that included Capcom's *Devil May Cry* (2001), a new breed of action game that encouraged players not only to keep protagonist Dante alive but to dispatch his foes in increasingly stylish and creative ways, and Rockstar Games's ***Grand Theft Auto III*** (2001), with an open-ended structure and lurid underworld narrative that proved extremely popular among gamers while igniting a firestorm of controversy in the mainstream media. Namco released a cult favorite in Keita Takahashi's *Katamari Damacy* (2004), a game with a charmingly offbeat aesthetic that tasked players with rolling environmental objects into ever-larger balls of debris, while Activision caused a mainstream sensation with *Guitar Hero* (2005), which included guitar-shaped peripheral that simulates the sensation of playing a real instrument. First-party Sony titles *Ico* (2001) and *Shadow of the Colossus* (2004), both developed by Fumito Ueda's Team Ico, also broke new ground by exploring the **emotional** relationship of the player to the game world with a more deft touch than had been previously done, and the company's Santa Monica studio brought the action genre to new heights of epic melodrama with *God of War* (2005), a blood-soaked reimagining of Greek mythology. Sony also followed SEGA's lead into the on-line arena with developer Zipper Interactive's *SOCOM: U.S. Navy Seals* (2002), which allowed players to verbally coordinate tactics via a USB-connected headset device, further narrowing the divide between computer games and console gaming.

Although the PlayStation brand continued to enjoy a position of industry dominance, the PlayStation 2 did not remain unchallenged for long with the 2001 release of two new competitors: the **Nintendo GameCube** and the **Microsoft Xbox**. The latter console's launch coincided with that of *Halo: Combat Evolved* (2001), a first-party game developed by Bungie Studios that would complete the work begun by *Goldeneye 007* four years earlier, cementing the first-person shooter as a mainstay of console gaming and bringing with it a resurgence in the popularity of four-player split-screen shootouts. In 2002, Microsoft would launch its for-pay on-line gaming service, Xbox Live, enabling death matches on a global scale in time for the release of *Halo 2* (2004). Microsoft also succeeded in securing exclusive titles analogous to major PlayStation brands, with Tecmo's *Dead or Alive 3* (2001) offering an alternative to *Tekken* and Bizarre Creation's Project *Gotham Racing* (2001) to *Gran Turismo*. The Xbox also found a major hit in Ubisoft's *Tom Clancy's Splinter Cell* (2002), a high-tech espionage thriller that pushed console graphics to new levels of realism with its dynamic lighting system. While Microsoft's early attempt to establish a fantasy adventure franchise with Adrenium Games' *Azurik: Rise of Perathia* (2001) failed to attract an audience. Lionhead Studio's *Fable* (2004) drew praise despite some compromise of creator Peter **Molyneux**'s expansive original vision of a completely open-ended fantasy experience.

Although Nintendo's handheld division, represented from 2001 by the Game Boy Advance and from 2004 by the **Nintendo DS** (Dual Screen), remained extremely profitable, the company struggled during this period to find an audience for its GameCube. The console's launch bucked Nintendo tradition by lacking an accompanying Mario game, opting instead for *Luigi's Mansion* (2001), a spinoff title that saw Mario's sibling trapped in a house infested with spirits that could be fended off using a modified vacuum cleaner. A new Mario title soon followed with *Super Mario Sunshine* (2002), a series anomaly in which Mario wielded a water canon to combat enemies and solve puzzles, along with a new Shigeru Miyamoto creation, *Pikmin* (2001), in which the player assumed the role of a spaceman commanding oversized plant life on an alien world. Nintendo scored a considerable third-party coup with Capcom's announcement that *Resident Evil* would become a GameCube exclusive, a move seen as contrary to Nintendo's child-friendly image. The publisher released *Resident Evil* (2002), a high-resolution remake of the PlayStation original, along with prequel *Resident Evil Zero* (2002) and sequel *Resident Evil 4* (2005), the latter a highly acclaimed reinvention of the series' traditionally awkward control mechanics. Also catering to older gamers was Retro Studies' reinvention of the venerable ***Metroid*** franchise as a first-person shooter, *Metroid Prime* (2002), while *The Legend of Zelda* received both a cartoon-inspired makeover that alienated some fans in *The Wind Waker* (2003) and a swan song for the GameCube in *Twilight Princess* (2006), a game that released simultaneously on Nintendo's next console, the **Nintendo Wii**.

It was Microsoft that made the first move to usher in the next generation of consoles, releasing the **Microsoft Xbox 360** in late 2005. The Xbox Live service became an ever more integral part of the second Xbox's appeal, hosting millions of games of *Halo 3* (2007, with Bungie Studio's final *Halo* title, *Halo: Reach*, following in 2010) and Activision's *Call of Duty 4: Modern Warfare* (2007). The service expanded its reach by ranking player achievements within individual games (which in turn fed into a cumulative Gamerscore) and launched the Xbox Live Arcade, where smaller games—including numerous independently developed titles such as Jonathan Blow's *Braid* (2008) and Playdead Studios's *Limbo* (2010)—were available for download. The console also boasted an impressive lineup of shooting games, including Epic Games's science fiction military epic *Gears of War* (2006) and 2K Games's ***Bioshock*** (2006), a sophisticated dystopian horror experience that stranded the player in a ruined underwater city. **Electronic Arts**' and MTV Games' *Rock Band* (2007), an evolution of developer Harmonix's previous Activision-published hit *Guitar Hero*, proved immensely popular among both hardcore and casual players, augmenting the guitar controller of the older game with karaoke vocals and drum pads that encourage groups of friends to jam in unison. The Xbox 360 sold well, although its reception was marred somewhat by hardware issues that plagued the console in its earliest iteration, with users dreading the "red ring of death" that signaled their system had overheated and become inoperable.

The **Sony PlayStation 3** reached the market roughly a year after the Xbox 360, positioned by the company as a home entertainment hub in addition to a video game console. Games used the Blu-ray format, allowing the console to serve as a high-definition movie player, and (unlike the 360) all models boasted a built-in hard drive. However, the resultant high price of the console limited sales before 2009, when a hardware redesign was accompanied by a price drop. The PlayStation 3's considerable processing power yielded action games of unprecedented polish and dynamism, among them Naughty Dog's *Uncharted: Drake's Fortune* (2007, with *Uncharted 2: Among Thieves* following in 2009) and Konami's *Metal Gear Solid 4: Guns of the Patriots* (2008), while Sony's attempt to challenge Microsoft's impressive lineup of shooting games included titles like Insomniac Games's *Resistance: Fall of Man* (2006) and Guerilla Games's *Killzone 2* (2009). Sony also strove to match Microsoft's Xbox Live service with its own PlayStation Network, home to highly experimental titles such as thatgamecompany's *Flower* (2009) and Namco's *Noby Noby Boy* (2009), the latter designed by *Katamari Damacy* creator Keita Takahashi. SCE Europe, meanwhile, launched a fresh property in Media Molecule's *Little Big Planet* (2008), a multiplayer platform game that allowed players to construct their own levels and publish them on-line.

Nintendo, on the other hand, made a bold gamble with the design of the Wii, opting out of direct competition with Microsoft and Sony's graphically intensive, on-line-focused machines and instead offering an revolutionary **motion control** system dubbed the Wii Remote. This popular innovation emphasized casual fun and off-line multiplayer experiences, allowing novice gamers to easily pick up golf, bowling, and other pastimes in *Wii Sports* (2006). Meanwhile, familiar multiplayer diversions were released in the form of *Mario Kart Wii* (2008) and *Super Smash Bros. Brawl* (2008), and even *Super Mario Galaxy* (2007) and *New Super Mario Bros. Wii* (2009) both included a multiplayer component. Nintendo branched out further into the **casual games** marketplace with *Wii Fit* (2008), a game that led users through a series of exercise routines and then graded their performance. Conversely, *The Legend of Zelda: Twilight Princess* (2006) and *Metroid: Other M* (2010)—the latter a cooperative venture between Nintendo and *Dead or Alive* developer Team Ninja—highlighted the system's relatively sparse offerings aimed at the hardcore demographic. Nintendo's gambit paid off, however; the Wii has been wildly successful, and in 2010, Sony and Microsoft both released motion-control devices (the Move and the Kinect, respectively) as supplements to their own consoles. What remains to be seen is whether such nontraditional control methods represent the future of console gaming or are merely a passing fad. ***See also*** CD-ROM-based games.

Ben Gill

Further Reading

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controllers

A video game controller is a device used to input commands into a video game system and, in some cases, to output feedback to the user. Controllers are used by players to interact with video games in order to control or manipulate elements of the game. Games are generally designed for a specific controller or set of controllers. Generic controllers include a mouse and keyboard combination, and a joystick and/or gamepad, which are frequently chosen for player familiarity. Other games can require genre- or even game-specific controllers such as steering wheels or musical instruments. Older controllers tended to be connected to the game system via wires, whereas modern controllers tend to be wireless.

Common Types of Controllers

Arcade cabinet controllers are often designed for use with one particular game, requiring a customized cabinet to house the game. The most common types of arcade cabinet controllers consist of buttons and joysticks. Other types of common arcade cabinet controllers include a steering wheel and foot pedal combination for **racing games**, mounted guns for **shooting games**, boxing gloves, skis, snowboards, fishing poles, and dance pads.

Camera controllers observe the player and surrounding environment, usually from the perspective of the display using images as input for a game (as opposed to light guns, which employ controller-mounted cameras). Some of the better known examples of camera systems include the **Sony PlayStation 2** EyeToy, the **PlayStation 3** Eye (and Move), the **Microsoft Xbox 360** Kinect, and the Nintendo DSi which features a built-in camera. Cameras use different techniques to detect objects in the environment, such as edge detection, motion detection, and color detection (like greenscreen technology). Stereo cameras or multi-camera arrays can infer **z-axis depth**, allowing the system to know where an object is in three-dimensional space. Modern camera systems can track user body movement and detect facial movement and expressions.

Gamepads are the most common form of game controllers. Typical gamepads are held by both hands and feature several buttons and joysticks as inputs. Directional pads (D-pads) are four-way buttons that are usually used for navigational purposes and have an arrow in each of the cardinal directions corresponding to movement. Most directional pads can sense 8-way directional movement and are often found on the left-hand side of the controller. Standalone buttons are typically found on the right-hand side of gamepads and are often labeled with letters or symbols (such as A and B or Circle and Triangle). These buttons are generally used to execute actions in a game. Shoulder buttons, or triggers, are buttons located on the top side of the controller. Shoulder buttons are frequently used in games for firing weapons or for rotational purposes. Many gamepads feature several reserved buttons that have standardized uses and are found in the middle of the controller. The start button almost always pauses games or brings up a menu. A select or back button is often used in menu navigation. Modern consoles feature a button for connecting wireless controllers to the system itself and for bringing up system menus. In addition to buttons, many gamepads feature one or two joysticks or thumbsticks. Modern gamepads may have several other embedded devices as well, including vibrator monitors for haptic feedback, orientation and acceleration sensors, speakers for audio feedback, and ports for connecting other **peripherals** such as headsets or secondary controllers.

The *keyboard* and *mouse* are both standard input devices for computers and are the only commonly used game controllers not specifically created with the express purpose of playing games. Because of the large number of keys on it, the keyboard can be used to input more commands than most other controllers, whereas the mouse is a fast and highly accurate pointing device (the mouse's control mechanism was developed from the trackball, an early pointing device used in the arcade). Common control **mappings** have evolved, such as using the W, A, S, and D keys for movement, and many games allow player-defined mapping of important or common functions to specific mouse buttons or keyboard keys. In many games, the keyboard is used to move a character in a **virtual world**, and the mouse is used to control where the character looks and/or aims. Many games allow players to remap, or customize, controls that use keyboard and mouse input.

A *light gun* is a controller that mimics the behavior of a firearm, allowing players to shoot objects on the screen. Light guns consist of a camera mounted in a gun-shaped device. The camera observes reference points (either a device mounted by the screen, such as a sensor bar, or the screen itself) to determine what it is aiming at. The **Magnavox Odyssey** was the first system to introduce a light gun controller and was followed many years later by **Nintendo**'s Zapper for the **Nintendo Entertainment System (NES)** and the Super Scope for the **Super Nintendo Entertainment System (SNES)**. The **Nintendo Wii** Remote effectively behaves as a light gun controller for the Wii.

Motion-sensing controllers embedded accelerometers and gyroscopes to detect player motion and orientation. The Nintendo Wii Remote and PlayStation Sixaxis and Move are examples of motion-sensing controllers.

Musical instrument controllers are devices which mimic the form and simulate the function of a musical instrument. These controllers are often used in conjunction with **rhythm games**, and tend to be specific to the genre. Common controllers include microphones, guitars, drums, and piano keyboards.

Touch screen devices are often seen on portable devices with small screens, such as the **Nintendo DS** and mobile devices like the Apple iPhone. Touch screens allow users to interact directly with the screen using their fingers or a stylus. These **interfaces** can double as buttons or joysticks by designating areas on the screen for such functionality, although they don't offer the same pressure feedback when pressed. Touch screens are frequently used for drawing or writing purposes.

Balance boards sense pressure from players standing on them and are most commonly used for fitness and snowboarding games.

Dance pads generally consist of an array of large, flat buttons that players can step on to activate and are frequently used with **arcade** (or arcade style) **dancing games**.

Brain-controlled devices are currently in development and promise to allow users to control (or partially control) games through thought alone. These devices detect electrical stimulation in the head and/or facial regions. As of 2011, these devices are very limited in functionality and are not in use by mainstream gaming.

Eitan Glinert

cooperative gameplay

Unlike competitive gameplay, cooperative gameplay requires players to work together as a team. To succeed, they must gain a mutual understanding of each other's style of **play**, anticipate each other's moves, and be willing to sacrifice for the good of the team. Early **arcade games**, especially **shooting games**, put forward the impression that video games are not, by nature, cooperative. ***PONG*** (1972), for instance, immediately became the template for video games as a player-versus-player activity, one which was competitive, not cooperative. Also, many early coin-op games, largely for economic reasons, allowed only one player at a time to play. Because of that, most early video games displayed a single tally of high scores that created an atmosphere of solo competition. This, in turn, helped to establish the image of video game player as a loner. Even so, cooperative games appeared early on in video game **history**. The very first cooperative video game was a "doubles" version of *PONG*, Atari's *PONG Doubles* (1973). In this configuration, two sets of players could play team against team. In particular, the creation of teams added an important element to video gaming; when one player was unable to return the ball, there was a chance that the player's partner could make the save, thus promoting camaraderie and a bond between players.

Although single-player games were the norm, notable exceptions were games that featured artificial intelligence, such as Howard Delman's *Fire Truck* (1978), the first game to offer a computer-controlled companion. *Fire Truck* was also the first video game to feature "tethered" play, gameplay in which players are not allowed to harm their own teammates or, in other cases, move outside of a prescribed region, usually the viewable display area. In the case of *Fire Truck*, the "tether" between players was tangible. On-screen, the game presented a top-down view of an articulated hook-and-ladder truck, and one or both players maneuvered the truck to avoid crashes. Two years later, *Rip Off* (1980), designed by Tim Skelly for Cinematronics, would offer two players the opportunity to play as an unfettered team, free to maneuver and shoot as they saw fit. Soon after that, *Space Duel* (1982), created by Owen Ruben for Atari, joined the ranks of early cooperative play games. His entry visibly tethered two players together in that game's two-player mode, forcing both players to stay in step with each other.

Leaving aside artificial players, cooperative games do have an obvious drawback: the need for more than one player at a minimum. In the past, this might have been a hurdle, but with the rise of gameplay over the Internet, the finding of like-minded players will not be a deterrent now or at any time in the future. Many early on-line multiplayer games were fantasy **role-playing games (RPGs)**, inspired by card games like *Dungeons & Dragons* (1974), a gaming genre that first appeared in video game **arcade** form as Ed Logg's *Gauntlet* (1985). *Gauntlet*, although multiplayer, was not strictly cooperative because each player had his or her own score and rewards. However, it was this cooperative/independent play game form that transmogrified into other genres and media spinoffs. In many games like these, a quest scenario is employed to motivate the **narrative** of the game. Ultimately, players spend most of their time tending to their personas and enhancing their personal status within the game.

So how cooperative are cooperative games? The answer depends on the game and the rules enforced within it. Demonstrating the variety of cooperative gaming styles, the website Digitalbattle.com chose as its top 10 cooperative games *New Super **Mario** Brothers Wii* (2009), *Halo 3: ODST* (2009), *Little Big Planet* (2007), *Left 4 Dead 2* (2009), *Army of Two* (2008) and *Army of Two: The 40th Day* (2010), *Guitar Hero* (2005), *Crackdown* (2007) and *Crackdown 2* (2010), *Borderlands* (2007), *Gears of War* (2006), and ***World of Warcraft*** (1994). As this list shows, cooperative play has both a strong following and can be adapted to many genres and **platforms**. As long as there are two human beings who are in the same room or who can access a computer at the same time, there will be cooperative play video games. Even within strongly antagonistic games, there is always the possibility of cooperation. The only way to prevent that would be for the rules of the game to completely prevent cooperation of any kind, and this would be highly unlikely. Human beings are social animals, and, even at our worst, we will always find a way to cooperate when we wish to.

Tim Skelly

crash of 1977

The great video game industry **crash of 1983** was not the industry's first; the crash of 1977, although not as big or as long-lasting, was the first to test the home video game **industry**. In some ways, it was a warning to the industry that was predictive of the great crash of 1983, with which it shared similar conditions: burgeoning commercial success encouraging high expectations, cheapened product glutting the marketplace, tough competition forcing the slashing of prices, and technical advances resulting in a new **generation of technology** that quickly outmoded older systems and sent them into obsolescence. The 1977 crash itself was even foreseen by some, based on the patterns followed by other electronics industries like those of electronic calculators, digital watches, and CB radios, in the years following the appearance of large-scale integrated (LSI) circuits and microprocessors, which video games used as well.

After the success of the **Magnavox Odyssey**, the first home video game system and ***PONG*** (1972), its **arcade** imitator, *PONG*-like games began coming out for the home and the arcade, and the video game industry began its phenomenal growth in the early 1970s. By the end of 1975 the industry was booming. Games sold out in stores, and demand outpaced supplies. But the real catalyst for the boom that preceded the crash was the AY-3-8500 chip, produced by General Instruments (GI) in early 1976. The AY-3-8500 had all the circuitry necessary for a video game on a single chip, greatly simplifying video game production and tempting dozens of companies, in **Europe** and the **United States**, to enter the video game industry. Coleco was the first company to order the chip, and many other companies followed. The cost of the chip was about $5 or $6, making it possible to produce home video game systems with retail prices of under $100 that still had enormous profit margins.

The rush to get systems on the market resulted in many second-rate products, and some did not even bother to include copyright notices on their boxes. Around 70 companies were competing for market share, and even systems that are considered obscure today sold well; for example, National Semiconductor's Adversary home game system sold more than 200,000 units in 1976. The Christmas season of 1976 would set a record for the home video game industry, with estimated retail sales of about $150 million, and many stores experienced shortages.

The craze continued into 1977, but one system from 1976 was different. The **Fairchild Channel F** home video game system was **cartridge**-based, as opposed to having only built-in games like all the other systems. After purchasing this system consumers could buy new games for it as new cartridges appeared, instead of having to buy new systems. Game makers took note and realized this was the future of the industry. RCA readied its cartridge-based Studio II system for release later in the year, and Atari would release its **Atari VCS** (later renamed the 2600) later in the year as well. Home computers were also developing, and many would come to include a slot for cartridges, as gaming was one of the reasons that many people bought home computers. **Handheld games** also appeared around this time and would provide further competition.

By January 1977, GI had shipped more than 7 million AY-3-8500 chips, and new chips were being planned. Consumers, tired of the same *PONG*-like games and waiting for more advanced games and game systems, pulled back, just as another surge of new games came on the market. The games were already selling at reduced prices, and the sudden drop in sales led to the first industry crash. Companies lost money, and some, like Allied Leisure, went bankrupt. Even three of the major game producers who made their own chips, Fairchild, National Semiconductor, and RCA, quit production and left the industry.

With the release the Atari VCS in October 1977, the industry would begin to bounce back. Although Atari's system was not the first cartridge-based one, Atari was already known for its **arcade games**, and the company also was quick to license other arcade hits, most notably ***Space Invaders*** (1978), which meant that many of the games produced for the VCS had some name recognition from the arcade. Atari also allowed third-party developers to develop games for the VCS, which allowed the game library for the system to grow quickly into hundreds of cartridges. Many companies, like **Activision** and Imagic, were initially begun as developers for the VCS. In the end, third-party game development and production, eventually resulting in more than 1,000 cartridges made for the system, would also keep the Atari VCS in production until its official retirement in 1992, making it one of the most successful consoles in video game history, rejuvenating the home video game system industry as a result. Although the crash of 1977 had less of an impact than the crash of 1983, it nonetheless provided a warning and demonstrated how unbridled enthusiasm within the industry would not necessarily be followed by consumers, who were looking ahead to what technology was on the horizon rather than adopting every new system and advance as it appeared.

Mark J. P. Wolf

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crash of 1983

One of the greatest turning points in the **history of video games**, the **North American** video game **industry** crash of 1983 was a sobering turn of events that countered the unbridled optimism of the early days and brought an end to the Golden Age of **arcade** video games. Many companies quit producing video games, some went bankrupt, and the few that stayed in the industry had to reassess their positions and concentrate their efforts in a new direction.

By the end of 1981, the arcade video game industry was booming with an estimated income of $5 billion (Langway et al., 1981; Skow, 1982). The production of home games and their systems was also at an all-time high, with its market tripling in 1981, and it looked as if it would reach $2 billion by the end of 1982. The largest video game company of the time, **Atari**, saw revenues of about $415 million in 1980, and even its competitors were doing well. Growth was phenomenal, and more was expected. An article in the May 1982 *Business Week* predicted that the home market "will continue to expand at least until 1985, at which point nearly half of all U.S. Homes with television sets will own a video game machine," and CBS Inc., the **television** network that produced several games, expected the **European** market for video games to "explode from $200 this year to $800 million by 1983."

Besides CBS, numerous third-party developers flooded the market with games, many of which were derivative, substandard, and cheaply produced. Many new startup companies appeared, hoping to cash in on the video game craze, and some, like **Activision** and Imagic, were started by former employees of Atari and Mattel. **Board game** makers like Parker Brothers and Milton Bradley, and companies from other industries, like 20th Century Fox and even Quaker Oats, had game divisions and published games hoping for a hit. With so many companies producing hundreds of games, many of which were poor, and home computers coming down in price while more software was becoming available, the video game industry was heading for a crash worse than the **crash of 1977**.

Warning Signs at the Arcade

By 1982, the video game industry was doing better than ever. Sales of home games had returned, and arcade games were pulling in billions of dollars, with hit games such as ***Space Invaders*** (1978), ***Pac-Man*** (1980), and ***Defender*** (1980) each pulling in hundreds of millions of dollars on their own. Despite all the optimism, the earlier crash led some industry observers to have doubts. Competition between game-producing companies, poor products, consumer and retailer doubts, as well as improved home computer systems soon began to hurt the video game industry, with some of the first effects appearing in **arcade game** sales. Hints of a drop in interest came rather early; Atari's Coin-Op $50,000 World Championship, held in Chicago in October 1981, drew only 250 players, when more than 10,000 were expected. By the end of 1982, arcade game profits started to drop. Distributors were overstocked, many arcades would close, and those that remained open would buy fewer new arcade games.

End of an Era

Although the number of video game arcades more than doubled from 1980 to 1982, reaching a peak of about 10,000 arcades, more than 2,000 would close in 1983 (Alexander, 1982; Mehrabian and Wixen, 1983). By the year's end, the home video game market was oversaturated, and consumers were disappointed with the products. Overall, the video game industry's profits in 1983 amounted to $2.9 billion, down about 35% from 1982 (*Business Week*, May 7, 1984). Industry-wide losses totaled about $1.5 billion.

Mattel, which had once been the third largest video game maker and had $250 million in revenue from its **Mattel Intellivision** system in 1981, left the market in 1983. Even Atari, with a majority share of the market and the only company producing games for all three market sectors (arcade games, home **console games**, and home **computer games**), lost more than half a billion dollars in 1983. In 1984, the home video game system market dried up, and only one new system appeared, Rick Dyer's Halcyon home **laserdisc game** system, and it was a failure.

The Halcyon system appeared because the year before, laserdisc games were seen as possibly rescuing the arcade game industry. Laserdisc games used video graphics stored on laserdiscs, either as background the player flew over, as in Mylstar's *M.A.C.H. 3* (1983), or as animated segments representing a player's actions during the game, as in **Cinematronics**' *Dragon's Lair* (1983). Although the graphics were improved, gameplay was severely limited because the **graphics** were already rendered and stored on the discs. In *Dragon's Lair*, for example, there were only a few choices a player could make in any given situation, all of them ready as animated scenes that the player would play next once he or she had made a choice. The games also cost twice as much as standard arcade games and charged players 50 cents a **play**. In the end, laserdisc games failed to catch on because of the lack of interesting gameplay and higher costs for both players and arcade operators.

The crash finally ended in 1985 when a new system appeared that advanced home video games to a new level. The **Nintendo Entertainment System (NES)** was already a success in **Japan**, where it had been released in 1983 as the Nintendo Famicom, and it, along with its large library of games, helped revive the American video game industry and bring an end to the problems it was suffering.

Mark J. P. Wolf

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Crawford, Chris (1951–)

Chris Crawford is an author and **computer game designer** who designed several noteworthy games for the **Atari** 8-bit Family, Apple Macintosh, and IBM PC. Crawford is also the founder of *The Journal of Computer Game Design* and the **Game Developers Conference** (GDC). He holds a bachelor's degree in physics from the University of California—Davis (1972) and a master's in physics from the University of Missouri (1975).

Crawford began his career by teaching at the University of California. His first foray into game design was a game titled *Tanktics*, which he designed in 1977 and published for the *Commodore PET* in 1978. The game is notable for being one of the first computer games to simulate the fog of war. Although not a commercial success, Crawford's work on *Tanktics* eventually led to his employment at Atari in 1979.

The first game Crawford created at Atari was *Wizard*. Designed for the **Atari VCS 2600**, Wizard was never released on the home **console**. It was not until 2005, 25 years later, that the game was eventually released on the Atari Flashback 2. After *Wizard*, Crawford began to design games for Atari's 8-bit family of home computers, including *Energy Czar* (1981) and *Scram* (1981).

Crawford soon began experimenting with Atari's hardware-assisted smooth **scrolling** capabilities. This led to the creation of *Eastern Front—1941* (1981), an early example of a war game that uses a scrolling **map** display. Using the same **game engine**, he followed up *Eastern Front* with the game *Legionnaire* (1982), which uses real-time tactics, as opposed to

Eastern Front's turn-based **play**. *Legionnaire* was actually a rewrite of a game that Crawford had initially written for the Commodore PET in 1979.

Crawford developed an **experimental game** for the Atari 400 called *Gossip*. *Gossip*'s gameplay is derived from a player's social interaction with seven computer-generated characters. *Gossip* was never officially published but stands as a precursor to life-**simulation games**, such as *The Sims*. The last game that Crawford designed for Atari was *Excalibur* (1983), an early example of a **strategy game** that was innovative for its mechanics of resource management.

Crawford was laid off from Atari during the video game **crash of 1983**. He began producing games as a freelancer, publishing with several companies, such as Mindscape and **Electronic Arts**. The first freelance game he created was the geopolitical strategy game *Balance of Power* (1985), which received numerous favorable reviews and became a commercial success, selling more than 250,000 units. Crawford followed with additional freelance titles, *Patton vs. Rommel* (1987), *Trust and Betrayal: The Legacy of Siboot* (1987), *Balance of Power: The 1990 Edition* (1990), *The Global Dilemma: Guns & Butter* (1990), *Balance of the Planet* (1990), and *Patton Strikes Back* (1991).

Crawford has written several books on the topic of game design. His first book, *De Re Atari* (1982), was a comprehensive guide to game design on the Atari 8-bit home computer. He also wrote *The Art of Computer Game Design* in 1982, the first book dedicated to the theory of video games. Crawford wrote *Balance of Power* in 1986, a book that chronicles the designing of his game of the same title. Crawford has written three additional books on game design in the 21st century: *The Art of Interactive Design* (2002), *Chris Crawford on Game Design* (2003), and *Chris Crawford on Interactive Storytelling* (2004).

In 1987, Crawford organized the first Computer Game Developers Conference, which took place in his own living room, with less than 30 designers in attendance. Now known as the *Game Developers Conference*, the conference attracts more than 18,000 attendees per year. Crawford also founded *The Journal of Computer Game Design* in 1988. He served as publisher and editor of the journal until 1996.

On March 23, 2009, Crawford released *Storytron*, an engine for running interactive storyworlds. The system launched with Crawford's sequel to *Balance of Power*, *Balance of Power: 21st Century* (2009).

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cut-scenes

Cut-scenes are sequences that occur between periods of gameplay, giving a player a break between levels or **narrative** sequences. They are usually short and often highlight the **narrative** threads of a game. By the end of the 1980s, the terms "cinematic" and "cut-scene" were used to describe these short interludes.

Cut-scenes are either rendered by the game's software in real time or prerendered video clips, usually with **sound**, and they help a game appear more cinematic. Today they rely mainly on **television** and **film** production aesthetics and conventions and bear witness to greater cross-media hybridization between video games and these media.

As early as the 1980s, video games such as ***Pac-Man*** (1980) had short sequences that would be considered cut-scenes today. The standardization of optical media, such as **laserdiscs** and CD-ROMs, with their great storage capacity (compared with earlier storage media), played an important role in the increasingly complicated process of making games. Other animation techniques also generated movement on screen: slideshows made from still images (drawings or scanned pictures) as in ***The Legend of Zelda****: A Link to the Past* (1991), zooms and pans using still images as in *Castle of Illusion starring Mickey Mouse* (1990), or even short animated sequences rendered by the **game engine** itself. Along with **graphics** and processing enhancements, these breakthroughs allowed for better visuals and definitively established the cut-scenes in the gaming landscape. Cut-scenes became a staple of the gaming paradigm, a guide to when to **play** and when to watch, and eventually a daring attempt to compete, at least narratively speaking, with the movie industry itself.

Thus, the cut-scene briefly switches the player's attitude from an active one to a more passive "spectator" mode for the duration of the scene. These game moments heighten awareness of the player-game relationship status, because the user is alternately a player and a spectator—and in some cases, both simultaneously.

Types of Cut-Scenes

There are four main types of cut-scenes: those using live action, those using traditional hand-drawn animation, those using prerendered computer animation, and those using computer-generated imagery rendered in real time.

Live-action cut-scenes use actual live actors who are filmed on a physical set or on a bluescreen or greenscreen and composited into other backgrounds. They were frequently used in the beginning of the 1990s, such as in *The 7th Guest* (1993), *Wing Commander III* (1994), or *Under a Killing Moon* (1994). The initial enthusiastic reception by press and public alike was the result of what was perceived as a spectacular technical breakthrough of full-motion video (FMV) displayed by a computer. However, this trend waned and had passed by 1998, except for the occasional use of video footage, as in *The Phantom Menace* (1999) and *Lord of the Rings* game adaptations. Finally, it appeared as parody in the 2000s, as in *Skate* (2007) or *Command & Conquer: Red Alert 3* (2008).

Cut-scenes using traditional hand-drawn animation began in such games as *Dragon's Lair* (1983) and are largely the result of **Japan**'s production and impact on gaming culture, borrowing heavily from the 1970s manga (**comic book**) explosion. Since the 1990s, video game companies usually hire traditional animation studios to create animated cut-scenes, especially in the typical Japanese role-playing game (J-RPG) genre.

Cut-scenes using prerendered computer-generated imagery (CGI) often use the same programs used by the movie **industry**. Prerendered CGI cut-scenes originated in the early 1990s, in games such as *Dune* (1991), *Final Fantasy VII* (1997), and *Heart of Darkness* (1998). These clips were smoother and had better **resolution** and lighting than the real-time imagery produced by the actual game engines. Such graphics have given way to a **race** toward photorealism—more details, more polygons, more visual accuracy, and even optical artifacts, as if the scene was shot by an actual film camera—but at the same time rendering camera moves that would not be possible with a physical camera. In all these cases, cut-scenes were prerendered, compressed video files that were played by the software.

When cut-scenes are generated with real-time rendering, the game engine is animating the scene the same way graphics are animated during gameplay. This approach guarantees a visual cohesion between gameplay and the cut-scenes because both are generated by the same program. Moreover, this allows player interaction: in some cases, the player can pan the camera, slow its course, or even control his character. In *The Legend of Zelda: The Wind Waker* (2002), the introduction sequence greets the player each time with a different number of clouds or wave motions. In *Ico* (2001), Fumeto Ueda and his team used an ingenious scaling effect: the game is displayed within a larger, "invisible" frame, allowing the player to use the right analog stick to zoom and pan with a virtual camera during the game and the engine-rendered cut-scenes alike. This gives the player an original experience each time, whether the player takes part or just watches the unfolding story.

Hollywood blockbuster aesthetics strongly influence the design of these cut-scenes, with their furious forward-motion movement, explosions by the score, speed, acceleration and slow motion, infinite framing possibilities, and the use of bombastic, full orchestral music. The real-time cut-scenes sometimes show off with impossible camera angles, as if they need to prove the processing system's firepower and mastery of such smoothly-rendered images. Most of the time, the editing seems to be unmotivated by any deeper meaning or aesthetic ambition.

The Key Roles of Cut-Scenes

Depending on their position in the continuity of the game experience, cut-scenes can play different roles. Some occur directly at launch, after the power button has been pressed; these openings have been used frequently since the 1990s. Used mainly by **adventure games** and narrative-bound games at first, they found their way into **sports games**, real-time **strategy games**, and puzzle games as well.

Cut-scenes set up a "horizon of expectations," unveiling parts of settings, levels, characters, and situations (such as racing, fighting, or exploring). These opening sequences are also sometimes technical demos, showing off the programmers' virtuosity and using every bit of available power from players' machines. They are used as benchmarks, proving a **platform**'s abilities and are thus often used by studios and publishers in their communication and marketing campaigns.

When the player has to actually start a game to trigger an introduction movie, the cut-scenes then play an introductory role, presenting the game **world**, characters, and story to the player. They often set an initial goal: a place to reach, an item to find, a foe to vanquish. In addition to spectacle, they are more than mere demos, bearing narrative and gameplay elements.

Throughout the game itself, when the player has completed a level or achieved a certain goal, a cut-scene comes as a reward for the player's skill and persistence. In more story-driven games, the cut-scene participates in the unfolding story, summing up what has happened and presenting challenges, places, characters, or enemies. In sports games, cut-scenes mostly serve as replays of the events in which the player has taken part. Designed to imitate television coverage, some cut-scenes generated after a touchdown in a football game allow the action to be scrutinized from multiple camera angles.

Finally, some cut-scenes act as closure sequences, either when "Game Over" has hit the screen after some failed attempt or when the last level of the game has been successfully completed. It is often an epilogue to the story, sometimes with rolling credits, imitating movie endings.

After 40 years of commercial video games, some may find it surprising that video games seek to reproduce an old-fashioned spectator relationship between the player and the game, taken from movies and television. The cut-scene, as a semiotic marker, provides pacing, gives breaks between frenetic sessions, and allows moments of idleness in a world where interactivity is the main attraction. Cut-scenes allow players to find some balance between active and passive reception and, by alternating between these modes, emphasize the presence of interactive stimuli within the more traditional pleasure of watching a story unfold. ***See also*** CD-ROM-based games.

Alexis Blanchet

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CVC GameLine Master Module

Control Video Corporation (CVC) was founded in 1983 by cable **television** pioneer William von Meister, also the founder of the largest computer network (phone-in data service) of the time known as The Source. Von Meister had created an innovative modem transmission technology that he planned to use to provide music to cable companies through a service to be called The Home Music Store. When cable providers abandoned the project as a result of legal woes by opposing music retailers, von Meister founded CVC to provide video game content using his revolutionary delivery tool instead.

The end product was an oversized silver **cartridge** that plugged into the **Atari**

VCS 2600 unit, referred to as the Master Module. It contained 8K of RAM onboard memory and included an internal 1200 baud modem that utilized a phone jack mounted on the side that allowed it to be connected to a telephone or telephone line. When activated, the GameLine Master Module would automatically dial the toll-free number to GameLine's mainframe computer in Vienna, Virginia. For optimum compatibility, it was capable of either pulse or tone dialing.

Upon first use, the user would be required to set up an account, register a credit card number for billing, and pay a one-time registration fee of $15. Once connected, the equipment was sophisticated enough to remember the appropriate settings for ease of use in the future. In return, the member would receive a personal identification number used to log into the central CVC computer.

Each title available had its own ID number, and this three-digit ID number could be entered into the software for access to a particular game title within the library. Although the service featured only 76 games in rotation, it had the potential to provide service for up to 1,000 games during any period of time.

For $1, GameLine users could download any game from the available library, which would be retained within the cartridge until the user turned off the **Atari console** or downloaded another game. Each game could be played 5 to 10 times to ensure sufficient play value, with the actual figure being determined by the manufacturer. When the player's credit expired, the unit would thank the player for playing, and then the game would cease to operate. One perk of registering with GameLine was that members were granted unlimited play on their birthday.

If the player scored high on a game title that had an ongoing contest, the player could enter the contest for a small processing fee. GameLine sponsored two competitions each month, beginning with *Demon Attack* (1982) and *CakeWalk* (1983). Prizes such as a GameLine jacket and other valuables were awarded by geographic region and were also planned to go national. Other prizes mentioned were free game-plays on the GameLine service, college scholarships, a sports car, and the ultimate World Video Game Championship award of $100,000 in gold.

The complete GameLine packet included the Master Module, a telephone cord, a duplex T-adapter, the sign-up agreement paperwork, a membership card, a poster, and a binder that housed rule summaries for games available on the service and included the premier issue of *Gameliner Magazine*.

Gameliner Magazine listed all the game titles available for **play** on the GameLine service and also featured game-playing suggestions, questions and answers, and developer interviews including Imagic's Dennis Koble, the programmer of *Atlantis* (1982), and CommaVid's Irwin Gaines, designer of *Mines of Minos* (1982) and *Cakewalk* (1983). *Gameliner* only lasted two regular issues before being reduced to a single instruction update and then ceasing publication altogether.

Originally, CVC promised several services beyond simple gaming: BankLine (for on-line banking), InfoLine (for an assortment of information such as classified advertising, flight schedules, horoscopes, and more), MailLine (for electronic mail), NewsLine (an electronic newspaper with news headlines and weather reports), OpinionLine (an open forum for users to share their own thoughts), SportsLine (for game scores and statistics), and StockLine (for obtaining stock quotes, commodity pricing, and portfolios).

Atari, the maker of the VCS, did not allow its games to be played via the GameLine service. The majority of the larger third-party publishers such as **Activision**, **Coleco**, Mattel, Parker Brothers, and **SEGA** also failed to accept GameLine's terms of use. As a result, some of the biggest hits of the console never appeared on the service.

Only one of the major developers, Imagic, participated. Consequentially, only smaller game makers such as 20th Century Fox, Apollo, CommaVid, Data Age, Serius-Fox, Spectravision, Telesys, Tigervision, U.S. Games, and Vidtec had games included in the library. After the great video game industry **crash of 1983**, most of these publishers folded, leaving GameLine with a minimal amount of content, negatively affecting the company and eventually contributing to its demise.

The GameLine service did have one exclusive game title. Steve Beck programmed a game titled *Save the Whales* (1984) that was originally intended to be sold at retail with proceeds to benefit Greenpeace. Although the game was never released commercially, the game was playable through CVC's service.

Through a series of reorganizations, licensing steps, joint ventures, and partnerships including such parties as Quantum, Play-Net, Bell South, Commodore, Apple, and Tandy, CVC eventually evolved into the powerhouse Internet service and media company known today as America Online (AOL).

CVC's GameLine is historically important because it marked the second time (following Mattel's PlayCable service in 1981) that video games could be downloaded through a telephone line. The June 1983 issue of *Electronic Games Magazine* featured the Master Module and GameLine service and stated that it was "The greatest thing to happen to video games since the **joystick**."

Michael Thomasson

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Cyan Worlds

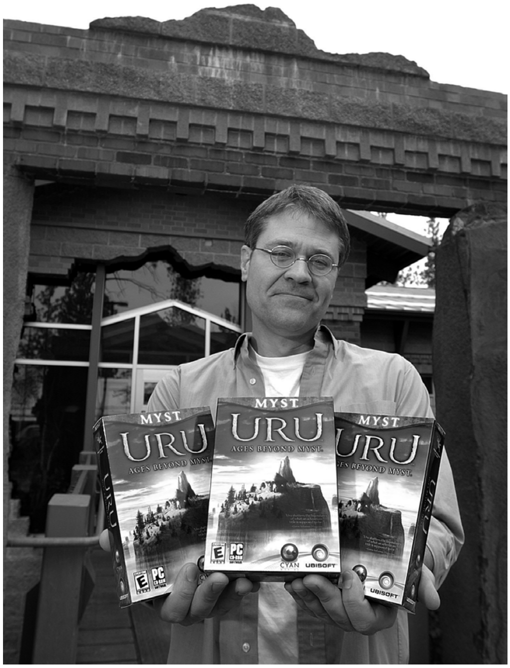
Cyan Worlds (also known as Cyan Inc. and Cyan Productions) is a developer based out of Spokane, Washington. It created the **adventure game *Myst*** (1993), which held the title of best-selling **computer game** of all time for almost a decade and was the first of a five-game series of *Myst* games. In the 1990s, it was one of the most important independent development studios, but the failure of *Uru: Ages beyond Myst* (2003), an **on-line game** set in the same world as *Myst*, threw the company on much harder times.

Cyan was founded by brothers Rand and Robyn Miller. While working as a programmer at a bank in Texas, Rand sent the idea for a computer game to his younger, artistic brother while he was a student at the University of Washington. Robyn, who was interested in illustration and music and had never worked on software before, nevertheless produced the artwork for the game and changed the **design**. The result was the 1987 release *The Manhole*, which went on to be the first entertainment software published on the new medium of the CD-ROM. The success of the game encouraged them to create a business, which they located in Spokane, where their parents lived.

The next two titles, *Cosmic Osmo and the World beyond Mackerel* (1989) and *Spelunx and the Caves of Mr. Seudo* (1991), were also moderate successes. All three of the games had the same kind of style: they were open-ended environments with a simple mouse-driven point-and-click interface. None of the games prescribed directions for players or had anything like win-or-lose conditions.

Cyan's next project, *Myst*, retained this open-ended exploration but added in a **narrative** and puzzles that were closer to those of classic adventure games than the activities in the company's first three titles. Published by Brøderbund in September 1993, the production took longer than anticipated and was overbudget at a cost of $650,000. However, *Myst* garnered excellent reviews and won several Software Publishers Association awards in March 1994. Within several months of the release, the game became Brøderbund's best-selling title and was at the top of the sales charts by the end of 1994. It would remain the best-selling computer game of all time until it was unseated by ***The Sims*** (2000) in 2002.

Shortly after the completion of *Myst*, Cyan embarked on the creation of its sequel, the game which would eventually be called ***Riven*** (1997), a production considerably more ambitious than *Myst*, with a budget that eventually totaled $10 million. The company brought in Richard Vander Wende, an accomplished expert of special effects in films to work on the game. Cyan eventually delivered the game almost a year later than it originally intended, releasing it in October of 1997. Nevertheless, *Riven* proved to be, like its predecessor, a huge critical and commercial success. In spite of its late release, it was the best-selling game of 1997. Cyan claims today that *Myst* and *Riven* combined have sold over twelve million units.



Rand Miller, CEO of Cyan Worlds, holds up copies of the company's newly-released computer game *Uru: Ages Beyond Myst* outside the company's Mead, Washington, offices on November 14, 2003. (AP Photo/Jeff T. Green)

The years after 2000 were not as successful for Cyan Worlds. Robyn Miller and Richard Vander Wende left the company at the conclusion of *Riven*. Aside from *realMyst* (2000), a three-dimensional update of the original (which used prerendered still images), Cyan stopped producing sequels of the game, licensing the right to Presto Studios (*Myst III: Exile*, 2001) and Ubisoft (*Myst IV: Revelations*, 2004). Cyan's next project, *Uru: Ages beyond Myst*, released in November 2003, was supposed to be a **massively multiplayer on-line game**, but low subscriber interest led Ubisoft to cancel the on-line component of the game in February 2004. Beta-testers, however, kept the game alive on private servers with binaries provided by Cyan—this unofficial game became known as *Until Uru*. Cyan developed *Myst V: End of Ages* as the final single-player installment of the series and released it in September 2005.

Because it had no more projects, Cyan laid off almost all its staff until on-line game provider GameTap stepped in to finance continued development of the previously canceled on-line project. In January 2007, *Myst Online: Uru Live*, was opened to the public, but in February 2008 GameTap announced the game was closing due to insufficient subscriber interest. After spending the summer working on the game, the lack of funding forced Cyan to give up on it, and in November 2008 they took the unusual step of announcing they would release the source code for the game, allowing the community to do what they wanted with it.

The games of Cyan World all share certain characteristics. They are all nonviolent, which the Miller brothers attribute to their evangelical Christian faith; the games emphasize exploration of virtual **spaces**; they feature very simple, transparent **interfaces**; they are often critically acclaimed for their **artwork** and music; and they eschew many standard features of games. This last characteristic is a major point of contention: some critics argue for a variety of reasons that *Myst* can hardly be called a game and should be classified more generally as interactive entertainment. The Millers themselves have said in an interview that they view their most popular games as "immersive environments" more than games.

Regardless, *Myst* had a major impact on gaming culture and the games industry in the 1990s at least. The Millers were celebrities of the games industry in the late 1990s. Their games helped encourage broad consumer adoption of CD-ROM drives and encouraged the **industry** to develop impressive three-dimensional **graphics**. Finally, Cyan games also helped diversify the adventure game genre. ***See also*** CD-ROM-based games.

Kevin Schut

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D

Dance Dance Revolution (DDR)

Dance Dance Revolution (1998), often referred to by its acronym *DDR*, is the first of a series of **rhythm and dance games** produced by Konami. The game was released in **Japan** in 1998 as an **arcade game** and was followed by a wider release across **North America**, **Europe**, and **Asia** in 1999 for a range of home **consoles** including the **Sony PlayStation**, the **Microsoft Xbox**, and, more recently, the **Nintendo Wii**. Since 1998, Konami has released more than 50 versions of the game worldwide across consoles. The popularity of *Dance Dance Revolution* has spawned many imitation dance games, but none have attained the same level of success.

Gameplay requires a **peripheral** dance pad **controller** for both home and **arcade** versions. The dance pad has four colored directional arrows (front, back, left, right), as well as the necessary controls to **navigate** the game's user **interface** (like select and start). Some versions allow the player to select an **avatar** that dances on the screen, and other versions have different avatars dance to different songs. After selecting a song, the player must **time** his or her steps on the arrows of the dance pad with those **scrolling** from the bottom of the screen upward toward a set of stationary arrows. Success is based on how accurate players time their steps on the corresponding arrow as the scrolling arrow overlays the stationary one. The arrow patterns resemble dance moves that are timed to the rhythm of the song. As the difficulty level increases, the arrows scroll across the screen more quickly, challenging the player to keep up with the speed of the scrolling arrows. Each step is rated by a series of voiced over comments such as "Boo, Good, and Perfect," which determines the player's overall score. As players successfully complete songs, they unlock more songs to be played, often increasing in difficulty. Different versions of the game have different rewards for successful completion of songs and levels such as unlocking access to special battles, more songs to **play**, or new avatars to play.

Both arcade and home console versions can be played as a single-player game or competitively against other players. Several home versions boast on-line multiplayer options as well. *Dance Dance Revolution* is also played competitively internationally. There are two types of organized competitions around the world that are judged on either mastery of the gameplay or freestyle dance, in which players must master the step sequencing while performing creative dance moves. *Dance Dance Revolution* has a large global fan base with active on-line communities that are dedicated to offering players tips and techniques, events, machine locations, player statistics, and player videos.

Dance Dance Revolution has often been credited for popularizing Asian pop **music** in North America by producing music in-house for the game (with the exception of

Naoyuki Yoshizumi, a 24-year-old businessman, dances to the music and lights of Konami's *Dance Dance Revolution* (1998) at a Tokyo arcade on January 20, 1999. (AP Photo/Shizuo Kambayashi)

Disney's Family Channel edition). Most versions also include a small portion of mainstream American hits. Original and remixed versions of the songs are often available on-line in various formats. Because *DDR* requires full body movement to play, it is often associated with "exergaming," video game play that promotes physical exercise and has even been used in physical education classes across the United States.

Kelly Boudreau

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dance games

See rhythm and dance games

death and resurrection

Death is ubiquitous in **computer games**, especially avatar-based games. Players experience the death of their **avatars** when they are killed by **non-player characters** or by other players' avatars. Death, dying, killing, and committing suicide are activities present in many computer games. Death in computer games is not final, and resurrection is an experience made differently depending on the game. The functions of death in digital games can be described as *part of the* ***game design***, an ***educational*** *function*, or a *symbolic function*.

The representation of death as part of a game's design can be observed in games that use Gothic aesthetics to create a specific atmosphere. We find graveyards, ghosts, zombies, and other undead characters and a spooky atmosphere in some games or just some spooky areas in games supported by the choice of specific **sounds** and game **music**. The presence of death not only by representations through the undead but as a biographical element adds to the experience of a game as a **world**, and its worldness (Klastrup, 2008; Krzywinska, 2008).

The educational function of death in computer games is related to the player's skill at playing the game. As a beginner without much knowledge about the game, the player will die more often than a player who knows the game. Different games deal with the beginner's lack of skills in different ways: in **platform** games, the easier levels, with which the games start, offer not only the chance to get used to the game's **interface** but also to collect items easily. Sometimes these items add another "life" to the number of "lives" a player has in the game, which means that the player can **replay** a sequence after dying according to the lives available. When no life is left, the game is over. In action games such as first-person **shooting games**, dying has an impact on the rank of the player. The more avatars the player kills and the fewer times he or she dies, the higher the rank will be. In **massively multiplayer on-line role-playing games (MMORPGs)**, dying has no major consequences for lower-level avatars. No experience points are lost, and no equipment is destroyed.

Another part of the educational function of dying in video games is the different punishment systems related to the avatar's death. Dying means a lack of control and leads to results that are annoying for the player. In **arcade games**, which are coin-operated machines, the game is over and another coin has to be inserted into the machine to start over again. Dying can have an impact on the player's rank, which is a nuisance when the player is ambitious and wants to reach a high rank. In **console-based games** or computer games, dying can have additional effects. The avatar's equipment might be lost or destroyed, which means the player has to pay in-game money to buy new equipment or repair whatever has been damaged. In some games, in-game money has also to be paid to recover from resurrection sickness by paying a non-player character known as a "soul healer." The higher the avatar's level, the higher the costs for the soul healer. If the resurrection sickness is not removed by paying, it usually needs a few minutes to disappear. During these minutes, the avatar moves slowly and is more vulnerable to attacks. Some games like ***World*** *of Warcraft* (2004) ask the player to run the whole way back from the resurrection point as a ghost of the avatar's dead body. Only by reuniting the ghost with the body can the player continue playing. Instead of respawning and thereby going back to the resurrection point, which is the point where the player had **saved** the game, other players' avatars can resurrect a dead avatar either by using an item that can be bought in game or by using a specific skill. The resurrection sickness does not disappear, but the avatar does not have to run back all the way to the place he or she died.

Another activity related to death is the killing of other players' avatars or non-player characters. Mastering the game means that one's own avatar survives, but the others are killed. "Killing" here means control and mastering the game. Because non-player characters and other players' avatars resurrect, they are not "dead," but killing gives an advantage to one's own avatar in the game as the winning of points or items.

The symbolic function of death in computer games is related to the fact that computer games are **simulations** of our real-life experiences. The avatar is a representation of the player in the game world. At the start of a new game, the player is inexperienced and has to learn how to play and what to do in the game world. As a young child has to acquire knowledge about the **rules** and conventions of its world, so must the player do in a game. **Role-playing games (RPGs)** in particular incorporate biographical information into gameplay. Although the experience of death is a part of life, it is an experience we can only observe from the outside. Games offer us a safe way to identify with our avatar and experience its death and thereby reflect on the mortality of our being from a safe distance.

The symbolic representation of death is used in forms of **deludic play**, a way to **play** that players use to deconstruct a games' rules (Kücklich, 2004 and 2009). Instead of avoiding the avatar's death, the player seeks its death to try out all the possible ways the avatar can die in the game. As a result, game videos, known as **machinima**, are produced to show the many ways that an avatar can die in a game.

Karin Wenz

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DECO cassette system

The DECO cassette system was an **arcade** hardware platform introduced in 1980 by the **Japanese** video game company Data East Corporation (DECO). It was developed as an inexpensive solution to the problem posed by **arcade games**' limited market life. To maintain profitability, arcade operators had to regularly update the roster of games available in their establishments, pulling out games with waning popularity in favor of new offerings. The process was both costly and inconvenient, involving the replacement of the main circuit board at best or of the entire unit at worst. In contrast, the DECO cassette system allowed operators to change games in the cabinet on software, rather than hardware, level. It is recognized as the first standardized system of this kind, predating other systems such as **Nintendo**'s PlayChoice-10 by 6 years and SNK's **Neo•Geo** MVS by 10 years.

The DECO Cassette System was available in cocktail or upright cabinets, housing three printed circuit boards (CPU and display system, memory and **audio** system, and input **controller**) as well as a tape deck used to load games. The games themselves were distributed on proprietary audio cassettes. A complete game package consisted of a tape with the game program, hardware security key (a copy protection measure), operator's manual, instruction sheet, marquee, and promotional materials (such as display cards or mini posters). After placing the game cassette in the deck and plugging in the associated key module, the system was powered on and, upon successful verification of the security key, loaded the program into memory. The loading process took approximately 2 to 3 minutes.

Theoretically, the innovative system was a convenient and inexpensive alternative to dedicated arcade cabinets. In practice, however, it was plagued by reliability problems, with the magnetic tape wearing out after just a few months of use. In addition, while DECO for the most part delivered on its promise of ten new games every year, many of them were mediocre and derivative. Approximately 50 games were released for the DECO Cassette System before it was discontinued in 1985. Notable titles include *BurgerTime* (1982) and *Bump 'n' Jump* (1982).

P. Konrad Budziszewski

Defender

The **arcade game** *Defender* was developed by Eugene Jarvis and published by **Williams** in 1980. *Defender* is a notoriously difficult space **shooting game**. Its difficulty is present in all aspects of the **game design**, from the basic controls, the movement of its enemies, to the way it punishes the player for failing to meet the game's core objective. *Defender* is at once a classic in video game **history**, an evolutionary dead end, and the pinnacle of a specific type of design.

Among the earliest games to feature a **scrolling** world larger than the game screen, it asks the player to move a spaceship across a planet surface while protecting "humans" from alien spaceships trying to abduct them (abducted humans transform into dangerous mutants). The game is also characterized by a number of well-crafted **graphics** and **sound** effects.

According to conventional wisdom, a game should be easy to learn but difficult to master (Juul and Norton, 2009). The obvious choice of **controller** for *Defender* would be a four-direction **joystick** that the player could use for moving his or her ship around the game **world**; instead, Jarvis chose to give players something much less intuitive: one stick that controls vertical movement, a button that thrusts the ship forward, and a button that reverses direction. Although conventional design wisdom would dictate that the player should be given a chance to make amends and return to the regular mode, *Defender* is also unusual in that if the player fails to protect the game's humans, the planet will explode, and the player must spend the rest of the game in an especially difficult hyperspace mode where all aliens are mutants.

Defender is considered one of the classic arcade games, but it has arguably had limited influence on subsequent game design in either its bidirectional scrolling or in its core design value of an extreme challenge. The latter was partially dictated by the economic model of the **arcade** and by the limited storage **space** available to game designers at the time. Technology would later allow game designers to create more variation in their game worlds, and home games removed the necessity of limiting the player's **play** time. Conversely, *Defender* is a game so difficult that it could not have come out even a few years earlier because it required a dedicated video game audience whose skills had been honed by earlier video games.

Jesper Juul

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definition of "game"

See game, definition of

deludic play

The term "deludic play" is derived from the Latin *deludo* (to delude, to **cheat**), and describes forms of **play** that deviate from the norms established in a given game **space**. These norms are not primarily determined by the **rules** (or the code) of the game but derive from the interplay between the expectations of **game designers**, genre conventions, game rules, and player interventions.

Forms of deludic play thus include different forms of **cheating** such as **walk-throughs**, FAQs, cheat codes, and **hacking** (Consalvo 2007, Kücklich 2008), as well as **game modifications** (Kücklich, 2005), emergent gameplay (Juul, 2005), creative player actions (Wright, Boria, and Breidenbach, 2002), player protests in virtual **worlds** (Thomas, 2005), artistic interventions such as Anne Marie Schleiner's *Velvet Strike* (2002), meta-gaming (Bainbridge and Bainbridge, 2007), deterritorialized play (Pearce and Pearce, 2009), power-gaming and griefplay (Taylor, 2006), and gold farming (Dibbell, 2007).

Insofar as certain forms of deludic play are politically motivated, the term shares similarities with Alexander Galloway's (2006) concept of countergaming as well as Nick Dyer-Witheford and Greg de Peuter's (2009) counterplay. Galloway's term is specific to **artist**-made game mods, which disrupt **narrative** flow and foreground the gaming apparatus. Counterplay is more inclusive and encompasses strategies of refusal against the "imperial" ideology of many video games.

Deludic play can occur both within and outside of games, but it always manifests itself as a critical yet playful engagement with games culture. Characteristically, it uses the means of games production, dissemination, and marketing to critique and challenge the commodification and ideologization of digital play.

Julian Raul Kücklich

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design

See game design

DIGAREC

See Digital Games Research Center (DIGAREC)

Digital Games Research Association (DiGRA)

DiGRA is short for the Digital Games Research Association. It is an association established in 2002–2003 to bring together academics and professionals who work on digital games research and advance their interests. One of the key activities of the association has been the series of conferences it has organized; starting from "Level Up" in Utrecht, the Netherlands, in 2003, and then moving to North America with "Changing Views" in 2005, which took place in Vancouver, **Canada**. The third conference, "Situated Play," was organized in Asia and took place in Tokyo, **Japan**. The series came back to **Europe** with "Breaking New Ground," which was organized in Brunel, West London, in 2009.

With a **history** spanning less than a decade, DiGRA is a rather young academic community, reflecting a new phase in the development of **video game studies**. The original ideas for DiGRA were born during a series of conferences that took place during the late 1990s and early 2000s, which all appeared to share a common, cultural, and **artistic** approach to video games. Particularly Western Europe, Nordic countries, and North America appeared as a breeding ground for new theoretically, culturally, socially, and artistically oriented game research at that time.

There existed several older associations already, like ISAGA, the International Simulation and Gaming Association, as well as various associations studying **play** and related phenomena (like TASP, The Association for the Study of Play, in the **United States**). The more technical aspects of **computer games** also had been researched and discussed for some time among computer scientists in associations like the ACM (Association of Computing Machinery). Whether they were right or not, the young generation of scholars who formed DiGRA felt their approach had an emphasis different from that of the older academic communities, giving DiGRA a slightly different mandate. The cultural context and character of video and computer games had greatly changed during the earlier years when games first began, and the range and complexity of games had increased, as well as their technological and artistic sophistication. Also, the social and psychological questions surrounding gameplay had grown in significance, as games became increasingly pervasive elements in everyday lives and the participation in virtual game **worlds** started attracting populations in the millions. All this meant that the 21st century games research addressed a sprawling popular cultural phenomenon, which presented new kinds of theoretical and practical demands to research and **education**.

Frans Mäyrä

Further Reading

DiGRA Web site, available at http://www.digra.org.

Digital Games Research Center (DIGAREC)

The Digital Games Research Center (DIGAREC) of the University of Potsdam is the first academic institution at a **German** university to study **computer games** on an interdisciplinary basis. The program was founded by media philosopher Dieter Mersch in December 2007 at the University of Potsdam's Department for Arts and Media. It works in cooperation with numerous scholars from different universities and research establishments in the region of Brandenburg and Berlin, including institutes for psychology, pedagogy, geography, digital culture, media law, and media **design**. The center operates an independent collection of more than 7,000 games and various **platforms** that are open to game researchers and subject to the development of a classification system. The categories integrate results from **video game studies** with the aim of establishing a systematic foundation for the comparison of games beyond genres. The nucleus of the center is a research project supported since 2008 by the German Research Foundation (*Deutsche Forschungsgemeinschaft*, DFG) on the "Mediality of Computer Games." The project focuses on aesthetic and performative aspects of the medium as well as its structural and technical specificities.

DIGAREC is the regular host of international lectures and conferences on interdisciplinary game studies. After Copenhagen in 2005 and Modena in 2007, in 2008 the international conference *The Philosophy of Computer Games* took place in Potsdam. It included keynotes by Richard Bartle, Ian Bogost, and Jesper Juul. In 2009, a conference on the *Logic and Structure of the Computer Game* followed, in which German Game researchers presented their approaches to international responders. Supported by the Medie board Berlin-Brandenburg since 2008, the DIGAREC Lectures take place in Potsdam, and past keynote speakers include Espen Aarseth, Lev Manovich, Frans Mäyrä, Katie Salen, Mark J. P. Wolf, and others. Proceedings, theses, and other research results are published in the *DIGAREC Series* at Potsdam University Press in print as well as on-line due to an open access-policy.

In Germany DIGAREC cooperates with the Computer Games Museum in Berlin, the Game **Art** festival A MAZE., and further research projects on **strategy games** at the University of Arts in Braunschweig and on the morphology of narration at the University of Siegen. International contacts are established with the School of Literature, Communication, and Culture at Georgia Tech in Atlanta, and the Center for Computer Game Research at the IT-University in Copenhagen, where in 2010 the first joint Ludotopia-workshop on computer game **spaces** took place. Since 2009, together with the University of Salford in England, Linz in Austria, and Valencia in **Spain**, DIGAREC is developing an international master's program on "Ludic Interfaces" within the EU's Lifelong Learning Program (LLP), giving worldwide scholarships within the framework of ERASMUS-Mundus.

Stephan Günzel and Michael Liebe

DiGRA

See Digital Games Research Association (DiGRA)

DIP switches

See dual in-line parallel (DIP) switches

Doom

Developed and published in 1993 by **id Software**, *Doom* became a pioneer in the **world** of video games for having popularized the first-person perspective in the **shooting game** genre. It paved the way for several similar titles such as Bungie Software's *Marathon* (1994) and 3D Realms's *Duke Nukem 3D* (1996), clones that were soon to join the genre of first-person shooters. Although *Doom*'s technical achievements are diverse, its most notable features are the novelty of three-dimensional **graphics** added to player-created expansions using composite data files and a vast potential of networked multiplayer gameplay via **cooperative** and "deathmatch" modes.

Doom's science fiction and horror-themed storyline is set around Mars, soon after a teleportation experiment ran amok and all hell broke loose. Looking through the eyes of an unnamed character whose facial expressions are represented in the bottom center of the game **interface**, the player incarnates a space marine working for a multiplanetary consortium, the Union Aerospace Corporation. Loaded with an arsenal of firearms and brass-knuckled fists, or a chainsaw in case ammunition runs out, this soldier must blast himself a way out. He will meet traps and search for keys in partly **abstract** environments of facilities and mineral formations on Phobos, Deimos, and in Hell to prevent the demonic hordes from invading the Earth.

Doom had a number of innovative features. In the outmoded three-dimensional space of its predecessor, id Software *Wolfenstein 3D* (1992), the ground level was on one horizontal plane corresponding with the horizon. Aiming with a weapon could only be achieved from left to right: no vertical direction or movements were considered. By presenting what is designated as a two-and-a-half-dimensional (2.5-D) game, *Doom* improved the player's viewpoint in relation to the game's space; although the aiming remained a strictly horizontal action, ground level had variable heights and characters could now be encountered from above or below (Boron, 2007).

Doom also had a similar software structure as its ancestor *Wolfenstein 3D*. It consists of folders that can be expanded due to a distribution method that involves promotional shareware. Players download the first parts for free and buy the remaining episodes if they want to complete the game. An intended side effect of this transparent architecture is that it allows players to change the **sounds** and appearance of the game themselves. During *Doom*'s development, id Software kept this concept in mind; its lead programmer John D. Carmack, along with level designer John Romero, designed the core system so that game data were stored separately from the **game engine**, allowing players to extend the game. This practice inspired new shooting game mod-making communities that shaped popular video game culture (Kushner, 2003). Since the release of *Doom*, its franchise has generated numerous expansions and sequels. It has also been adapted to novels, **comic books**, a **film**, and a **board game**.

Vincent Mauger

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door games

See bulletin board systems (BBSs)

dual in-line parallel (DIP) switches

Dual in-line parallel (DIP) switches (the "P" can also stand for "package") are switches inside **arcade** video games that allowed operators to change certain game settings to customize the games and make them more appropriate for the specific audience of a particular arcade. By changing the settings, arcade operators could set the difficulty levels, the number of points needed for extra lives, the number of players, the number of rounds per game, the number of quarters the game would charge players per play, language (typically either **Japanese** or English), whether the **music** was on or off, attract mode settings, and so forth.

DIP switch settings appeared in **arcade games** in the late 1970s, in such games as **Midway**'s *Checkmate* (1977), which could be set for multiple languages (English, **German**, **French**, or **Spanish**) and had a test mode for troubleshooting, and Exidy's *Fire One!* (1979), a submarine game.

The 1980s saw some interesting uses of these switches. For example, GAT's *Dambusters* (1981) had a DIP switch that could filter out swear words that players might leave on high-score tables on the game. **Bally**/Midway's *Domino Man* (1983) had a DIP switch that could set the skin color of the game's main character to either "light-skinned" or "dark-skinned," depending on what the operator thought would be better for business, making it the first video game to cross color lines because one could choose the **race** of the main character. Other games, like Toaplan's *Demon's World* (1989) had DIP switches to change between an English title screen and a Japanese one, or change the game's legal warnings or licensing information for different regions. Sex and **violence** levels could also be controlled by DIP switch settings; Midway's ***Mortal Kombat*** (1992) would use DIP switch settings to set the level of violence and blood displayed in the game's **graphics**, and a 1998 game, *Dead or Alive++* (1998), a **fighting game** with buxom female fighters, had an operator control that could turn "breast bounce" on or off.

DIP switches were used into the early 1990s but were eventually replaced with less expensive battery-powered RAM. Because DIP switch settings could not be controlled by players, they could result in different gaming experiences, and arcade game scholarship must take them into account so that a single game variation will not be assumed to be the only one possible. Arcade game collectors are also interested in DIP switch settings, and settings for more than 5,000 arcade games can be found at http://www.solvalou.com/subpage/arcade_dips.

Mark J. P. Wolf

DVD and Blu-ray Disc games

By the close of the first decade in the 21st century, the immense success of DVD (introduced in 1995) and Blu-ray discs (introduced in 2003) in delivering feature **films** and other long-format video was indisputable. Figures for consumer purchasing show that by the beginning of 2010 more than 80 percent of **United States** households had at least one DVD or Blu-ray player (DEG Press Release, October 19, 2009). The phenomenal market penetration of the DVD and Blu-ray has brought in its wake an unforeseen new locale for video games. A steady number of releases include games playable on standard set-top players as special features. Although the majority of these games are found on releases aimed at children, such as family-oriented animation, some clearly have an adult audience in mind, playing at a more challenging conceptual level. Even some of the earliest DVD games were quite sophisticated in a visual sense, deriving as they did from animated films with tremendously high levels of **art** direction. What has often been lacking is **design** that involved setting more challenging interactive goals for the gaming audience (Falstein, 2004, p. 47).

Because both DVD and Blu-ray discs share the market for household consumption of long-format video and work through the use of specialized set-top players, it is the case that with regard to audience and apparatus, they also share many important characteristics. This becomes even more apparent when the development of DVD and Blu-ray games are considered. For this reason, this entry covers occurrences of games on both these kinds of optical discs.

DVD Games

An early form of DVD game involved asking a series of yes-or-no questions. The DVD release of *The Cell* (2000) contained as a special feature an "Empathy Test" that first determined the viewer's "**emotional** IQ," and next ascertained how "empathic" the viewer was. The game "measured" the viewer on an implied scale between the film's empathic protagonist and its unempathic villain. Interestingly, whether the viewer was allowed to take the second part of the test depended on the "emotional IQ" result obtained in the first part of the test. If a viewer fell too close to the villain in "emotional IQ," the game advised him or her to seek professional counseling and refused to proceed to the second part. The "Empathy Test" is a good example of two of the fabled "400 rules" for game design: "Provide an Enticing Long Term Goal" and "Provide Clear Short-Term Goals" (Falstein, 2002, 26). The individual questions of the test made up the short-term goals, whereas the long-term goal became the quest to finish the test and receive the final "diagnosis" revealing how empathic the test-taking viewer was.

The DVD of *The Cell* is noteworthy for another feature: it is one of the first to contain a demo version of a **computer game** based on the **film**. It also has demos for the computer games *Homeworld* (1999) and *Homeworld: Catacylsm* (2000), which are included purely as **advertisements** (when the DVD was placed into a PC the demos were playable). This sort of product placement has been common in films since the 1970s but had never been directly positioned on an interactive vehicle like the DVD (Babin and Carder, 1996, p. 33); the DVD of *The Cell* was ahead of its time in both these commercial strategies. This strategy has been continued and extended in other DVD releases, for example, *Van Helsing* (2004; which includes a one-level demo of the **Microsoft Xbox** game of the same name), and *Spider-Man 2* (2003; DVD, 2004; which has links to **on-line games** via MSN-Microsoft Online Gaming Network).

One of the earliest DVD releases to include video-based "games" was the Disney release of the Pixar film, *Monsters, Inc.* (2001). Two of these "games" were created for a Japanese animated series (titled in English *Ponkickies 21*) and are merely short video clips depicting the host, "Go-Go" Connie-chan introducing a simple "guessing game." One of these "games" is the Japanese version of Paper-Rock-Scissors called Janken, and the other is the "Lucky Door Game" in which the object is to guess which one of the animated characters will come out of the door. Neither of these was genuinely interactive because the player simply made a guess or gesture while the clip ran to the end, revealing the outcome (with no input from the player). The game "Peek-a-Boo: Boo's Door Game" had true interactivity through the DVD apparatus (the industry specification of the DVD format plus the physical hardware, which makes the specification a working reality; Baudry, 1999, pp. 346–347). This was essentially a guessing game as well, it worked as follows: (1) an animation is played showing three doors being placed in a simplified form of what appears in the film; (2) the viewer picks one of the doors; (3) an image of a location from the film is shown on the screen; (4) the DVD apparatus waits for the viewer to choose a visual location on the image that might hide a missing door piece; (5) if the user guesses correctly, a reward is given; (6) the game repeats until all the missing parts of the door are found. The video segments between the choices were primarily designed to segue from one choice-making opportunity to another.

The subsequent DVD release of *Lilo and Stitch* (2002) brought a greater complexity to DVD gameplay by breaking its game into two interactively distinctive styles of play that combine the ideas of *The Cell* with *Monsters, Inc.* Dr. Jumba Jookiba, the evil mad scientist who created Stitch, first poses a series of questions that when answered correctly activate an "injector."

After activating all three injectors, the viewer must correctly choose the order of the chemical ingredients to create a new life form. The creature creation game requires both memory skill and pattern matching. Critically, the video elements take on a new role in the gameplay, working as particular responses to the viewer's actions and not simply as transitional elements between choices. They provide a sense of real-time interactivity that was missing in *The Cell* and only minimally employed in *Monsters, Inc.*, and the game marks a definite evolution from these earlier examples.

In 2004, New Line Entertainment released the DVD for *Elf* (2003), which contained four games: "Fix Santa's Sleigh" (a question-and-answer game), "Elf in the City" (a maze game), "Snowball Fight" (a first-person **shooting game**), and "The Race Down Mt. Icing" (a driving game). The maze game used video segments of moving streams of traffic to block off sections of the maze, while the snowball fight showed video of snowballs both thrown at and thrown by the viewer. Of the four, "The Race Down Mt. Icing" most fully exploits the use of video segments to present a **simulation** of a luge-style run down a candy-cane strewn course. Each portion of the course appears as if it were displayed by a real-time render **engine**, but it is actually prerendered video. As the viewer passes from one area to another, obstacles such as giant candy canes or rolling snow boulders intervene, giving players a choice between moving right or left, ducking down, or jumping up, all of which are performed by pressing the appropriate buttons on the DVD remote. If the viewer chooses the correct direction, the video clip for the next portion of the course is played and the game progresses. If the viewer makes an error, a video clip of a wipeout is played, and the viewer begins descending again at the point before the wipeout. To increase the sense of real-time rendering, the DVD software randomly changes the course in small ways by using different video clips for the same stretch of the course. The wipeout clips are also varied among three crashes so that each spill looks somewhat unique when occurring over different portions of the course. The appearance of complexity relies primarily on the careful preparation of many small pre-rendered video segments that can be concatenated together rapidly by the DVD player.

During 2005 to 2009, most DVD games followed the simple **game designs** pioneered by earlier games. The 2009 release of *Pinocchio* (1940) on DVD exemplifies this in the three games included as extras: "Pleasure Island Carnival Games," a set of simple games with minimal interactivity; "Pinocchio's Puzzles," a puzzle game hosted by Jiminy Cricket; and "Pinocchio Knows Trivia Challenge," an interactive, multiplayer trivia game. Given the limited capabilities of the DVD apparatus (the rudimentary scripting language plus the underpowered processors of most players) other **play** experiences (such as simulation, first or third-person shooting, and difficult tests of perceptual and motor skills) are much more difficult to implement. The complexity of the games rely on the preparation of many small video segments that are played rapidly in succession depending on the viewer's interaction with the game scripts, with the result that the speed of the script-processing engine, the video decoders, and the reading speed from the disc all directly affect the performance of the game. Unfortunately, because of these constraints, the limits of DVD game design may have already been reached, leaving any further developments to Blu-ray Discs.

Blu-ray Games

As Blu-ray Discs developed as a consumer format, games came to form an integral part of their content. The first commercial Blu-ray release (June 20, 2006), *Charlie's Angels: Full Throttle* (2003), included *Charlie's Angels: Angel X*, an **on-line game** playable when the disc was used in a computer, but not in a set-top Blu-ray player. In May 2007, Disney released its first BD-J discs, for *Pirates of the Caribbean: The Curse of the Black Pearl* (2003) and *Pirates of the Caribbean: Dead Man's Chest* (2006). BD-J has been part of the Blu-ray specification since 2005 and implements a subset of the Globally Executable Multimedia Home **Platform** (MHP Website). Based on Sun Microsystems's popular and robust Java programming platform, BG-J allows advanced interactive applications on home entertainment devices (Bluray Disc Association, Application 6.2.4). In the *Dead Man's Chest* extras, Disney included the Java-based game, "Liar's Dice," based on the game of dice played in the film. The gameplay, although simple, uses the real-time rendering of menu overlays made possible in Java on top of pre-rendered video. The goal is to outwit the pirate Pintel (played by Lee Arenberg) in a game of dice. Starting with five dice, each player shakes and rolls them under the die cup. Over successive rounds, each takes turns bidding at the total number of dice held by both players showing a given number—"one two die," "two three dice," "four six dice," etc. Each successive bid must increase in either quantity (for example, from "one three" to "two threes") or in die value (for example, from the "three fives" to "one six"), or in both. After each round, the losing bidder must forfeit one die, until the player with the last die wins the pot. This level of interactivity (and amount of machine strategy in its bidding) had never been accomplished on Blu-ray before, making this a high point of Blu-ray gaming.

The Blu-ray disc for *Cars* (2006) included a highly interactive BD-J game with a new approach: the game was integrated into the movie itself. Make the "Carfinder" selection during playback, and it runs as the movie plays, presenting the viewer with three challenges that appear automatically at predetermined times during the film. The first displays a small **interface** that has various types of cars; the challenge is to select the correct car that matches the one appearing in the film. Each correct choice is added to the "Showroom," which allows the viewer to "unlock" special information and features about a vehicle including its backstory, 360-degree view, or images of other versions that were not used in the film. In the second, the screen freezes, and the viewer must find a certain type of car hidden in the frozen *mise-en-scene*; the quicker the response, the more points are scored. In the third, three images of the same car are displayed with each one slightly different from the others. The viewer must find the correct match for a specific car in the *mise-en-scène*; again, the faster the car is found, the more points are gained. This innovative approach allows the film and game to intertwine, perhaps achieving a greater level of interest for repeated viewings of the disc.

Iron Man (film released May 2008; Bluray Disc released September 2008) returned to an old quiz game format for its one extra but added the BD-Live feature, allowing for the quiz contents to be updated from the Internet. *Kung Fu Panda* (film released June 2008; Blu-ray Disc released November 2008) included two minimally interactive games: "Dumpling Shuffle," a simple interactive game involving three bowls and a shifty dumpling, and "Dragon Warrior Training Academy," in which players attempt fabled hero status by simple interactive strategies. Other Blu-ray releases with interactive games include those for the films *21* (2008), *Chicken Little* (2005), *The Day after Tomorrow* (2004), *Fantastic Four: Rise of the Silver Surfer* (2007), *The League of Extraordinary Gentlemen* (2003), *Men in Black* (1997), *Ratatouille* (2007), *Speed* (1994), and *National Lampoon's Van Wilder* (2002).

Conclusions

After tracing the development of DVD and Blu-ray games, three things stand out:

1. Pattern matching, whether visual or semantic/syntactic (that is, the answering of questions; Jurafsky and Martin, 2000, p. 84), is the most common play strategy of all these games.
2. Over time, they have developed an appearance of interactive complexity sometimes reminiscent of **console** and computer games rendered in real-time. For Blu-ray games, real-time interactivity has been a growing trend through the use of sophisticated BD-J programming.
3. The various combinations of the video elements produce a deeper sense of realtime interactivity at the heart of all electronic gaming.

These three linked observations imply that the current design trend placing interactivity at the center of DVD and Blu-ray game design has yielded better, more entertaining games that can be played more than once with enjoyment. The growing practice of providing two or more discs for a major film's release means that gaming content to fill them will increase. Will the new **generation** of DVD and Blu-ray games continue to improve as they have over the last few years?

As in console gaming, fixed capability hardware provides both a stable delivery platform and a troublesome bottleneck for newer game designs ("Brave New Worlds," 2003, pp. 30–31). Moreover, a move toward game styles such as three-dimensional simulation, which requires indeterminate interactivity very difficult to pre-render, may well be beyond the DVD set-top. However, with the higher-level programming of BD-J and BD-Live network capability, game development is already at the next level via the Blu-ray "Blue Highway" (Dixon, 2005, pp. 60–61). ***See also*** board games.

John Reid Perkins-Buzo

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Easter eggs

An “Easter egg” is a hidden feature present in a video game that is intentionally put in by the game’s creator and is often made difficult to discover. To reveal the Easter egg, players must perform a special action or series of actions, such as finding a code, typing a special keystroke combination, or looking carefully at details in **graphics** that indicate the presence of something hidden. Usually Easter eggs are funny and entertaining; they are “extras” for players and not essential to the games in which they appear. The pleasure they provide comes from the search for and discovery of these surprises or jokes. Looking for Easter eggs can become a game in itself because they are often part of the game but usually not a part of the main storyline or game mechanics (thus **cheats** and shortcuts are normally not considered Easter eggs). Easter eggs can be writings, pictures, **sounds**, videos, **minigames**, or even more complicated productions. For example, in *Doom II* (1994) players could find John Romero’s picture, one of the creators of the game, and in *Super Mario Bros*. (1985) an entire underwater level was hidden as an Easter egg.

The first known Easter egg appeared in the **Fairchild Channel F** game *Video Whizball* (1978). The hidden feature was the programmer Bradley Reid-Selth’s surname, “REID-SELTH,” which could be unlocked and displayed when the right conditions and combinations of play settings occurred (Whalen, 2012). Reid-Selth’s Easter egg was only discovered in 2004; however, the first Easter egg ever to be *found* by players was the hidden screen credit “Created by Warren Robinett” in ***Adventure*** (1979) for the **Atari VCS 2600**, the first graphical **adventure game**. **Atari** did not credit **game designers** at the time, either within games or on **packaging**. Inspired by secret messages found by listening to a music album backward, Robinett decided to put a secret room in his game, which displayed his colorful message on-screen. The hidden room was accessible only by discovering and picking up a single gray pixel called “the dot.” The dot was located in the middle of a gray room and was so well concealed that Robinett was nearly sure that no one would ever find it, and, fearing the reaction of Atari executives, he never spoke about his secret. But in 1980, after the production of 300,000 copies of the game, a 12-year-old boy discovered the secret room and informed the company. By then Robinett had already quit Atari but his initiative became well known. In the now-defunct magazine *Electronic Games*, Steve Wright, who was working for Atari, explained that this idea of hiding some surprises for players was good and evoked the idea of searching for Easter eggs on Easter Sunday, giving the hidden features their name. Atari even started planting Easter eggs in its games, and the phenomenon expanded into other video games. Today, examples of Easter eggs are now numerous, and Easter eggs can occasionally be found even in nongame software, including from a **scrolling** credit box in Microsoft Excel 2000 to a whole pinball game in Microsoft Word 97.

Maude Bonenfant

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Eastern Europe

See Europe (Central and Eastern)

education (general)

There has been a growth of interest in the educational use of games, where education can broadly be defined as teaching and learning across one's life span. Evidence for this claim can be seen in the increase in the number of education and gaming conferences, books, journals, and foundations/grant agencies interested in supporting this work (Ferdig, 2007).

There are at least three reasons for this expanded interest. First, there are recent empirical and theoretical research claims supporting the positive impact of games for teaching and learning (Gee, 2003). Second, there is an increased availability of game development tools, most of which are open source; ALICE, RPGMaker, Microsoft's **XNA**, and MIT's Scratch are all examples of tools educators can use to develop innovative learning environments. A third reason is the increased use of games today. A 2008 Pew Internet Study found that game **play** was almost universal among teens. Half the teens in the study played games on any given day. A similar memo from the Pew Internet Study in 2008 also suggested over half of adults play video games, with one in five playing every day or almost every day (Lenhart, Jones, and Macgill, 2008). Finally, recent on-line data suggest there are millions of users of **massively multiplayer on-line role-playing games (MMORPGs)**; for instance, more than 12 million people play ***World of Warcraft*** (2004).

Games are used for educational purposes in either a direct or indirect method. A direct approach would be to use a game that teaches concrete skills or knowledge. For instance, a game might teach emergency workers proper procedures in responding to a fire. Conversely, an indirect approach provides players with gameplay that has indirect consequences or outcomes. For instance, a surgeon might hone hand dexterity while playing a **sports game**; a student might learn **history** while playing a commercial-off-the-shelf (COTS) war **adventure game**.

Much of the current research and practice on the educational use of games has focused directly on consumption of those games. Current and past pedagogic theories have suggested that play provides a safe and motivational environment for learners to try out knowledge and skills they have gained (Bettelheim, 1987; Vygotsky, 1967). Video game play (consumption) provides a point of interaction between learning and doing; it can enable the practical application of concepts, skills, and knowledge. Electronic games also offer added features of automation and complexity. Because play within electronic games includes interaction mediated through electronic hardware such as a computer or gaming **console**, the application of game **rules** are applied automatically through the electronic hardware. This, in turn, allows for more complex game **worlds** (Juul, 2004).

The educational use of games can also include game development (Kafai, 1998). Video game creation is important because it provides learners with authentic opportunities to create artifacts of their learning as well as opportunities for others to learn from their creations (Ferdig, 2006). Developers end up having to learn content and skills as they prepare to create a meaningful and engaging environment for teaching and learning.

The use of the term "education" to describe gaming might lead some to reference work in K–12 settings or in colleges of education. Interest in the educational use of games might reside in multiple departments. Computer science, engineering, education, **journalism**, English, **psychology**, literature, anthropology, sociology, communication, **advertising**, and **health** are just some of the disciplines that are interested in the use of games. Therefore, a critical component of exploring the educational use of games is an understanding of the motivation behind the use of the game or game development (DiPietro, Ferdig, Boyer, and Black, 2007). Some are concerned with the pedagogic use of games, or how teachers and students can develop or consume games. Others are more interested in the psychological aspects of gaming, in which what is being learned or studied relates to educational concepts of expertise, motivation, or individual and social **cognition**. Still others view "learning" through games as what is known as media effects, or the study of how video games teach about **violence**, **gender**, and stereotypes. Finally, there are those interested in **game design**, usability, and human-computer interaction.

With these necessary but multiple perspectives, it becomes increasingly complex to summarize what we know about the educational use of games. The answer depends somewhat on the genre, discipline, and context in which the question is asked. Recent research has provided evidence that the success of educational use of games depends largely on how educators align the content, the learner characteristics, the pedagogy, and the design of the game (Ke, 2009). All researchers seem to agree that more research within specific disciplines needs to be carried out to more completely understand the educational use of games. ***See also*** education (job training); education (religious).

Richard E. Ferdig

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education (job training)

The use of video games in education among adults often pertains to job training. For certain kinds of jobs, games can be designed to teach job-related skills or simulate decision-making situations, and the real-time interactive nature of video games means that reaction time can be factored into the abilities being learned and tested. Other areas tested by such games include technical abilities and customer service.

The use of games for job training can be traced back to flight simulators and other vehicle simulators, for example, the "Bradley Trainer" conversion of **Atari**'s ***BattleZone*** (1980) that was commissioned by the **United States** military. Training games can be seen as an extension of training videos used by corporations, as on-the-job training in general became more codified and structured during the 1980s and 1990s, along with the growing integration of computer technology. Today the use of games for corporate training is big business and a growing percentage of what are now termed **serious games**.

In 2000, the Digital Media Collaboratory at the University of Texas at Austin's IC[2] Institute introduced the EnterTech Project, describing it as "a multimedia job skills training program preparing learners through simulated work experience in a virtual technology manufacturing company" (EnterTech website, 2000). Throughout the 2000s, many corporations began using games for job training, and by 2008 a study by the **Entertainment Software Association (ESA)** found that an estimated 70% of major domestic employers used games for training purposes (Steinberg, 2010).

Examples of job training games include *Incident Commander* (2007) from the U.S. Department of Justice and BreakAway Games, about the coordination of disaster relief efforts; The MITRE Company's *Job of Honor* (2007), used for recruiting; and *The Cisco Mind Share Game* (2009) used for network certification training.

There have been two innovative trends in research and practice on games and simulations for job training. First, James Rosser has led research that demonstrated surgeons performed better after playing video games. In a 2007 study, Rosser and his colleagues compared laparoscopic skills and suturing capability with video game scores and video game experience. The authors reported video game skills and experience as significant predictors of laparoscopic skills. Their study also pointed to video games as practical tools for teaching surgeons (Rosser et al., 2007).

A second innovation has come in the form of using games and simulations for crowdsourcing job training; for instance, the U.S. Army built *America's Army* (2002), a software series aimed at supporting recruitment of soldiers. More recently, the U.S. Navy in collaboration with the Defense Advanced Research Projects Agency (DARPA) built a simulation called ACTUV (Anti-Submarine Warfare Continuous Trail Unmanned Vessel). The simulation asks players to keep track of enemy submarines. After playing the game, users can submit their results to DARPA, which will use crowd sourcing to develop new ways to train its submarine personnel (ACTUV website, 2011).

As of 2011, a number of companies, including Minerva Software (formerly Cyberlore) and Marc Prensky's Games2Train specialize in developing games for job training, and studies have shown that the interactive learning found in video game training is often more effective than traditional methods (Orland, 2010).

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education (religious)

As an academic discipline, religious education seeks to use the social sciences to describe and prescribe strategies for religious growth and development. Religious education can focus on a variety of sacred concerns, including myth, **ritual**, symbol, scripture, doctrine, and experience. Although religious education formally encompasses a wide range of theological traditions, substantial research has been conducted within the primary contexts of Catholicism, Protestantism, and Judaism (Miller, 1995). For example, Jeff Astley notes that religious education within a Christian context can and does encompass indoctrination, personal formation, reason, and **emotion** (Astley, 1994). A variety of video games explicitly aim toward religious educational outcomes such as these.

Throughout the 20th century, religious educators consistently called attention to the overlapping concerns of religion and education. In the first half of the century, Alfred North Whitehead asserted that education at its best should artfully foster a joyful spirit of discovery, a passion for learning, a sense of ethical duty, and a reverence for mystery and eternity (Whitehead, [1929] 1967). Likewise, John Dewey argued that the "common faith" of education shapes a general concern for human wholeness, imaginative self-expression, relational interconnection, and an aspiration for ultimacy (Dewey, [1934] 1972). More recently, Philip Phenix asserted that education seeks transcendence—expressed in terms of hope, creativity, wonder, awe, and reverence (Phenix, [1971] 1975). Similarly, David Purpel associates education with the religious impulses toward mutuality, ecological concern, hospitality, human dignity, peace, and justice (Purpel, 1999). In one sense, the concerns of religious education may seem to range very widely. In another sense, however, these concerns tend to fall into two general categories: the ethical (or relational) and the transcendent (or aspirational).

Currently, religious educators take a variety of views on the religious and educational dimensions of media technologies within popular culture. For example, Ronald A. Sarno argues that the procedural and multimedia dimensions of the computer can allow learners to play an active role in their own religious education (Sarno, 1987). Pierre Babin and Angela Ann Zukowski suggest that media technologies can effectively sponsor religious education by addressing the imagination and facilitating meaningful relationships (Babin and Zukowski, 2002). Likewise, Mary Hess suggests that popular culture can provide an imaginative, participatory bridge to the resources of religious communities (Hess, 2003). Elsewhere, Hess recognizes that media technologies may also limit the exercise of the imagination and the development of relationships in some cases (Hess, 2004). Dean Blevins understands computer technology as a potential religious educational resource for the development of relationality and complexity, or, a sense of awe and mystery (Blevins, 2008). Among these scholars, their religious educational concerns again tend to focus on the possibilities of the ethical and the transcendent.

Particular religious educational research in video game technologies is a newly emerging field. Michael Walthemathe suggests that video games provide a **narrative** and procedural **platform** for playful identity formation and ethical reflection—both concerns of religious education (Walthemathe, 2003). Likewise, Christopher Scholtz argues that religious educational research in video games must account for the dual domains of both **narrative** and **ludology**, as well as the reflective experience of players (Scholtz, 2004). Elsewhere, Scholtz suggests that the concerns of religious educational research can and do overlap with video game research concerns at the points of explicitly religious content, identity formation, longing and desire, daily rituals, fascination, and Mihaly Csikszentmihalyi's flow theory (Scholtz, 2005).

Other video game researchers note that religion within video games tends to suffer from a narrative and procedural incongruity. For example, Ian Bogost observes that explicitly religious video games often adopt the conventions of mainstream video game genres without regard for their implicit procedural rhetoric, thus undermining their religious aims (Bogost, 2007, p. 288). Similarly, Harry J. Brown argues that without care, conventional video game procedures may overwhelm or undermine any religious messages that video games intend to communicate (Brown, 2008, pp. 104–107). For example, Brown notes that although video games often promote an ethic of concern for the weak, they also promote a reactive ethic of vigilantism and **violence** against all members of a given social class or oppositional alignment. Thus, Christian religious video games that import these procedures tend to carelessly undermine their own narrative message.

Many explicitly religious video games tend to leverage gameplay as a means to confront players with religious content. Notable examples include *Catechumen* (2000), *Left Behind: Eternal Forces* (2006), and *Heaven* (2010), and the Wisdom Tree Games series for the **Nintendo Entertainment System (NES)** including *Bible Adventures* (1991), *Joshua & the Battle of Jericho* (1992), and *Spiritual Warfare* (1992).

Mark Hayse has analyzed ***Ultima IV: Quest of the Avatar*** (1985) in terms of religious education curriculum (Hayse, 2009, 2010). In *Ultima IV*, the player practices critical ethical reflection to realize self-transcendence. Throughout gameplay, the player seeks to practice the virtues of a concealed "moral economy," which is only gradually revealed through "unfolding revelation." This tension creates an inductive gameplay experience that reflects the nature of religious experience—the quest for the good life in response to a divine direction that is only partially revealed. Hayse describes the structure of *Ultima IV* in terms of a "religious architecture" within which religious significance can emerge. ***See also*** god games; education (general); morality and ethics; spirituality.

Mark Hayse

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electromechanical games

Before video games came to dominate the **arcade**, electromechanical games were the typical games found there. As their name implies, electromechanical games are coin-operated games that combine electrical and mechanical elements requiring playing skills and timing from the player. Many of these games were housed in a floor-standing wooden cabinet (often covered with colorful, fantastic game **art**), with player controls on a panel in front, and game actions occurring behind a glass screen above the panel, a mode of exhibition that would be adopted by video **arcade games**.

Electromechanical games arose when purely mechanical arcade games were electrified, allowing **game designers** to include such features as lights, solenoids, motors, switches, and other electrical hardware into the games, as well as feature electronic **sounds**. The most common type of electromechanical game is pinball, which first used electricity in 1933. Many video games and game genres can trace their conceptual roots back to electromechanical ancestors, including **shooting games** with mounted guns, driving and **racing games** with built-in steering wheels, bowling games, tank games, and plane and helicopter games. A number of video game **controllers**, like **joysticks**, can also be found on electromechanical games. Some games required physical skills and could not be duplicated by video games; in *Airball* (1971), players used jets of air to physically manipulate a ping-pong ball through various targets. Companies that produced early arcade games often had first produced electromechanical games, including Allied Leisure, **Bally**, Chicago Coin, Gottlieb, **Midway**, **SEGA**, and **Williams**. Occasionally, video game companies even produced electromechanical games, like *F–1* (1976) made by **Atari** and Midway, or Atari Games's *3-on-3* (1993).

Although their numbers declined sharply during the 1970s when video games came to dominate the arcade, electromechanical games paved the way for video games by providing the manufacturers, themes, venues, conventions, styles, and audience that would allow the video game **industry** to grow as rapidly as it did, and in many ways determined much about the way arcade video games would look and sound and what kinds of games would be made. To some extent, video game technology can be seen as a solution to the problems with games made with electromechanical technology, including those involving the games' interactive limitations (games had to be able to be built and operated mechanically, and reset between playings) and their reliance on moving parts (electromechanical games required a higher level of maintenance than video games). Perhaps because they were the most unlike video games, pinball games survived and held their own alongside video games, although their numbers and popularity decreased dramatically.

Because of the way they quickly fell out of favor at arcades and their constant need for repair, working examples of electromechanical games are today much harder to find than old video arcade games, making it difficult for collectors as well as for researchers who wish to play them. Videos of them being played can sometimes be found on-line, and preservation attempts can be found at locations like the Retro Arcade Museum in Beacon, New York, which houses a collection of several dozen electromechanical games.

Mark J. P. Wolf

Electronic Arts (EA)

Electronic Arts develops and publishes games for personal computers, the **Nintendo Wii**, **Microsoft Xbox 360**, **Sony PlayStation 2**, **Sony PlayStation 3**, PlayStation Portable, **Nintendo DS** and cellular phones. The company generates its revenue by diversifying the games it publishes across these various **platforms**. EA develops games at studios around the world in **Canada**, the **United States**, the United Kingdom, Sweden, **Germany**, **China**, and **Australia**. It also houses quality assurance centers in **Japan**, **India**, **Spain**, Singapore, and **South Korea**. Given the vast size of the company and its considerable marketing power, EA has positioned itself as one of the leading game development and publishing companies in the world.

History

Electronic Arts was formed in 1982 when Trip **Hawkins**, the company's founder and chief executive officer, resigned from Apple Computer. Hawkins intended that EA work as an independent publisher. EA would be devoted to finding and promoting game

The Electronic Arts headquarters in Redwood City, California. (AP Photo/Paul Sakuma)

developers and their games but would not create games itself. EA saw early success in publishing well-received and respected titles including *Archon* (1983), *M.U.L.E.* (1983), *Seven Cities of Gold* (1984), *The Bard's Tale* (1985), and *Wasteland* (1988). The company continued its strict commitment to publishing until 1987 when it created the skateboarding game, *Skate or Die!* (1987).

Hawkins left EA in 1991 and was succeeded by new CEO Larry Probst. Under Probst's guidance, EA quickly began a series of acquisitions of game development studios. The company purchased Origin in 1992, Bullfrog in 1995, Maxis in 1997, Tiburon in 1998, Black Box in 2002, Criterion in 2005, and Bioware in 2007. EA would take notice of a studio that had created a popular game, purchase that studio and then have the studio generate sequels of the title they had popularized, profiting from publishing these sequels. John Riccitiello became EA's CEO in 2007 and has continued following Probst's strategies for the company's growth by emphasizing the need for successful game franchises that build on successful intellectual property and continuing the acquisition of game development studios.

Not only has EA pursued the acquisition of game development studios, it has also aggressively acquired licenses to include various forms of popular culture in its games. In 1998, EA purchased an eight-year license to make games using soccer's FIFA and European Cup competitions. In 1999, the company acquired the license to the elite Formula One racing series. One of the most prominent license acquisitions occurred in 2004 when EA successfully negotiated for an exclusive five-year license with the National Football League and its players. These licenses allowed for the inclusion of real world leagues, teams, and athletes in the company's **sports games** and enabled the company to more accurately create sports **simulation games**. These license acquisitions have not been limited to sport. EA has also forged licensing deals for games based on *Harry Potter* (2000), Marvel **Comics** characters (2004), and *The Simpsons* (2005). In 2008, EA partnered with Hasbro to create the prospect for games based on properties such as Nerf and the game *Monopoly*.

Divisions

In 2008, EA reorganized itself into four units: (1) EA Sports, (2) EA Games, (3) EA Casual Entertainment, and (4) The Sims.

The EA Sports unit was originally formed in 1993. It uses its licenses for professional sports leagues, teams and athletes to produce a variety of sports games that simulate different sports to varying degrees. Among the more prominent titles published by EA Sports include the *FIFA Soccer* and *Madden Football* series.

The EA Games unit was initially established in 2000 and represents the largest of the four units; it focuses on creating big-budget blockbuster games. Some examples of EA Games titles include the *Need for Speed* series, the **massively multiplayer on-line role-playing game (MMORPG)** *Warhammer Online* (2008), and the **music game** *Rock Band* (2007).

The EA Casual Entertainment unit focuses on lighter, **casual games** marketed toward families, women, and children and typically played on-line or on **mobile gaming** systems. The *Pogo* **web-based game** website that EA acquired in 2001 serves as the primary responsibility for EA Casual Entertainment, but the unit also increasingly focuses on adapting titles like *Spore* (2008), *Tetris* (1985), and *Trivial Pursuit* (2009) for cellular phones.

Finally, The Sims unit, established in 2008, publishes games and expansion packs specifically oriented around the **Sim series**. In keeping with EA's corporate strategy, The Sims unit has been charged with developing the brand across a variety of game platforms.

Controversy

As the company has grown, EA has increasingly been beset by controversy. In 2004, a blog posting from someone self-identifying as "ea spouse" charged the company with working employees to exhaustion without providing overtime or additional compensation (EA_Spouse 2004). The posting triggered a class action lawsuit brought against EA by its employees calling for payment to be made for overtime (Feldman and Thorson, 2004). The suit would be settled for $15.6 million two years later but caused the video game **industry** to reconsider its labor practices (Jenkins, 2006).

The year 2004 also saw EA controversially acquire the exclusive license from the

National Football League. Under competitive pressure from rival publisher 2K and its *ESPN NFL 2K5* (2004), EA signed a five-year deal with the NFL enabling it to become the only game company allowed to use NFL teams and players. Morris (2004) reported that financial analysts expressed concerns about how the deal limited consumer choice and prevented EA's competitors from producing an NFL game in the future.

Andrew Baerg

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ELSPA

See Entertainment and Leisure Software Publishers Association (ELSPA)

emotion

When we **play** a video game, different parts of our brain activate in a particular sequence. There is the binding of somatosensory information that then hits the emotion or "limbic" system that includes processing by the hypothalamus and amygdala. It is the emotion center that triggers a reflex emotion in the player in response to the environment presented: negative emotion to the threatening and unsafe and positive emotion to the comforting and safe. Either way, the stimulus is then processed by the reason or "executive brain" system that includes processing by the orbitofrontal, prefrontal, anterior cingulated, and motor cortex areas. This reason system overrides the emotion center, telling the brain that we don't have to actually run from the living room—or shoot the **television** set—when playing *Call of Duty* (2003).

In short, when we play video games, the stimuli or signals pass through the human brain's amygdalar-hippocampal system (where those signals have their first impact and leave their first trace), the left perisylvian region (where language is formulated), and the frontal cortices and their subcortical connections (where the distinction between real and fictional is made).

Both real-life emotions and fiction-elicited emotion signals follow the same neurologic circuits from the brain's emotional system to its **cognition** system and then *diverge* in their effects when the latter determines what kind of response is warranted: to act or react when the information is identified as pertaining to real life and to stop or not initiate action when the information is identified as pertaining to the make-believe of the video game. This is why when we play video games, our executive center knows they are not the same thing as reality, but the emotions already triggered can be felt as intensely as the real emotions triggered in a real-life like situation.

This pendular swing between video game somatosensory stimuli triggering us to experience an emotion all while telling us to respond in an *as if* way creates tension (reflex emotion) and *dis*-tension (the executive brain) that leaves an emotion residue. In a way, **game design** and play is all about this initial emotion trigger and the emotion residue that is left behind.

Of course, all this assumes a fluency with video game play in which the player knows the **controllers** well enough that he or she loses the sense of the mechanics of the playing; it assumes a literate video game player who, just as we do not think of grammar when speaking, does not think about the mechanics of play. The growing of our capacity for fiction-elicited emotions plays a central role, then, in our engagement with and creation of video games. Research in neurobiology has shown that there is a rational, discerning function present to a certain extent also in the so-called limbic system, so the distinction between real and not real begins to take shape already at this level, before even reaching the "reasoning" areas of the brain. Also, the "executive brain" does not always override completely the limbic system.

Video Games and the Growing of the Emotion System

We arrive in the world with a fully charged emotion system: we cry when hungry or neglected and smile when touched and fed. Parents and caregivers function as surrogate reason systems until we grow our own. They sooth and inhibit so we can *think* instead of reflex emote. As we grow, our emotion and reason systems become more in balance—we even begin to *think* about the emotions we experience. Working together, the emotion and cognitive systems allow us to ponder, assess, and modify our actions—and sometimes in ways that run counter to our reflex emotions.

On both scores, what we are doing is growing our capacity for causal and counterfactual (and probabilistic) **mappings** of our physical **world** (objects and functions) and of the social arena (people and institutions). We get nice kickbacks here too. Whether a social or natural world occasion, when we plan, put into play, and accomplish a goal we are rewarded with neurochemical release of oxytocin and dopamine—the feel-good brain drugs. One way or another, video games trigger these causal and counterfactual mechanisms as the player follows its emotion blueprint: the particular pattern and predominant types of emotion present in any given game.

In many ways, what we call genres are a more formal way of understanding a video game's mood. How the emotion peaks (short in duration) of any given game add up to that feeling (long in duration) that lasts after the game has been finished: action,

adventure, horror, comic, and so on. In a sense, genre is really the formal expression of the cumulative effect of the dominant emotions types experienced (either non-self-reflectively as with basic emotions or what we call feeling, or the after-effect, meta-cognitive awareness that tells you an emotion occurred) during gameplay. So the **survival horror genre** is designed for repeated encounters with danger, constantly conditioning the player's appraisal mechanism and what he or she will do next, either when alive again or when entering a new **space**.

One of the most dominant emotion patterns is that of reward: puzzle-solving or overcoming obstacles to attain the goal of a game. So although the player's cognitive causal mapping of the natural world is at play in a **shooting game** like *Medal of Honor* (1999), it is the pattern of positive emotion (successfully advancing through the game by killing the enemy) that keeps the player going until he or she achieves the goal.

Other emotions arise in playing video games, including the one the player feels when *moved* by its aesthetic design. This can be a positive or negative reaction and can also determine whether the player returns for more. We can feel emotions toward characters as well. Again, this can be a range of emotions (as in a role-playing game) or a rather simplified set of basic emotions (as in a shooting game). Video game designers can bring to a shooting game a greater range of emotion by using techniques such as **narrative** framing, writing and voice, and **cut-scenes**. For instance, writing, voice, and cut-scenes are used to intensify the third-person combat play and puzzle-solving tasks in *Uncharted 2: Among Thieves* (2009).

Video games that require the player to map social worlds rely heavily on social emotions; those we grow from infancy in our mapping of the complex webs of attachment to various loved ones. These games build in characters with interior states of mind; they require the player to read subjective states and intentions of the characters encountered. Game designers therefore spend more time on ingredients such as facial expression and body movement, all of which trigger our Theory of Mind (or mind-reading) capacity; these games arguably also trigger the player's empathic faculty. There are specialized neurons in the brain that form a system that mirror another's action-oriented gesture. Video game designers intuitively create games that trigger this so-called Mirror Neuron System—the system that allows us to understand actions and emotions automatically in our brain's simulating of them—without any reflective cognitive processing, conceptual reasoning, or conceptual assessment. Video games that attend to facial expression, micro-gesture, and body movement in their characters seek to activate the MNS—the reflex center for processing another's actions and emotions. This helps explain, too, why **role-playing games (RPGs)** and character-driven video games (more than, say, shooting games) trigger more our empathic capacity.

Real-World Emotions Expressed in Play

Video game emotions are real-world emotions but without the real-world consequences. We experience shock, surprise, fear when playing *Dead Space* (2008), but our reason system tells us that this is taking place in the realm of play and make-believe. This is why we do not have the more than 90% of kids who play video games (nearly half of which contain **violence**) actually shooting real people (Children Now, 2001; Kaiser Family Foundation, 2002).

Video game designers create protected, exploratory environments in which the players can exercise safely their causal and counterfactual mechanisms. As social and natural maps take shape and players realize goals, neuropeptide release happens. Just as neuropeptides (like oxytocin) reward and create deep bonding and attachment between parent and child, so, too, the game (the implied designer) can reward (dopamine release) and create attachment. (There are, of course, tragic anomalies such as the **South Korean** 28-year-old who died from heart failure after playing ***StarCraft*** [1998] for 50 straight hours without sleep or food.)

Certain video games seek to intensify the interactive and transformative nature of the game to heighten the player's experience of agency during gameplay. These are games that give the player a sense of learning and mastering of the game's social and natural world mappings in ways that matter—that can be felt as personalized in some way. Blizzard Entertainment's ***World of Warcraft*** (2004) allows players to customize their **avatar**'s physical appearance, **race** (orc, elf, or druid, for instance), profession, and skill sets as they set out on adventures that take place in a variety of resplendent terrains (such as cities, forests, jungles, and deserts).

Video games establish **rules** that involve the player's choices, obligations, prohibitions, and permissions. And video game play intensifies when unstated constraints are identified. Rules are necessary in the design of video games, right down to the actual binary codes used in the programming. They are also necessary for the players to invest emotionally in the game. The player needs to know or to discover the game's basic constraints to better explore and evaluate the options and to heighten the experience of emotions during gameplay.

This also means that there has to be a certain logic and coherence to the game. If the constraints are too tight (leaving little room for options) or the logic breaks down, then the player stops investing emotionally. *Final Fantasy XIII* (2009) is aesthetically well crafted with compelling animation but too restrictive in its movement options; the rather mundane movement through doesn't elicit emotional investment in the game. The player also may stop investing emotionally if he or she senses that there is no way to lose and therefore no way to win either. *Heavy Rain* (2010) is a case in point. Although well-scripted, narratively interesting with its shifts in point of view, and packed with expressive and detailed facial animation, it offers no emotional reward because it offers no way to lose.

Video games are about movement—our movement as actual players in an actual room toggling a controller or holding a Wiimote. In fact, it is the player's action-oriented dexterity that intensifies the immersion and therefore also the emotive payoff. It bears mention that there is a long history of scholarship (William James through Antonio Damasio) that seeks to make explicit all the consequences one may derive from the fact that many (if not all) emotions, according to James, are the products of physiological and neurological changes; we first produce the bodily symptom of an emotion and then *feel* the emotion. As such, when playing a video game, it is physical changes in the body (acceleration of pulse, surge of adrenaline, and contracting of muscles) that are detected first by the prefrontal cortex and somatosensory cortex and then by the emotion system. According to this approach, a video game's image and **sound** initiate bodily changes that trigger this biofeedback loop formed between body and brain that ultimately creates the feeling of the emotion.

Common experience and today's science tell us something a little different, however. Not only that we can experience emotion just sitting and watching others play a video game but also, as science proves, the processing of video game sensory stimuli is a process that moves from the senses, to the emotion system, to the reason system, and then back to the emotion system. If it were not so, we would not know the difference between the video game and real life; if it were not so, we would not be able relish in the residual of the real emotion felt in the fictional play.

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emulators

An emulator is a program used to play video games originally designed for another system. The most common usage for these programs is to emulate older game **consoles** (**Atari VCS 2600**, **Nintendo Entertainment System (NES)**, **SEGA Genesis**, etc.) or older operating systems (such as DOS) through a modern computer OS (such as Windows or Mac OS). The program mimics the way the older machine renders **graphics** and **sound** so that the game experience is as similar as possible to what it was on the original system. Games are enclosed in ROM files (which replace the **cartridges**) and then read by the emulation program (which plays the role of a specific console) to be played within the newer **interface**.

Although the original software is often accurately embedded in a snapshot file, the newer hardware can be very different. Processors, **sound technology**, and monitors all have an impact on the output. Therefore, the final appearance of the game might be affected by the emulation process: aspect ratios, colors, sound, speed, for example. In addition, the **controllers** of the console (such as **arcade joysticks** or home gamepads) must be replaced in the newer hardware configuration (which is often mouse and keyboard), inevitably altering the gameplay. For example, the NES Zapper, a pistol-shaped controller used for *Duck Hunt* (1985), has no suitable replacement on the average home computer setting. The easiest way to replace it—aiming with your mouse—leads to a completely different gaming experience. Yet much effort is invested to improve the illusion: USB adaptors are available so that, for example, original SEGA Genesis gamepads can be used for home computer gaming.

Moreover, rather than only trying to mimic the original experience of a game, most emulators add new possibilities or features that were not present in the old system. These include fast-forward and backward functions; by pressing a key, the player can reverse gameplay for few seconds, going back to a time before being hit by an enemy, thus avoiding losing lives, or using "continues" or restarting all over. Fast-forwarding allows the player to skip parts of the game sometimes judged uninteresting (such as **cut-scenes**). The possibility to save states everywhere in the player's path—probably the most common of these new features—makes obsolete all **game design** effort to control the frequency of save points, and decreases the difficulty of games that originally did not offer any **save function**.

If the emulator program itself isn't really involved in legal issues, the files of game code reproducing them (referred to as "game images") are usually unauthorized by copyright owners, forcing ROM files into underground circulation. But the emulation process is not always subject to legal issues. For example, the **Microsoft Xbox 360** has emulation software to offer original Xbox compatibility. The same principle applies for the Nintendo's Virtual Console on the **Nintendo Wii** and **Sony PlayStation** games sold on the PlayStation Network for **PlayStation 3** and PlayStation Portable. Microsoft, **Nintendo**, and **Sony** can release games for some of their older consoles without having to change the original code.

These ways of using emulators show their importance for the **retrogaming** movement. Old game consoles may no longer be functional, but emulation gives a way for nostalgic players to access their games nevertheless. With the **Multiple Arcade Machine Emulator (MAME)**, an emulator of different arcade systems, some early video games mostly unavailable by any other means are now playable.

Emulators also increased the possibility of user-generated content related to old games. For example, emulators gave birth to homemade translations (such as the English translation of *Final Fantasy V* [1992] from **Japanese** before it was released in North America within *Final Fantasy Anthology* [1999] on the PlayStation). New games are also designed as if they were working on old **platforms** sometimes using emulators, thus combining nostalgia and novelty.

Of course, emulation is a useful way for researchers to discover games sometimes unavailable by other means. Game states can easily be exchanged between players or researchers by e-mail. Nonetheless, one must remember that what is experienced with emulation programs is not exactly what was originally experienced with the original platforms.

Simon Dor

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engines

See game engines

Entertainment and Leisure Software Publishers Association (ELSPA)

The Entertainment and Leisure Software Publishers Association (ELSPA, renamed the UK Interactive Entertainment Association in 2010) is a trade organization which primarily represents software publishers and distributors in the computer and video games industry in the United Kingdom. The ELSPA was founded in 1989 and primarily comprises companies from the United Kingdom and **European** video games **industry** (it was established as the European Leisure Software Publishers' Association before being renamed to "Entertainment" in 2002). In many respects, the ELSPA is comparable in form and function to the larger American trade organization the **Entertainment Software Association** (**ESA**; formerly the Interactive Digital Software Association). ELSPA constitutes one of the two primary trade associations for the British and European games industry, along with The Independent Games Developer's Association (TIGA).

Membership in the ELSPA has grown considerably since its inception in 1989 from 11 founding members to 42 members in 2010. The association's stated goal is to "protect, promote, and provide for the interests of all its members," and the organization functions in multiple capacities, including organizing conferences and events such as the now defunct European Games Network Event (last held in 2004 and similar to the Electronic Entertainment Expo), the London Games Festival (an annual weeklong event focused on industry promotion, business development, and workshops), and the Edinburgh Interactive Festival (similar to the London Game Festival). As a trade organization, the ELSPA provides services for its members through industry promotion and public relations, governmental lobbying for legislative issues and economic support, and advertising and content self-regulation. Furthermore, the ELSPA operates specific services such as the ELSPA IP Crime Unit, which assists with enforcement and provides protection for intellectual property for the games industry against software **piracy** and copyright infringement, and consumer information programs such as Askaboutgames.com. The ELSPA also compiles and produces weekly, monthly, quarterly, and annual sales charts for the UK computer and video games markets in conjunction with GfK Chart-Track, a retail research firm.

With the aid of the Video Standards Council, the ELSPA established a voluntary self-rating system for video games beginning in 1993. The association oversaw game ratings in the UK from 1993 until 2010, functioning in a role similar to the **Japanese** Computer Entertainment Rating Organization and the American **Entertainment Software Ratings Board (ESRB)**. Following the passage of the Digital Economy Bill in 2010, rating responsibilities in the United Kingdom were then passed to the **Pan European Game Information (PEGI)** group. The ELSPA has also supported educational initiatives to explore the instructive potential of games, in conjunction with the British Educational Communications and Technology Agency (BECTA). As of 2010 the ELSPA Chairman is Andrew Payne of Mastertronic, and board members include representatives from the British and European branches of Disney, **Nintendo**, Ubisoft, Microsoft, Sony, and Eidos.

Christopher Hanson

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The Independent Games Developers Association Web site, available at http://www.tiga.org.

Entertainment Software Association (ESA)

According to their website, "The Entertainment Software Association (ESA) is the U.S. association exclusively dedicated to serving the business and public affairs needs of companies that publish computer and video games for video game **consoles**, personal computers, and the Internet" (ESA Web site, 2010).

The ESA was founded by Doug Lowenstein in 1994 as the Interactive Digital Software Association (IDSA), which it remained until it was renamed in 2003 for the sake of greater concision. Its membership includes many major video game publishers who have a branch in the **United States**, and its office is located in Washington, DC, where it lobbies against government-imposed regulation censorship. The ESA is also active in business and consumer research for the video game **industry** and in intellectual property policy and anti-**piracy** programs around the **world**.

Lowenstein was president of the ESA until 2007, and during his tenure the organization established the **Entertainment Software Rating Board (ESRB)** in 1994, the rating system of which has become the standard used in the United States and **Canada**. The ESA (then IDSA) also established the Electronic Entertainment Expo (E3) Tradeshow in 1995, and the Academy of Interactive Arts and Sciences in 1996, which began giving its Interactive Achievement Awards in 1998 and in 2002 began the annual D.I.C.E. (Design, Innovate, Create, Entertain) Summit.

In 2000, the ESA began the ESA Foundation, which according to their website, "is dedicated to supporting positive programs and opportunities that make a difference in the lives of America's youth. The Foundation seeks to harness the collective power of the interactive entertainment industry to create positive social impact in our communities. We support geographically diverse projects and programs that benefit American boys and girls of all **races** and religions." (ESA website, 2010).

Following Lowenstein's departure in 2007, the next president of the ESA was Michael D. Gallagher, whose background included working as the Department of Commerce's Assistant Secretary for Communications and Information, as well as serving as Director of the National Telecommunications and Information Administration.

Mark J. P. Wolf

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Entertainment Software Rating Board (ESRB)

The Entertainment Software Rating Board (ESRB) is a nonprofit, self-regulatory organization responsible for rating computer and video game content and the enforcement of **advertising** guidelines in **North America**. The ESRB was created in response to increasing concerns over video game **violence** and its effects on minors. By the standards of the early 1990s, the digitized **graphics** of certain games appeared unsettlingly realistic, including those of ***Mortal Kombat*** (1992), a brutal **fighting game**, and *Night Trap* (1992), a **SEGA CD** release using full-motion video (FMV), which tasks players with protecting a slumber party from vampire-like assailants. The two games took the spotlight during the joint hearings before the Subcommittee on Juvenile Justice of the Committee of the Judiciary and the Subcommittee on Regulation and Government Information of the Committee of Governmental Affairs of the 103rd **United States** Congress, held from December 9, 1993, to March 4, 1994, and headed by senators Joseph Lieberman and Herbert Kohl. Faced with the prospect of federal regulation, the video game **industry** initiated efforts to adopt a voluntary rating system. In April 1994, the Interactive Digital Software Association (now **Electronic Software Association, ESA**), a trade association of the U.S. video game industry, was created. The IDSA proceeded to draft a proposal for a video game rating system. The proposal was accepted by the U.S. Congress in July 1994, resulting in the foundation of the ESRB in September of the same year. The earlier, publisher-specific self-regulation practices—such as **SEGA**'s Videogame Rating Council and the **3DO** Rating System (both introduced in 1993)—were discontinued with the introduction of the industry-wide ESRB ratings.

Having undergone a number of revisions over the years, as of 2011 the rating system consists of six age-based categories: EC ("Early Childhood," ages 3 and older), E ("Everyone"), E10+ ("Everyone 10 and older"), T ("Teen," ages 13 and older), M ("Mature," ages 17 and older), and AO ("Adults Only," ages 18 and older). These are supplemented by over 30 content descriptors, such as "suggestive themes," "blood and gore," or "mature humor."

To initiate the rating process, the publisher is required to complete a detailed questionnaire, describing the content of the game in all relevant categories (including language, violence, sexuality, substance use, etc.) and submit a video recording featuring typical gameplay as well as examples of the most extreme content. Following the controversy sparked by the "Hot Coffee" **modification** (which activated a nonexplicit sex-based **minigame** in ***Grand Theft Auto****: San Andreas* [2004]), the publishers are now also required to disclose any content that cannot be normally accessed by the players but is nevertheless present in the code of the final release. The submitted materials are reviewed by at least three anonymous raters, each of whom then submits an initial rating recommendation. Discussion follows, until agreement is reached regarding the final rating recommendation. Following a parity examination, which ensures the consistency of ratings between different titles, an appropriate certificate and a rating summary are presented to the publisher. If the latter opts to revise and resubmit the game, the process is repeated from the beginning.

Although the ESRB rating system is strictly voluntary, unrated titles are usually not supported by game console manufacturers or carried by major retailers.

P. Konrad Budziszewski

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environmentalism

Video games arose during the late 1960s and 1970s around the same time as the growth of environmentalism, but their technological basis and digital and virtual nature did not make them likely candidates for involvement in the Green movement, so it was some time before the two found a connection. Today, however, they can be connected to the Green movement in two ways: through their form (because they consume energy) and through their content (which can be designed to teach and encourage Green ideas and practices).

As electronic devices that consume energy, home video game console systems should be turned off when not in use. A 2008 report from the Natural Resources Defense Council reported that many game consoles are left on continuously, and that more than 11 billion kilowatt hours a year of wasted energy, costing consumers over $1 billion, could be saved by turning them off (Horowitz, 2008). According to the report, of the three seventh-generation consoles, the **Nintendo Wii** uses the least energy at 16 watts, whereas the **Microsoft Xbox 360** uses 119 watts and the **Sony PlayStation 3** uses 150 watts. **Sony** does feature an online update that helps power management in the system, and both the Xbox 360 and the PlayStation 3 have auto-shutdown modes, but these have to be enabled by the user.

Some companies have designed their systems to be energy-efficient. San Diego–based **Zeebo** Inc. has produced the Zeebo console, which is aimed at consumers in emerging markets in Brazil, **India**, **China**, and Mexico, and which uses only 1 watt of power, making it by far the most power-efficient contemporary system. **Packaging** is another area in which costs to the environment can be reduced. Like the music **industry**, some games companies have reduced the amount of packaging surrounding their products, and on-line distribution of games has eliminated the need for packaging altogether.

Games also can encourage the Green movement by teaching and embodying environmentalist ideas in an interactive, **educational** format. Some of the earliest games that could be arguably connected to the Green movement would include ***SimCity*** (1989) and *SimEarth* (1990), which simulate environments and require players to manage resources to keep their cities and planets healthy. The design of *SimEarth* was even assisted by James Lovelock, author of the "Gaia Hypothesis," which looks at a planet's organic and inorganic elements as one big self-regulating system. Since then, a number of games have contained green themes, like *Awesome Possum . . . Kicks Dr. Machino's Butt* (1993), in which players collect recyclable bottles and answer questions about the environment, or *Oddworld: Abe's Oddysee* (1997) about environmental destruction. More recently, one can find Green games ranging from **casual games**, like **Nintendo**'s *Chibi-Robo Park Patrol* (2007) or National Geographic's *Plan It Green* (2009), to **serious games** likes the urban-planning simulator *IBM CityOne* (2010), or Red Redemption's *Climate Challenge* (2006) and *Fate of the World* (2011). Other games, like the **experimental game** *Flower* (2009), also can evoke green themes in more subtle ways, causing players to consider the natural world and our effects on it.

Mark J. P. Wolf

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ESRB

See Entertainment Software Rating Board (ESRB)

ethics

See morality and ethics

Europe (Central and Eastern)

Unlike the situation in **Western Europe**, the **United States**, or **Japan**, video games in Central and Eastern Europe have had quite a different **history**. The principal difference lies in a highly diversified historical, cultural, and linguistic background of the territory that comprises no less than 21 countries (Poland, Czech Republic, Slovakia, Hungary, and Slovenia in Central Europe; Russia, Belarus, Estonia, Latvia, Lithuania, Moldova, and Ukraine being considered part of Eastern Europe; and Albania, Bulgaria, Bosnia and Herzegovina, Croatia, Kosovo, Republic of Macedonia, Romania, Montenegro, and Serbia in Southeastern Europe).

The other key difference can be seen in a certain sort of "popular culture gap," because the citizens of Central and Eastern Europe as a whole have experienced very limited exposure to various forms of Western entertainment during the post–WWII era given the political decisions that split continental Europe into two parts for decades. Although the cultural and social landscape behind the former "iron curtain" may seem to be a homogenous one from the global perspective, many local nations still argue for more precise geographic distinction.

An example of the situation video games faced in the former Eastern bloc can be illustrated by their situation in the Czech Republic, a small country of 10 million that suffered heavily from Moscow-driven political conditions. Despite the country's lack of a market-based economy, quite a few people could enjoy the possession of video gaming devices, either purchased through special shops importing Western "luxury goods" (such as **Atari** and Commodore products) or acquired as a domestic hardware clone (such as a ZX-Spectrum compatible Didaktik Gama), causing a specific approach to video game culture. In the Czech Republic and other countries of Central and Eastern Europe, fan groups exchanged the relatively simple code of the **time** via brochures, whereas most of the games were stored on tapes or **cartridges**. Because **arcade games** (available in trucks cruising the country, equipped with coin-operated machines) were a rare occurrence, the ownership of a home computer was highly prized both among students and adult technological geeks from the crowds of parents or teachers. To cope with growing consumer demand, some state-owned enterprises turned part of their manufacturing capacity to assembling 8-bit systems—most of them being ZX-Spectrum clones—and engineers in Bulgaria, Yugoslavia, Hungary, Poland, Romania, and the Soviet Union also tended to construct their own hardware designs.

In the early 1990s, Central and Eastern European gamers and designers started to include more up-to-date technological advancements and video games programming as used in the rest of the **world**. Some time before, printed, low-circulation video game magazines also appeared, which often met with an enthusiastic and almost cult following of readers (accustomed to visually monotonous retail stores and public **spaces**), who appreciated both the derivatives of gonzo **journalism** and more serious writing style of which the British *Edge* magazine was a top example and a model to follow. The **design** and marketing of a universally accepted video game in Central and Eastern Europe also ran into the problem of language. As a consequence, only a handful of high-profile projects distributed in the English language have left their mark on the global gaming scene, while other creative efforts are often limited almost exclusively to the territories of their origin.

Perhaps the most significant video game and best-selling classic ever to come from this area is Alexey Pajitnov's ***Tetris*** (1985), which has become, along with its many versions and variations, synonymous with the puzzle game. During the 1990s and 2000s, other interesting video games emerged with a potential for global recognition. Russian game developers delivered two of the best, and most realistic, flight **simulators**: 1C's *IL–2 Sturmovik* (2001) and Eagle Dynamics's *Su–27 Flanker* (1995). Of the Ukraine's creative efforts, two standout titles were made by GSC Game World: an isometric view real-time **strategy game**, *Cossacks: European Wars* (2001), and *S.T.A.L.K.E.R.: Shadow of Chernobyl* (2007), a long-anticipated first-person **shooting game**. In Hungary, *Ecco The Dolphin* (1992), developed by Appaloosa Interactive (formerly Novotrade International) for SEGA, contributed to the action-adventure genre, garnering enormous popularity among both players and critics. Although relatively unknown in the **United States** and Western Europe, *Earth 2140* (1997), a Polish two-dimensional real-time strategy game by Reality Pump Studios, has proven to be on par with its more famous counterparts. More recently, People Can Fly's *Painkiller* (2004) and Techland's *Call of Juarez* (2006), both first-person shooters, were met with positive reception. In the Czech Republic, we can find at least two highly successful game titles: Bohemia Interactive Studio's *Operation Flashpoint: Cold War Crisis* (2001), a critically acclaimed tactical shooter that has even been adapted for the U.S. military combat training program, and Illusion Softworks's *Mafia: The City of Lost Heaven* (2002), an innovative third-person shooter with sales reaching 2 million copies worldwide.

Getting an overall picture of the history of video games in Central and Eastern Europe is complicated by the variety of different national languages in use and the sporadic appearance of video game researchers from these countries at Western game studies events as well as in English-language publications. However, some of the countries of the region have managed to promote video games (frequently referred to as **computer games** because of the historical predominance of computer-based gaming) successfully in everyday life. Good examples can be observed at the Enter Multimediale, a Czech multimedia conference with significant emphasis given to interactive culture (and video games in particular) or, in the past 20 years of *Computer Space*, an annual digital media and computer arts festival held in Bulgaria, and other local events involving video game culture (such as regular national pro-gaming tournaments and occasional meetings of academics or game developers) have also occurred and continue to grow.

Patrik Vacek

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Europe (Western)

When the first video games were launched, Western Europe was divided from **Eastern Europe** during the Cold War (1945–1991). Eastern Europe, including the Soviet Union, was far behind not only technologically but also in its mentality. Eastern Europe was mentally locked in a **time** stasis of a Marxist Industrial Society and consequently less able to comprehend or develop new ideas for art and entertainment in a postindustrial society. During the Cold War, this divide grew wider, and even today we find a division in Europe between former Soviet vassals and Western Europe.

Video game **history** is closely related to the history of computing technology. A pioneer in this area, British mathematician Alan Turing worked on software for the Manchester Mark I computer in the late 1940s and early 1950s. It was at this time while working with his former undergraduate colleague D. G. Champernowne that he began writing a chess program. The chess program was made for a computer that didn't even exist at the time, and lacking the necessary computer power, it was only presented by Turing, simulating the computer and taking about half an hour per move.

It wasn't until the 1970s that Europeans really tried taking up the challenge of combining computers and games. At this time, the Americans had already moved forward with games like ***PONG*** (1972). The **Magnavox Odyssey** was imported to the United Kingdom in 1973 and 12 other European countries in 1974. Many obscure European game systems appeared from 1974 into the late 1970s, such as the British Video-Sport MK2, the German Interton Video 2000, and the French Lasonic 2000, all of them inspired by Magnavox Odyssey and the system's relatively simplistic game mechanics.

In February 1980, the British inventor Clive Sinclair launched the ZX80, which was followed up by the much more popular ZX81 and later the ZX Spectrum in 1982. The ZX Spectrum had **sound** and eight-color **graphics** and came in two versions, either 16 kilobytes or 48 kilobytes, and it turned out to be a very popular game machine. During the early and mid-1980s, Sinclair Computers had a vast share of the European game computer market, but at the end of the decade, the venture ended due to a lack of invention, poor strategy and marketing, and consequently low sales. Most of the games for the ZX Spectrum were inspired by **arcade**-style gaming, although **adventure games** and **strategy games** were also made.

Some prominent video game designers came from the **game design** of **board games** and **role-playing games (RPGs)**. In 1975, Ian Livingstone and Steve Jackson founded the Games Workshop and made innovative games, creating *Warhammer Fantasy* (1983) and *Warhammer 40,000* (1987) that worked as inspiration for Blizzard's *Warcraft* (1994), *Starcraft* (1998), and ***World of Warcraft*** (2004). A series of Warhammer games was released during the late 1990s, and *Warhammer Online: Age of Reckoning* was released in 2008.

During the 1980s, Livingstone worked for Domark, which later merged with Eidos. In 1987, Les Edgar and Peter **Molyneux** founded the British video game company Bullfrog Productions that made innovative games like *Populous* (1989) and *Dungeon Keeper* (1997). In 1995, **Electronic Arts (EA)** acquired Bullfrog Productions and in 1997, Peter Molyneux, together with Steve Jackson, founded Lionhead Studios, creating games like *Black & White* (2001), *Fable* (2004), and *The Movies* (2005).

The Western European video game **industry** has been dominated by the big distribution companies in Britain and **France**. The British company Eidos (known for publishing games like *Tomb Raider* [1996], *Thief* [1998], *Commandos* [1998], *Hitman* [2000], and *Deus Ex* [2000]) and the three French distribution companies, Vivendi, Ubisoft, and **Atari** (formerly Infogrames), comprise the influential distribution companies in Europe. The two biggest distribution companies, SCi (founded in 1988) and Eidos (founded in 1990), merged in 2005 when SCi acquired Eidos. In 2009, the **Japanese** company Square Enix purchased Eidos and planned to change its name to Square Enix Europe.

Founded in 1983 by Bruno Bonnell and Christophe Sapet, Infogrames became a success, not only distributing games but also designing games based on European **comic books**. They acquired GT Interactive in 1999 and Hasbro Interactive in 2001. Hasbro Interactive owned rights to Atari, and a few years later, titles were sold under the widely known Atari brand. Via their Hasbro connections, they launched licensed *Dungeons & Dragons* games such as *Dungeons & Dragons Heroes* (2003), *Neverwinter Nights: Hordes of the Underdark* (2003), and *The Temple of Elemental Evil: A Classic Greyhawk Adventure* (2003). In 2008, Infogrames completed its acquisition of Atari, Inc., making it a wholly owned subsidiary, and the official name was changed to Atari in May 2009. At the end of 2009 the company was struggling with great losses despite having produced famous games such as *Alone in the Dark* (1992), *Rollercoaster Tycoon* (1999), and *Civilization III* (2001).

Ubisoft was founded in 1986 by five brothers of the Guillemot family. Ubisoft started out as the distribution arm of MicroProse and EA and soon was engaged in distributing games for the United Kingdom and **Germany** as well. They have been involved with titles such as *Rayman* (1995), *Prince of Persia: Sands of Time* (2003), *Far Cry* (2004), and the Tom Clancy video game series. They also committed themselves to **on-line games** with their involvement with *Uru: Ages Beyond* ***Myst*** (2003), *The Matrix Online* (2005), and the European and **Chinese** operation of *EverQuest* (1999).

Compagnie Générale des Eaux began in 1853 as a water company. More than a century later, in 1998, the company had the name Vivendi Games. Since then, it has played a major role in video game distribution in Europe with games from Blizzard Entertainment such as *World of Warcraft* (2004). In 2008, Vivendi Games merged with **Activision**, and the company is now known as Activision Blizzard.

Popular Western European game titles include *Hugo the TV Troll* (1990) from Denmark; *Tomb Raider* (1996) and the Lara Croft series of games from the United Kingdom; *The Settlers* (1993) from **Germany**; *Commandos* (1998) from **Spain**; *The Longest Journey* (1999) from Norway; *Hitman* (2000) from Denmark; *Anarchy* (2001) and *Age of Conan: Hyborian Adventures* (2008) from Norway; and *Eve Online* (2003) from Iceland.

Western European video game design is struggling with economic instability, and during the economic crisis of the first decade in the twenty-first century many video game companies had economic problems. The fragile situation will have to improve if there is to be a future of European video game design.

Lars Konzack

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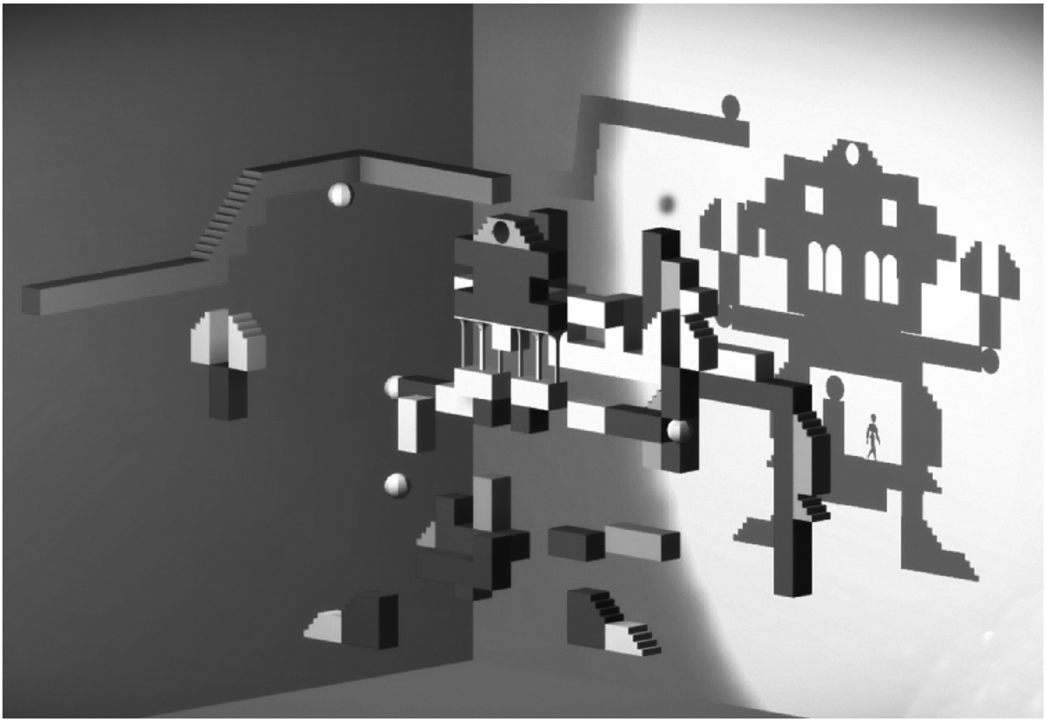
experimental games

Experimental games are, by definition, games that experiment with something that has not been tried before in the area of software, hardware, gameplay mechanics, theme, or some combination of these. As all of these are constantly changing, historical context must be taken into account when judging to what degree a game can be considered experimental.

In their earliest days, many video games were experimental. **Mainframe games** often introduced new ideas and implemented new gameplay mechanics as mainframe computers developed. Early **arcade games** and home video games also introduced new concepts and ideas, with the most successful innovations inspiring a host of imitations. Many **abstract games** of the **time**, which often had idiosyncratic forms of gameplay, could arguably be considered experimental games (like *Qix* [1981], *Quantum* [1982], or *Aztarac* [1983]). Only after the establishment of video game conventions could the term "experimental games" take on the more narrow meaning it has today, indicating a position outside of established conventions and, quite often, the commercial **industry** as well, because many experimental games are created as a part of **artistic** practice, similar to how experimental **film** and video exist alongside their companion industries (see also **art**, and **art, video games as**).

Games created as artistic practice outside of the commercial industry arose along with the means to create them; in the late 1970s and into the 1980s, home computers brought the technical means for game creation to an audience beyond professional programmers (see **homebrew games**). Some of these games were original games, and others were **game modifications** of existing titles. Such games continued to be created in the 1990s, some using **game engines** originally designed for commercial games, and the trend continued into the 2000s, including such subgenres as "indie physics games" (Camper, 2007, p. 198). With the appearance of the World Wide Web around 1993, **web-based games** became another venue for experimental game designers and one that could easily reach a larger audience. The web also made it easier for communities of experimental game designers and players to form, encouraging game production.

Experimental games include a wide variety of forms and content, sharing only a sense of innovation. Some artists are



A screenshot from SCE Japan Studio's *Echochrome II* (2010), which plays with three-dimensional objects and the manipulation of their two-dimensional shadows. (Mark J. P. Wolf)

technologically experimental, like Julian Oliver, whose game *levelHead* (2007) involves **augmented reality**; other artists use simpler technology and explore how games can express the human condition, for example, Jason Rohrer's games *Passage* (2007) and *Gravitation* (2008). The study of **game design** in university programs promotes innovation, and some experimental games find their way to release for major game systems like the **Sony PlayStation 3**, for example, games like Jenova Chen's *Flow* (2006, which began as an MFA thesis), and *Echochrome* (2008) by Sony's **JAPAN** Studio and Game Yarouze.

Mark J. P. Wolf

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F

Fairchild Video Entertainment System

See Fairchild/Zircon Channel F

Fairchild/Zircon Channel F

The Fairchild/Zircon Channel F was a second-generation (see **generations of technology**) video game **console**. Designed by Jerry Lawson and released in 1976 by Fairchild Semiconductor, it was the first **cartridge**-based home system. Originally named Video Entertainment System (VES), it was renamed to Channel F following the release of **Atari's Video Computer System (VCS)**.

Built around a Fairchild F8 CPU, operating at 1.76 MHz, the system included 64 bytes of main memory and 2 kilobytes of video memory. It could display **graphics** in eight colors (with up to four colors per line) at the resolution of 128 by 64 pixels (only 102 by 58 pixels were visible, however). **Sound** was produced through an internal speaker within the console itself. Hard-wired into the base were two unique hybrid **controllers**, combining **joystick** and paddle functionality into a unified design. The system featured two built-in games: *Tennis* and *Hockey*.

Launched with the price of $169.95, the system was moderately successful during the 1976 Christmas season. However, it suffered a sharp drop in sales after the release of the superior Atari VCS the following year. To compete with the new contender, Fairchild redesigned the original model and released it as the Channel F System II. The new design sported a smaller, sleeker case, used removable controllers, and eschewed the internal speaker in favor of mixing the **audio** signal into the TV output. By that point in **time**, however, the market had been flooded with increasingly obsolete dedicated consoles, sold at a loss to clear surplus stock (see **crash of 1977**). Unable to compete, Fairchild decided not to release the redesigned console and withdrew from the video game business altogether.

In 1979, the rights to the system and the entire unsold stock were acquired by Zircon International. The company released the System II in the United States, and licensed it for **European** markets. It was sold in Sweden as the Luxor Video Entertainment System, in Great Britain as the Adman Grandstand Video Entertainment Computer, and in **Germany** as the Saba Videoplay and ITT TeleMatch Processor. Zircon also released a new production run of games first published by Fairchild, as well as six original titles. All in all, 26 commercially released "videocarts" (cartridges) are available for the Channel F, some containing multiple games. Most of these were simple **adaptations** of traditional games, such as **sports games** (*Hockey* [1977], *Baseball*

[1978], and *Pro-Football* [1981]), card games (*Video Blackjack* [1976] and *Casino Poker* [1981]), **board games** (*Backgammon* [1977] and *Checkers* [1978]), puzzle games (*Maze* [1977] and *Memory Match* [1978]), or pencil-and-paper games (*Tic-Tac-Toe* [1976] and *Hangman* [1978]). The Channel F also received several clones of popular **arcade games** of the day, including *Desert Fox* (1976, based on Kee Games's *Tank* [1974]), *Space War* (1977, a ***Spacewar!*** [1962] derivative), *Lunar Lander* (1980, an adaptation of the **arcade** game by the same name), and *Alien Invasion* (1981, a *Space Invaders* [1978] clone). Perhaps the most original addition to the system's library was *Drag Strip* (1977), a **racing game** making use of the unique controller design to simulate gear stick and throttle (with an 8-way joystick and rotary knob, respectively).

The system was discontinued in 1984 when Zircon withdrew from the video game business in the wake of the industry **crash of 1983**.

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Famicom

See Nintendo Entertainment System (NES)/Nintendo Famicom

fandom

As an analytical term, "fandom" refers to the cultural domain of audiences that actively group around certain fiction such as a game, novel, **television** series or popular **music** and the products derived from them. Fandom based on such sources consists of various on-line and off-line communities, which have three defining features. First, fandom involves a highly interpretive community in which media products are analyzed and discussed. Second, these communities are also social communities in which individuals can establish relations with other aficionados. And third, fandom often involves a considerable creative function. Within fan communities, it is quite common for individuals to create their own stories (fan fiction) and artwork based on the sources they love. Other fans, in turn, read and evaluate these fan products.

The origin of the term "fandom" is rather unclear. Its earliest media citing appears in a sports column of the *Washington Post* on October 10, 1896. The word "fan," in turn, is an abbreviation of *fanaticus* or "fanatic," which has connotations of "fancy," religious zeal, and overactive engagement. The popular imagery surrounding fans tends to depict the fan as deviant, tragic, narrow-minded, or **violent** (Bailey, 2005; Jenkins, 2006). Such negative images of fans have been circulating for some **time**. These were argued against by the first scholars of fandom (Jenkins, 1992; Jenson, 1992). Early studies of fans aimed to portray fandom not as deviant, but as a creative, somewhat subversive lifestyle that is worth examining.

The first traces of fandom as an institutionalized phenomenon can be found in the

1930s when several literary fan clubs for the Sherlock Holmes novels were founded. In the 1950s, the institutionalization of fan practices continued with the founding of the first fan conventions: readers of science fiction would meet up in hotels to attend events such as panels, in which they could discuss the material with its creators or among themselves.

Although much has been written about the history of television fandom, the development of game fandom has scarcely been examined. Game fandom as such can be traced back to the 1970s, when the tabletop **role-playing game (RPGs)** *Dungeons & Dragons* (1974) was created and, along with it, a franchise. Players could, for instance, collect miniatures based on the game. Additionally, in the late 1970s live-action role-playing (LARP) was founded. This practice originated directly from the fantasy fandom and was based on tabletop role-playing games and literature.

Since the 1980s, video game fans started to program their own versions of video games, be it improvements, alterations, or entirely new games. With these **game modifications**, fans also boosted the development of video games. In this way, fans directly influenced the industry with their independent games or **experimental games** (Martin and Deuze, 2009). In fact, the **adventure game** genre itself originated in the late 1970s and arose from enthusiasts' experiments on mainframe computers (like Crowther and Woods's *Colossal Cave Adventure* [1976]) rather than from the industry (Aarseth, 1997).

Game fans are also often active in practices that originated in other kinds of fandoms. For instance, fans derive stories from games, so-called fan fiction, which has been a dominant practice in television fandom since the 1970s. Similarly, video game fans create their own fan videos which, in the case of video games, are called "**machinima**." Lastly, fans can dress up as characters from video games or other media. This is called "cosplay," short for costume playing, a form of performance that can be seen at many fan conventions, events, or meetings.

For some decades, fandom within all media was mostly limited to institutions such as conventions and fan clubs. In the 1990s, this changed when the World Wide Web became a communication platform. Through mailing lists, chat rooms, and message boards, it became easier to find other enthusiasts of a given series or franchise. Sites such as FanFiction.net (1998) were founded where fans could publish their fiction. At first, broadcasting networks perceived these fan activities as challenging terms of copyrights and some corporations thus took legal action to stop fan activities. More recently, networks and other institutions have become rather tolerant of fan activities and even encourage them.

Although fandom as a term is restricted to fans of a certain media product, being a fan often takes place in a larger framework. Fan communities typically include a variety of participants. Some may be a fan of various franchises or series; others may be very keen on one product or on one specific game of a series. Many fans show an affinity with a certain genre (such as animé or science fiction) or with a certain lifestyle rather than with just one series. They may, for instance, describe themselves as a "gamer," "geek," or "otaku," the latter being a term which refers to fans of **Japanese** popular culture.

Contemporary studies of fandom face two notable challenges. First, with the recent emergence of fan communities as a mainstream part of the on-line environment, the view of fandom as a subculture is challenged. Whereas fans used to be an exception as a creative, active audience, the recent participatory climate on-line—sometimes described as Web 2.0—motivates all users to show, create, and upload their own content. Recent studies show how problematic it becomes to define fan practices when they blend with general on-line practices (Jenkins, 2008) or youth culture as such (Ito et al., 2010). Second, fandom is a highly diverse phenomenon on-line and off-line. Fans make use of many **platforms** to discuss content and to upload their own texts, ranging from YouTube.com and DeviantArt.com to blogging systems or private chat channels. The products of fandom can be found at various off-line sites, such as fan conventions, although a poster in one's office can just as well be a signifier of fandom. Fandom provides a prime example of an active audience, but it also challenges views of how on-line and off-line audiences operate in general.

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FarmVille

FarmVille is a real-time farm **simulation game** that builds on the multiplayer possibilities of social software, namely Facebook, and can be characterized as a social game and a **casual game**. The game was launched by Zynga in June 2009 and copied many of the features of an already existing *Farm Town* (2009) game by Slashkey.

In 2010, *FarmVille* was made playable also on iOS and Android platforms.

The game is about managing both the simulated farm with crops, trees, and livestock, and the friendships that help in taking care of the farm. Neighboring friends' farms are **accessible**, and friends are able to help each other in different tasks and by sending gifts—such as decorations, animals, and trees—as these are sources of in-game currency and experience. Alongside succeeding in farming, the player can engage with the looks of the farm, which can be customized with thousands of items and by arranging these items in unique ways.

By 2010, *FarmVille* was the most popular application on Facebook, with a player base of more than 62 million active users. The game's fast growth can be explained by the already-existing networks on Facebook, because the game's status updates can become posted on a player's Facebook wall. Players can also easily invite their friends to be players. Furthermore, other Zynga games, including *Mafia Wars* (2009) and *Treasure Isle* (2010), cross-promote each other on their game websites. In late 2010, new tasks were added to *FrontierVille* (2010), the completing of which required specified success in *FarmVille*.

FarmVille remained in a "beta" state for nearly two years, and the game's development is heavily based on player statistics and feedback. Both the mechanics of the game and the available objects are changing constantly. For instance, the players wanted to include a way to harvest more than one plot of crops at a time; such a feature was added in to the game as a harvester that can be used to harvest several plots. One of the changing features of the game is the inclusion of seasonal, often **Northern American**, cultural references such as Thanksgiving and Valentine's Day decorations.

The various objects in the game can be purchased with "Farm Coins" or "Farm Cash." Both virtual currencies can be gained through gameplay: Farm Coins through harvesting and selling, and Farm Cash by gaining levels with experience points. Both types of currency are also available for purchase with real money. The prices for Farm Cash (FC) vary from $1 USD for 4FC to $100 USD for 650FC, as of late 2010 (a decorative lake costs 56 FC, which is worth about $10 USD). The currencies can be bought on the game website or as game vouchers in participating stores worldwide. Zynga has also engaged in in-game advertising with partners such as 7-Eleven.

The game has also participated in fundraising through special game items. After a major earthquake in Haiti in 2010, Zynga raised $1.5 million USD for a Haitian school by selling special nonwithering beet seeds and virtual school supplies. However, only 50% of the raised funds were used in charity, and some controversy has arisen around the type of charity work conducted. The game's success has also prompted a satirical response in the form of the game *Cow Clicker* (2010) by Ian Bogost, a game researcher and **designer**. Containing only its namesake activity, *Cow Clicker* mimics the allegedly simplistic gameplay of games such as *FarmVille*.

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5200

See Atari 5200

fighting games

The term "fighting game" refers to a genre that emphasizes close-range combat between two or more characters, usually with a martial arts influence. The goal is typically to deplete your opponent's **health** via various offensive abilities, the nature of which depends on the character being used. Each character also has a set of defensive abilities used to avoid, repel, or absorb attacks. The manner of offensive and defensive abilities varies from game to game, but the presence of both is a standard convention.

A single match in a fighting game often comprises a series of rounds, with a "first to" system for determining the winner. For instance, the first player to win two rounds is a common convention, although most home versions of various games allow the number to be changed. Rounds are commonly timed, and if **time** runs out, the winner is the player with the most remaining health.

Offense

In many fighting games, each character has access to a set of "basic" and "special" attacks. Basic attacks tend to be activated by a single button on a **controller** or **arcade game**. For example, in **Capcom**'s ***Street Fighter II*** series or **SNK Playmore**'s *King of Fighters* franchise, these buttons correspond to punches and kicks of varying speed and strength. Other games, notably the *BlazBlue* series and **Capcom**'s *Tatsunoko vs Capcom* (2010), use more generic button configurations that **map** to weaker or stronger attacks using punches, kicks, or weaponry. Other variations include **Namco**'s *Tekken* series, where four buttons are used for attack and are mapped to the character's four limbs. SEGA's *Virtua Fighter* series uses three buttons, with one for punches, one for kicks, and one for blocking.

Another common trope is the existence of "special" attacks, which are often activated through a combination or series of button inputs. These can be initiated in a variety of ways, such as pressing multiple buttons simultaneously, pressing a specific button in tandem with a directional input, or entering a series of directional inputs in quick succession followed by one or more button inputs. These allow for greater character individuality and are often more damaging and visually spectacular than basic attacks. Many games give each character a throw attack, allowing the player to grab the opponent and toss them in a chosen direction.

Furthermore, some games add one or more meters for each character, which can be depleted in a variety of ways. The most common example is a meter that slowly fills as a character takes damage, and when full enables the character to perform an even more powerful and spectacular special move.

Defense

In many fighting games, the attacks described here will strike an opposing character in a variety of ways and places. A kick delivered while ducking will hit lower than one delivered while jumping, for example. This forms the basis for a game's defense system. The most common defensive mechanic is a simple block, usually activated through directional input or a separate button. Blocks greatly reduce the damage delivered by an attack, although not completely (the resulting damage is referred to by players as "chip damage," because the effect is seen as chipping away at a character's health). A block is usually considered "high" or "low," meaning that it is effective against attacks at the same height but ineffective at attacks at other heights. Some games include a "middle" height as well, resulting in minor variations. For example, in many *Street Fighter* games, an attack at middle height can be blocked high or low. Throws are typically unblockable.

Although blocking is present in nearly all fighting games, several franchises have implemented other defensive mechanics. Tecmo's *Dead or Alive* series features an elaborate system of counterattacks that rewards a player for correctly guessing the height of an incoming attack and responding appropriately. Capcom's *Street Fighter III* series includes a parrying system that lets players deflect attacks and immediately counterattack.

Characters

The most identifiable feature of a fighting game is the cast of available characters players can choose from; many games and franchises come to be identified with prominent characters, for example, Ryu from *Street Fighter*, Nina Williams from *Tekken*, Sub-Zero from *Mortal Kombat*, and Terry Bogard from *Fatal Fury.*

In a game, characters are often very different from each other, differing in offensive and defensive capabilities, speed, size, and overall style of play. For example, in *Street Fighter II***,** Zangief is slow, strong, and powerful at very close range. Dahlsim is also slow, but weaker and more effective at long range. This difference arises from the nature of each character's basic attacks (Zangief's tend to be slower and stronger, while Dahlsim's limbs stretch, giving him added range), as well as their special attacks. Early fighting games would often include several "clone" or "palette swap" characters to save on memory. In early *Street Fighter* games, Ken and Ryu are nearly indistinguishable aside from the sprites used. In the early *Mortal Kombat* games, Scorpion and Sub-Zero are nearly identical, except for minor graphical differences and different special moves. In these franchises, such early technical limits have been incorporated into the fictional **worlds** in which the games take place. For example, Ken and Ryu are said to have trained together under the same master, thus explaining their similar fighting styles.

Although many fighting games are designed around one-on-one matches, two common team variants exist. In the first, players select two or more characters each. After each round, the winning character stays in, and the losing character is replaced by another character from the same team. Once all of a team's members have been defeated that team loses. This method of team **play** can be seen in several *The King of Fighters* games, as well as the *Capcom vs SNK* series. Another popular variant allows players to pick a team of characters and then freely switch between them throughout the course of the match, with the goal being the defeat of all the opposing team's members. This mode is present in all of the *Marvel vs Capcom* games released to date. *Tekken Tag Tournament* (1999) modifies this mechanic in that only one character from a team must be defeated to win.

Spatial Configurations

Another key element in a fighting game is the **space** or arena in which the fight takes place. Two-dimensional fighting games such as the *Street Fighter*, *King of Fighters,* and *Guilty Gear* series take place on a flat plane, with the characters shown in side view. Movement is restricted to the horizontal and vertical planes: characters can walk back and forth, jump up, and crouch down. Several *Fatal Fury* titles add a second plane located behind the first that characters can jump back to. The depth this creates is limited, however, because characters cannot occupy the space between the two planes, but can only pass through it.

Three-dimensional fighting games offer a greater variety of spatial configurations. In later *Tekken* games, the characters can move any direction in a predefined space, although that space does have limits. Characters are almost always facing each other, which creates an effect similar to fighting on a flat plane. This is similar to *Virtua Fighter*, although several entries in this series allow players to knock each other out of a predefined "ring," which results in a victory. The *Powerstone* series takes place in three-dimensional spaces, and the characters can run freely in all directions much more fluidly than in *Tekken* or *Virtua Fighter*.

Several games feature what is referred to as "2.5 D" graphics, which refers to configurations wherein the characters and backgrounds are rendered in three dimensions, but the gameplay only takes place in two dimensions. These games typically have a side perspective, thus resembling two-dimensional games. Examples of this type include *Super Smash Bros.* (1999) and *Street Fighter IV* (2009).

History

The first game in the genre is generally considered to be *Karate Champ* (1984), an **arcade game** released by Technos **Japan** Corporation. (Although earlier games such as **Cinematronics**'s *Warrior* [1979] and **Activision**'s *Boxing* [1980] featured basic genre tropes, notably one-on-one combat within a confined space, they are not often cited as part of fighting game **history**. This is due to their top-down perspective, lack of defensive game mechanics, and the fact that they were not inspired by Asian martial arts. In this respect, the term "fighting game" refers to a relatively narrow set of games.) Many current genre conventions were established when Capcom released *Street Fighter II* to arcades in 1991. Although this title built on the earlier *Street Fighter* (1987), it was much more successful, leading to a period of explosive growth in the genre. Soon after came **Midway**'s ***Mortal Kombat*** (1992). The game was very controversial in the **United States** because of its **violence**, particularly the "fatality" moves that allowed a character to kill an opponent after winning. These moves were very **graphic**, often featuring dismemberment and large quantities of blood, albeit with a slight sense of dark humor. Japanese developer **SNK** released several fighting games in this period, notably *Fatal Fury* (1991), *Art of Fighting* (1992), and *Samurai Showdown* (1993). Another fighting game milestone was SEGA's *Virtua Fighter*, released in 1993 and the first in the genre to feature fully three-dimensional characters.

During the mid-to-late 1990s, the genre's popularity in the United States began a rapid decline. New games were still being released at a fairly continuous rate, but none approached the success of *Street Fighter II*. The reason for this decline is generally considered to be a combination of two factors. The first was the oversaturation of the market: after *Street Fighter II*, many developers pushed imitations to market. Most of these imitators were unpopular, usually due to poor quality and because they were perceived as little more than attempts to cash in on a current fad. The second major reason was increasing complexity: as the genre evolved, the games required players to learn more commands, game mechanics, and systems, thus increasing the barrier to entry and narrowing the viable audience to the most dedicated players.

Even so, during this time several major games were released. SNK began its now-iconic *King of Fighters* series in 1994, starting a tradition of annual releases that would last until 2003. *The King of Fighters* existed alongside SNK's other franchises (notably *Fatal Fury, Samurai Showdown,* and *Last Blade*), including characters from each. That same year Namco released *Tekken* to the arcades and the **Sony PlayStation**. *Tekken* featured three-dimensional characters and placed heavy emphasis on long, complex combos. Arc System Works released *Guilty Gear*, a new two-dimensional franchise, in 1996. *Soul Blade*, another three-dimensional game by Namco, was released in 1997 and later evolved into *SoulCalibur*. During this period, the *Street Fighter* and *Mortal Kombat* franchises also saw a number of releases. Capcom was particularly prolific, releasing games in the two-dimensional *Street Fighter Alpha, Street Fighter III,* and *Marvel vs Capcom* series. *Mortal Kombat* switched to three-dimensional graphics with *Mortal Kombat 4*, released in 1997.

Despite the large quantity of games being released, fighting games (particularly two-dimensional games) stayed in decline through the early 2000s. However, beginning in 2008, several releases began to reinvigorate the genre in the United States. That year Capcom released *Super Street Fighter Turbo HD Remix* for the **Microsoft Xbox 360** and **Sony PlayStation 3**. This was a rebalanced version of *Super Street Fighter II Turbo* and featured new high-definition **art** and on-line play. In 2009, they followed with the long-awaited *Street Fighter IV*, which saw enormous success. Also that year, Arc System Works released *BlazBlue*, a new franchise and spiritual successor to *Guilty Gear*, to significant critical acclaim. Although it was less well received, SNK Playmore released *The King of Fighters XII*, which also featured a high-definition graphical overhaul.

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film

The **history** and evolution of video games as a medium and an **industry** is inextricably intertwined with film. Both have origins as coin-operated boardwalk entertainment, with film evolving from simpler technologies such as the camera obscura and Edison's Kinetoscope, and video games evolving at least in part from midway attractions such as shooting galleries, pinball, and other games of chance and skill. Although both have roots in **arcades** and the nickelodeons, they also share an evolution from simple attractions into technically advanced, **narratively** and **artistically** sophisticated forms, and their respective industries have similarly struggled for social acceptance and legitimacy as their financial significance has grown. However, as the solidification of the film industry and the blossoming of the film medium came several decades before the commercial viability of video games, it has been perhaps inevitable that film, both as commerce and as **art**, has overshadowed video games to an extent that only recently has begun to be reversed. As computers have become more powerful, affordable, and available, and as the video game industry has shifted from the destination-based medium of arcades to the home-based medium of **consoles** and computers, the video game industry has likewise shifted from a lesser and sometimes ancillary role to film into an equal and competitive generator of intellectual property, income, and social commentary.

The film industry was an early adopter of video games as a source of inspiration, directly in the **adaptation** of stories and characters from games to film, but also in understanding the burgeoning importance of video game art and culture. The results have not always been artistically or commercially successful. Initially, films based on or generally concerning video games have also tended to display the imbalance of position between the two industries. Whereas films like *Tron* (1982), *The Last Starfighter* (1984), or *The Wizard* (1989) reflect the growing significance of video games by prominently featuring video game players in their narratives, the tendency is to portray those characters as socially awkward and the medium as essentially adolescent, with much of the narrative conflict depending on the main character's transition into a more vibrant and respectable reality by leaving video games behind. Similarly, early attempts to translate video games into film were largely the domain of low budget productions, with films such as *Super **Mario** Brothers* (1993) or ***Street Fighter*** (1994) attaining a certain critical notoriety for their artistic limitations.

Likewise, a segment of the video game industry has depended directly on film adaptation, with game development studios attempting to turn a narrative form into compelling gameplay. This has produced a wide range of results, from early attempts like the now-legendary failure of **Atari**'s *E.T.: The Extra-Terrestrial* (1982) to later, more successful games like *The Chronicles of Riddick: Escape from Butcher Bay* (2004). The regular widespread production of video games based on films is now a thriving, if artistically disputed, sector of the video game industry. Similarly, films based on video games have ranged from B-film legend Uwe Boll's *In the Name of the King: A Dungeon Siege Tale* (2008) based on the series from Microsoft and 2K or *Postal* (2008) published by Ripcord Games, to the financially viable though lukewarmly reviewed *Resident Evil* film series based on **Capcom**'s horror franchise of the same name. Nearly every major action film release, particularly the summer blockbuster, is accompanied by a video game version, usually shipped simultaneously. Although some critics deride the quality of these games, the commercial success of games such as **Activision**'s *Spider-Man* series or Ubisoft's *King Kong* (2005) guarantees that video games will continue to have a close relationship with movies.

Most major non-film-based video game successes are also quickly optioned for film adaptation, even if the films never reach the silver screen. Seen in that light, the coevolution of film and video games has seen a gradual shifting from film overshadowing video games and essentially treating them as ancillary products to the film intellectual property (IP), toward a more equally footed situation in which ideas, commerce, and developers begin to flow back and forth between the two industries. The growing tendency to develop creative IP by simultaneously planning for film, video games, and other media, or the emphasis on franchises as comprehensive fictional **worlds** or sources from which numerous media products can evolve, has led to what Henry Jenkins refers to as "convergence culture" (Jenkins, 2), the emphasis being that media, audiences, and content are converging upon each other, rather than being treated as discrete products (see also **subcreation**).

Nevertheless, comparisons between the two industries are still lopsided affairs. Despite the common myth that the video game industry is larger in terms of annual revenue than the film industry, in truth, the film industry continues to dwarf the video game industry. It is difficult to estimate a single figure for gross or net profits from the global film industry, in part because of its massive scope and in part from the general reluctance of film companies to release hard numbers on their net profits. Similarly, drawing direct comparisons between the film industry and the video game industry is an imprecise comparison because the film industry includes home video sales, TV and cable distribution, licensing, and other revenue sources beyond box office sales. Indeed, as Toby Miller et al. (2001) note, "theatrical exhibition accounts for barely a quarter of Hollywood's global revenues" (p. 8). Figures do not account for other national film sectors, whereas the video game industry to date is still largely based on one source of revenue, the game itself, whether it is distributed via hard media like a disk or on-line. Opportunities for ancillary profits, though growing, are far fewer. The pervasiveness of the false claim that the video game industry was larger than the film industry led Douglas Lowenstein, then head of the Entertainment Software Association (ESA), to claim in 2005 that "it has never been true. . . . In truth, the worldwide film industry stands at about $45 billion and the worldwide video game industry checks in at around $28 billion," numbers that seem to be based on box-office sales versus software sales. If the additional sources of revenue available to film companies, particularly the larger conglomerates like Sony and Time Warner, were included in those figures, the gap between industries would grow considerably.

The influence of film on video games is clear. Although video games have origins in part in midway and carnival games, the hard origin of the medium based directly on computer technology owes a great deal to science fiction film tropes. ***Spacewar!*** (1962), often credited as the **first** interactive computer game, features a duel between two spaceships in a direct analogue to popular science fiction films of the era. Similarly, popular games of the **arcade** era such as ***Space Invaders*** (1978) and *Asteroids* (1979) clearly owe a debt to the science fiction film boom of the 1970s and 1980s. However, many of the great successes of the video game industry exist separately from film tropes, with an emphasis on ideas and gameplay that seem to owe little to film. From early sports **simulations** like ***PONG*** (1972) to novel creations such as ***Pac-Man*** (1980) or *Donkey Kong* (1981), the film industry seemed for a time to be following behind the video game industry and, if anything, looking to it as a source of easy, if not always successful, inspiration. As movies based on video games, and video games based on movies, became a standard for each industry, the clear lines between the two industries increasingly blurred.

With the video game industry **crash of 1983**, in which numerous major players collapsed or experienced severe reduction, many film companies backed away from video games in general, spurred in part by critical and commercial flops such as Atari's *E. T.: The Extra-Terrestrial* (1982). Tempted by the success of home video game releases like *Space Invaders* and *Asteroids* and anticipating enormous sales based on the blockbuster success of the Spielberg film, Atari's parent company, Warner Communications, itself a branch of the Warner Bros. movie-based entertainment conglomerate, directed the company to rush the production of the game for the market-dominant Atari home **console**. As sales of *E.T.* and similar low-quality titles stalled at launch, Atari suffered $536 million in losses. Warner Communications sold Atari in 1984, and millions of *E.T.* cartridges were buried in the New Mexico desert (Kent, 2001, p. 240). Other film-based companies followed suit, divesting themselves of holdings in video games as the industry went into a long decline in the 1980s, particularly in the arcade sector.

The trend of the film and video game industries coming together and then separating continued over the following two decades. Synergy between film and video games, although attractive on the surface, faces several immediate challenges. Early video games were conceptually obligated to film but tended to focus on gameplay over other factors such as narrative content or **graphic** quality. Part of this was directly due to the computational limits of early video game hardware. With limited means, early games necessarily focused on interactivity over story or graphical capacity. Early experiments in making games more like movies—such as **laser-disc games** *Dragon's Lair* (1983) or *Space Ace* (1984)—offered film-quality graphics and animations, but gameplay was limited to a series of memorized choices made through the **joystick**. Playing the game became a matter of knowing the correct order of joystick moves, with no variation or skill required beyond memory and timing. However, as computer capacity has grown, so has the ability of video games to offer film-quality graphics while maintaining a film-like narrative through voiceover content and cinematic **cut-scenes**. It is perhaps not a coincidence that most media conglomerates are now solidly invested in video games once again, with major film companies like Disney, Warner Bros., and Paramount growing their interactive divisions, while at the same time, companies that started in electronics and video games, such as Sony and Microsoft, are increasingly involved directly in film production or are aggressively licensing their IP for film adaptation, as with Peter Jackson's now-shelved *Halo* film project. As films come to rely more on computer-generated images and the tools used to create video games become more sophisticated and require more computational power, the two industries are converging along lines of technology and labor as well, with the software being used to create film effects often being the same used to create video games, and the practitioners of those skills able to move more freely back and forth between the two industries. This will most definitely have a direct effect on the convergence of the media as ideas are shared across industries. Similarly, the industries continue to share in advancing software and hardware technology, a case shown most clearly in the hardware wars between Sony and its Blu-ray technology on one side and Microsoft's backing of HD-DVD. The outcome of that competition bore consequences not only for home video sales but also for the video game industry as the means of distributing console games.

Film industry influence is only one thread among many in the overall evolution of the video game as an industry and as a medium. However, the undeniable ongoing role of film as a source of both inspiration and finance is a crucial factor for understanding both the history and the contemporary position of video games. ***See also*** silent film.

Trevor Elkington

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film, silent

See silent film

"first" video game

Determining what video game can be called the "first" involves defining what exactly one means by "video game," which itself depends on definitions of "video" and "**game**." Both terms have definitions ranging from precise technical or conceptual criteria that narrowly define them, to broader, popular usages that tend to be very inclusive and loosely defined, yet have an effect on the ways video games are produced, marketed, and used.

The earliest recorded idea for an electronic interactive game can be found in **United States patent #2,455,992** for a "Cathode-Ray Tube Amusement Device," from 1948. The device described did not get beyond the prototyping stage, nor did it produce a video signal, which, by a strict definition, would have denied it the status as a "video" game even if it had gone to market. Likewise, most **mainframe games**, such as versions of Tic-Tac-Toe or Chess, did not produce a video signal or use any kind of pixel-based imaging, and Willy Higinbotham's electronic experiment *Tennis for Two* (1958) used an oscilloscope to produce its imagery and also did not produce a video signal. Also, early **simulation games** like *The Management Game* (1959) used computers but were mostly text-based and are generally not considered "video games" by today's standards.

One mainframe game, ***Spacewar!*** (1962) by Stephen Russell, J. Martin Graetz, Alan Kotok, and Wayne Witanen, is probably the most often cited as the first real video game, as it was written for the PDP-1 computer and used a cathode-ray tube as its display (although it used vector graphics, not raster graphics). *Spacewar!* also influenced the **industry** that was to follow because it inspired the first coin-operated video game, ***Galaxy Game*** (1971), as well as the first mass-produced video **arcade game**, ***Computer Space*** (1971), and the first two commercial **vector games**, **Cinematronics**'s *Space Wars* (1977) and **Vectorbeam**'s *Space War* (1977).

In 1951, inventor Ralph **Baer** had the **idea for home video games** that could be played on a **television** set while **designing** and building a TV set at Loral in New York. He returned to the idea in 1966, when he wrote a four-page description of a home video game system, for which he received a patent in 1967. Baer created a series of prototypes over the next two years, the last of which became the first **Magnavox Odyssey** system, which became the first home **console** game system in 1972. The Odyssey began the home video game industry and was also an inspiration for ***PONG*** (1972), the first hit **arcade** game.

The definition of "game" also demarcates what will be considered a video game (see **game, definition of**). This usually requires such things as **play** according to **rules**, some kind of valued outcome (such as a win or high score), and a competitive or **cooperative gameplay** situation or, in the case of single-player games, a challenge to be overcome. Although they may be popularly considered as games, some programs such as ***Myst*** (1993) and those of the ***Sim* series** do not contain all the elements that a very strict definition of "game" might require, nor would certain programs used for the purpose of **education** qualify, such as *Mario Teaches Typing* (1991). However, by broader, more loose definitions found in popular usage and by software marketing departments, many of these programs are referred to as games. Some argument can be made for their inclusion, insofar as they use similar displays and **interface** devices as video games, and contain challenges that require skills and problem-solving abilities, much as games do, and that fact that they are "played" in a manner similar to games.

Mark J. P. Wolf

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France

From the 1990s "French Touch" to Ubisoft's international development, video games in France have grown into a major sector of entertainment. During the late 1970s, arcade games and the first home ***PONG*** systems (such as those from Radiola, Pathé Marconi, and Occitane Electronique) were selling in France, introducing the video game as entertainment in cafés and domestic places. In the 1980s, electronic games on personal computers were the most popular **platform** for French gamers: **Nintendo** Game & Watch or Asian ersatz distributed in France by Lansay or Ludotronic; the French computer systems TO7 or MO5; and the American and British standards, Apple II, Commodore 64, Amstrad CPC, Amiga, and Atari 520 or 1040. The first French computer and video game magazines were published in the 1980s, including *Tilt* and *Virus Informatique*, which gave BASIC programs for coding games or testing new applications. In the late 1980s, **Japanese** toy company Bandai introduced the **Nintendo Entertainment System (NES)** into French territory. At the same time, Virgin was selling **SEGA** systems such as the **SEGA Master System** and the **SEGA Mega Drive** (the Japanese and **European** name of the **SEGA Genesis**). Progressively, games companies raised their own subsidiaries to control their distribution in the French market as a component of the European market. Retail companies such as Micromania and Score Game appeared in the early 1990s, as French publishers like Infogrames, Ubisoft, and Cryo began to become active in the international marketplace. In the 2000s, Nintendo, Sony, and Microsoft shared the French gaming market with the dominant **Nintendo Wii** system.

French creativity hit the world during the 1990s with what the international press named the "French touch." Behind this label were **game designers** and game producers including Philippe Ulrich (designer of *Captain Blood* [1988], Infogrames), Eric Chahi (*Out of This World* [1991], Delphine Software), Frédérick Raynal (*Alone in the Dark* [1992], Infogrames), Michel Ancel (*Rayman* [1995], Ubisoft) or David Cage (*The Nomad Soul* [1999], Eidos Interactive). The hallmarks of the "French touch" include an interest in voiceover narration, complex game **worlds**, and the use of cinematographic techniques such as rotoscoping or **motion capture**.

Since the early 2000s, the French government and other French institutions have shown a great interest in the video game **industry** and culture. In 1992, the National Library of France became one of the first international public establishments to compile a collection of digital documents, including video games. During the late 1990s, the first preservation associations, such as MO5, worked on gathering old systems and conserving software, creating some exhibitions and meeting public institutions to found a national museum of video games. The Ministry of Culture honored a few game designers, including Philippe Ulrich in 1999, Shigeru Miyamoto, Michel Ancel, and Frédérick Raynal in 2006, and Peter **Molyneux**, Eric Viennot (*In Memoriam* [2003]), and Antoine Villette (*Cold Fear* [2005]) in 2007. In 2003, the first national school of video games, Enjmin (located in Angoulême), was announced by Prime Minister Jean-Pierre Raffarin. In the academic field, French research work first focused on **psychological** approaches to video games in the 1990s, after which the fields of sociology, communication, **film** studies, political science, philosophy, and geography began to take an interest in video games. Nowadays, video games are no longer considered as purely entertainment in France but as a cultural domain and more, even called the Tenth **art**, following cinema, which was defined by Riccioto Canudo as the Seventh Art in the 1920s.

Alexis Blanchet

G

Galaxy Game

In the early 1970s, several influential projects were inspired by MIT's ***Spacewar!*** (1962). For example, Nolan **Bushnell** began working on *Computer Space* (1971), whereas two years earlier, in 1969, Rick Blomme wrote a two-player version of *Spacewar!* for the PLATO (Programmed Logic for Automatic Teaching Operations) time-sharing system at the University of Illinois. A common element in these projects was the goal of creating a multiplayer, competitive game like *Spacewar!* that could be deployed in promising new environments for computer or video games, such as **arcades** or on-line networks.

At Stanford University, a recently graduated student from the Stanford Artificial Intelligence Laboratory (SAIL), Bill Pitts, and his friend, Hugh Tuck, began work on a coin-operated ("coin-op") version of *Spacewar!* during the summer of 1971. *Galaxy Game* was developed for the newly released PDP 11/20, DEC's first 16-bit computer. DEC had fit the PDP 11 into a relatively small box and listed it for a mere $20,000, hoping thereby to open "new markets and new applications" (Pearson, 1992). Pitts and Tuck saw an opportunity here and formed a company called Computer Recreations. They acquired the low-end version of the PDP-11 for only $13,000 and reprogrammed the PDP-10 version of *Spacewar!* so that it would run on this machine. Including a Hewlett-Packard 1300A electrostatic vector display, walnut-veneer cabinet, and other parts, their total expenses came to roughly $20,000. *The Galaxy Game* was faithful not only to *Spacewar!*, having been developed from this game's software code, but also to the player community (university students and computer engineers) and technical configuration (software code, **vector** displays, timesharing, etc.) that had produced the original game.


This *Galaxy Game* (1971) arcade console was restored by Bill Pitts and Ted Panofsky in 1997. (Gio Wiederhold/Stanford University)

In September 1971, Pitts and Tuck installed *Galaxy Game* in Stanford's student union, two months before the release of Bushnell's *Computer Space*. It therefore appears to be the first installed coin-op video game, whether based on computer or **television** technology. A later version of the game that supported up to four monitors (eight players) remained at the same location until 1979. A restored version of *Galaxy Game* was displayed between 1997 and 2000 in the Gates Computer Science Building at Stanford University and is currently available at the Computer **History** Museum in Mountain View, California.

Henry Lowood

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Game Boy

See Nintendo Game Boy

game, definition of

At first glance, it might seem that defining the word "game" would be a foundational issue for **video game studies**. In practice, though, it makes more sense to view this act of definition as a foundational claim in an argument. Within a complex, interdisciplinary field experiencing an influx of practitioners from other disciplines, the act of defining "game" is a rhetorical strategy. It is a way to recognize one's assumptions carried over from previous study, a way of constraining the following discussion, and sometimes a way of claiming that one's writing is itself foundational.

Katie Salen and Eric Zimmerman begin their exhaustive introductory text to the study of **game design**, *Rules of Play*, with a justification for their focus on definitional claims. They hold that building a stable vocabulary "establishes a critical discourse" that facilitates training, generational transfer, audience-building, and a buffer against criticism (Salen and Zimmerman, 2004, pp. 2–3). They see definitions not as objective truths but as tools for the work of designers and scholars. Salen and Zimmerman execute a comparative study of the efforts of eight previous writers to define the term, spanning the 20th century (Salen and Zimmerman, 2004, pp. 73–80). This creates a matrix of elements highlighting those aspects of "game" that tend to repeat across disciplines.

Perhaps the only nearly universal inclusion in contemporary definitions of "game" is its rule-based nature. Even a number of authors that interpret games as a form of symbolic textual artifact recognize the fact that, at their core, games are composed of procedures for establishing a game's **space**, permitting certain actions, and specifying what results those actions will have on the current game state (for example, see Geertz, 1973, pp. 421–432 and 437–441). All other clauses in a definition of game seem to be important primarily for the purposes of distinguishing games from alternative modes of **play** (drama, puzzles, or "free" play) and other rule-based systems (such as those of natural law and social law).

Salen and Zimmerman finish their study by condensing the matrix, "whittling away the unnecessary bits" to formulate their own definition: "A game is a system in which players engage in an artificial conflict, defined by **rules**, that results in a quantifiable outcome" (Salen and Zimmerman, 2004, p. 80). Their general agenda is to remove all aspects of the definition that they see as contentious, ideological, or experiential. The result is as democratic a definition as any, but it is possible that their whittling of the unnecessary may sterilize what makes each source definition truly interesting.

Of the authors surveyed in *Rules of Play*, only Greg Costikyan explicitly refers to games as works of **art**. Although one can understand how Salen and Zimmerman would want to remove this outlier from their definition, it is important to question exactly why Costikyan would include it in his own. As the years since the writing of *Rules of Play* have shown, the formal classification of games as expressive works has become a major issue of contention within the **United States**—to pick an obvious example, the question of whether video games have constitutional protection as acts of speech was raised in 2010's *Brown v. Entertainment Merchants Association*. Furthermore, the definitional status of games as art is something that a number of developers in many countries take personally, reiterating the need to sometimes look beyond the formalist construction of words.

One aspect of some definitions of "game" to recently undergo major revision is Johan **Huizinga**'s "**magic circle**" of play, holding that games create a protected space separate from the ordinary **world** (Huizinga, 1971, p. 10). Vestigial notions derived from specific play communities become abstracted over time, and we can see that the contemporary idea of a game's necessary artificiality is derived from earlier concepts such as that of the magic circle. The common element between these two formulations is the emphasis on a reduction of real-world consequences within the space of play, or what James Paul Gee calls "psychosocial moratorium" (Gee, 2007, p. 59). Mia Consalvo argues, against a definitional artificiality and the magic circle, that the ordinary rules of life do apply in games, "but in addition to, in competition with, other rules and in relation to multiple contexts" (Consalvo, 2009, p. 416).

Another point of contention is whether a game must be entered into voluntarily. By removing this specification, one muddies the waters between games and other procedural systems such as legal, political, and economic constructs that are often entered into involuntarily. Although recent examples from the genre of alternate-reality games show that it is sometimes the case that players can stumble upon a game without complete knowledge that they are participating, it is a valid question whether this participation can actually be called "gameplay" rather than whatever it is these would-be players think they're doing—arguing on web forums, solving puzzles, piecing together a story, and so on. The same question holds in the case of someone being forced to play a game.

The question of whether or not a "quantifiable outcome" is a necessary element of the definition has also arisen in a number of recent debates. One traditional view is that the inclusion of a quantifiable outcome is what separates a game from a toy or from informal play. And in 2010 the "Notgames Initiative" banded together, seeking an alternative to the overwhelming number of video games that heavily emphasize explicit goal-setting and win/loss conditions. Yet it is by no means clear that someone playing with a toy might not formulate goals and a quantifiable outcome, nor that a digital artifact fitting all other common specifications for being a game suddenly becomes "not a game" simply because it does not distinguish winning from losing.

Finally, we might ask whether we can identify a hard definitional difference between "game" and "video game." Many authors simply recognize that the computer is able to keep better track of complex game states, provide instant feedback for player action, and connect players across the globe. On the other hand, Miguel Sicart asserts a single element to clearly distinguish the two: "when games use a computer to uphold the rules, it is not possible to discuss the rules during play" (Sicart, 2009, p. 27). This means that traditional games feature conventional enforcement of rules by the players, whereas computers materially enforce the rules as specified in code, altering gameplay both formally and experientially.

Simon Ferrari

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game design

Game design is the conception and realization of interactive systems that produce contexts for strategic and quantitative outcomes. The natural design activity, present in many professional activities, is a driving force for innovation and change in our societies.

In the mid-eighteenth century, the two meanings of "design," suggesting both the pre-production and the development phases of an artifact's creation through design practice, were established in the French language: *dessein* (literally "purpose," the idea) was dissociated from *dessin* ("drawing," as a recognized art practice). "Design," which goes back to the Latin *de* and *signare* (to mark out, set apart, or give significance by assigning it to a use, user, or owner), can then be understood as a sense-making activity.

The practice of game design is the design of systems of meaning, established by a set of **rules** and procedures to apply them. This explains why game design is considered a second-order design problem: players enacting those rules are engaged in the experience of **play**, which the game designer crafts only indirectly. However, that the rules do not formally define player's overarching gameplay experience does not imply that those rules cannot fashion the player's informal experience (that is, experiences that are not a part of the official, prescribed, or customary way of doing things); for example, through thematization or suggestions about specific play practices such as **cheating** or meta-gaming.

Pragmatically, in the video game **industry**, the most essential thing that a game designer does is to provide, for the development team that will collaboratively produce a new video game, a description of what the game should be like. The game designer's aim, therefore, is the communication of a specific game design proposal, or game design document. This design must be fluid: like a living system, a game transforms over the course of its development cycle. This upkeep of the game documentations and the promotion of a communal vision of the game project is often the duty of the game designer, if a creative director does not assume this responsibility.

A game designer may also draw concept sketches, create other art assets, and even design part or all of the game **world**, building game levels. Game designers can execute a wide variety of tasks on a game project and contribute to the programming, management, and production of a video game. However, their central concern always remains the same: to create the form of the gameplay, and interaction, which differentiates the video game medium from other media. Briefly defined, gameplay is the degree and nature of the interactivity that a game includes. Usually repeated over and over throughout the game, the elemental activities of the player can be decomposed in experiential building blocks called "core mechanics." The gameplay procured is often a basis for the formation of player-driven communities. It does not consist of how the game's world is represented graphically or what **game engine** is used to render that world, even if technology plays an important role in determining the nature and qualities of the game's **spaces**. Game design requires the conception of a possibility space, concretized through the design of both a system of rules and an organized space delimited by boundaries, within which the game is played in relative freedom. Another key task of the game designer is to define the win-and-loss states that indicate what must be achieved to close the game, and a quantifiable outcome necessary to consider it a game, according to traditional definitions. The interaction between the player and an input device allows the player to control elements within this definite game space.

Player interaction and **interface** are modeled on three levels: human-to-technology interaction, human-to-game interaction, and human-to-human interaction. These interactions are defined by rules that describe what happens when different components interact during the game sessions. Game components are resources: commodities of limited availability with values fixed to them, like money, population, land, health, and so on. In some games, resources are part of economic systems that do not always refer to currency but to large collections of items that form the game system.

A highly interdisciplinary practice, game design involves collaboration between a large team of expert designers in visual design and **sound** design, as well as production design, and programmers and writers: modern video games are complex and laborious to create. On the other hand, the design of smaller independent games, **mobile games**, and **casual games** may encourage a jack-of-all-trades design practice in tightly knit design teams. Accordingly, game design requires a broad range of artistic and technical expertise as well as good writing and collaborative skills because that seems more to the point. Game designers must speak the "languages" of many fields, and learn, integrate, and share information with their colleagues. This allows game designers to see the possibilities and constraints of their design to receive feedback—as it will become increasingly difficult to see their creation objectively throughout the game development—all while maintaining an inspiring team spirit.

The design of a game, as with any other product of human culture, is about understanding initial limitations, then turning those constraints into advantages that drive forward the design process where problems and solutions often develop together. A game is designed through an iterative design process: a sequence of modifications to the rules and behaviors of game components following a cycle of modeling, play testing, and modifying after analysis. Through iterations, game designers, acting as advocates for the players must attain the right balance among challenge, choice, and fun. One way game designers balance the strategic choices players have in games is through the use of degrees of randomness. The amount of challenge and the difficulty of the obstacles a player must cross to reach the goals set by the game rules must be balanced just right—neither too hard nor too easy to overcome.

Challenging games are meaningful leaning experiences: games are played to improve a repertoire of skills, even if most exercises are limited to a game context. Still, in the best games, lessons learned from gameplay can be applied to other aspects of life, such as problem solving, socializing, or spatial skills, even if players do not realize it. One way a video game communicates is through the different rewards or feedback regarding the player's performance. The meaning conveyed by game actions resides in the relationship between these actions and their outcomes, which must be immediately perceivable and integrated into the larger game system as a whole. Over the course of play, all decisions present and future must feel connected to previous ones.

The integration of formal elements of the game system into the fictional game world may create a meaningful experience that cues the player into understanding **rules**. Fundamental dramatic elements like challenges are found in all games. If well implemented in the game rules during the design process, more elaborated stories and dramatic techniques like premises and well-rounded characters may also explain the abstract elements of a game system, thus enriching the overall play experiences by creating a deeper sense of involvement for the players.

Vincent Mauger

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Game Developers Conference (GDC)

The Game Developers Conference (GDC) is an annual professional conference for developers of **computer games** and video games, traditionally held in the spring in San Francisco. The conference consists of a combination of discussion panels, workshops, lectures, and presentations focused on the development of computer games and video games, along with **industry** awards, an expo, and other events. Participants in the GDC include game designers, programmers, artists, marketing and other professionals in the game industry. The GDC is a smaller conference than the Electronic Entertainment Expo (E3) and, unlike E3, is geared specifically toward games development rather than the larger game industry.

The conference was founded by game designer Chris **Crawford** and first held in 1987 as a meeting of 26 developers in San Jose as the Computer Game Designers Symposium before being renamed the Computer Game Developers Conference (CGDC). Ernest Adams functioned as director of the conference from 1991 until 1995; according to Adams, the original meeting of CGDC was inspired by an event called the Artists' Symposium hosted by Trip **Hawkins**, cofounder of **Electronic Arts (EA)**, for EA employees. In 1995, the CGDC was sold to Miller Freeman, Inc. (later renamed United Business Media Limited; UBM), and the CGDC was renamed to the GDC in 1999. UBM also publishes *Game Developer Magazine* and operates the website Gamasutra.com.

The GDC hosted the first Game Developers Choice Awards in 2001 (formerly known as the Spotlight Awards, begun in 1997), in conjunction with the **International Game Developers Association (IGDA)**. The Game Developer Choice Awards are peer-nominated awards that are now awarded annually and include categories for innovation, **game design**, technology, and lifetime achievement. The Independent Games Festival (IGF) was founded in 1998 as part of the GDC to recognize and highlight independent and student game developers and includes events such as the IGF Awards and the Independent Games Summit (first held in 2007).

As part of the CGDC in 1994, Adams established the Computer Game Developers Association, now the International

Game Developer Association (IGDA), to function as an advocacy organization for game developers. The IGDA now operates as an independent entity for purposes of professional development and support for game developers, as well as meeting and awarding scholarships at the GDC. Starting in 2009, UBM initiated several conferences based on the GDC model, including GDC Austin, GDC Canada, GDC China, GDC Europe, and GDC Online.

Christopher Hanson

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game engines

There are many forms of game engines available for professional and hobbyist game development and modification, but there are defining characteristics shared by all engines. As a section of the software code that enables the game to run, a game's engine is not directly concerned with particular elements in the game **world** (what in development are referred to as the game's "assets," such as sprites, models, textures, audio, and so on) but with allowing and enabling the use of those assets inside the game. An engine, then, may commonly handle issues such as how the image is rendered to the screen (sometimes described as a **graphics** engine, a subset of the game engine), how objects interact with one another (sometimes described as a physics engine, a subset of the game engine), communication between computers on-line or through local area connection (LAN), or how the code relates to various forms of input devices. The game engine, therefore, is responsible for controlling the behavior on which a game is then built. How dialogue text and **audio** is stored, recovered, and presented to the player, for example, may well be a matter handled by the game engine, whereas the specifics of plot, story, **narrative**, or the individual phrases used would not be. How we see what we see on screen is controlled and determined by the game's engine, but what we see is not, as the differences between games built on the same engine demonstrates.

Professional developers may substantially adapt, rewrite, and add to the code of the game engines they deploy across different games, but the basic underlying engine often remains the same in a fashion more or less invisible to the player. A clear example of the difference in games built on the same engine would be that between **id Software**'s *Quake* (1996) and Valve's *Half-Life* (1998), in which the look and feel of the two games varies greatly, despite their both being first-person **shooting games** and their shared engine technology. Although built on a modified version of the Quake GoldSrc engine, which added complex physics properties among other changes, *Half-Life* produced a very different **play** experience much praised for its embedded narrative elements and richly imagined world. Valve has subsequently gone on to recognize the significance for both a player community and commercial exploitation of engine development distinct from game development and has released the Source engine, developed for subsequent releases of *Half-Life*, both commercially and for hobbyist modification.

It is crucial to recognize the difference between games and engines, despite the origination of many engines that are developed for a specific game. Some game engines, such as Criterion Software's RenderWare, had no flagship commercial title associated with them and were always seen as what is termed "middleware" in software development (sitting between the finished consumer product and low-level code intended for use by other professional developers), but others, such as the Epic Games *Unreal Tournament* series (and its Unreal 1 [1998], Unreal 2 [2002], and Unreal 3 [2007] engines) or the *Far Cry* series (and associated CryEngine [2004–2010]) have released full commercial games while using their potential for player **modification** as a key selling point.

Although it might be argued that the production of any game necessitates the inclusion of a game engine, the development of game engines that are not specific to an individual game and are used as part of the code of multiple games has come as a result of the increasing complexity and expense of game development. Being able to transport a substantial section of code across different games has obvious economic benefits for developers in reducing the person-hours required to produce each individual game, for example. Similarly, the economic benefits of building a game on existing code, rather than starting each project from scratch, mean that developers such as id Software, Crytek, or Epic have been able to capitalize on the development of an engine that might be more profitable when licensed to other developers than in simply selling its standalone titles. Distribution of a game's engine with a retail release has also been seen as a key tool for increasing sales, particularly over the medium and long term, with developers benefitting from the distribution of community and user-created content that increases the available content associated with a game and adds longevity to a purchase at relatively low cost to the developer.

When most players and hobbyists encounter game engines, they are usually accompanied by tools that allow an individual with less technical knowledge to build working games. The Aurora Engine developed by Bioware, which was included with the **role-playing game (RPG)** *Neverwinter Nights 2* (2006), for example, included all the requirements to build a game with a moderately user-accessible **interface** and toolset. The initial availability of game engines to player communities had been through the personal computer, with PCs allowing a common interface shared by both developer and consumer and focused on the first-person shooter (FPS) as a genre. The popularity of user modification on PC, however, has since led to the retail release on other platforms of games that are essentially carefully packaged engines with a user-friendly interface that also include creation tools that aim to lower the barrier to content creation.

Examples include *Little Big Planet* (Media Molecule, 2008, developed for the

Sony **PlayStation 3** and then the PlayStation Portable [2009]) and *Wario Ware D.I.Y.* (2009). At the same time, there are a number of game creation tools (often for games with two-dimensional graphics) distributed freely or sold as software that are effectively game engines in that they include much if not all of the code you would expect to find in an engine. Examples include *Game Maker* (1999), *RPG Maker* (1992), and *Adventure Game Studio* (1997), and for iPhone development, *GameSalad* (2009).

Barry Atkins

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game genealogies

A game genealogy traces the design and idea for a video game back through a series of precursors and innovations that reveal the conceptual history behind the game's final incarnation. Such connections can trace the rise and expansion of **game designs** and genres as a series of variations and additions, each building on what came before it, acknowledging the influence of a game's many predecessors.

For example, one can trace the roots of Namco's *Galaga '88* (1987) back to Ralph **Baer**'s early home video game prototypes. Baer's 1968 "Brown Box" video game system prototype featured a ping-pong game, or "TV Tennis" game, which would eventually be released on the **Magnavox Odyssey**, the first home game system. On May 24, 1972, the Magnavox Odyssey was on display at the Airport Marina in Burlingame, California, where it was seen and played by entrepreneur Nolan **Bushnell**, the founder of **Atari**. The Odyssey's tennis game inspired the arcade game ***PONG*** (1972), which Atari released a few months later. Bushnell and his employee Steve Bristow wanted to create a single-player version of *PONG*, and by replacing one side of the screen with a grid of bricks, and rotating the screen a quarter turn, came up with the design for *Breakout* (1976), which Atari then produced. *Breakout* went on to inspire Japanese game designer Tomohiro Nishikado to create a similar game with a space theme (a science fiction touch influenced by the film *Star Wars* [1977]) in which the grid of bricks was replaced with a grid of aliens (the design of which was influenced by tentacled aliens of *The War of The Worlds* (1953) film adaptation of H. G. Wells's book) and allowed the player-character and the aliens to shoot at each other. Nishikado's game, ***Space Invaders*** (1978), inspired the design of **Namco**'s *Galaxian* (1979), designed by Kazunori Sawano, who added a wraparound screen (which first appeared in ***Spacewar!*** [1962]), colored sprites, and enemies that would occasionally charge down at the player-character (*Tempest* [1981] was also inspired by *Space Invaders*). *Galaxian*'s success led to a sequel, Namco's *Galaga* (1981), which added such features as enemy tractor beams, a capturable ship, the ability to shoot more than one projectile at a time, and a recurring "Challenging Stage." *Galaga* itself inspired a sequel, *Galaga '88* (1987), which included even more new features such as enemies that begin as eggs, canisters that are collected to allow the player-character to move to new dimensions, a double ship that can be captured, and background images from the game *Bosconian* (1981). Thus, *Galaga '88* can be seen as the descendent of several video games, its genealogy reaching back two decades and into works from other media as well.

Mark J. P. Wolf

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game guides

A video game strategy guide is a printed or digital manual with instructions on how to **navigate** the **play** of a specific video game. The content of a strategy guide is more detailed than a **game manual** and is usually broken into several chapters that each deal with a different aspect of gameplay. Some of the common sections found within a guide are chapters that explain game mechanics such as **controllers** and menus, **walkthroughs** that show what the player must do in sequence to complete the video game, details on items that can be found and equipment that can be used, information about computer-controlled opponents and characters, equipment used by players and their opponents, and appendices for important statistics, gameplay goals (such as achievements or trophies), and inventories of game items. The organization or inclusion of the sections is not standardized. Other information may be included or some of the sections just described may be excluded. Guide content can vary greatly depending on the type of game being covered or the quality of the information presented.

The term "strategy guide" is most accurately applied to documents that include more than one section of information on a video game. A document with just a walkthrough or dealing with only enemy statistics and tactics is usually not considered a complete "guide."

Two companies, Prima Games and Brady Games, currently dominate the market for printed, standalone strategy guides. Magazines and websites, such as GamePro and IGN.com, offer guides for many games as well. Prima Games is credited with publishing the first standalone strategy guides in book form in 1990, a series of "Game Secrets" books that compiled information for the **Super Nintendo Entertainment System (SNES)**, **NEC PC-Engine/TurboGrafx-16**, **Nintendo Game Boy**, and **SEGA Genesis**. Magazines had published similar information previously, but Prima was the first company to compile and sell guides as books. Several companies followed suit, peaking in the mid-1990s with a crowded marketplace that included imprints such as Brady Games, Versus Books, Nintendo Power, and DoubleJump.

In the early years of strategy guide publishing, the guide companies, if they could not secure an official license, would release unauthorized guides. These were hastily created postrelease using retail versions of the games and avoided use of screenshots from the actual game or official **art**. This practice was frowned on by video game developers and challenged when **Nintendo** took legal action against Prima Games in 1997 over an unauthorized guide for *GoldenEye 007* (1997) for the **Nintendo 64** system. The case, settled out of court, actually opened up the relationship between developers and the top strategy guide publishers.

The practice now is for developers to treat game guides like other licensed products based on their IP (intellectual property). Guide publishers pay a fee to license the right to create a book based on a video game. In return for this fee, the publishers are granted early access to game code as well as official game art and other support such as documentation.

As unauthorized guides became less common, the pendulum swung the other way, and multiple official game guides would be published for a single video game title. Developers would license the rights to several guide publishers who would create competing guides. Consumers could find as many as four game guides for a single video game title. For example, Prima Games, Brady Games, Versus Books, and Nintendo Power all published game guides for *Super* ***Mario*** *Sunshine* (2002) for the **Nintendo GameCube**.

The game guide industry contracted when Versus Books folded in 2003 and Nintendo Power decided to focus on magazine publication instead of stand-alone guides. This left Brady Games and Prima Games with a few smaller publishers that generally covered niche games.

The licensing deals between the two major publishers and video game developers have shifted to long-term exclusive contracts. For example, Prima Games has been the exclusive publisher of Nintendo first-party game guides, whereas Brady Games has an ongoing relationship with Blizzard Entertainment.

The two publishers have lost exclusivity as well over the years. The license to create **Capcom** game guides, for instance, has switched hands a few times over the years, residing with Brady Games as of early 2011. Some video game publishers continue to offer licenses on a game-by-game basis. It can also be the case that a game developer retains the rights to license a game guide even though its publisher has an exclusive deal with one of the guide publishers.

When a license is granted, the book publisher is then responsible for the writing, **design**, and layout of the game guide. The game developer is contractually obligated to give support, but this can vary from title to title. At the very least, the game guide publisher gets a beta version of the video game to work from.

A writer, or team of writers, will begin to play the game and create the text of the guide. A **graphic** design team, usually working with art supplied by the developer, will create the page design and lay out the text once it is finished and edited. Screenshots will be taken from the game, and **maps**, either created by the game publisher or supplied by the developer, will be labeled and polished for inclusion in the guide.

The finished product will be reviewed by the video game developer (often by the testing group involved with the project), which will check for accuracy and for brand alignment (correct terminology, tone, etc.). Due to the schedules for printing the game guides, final files for the book must be at the printer several weeks before the release of the game. It can therefore be the case that the guide writers are not working from a final copy of the game. The developer review is to ensure the book is as accurate as possible to the retail game.

In recent years, the focus of guides has begun to shift toward offering more exclusive content that may not be directly related to the playing of the video game. Examples include developer interviews, production art reproductions, developer studio tours, or other behind-the-scenes material. Plus, a greater number of hardcover collectors' edition game guides have appeared in recent years, in response to the availability of strategy and walkthrough information on-line. Guide publishers have leveraged their relationships with game developers to obtain material that cannot be mined from the games themselves, thereby creating unique, physical artifacts of the game experience. Game publishers also offer electronic versions of their guides as well as pay-to-access Web sites.

Mario De Govia

game manuals

A game manual is typically a printed booklet of less than 50 pages that is packaged with the software. The manual explains the basic operations a player will need to know to begin playing the video game and covers such topics as game installation, **controller** maps, saving and loading, basic movement, legal text and warnings, and other options available. Some manuals also include a brief précis of the game's storyline and characters or other game **world** content to help orient a player in the game's environment. Unlike a **game guide**, a game manual does not provide detailed instructions for how to complete the video game.

The history of the game manual goes back to **board games**, and game manuals accompanied early video game hardware such as the **Magnavox Odyssey** (1972), which came with a 36-page manual that included detailed connection and game instructions. With overlays for the TV and physical game pieces (including play money and "frosted tape"), the Odyssey games were somewhat involved undertakings. The Atari Home *PONG* system (1975), with its very limited game choices, only gave directions to attach the system to the customer's television, with a few paragraphs dedicated to the mechanics of playing the game itself.

With the appearance of the **Atari VCS 2600** in 1977 and the resultant boom in video game development, game manuals showed the controls and unique gameplay elements of their products. **Graphics** were rudimentary, but to differentiate their colored digital block graphics from those of other companies developers would create hooks such as exciting titles and short backstories for their games. These stories were typically rudimentary, needing no more than a few paragraphs to give a **narrative** context to the action onscreen. The manual for ***Adventure*** (1979) for the Atari 2600, with its sword-and-sorcery game world of 31 screens, has four paragraphs of story, and yet *Super Breakout* (1978) for the Atari 2600 also has four paragraphs of narrative context as well, despite its simple and abstract gameplay. Other manuals of the time, like the one for *Pitfall!* (1982), gave more information regarding character motivation, but not much.

Similarly, the simple controls of the Atari 2600 usually did not warrant very many instructions for playing the games. There were a few exceptions; *Stellar Track* (1981), which also had only four paragraphs of narrative context, had 17 chapters of explanations of how to play the game, and Activision's *Space Shuttle* (1983) had a 32-page game manual and special overlays for the console itself. Players had to use almost every switch on the 2600 console to control their shuttle flight which required a much more detailed booklet of instruction.

The **Mattel Intellivision** (1980), **Colecovision** (1982), and **Atari 5200** (1982) consoles introduced more complex controllers, with keypads and more than one button to complement the joystick. With the added complexity of the controls, more involved instructions were necessary resulting in larger game manuals overall. Often the video games would still only have the barest hint of a plotline.

The launch of the **Nintendo Entertainment System (NES)** also heralded a change in video game manuals. The booklets continued to give controller instruction, but with a more complex game world possible the world building information could also be expanded. The most extreme and popular example of this was the game manual for *The Legend of Zelda* (1986); the first 10 pages include a full introduction to the game world and a hint-filled summary of the game story complete with illustrations. The 48-page manual includes almost all the same type of information as a modern strategy guide, with the exception of a full walkthrough.

During the late 1980s, game guides were not available so several video game manuals followed the example of *The Legend of Zelda*. Most noteworthy was the release of *Phantasy Star II* for the SEGA Genesis in 1990. The video game box included a standard instruction manual but also came with a 113-page hint book and a poster **map**.

Home **computer games** during this time were more likely to be packaged with robust instruction manuals as the game types were often more complex than those that could be developed for home **consoles**. However, as game guides (also known as strategy guides) became popular and the Internet became more accessible, game manuals have tended to constrain themselves to the basic functions described above.

Even with the more involved narratives possible in modern games, game world information is often no more than a page in the game manual because a story can be told completely during the **play** of a game through dialogue, action, and cinematic **cut-scenes**. For example, *Fallout 3* (2008) is a **role-playing game (RPG)** with more than 100 hours of gameplay and a massive storyline, yet the manual only allots one page out of 45 to backstory, although the game manual's text and design hints at the atmosphere of the game's postapocalyptic world. *Mass Effect 2* (2010), another role-playing game with a sprawling story and multiple characters, has only a four-sentence paragraph of backstory in its manual. In games with highly interactive gameplay that reveals story, characterization, and history of their environments, discovery of these narrative elements is key to the entertainment value of these games, so they are not revealed in the manuals.

Perhaps the most involved game manuals in the modern era of video games are those for **massively multiplayer on-line role-playing games (MMORPGs)**. The ***World of Warcraft*** (2004) game manual is 114 pages long and incorporates highly detailed instructions on how to use the game's systems as well as over 40 pages of game world information. Even with such a large game manual, the complex systems involved in playing *World of Warcraft* have warranted several stand-alone, full-sized game guides and uncountable numbers of on-line guides.

Game manuals will continue to evolve along with the games they represent, either by going fully on-line along with the games they accompany or by being completely integrated in gameplay through tutorials.

Mario De Govia

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game modifications

Game modifications, or "mods," are the ways in which players alter the artwork and other content of video games. Understood broadly, it also covers hardware and **interface** modifications. A "modder," then, is a person who creates mods. Such modifying requires a degree of technical skill and may focus on the **sound**, **graphics**, **maps**, mechanics, **narrative**, game modes, or physics of the game. From the player's perspective, a mod can, for example, offer new items or characters to play with.

Modifications fall into wider categories of custom content, user-generated content, and player **co-creativity**. Mods are sometimes called "add-ons," which is a general term used when referring to optional extensions of software. Furthermore, specific kinds of mods have their own names. Alterations of character and item graphics are known as "skins." "Skinning" is thus about creating the images, or textures, that a game program wraps around three-dimensional character models, also known as "meshes," in the process of three-dimensional rendering.

Those mods that stand alone as new games altogether are called "total conversions." The most famous mods are those that have also been known as independent games and may be released as retail products. First-person **shooting games** have been an especially good breeding ground in this regard. *Counter-Strike* (1999) is one of the most famous mods and an extremely popular total conversion. It was created as a *Half-Life* modification by Minh "Gooseman" Le and Jess "Cliffe" Cliffe in 1999 and later expanded into a series of games. *Half-Life* (1998) itself was originally a mod of *Quake II* (1997), but unlike *Counter-Strike*, created as a commercial product by two former Microsoft programmers, Mike Harrington and Gabe Newell. They founded Valve Software and built *Half-Life* using the *Quake* **game engine** (Kücklich, 2005).

Valve has had an impact on *Counter-Strike*'s distribution as well. After *Counter-Strike* was published within a player community, Valve soon teamed up with its developers and a retail version of the original mod was published in 2000. According to Valve's sales figures, *Counter-Strike* had sold 4.2 million copies by 2008 despite its availability as a free download for years. In 2003, Valve also released *Steam*, an on-line distribution, communication, and multiplayer platform. Such a platform enables fans and independent publishers to make their mods more available.

Varying from independent skins to total conversions, content modifications differ in the degree to which they change the original game. Instead of adding new content, some mods unlock material that already exists in the original. A mod unlocking the "Hot Coffee" **minigame** in ***Grand Theft Auto:*** *San Andreas* (2004) is such example. "Hot Coffee" is also an example of how mods may affect the rating of the original game; because it represents sexual intercourse between the game's characters, the mod's release triggered reconsiderations in regard to the age rating of the original game.

User interface (UI) mods are yet another type of mod. Typically, a UI mod allows a more efficient way to perform certain commands. The majority of these mods are for **massively multiplayer on-line role-playing games (MMORPG)** and add functions that were not originally implemented in their interfaces. For example, an interface mod may allow the player to use the game's map in a new way or offer shortcuts to specific items such as weaponry.

Hardware modifications require knowledge of the game hardware and include installing modification chips ("modchips") into game systems. Hardware modding usually involves game **consoles** and is done to enable the use of unlicensed, and sometimes illegal, software such as copied games (see **piracy**) and third-party software, including **homebrew games**. The main function of a modchip is to replace or override the game system's protection hardware or software against the use of such media. Because the spread of modchips has affected the sales of legally manufactured and distributed games, the games **industry** has taken measures to reduce their use. For instance, Microsoft has banned the modded **Xbox 360** from using on-line gaming services, and the installing of certain modchips has been made more complicated.

Content modifications appear controversial because of possible copyright infringements. The games industry has approached modding in various ways, with some people attacking the modding communities and others openly supporting such creativity and sharing. Many companies encourage modding with free modifying tools, and a number of games in the late 2000s, such as *Little Big Planet* (2008) and *Spore* (2008), were actually created with the expectation that players would contribute significantly to content creation. *The Sims* (2000), with its mod-inspired expansions and two sequels, has developed into a modder-friendly game inspiring the latest sequel, *The Sims 3* (2009), which integrates the creation of skins into the actual game product and results in the blurring of the line between gameplay and modding.

Mods are often offered as free downloads on-line on hundreds of modding Web sites. These websites' fora, especially those maintained by game publishers, often concentrate on a specific game, but large all-encompassing modding databases also exist. Mod DB, created by Scott "INtense!" Reismanis in 2002, is the largest general modding website. The website gathers together thousands of mods for numerous platforms and games as well as tutorials, videos, news, and information on games, and it is now owned by a private company, DesuraNET Pty Ltd.

Profits and other kinds of benefits in regard to mods are complicated because they involve questions of copyrights on one hand and potential exploitation of free labor on the other. For example, the economic importance of players' creativity has been openly acknowledged by The ***Sims* series** creator Will **Wright**. Content mods aid the industry by extending the lifetime of games because they are being elaborated with new objects, levels, or quests, offering the industry the benefits of free labor. Modifying is also a source of innovation and inspiration for the industry (Sotamaa, 2007). Although those who create mods rarely see profits from them, mod-making is a useful form of training for future game developers because it often involves similar teamwork as commercial game development; for example, the development team Home Front's mod for *Battlefield 1942* (2002) was composed of 27 members (Postigo, 2007).

Finally, game modifications created as independent **art** pieces are often targeted toward different audiences than the players of the original games and presented at art galleries and other such venues. One of the earliest artistic works is Julian Oliver's *The Quilted Thought Organ*, or *QTHOTH* from 1999 through 2001, which explored the possibilities of performing experimental music with first-person shooter **game engines**. *Velvet-Strike* (2002) by Anne-Marie Schleiner, is an antiwar in-game graffiti collection for *Counter-Strike*. Dan Pinchbeck's "Dear Esther" mod for *Half-Life 2* (2004) is an interactive narrative that has been acknowledged for its storytelling and **world** and was selected for exhibition at the 2008 Ars Electronica animation exhibition. Another work, *PainStation* (2001) by Volker Morawe and Tilman Reiff, turns a ***PONG*** (1972) **arcade game** into a two-player game in which a failure to return the ball to the opponent is "punished" with a real physical electroshock. *PainStation* has been widely exhibited around the world—at the MOCA Taipei and MoMA New York, among other museums. Such examples demonstrate the multitude of mods being created by players and artists, who approach video games from a variety of angles.

Hanna E. Wirman

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game world

See world (of a video game)

game writing

The textual content of video games, and the narrative situations they produce (as **abstract** or minimal as they may be) are shaped in many ways. Depending on the type of **narrative** and the game genre, approaches to writing differ greatly from each other, from the casual **platform** game to **massively multiplayer on-line role-playing games (MMORPGs)** written to be never-ending and played for years; furthermore, the methods through which story materials are communicated to audiences are diverse and intertwined within a complex game development process. This multifaceted aspect of narrative in games, combined with their interactive context, adds to the inherent complexity of the game writing practice.

The writing of video games narratives differs significantly from the writing of narratives in traditional media like **film** or **television**. Whereas narrative practices are codified and consensually agreed on in some artistic disciplines, the evolutionary flux characterizing video game narrative conventions, correlated to rapidly changing technological innovations, could take decades to stabilize. This explains the relative lack of solid models for great game narratives.

Video game writing has much in common with screenwriting and fiction writing (such as characters, viewpoints, or dialogue, and dramatic situations), yet some codes, expectations, and limitations are unique to the medium of video games and relate to technical writing (like coding). Screenplays, novels, and short stories mostly present paths fixed in their material; all their textual mechanisms are left in the readers' hands and minds. In contrast, video games are all about dynamic **adaptation** and reactions to players' choices and performances. Table-top **role-playing games (RPGs)** also involve player choices, but they are written to be open experiences directed by game masters who may ad-lib on the fly, if players outrun them. Such improvisation out of thin air is impossible in video games: narrative elements must be defined in advance to be communicated, or its potential to support players' narrative elaborations must be present in the game structure beforehand.

To write for video games, then, one must conceive of a closed system scripted in such a way so as to keep players satisfied within the confines of a limited set of actions that the game writer must anticipate in advance. This can be a considerable task in larger and more complex games. A video game script, then, must also be sufficiently adaptable, accounting for the actions that a player is likely to try during gameplay and, at the same time, constrained enough to fit within the specific technological limitations of software and hardware.

Although game writers may guide the way games convey narrative information and integrate action sequences and **cut-scenes**, their main task is the codifying of narrative information. They write dialogue and script events and compose any other texts that are needed. Interactive script formats are varied and may be a mix of general script, programmer script, voice actor script, and translator script, all of it augmented by artist and animator references. Game writing is not the same discipline as **game design**, although this is a frequently held misconception resulting from the close connection between a game's narrative and the maintenance of a consistent vision behind the game. Yet game writers do not create video games; they produce assets needed for them, and their connection to gameplay means that they must immerse themselves in game design documents. Game writers are a part of the whole game development team, they may write in groups or on specific pieces of vast narratives, and may be contracted as freelancers too.

Vincent Mauger

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GameCube

See Nintendo GameCube

GameLine

See CVC GameLine Master Module

gameplay

See play

Gamers Outreach Foundation

Gamers Outreach Foundation is a nonprofit organization that uses interactive entertainment to promote social interaction and raise money for charity. The organization was founded by Zach Wigal and Nick Russell in 2007. The Gamers Outreach Foundation was created after public safety officials cancelled a scheduled *Halo 2: Combat Evolved* (2004) tournament at a high school in Saline, Michigan. The event had been planned by Saline high school students, Zach Wigal and Nick Russell. The two students had been previously issued a permit enabling them to use the high school's cafeteria as a space to hold the tournament. Three hundred students were expected to participate in the event.

After a local police officer (and member of the Parents' Television Council) protested the tournament, due to *Halo 2*'s "mature" rating, the permit was rescinded out of concern for public safety. The cancellation of the tournament caused controversy in the community, and the conflict made the front page of Saline's local newspaper and eventually spread to various **television** news outlets.

Encouraged by many after the setback, Wigal and Russell set out to host their own tournament, with the intent of raising money for charity and to illustrate the positive aspects of interactive gaming. Working under the title of *Gamers for Giving*, they organized a *Halo 3* (2007) tournament. More than 500 participants attended the tournament, and the event raised approximately $15,000 dollars, $4,000 of which was donated to the local chapter of the Autism Society of America. After the success of the event, the Gamers Outreach Foundation was created. Gamers for Giving continues to be hosted annually as a nonprofit competitive gaming event.

The Gamers Outreach Foundation offers two unique programs that provide interactive entertainment to those who may not otherwise have access to it: Project GO Kart and Fun for Our Troops. Project GO Kart uses portable gaming kiosks called Gamers Outreach Karts to offer gaming to hospital patients who may have limited **access** while confined to hospital grounds. Fun for Our Troops provides gaming care packages to U.S. soldiers serving overseas. A third program, Gaming4Others, provides both **on-line game** tournaments and community game nights to raise money for a variety of charity organizations.

Gamers Outreach Foundation is funded by its annual charity events, charitable donations, on-line tournaments, and various sponsorships from local businesses. The foundation continues to hold events and is currently managed by a board of directors comprised of Zach Wigal, Rusty Wigal, Nick Russell, and Dave Walsh.

Aaron D. Boothroyd

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Gamers for Giving Web site, available at http://www.gamersforgiving.org/.

Gamers Outreach Foundation Web site, available at http://gamersoutreach.org.

games, philosophical critique of

Since Greek antiquity, philosophers have commented on the role of **play** in human development, often in **moral** or ethical terms. For example, Plato, Aristotle, and Pascal discussed games only in terms of **rules** of conduct, associating rules of life with rules of play. Plato (sixth century B.C.) saw games as a way to learn about being good citizens. Games teach good or bad actions, and their lessons can be applied to the real world outside. Thus, Plato advocated game-playing on the condition that humans play the "right" games and remain the "puppet" of the gods.

Unlike Plato, Aristotle (fourth century B.C.) condemned games, seeing them as a weakness and contending that playful activity distances humans from pure happiness and pleasure. Games may serve as respite amid serious activity but should not be played for sheer fun. This contention echoes that of Herodotus (5th century B.C.) for whom man is like a bow that cannot be held in permanent tension but must release at the right moment. A permanently taut bow will snap, just as a man constantly working goes crazy.

The *Pensées* (1670) of Blaise Pascal (1623–1662) added nuance to the Aristotelian view. Pascal argued that games should not be condemned because they are reason-based and potentially beneficial. For better or ill, games can divert man from his miserable state. Play can enhance life but ultimately diverts man from the happiness he must discover himself. Play is not inherently sinful, but man must play a "good" game that brings him closer to God and "true" happiness.

Besides this philosophical perspective of games, Pascal also developed a probability theory to calculate a fair division of gaming stakes. This helped build a bridge between the moralists of his time and men of science. From the 17th and 18th centuries, mathematicians became increasingly interested in games of chance, devising calculations for wagering. For instance, the German Gottfried W. Leibniz (1646–1716) encouraged the study of games, recognizing man's great ingenuity and creativity in this area. Freed of life's constraints, games spark human inventiveness and stimulate great minds.

Nonetheless, in the West, playful activity was still seen as childish. At the end of the 18th century, the *Encyclopédie* of Diderot and d'Alembert described gaming as conventional and frivolous, primarily money-driven and risky in terms of wagering, chance, and uncertain outcome. However, gaming could be legitimate if restrained from excess and with fair criteria among players.

Immanuel Kant (1724–1804) distinguished games from work. Without confusing the two, children learn about limitations from the coercive aspect of work. Although games are inherently fun, work has a purpose that may take pains to achieve. Games should not impinge on schooling but can play an essential role in **education**: games promote human development. Fredrich von Schiller (1759–1805) further developed this idea in perceiving play as a meeting point of the rational (intelligible) and the experiential (empirical). Schiller attributes an aesthetic value to games and puts the metaphysical concept developed in ancient Greece in a relativist context.

Until the end of the nineteenth century, philosophers held sway in speculating about games but never really questioned their essential nature. Games were not deemed a subject of study in themselves but cropped up sporadically in writings on other topics. The classification of games was sometimes discussed, but most considerations dwelt on the moral aspect: whether or not human beings ought to play. Should children play during periods of learning? And so on.

As the nineteenth century drew to a close, however, the subject of games gained status as a valid research topic in such disciplines as biology, anthropology, psychology, sociology, and so on. Karl Groos (1861–1946), for instance, wrote about the play of animals (in *Die Spiele der Tiere*, 1896) and of human beings (in *Die Spiele der Menschen*, 1899), describing playfulness as a biological function. Stewart Culin (1858–1929) took an ethnographic approach, studying games among different peoples (**Chinese**, American Indian, **Japanese**, and so on) from 1889 to 1925. Other authors such as M. G. Hartgenbusch (*Beobachtungen und Bemerkungen zur Psychologie des Sports*, 1926) and Merleau-Ponty (1908–1961) analyzed the psychologies of players. Psychologists also explored the question of play among children, and Jean Piaget, among others, developed a categorization of games based on the developmental stages of children. Ludwig Wittgenstein (1889–1951) also formulated a theory on **language** games that would influence philosophy. John Von Neumann (1903–1957) and Oskar Morgenstern (1902–1977) published a major mathematical work on the fundamentals of game theory entitled *Theory of Games and Economic Behavior* (1944). This theory became widely known and is still studied in economics and political science.

A qualitative approach to the study of games was also forming. Dutch historian and anthropologist Johan **Huizinga** published *Homo Ludens* (1938), entirely devoted to games, in which he maintained that games beget culture. For the first time in history, the structure of games themselves was examined in depth, and Huizinga advanced a new definition of games (see **games, definition of**). This celebrated work would influence several generations of researchers in games studies, arguably earning Huizinga the distinction of "founding father" of the discipline. It must be noted, however, that his essay draws on *Kulturgeschichte Afrikas* (1933) by Leo Frobenius (1873–1938), which had already begun to set the basis for studies on games.

Inspired by Huizinga, the Frenchman Roger **Caillois** was quick to further this games analysis by publishing his *Les Jeux et les Hommes* (1958). Among other things, this work proposed a categorization of games that would be widely adopted (agôn, alea, mimicry, and ilinx). Shortly after this, a German philosopher wrote the first philosophical book entirely devoted to game and play: Eugen Fink, a student of Edmund Husserl and Martin Heidegger, wrote *Spiel als Weltsymbol* (1960) in which he asserted that play can be understood as a symbol of our relationship to the world. Since then, games are no longer seen as a trivial subject of study. After 1960 and the birth of video games, a tremendous surge in writing on games ensued, and before long the discipline of **video game studies** officially emerged. In this new discipline, more and more authors studying both the concept of game (Henriot, Axelos, Suits, and so on) as well as video games (Wolf, Cogburn, Silcox, Sicart, etc.) adopted a philosophical perspective.

Maude Bonenfant

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Garriott, Richard (1961–)

Richard Garriott is the creator of the influential ***Ultima*** **series** of **role-playing games (RPGs)** and played an instrumental role in the creation of *Ultima Online*, the first highly successful commercial **massively-multiplayer on-line role-playing game (MMORPG)**.

Garriott's father is Owen Garriott, a former NASA astronaut, and his mother Helen was an artist. Garriott was born in Cambridge, England, on July 4, 1961, and spent his childhood in the Houston, Texas, area. He started to learn computer programming in high school and at an extensive summer programming camp at Oklahoma State University in 1977. He used his high school computer-programming project to develop his first computer role-playing game *Akalabeth* in 1979. Although Garriott initially printed only a handful of copies to sell in the local computer shop that he worked in, California Pacific Computer Company published it in 1980 and eventually sold 30,000 copies.

Garriott dropped out of the university to work on additional games. California Pacific published *Ultima* in 1980 but then went bankrupt. Garriott then published *Ultima II: Revenge of the Enchantress* in 1982 with Sierra On-Line (see **Sierra Entertainment**) because they were the only publisher willing to meet his demands for high-quality box printing and cloth **maps**, both of which were unusual at the time. In 1983, with support from his father, he founded Origin Systems with his brother Robert (who ran the business side of operations) and his friend Chuck Bueche. Origin eventually published a large number of games, including the well-known *Wing Commander* series. Garriott's focus, however, was the *Ultima* series. Origin released *Ultima III: Exodus* in 1983, *Ultima IV: Quest of the Avatar* in 1985, *Ultima V: Warriors of Destiny* in 1988, *Ultima VI: The False Prophet* in 1990, and *Ultima VII: The Black Gate* in 1992.

In the first few games in the *Ultima* series, Garriott was the primary creator of the games and did most of the programming and artwork. As Origin grew in size, however, more and more people participated in constructing the games, and *Ultima V* was the last game for which Garriott did any coding; afterward, he moved into the role of creative director. Garriott did not deal well with the stress of running his own business, however, and in 1992 the Garriott brothers sold Origin to **Electronic Arts (EA)**.

In the mid-1990s, Garriott split his time and energy between continuing the *Ultima* single-player games (*Ultima VIII: Pagan* [1994] and *Ultima IX: Ascension* [1999]) and developing *Ultima Online* (1997), which would go on to be the first significantly successful Internet-based graphical MMORPG. Garriott was increasingly unhappy with EA and left Origin in 2000 to found Destination Games with his brother and *Ultima Online* producer Starr Long.

A year later, this new company merged with MMORPG-maker NCSoft and became the American branch of the corporation. The studio released *Tabula Rasa* (2007), a project Garriott had been working on for many years. The game fell short of NCSoft's expectations, and the company shut it down after about a year of operation. Garriott left the company apparently willingly in the fall of 2008 but filed a lawsuit against NCSoft in the spring of 2009 in which he alleged that he had been forced out.

Garriott is well known for a variety of eccentric behaviors. He has been a participant in the Society for Creative Anachronisms since the early 1980s and will often appear at public functions in Renaissance-themed clothing as his alter-ego Lord British. He has built two mansions in the Austin area, each called Britannia Manor, full of unique architectural features like a dungeon and an observatory. The first house was famous for being the site of extraordinarily elaborate Halloween haunted house shows. Garriott is also famous for his exotic trips, including two expeditions to Antarctica, deep-sea submersible voyages, and a well-publicized trip to the International Space Station in the fall of 2008.

Kevin Schut

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GCE/Milton Bradley Vectrex

The GCE/Milton Bradley Vectrex was a second-generation (see **generations of technology**) home video game **console**, and the first and only home video game system to use vector graphics (see **vector games**). Introduced in November 1982, it was developed by Smith Engineering/Western Technologies and licensed to and distributed first by General Consumer Electric and later by the Milton Bradley Company.

The Vectrex was meant to bring **arcade**-quality games home and was initially called the Mini Arcade. Based on Motorola 68A09 8-bit CPU, operating at 1.5 MHz, the system included 1KB of random access memory (RAM) and 8 KB of read-only memory (ROM), and three-voice sound was produced by a General Instruments AY-3-8912 chip. A self-contained system, the Vectrex sported a built-in 9-inch monitor, with a vertically oriented screen. The display was black and white, with plastic screen overlays used to add color and background decorations to the games. The **controller** utilized a self-centering analog

joystick (for the first time in a home system) and four buttons. When not in use, it slotted into the base beneath the monitor for convenient storage or transportation.

The Vectrex featured one built-in game, *MineStorm* (1982), which was an *Asteroids* (1979) clone. Additional games were distributed on **cartridges**. Thirteen titles were available at launch, of which eight were licensed conversions of existing coin-op games (most of them from **Cinematronics**, including *Space Wars* [1977], *Armor Attack* [1980], and *Rip Off* [1980]), while the remaining five had been developed by GCE.

The system launched at $199 and enjoyed moderately successful initial sales. Following Milton Bradley's purchase of GCE, the system was also distributed in **Europe** and, in a cobranding agreement with Bandai, in **Japan**. There were 27 commercially released cartridges. The Vectrex also received two official **peripherals**: a light pen and an electromechanical **3-D** imager.

A color version of the system was in development but was never released. Also planned was a computer add-on, with 16-KB memory (expandable to 64 KB), a full QWERTY keyboard, and a BASIC cartridge. With the ability to connect a printer, a mass storage drive, and a modem, the add-on would have transformed the system into a fully featured home computer but never left the planning stage.

When Vectrex sales floundered in the wake of the video game **crash of 1983**, Milton Bradley shut down GCE in early 1984 and discontinued the Vectrex shortly thereafter. Barely over a year on the market, the Vectrex enjoyed one of the shortest commercial life spans of all home consoles.

Following the closing of GCE, Jay Smith, of Smith Engineering, reacquired the rights to the Vectrex hardware and software and in 1996 released them into the public domain for nonprofit use. While the system's uniqueness had already guaranteed it a cult following among **retrogaming** enthusiasts, Smith's move opened the door wide for the development of **homebrew games**, with the first title (John Dondzila's *Vector Vaders*—a ***Space Invaders*** [1978] conversion) released the same year. Since 1996, nearly 90 titles have been released (including original games, conversions, modifications, and **hacks**), making the Vectrex one of the most popular homebrew **platforms**.

P. Konrad Budziszewski

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GDC

See Game Developers Conference

gender

In trying to better understand the content of video games as well as who plays them and why, games scholars have paid a great deal of attention over the past two decades to studying issues of gender. That work has fallen into several categories or areas including representations of female characters in games, the interests and experiences of female players, and the composition of the game industry in terms of demographic representation. Few scholars have studied male gamers and their own gendered uses of video games. But as with video games themselves, findings in these areas are constantly evolving as we see new types of games, new **platforms**, new players, and new business models emerge.

Some of the earliest work on gender and games focused on the content of video games, asking what kinds of images of female characters were being presented to the player. The answer was that there were actually few if any female characters portrayed in video games in the late 1980s and through the 1990s. Of those female characters that did appear, many were stereotypical in their appearance—overly sexy and wearing revealing clothes—or in their actions—as princesses in need of rescue. The female characters that did break out of such roles were few and far between and were often nonhuman or played minor roles in the game. In contrast, male characters were the drivers of the action yet often also drawn from stereotypes and limited types.

More recent research on how female characters have evolved past the 1990s does not suggest that much has changed. Large-scale studies of the top-selling games across multiple platforms confirm that female characters—particularly the central, playable character in games—are only the lead in about 10% to 15% of games. And they remain hypersexualized and trapped in limiting roles.

In response, some researchers have looked past the images of females in video games to see if the actions of the characters are any better. In that regard, scholars have argued that even if characters have stereotypical appearances, they might still drive the action and thus represent a more powerful portrayal than a princess in need of rescue. Certainly the growing prevalence of games that allow players to choose their avatar's gender, and possibly even their appearance, has also helped to broaden the potential for more female characters in games, particularly in the realm of **massively multiplayer on-line role-playing games (MMORPGs)** such as ***World of Warcraft*** (2004) and **role-playing games (RPGs)** such as *Mass Effect* (2007). Likewise, the growing popularity of **casual games** has led to certain genres (hidden object games, time management games, puzzle games) that feature many more female characters as the lead, playable character, in a wider range of ages and occupations than traditional **console-based games** have allowed.

Another popular area for research has been the study of players and their interests and preferences in gameplay. Early research sought to understand whether girls and women had different preferences than boys and men for types of games or the activities within games themselves. Some early research found girls and women less interested in violence and competition and more focused on social, cooperative experiences that also featured strong narrative components. More recently, researchers have found those differences to be diminishing, although certain genres of games—such as first-person **shooting games**—still tend to appeal more to younger male players than other demographic groups. Other studies have shown that some of the early differences among female players were more likely due to their relative newness to game playing, rather than their gender. Furthermore, there are differences between different age groups of women and players with different playing frequencies that might matter more than simple male/female differences. More recently, scholars have started explicitly studying male players—particularly those in adolescence—and find that they often play games to reduce tension and work through anger that results from their daily lives. Others have found that male gamers are often surprisingly multimodal, still enjoying the pleasures that other media can provide, including books and **film**.

Some researchers have taken female players as the starting point, asking those who do enjoy competitive, often violent games what they find engaging and rewarding about them. Their answers are similar to those of male players—that they take pleasure in gaining skill and expertise and enjoy the competitive aspects of certain games. Likewise, other researchers have pointed out that being social is not necessarily a female preference—many male players enjoy socializing via games as well. Recent studies of MMORPG players also suggest that female players may be the "hardest of the hard core" in that of those who played the game the most, women were the most excessive in their gameplay and were much less likely to have plans to quit the game. Likewise, significant numbers of female players of casual and social games also report frequent, long gameplay sessions, suggesting that the gender gap in time and devotion to play may be diminishing or may disappear entirely in the near future.

One other area for research that relates to gender is the least explored, yet has the greatest future potential implications. Researchers have studied the composition of the game **industry** and the beliefs and practices of women working there. The game industry is still estimated to be about 85% to 90% male-dominated, with women concentrated in certain areas including **art**, animation, and production. There are also a small number of female programmers and designers, but many of the most well-known developers continue to be male, and most startup game companies are created by male developers. Researchers have explored why this is so and suggest that it is due to a variety of factors, including the unabated use of "crunch time" in the industry, an insistence on a passion for playing particular types of games, and a lack of role models. Whether these trends will continue with the growing popularity of social, casual, and gestural-based gameplay is an open question. We do know that the social game space has attracted many game industry veterans, including prominent female developers in leadership positions.

In conclusion, the study of gender and games is evolving and paints a mixed picture of video game content and player activities and interests. Most of the research has focused on gender in terms of female players; however, with a few exceptions, researchers have not specifically taken up masculinity and gameplay, instead leaving it as an unmarked category when referencing "the player." Yet the growing diversity of platforms for games, including mobile phones, consoles, and computers, and the emergence of new genres of games such as social and casual games, points to the need to continue to investigate what games offer, and who is playing them and why.

Mia Consalvo

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genealogies

See game genealogies

generations of technology

Home video game **consoles** are often grouped together by both their active retail life span and their technological underpinnings. Market influences tend to cause hardware manufacturers to produce new consoles within a few years of their contemporaries. This cycle of development and production has produced video game hardware technology that can be organized into roughly seven generations. Although not comprehensive, this list represents the most popular and influential hardware releases from a **U.S.**-centric perspective.

First Generation (1972–1977)

The first generation of consoles is defined by dedicated systems that hooked up to a **television** to **play** hardwired games. In response to engineering and cost restrictions, dedicated consoles used discrete logic circuits instead of microprocessors to run only the games built into the hardware. Some home consoles only played a single game, whereas others featured a switching mechanism to select between available games. The first of these, the **Magnavox Odyssey**, was released in 1972 and used cartridge-like boards that consisted of the hardware necessary to switch between the games hardwired into the console's circuitry. A number of "table tennis" consoles also came to market during the era of the Odyssey. Atari released its *Home **PONG*** through the Sears department store under the label of Tele-Games in 1975. **Coleco** released the original Telstar console, which featured three *PONG*-like variants in 1976 but continued to evolve the Telstar line of products to include technological upgrades as well as new hardwired games and their variations.

Second Generation (1976–1984)

Although dedicated hardware served the early purpose of getting video games out of **arcades** and into people's living rooms, the second generation focused on building hardware that could run interchangeable software **cartridges**. To accomplish this, consoles were designed with inexpensive microprocessors and random access memory (RAM). The first of these was the **Fairchild Video Entertainment System** (later renamed Channel F), which launched in 1976 as the first cartridge-based home console (DeMaria and Wilson, 2002, p. 29). In addition to the tennis and hockey games hardwired into the console, the Fairchild VES could read "Videocarts" with multiple games stored on microchips. Having already made its name with the immensely successful arcade and home versions of *PONG,* **Atari**'s Al Alcorn conceived of the **Atari Video Computer System** (VCS, later renamed the Atari 2600) as "a system or base unit that was flexible enough to play a lot of kinds of games" (DeMaria and Wilson, 2002, p. 36). In designing the VCS, Atari needed both an inexpensive microprocessor and inexpensive **graphics** and **sound** adapter to keep the price down (Montfort and Bogost, 2009, p. 13). The second generation of consoles all faced this balancing act of finding innovative ways of maximizing the potential of affordable hardware.

Other systems of the second generation include the **Mattel Intellivision** released in 1979, and the **Atari 5200** and the **Colecovision**, both released in 1982.

Third Generation (1983–1995)

The third generation began in **Japan** in 1983 with the release of the Nintendo Famicon (later renamed the **Nintendo Entertainment System (NES)** for its North American release). The third generation of consoles offered greater processing power and expanded color palettes and was the first to employ hardware-based **scrolling**. Hardware-based scrolling had previously been available in some **arcade games**, but home consoles of the previous generation either used single-screen environments like *Combat* (1977) or *Kaboom!* (1981) or cut between screens as in ***Adventure*** (1979) and *Pitfall!* (1982), or simulated scrolling by moving sprites (as in *Barnstorming* [1982] or *Cosmic Commuter* [1985]). Hardware-based scrolling enabled home consoles to evolve some of the most familiar genres of games and bring arcade games to the home. Platform games such as *Super **Mario** Bros.* (1985) and *Alex Kidd in Miracle World* (1986), side-scrolling **shooting**

games such as *Gradius* (1986) and *R-Type* (1988), and **fighting games** such as *Kung Fu* (1985) and *Double Dragon* (1988).

Third-generation technology enabled games to grow in length and scope. They moved from arcade-like short **play** sessions to longer, more involved experiences. As a result, many designers created methods for players to **save** their games when ROM cartridges afforded no storage. Password-based saves, with elaborate passwords consisting of letters, numbers, and symbols, were used to reflect game states including progress, lives, player items, and statistics. With the inclusion of RAM chips and batteries in cartridges, some games could keep data stored in RAM even when the system was off. ***The Legend of Zelda*** (1986) and *Dragon Warrior* (1989) used this kind of battery save to record players' progress on their lengthy journeys.

Other systems of the third generation include the **SEGA Master System** released in 1985 and the **Atari 7800** in 1986.

Fourth Generation (1987–1999)

Commonly known as the 16-bit era, the fourth generation of consoles is remembered by the heated competition between **Nintendo** and **SEGA** company mascots Mario and Sonic. Improvements in central processors and distinct memory for **audio** and video created **platforms** for faster, more colorful, and more ambitious games. Both the **Super Nintendo Entertainment System (SNES)** and **SEGA Genesis** used true 16-bit processors, whereas the **NEC PC-Engine/TurboGrafx-16** was actually a hybrid of an 8-bit CPU and 16-bit video display **controller**. Vibrant colors continued to be important to graphical quality and differences in the palettes of each console gave them their distinct looks. The Genesis and TurboGrafx-16 each had 512-color palettes, although the Genesis could only display 61 colors on screen, compared with the 482 colors the TurboGrafx-16 could display at once. The SNES, on the other hand, could display 256 colors at once but had more than 32,000 colors to choose from.

The increased processing and graphical power meant that games of the 16-bit era could simultaneously display more objects, employ larger sprites, and perform parallax scrolling. The picture processing unit (PPU) of the SNES, for example, was able to produce one of eight kinds of backgrounds that varied in their number of layers, color palettes, scrolling, rotation, and transformation. The most famous of these was Mode 7, which translated and rotated the background, often laying it down as if it were a ground surface with a vanishing point to give the illusion of **z-axis depth** and a camera perspective.

Fifth Generation (1993–2002)

The fifth generation of consoles was perhaps the most diverse in terms of hardware technology. Processors ranged from 16-bit to 64-bit; some consoles continued to use game cartridges, but others had moved to **CD-ROMs**. Dedicated CD-ROM-based consoles were introduced first in Japan in 1991 with the FM Towns Marty and then in North America in 1993 with the 32-bit **3DO Interactive Multiplayer** manufactured by Panasonic. The **Atari Jaguar**, which continued to use cartridges, was technically a 16-bit system, but like the TurboGrafx-16, it was beefed up with powerful 32-bit graphics processors and CD quality sound chip (Kent, 2001, p. 488).

The next three consoles of the generation moved home consoles into polygonal graphics, which enabled true three-dimensional worlds, although many games continued to employ sprites and pre-rendered environments. The **SEGA Saturn** featured two 32-bit processors while the **Sony PlayStation**'s single 32-bit main CPU also acted as its three-dimensional graphics renderer. Both consoles also read their games from CD-ROMs. Nintendo, on the other hand, chose to stay with cartridges with its 64-bit **Nintendo 64**. The immediate benefit was quick load times, but cartridges were expensive to manufacture and could not hold nearly as much data as a CD-ROM (Kent, 2001, p. 511). Nintendo also chose to deviate from industry trends with its unique analog controller, and the four controller ports in the system set it apart as a multiplayer favorite.

Sixth Generation (1998–2004)

The sixth generation made great strides in processing and graphics power, although increasing hardware complexities made it more difficult to compare numbers between systems. Instead, features such as on-line play or the utility of the hardware as a media player became the distinguishing features of the consoles.

In May 1998, SEGA announced the **SEGA Dreamcast**, a 128-bit console with a three-dimensional graphics chip, Windows CE, a 56 K modem, and a proprietary disc format called GD-ROM. It launched in Japan in November 1998 and almost a year later in North America. The **Sony PlayStation 2** launched in Japan in March 2000 and in North America in October. Beyond its processing, graphical, and audio upgrades, the hardware featured an expansion slot to add an Ethernet modem or hard drive, was backward-compatible with original PlayStation games, and used **DVDs** for its software (its DVD player was an early selling point). Whereas all of the other consoles of the generation had four controller ports, the PlayStation 2 had only two.

The **Nintendo GameCube** launched in Japan in September of 2001 and two months later in North America. Its CPU was based on IBM's PowerPC architecture and a GPU from longtime PC graphics card producer ATI. Like the PlayStation 2 and the **Microsoft Xbox**, the hardware had Internet capability, although no centralized service for on-line play meant relatively few games took advantage of the feature. Instead, local four-player games such as *Super Smash Bros. Melee* (2001) became immensely popular. Nintendo also experimented with connectivity between its Game Boy Advance and the GameCube, using the handheld as a controller and secondary screen for games like *Final Fantasy: Crystal Chronicles* (2003), *Pac-Man Vs.* (2003), and *The Legend of Zelda: Four Swords Adventures* (2004).

The last entrant of the generation was the Microsoft Xbox, which launched in North America in November 2001. Having provided a platform for PC gaming for more than a decade, Microsoft conceived the Xbox as a console that took advantage of the best that PC gaming offered without worrying about supporting multiple possible hardware configurations (Takahashi, 2002, p. 9). Based on Microsoft's PC technology DirectX, the Xbox used an Intel Pentium III processor and a video card codeveloped with Nvidia. As the gap between the performance capabilities of the different consoles closed, features and services grew more important. Predicting this, Microsoft designed the hardware with a built-in hard drive to replace memory cards and an Ethernet port. The Xbox's most popular launch title was *Halo: Combat Evolved* (2001), but it wasn't until the release of *Halo 2* (2004) that Microsoft launched its centralized on-line Xbox Live play service.

Seventh Generation (2005–)

The seventh generation began with two wildly divergent approaches that have converged over time. Both Microsoft and Sony released improved hardware with high definition graphics and focused on the on-line capabilities of their services, whereas Nintendo charted an entirely different route with their wireless **motion-based controllers**, a lead which Microsoft and Sony would soon follow. All three seventh-generation consoles have on-line stores for downloading new and old games, and Microsoft's and Sony's consoles have additional services for buying music and movies.

The first company to move into the current generation was the last to enter the previous generation. The turnover was a quick one for Microsoft, which had launched its first console only four years earlier, but the first-to-market move was a strategic play to establish its updated Xbox Live service. The **Microsoft Xbox 360** has seen numerous hardware feature configuration since its launch in November 2005, but it is generally defined by two versions that differ in their amount of storage. Wi-Fi was available as an add-on peripheral for the original design of the system and became standard in the form factor redesign. In November 2010, Microsoft released the Kinect add-on, a controller-free **interface** that uses the player's body as a **gestural interface** for specifically designed Kinect games.

The **Sony PlayStation 3** appeared in November of 2006 in Japan and North America. It uses Sony's **Blu-ray Discs** for games and can also play Blu-ray movies, DVDs, and CDs. Like the Xbox 360, the console has been available in multiple hardware configurations at different costs and uses an account-based on-line service called PlayStation Network. Sony's handheld motion-controller, called PlayStation Move, uses the PlayStation Eye camera to track the motion of a lit sphere on the end of a wand controller and was released in September of 2010.

The original motion-controlled console was the **Nintendo Wii**, which also appeared in November 2006. Rather than spend money upgrading its hardware to the level of the Xbox 360 or PlayStation 3, Nintendo chose to focus on building a different kind of game system to distinguish itself in the market. The motion-based controller consists of two parts. The primary controller is a remote (known colloquially as the "Wiimote") that uses accelerometers and an infrared sensor interfacing with a sensor bar to track motion in **space**. The second, called the Nunchuck, is an analog stick with an accelerometer and two trigger buttons that connects with a cord into the remote. The remote can also be held sideways like the original NES controller. Instead of a hard drive, the Wii uses internal flash storage and also accepts SD memory cards. The console is backward-compatible with GameCube games and features four controller ports for the previous console hidden under a panel. Nintendo did not create a centralized service for on-line play for the Wii so players must share codes unique to each game with their friends to play on-line.

The extended duration of the seventh generation of consoles is a product of multiple factors. The powerful hardware in the Xbox 360 and PlayStation 3 did not cause the graphics plateau that is often a motivating force in technological improvement, the on-line services of these consoles created new consistent sources of revenue for the console manufacturers, downloadable software updates allowed the manufacturers to keep improving their operating systems, and the release of new peripherals negated the need for all-new hardware.

As of summer 2011, the eighth generation of consoles has not yet appeared. However, industry trends point to possible features manufacturers might adopt: **3-D hardware**, touch-screen interfaces, and the emerging primacy of digital content distribution. The major console manufacturers have already felt pressure from the exploding mobile phone game market of Apple's iOS and Google's Android and will likely react to these platforms when designing their new hardware.

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Genesis

See SEGA Genesis

Germany

Germany is home to one of the main predecessors of **computer games**. In the late 18th and early 19th centuries the "war game" (*Kriegsspiel*) was developed by Johann Chr. L. Hellwig, Georg Leopold von Reisswitz, and his son Georg Heinrich von Reisswitz. It was the first complex simulation of strategic battles that included mechanics that are still defining for any modern **strategy game**. A "computer" at the time was a human calculator who literally computed the results of actions undertaken by the "players," who were military generals wanting to estimate the outcomes of different strategies in battle.

The use of electronic computer technology for gaming started in 1951 at the international trade fair IFA (Internationale Funkaustellung) in Berlin. To demonstrate the value of the first electronic computer in Germany, the *Nimrod* (developed by Ferranti from England), the game Nim was presented to high profile politicians such as the Minister of Economic Affairs, Ludwig Erhard, and Federal Chancellor Konrad Adenauer.

In Germany's games economy, in regard to commerce and production, imports still dominate heavily over exports. During the rise of video games in the 1970s, public skepticism was high and the medium as a whole was widely rejected as dangerous for the healthy **education** of the youth. In 1985, the "law for protection of the youth" was updated, and **arcade games** were banned from public **spaces** open to the youth, putting them into the same realm as "one-armed bandits" and other gambling machines. Also, the *Bundesprüfstelle für jugendgefährdende Schriften* (Federal Department for Media Harmful to Young Persons) started policing games more and more. The first game banned was the **Atari VCS 2600** game *River Raid* (1982) because of its military content.

Since then, video game research and education in Germany has diversified into various branches, with empirical studies and quantitative research on one hand, and fundamental/**philosophical** studies and qualitative research on the other. Cultural research first started as **journalism**, and the work of Florian Rötzer, Konrad Lischka, and Mathias Mertens had an influence on **video game studies** in the early 2000s. Game studies in particular had its origin in the "Arbeitsgemeinschaft Games" (*Game Studies Group*), a chapter of the "Gesellschaft für Medienwissenschaft" (*Society for Media Studies*), founded in 2000 by Britta Neitzel and Rolf Nohr. Today the **Digital Games Research Center (DIGAREC)** of the University of Potsdam, and the Game Lab Cologne (GLC) are major centers in the field. Private schools such as the Games Academy (Berlin, Frankfurt/Main), the Mediadesign Hochschule (Berlin, Dusseldorf, Munich), or QANTM/SAE Institute (Berlin, Munich) also have established training programs.

In 1994, the USK *Unterhaltungssoftware Selbstkontrolle* (Self-Monitoring of Entertainment Software) rating system was developed, one of the most restrictive youth protection system in the world. Since 2008, the USK is administered by the **industry**. A milestone in the cultural debate was the declaration of video games as cultural—and potentially **artistic**—artifacts, which was announced in 2007 by the CEO of the Deutscher Kulturrat (German Culture Board), Olaf Zimmermann. Also, several federal governments institutionalized game content support programs. These mainly come in the form of funding for prototypes from the regional media funds of Baden-Württemberg, Bavaria, Hamburg, and North-Rhine Westphalia. Berlin-Brandenburg, as well as Saxony, Saxony-Anhalt, and Thuringia, have joint programs.

Within the framework of these public support programs, a unique German institution could open its doors again; the Computerspielemuseum (Computer Game Museum) in Berlin was founded in 1997 but had to close its public exhibitions five years later due to financial cuts. Its director, Andreas Lange, opened a new permanent exhibition on the culture and history of video games in 2011 with an extensive collection of early video game software and hardware as well as game magazines and art installations. Germany is also host of the largest European video game fair, *Gamescom*, in Cologne. During the fair, the most important European **Game Developers Conference**, GDC **Europe**, also takes place. The fair ran under the name "Games Convention" in Leipzig from 2002 until 2008.

Typical German games—in the sense that the genre is either more popular in Germany than in other countries or that the games are produced in Germany—are strategy games such as the *Anno* series or the *Settlers* series from Bluebyte Studios (not to be confused with another very typical German game, *The Settlers of Catan* [1995], which is a **board game** by Klaus Teuber); soccer manager titles such as the *Bundesliga Manager* series or Ascaron's *Anstoss* series; and **simulation games** ranging from dredge simulators, train simulators, subway simulators, farm simulators, and even road sweeper simulators (Astragon is an active publisher in this genre). Also popular are fantasy **role-playing games (RPGs)** such as Piranha Bytes's *Gothic* series, Attic's *Das Schwarze Auge* series, and Radon Labs's *Drakensang* series. Presumably the best known German action games are Rainbow Arts's *Turrican* (1989) and *The Great Giana Sisters* (1997), both programmed by Manfred Trenz.

Although video game imports dominate over indigenous production and exports, with a total revenue of 1.563 billion Euro in 2009 (Bundesverband Interaktive Unterhaltungssoftware [BIU; German Trade Association of Interactive Entertainment Software], 2009), the consumption is the third largest in Europe, after the United Kingdom and **France**. Hence, every international publisher—ranging from **Nintendo**, Sony, **SEGA**, **Electronic Arts (EA)**, Ubisoft, Take 2, and Vivendi—has an office in Germany. CDV (established 1989, insolvent 2010) and Frogster Interactive Pictures (FIP; established 2005 taken ofver by Gameforge in 2910) are game publishers with a German origin, but neither focuses on AAA console titles; FIP has shifted its portfolio in 2008 completely to on-line games (including adaptation of Runewalker Entertainment's *Runes of Magic* (2009) and Bluehole Studio's *The Exiled Realm of Arborea* (2011), establishing close ties to **South Korea**. Publishers in Germany are represented by the BIU.

Crytek (established 1999) today is the biggest AAA developer in Germany. Internationally lesser known, Blue Byte (established 1988) has a longer tradition, and their most successful games include *Battle Isle* (1991), *The Settlers* (1993), and *Anno 1404* (2009). Yager (established 1999) recently got a contract to develop *SPEC OPS: The Line* (forthcoming) for the international publisher Take 2 and hence has become one of the big studios. Developers in Germany are represented by the G.A.M.E. Bundesverband der Computerspielindustrie (Association of Game Developers). In 2010, all big German browser game producers joined G.A.M.E. Browser games do not need a client to be installed and run entirely through standard web browsers such as Firefox, Safari, Netscape, or Internet Explorer. Registration is free, but by paying micro amounts starting at one cent, constructions or other tasks are sped up, making gameplay faster for players willing to invest. Companies such as Bigpoint (established 2003 as m.wire, renamed Bigpoint in 2007), Gameforge (established

2003), Wooga (established 2009), and several more are new but potent players on the international browser game and social media game market. Two other companies are successful in the on-line **casual games** market: GameDuell (established 2003) and Intenium with www.deutschland-spielt.de (established 2003). Because of the current structure of the German full-price market, services such as localization (every video game published in Germany is translated into German and in certain cases is adapted according to the youth protection system or other cultural aspects), on-line payment systems, community management, or distribution play a major role.

Germany is known for a vibrant demoscene, continuing the tradition of code-efficient skill demonstrations. *Evoke* takes place regularly in Cologne since 1997 and is still one of the biggest demo meetings worldwide. Prominent organizations in the field of game art and game culture are the A MAZE. Festival (established 2008), the Computerspielemuseum (Computer Games Museum) in Berlin, the Videospielkultur (VSK) in Munich (established 2006), the ZKM in Karlsruhe (with programs since 2009), and the Next Level Conference in Cologne (since 2010).

Regarding gaming hardware, Germany does not have a history or market structure significantly different from the rest of Western Europe. In the 1970s, the market was flooded with ***PONG*** (1972) clones (called "Telespiel" for "**Television** Game"). Later, the Atari 2600, **Nintendo Entertainment System (NES)**, **Super Nintendo Entertainment System (SNES)**, **SEGA Mega Drive**, and **Sony PlayStation** were as dominant as they were in the **United States**. Yet with the rise of Commodore computers (the Commodore 64 [1982] in particular), and IBM-compatible systems (using the Intel 80286 processor of 1984) the games market mainly shifted toward PC-based games. This market sector is still relatively strong in Germany, although in recent years with the introduction of the **Microsoft Xbox 360**, the **Nintendo Wii**, and the **Sony PlayStation 3**, **console-based games** have gained more market share; total revenue for consoles (including hardware) in 2009 was 857 million Euro, versus 413 million Euro for PC gaming (software only) (BIU, 2010).

During the **arcade game** and home console boom of the 1970s and 1980s, a truly exotic piece of video game hardware was created in former East Germany, the GDR (the socialist German Democratic Republic). To foster an interest in micro electronics in the youth and society, the BSS01 (Bildschirmspiel 01, "Screen game no. 1") was developed in the Halbleiterwerk Frankfurt-Oder in 1980, based on the AY-3-8500 "*PONG* chip" made by General Instruments. By Western standards, it was yet another *PONG* clone, but in East Germany the four integrated games (*Tennis*, *Pelota*, *Squash*, and *Soccer*) marked a revolution in micro electronics. Because of the very high price of 500 Marks (at the time about the same amount as a standard monthly salary) the console was mainly set up in public youth centers ("Jugendfreizeit Zentren") where it, in contrast to the public bans undertaken in the West, was integrated into the general educational strategy. The GDR also developed its own arcade machine called *Poly Play* (1985), with up to eight integrated games, but it never reached the standards in quality the youth were used to from illegal and half-legal imported games from Western Germany.

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gestural interfaces

Gestural interfaces, or motion **controllers**, are video game and computer **peripherals** that translate a variety of human movements, such as swinging arms or moving legs, into onscreen action. By the broadest definition of gesture, "actions that have the features of manifest deliberate expressiveness" (Kendon, 2004, p. 15), nearly all physical **interfaces**, such as the typical button-pushing or click-and-drag functions of the gamepad, keyboard, and mouse, are considered gestural. However, the term is typically reserved for interfaces that recruit more of the body's biomechanical possibilities for **computer game** and video game input. Technologically, gestural interfaces combine various hardware devices, such as accelerometers, cameras, and touch sensors, which can communicate player speed, position, and force to the computer. The resulting motions or gestures are often evocative of those used in other, nondigital activities, although usually simplified, enhanced, and **abstracted**. Thus, the **Nintendo Wii** tennis player or *Rock Band* (2007) guitarist, for example, may simulate the experience of hitting a forehand or jamming with the band not only within the space of the screen, but also within the posture and movement of the body. The Nintendo Wii console and the Wiimote controller, introduced in 2006, have rekindled industrial and theoretical interest in developing new interfaces and understanding their consequences for interface **design**, video gaming, and the culture at large.

Origins of Human-Machine Interfaces

Scholars have traced the origins of human-computer interfaces back to the increased mechanization of work and play during the late 19th and early 20th centuries. Assembly-line production drove the study of human **biomechanics** in the name of efficiency, perversely adapting the human to the machine instead of the reverse. In their spare time, workers increasingly turned to a variety of recreational machines, including the phonograph, the one-armed bandit gambling device, and various coin-operated precursors of the film projector like the mutoscope and the kinetoscope. The bar or saloon, the midway, and eventually the penny **arcade** became settings for playing with machines, the pleasure of which seemed to derive from both their seemingly autonomous function and their responsiveness to human input. Many coin-op games were derived from activities of the farm and field (already nostalgic in an era of increasing urbanization), such as strength tests reminiscent of wielding an ax, mechanized duck hunting in shooting galleries, or arm-wrestling mechanical strongmen.

The most common antecedent to video **arcade games**, however, is pinball, a modernization of Bagatelle, a billiards-style game. The first pinball-style game, *Baffle Ball*, was introduced in 1931. It wasn't until after World War II, however, that the pinball flipper made its debut, cementing the effectiveness of pressing a button as a means of skillful, real-time, interactive **play**. The agility, force, and speed of the human finger to tap or press—in effect, one of the body's smallest, most efficient and precise gestures—became the basis for machine and computer interactivity, from the keyboard to the gamepad.

Video Games and Their Interfaces

Video games emerged from the lab in the early 1970s in two guises: as **television**-based entertainment in the home and as the newest generation of coin-op amusements in the arcade. New video game companies, most notably **Atari**, joined old pinball manufacturers in leading the development of video games, introducing consumers to a variety of knobs, buttons, levers, and other interface controls for predominately **ball-and-paddle games**. However, game-specific interfaces quickly emerged, including steering wheels for driving games and **racing games**, such as Atari's *Gran Trak 10* (1974; which included pedals and gear shift), and various types of guns for **shooting games**, such as **SEGA**'s *Bullet Mark* (1975) and *Balloon Gun* (1975). Various sit-in games altered the posture of the player, suggesting a cockpit experience akin to driving a car or flying an airplane. Such interfaces traded on both familiarity and novelty for their appeal, because the skills and experience of everyday driving, for example, could now be emulated—and amplified—in a race-car simulation.

Guns and steering wheels were common gestural interfaces for early home video game **consoles** as well. The first home console, the **Magnavox Odyssey** (1972), featured a light gun peripheral, and the **Coleco** Telstar Arcade (1977) included a steering wheel, which was built into the standard console along with a pistol grip and the usual knob controllers. Control sticks—**joysticks** molded to fit the grip of the hand and often crowned with a button or trigger—also became a popular peripheral for playing video games such as Microsoft's *Flight Simulator* (1982) on personal computers. However, most console manufacturers were more concerned with developing interfaces that were compatible with many games, as increasing market share depended on a steady stream of new titles that would work with existing hardware. Although the **Atari VCS 2600** (1977) joystick became the icon of video game interactivity, it was the **Mattel Intellivision** (1979) interface, with its phone-like bank of buttons, that foreshadowed the gamepad, the dominant console-based interface since its introduction by **Nintendo** in 1985.

Manufacturers continued to experiment with guns (such as Nintendo's Zapper), steering wheels, pressure pads, and other devices in the 1980s, but few devices caught on with the public. One notable failure that anticipates contemporary gestural interface design was Mattel's Power Glove of 1989, a peripheral worn on the hand and equipped with a gamepad-like interface at the wrist. Designed for the popular **Nintendo Entertainment System (NES)**, the Power Glove nevertheless received little software support and later was best remembered as a prop in the 1989 film *The Wizard* ("I love the Power Glove. It's so bad."). Although the glove failed to catch on, it did prove the technological viability of "hands-free" gestural interfaces for video gaming.

As the home became the predominant site for video game play, arcade game manufacturers responded in the 1990s with higher-resolution **graphics** and elaborate novelty interfaces to attract customers. Cockpits, skateboards, soccer balls, boxing gloves, fishing poles, motorcycles, jet skis, and many other game-specific interfaces—some reminiscent of carnival and boardwalk games from a century before—crowded into the decreasing number of arcades. One genre that debuted in the arcade and migrated to the home was music or **rhythm and dance games**. Konami's ***Dance Dance Revolution*** (1998) had players dancing on a pressure-sensitive floor in time with audio-visual cues on-screen; the game became an international phenomenon and was adapted for home use—with a dance mat peripheral—in 2001. Less well known but prescient of games such as *Guitar Hero* (2005) and *Rock Band* (2007) were musical instrument games, including Konami's *GuitarFreaks* (1998) and *DrumMania* (1999), which used prop instruments to enhance the physical experience of playing like a rock star.

Early interface developments anticipated the later split in gestural interface design between single-use or prop-like interfaces with specific form factors, such as those found in musical instrument-based games, and interfaces that are minimal in appearance but offer a wide range of motion-sensitive control. In the latter category, the Nintendo Wii, which debuted in 2006, has spurred widespread consumer interest in **motion control** interfaces, thanks to the console's motion-sensitive Wiimote controller. The Wiimote, followed by the *Wii Fit* (2007) balance board, has been effective in reclaiming the home as the setting for casual, social video games by combining intuitive interface design with familiar sports titles. In doing so, Nintendo has compelled hardcore-game console manufacturers Sony and Microsoft to develop their own gestural interfaces, the Move and the Kinect. In some cases, gestural interfaces have become transparent, disappearing into a touch-sensitive and motion-sensitive screen, as is the case with the iPhone and the latest generations of mobile devices. For the Microsoft Kinect, the interface shifts to the body itself, as a camera and other sensors are designed to respond to full-body motion and voice commands in a hands-free fashion, with gestures for pointing and selecting replacing button functionality.

Implications of Interface Design on Interactivity

Designing for computer and video game interactivity takes into account both software and hardware concerns, as objects on-screen must respond to physical input in ways that require only minimal **adaptation** by the user. An early principle of interface design known as Fitts's Law formulates a mathematical model for relating movements of the hand to the size and distance of an intended target. The model has proved useful in the design of many interface elements, such as the movement of a mouse in relation to the size of folder icons on the screen. Additionally, the principle of affordance also comes into play. Psychologist James J. Gibson first advanced the concept of affordances, or the perceived possibilities for action that an object may present in a given context or environment (for example, a chair in a room "affords" sitting). For video game controllers, affordance suggests a consideration not only of the device's physical construction (such as buttons for pushing), but also the actions it enables in the screen-based environment to which it connects the user. The resulting correlation between player action and screen result can be highly representational, such as the upward push of a thumbstick to move forward on-screen. Most video game interfaces are predicated on a maximal result for minimal effort (for example, carjacking in *Grand Theft Auto IV* (2008) requires only the press of a button), but gestural interfaces invite a closer relationship between biomechanical action and on-screen result. In the presence of an **avatar**, gestural interfaces can afford highly literal motions in a nearly one-to-one relationship between the player's character and his or her own body.

Although the pursuit of fidelity between body and character movement—a concept known as motor isomorphism—promises to expand the possibilities of interface design and interactive experience, the implications of increased biomechanical involvement in video game play requires further research and theorization. Gestural interfaces alter the space of play and the role of the body, shifting the focal point of interactivity from a predominantly screen-based environment to a more hybrid relationship between digital and physical bodies and spaces; for example, while playing tennis on *Wii Sports* (2006), physical bodies may move into optimal spatial position to hit a purely digital ball. Scholars have observed that gestural interfaces may raise problems of perception: even though the body is more active with gestural interfaces, feedback to the body remains relatively mute, as only the standard audiovisual cues convey whether a forehand swing results in a hit or a miss. Some interface designers contend that the rush toward gestural interfaces fosters bad design, such as touch screens prone to accidental inputs, inconsistent gestural interface standards, and even hand positioning that blocks the screen from view. Additionally, the physiological benefits of gestural interfaces remain unclear, as overuse injuries may undercut fitness claims made by Nintendo and other manufacturers (see **health [physical]**). Nevertheless, the growing pains of gestural interfaces appear to be offset by the interactive pleasures such devices offer.

Possible Directions for Gestural Interfaces

The promise of **virtual reality**, or the notion of digital **simulation** that completely envelops the user (like the holodeck in the *Star Trek* television franchise), may represent the theoretical endpoint at which gestures become the "actual" movement

The depiction of motion control in the movie *Minority Report* (2002) [top] is derived from an actual gestural interface platform called g-speak [bottom]. John Underkoffler, whose company Oblong Industries developed the interface, served as a science advisor to the filmmakers. (Parker Loris Underkoffler/Oblong Industries) itself. However, the vision of gestural interface as depicted in films such as *Minority Report* (2002) and *Iron Man* 2 (2010) perhaps come closest to current aspirations for embodied, real-space digital interactions that are intuitive, organic, and responsive to a variety of biomechanical manipulations.

As mainstream video game manufacturers continue to test the waters of high-end gestural interface design, **artists** and hobbyists are taking advantage of relatively inexpensive motion-control components, such as accelerometers and infrared sensors, to create custom interfaces. An Arduino, for example, combines a micro-controller motherboard with a software package allowing users to customize and program controller hardware. Hardware **modding** of Wiimotes and other manufactured gestural controllers is yielding novel interfaces for use with indie and conventional games, as well as providing unprecedented access to gaming for players with physical limitations (see **accessibility**). Customizable gestural interfaces may ultimately move from the fringe to the mainstream and prove a viable mass production alternative to one-size-fits-all configurations.

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girls' games

The idea of "girls' games" arose in the late 1990s after the video game market had been firmly established in **North America** starting with the release of the **Nintendo Entertainment System (NES)** in 1985. Although there have always been female video and **computer game** players (one of the earliest computer games, *Colossal Cave Adventure*, was in fact created in 1975 by William Crowther for his two young daughters), early sales of NES systems and game titles were mainly by and for boys and male adolescents.

A "girl game" is frequently defined as a game designed for and marketed to young girls and adolescents. (Use of the term to refer to games enjoyed by or marketed to women may be derogatory.) Some of the earliest attempts to attract young female players involved adapting popular girls' toys and stories into video game form, such as Mattel's *Barbie Fashion Designer* (1996). The success of this game led to further titles offering young girls the opportunity to engage in hair styling, clothing **design**, horseback riding competitions, and friendship adventures. These were counterposed to the more male-coded game activities such as shooting guns, defeating monsters, and virtual sports competitions. Following the success of *Barbie Fashion Designer*, a number of female-owned and designed software companies were founded to try and widen the game market to include young girls (adult women were generally not a target market). These include Purple Moon, Her Interactive, Girl Games, Girl Tech, and, later, Silicon Sisters. Other game software companies diversified their offerings by creating girl games in addition to their more male-oriented or general audience games.

Although some applaud the creation of girls' games, others have criticized the way categorizing games by **gender** reinforces negative stereotypes. Additionally, having a small number of separate girls' games may discourage game designers from discontinuing the practice of primarily designing games for boys and men. As a result, games that appeal to girls may be given little thought and be of lower quality, functioning as a token gesture to a market for whom the industry is not truly designing. Opponents note that many girls' games are designed by women, giving them an entry into an industry that is otherwise still dominated by men. Additionally, market research has demonstrated that girls and boys favor different activities and characteristics in games. Yasmin B. Kafai's 1994 study, "Video Game Designs by Girls and Boys: Variability and Consistency of Gender Differences," found that girls strongly preferred realistic settings and androgynous characters. Kafai also studied how girls and boys chose to design video games when given the opportunity to do so and found that girls created games with little or no violence or aggressive competition. In 1996, Leslie Miller, Melissa Chaika, and Laura Groppe's study, "Girls' Preferences in Software Design: Insights from a Focus Group," indicated that girls' preferences in video games differed from boys' preferences. The girls in their study liked games that focused on exploration and collaboration. They also had a preference for high-quality **graphics** and **sound** design. Additional studies have produced similar findings (see, for example, de Castell and Bryson, 1998).

Examples of girls' games include *Barbie Fashion Designer* (Mattel, 1996), *McKenzie and Co.* (Her Interactive, 1995), *The Vampire Diaries* (Her Interactive, 1996), *Let's Talk about Me* (Simon and Schuster Interactive, 1996), *Rockett's New School* (Purple Moon, 1997), *Secret Paths in the Forest* (Purple Moon, 1997), *The American Girls Premiere 2nd Edition* (The Learning Company, 1998), *Nancy Drew Adventure* series (Her Interactive, 1998–present), *Let's Ride* (ValuSoft, 1999), *Cosmopolitan Virtual Makeover* (Riverdeep, 2002), and *Keepsake* (The Adventure Company, 2006).

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god games

Narrowly speaking, a "god game" is a video game in which players assume an explicitly divine role in the emergent growth and development of a simulated life-system. More broadly, however, god games share some characteristics with other video game genres such as real-time **strategy games** and **simulation games** in which players construct and manage the emergent growth of other systems such as cities, civilizations, neighborhoods, and nations.

According to Agata Meneghelli, god games simulate the divine experiences of omnipotence, omniscience, and omnipresence (Meneghelli, 2007). For example, god game players practice a form of omnipotence in their ability to create and destroy units at will with a simple mouse-click. In addition, god game players typically view the simulation from an omniscient bird's eye view—influencing multiple points of contact at once as if omnipresent. Also, Meneghelli interestingly notes that god game screens generally feature two kinds of **play space**: a large window into the simulated life-system and a set of toolbar controls which border the window. Thus, god game play tends to oscillate between a transcendent plane (the toolbars) and an immanent plane (the window).

In his essay on ***SimCity*** (1989), Ted Friedman suggests that playing god games also engages players through integrative absorption (Friedman, 1995). In the case of

SimCity, players must practice multitasking to pay attention to the various demands of real-time city management. Simultaneously, players monitor the window, a bar graph, and a news ticker, all while scrolling back and forth throughout the virtual city and clicking on dozens of functions. In one sense, this kind of multitasking may seem to act as a set of distractions. However, Friedman suggests that the multitasking god game player deeply identifies with the whole city as a single system in an "almost trance-like state of gameplay." From Friedman's perspective, this kind of engrossing experience transformatively blends together person and computer in "complete communion." Thus, god games possess the potential to engage players in an integrative, absorbing experience.

God games also inspire some theorists to reflect on the player-game phenomenon as a divine-human metaphor. Kevin Kelly imagines that the player's work of designing and directing an emergent video game **world** reflects the ongoing divine activity of creation (Kelly, 1995). For example, Kelly observes that god games feature an evolving future in which players directly control global events such as the weather while only indirectly influencing the response of those simulated organisms that are affected by it. Kelly speculates that god game players come to feel interest and affection for the worlds that they make. Elsewhere, Kelly argues that technology can "advance our understanding of god-ness by experiencing the limits and powers of unfolding creations of our own" (Kelly, 1999, page 392). Similarly, Steven Garner (2005) suggests that creative engagement with technology is an expression of the *imago Dei*, the image of God within human beings (Garner, 2005). Garner reasons that just as God might create persons, so those persons might imitate God through creative acts of their own. However, Noreen Herzfeld argues that god games do not fairly reflect the creative *imago Dei* (Herzfeld, 2005). She maintains that the *imago Dei* implies a kind of mutual relationship that computers cannot reflect. Instead, Herzfeld contends that god games foster playful experiences of power and control.

SimCity creator Will **Wright** recalls his own form of divine-human fascination with video game design while writing *Raid on Bungeling Bay* in 1985 (Kelly, 1995). While designing the game, Wright wrote a separate utility program that automatically created simple island **maps** for a military helicopter to bomb. After completing the game, Wright strangely found that his interest in the utility continued while his interest in the game waned. As he kept on tinkering with the utility, Wright came to understand that creating simulated life was more compelling than destroying it. This experience led directly to the development of *SimCity*. The work of Will Wright eventually led to *The* ***Sims*** **series** of social, artificial life simulations, and to the *Spore* series of evolutionary, artificial life simulations.

The work of Peter **Molyneux** explicitly explores the religious dimension of god games in his *Populous* series and *Black and White* series. In both series, players adopt divine roles as they seek to guide, direct, protect, and prosper a simulated civilization—while opposed by enemy deities. However, each series reflects a different tone and character. *Populous* (1989) and its sequels primarily reflect the tradition of real-time strategy war games. In contrast, *Black and White* (2001) and its sequels function much more explicitly as a series of god simulators.

Several other notable video games deserve mention in this discussion. *Utopia* (1982) for the **Mattel Intellivision** casts players in the role of godlike island rulers, predating *SimCity*. **Activision**'s *Little Computer People* (1985) casts players in the role of family managers, predating *The Sims*. Real-time strategy game series such as Sid **Meier**'s *Civilization* (1991) reflect the game play of Molyneux's *Populous* series. More recently, the serialized iPhone application *Pocket God* (2009) places players in a divine role as they alternately bless and curse a small tribe of cartoonish islanders. ***See also*** education (religious), morality and ethics, spirituality, subcreation.

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Grand Theft Auto series

Released in **console**, PC, and **handheld** format from 1997 to present, the *Grand Theft Auto* series is a franchise of driving/action-**adventure games** that has been widely praised for innovating **game design** practice with the freedom and openness of its gameplay, at the same time as its realistic **graphics** and adult themes and violent content have generated much controversy. With the release of *Grand Theft Auto III* (2001) in particular, the series became a touchstone for how video games were maturing as a medium. However, the moral outcry inspired by *Grand Theft Auto III* and later games in the series also revealed the residual public perception of video games as children's entertainment, despite their increasing sophistication and the aging demographics of people who **play** them.

The series' basic template for gameplay and content were laid out in its first two installments, *Grand Theft Auto* (1997) and *Grand Theft Auto II* (1999) developed by Scotland-based DMA Design and released for the **Sony PlayStation**. Players are aligned with petty thugs who can ascend the criminal underworld by accepting a series of missions that advance them toward completing the game, but they can also indulge in a range of digressive, often-violent side missions and seemingly open-ended explorations of the games' fictionalized urban **spaces** by getting into certain vehicles. (The three main locations explored in later games in the series—Liberty City, Vice City, and San Andreas—are each levels to be explored and "unlocked" in these early games.) By allowing players to prioritize freeform play over linear, goal-oriented progression according to the **rules** of the game, the series helped pioneer and popularize the so-called sandbox game: a game (or game mode) that allows the player to experiment with its mechanics, regardless of the game's overarching goal, if any. Within the game industry, the term "sandbox" has since become widely used to describe and market any type of game or gameplay that expands the player's experience by allowing them to play freely in its world without obligation to advancing a linear narrative—to treat the game's **world** like a sandbox, so to speak.

Although these early games possessed many of the hallmark traits of later *Grand Theft Auto* games that would go on to garner the series both acclaim and controversy, *Grand Theft Auto* and *Grand Theft Auto II* received relatively little of either. Indeed, both games tend to be overlooked in both **industry** and academic discussions of the series. This has been attributed in part to the technical constraints of the original Sony PlayStation console and the games' limited, two-dimensional top-down perspective on the action, as well as their use of simple, non-photorealistic sprites to represent cars and people. While open-ended exploration and violent criminal exploits were possible, the player's perspective on them remained decidedly distanced. Instead, the series was brought to its current level of notoriety by *Grand Theft Auto III* (2001), the first *Grand Theft Auto* game to feature a real-time three-dimensional, third-person perspective.

Grand Theft Auto III was initially a **platform**-exclusive release on the **Sony PlayStation 2.** It was developed in part to showcase the graphical and storage capabilities of the next-**generation** console and, in so doing, appeal to a growing demographic of older gamers to whom Sony hoped to sell the PS2 as an entertainment system. The high-**resolution**, realistic digital worlds made possible by the PS2 made exploring and interacting with the vast urban setting of Liberty City all the more engaging, and the sandbox gameplay of the previous games in the series was suddenly met with lavish critical praise and unprecedented commercial success. Each console game to follow *Grand Theft Auto III* in the series took advantage of advancing hardware technology to further expand these urban spaces, making them all the more elaborately detailed and open for exploration. For example, *Grand Theft Auto: Vice City* (2002) constructs a neon-lit cityscape and drug underworld reminiscent of *Scarface*-era Miami, whereas *Grand Theft Auto: San Andreas* (2004) lets players traverse the various gang-riddled neighborhoods of three cities (roughly based on Los Angeles, Las Vegas, and San Francisco) as well as the highways, deserts and coastal regions that separate them. *Grand Theft Auto IV* (2008), the first game in the series released for the **Sony PlayStation 3** and **Microsoft Xbox 360**, features an expanded and exhaustively detailed Liberty City complete with five separate boroughs roughly based on those of New York City. In a gesture revealing of how crucial the sheer size and scope of *GTA*'s game spaces have become to the franchise's success, before *Grand Theft Auto IV*'s release, Rockstar Games boasted that the game would feature an astounding 100 hours of gameplay, encouraging players to explore and navigate the expansive Liberty City to optimize their gaming experience.

Starting with *Grand Theft Auto: San Andreas*, the series introduced some role-playing elements to gameplay, allowing players to customize the appearance, dress, and conduct of player-characters through the foods they eat, the exercise they get, and the clothes they buy, all of which may affect the character's skills and actions in the game world, as well as the way other characters may react to and assist them. For example, one of the first missions assigned to *Grand Theft Auto IV*'s protagonist, Niko Bellic, is to shop for new clothes to replace those he wore over on the boat from Eastern Europe. Although the task seems mundane and even arbitrary compared with the subsequent assassinations, heists, and carjackings Niko must perform, his new wardrobe serves to impress his date later that night and underscores the importance of how seemingly subtle elements of character customization may have an impact on his (and thus, our) progress through the game.

Following the release of *Grand Theft Auto III*, the series was praised for its increased technical and aesthetic sophistication; however, it also came under fire for its newly realistic depiction of **violence**. Although the games' more outlandish activities—running over random pedestrians in one's stolen car, for example, or soliciting prostitutes and then beating, robbing, and even killing them—were presented by the game's designers as highly satirical and widely received by its fans as such, they also became all the more graphic with the move to three-dimensional **graphics**. The series' critics argued that it brought violence into a realistic urban setting and aligned its players with the perpetrators of that violence, and thus, a life of criminality and deviance. As a result, *Grand Theft Auto III* and the games that followed it have found themselves at the center of almost as much controversy as they have critical and commercial success.

Although Rockstar Games, publisher of the *Grand Theft Auto* series, has insisted the games were designed for adults, since the release of *Grand Theft Auto III*, the series has been widely decried as a menace to children, and subject to **censorship** and prohibitive ratings practices. For example, a censored version of *Grand Theft Auto III* was released in **Australia** to take out the "sexualized violence" deemed particularly offensive by the country's ratings board. In the **United States**, the **Electronic Software Ratings Board (ESRB)** changed the "Mature" rating of *Grand Theft Auto: San Andreas* (2004) to "Adults Only" when its initial release was found to contain what became known as the "Hot Coffee" **minigame**, where players could **mod** the PC and console versions so that their character could engage in on-screen sex with his girlfriend. In 2005, citing the series as one of her prime motivators, Hilary Clinton proposed the Family Entertainment Protection Act, legislation that would control games ratings at the point of sale.

This **moral** outcry over the *Grand Theft Auto* series has come under fire from academics and the games **industry** alike. Both parties have argued that the controversy reveals that, although the audience demographics of video games have shifted to include adult tastes and interests, and games technology has advanced to the point that it can accommodate these shifting demographics, there remains a residual cultural perception of games that trivializes them as immature, children's entertainment rather than a legitimate cultural form. ***See also*** immersion; journalism; platforms.

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graphics

In the context of computer science, the expression "graphics" refers to the visual output produced on a screen through the underlying operations of physical and algorithmic processes. The study of video game graphics encompasses a great variety of technological devices and processes that have evolved considerably over the short history of the medium. As Mark J. P. Wolf has pointed out (2001, pp. 14–23), video game researchers are faced with many interstitial cases, such as **board games** that make use of video material, or LED/LCD based **handheld game** devices in which all the variations of the game state are represented through discrete images or image elements to be lit at the appropriate time. Following Wolf, this overview of video game graphics is limited to devices that manipulate a grid of identical visual units—pixels—to construct images.

When video games appeared in **arcades**, a typical **television** set could reproduce a relatively complex color signal broadcast over the air. To create an interactive encounter, early video games had to give up most of the rich visual stimuli people had enjoyed on television sets. Although cathode-ray tubes (CRTs) could display images with thousands of colors at nearly 30 times every second (NTSC standard), the underlying machinery used to create the interactive experience—a variety of circuitry and chips with increasingly dedicated functions—could not make full use of that potential for many years. Throughout the history of graphics in video games, the goal of developers and engineers has been twofold: increasing the illusionistic potential of interactive imagery, while making sure that these images could react in a significant manner to user input. Multiple technological advances have occurred in the progressive remediation of visual techniques developed in visual arts and **film**, as well as in the techniques that allow game developers to manipulate visual assets with the help of computer algorithms, which are essential to the creation of a greater sense of reactivity to user input.

The Refinement of Illusion

The TV game project designed by Ralph **Baer** in the late 1960s made use of a relatively simple array of transistors and diodes to generate three white dots on the screen. The famous "Brown Box" could also switch the color of the whole screen to change the nature of the simulated events: a blue screen was meant to evoke the ice of the hockey rink, a green screen became a football field, and so on. However, that function was removed in the final product, the **Magnavox Odyssey** (1972), and replaced with 12 acetate overlays that represented a variety of settings, from simple table tennis to a haunted house. The decision to rely on exogenous visual elements is clearly indicative of the representational ambitions of games that would qualify as **abstract art** to distant onlookers. The hardware limitations of the time were more suited to specific make-believe scenarios. The popularity of **space** settings in early games is a clear indication of the representational affordances created by technology: a black backdrop could depict the emptiness of space with minimal costs in terms of technological resources.

Through transistors and diodes, ***Computer Space*** (1971) and the Odyssey could move simple white shapes on the screen; TTL (transistor-transistor logic) architectures were not able to generate detailed visuals. In 1974, *Tank!* became the first game to use a memory chip (read-only memory, or ROM) to store graphical information, an innovation that would be a turning point in the development of richer visual assets. Depending on their capacity, memory chips can store arrays of pixels, typically referred to as "bitmaps," that are assembled by the program and sent as a video signal to the display. In raster mode, the electron beam at the back of the CRT scans the surface of the screen many times every second in order to recreate the image. For example, the first **Atari arcade games** were played on CRTs that could display a grid of 336 by 244 pixels. Screen **resolution** was not the factor responsible for the "blockiness" of early games, but rather the inability to manipulate detailed bitmaps, which led to the use of large, uniformly colored "blocks" in many games. The first video games had to rely on overlays to overcome their monochrome displays, but the release of the **Fairchild Channel F** (1976) and the **Atari VCS 2600** (1977) marked the transition to color games and a race to overcome the hardware limitations in terms of color palettes and simultaneous on-screen colors. In 1979, *Galaxian* was the first arcade game to display graphics in three-channel RGB color.

In the early years, game **worlds** were often depicted from a lateral or aerial vantage point, and this lack of **z-axis depth** was largely due to technological constraints. The integration of higher-resolution bitmaps made it easier to represent objects from various angles, adding some volume to the scenes. For example, *Zaxxon* (1982) would feature the objects in the world from an isometric perspective. This type of axonometric perspective represents a tridimensional space with no vanishing points, giving all three dimensions equal importance. To convey a sense of depth, video games made use of most of the types of perspective typically seen in technical drawings.

During the 1980s, the graphical **adventure game** genre increased in popularity and contributed to the adoption of more capable graphics cards. Developers made use of larger bitmaps and sought to remediate visual arts to a greater extent. Whereas their predecessors used the EGA visual standard (16 on-screen colors out of a palette of 64), *King's Quest V* (1990) and *Police Quest III: The Kindred* (1991) were among the first Sierra games to fully use VGA graphics (256 on-screen colors from a palette of 262,144); digitized drawings and photographs were used to create the games. Some developers, most notably Access Software, used digitized photographs more extensively to produce the visual assets of their games (as in *Mean Streets*, 1989). The remediation of pictorial arts was further facilitated by improvements over IBM's VGA standard by other manufacturers; Super VGA games ran at 640 × 480 or even higher resolutions.

In many early games, dynamic objects (for instance, the vehicle controlled by the player) moved laterally across the screen without much variation in their appearance. In *Computer Space*, the spaceship and other moving objects were actual images stored in diodes, and were manipulated through transistor logic. As Henry Lowood has pointed out (2009), this is the ancestor of the "sprite," a term that initially referred to specific hardware that could handle dynamic objects on-screen and later became the common name for all moving objects. With more memory and processing power available, developers started to animate sprites beyond the binary variation of life/death. A few years after *Karateka* (1984), Jordan Mechner's *Prince of Persia* (1989) made good use of a well-known animation technique: rotoscoping. The prince's impressive action range was brought to life with unknown fluidity for the time. To create the animated sprites of *Mortal Kombat* (1992), game developers used video sequences shot with real actors.

Fully animated images had been integrated in some **laserdisc games** in the 1980s (like *Dragon's Lair* [1983]), but gameplay was limited, and relatively few such games were produced. With CD-ROM technology, the video game **industry** attempted to replicate a **film**-like illusion of motion in video games; however, the quality of full-motion video (FMV) varied greatly from game to game. The long-running *Tex Murphy* series illustrates the evolution of FMV integration: after the tiny windows in *Martian Memorandum* (1991), the live-action sequences were integrated directly on static settings in *Under a Killing Moon* (1994), and *Overseer* (1997) benefited from fully animated sequences taking up most of the screen.

In addition to digitized drawings, photographs, or movies, pre-rendered synthetic images were also commonly used to create visual assets in the early 1990s. In 1993, *The 7th Guest* and *Myst* debuted virtual worlds that could be explored through breathtaking computer-generated images, the former in glorious full motion. Most of the assets for *Donkey Kong Country* (1994), from backgrounds to animated sprites, were pre-rendered on Silicon Graphics workstations. The basic steps to create computer-generated images and animations remain the same to this day; **artists** model objects and scenes from geometric primitives, textures are applied to the modeled surfaces, and specific algorithms handle phenomena like lighting, liquid, volatile matter, and so forth. Virtual skeletons are incorporated into objects, with each joint possessing its own set of attributes. For more realistic movement, animators often rely on the technique of **motion capture**: a performer executes the needed movements wearing a special suit equipped with a set of captors at key joints, allowing the movements to be recreated digitally.

The Language of Illusion

The development of bitmap-based imagery involves many procedural manipulations, which can be hardwired into the systems' infrastructure or completely handled by software. In two-dimensional games, bitmaps are tiled to form the scene defined by the program, and sprites move on the screen according to specific algorithms that simulate inertia or gravity. The technique of **scrolling**, first introduced in *Super Bug* (1977), makes the game worlds appear progressively on the screen; the motion is either controlled by the computer (as in *Xevious* [1982]) or in response to user navigation (as in ***Defender*** [1980]). Irem's *Moon Patrol* (1982) made use of parallax scrolling: three independent, overlapping layers of scenery moved at various speeds, producing an illusion of depth. With hardware or algorithms that can scale or rotate bitmaps, developers were able to make game worlds move in new ways and even direct the gameplay on the z-axis (as in *Hang-On* [1985] and *Space Harrier* [1985]).

The three-dimensional models used by CGI artists are mathematically formulated and thus can be manipulated endlessly by the computer; a rendered image is but one of many possible actualizations of the model. But pre-rendered imagery is at odds with the reactivity expected by players in the course of the interactive experience; the ideal apparatus should be able to manipulate objects and spaces in real time. Even though three-dimensional graphics became the norm during the 1990s, the techniques were developed much earlier in the form of **vector games**, in which the CRT's electron beam drew primitive shapes like points or lines directly on-screen only where needed, instead of scanning the whole screen. Vector primitives were also formulated mathematically and manipulated more easily. Two-dimensional games with sharp images and fluid movement were produced (like *Asteroids* [1979]), and many years later, *Another World* (1991) still impressed the gaming community with its two-dimensional vector graphics engine that provided smooth animation.

Vector displays quickly became associated with the creation of three-dimensional worlds. In 1980, ***Battlezone*** offered the first true three-dimensional environment in a video game. The world's objects were made of basic geometric solids (cubes and pyramids). To represent solid three-dimensional objects, polygons had to be filled in, something vector displays couldn't achieve easily. In 1983, ***I, Robot*** became the first video game to implement filled-polygon graphics using a raster display. This type of imagery has been associated with the vehicular simulation genre through long-running series, such as those begun with *Falcon* (1987) and *Chuck Yeager's*

Advanced Flight Trainer (1987). Three-dimensional gaming became truly popular with the release of *Doom* (1993), which had a **game engine** that rendered textured environments in real time, although objects (such as power-ups and enemies) were made of sprites scaled in response to the user's virtual position.

In 1996, the game engine designed for *Quake* rendered most of its hellish game world, including its inhabitants, with textured polygons. Id Software later released a version of the game running under Windows 95 that used the 3-Dfx Voodoo (1996), one of the first three-dimensional graphics cards for personal computers. Many innovations introduced by the *Quake* engine pertained to the necessity of limiting the amount of polygons and information to be calculated at any time so the game could run on limited hardware. To this day, three-dimensional games use many rendering shortcuts to run at a decent frame rate. Arcade games and home **consoles**, too, gained three-dimensional capabilities; engineers now tried to produce hardware that could manipulate ever more astronomical amounts of polygons. According to Sony, the first **PlayStation** (1994) was able to handle 360,000 polygons per second, and the NEC PowerVR Series II that powered the **SEGA Dreamcast** (1999) was said to handle up to 3.5 million polygons per second.

CGI artist Alvy Ray Smith once estimated that 80 million polygons per second would be required to reproduce reality on the screen. It would be naïve, however, to think that the sole challenge of game engines resides in geometrical complexity. Polygons, as Steven Poole insisted (2000), might be the "building bricks" of contemporary video games, but our visual world is populated with phenomena infinitely less tangible than bricks; water, smoke, fog, fire, and explosions are difficult to mimic with simple textured polygons. To simulate the subtle visual behavior of these phenomena, developers use *particle systems* in which the behavior and appearance of simple, primitive shapes are handled by algorithms and can be modified in response to the actions of the user or other elements of the simulated world.

Within animation, **artificial intelligence (AI)** determines how characters act in the environment and react to the virtual world's other actors. Virtual physics simulate gravity and calculate the intensity of deflagrations in real time. As they integrate dynamic behavior models, game worlds explore a whole new layer of visual realism. Although video games do not evolve solely to integrate ever more complete and complex simulation models, as new techniques emerge, and video games strive to refine their power of illusionistic deception, it is undeniable that these models, too, affect the way we look at games.

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guides

See game guides

H

hacking

"Hacking" refers to acts of technological manipulation (known as "hacks") that result in the reappropriation of systems, software, and/or hardware. Hacking can be as sophisticated as decrypting a government security system and as elementary as workplace sabotage. The term has developed to describe the activities of the subculture group known as hackers. Hacking is often referred to as an illicit or illegal activity, and hackers are typically cast as the anarchists of the information age. Cultural anxiety over hacking has dissipated as digital technology has become a more ubiquitous and commercially regulated element of society. The history of hacking and the hacking practices that have evolved and endured are the two factors that inform the current understanding of this social practice.

The subject of "hacking" has been analyzed in the fields of Information and Technology Studies, Computer Science, New Media Studies, Cultural Studies, and Political Science. It has been discussed more colloquially in reference to proper Internet behavior and video game **modification**.

The History of Hacking

Despite its association with computer technology, hacking has been a cultural phenomenon since the 1910s. Early amateur radio operators would occasionally access naval frequencies and hassle communications officers with false or obscene messages. During the 1960s, a noncomputer hack known as "phone freaking" was developed. The hack targeted phone systems and allowed people to call around the **world** free of charge if they knew how to produce a high-pitched whistle at the appropriate moment.

The first written description of computer hacking can be found in Joseph Weizenbaum's 1976 book *Computer Power and Human Reason*. However, the practices and beliefs associated with computer hacking have been evolving since the 1950s. Computer science students in prestigious universities created some of the hardware and software that became the basis for modern computers. During the 1960s and 1970s, a new group of computer enthusiasts took the hardware of their cultural ancestors and began to experiment with advanced computer programs and the Internet. By the 1980s, a complete computer subculture had developed with its own beliefs and rituals. During these 30 years, this subculture established hacking as a key use of computer technology.

Accounts from computer science departments in the early 1980s describe the aesthetics of hacking. A successful hack would use simple means to achieve a surprising result. The status of a hack was determined by the hacker's ability to demonstrate his or her expertise by trespassing in a large system in an amusing way. Novice hackers would engage in hacking "mastery games" to prove their worth to the group. Sherry Turkle describes the development of a hacking ethos in her book *The Second Self: Computers and the Human Spirit* (1984). The ethos is predicated on the phrase "information wants to be free," a motto first articulated in the 1950s by the MIT students that developed the first multiple-access user system computer program. For these pioneering computer engineers, hacking was an attempt to achieve the utopian potential of the computer through an emphasis on decentralized power and techno-libertarian principles. Hackers aligned their activities against those of the "straights" who used the computer as a business tool and not as a "magical machine." Journalists, authors, and filmmakers bolstered the countercultural status of early hackers and hacking. In these accounts, hacking was an exciting act of protest from a group of misunderstood loners against powerful corporations or governments. The legacy of this characterization is present in the cyber-punk fiction of the 1980s and in films such as Ian Softley's *Hackers* (1995) and the Wachowski brothers' *The Matrix Trilogy* (1999–2003).

By the mid-1990s, businesses adopted computer technology and digitized labor. Hiring members of the hacker subculture became a standard practice. Technology companies redesigned the standards of professionalism to accommodate the work modes and interests of hackers. Books such as Douglas Coupland's *Microserfs* (1995) and Andrew Ross's *No-Collar: The Humane Workplace and its Hidden Costs* (1991) describe the work environment of this second stage of hacking. Hackers of this era had become largely domesticated by the lure of a steady paycheck, health benefits, and the corporate campus work environment. At the same time, news stories villainized hacking by painting all acts of transgressive computer use with the same brush. Reports of hackers breaking into bank accounts and the mailbox of the Duke of Edinburgh conflated hacking with "cracking." Cracking refers to the deliberate malicious form of hacking designed to cause destruction or theft. If hacking is equal to trespassing, then cracking is vandalism. The negative press portrayals of hacking and the hacker migration to corporate "campuses" brought hacking into the mainstream. This second stage of hacking informs contemporary understanding of the activity. Hacking is now associated with the "good" activities of corporate IT departments or with the "bad" or dangerous practices of malicious groups of Internet criminals.

Situated between these charged poles is the "open-source" movement. Open-source refers to the independent creation and free distribution of computer software. Open-source content is "open" because it is designed to allow anyone to view and improve the code for the software. Thus open-source content is constantly evolving through the collective hacking of a nonhierarchical network. The Linux operating system is the most notable achievement of the open-source movement. Members of the open-source community value the purity of anticapitalist hacking. They share the utopian beliefs of the earliest hackers and use their collective computer knowledge to produce free content.

If the open source movement is connected to the earliest hackers, then the

"Hacktivist" movement is the descendent of 1980s prankster hacking. Hacktivism is a term that describes politically motivated, direct-action hacking. The hacktivism movement is described in the book *Hacktivism and Cyberwars: Rebels with a Cause?* (2004) by Tim Jordan and Paul A. Taylor. The authors explain that this type of hacking is made possible by the collaborative nature of our networked society and the history of popular protest. Examples of hacktivism include the 1999 Seattle protest of the World Trade Organization (WTO). Hacktivist protestors successfully crashed the WTO website for the conference by collectively bombarding it with repeated page requests. The protestors succeeded in dismantling a tool of the conference and made their political opposition felt. The political agenda of the hacktivist movement complements the beliefs and practices of the hacking community.

Hacking Ethos in Video Game Culture

The history of hacking reveals several consistent elements of the activity. Hacking is based on a reverence and a delight in the mastery and exploration of computer technology. Even in its most institutionalized forms, within corporations, the desire to participate in interesting hacks keeps employees engaged with the goals of the company. At the same time, there is an element of transgressive play involved with hacking. Hacking often expresses itself in opposition to the mainstream and to commercial desires. It is striking how the beliefs of the hacker community have helped to frame the mainstream understanding of Internet culture. File sharing, Internet pranking, and the hacker work ethic (defined by the blending of leisure and work) represent many of our computer experiences.

Examples of hacking are prevalent in the context of video game culture. The "modding" of video game **consoles** is hacking that has parallels with the earliest computer programmers and hardware tinkerers. Modding is a hack that requires the reappropriation of video game hardware and software. Modding a video game console improves the technology for the user and can enable the hacker to store, **play**, and access games in a way that was not originally intended. For example, modding software can add creative elements to the game that were not originally conceived. Popular mods often require hours of painstaking coding and demonstrate the author's expertise and knowledge of the technology.

Prankster hacking is also prevalent in the world of video games. Groups like the on-line community 4Chan have coordinated their efforts to enter game **spaces** and disrupt gameplay as a way of gaining attention and notoriety. During the fifth anniversary of the 4Chan website, members of the community invaded the game *Habbo Hotel* (2000; now *Habbo*) and blockaded a feature of the game (the pool). The group all selected the same **avatar** and repeated the same phrase "the pool is closed." The prank (similar to a flash mob) soon became an Internet meme. Hacking of this nature can be compared with the "mastery games" of previous hacker groups.

Hacking the source code of video games has led to the creation and distribution of macros, bots, and add-ons. This hacking activity is similar to the efforts of the open-source movement. Some games encourage their users to engage with this code and create new gameplay possibilities. During the release of Valve Software's *Half Life 2* (2004), the company released information on how to access the programming code and encouraged gamers to modify the game. Other games try to keep the code hidden but are hacked by gameplayers, and the code is then made available to the larger community. Code hacking in video games allows certain users an advantage in the world of the game or allows users to fix a perceived limitation. Hacking the source code of video games brings to the forefront issues of proprietary ownership and Internet collectivism.

Hacktivism is also present in the world of video games. Virtual protests have occurred on a variety of **massively multiplayer online role-playing games (MMORPGs)**. In July 2003, a protest in Second Life by a group of residents involved the virtual destruction of crates of tea and the raging of bonfires. The protestors were unhappy with the tax system the games architects had employed. Through their hijacking of the gameplay, these protestors were able to gain concessions from the game designers.

It is clear from these examples that hacking is a daily reality in video game culture. The hacking activities of many gamers reflect the attitudes of the earliest computer designers. As **game design** embraces on-line components it is reasonable to assume that collective hacking will become an increasingly common part of the gaming experience. ***See also*** cheating; co-creativity; cooperative gameplay; Easter eggs; emulators; game modifications; machinima; programming.

Ethan Tussey

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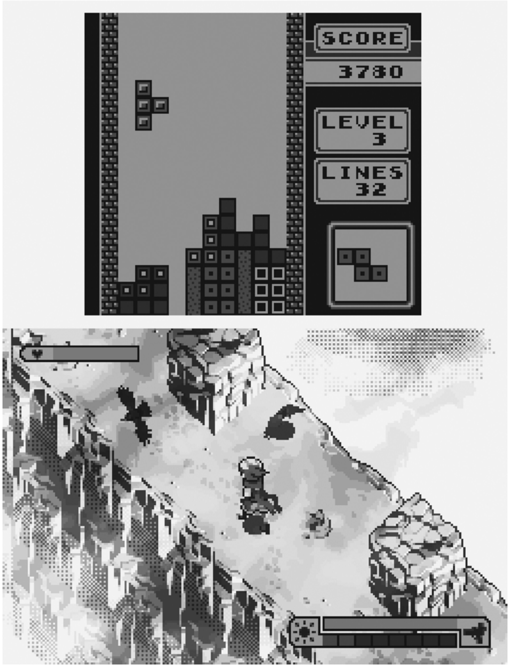
handheld games

The earliest significant handheld devices that served as **platforms** for video games (as opposed to simpler electronic or mechanical handheld games or toys) were from Microvision, released by toy company Milton Bradley in 1979, and **Nintendo**'s Game & Watch line, which debuted in 1980. The Microvision was the first handheld system to use removable **cartridges**, and it was remarkably quick in adopting the model, which had only recently been pioneered by the **Fairchild/**

Zircon Channel F home **console** in 1976 and popularized by the **Atari VCS 2600** in 1977. Yet although the Microvision was intellectually ahead of its time, it was also hamstrung by poor ergonomics, a minuscule 16 × 16 pixel monochrome screen, and notoriously unreliable hardware susceptible to damage from even modest day-to-day use. Nintendo introduced their own innovation more or less in parallel: Game & Watch, a brand of lo-fi, single-game LCD handhelds. Each model was limited to a single title because the **graphics** and gameplay were literally etched into the screen, with a predefined set of character and obstacle positions that were created with "segmented" LCDs similar to those used in calculators and watches (hence the name: Nintendo's handhelds included a watch function). Game & Watch was cheap and fast to produce as well as to **play**, with short, pseudo-action gameplay that was almost turn-based, with its timing and memorization-dependent mechanics. The **design** was the brainchild of Gunpei **Yokoi**, a Nintendo employee—widely regarded as handheld gaming's godfather—responsible not only for Game & Watch but also the original **Nintendo Game Boy** and (with a posthumous release in 1999, after Yokoi's death in a 1997 traffic accident) Bandai's WonderSwan, a simple yet surprisingly successful monochrome machine that held its own against Nintendo's updated Game Boy Color in the Japanese market (WonderSwan never saw a U.S. release).

It was with Nintendo's debut of the Game Boy in 1989 that handheld gaming emerged as a major market segment, and no discussion of the medium would be complete without an acknowledgment of its impact. From its introduction until its official successor the Game Boy Advance arrived in 2001, the Game Boy continuously dominated handheld gaming—and was arguably more successful in its field than any other juggernaut platform before or since, from the Atari VCS 2600, to Nintendo's own **Nintendo Entertainment System (NES)**, to the **Sony PlayStation 2**. The Game Boy was the pinnacle of designer Gunpei Yokoi's philosophy that affordable, "good enough" technology trumps the cutting edge. While Epyx and **Atari** packed their handheld Lynx (1989) system with impressive color graphics capabilities and a back-lit LCD—including sprite rotation and scaling effects that rivaled those of Nintendo's 16-bit **Super Nintendo Entertainment System (SNES)** home console, despite predating it—Yokoi left the initial Game Boy model with a monochrome screen and 2-bit graphics with a mere four shades of gray-green and 160 × 144 pixel resolution. Its 8-bit Z80-based CPU was already 13 years old at the time of the system's debut. Many of these hardware decisions resulted from Yokoi's sensitivity to the different human use cases for handheld games, particularly the importance of battery life for portability. With four AA batteries, the Game Boy could run for about 10 hours, comparable to the span of today's portable consumer electronics (gaming-dedicated or otherwise); meanwhile, competitors including the Lynx and SEGA's Game Gear topped out at around 4 to 6 hours, despite using six AA batteries.

Game Boy played host to two decade-defining titles in handheld gaming: ***Tetris*** (1989, Nintendo version) and the *Pokémon* series, begun in 1996. Both are inextricably



Top: Nintendo's iconic edition of *Tetris* (1989) for the Game Boy. As a system "pack-in," *Tetris* introduced millions of players to the unique strengths of handheld gaming. Bottom: *Boktai: The Sun Is in Your Hand* (2003) for the Game Boy Advance highlights the unusual input possibilities for handheld hardware, with a solar sensor that causes sunlight to affect the RPG game world. (Brett Camper)

linked with the Game Boy brand, particularly with their reach beyond traditional gaming audiences and perception as "family friendly" franchises. *Tetris* debuted as a system "pack-in" with the platform's launch, ensuring widespread distribution. But more important, the game embodied the unique strengths of the handheld as a mode of play: short play sessions, economy of motion, thinking over flashiness, and graphics that did not improve with size, speed, or color depth. Although *Tetris* was ported to every platform of its time big and small, the Game Boy version saw far greater reach than its larger format, more colorful NES counterpart and was the predominant channel through which Americans were introduced to the canonical Russian puzzle game. Seven years later, a similarly successful franchise was born with the release of *Pokémon Red* and *Blue*, a pair of **role-playing games (RPGs)** that simultaneously distilled the genre's essence, increasing its accessibility to a wide audience, while extending it with new networking and "collectible" concepts that turned a solitary activity into a social one. *Pokémon* gameplay revolves around **world** exploration in search of new Pokémon species (Pokémon being a contraction of the phrase "pocket monsters"), with RPG-style turn-based "battles" used as a means of capturing or collecting each new type of creature. Despite its emphasis on "combat," the series is oriented toward a younger audience and avoids realistic violence; Pokémon only become tired and never die. The truly viral nature of the brand is facilitated by its division into separate, individually incomplete versions; for example, the initial *Red* and *Blue* game variants each contain unique species that are exclusive to one another. Using the Game Boy's link cable, players are able to trade Pokémon, requiring collaboration to create a complete set. This simple social mechanism, anticipating the explosion of on-line social networking in the latter half of the 2000s, makes the franchise notable not only as a commercial success but also as a design innovation of historical significance within the game medium more generally.

Handheld gaming has also provided a notably fertile ground for "new" technologies, serving as an advance guard for everything from the ubiquitous four-way "D-pad" **controller** component, to multiplayer networked play, to touchscreens. Of these, the innovation with the longest historical impact on the medium is likely Yokoi's particular brand of D-pad (or directional pad), introduced with an iteration of the Game & Watch line in 1982. Yokoi's iconic D-pad standardized the four-way "plus" (or "cross") formation, with a single piece of continuous plastic that has four distinct tilt positions for up, down, left, and right; proximate pairs of up-right, down-left, and so forth are also possible, providing eight input options and making both cardinal and diagonal movement immediately intuitive. The discrete, digital nature of the D-pad—on the face of it, a downside compared with more free-flowing analog **joysticks**—proved appropriate to the limited positional and graphical model of the era's tile-and-sprite-based 8-bit systems, and Nintendo's D-pad went on to cement its position by anchoring the controllers of the Famicom/NES and Game Boy. All major hardware primarily marketed as a gaming device (whether home console or handheld) has included the canonical D-pad ever since.

The self-contained proximity of small handheld hardware platforms—everything from the screen to the game cartridge to the controls are all within inches of one another—has made the form convenient for more unusual, physical input models, such as the solar sensor found in Konami's *Boktai: The Sun Is in Your Hand* (2003) for Game Boy Advance. *Boktai*'s solar sensor detects sunlight by measuring UV-ray levels, and the game integrates this real-world state into its fiction, with sunlight a scarce and collectible commodity that must be strategically managed. *Boktai* was an early commercial example of the "tangible computing" movement that has since seen the rise of location-based GPS (Global Positioning System) as a common input device. Further examples of physical handheld gaming include the tilt sensor found in *Mawaru Made in Wario* (2004) for the Game Boy Advance; in this collection of short "micro-games" (played within a few seconds each), the player rotates the entire device as a means of control. Likewise with the touchscreen: when Nintendo included the technology in its **Nintendo DS** handheld in 2004, it was met with skepticism over its precision and practicality (the **interface**-poor experience of the ATM machine having set a discouraging precedent). Yet the DS went on to sell more than 135 million units worldwide as of late 2010, anticipating the interface curve of consumer electronics, with both touchscreens and gyroscopic motion sensors now the centerpiece of Apple's iPhone and commonplace on a range of devices (meant for gaming or otherwise). Nintendo aims to continue this pattern with the introduction of a **3-D** screen in its upcoming 3DS handheld in 2011, based on autostereoscopic lenticular lenses (able to produce the perception of a 3-D image on-screen without the use of any separate hardware augmentation such as specialized glasses). The 3DS embodies the advantages that handheld gaming hardware has often held: while the rest of the consumer electronics industry seeks to establish 3-D imaging through expensive and bulky TV and theater experiences, the 3DS leverages its player intimacy to make new technology immediate and **accessible** with a screen technique that is only possible with an eye distance of inches rather than feet.

In recent years, significant competition to the dedicated handheld gaming market has emerged for the first time because of the confluence of two factors: on the hardware side, the rise of Apple's iPhone as an everyday consumer device, and in software, the establishment of the **casual games** sector. **Online games**, often built on Flash or Facebook, have acclimated a new audience previously unfamiliar with games, and these "casual" players are more receptive to games on general-purpose handheld platforms, particularly the iPhone but also Android platform phones and related devices. Nintendo itself has sought to pivot its Nintendo DS brand toward the casual sector with puzzle-oriented titles such as the *Brain Age* (2005) and *Professor Layton* (2007) series. Together these trends have significantly expanded the scope and market for handheld games. The breakout *Angry Birds* (2009) for iPhone/iPod, based on a simple physics engine, sold more than 10 million copies in less than a year, eclipsing typical single-digit-million sales for handheld versions of Nintendo's core franchise games, such as ***The Legend of Zelda****: Phantom Hourglass* (2007) for DS. For the first time since 1980, the handheld market is not a monopoly, but an oligopoly.

Brett Camper

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Hawkins, Trip (1953–)

Trip Hawkins (William M. Hawkins III) is the founder and CEO of **Electronic Arts (EA)** and **3DO**. He holds a degree in Strategy and Applied Game Theory from Harvard, as well as an MBA from Stanford University. As of 2010, Hawkins presides as CEO of Digital Chocolate. He was the first business executive to be inducted into the Academy of Interactive Arts and Sciences' Hall of Fame in 2005.

Hawkins began his professional career as the Director of Strategy and Marketing at Apple Computer before founding Amazin' Software in 1982; the company was renamed Electronic Arts in 1983. Electronic Arts started out as a software publisher and pioneer of the home computer gaming industry. In the early 1980s, EA published software titles such as *Archon* (1983), *M.U.L.E.* (1983), and *The Bard's Tale* (1985). In 1987, EA made the transition to developing software internally with the video game *Skate or Die!* (1987). While heading EA, Hawkins is notable for having innovated the concept of using the likenesses of celebrities and professional athletes in video games. *One on One: Dr. J vs. Larry Bird* (1983) and the original *John Madden Football* (1988) are examples of this trend. Electronic Arts is also notable for having published the first computer "**god game**," Bullfrog's *Populous* (1989). Hawkins remained CEO of Electronic Arts until 1991 and remained its chairman of the board until 1994.

In 1991, Hawkins founded SMSG, Inc. in partnership with several other high-profile companies including Time Warner, AT&T, MCA, and LG. Hawkins's objective for the company was to create a next generation, **CD-ROM-based** video game **console**. The company was later renamed 3DO, and the **3DO Interactive Multiplayer** video gaming console was released in 1993. Even though the console had advanced **graphics** and **sound** capabilities, the 3DO's high price, lack of third-party development support, and the arrival of the **Sony PlayStation** in 1994, resulted in relatively poor sales. By 1996, 3DO ceased production of the console and made the transition from being a hardware developer to a video game developer, creating titles for other gaming consoles and the IBM PC. 3DO created several well-received franchises: *Battletanx* (1998–1999), *Army Men* (1998–2002), *High Heat Baseball* (1999–2003), and *Heroes of Might and Magic* (1996–2003). 3DO is also notable for publishing the first **massively multiplayer on-line role-playing game (MMORPG)**, *Meridian 59* (1995). In 2003, due to lack of interest in their software titles, 3DO filed for Chapter 11 bankruptcy. Hawkins purchased the rights to some of 3DO's older franchises, while other intellectual properties were sold to rival game developers.

After 3DO's bankruptcy was finalized, Hawkins founded a new game company, Digital Chocolate. Digital Chocolate **designs** games and nonentertainment titles for handheld devices, in addition to Microsoft Windows and the iPhone OS. Digital Chocolate has received several "Best Game Developer of the Year" awards from multiple sources. On November 7, 2009, Digital Chocolate was selected for the 2009 Best of Business Award in the Video Game Publisher category.

Aaron D. Boothroyd

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HDTV games

There are four conventional terms used to describe **television** image definition, standard (480i), enhanced (480p), high definition (720p; 1080i), and full high definition (1080p). The numbers offered in brackets indicate the quantity of vertical pixels available for display, known as scan lines, whereas the "i" and "p" indicate interlaced or progressive scan. Interlacing is a practice originating with cathode ray tube (CRT) televisions where an image is constructed by alternating between displaying the odd and even numbered rows. In 1990, well before HDTVs were commercially available, the International Telecommunications Union standardized a new aspect ratio of 16:9 as opposed to the CRT standard of 4:3 to match that of the **film industry**, in addition to specifying that 1080p would be the standard number of scan lines.

Although HDTV has been around since 1958 (GizMag Team, 2009), few storage media could accommodate the rate of data transfer required to display HD. Although public HD broadcasts did emerge in the 1990s, these were rare. However, in 2005, two formats, HD-DVD and **Blu-ray**, emerged as competing forms of HD discs. Sony, a member of the Blu-ray Disc Association, built its **Sony PlayStation 3** to include a Blu-ray player, contributing to an estimated $240 to $307 loss on each unit sold (Fulton, 2006). At the time, Blu-ray players sold for more than the retail price of a PS3. This gambit is often attributed as the reason why Blu-ray became the standard format, forcing HD-DVD to fold (Smale, 2008). Although the **Microsoft Xbox 360** eventually offered HD-DVD compatibility, it came at additional cost to consumers, failed, and was subsequently discontinued. Regardless, the Xbox 360 is capable of outputting in HD and has been said to have stimulated $73 million in HDTV purchases in its first year after launch (Crandall and Sidak, 2006).

Several profitable games are being remade to display in HD. The only high-budget games to move to HD have been *God of War* (2005) and *God of War II* (2007), which first appeared in 480p on the **Sony PlayStation 2** and were rereleased together in 720p just months before *God of War III* (2010) on the PS3. However, smaller titles for **platforms** can be remade and sold at a lower price, in part because of the on-line distributing mechanisms of the PlayStation Network and Xbox Live Arcade. Although the **Nintendo Wii** features remakes of **Nintendo**'s older titles, the **console** cannot display in HD, and consequently the games are usually upgraded from 480i to 480p. Although this makes a difference in image quality, it also ensures that the HDTVs lag less while upscaling their input. Although HDTVs have different native **resolutions** at which to display images, 480i is not supported and therefore must be processed for upgrading. Some HDTVs feature a game mode that reduces the lag on older games simply by curtailing the upscaling process.

At the time of this writing, Sony has announced that the *Sly Cooper* series, which appeared on PS2, will be released in HD but also with an optional 3-D display and **motion control**, via its recently announced PS Move. By doing so, Sony limits the perceived risk of investment on behalf of consumers who already know the game or know it to be well liked; they lower their own risk given that the game has already been largely completed, while synergizing their technologies and giving consumers a reason to evolve their home entertainment system (an HDTV owner might purchase the game for its updated **graphics** and low price and eventually decide to try the motion control or upgrade to **3-D hardware**).

William B. A. Robinson

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health (mental)

With the popularity of video games constantly increasing, researchers are exploring the impact they have on mental health. Psychological well-being encompasses **cognitive**, behavioral, **emotional**, and physical aspects of health. The Ryff scales of psychological well-being include establishing positive relationships, employing effective coping skills, possessing self-acceptance, demonstrating independent thoughts and behaviors, identifying purpose in life, and working toward continued personal development (Ryff and Keyes, 1995). Bradburn's (1969) notion of psychological well-being focuses on aspects of positive and negative affect or subjective emotional experiences. Higher levels of psychological well-being are directly connected to happiness and elevated quality of life.

Smyth (2007) examined **arcade games**, **console-based games**, **computer games**, and **massively multiplayer on-line role-playing games (MMORPGs)** with factors of well-being. Results indicated that MMORPGs were associated with highest number of hours played and lowest levels of sleep quality, academic performance, overall health, and social life. However, overall levels of well-being were nearly equal among the four groups. Chen (2008) suggested **on-line games** may be used to enhance satisfaction with life if individual personality characteristics are taken into consideration by game providers. Ryan, Rigby, and Przybylski (2006) indicated that the relationship between video games and well-being is complex. Mere exposure to video games was not related to positive or negative affect. Yet those individuals who felt competence and autonomy while playing video games experienced higher levels of enjoyment, self-esteem, and positive affect. Conversely, gaming was related to fatigue and had a negative impact on measures of vitality.

Perceptions of abnormality are largely connected to culture and societal norms. Guidelines for determining whether behavior is abnormal include evaluating whether the behavior falls outside of what is considered normal within a particular society, if the behavior interferes with aspects of daily life, and if the behavior is long-lasting or persistent (Meyer, Chapman, and Weaver, 2009). A psychologist may deem video game **play** as abnormal if it interferes with work or school performance. In addition, if video game play affects physical health (see **health [physical]**) or social/familial relationships the behavior may be considered outside of the normal range. Lastly, a problematic pattern of video game play must be observable, for example, for at least 6 to 12 months.

The fourth edition (text revision) of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV-TR; APA, 2000) is the reference that the fields of psychiatry and psychology use to categorize mental illness and diagnoses. Its conceptualization of mental health is based on research on mental illness with respect to causes, features, and treatment. The DSM-IV-TR acknowledges the multidimensional nature of mental health in its diagnostic assessment format as it recognizes cognitive, behavioral, emotional, environmental, and physical factors that contribute to mental health. Researchers have applied DSM diagnostic criteria for substance dependence and pathological gambling to assess problematic video game playing (Tejeiro-Salguero and Bersabé-Morán, 2002). A revision of the DSM is expected in 2013, and a potential mental health diagnosis related to video game playing is being explored by experts.

There are numerous ways to improve mental health and enhance psychological well-being. Prevention techniques such as psychoeducation can be effective with healthy populations and/or populations at risk for developing problems. Psychoeducation includes teaching individuals about psychological concepts and effective coping strategies to foster healthy, happy living. For example, video games can be used to support learning (de Freitas, 2006) and may enhance spatial abilities in females (Terlecki and Newcombe, 2005). Psychotherapy can be used as prevention, as well as a tool to work through current mental health issues or maintain quality of life while living with chronic mental illness. Psychotherapy with a counselor may include focusing on thoughts, feelings, self-exploration, examination of past experiences, or learning new ways to deal with problems. Video games have been used in exposure therapy for treating anxiety disorders such as phobias (Walshe et al., 2003). Also, social support, or building relationships with others, may improve psychological well-being. Longman, O'Connor, and Obst (2009) suggested that ***World of Warcraft*** (2004) may foster social support. Low levels of *WoW* play may increase well-being with respect to symptoms of depression, anxiety, and/or stress. ***See also*** psychological research on video games; virtual reality (VR).

Rachel F. Pickett

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health (physical)

In their early days, home video games were accused of promoting a sedentary lifestyle (players usually stood while playing **arcade games**, but this fact was not noted, and arcade games were not defended as being any healthier than home video games). The argument was that video games kept players from participating in more vigorous activities such as sports and that video game sports were poor replacements for the physical activities they represented. What was worse, the activity they did require, such as wrist movements and button pressing, sometimes led to repetitive stress injuries (RSI) that were even given such names as "Space Invader wrist" and "Gamer's thumb." Such specialized injuries or disorders continue to emerge, and more recently one can find mentions of "Wii-itis," "Wii elbow" (similar to tennis elbow), and "**PlayStation** palmar hidradentitis," a skin pathology that includes painful lesions on the palm and fingers.

In addition to such specific injuries, video games were blamed for causing headaches, eyestrain, epileptic seizures (due to flashing screens), carpal tunnel (common to other computer users as well), nerve damage caused by vibrating haptic controllers (like **Nintendo**'s Rumble Pak), fatigue, and lack of sleep due to excessive on-line activity. Clearly, most of these ailments were due to excessive and prolonged use of video games and more the result of players' use (or abuse) than of video **game design** or hardware design. Such overuse also led to questions regarding video game **addiction** and other effects on mental health (see **health [mental]**). With proper levels of use, however, such effects are no more present than they are with other computer technologies or physically manipulated hardware.

During the late 1990s and early 2000s, some games and game series were designed to challenge the sedentary image that video games had acquired, the most widely known one being **Konami**'s ***Dance Dance Revolution*** game series, which has even been used in high school physical education classes as an activity. In 2006, the **Nintendo Wii**, with its **gestural interface**, also introduced games requiring large-scale bodily movement on the part of its players. Although its *Wii Sports* and *Wii Play* games make players move around (even giving players warnings suggesting they take a break after the system has been in use for awhile), the game *Wii Fit* (2007), with its Balance Board, combined exercise and entertainment.

Video games have already been used to help people overcome phobias (see **virtual reality**), and now hospitals are beginning to use the Wii as a therapeutic tool in rehabilitation and physical therapy routines for patients recovering from illnesses, strokes, accidents, and combat injuries. Besides encouraging exercise, video games can also help players question unhealthy eating habits, like Ian Bogost's on-line game *Fatworld* (2007), which examines America's obesity epidemic.

As more of these aspects are addressed by video game hardware designers and as newer games and game systems continue to incorporate new types of **interfaces**, the overlap between medicine and video games will continue to be a fruitful area of research and one that may find ways to improve the health and well-being of video game players. Projects such as Games for Health (www.gamesforhealth.org), which wants to help foster and support the community that uses video games, game technologies, and game development talent to find new ways to improve the management, quality, and provision of health care worldwide, are already working in this direction.

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help function

The help function encompasses a variety of strategies that seek to assist users in their progress throughout the interactive experience. It can be provided by objects surrounding the game—such as cabinets, game cases, or **game manuals**—or by the software itself. Software-based help can go beyond a purely static presentation and be integrated dynamically and/or covertly throughout the user experience.

Tutoring the Player

As many scholars have pointed out, the interactive nature of video games allows users to learn how to operate a system through observation. However, the clarity of **rules** is one of the essential features of games according to many **definitions**, and early video games did indeed provide basic instructions to help players. Early games were often simple enough to require only a few directives displayed on the screen or on the cabinet itself: "Avoid missing ball for high score" (***PONG*** [1972]); "Jump button makes Jumpman jump" (*Donkey Kong* [1981]). The *Galaga* (1981) and *Zaxxon* (1982) cabinets used a combination of written instructions and color images to detail the introduction in the **shooting game** genre of the "ship recovery" mechanic and the altitude variation system, respectively. Information redundancy between the printed instructions and the attract mode of the game is also a common strategy. In *Berzerk* (1980) and *Zaxxon*, the short on-screen demonstrations echo the written directives.

With the development of complexity and variety in genres such as **role-playing games (RPGs)**, it became increasingly difficult to limit tutoring to the periphery of the interactive experience. *Dungeons & Dragons*–inspired games such as the ***Ultima* series** or the *Phantasie* series provided voluminous instruction manuals detailing the numerous commands, objects, and enemies to be found in their expansive **worlds**. In the action role-playing game *Gauntlet* (1985), the early levels were created as interactive tutorials that sought to acquaint the players with the newfound complexity; when the player faced a new situation, the game paused to provide textual instructions that were also spoken by a synthetic voice (for example, "save potions for later use"). Levels with overt tutoring, or easier early levels specifically designed to facilitate the assimilation of basic mechanics, have rapidly become the norm in video **game design**. The open-ended nature of early computer RPGs and other genres made it harder to implement this strategy, but guidance toward the appropriate challenges were often provided by alternative means; for instance, the manual for the *Bard's Tale* (1985) specified which three dungeons should first be explored. In contemporary examples such as *The Elder Scrolls IV: Oblivion* (2006), the first dungeon is mandatory before letting players explore the vastness of Tamriel on their own.

To assist players further, designers provided additional information on the system's inner workings. In the **arcade**, these hints—as they were most commonly labeled—often pertained to the possibility of maximizing one's score but could also provide valuable gameplay strategies: the ***BattleZone*** (1980) cabinet recommended to "use the radar, keep moving, use the cubes and pyramids as shields, listen for the enemy's tank shots"; whereas *Tempest* (1981) players received hints such as "Hold the fire button down for continuous fire" and "Use the 'SUPERZAPPER' to zap all enemies on the tube." The manuals or leaflets that came with the home versions of popular arcade titles usually proposed additional tips and strategies. Throughout its 30 pages, the manual for SSI's *Phantasie* (1985) is scattered with "playing hints" under appropriate sections. Some games allowed players to demand instructions or hints during gameplay. Mike Edwards's *Zombies* (1983) featured "on-line" help screens when the spacebar was pressed. In the interactive fictions of the SAGA series, users were instructed to type "HELP" on the text parser in the hope of receiving some assistance. Adventure games such as *Under a Killing Moon* (1993) and *Roberta William's Phantasmagoria* (1995) featured built-in hint systems. Contemporary games such as *Infamous* (2009) and *Batman: Arkham Asylum* (2009) automatically provide textual hints when players face certain new challenges. This assistance often takes the shape of a reminder of a tutorial element; in *Crysis 2* (2011), for instance, the player is instructed to "press Q to activate armor mode" before jumping down from high ground in specific places.

Managing the Performance

On top of tutorials and hint systems, game designers have come up with another major strategy to provide assistance: the possibility to evaluate and control the difficulty of the challenge to some extent. In the home market, users could rely on the challenge rating that many companies provided for their home products to decide which game to buy and play. Epyx games were rated with three icons (action, strategy, and learning), and the side of the boxes for SSI games always specified the difficulty level (like intermediate or advanced) and the estimated play times ("up to 100 hours"). **Arcade games** did include variable difficulty settings. For instance, in *Tempest* or *Star Wars* (1983) players could select to start at easier waves if they were willing to sacrifice a generous score bonus. Considering the ever-present concern of play time versus profitability in the arcades, adjustable difficulty made more sense for domestic systems. Home versions of classic arcade games such as *Joust* or *Berzerk* often added different skill levels to choose from. On the **Atari VCS 2600**, one could find switches labeled "game select" and "difficulty." In the VCS version of *Space Invaders* (1978; VCS version, 1980), these switches allowed players to adjust the size of the laser cannon and, consequently, the probability of being hit by the invaders' bombs. Game designers sometimes addressed the ego of players more directly: *Wolfenstein 3-D* (1992) had five difficulty settings, from "Can I play, daddy?" to "I am death incarnate." On the other hand, the adjustment of difficulty can be made covertly. In *Astrosmash* (1981), an *Asteroids* (1979) clone released on the **Mattel Intellivision**, the system lowered the difficulty automatically when players only had one life left. Some contemporary games push this strategy even further: in *Left 4 Dead* (2008), the "AI director" algorithm modifies the density and ferociousness of the zombie horde in response to the user's performance.

The pause function also made more sense in the domestic context. Arcade games were more concerned about players ending their session quickly, hence the presence of timers and other incentives like Evil Otto in *Berzerk*. In 1976, the **Fairchild Channel F** home console already featured a dedicated pause button. Home computer games also integrated the function early on through the spacebar or the "p" key. Of course, turn-based games (like *Roadwar 2000* [1986] and *Dragon Warrior* [1986]) integrated pauses during the combat sequences. As games became lengthier, other strategies to manage the experience appeared. To prevent the frustration of starting over from a game's beginning, many arcade games in the 1980s offered the possibility of inserting another quarter to continue from the start of the current section. In 1983, the box of *Moon Patrol* for the Atari 5200 highlighted its "unique continue feature." However, save systems were already implemented in many **adventure games** (*Adventureland* [1978]), **strategy games** (*Invasion Orion* [1979]), and **role-playing games** (*Ultima* [1980]); writable floppy discs allowed information about the game state to be stored. **Cartridges** used for home **consoles** did eventually integrate battery-powered chips to store games (as in ***The Legend of Zelda*** [1986]), but many relied on alphanumeric codes that were provided to players at the end of a session allowing them to restart at a similar game state (as in the home version of ***Metroid*** [1986]). In *Snowball* (1983), users who faced death on the colony starship could undo their last command by typing "OOPS" in the text parser. Contemporary games don't save the player's progress at every move, but there is a tendency to automate the game saving function with frequent automated checkpoints; players can load the last autosave quickly upon death. All these features provide assistance by salvaging the efforts of users and giving them control over the pacing of the experience.

Carl Therrien

hip-hop

The term "hip-hop" refers to both a style of music and a larger subcultural mode of expression. Musically, hip-hop usually includes the **art** of emceeing or rapping in rhyme or verse over beats that are synthesized with a combination of sampled music, live music, beat-boxing, **sound** effects, drum machines, and/or singing. Culturally, hip-hop can be thought of as including b-boy (break) dancing, graffiti art, and political and philosophical perspectives that are most often associated with the social advancement of minority youth. Like gaming, hip-hop has become a global cultural phenomenon, and the hip-hop **industry**'s formative years of growth, rise in mainstream popularity, and product diversification mirrors the early years of **console** and **arcade** gaming in notable ways. Because hip-hop originated in the South Bronx of New York City in the 1970s (during the key years of the rise in popularity of arcade and console gaming), technological advancements in the areas of electronic music, computer hardware, sound and video chips, and in the distribution of portable devices simultaneously affected both industries. A number of hip-hop legends such as the members of the Wu-Tang Clan describe themselves not only as being well versed in the technological innovations of the times but also as participating in the evolving gaming scenes of the 1970s and 1980s, so that there was always a relationship between producers of hip-hop music and gaming communities.

Since the 1970s and 1980s, the creators of hip-hop music and the world of gaming fandom have most often collided at the level of sound engineering. In this regard, a good number of hip-hop artists have paid homage to their lives as gamers in their music. In these songs, the lyrics range from brief "shout outs" about individual game franchises to longer, **narrative**, commentaries on games, classic systems, and on the nostalgic memories of particular gaming eras. Jean Grae, Pharrell, Del the Funkee Homosapian, Biggie Smalls, MC Lars, Eminem, and a seemingly endless number of both mainstream and underground emcees have rhymed about video games in their music to varying degrees of commercial success and recognition. In other cases, artists like Beanie Sigel in "Mac Man," Bone Thug and Harmony in "Eternal," and Tonedeff in "Round 'Em Up" (songs which sample *Ms. Pac-Man* [1981], *Eternal Champions* [1993], and *Kid Icarus* [1986], respectively) have integrated portions of video game theme songs into their tracks to create a sound fusion of rap and the techno-heavy nature of most classic game beats. One example of this type of fusion, Random's entire 2007 album *Mega Ran*, pays homage to his "love affair" with Nintendo's 1987 hit, *Mega Man*. The song "Splash Woman" includes gaming references in both the lyrics and in the sampled beats as Random raps a lengthy serenade to the game's female robot and her challenging "boss battle." Random narrates, "I was breezin, battlin bosses/ The record is flawless, zero losses/ 'Til I came across this, stunning young piece/ who resided at the bottom of the sea and she/ told me her name was Splash Woman/ Beautiful but deadly, she was mad cunning." The techno electronic beats of the game's level music combined with a heavy, hip-hop bass downbeat and Random's rapping and alternating singing give it an eclectic and hardcore aesthetic—both in terms of its sound and production values and in terms of Random's credibility as a gamer. In this vein, there are also albums that are multi-artist compilations of rap songs that reference or sample video games, including the cult favorite albums *Game Over* (2000) and *Game Over 2* (2001).

The two industries have also intersected in the area of **game design**, where developers of music, graffiti, and **fighting games** have attempted to capitalize on the continued popularity of hip-hop music with gaming audiences. **Rhythm and dance games** most obviously demonstrate hip-hop's relevance to the gaming industry, and games such as *Parappa the Rappa* (1996), *Get on Da Mic* (2004), the *MTV Music Generator* series (1999–2004), and *DJ Hero* (2009–2010) give gamers a chance to flex their own musical prowess as they emulate the art of rapping, scratching, and deejaying on cue. More recently, *Def Jam Rapstar* (2010) uses voice recognition technology and microphone controllers to try to measure intonation, accurate rhythmic mimicry, and flow. Other elements of hip-hop culture, such as tagging, graffiti art, and break dancing, have been featured in a number of nonmusic game titles, most notable among these are *Break Dance* (1984), *Marc Ecko's Getting Up: Contents under Pressure* (2006), *Jet Grind Radio* (2000), *Jet Set Future Radio* (2002), and *B-Boy* (2006). Hip-hop-inspired fighter games, such as *Wu-Tang: Shaolin Style* (1999), the long-running *Def Jam* wrestling series (2003–2011), and *Afro Samurai* (2009), often feature rappers as characters and require gamers to coordinate a variety of combos, special moves, and acrobatic jumps with a pulsing soundtrack of licensed rap music.

A number of controversial action games—namely, ***Grand Theft Auto****: San Andreas* (2004), *50 Cent: Bulletproof* (2005), *Saints Row* (2006), and *Saints Row 2* (2008)—have also capitalized on the widespread consumer interest in hip-hop culture by featuring an "urban" setting. These titles' visual style, story, plot, character costume, and character development often contain direct allusions to hip-hop legends from the past. Contemporary rappers often participate in urban action games by delivering voice acting performances that attempt to further lend the titles credibility with the growing demographic of gamers who are also fans of hip-hop music and culture. The criticism of these games mirrors critiques of some mainstream rap, with opponents stressing that the collaborations seem to glorify crime, **violence**, and misogyny. Others would say, however, that such content does not accurately reflect the totality of what hip-hop stands for; rather, the tendency to equate hip-hop with violence and crime (in video games and music) only reflects how the culture is often misappropriated for profit.

Using video game soundtracks for in-game advertising illustrates an additional way in which the video game and hip-hop industries have proven invaluable to each other in recent years. Games across genres—but especially **sports games**—have consistently used the latest tracks from hip-hop and rap artists to create a contemporary sonic aesthetic for everything from the *Madden* series to most basketball franchises (*2K NBA*, *NBA Street*, *NBA Ballers*) to **racing games** such as the *Need for Speed* series, to golf simulators. Music artists, from The Roots and Kid Cudi to T.I. and Snoop Dog, have viewed games as another way to distribute their music and gain new fans. This mix of distribution, promotion, and cross-marketing is further complicated by the fact of media conglomeration in the global marketplace. For example, Viacom, Sony, Time Warner, and other conglomerates now include game hardware manufacturers, game distributors, and game producers, along with music artists, record labels, and music television networks (like MTV, VH1, and BET) as assets in their financial portfolios. Such media conglomerations have a vested interest in sustaining the connection between gaming and hip-hop because it is becoming more possible for a single conglomerate to own the rights to a song, the game in which it appears, and the system on which it is being played. As sales in traditional music distribution decline while video game sales garner more and more of the consumer market share, video games are likely to continue to be important to hip-hop artists, to their fans, and to the corporations that profit from all of the above.

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history of video games

The history of video games began around the mid-20th century, and although it had a relatively slow start, video games' development sped up considerably after they become a commercial product in the early 1970s, and a decade after that they became a formidable cultural force. The history of video games has made an impact on the history of all other contemporary media and is central to the history of public computing because **arcade** video games and home game **consoles** were the first computers used and purchased by consumers, they introduced the computer into the public arena, and were the first form of electronic interactive audiovisual entertainment.

Early Experiments

The idea for video games can be traced back to 1947, with the filing of **patent #2,455,992**, which described an interactive game played on a cathode-ray tube; however, an actual working video game did not appear until sometime later. Although there is some debate as to what should be considered the **"first" video game**, which also depends on the definition of "video" and "game," the early **mainframe games** are usually the first to qualify, with ***Spacewar!*** (1962) often considered the first complete game by today's standards. Mainframe games were found mostly in university laboratories, and the first communities of game players and programmers formed around them. The development of such games continued into the 1970s and also included the first **on-line games**.

In 1966, inventor Ralph H. **Baer**, looking for a new use for **television** sets, began developing his "Brown Box" series of experiments at Sanders Associates. The series of prototypes he produced would lead to the first home video game console, the **Magnavox Odyssey**, in 1972.

The Odyssey included 12 built-in games, along with colored screen overlays, playing cards, and dice. New versions of the Odyssey would continue to appear until 1978. Although home games were developing, Stanford University graduate Bill Pitts and his friend Hugh Tuck were working on a coin-operated version of *Spacewar!*, which resulted in ***Galaxy Game*** (1971), the first coin-operated video game, which was installed in Stanford's student union. The first mass-produced coin-operated video game, however, appeared a month later, Nolan **Bushnell** and Ted Dabney's ***Computer Space*** (1971), which was also based on *Spacewar!*.

An Industry Begins

Bushnell went on to found **Atari**, and the company's first game was ***PONG*** (1972). In the years that followed, more **arcade games** and home game systems began appearing, many of which were **ball-and-paddle games**. In 1976, General Instruments released the AY-3-8500 chip, which included all the components needed to make a ball-and-paddle game, encouraging their production. The market flooded with these games, while their novelty faded, eventually leading the video game **industry** to the **crash of 1977**. The industry recovered quickly, however, largely thanks to the appearance of programmable video game consoles that used **cartridges** instead of having all of their games built-in. The first such system was the **Fairchild/Zircon Channel F** in 1976, which was soon overshadowed by the **Atari VCS 2600** released in 1977. In the years that followed, several hundred games would appear for the 2600, including ports of Atari's arcade games, and a large number of original games designed for the system, many of which were made by third-party developers. Following Atari's success, other home systems appeared, including the **Coleco** Telstar in 1978, the **Mattel Intellivision** in 1979, the **ColecoVision** in 1982, and the **Atari 5200** in 1982.

Arcade games also saw a new technology in 1977. **vector games**, which drew their images on-screen line-by-line instead of by full-screen raster scanning, appeared and were produced during the late 1970s and early 1980s by companies such as **Cinematronics**, **Vectorbeam**, and Atari, and one vector-based home console system appeared in 1982, the **GCE/Milton Bradley Vectrex**. Notable vector games include *Speed Freak* (1978), *Warrior* (1979), *Asteroids* (1979), ***BattleZone*** (1980), and *Tempest* (1981). Vector games would be the first to present computationally true three-dimensional **graphics** to video games.

The late 1970s and 1980s would also see the rise of the home computer and **computer games**, which gave many people a reason to buy a computer. Computers and video games were also being exported to **Europe**, **Asia**, **Australia**, and **New Zealand**, and indigenous production of games and systems in these areas also began around this time. This interest in video games around the **world** would serve to open up foreign markets even further; for example, **Nintendo**'s first venture into video games was distributing the Magnavox Odyssey in **Japan** in 1974, and the next year it produced its first arcade game, *EVR Race* (1975).

Video games became a force in popular culture as their popularity increased, with some games, like ***Space Invaders*** (1978), ***Pac-Man*** (1980), and ***Defender*** (1980), succeeding internationally and taking in hundreds of millions of dollars. By 1982, arcade video games had reached their peak, with about 10,000 arcades in operation in the **United States** alone (Wolf, 2007, p. 105). However, the arcade and the home market were growing more competitive and were saturated with cheap imitations of successful games, and video games' novelty was waning, making another industry crash imminent.

The Great Crash and Recovery

Warning signs appeared as arcade profits fell in late 1982 and the North American home market collapsed, leading to the great video game industry **crash of 1983**. Thousands of arcades closed, and almost no new home systems appeared on the market. Mattel, which had once been the third largest producer of games and its Intellivision system, left the market. The arcade industry was looking for a new technology to revive the market and briefly pinned its hopes on **laserdisc games**; these provided better graphics, which were stored as video clips on laserdiscs. Limiting games to the clips and the graphics sometimes placed over them reduced interactivity, and because of the technology, laserdisc games often cost twice as much as other arcade games, resulting in their failure overall. A laserdisc-based home game system, Rick Dyer's Halcyon, also appeared in early 1985, but its high price and limited game library led to its failure. But no new console systems appeared in 1984, as the American video game industry waited to see what would happen. Video games' novelty had worn off, the golden age of arcade games was over, and no one knew how long it would be until the industry bounced back, or even if it would.

The crash finally ended in 1985 when a new system advanced home video games to a new level and revived consumer interest. The **Nintendo Entertainment System (NES)** was already a success in Japan, where it had been released in 1983 as the Nintendo Famicom. The NES was an 8-bit system, making it more advanced than any of its predecessors, and Nintendo allayed retailers' hesitance to stock another video game console by promising to buy back unsold systems. The system was a success, the NES soon had a large library of games, and Nintendo was more careful than Atari had been when it came to third-party licensing.

During the early 1980s, the home computer market was also expanding, with the release of such machines as the IBM PC, Commodore VIC-20, and the Xerox Star in 1981, the Commodore 64 in 1982, the Apple IIe and the Apple Lisa in 1983, and the Apple Macintosh and Tandy 1000 in 1984. With their first appearance in the 1970s, home computers provided a new venue for games, many computers were purchased for their game-playing abilities, and the two industries overlapped each other. Atari produced its own line of home computers, while some computer systems, like Texas Instruments' TI-99/4a, had slots for game cartridges built into them. Home computers also allowed hobbyists to write and exchange their own **homebrew games**, and some, like programmer **Richard Garriott**, creator of the ***Ultima* series**, went on to sell thousands of games and start their own companies.

On-line games also began to grow in popularity, as modems allowed home computers to communicate with each other, leading to **bulletin board systems (BBSs)** and participation in **multi-user domains (MUDs)**, which were previously only available on mainframes. Some early on-line such as *Sceptre of Goth* (1983), allowed as many as 16 users to dial in at once and play. Home video game console systems first connected to the on-line world with the release of Mattel's PlayCable service in 1981, and two years later, the **CVC Gameline Master Module**, a device that plugged into the cartridge bay on the **Atari VCS 2600** and into a phone jack, allowing games to be downloaded and played, and required a subscription to the service.

In the mid-1980s, CD-ROM technology would greatly enhance the storage capacity of home computers with optical discs that could store 650 megabytes of data. **Cyan**'s *The Manhole* (1987) is generally considered to be the first game released on CD-ROM, leading the way for **CD-ROM-based games**, which could contain much larger game **worlds** because of the greater memory capacity, such as Cyan's ***Myst*** (1993), a best-selling game that encouraged the sales of computers with CD-ROM drives. More memory also allowed room for full-motion video (FMV) to be incorporated into games, essentially picking up where laserdisc games had left off. Soon home console systems began the changeover to CD-ROM technology; a CD-ROM add-on was released as a **peripheral** for the **NEC PC-Engine/Turbografx-16** in 1989, and for the **SEGA Mega Drive/SEGA Genesis** in 1992; and in 1991, the FM Towns Marty, the first 32-bit system, became the first console system with a built-in CD-ROM drive. Released only three years later, the **Nintendo 64** would be the last major system *not* to use CD-ROMs.

By the late 1980s, computing power was becoming fast enough for three-dimensional computation using filled-polygon graphics. Computationally true three-dimensional graphics had appeared in vector games like *Speed Freak* (1978), ***BattleZone*** (1980), and *Star Wars* (1983), and in one raster game, ***I, Robot*** (1983), in which filled-polygon graphics were used, but the demands of such graphics resulted in a simpler game world than what two-dimensional graphics could offer using hundreds of sprites. As computing power and speed improved, three-dimensional filled-polygon graphics returned to the arcade in such games as *Hard Drivin'* (1989) and *S.T.U.N. Runner* (1989), but it was not until the 1990s that three-dimensional graphics became the dominant form of graphics. Home consoles and home computers were not far behind arcade games, and they also began to feature three-dimensional graphics as well, both as pre-rendered graphics (like those of *Myst* and ***Riven*** [1997]) and those rendered in real time (like those of *Tomb Raider* [1996]). By the mid to late 1990s, home games had advanced to the point where they could compete with arcade games and draw their audiences away from them.

Home Games Dominate

Home game consoles grew more powerful with each new **generation of technology**. After the NES and other consoles of the third generation, like the **SEGA Master System** and the **Atari 7800 Prosystem**, a new generation of 16-bit machines appeared, including the NEC PC-Engine/Turbografx-16 in 1987, the SEGA Mega Drive/SEGA Genesis in 1988, and the **Neo•Geo** produced by **SNK (Shin Nihon Kikaku) Playmore** and the **Super Nintendo Entertainment**

System (SNES), both released in 1990. Arcade game technology and home game technology were converging to the point that some systems made the transition from one to the other. The Neo•Geo was SNK's home version of their arcade technology of the same name that allowed arcade operators to change games in a machine by simply changing a cartridge (an idea pioneered by Data East's **DECO Cassette System** in the early 1980s). In the other direction, the Nintendo Playchoice-10 system allowed Nintendo's arcade machines to play games that had been previously only available on the NES. Such interchangeability demonstrated just how far home consoles had come, as arcade games continued to lose their superiority.

The fifth generation of consoles were mainly 32-bit machines, including the FM Towns Marty released by Fujitsu in 1991, the **3DO Interactive Multiplayer** and the **Atari Jaguar** in 1993, the **SEGA Saturn** and the **Sony PlayStation** in 1994, and the 64-bit Nintendo 64 in 1996. Home computers became more powerful during this time as well, and **emulators** for earlier game consoles began to appear on them. The mid-1990s were also long enough after the early days of video gaming so that nostalgia for early games began to appear, as well as **retrogaming**, which also encouraged an interest in emulators. With more computing power and larger storage capacities, thanks to CD-ROMs, which became the standard medium for games released, replacing cartridges, home video games could now have three-dimensional graphics that were rendered in real time, allowing certain genres, like first-person **shooting games** and first-person **racing games**, to become popular in the home, and allowing many arcade games and franchises to be ported to home systems.

As arcades lost audiences to home games, the industry made attempts to win audiences back. More unusual **interfaces** and **controllers** that were not available in the home appeared and helped to redefine the arcade experience throughout the decade, such as cabinets with sit-on or ride-in capabilities, dance mats (like that for ***Dance Dance Revolution*** [1998]), drum kits, guitars, and other interfaces for **rhythm and dance games**. Two **virtual reality** games, *Dactyl Nightmare* (1992) and *Virtual Combat* (1993), even appeared. But along with technological innovations came a cautious retreat to more tried-and-true genres, including vertically-oriented shooting games, **fighting games**, and driving games. The number of games produced in these genres expanded while other genres shrank, and fewer innovative **game designs** were produced. More sequels and series games were made, relying on their predecessors' successes for instant recognition and acceptance. Few, if any, arcade games from the mid-1990s became household names among non-players. Perhaps only ***Mortal Kombat*** (1992) was widely known among the general public, and infamously at that, because of the controversy surrounding the game's extreme **violence**. Eventually even the arcade itself would be redefined as a game center or cybercafé, as operators tried to lure players back. In Japan as well, the 1990s saw arcades being transformed into *amyuuzumento sentaa* (amusement centers) that were more family-oriented and untainted by the seedy image that arcades sometimes had.

Another way that home gaming became dominant was through the growth of **on-line games** during the 1990s. On-line gaming gave home gamers the social element and the opportunity to play with strangers that only the arcades could provide before. Multiplayer on-line games grew and were able to accommodate larger and larger number of players, eventually becoming known as **massively multiplayer on-line role-playing games (MMORPGs)**, with hundreds of thousands of players around the world. The first game to be considered an MMORPG was 3DO's *Meridian 59* (1996), but by the end of the 1990s, the three main MMORPGs with the most players were *Ultima Online* (1997), *EverQuest* (1999), and *Asheron's Call* (1999).

Handheld games and portable gaming systems also grew in popularity during the 1990s. Handheld electronic games had been around since the mid-1970s, and the first handheld game console system was Milton Bradley's Microvision system of 1979, but it was not until a decade later that handheld consoles found success. In 1989, the **Nintendo Game Boy**, designed by Gunpei **Yokoi**, was released, as was the **Atari Lynx**, and in 1990 they were joined by SEGA Game Gear. Of the three, the Game Boy was the most popular and, with its line of other Game Boy systems, went on to become the best-selling line of game console systems, selling more than 200 million units combined as of 2011. Handheld game systems, with their tiny screens and limited graphics capabilities, proved that simpler games with low-**resolution** graphics still could attract an audience.

Handheld systems, portable gaming devices, and on-line gaming helped video games to spread around the world, where console gaming had begun to establish a foothold since the days of *PONG* clones in the 1970s. During the 1980s and 1990s, video games grew into a global industry, as imports from North America and Japan found success and encouraged indigenous game production. Although some countries produced their own game systems or computers, like the Italian Zanussi Ping-o-Tronic of 1974, **New Zealand**'s Sportronic system in the late 1970s, and Al-Alamyeeh's Sakhr home computer system in Kuwait in 1981, indigenous game production flourished on home computer systems because companies only needed to produce software that could run on other established systems, which also provided a much larger potential audience than would the sales of a new hardware system. (It is perhaps for this reason that the term "computer games," as opposed to "video games," is found so often in European game scholarship.) By the end of the 1990s, the global reach of video games provided a worldwide audience that made the industry even more competitive, as technology advanced and more venues for video games appeared.

The Industry Expands

The sixth generation of home video game consoles began with the **SEGA Dreamcast** in 1998, which would be the company's last console system and was discontinued in 2002. Other systems of the generation included the **Sony PlayStation 2**, released in 2000 (and still selling as of 2011), the **Nintendo GameCube** released in 2001 and discontinued 2007, and the **Microsoft Xbox** released in 2001 and discontinued 2006. Part of the reason for the shorter life spans of these systems was the relatively quick advance to what is considered the seventh generation of consoles, which includes the **Microsoft Xbox 360** released in 2005, and the **Sony PlayStation 3** and **Nintendo Wii**, both released in 2006. These systems all had on-line capabilities and services, could play other media like CDs and **DVDs**, made **gestural interfaces** available, and in the case of the PS3, also introduced high-definition gaming on **Blu-ray Discs**.

Other game markets grew as well. During the 2000s, the numbers of players of MMORPGs rose into the millions, with the largest one, ***World of Warcraft*** (2004), reaching 14 million subscribers by the end of 2010. As the World Wide Web continued expanding, **web-based games** became a new type of on-line game, one often associated with **casual games**, and were played on personal computers as well as cell phones and eventually iPods, iPads, and other devices used for **mobile gaming**, which is a dominant form of gaming in areas of the world with limited infrastructure, such as **Africa**.

The ability to play games on-line also led to the production of **advergames**, used to advertise products in a way that engages the user, and games designed for social media, such as ***FarmVille*** (2009) and *Mafia Wars* (2009). With the growth of cloud computing, an increasing number of games can be leased on-line instead of purchased. As digital distribution and downloadable content (DLC) and the bandwidth of home Internet connections continues to expand, online games may one day begin to supplant home consoles and home computer gaming, becoming the dominant form of gaming.

In addition to advergames, the 2000s also saw a variety of other new uses of video games in business, **art**, and **education**, in such areas as job training, gym class, and **simulations** demonstrating or exploring ideas interactively. **Video game studies** also arose and scholarly investigation of video games began in the form of books, journals (both print and on-line), conferences, museum exhibits (like **Videotopia**), and university classes and programs, not only in North America and Europe but in many countries around the world. The study of older games occurred in academia as well as in many on-line communities of gaming hobbyists and people **collecting video games** who together have built extensive on-line archives of games and game-related materials—for example, the **Killer List of Videogames**, the Arcade Flyer Archive, and the **International Arcade Museum**. The retrogaming movement also has increased interest in early games, and a growing number of archives and organizations, like the **Video Arcade Preservation Society**, are attempting to document and preserve as much early video game history as possible.

Video games have become as established a medium as are **film** and television and represent a good part of the way many people spend their free time. As games become even more embedded in daily life, through their use in forms of interactive media, they will remain both a part of popular culture and an intriguing object of study.

Mark J. P. Wolf

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Hollywood cinema

See representations of video games in Hollywood cinema

home computer games

See computer games

home console games

See console-based games

home video games

See console-based games; handheld games

homebrew games

Homebrew games are new titles created for classic game consoles such as the original **Atari** consoles, the **Colecovision**, and other systems that traditional software publishers have abandoned. Homebrew games are often created by fans and video game hobbyists, and the quality of homebrew titles often matches or exceeds commercially released games. This is possible because the Information Age has made more knowledge and tools available to the modern retro-programmer than what was available to the original commercial developers.

When million-dollar room-sized mainframe computers left technology institutes and entered the home in the more practical form of home computers, manufacturers such as Tandy, Apple, Commodore, and Atari brought computer programming, previously available only to a select few, to the masses.

Kids and adults alike, wanting to make their own applications for business and **play**, began coding for their own needs and entertainment. Many computer magazines such as *Electronic Fun* and *Compute!* published homegrown code for others to type into their own computers. **Shareware** emerged on the computer scene as programs could be easily copied and doled out on floppy diskettes and other forms of distributable media.

In time, **console-based games** began to emulate computers and offered **cartridge** programs such as *Bally BASIC* (1978) for the Astrocade, *Computer Intro!* (1979) for the Odyssey^2, and *BASIC Programming* (1979) for the **Atari VCS 2600**. These were great learning tools and served to introduce home programming to the public. However, in the end, they were primitive and more of a novelty, not to be used for serious development.

So when Atari released *KLAX* (1990) for the Atari 2600, the general consensus and expectation was that no further software would become available for the aging console. After all, games had been made for the system for 13 years, and the system was originally meant to be marketed for only a few years.

However, the fan base and hobbyist scene continued and, as technology marched forward, private individuals learned how to resurrect the market from their basements and garages. Homebrew titles are mostly created in the programmer's spare time, as a labor of love, and with the most miniscule of budgets. Initially, programming for the 2600 was fairly complex. A programmer needed to learn how to write in computer code, including assembly **language**, how to deal with ROM and RAM (and do so in severe circumstances such as limited memory **space**), and how to compute with binary and hexadecimal number systems. Even understanding how a **television** set operates and how the screen refreshes was required to program the 2600. As if those obstacles were not enough, creating the physical cartridge hardware without a manufacturing plant was yet another massive hurdle to the homebrewer.

However, Harry Dodgson wanted to put his computer systems engineering degree to work by making new software for the **Atari 7800**. Dodgson did not have access to an Atari 7800 development kit, so he wrote one himself, and the result was the *7800 Monitor Cartridge* (1993). Dodgson manufactured them himself, creating six copies before modifying them to also allow 2600 programming. At this point, the project was renamed to the *7800/2600 Monitor Cartridge* (1993), and he created an additional 19 more cartridges before selling the rights to Atari retailer Video 61 and handing the task over to them.

A Monitor Cartridge user was able to program their own games by entering commands in 6502 assembly language using the Atari Keypad, Atari Kid's **Controllers**, and *Star Raiders* controllers. The actual programs had to be entered by converting the assembly language code to hexadecimal or by downloading the program via serial **interface**.

Ed Federmeyer, a software engineer, heard about Dodgson's work on Usenet and decided that he wanted to live his childhood dream and create software for the 2600. Before he could make his game, he needed a way to find out what sound the Atari 2600 would make when the sound register was changed. He did not want to have to assemble and burn an individual EPROM for each **sound** test, so he programmed *Sound X* (1994) to accomplish the task. When finished, he realized that other hobbyists might have use for the utility, so he polished it up and had Randy Crihfield, later known for Hozer Video Games, publish it in cartridge form.

With *Sound X* behind him, Federmeyer, seeing the demand for the utility, programmed and released the first console homebrew game on a cartridge for the 2600. The game was a *Tetris* (1985) clone titled *Edtris 2600* (1995). It sold for $16 and featured a continuous musical soundtrack, sound effects, an instruction **manual**, and a serial number programmed right into the game. It was Federmeyer himself who coined the term "homebrew" after reading about the Bay Area Amateur

Computer Users Group in Steve Levy's book, *Hackers*. Members that attended the club's monthly meetings included Eugene Jarvis, Steve Jobs, and Steve Wozniak.

To create these first pieces of new software for the 2600, Federmeyer did his programming on an IBM 486 clone using a 6502 cross assembler. He programmed with assembly language because the hardware had such limited memory. Programming on the 2600 is difficult, even for professional programmers. Procedures such as counting how long a task takes to execute is necessary when working with the 2600, a method usually not required with typical programming. On the 2600, depending on where the instruction is in memory, it may take longer to execute. So one instruction inserted into the wrong place will move any additional code up a byte in memory, and suddenly all the calculations will be incorrect. To actually manufacture the Atari 2600 cartridge, an EPROM burner was used to burn an EPROM and then the ROM chip was replaced with a socket and some additional wiring on an existing retail 2600 cartridge.

In January 1997, Bob Colbert's Retroware released *Okie Dokie* (1997) a puzzle/strategy game also for the Atari 2600. When working on the title, Colbert limited himself to working with only 2K of memory. He purposely did this to see what it was like to program within the same standards and limitations of the original Atari employees. Colbert also holds the distinction of creating the third homebrew game, *Stell-a-Sketch* (1997), an Atari adaption of the popular Etch A Sketch children's toy by The Ohio Art Company. The title derived its name from "Stella," which was the codename for the Atari 2600 before it was released.

By late 1997, the 2600 homebrew scene had grown exponentially, with such releases as *The Dark Mage* (1997) and *Lunar Rescue* (1997; also known as *This Planet Sucks*) by Greg Troutman and *Oystron* (1997) by Piero Cavina. A website, referred to as the Atari 2600 Programming Page, organized by Nick Bensema, emerged that was dedicated to 2600 programming and hacking. The website promoted 2600 development and featured programming examples, learning exercises, programming tools, and other helpful documentation.

Currently, almost 35 years after the launch of the Atari 2600, game development is still going strong on the **platform**. Dozens of homebrew games have been released, and most of the games are still being created in the traditional 6502 assembly language. In recent years, high-level compilers have become available for VCS development with the introduction of *batari Basic* (2005) and *Visual batari Basic* (2008) emerging as development tools.

While the Atari VCS currently has the largest homebrew community, it was not alone after Kevin Horton released *Kevtris* (1996) for the Colecovision. Horton chose **Coleco**'s platform because it was the only console ever released that used no proprietary parts. As a result, he was able to reverse-engineer the system easily to learn how it worked. One programmer, Daniel Bienvenue, graciously shared years of research, documentation, and programming toolkits he created for the Colecovision to the community. These proved invaluable to the emerging homebrew community as they allowed other programmers to improve their skill set and even encouraged amateurs to give it a try.

Homebrew programmers usually focus on one platform. John Dondzila was the first to tackle multiple projects on numerous systems. While Dondzila made games for the Colecovision, he also released the first Odyssey[2] homebrew game, *AMOK!* (1998) based on Stern's popular arcade game *Berzerk* (1980). Dondzila also created the first Vectrex title, *Vector Vaders* (1996). The **GCE/Milton Bradley Vectrex** had a short life span on the market, selling for less than two full years, and had fewer than 30 commercially released titles during that time. The Vectrex is unique in the homebrew scene because more homebrew games have been produced for it than there were original commercially released titles.

No gaming hardware seems to be exempt, as homebrew games have been made available for most home consoles. Popular gaming platforms such as the **Nintendo Entertainment System (NES)** and the Game Boy Advance (GBA) easily attract development, but even more obscure systems such as the **3DO Interactive Multiplayer**, Philips CD-i, **Fairchild/Zircon Channel F**, VM Lab's Nuon, Atari Lynx, **Atari Jaguar**, and more have all seen homebrew activity.

Even the first home video game console, the **Magnavox Odyssey** released in 1972, has received attention from the homebrew community. Retail titles were published for the system only in 1972 and 1973. In 2009, *Odball* was released as a homebrew title. This marked the longest period of time (36 years) between an official release and a homebrew release for any console.

In 2004, Atari (currently owned by Infogrames) released a plug-and-play console resembling a miniature Atari 7800 called the Flashback. Although it did not have a cartridge port, it did have fifteen 2600 and five 7800 games that were all stored internally. The following year saw the release of the Flashback 2, which resembled the original Atari VCS 2600 console and featured 40 Atari game titles. Surprisingly, it included several previously unreleased prototypes, game hacks, and homebrew games including *Adventure II* (2005), *Combat II* (1983), *Wizard* (1980), and *Climber 5* (2004) (renamed *Atari Climber*). Although it does happen periodically, it is a rare occurrence for a homebrew game to be legitimately published. Because of the underground nature of homebrew gaming, it is unlikely that one would find them advertised in magazines or on television, or on store shelves. Many homebrew game releases are the highlights of small retrogaming get-togethers and conventions such as the recurring Classic Gaming Expo or sold on-line by the programmers themselves and a few small companies.

Modern-day distributors and publishers include Atari Age (AtariAge.com) and Good Deal Games's Homebrew Heaven (Good DealGames.com). The original homebrew manufacturer, Randy Crihfield, also still builds games for the 2600 and, as of 2010, proudly stated that he had personally manufactured more than 20,000 individual Atari 2600 cartridges.

Michael Thomasson

Hong Kong

Hong Kong is one of the game consumption centers in Asia. Gaming is more than a mainstream youth culture, it is also well-received among children and adults. It is no exaggeration to say that gaming has become a part of daily-life entertainment; on a train or bus you will always find someone playing games. An interesting episode occurred in 2003 when the Secretary for **Education** and Manpower was criticized by the media for playing his **handheld game** in the Legislative Council. Gaming has had a strong impact in Hong Kong, and game jargon has been picked up by young people and the media. Game **consoles**, software, magazines, and other forms of merchandising sell well in the market. Almost all families have at least one home game console, and most young people have their own handheld game console. Game shows such as Asia Game Show (since 2002) and Animation-Comic-Game Hong Kong (since 2006) attract large audiences and media coverage.

Gaming in Hong Kong has the following five major characteristics. First, it follows the latest developments closely. For geographic, economic, and legal reasons, foreign game consoles and software are usually introduced into Hong Kong soon after their global launch. Hence, the craze for new consoles or software occurs almost simultaneously in Hong Kong as in Tokyo and New York. Many foreign game manufacturers have branches or agencies in Hong Kong to launch their latest products. Through the parallel importation of both licensed and pirated items, local electrical appliance shops and game shops introduce new game products sometimes even faster than authorized agencies.

Second, game consumption is comprehensive. Whereas **China** and **South Korea** focus on **on-line games**, Hong Kong is more balanced in gaming and different types of games, such as home console games, handheld games, **arcade games**, home **computer games**, on-line games, and **mobile games** share the market. In particular, home console games and handheld games are extremely popular. In the public space, game arcades and on-line game centers are everywhere in Hong Kong, patronized by adults as well as youngsters.

Third, Japanese games have been leading the market. Since the rise of the game culture in Hong Kong in the 1980s, **Japan** has been the name of the game. From the arcade games and **Nintendo Entertainment System (NES)** games in the 1980s, to the **Nintendo Game Boy** and **Sony PlayStation** craze in the 1990s, Japanese games had dominated the Hong Kong market for more than two decades until the debut of **Microsoft Xbox** and the rise of Korean on-line games in 2002. The popularity of the Xbox and on-line games is lukewarm, and thus Japanese games remain the leader of the Hong Kong market.

Fourth, game **piracy** is prevalent. The Hong Kong government has been more successful in cracking down on audio-visual piracy and computer software piracy than on game piracy. From the 1980s to the present, Hong Kong has been a consumption and distribution center of game piracy, and pirated game **CD-ROMs** made in China, Taiwan, and Hong Kong have had a wide circulation. Recently, digital piracy has become the major form of game piracy, as Hong Kong players download games for free from websites in China. Piracy is the main reason for the popularity of home console games and handheld games. Many

Hong Kong players have never purchased any licensed game software.

Fifth, the development of Hong Kong games is slow. Hong Kong is a consumption base for Japanese and foreign games. Because of problems in capital, talent, and technology, Hong Kong games are few in number, and most are not very popular. Hong Kong game companies are more willing to serve as the agencies for foreign games rather than to develop their own games. Hong Kong games are usually computer games and on-line games, but only a few do well in the local market. The Hong Kong government has been discussing developing a creative **industry** for years, but neither long-term development plans nor logistics support have been made to help the Hong Kong game industry. Hence, the video game industry in Hong Kong does not appear promising.

Benjamin Wai-ming Ng

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horror games

See survival horror games

Huizinga, Johan (1872–1945)

A Dutch cultural historian known for his interest in the Middle Ages (famous for *The Waning/Autumn of the Middle Ages* [1919]), Johan Huizinga is unquestionably the author of the most influential 20th-century examination of **play**. Followed as much as criticized (as with many ground-breaking works, it is not free of contradictions), his *Homo Ludens: A Study of the Play-Element in Culture* (1938) remains the founding work of game studies.

As opposed to the **German** psychologist Karl Groos, who explained play from a biological perspective (in *The Play of Animals* [1896] and *The Play of Man* [1899]), Huizinga considers play as a cultural phenomenon. For him, play is not a part of culture insofar as culture had already a play-like character in its earliest phases. Because "play is older than culture," he argues, "civilization arises and unfolds in and as play." The Roman Empire, the Middle Ages, the Renaissance, the Age of Humanism, the 17th century with its Baroque forms, the 18th century with its Rococo ones, and contemporary civilization can therefore be seen from the perspective of play. For Huizinga, "real civilization cannot exist in the absence of a certain play-element." It will always be played according to certain **rules** and will always demand fair play.

Because Huizinga sees play as a special and significant form of activity with a social function, he wishes "to take it as the player himself takes it." Showing that the play-concept as expressed in **language** doesn't have a clear definiteness, one of his first tasks in *Homo Ludens*, and certainly the most important one, is to give a definition of play:

> Summing up the formal characteristics of play, we might call it a free activity

> standing quite consciously outside "ordinary" life as being "not serious" but at the same time absorbing the player intensely and utterly. It is an activity connected with no material interest, and no profit can be gained by it. It proceeds within its own proper boundaries of **time** and **space** according to fixed rules and in an orderly manner. It promotes the formation of social groupings which tend to surround themselves with secrecy and to stress the difference from the common **world** by disguise or other means. (Huizinga, [1938] 1955, p. 13)

Coupled with its historical-cultural approach, the identified criteria enable Huizinga to show and to analyze the presence of play in the advent and the state of various forms of social activities. For instance, as play-category, competition can be seen in "an oracle, a wager, a lawsuit, a vow or a riddle." **War** and all fighting bounded by rules limiting actions are to be associated with play. By their polemical and agonistic nature, science and philosophy fall within the realm of play. Because poetry and **art** lie beyond seriousness, creating things that are not bounded to the physicality, logic, and causality of "ordinary life" but lying outside the reasonableness of the practical, they have a ludic function.

Although "in acknowledging play you acknowledge mind, for whatever else play is, it is not matter," our species should not only be called for Huizinga by the name of *Homo Sapiens* (Man the Thinker) or *Homo Faber* (Man the Maker), but also by the nomenclature of *Homo Ludens* (Man the Player). ***See also*** Caillois, Roger; magic circle.

Bernard Perron

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I

I, Robot

Atari's *I, Robot* (1983) is a historically significant, but largely unknown, video **arcade game**. The game was designed and programmed by Dave Theurer, who also created *Missile Command* (1980) and *Tempest* (1981), and Dave Sherman designed the **arcade** system. Although an **abstract** game, *I, Robot* combined various elements of different game genres, resulting in unique and difficult gameplay for its time. *I, Robot* was the first game to feature three-dimensional filled-polygon graphics rendered and manipulated in real time, as well as an interactive camera system that could change the player's point of view during gameplay (players also received more points for closer viewing angles).

The game's title is a reference to the Isaac Asimov science fiction novel of the same name, the story of which was inspired by George Orwell's novel *Nineteen Eighty-Four* (1949). The player personifies "Interface Robot # 1984," an unhappy robot that rebels against the totalitarian power of Big Brother and his Evil Eyes. In his world, every part of the field is watched over by a giant Eye, which executes a simple and relentless law: if the player's **avatar** jumps while the Eye is open, the Eye annihilates it. The robot must then travel through a labyrinthine structure, recolorizing the platforms to destroy the Eye. The robot must also avoid traps and projectiles while firing at enemies with a laser weapon. After defeating the Eye, the robot jumps into a spatial void for a shooting sequence before reaching the next level. The game contains 126 levels (the two-digit counter only goes to 99, displaying the next levels as 00-26), looping through 26 distinctive level designs with additional gameplay mechanics, faster pace and different colors. At the entrance of certain levels is a teleporter that allows the robot to go directly to a level previously achieved. The game features a tutorial in the attract mode and includes a recreational mode called *Doodle City*, which allows the player to view and manipulate three-dimensional forms.

Despite *I, Robot*'s conceptual and visual innovations, the game was a commercial failure, with around a thousand units produced. Perhaps too complex and too advanced for the general public at the **time**, critics and historians have since reevaluated this underappreciated title because of its position in video game **history**. *I, Robot* remains an arcade **collector**'s item and is available for **emulators**.

Martin Picard

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id Software

id Software is an American video game developer founded on February 1, 1991, by programmers John Romero and John Carmack, game designer Tom Hall, and artist Adrian Carmack (no relation to John). They met while developing video games (including *Dangerous Dave* [1988]) for Softdisk, a magazine-on-disk company. When Scott Miller, the founder of video game publisher Apogee Software, asked Romero to produce a **shareware game**, Romero gathered Carmack, Hall, and Carmack as well as project director Jay Wilbur and artist Kevin Cloud to work on the project. Hall designed their first game, and three months later *Commander Keen: Invasion of the Vorticons* (1990) was ready. A month later, the group received a $10,500 royalty check because of Miller's innovative selling strategy in which only a part of the game was free and the players had to buy the rest of the game if they wanted to continue. After that success, they founded "id Software," named after the Freudian concept of the "id," the primal level of the human psyche, and set up their headquarters in Mesquite, Texas.

After *Commander Keen*, id Software released several small games published by Softdisk including *Hovertank One* (1991) and *Catacombs 3D* (1991). Those two games used the three-dimensional **graphics game engine** created by John Carmack. Miller asked them to create a three-dimensional shareware game using this technology, and the result was id Software's third three-dimensional game, *Wolfenstein 3D* (1992), a first-person shooter (FPS) that takes place in a Nazi stronghold, which helped establish the FPS genre. Following *Wolfenstein* (and its sequel, *Spear of Destiny* [1992]), id Software produced another FPS called *Doom* (1993). *Doom* used a powerful new game engine also developed by Carmack and was the first local area network (LAN) game that could be played simultaneously by four players (in a cooperative mode, or "death match" mode). It rapidly became a big success that influenced the game **industry**, and many *Doom*-like games would soon follow. Later the team stopped publishing with Apogee and became independent; id Software used the business model developed by Miller and gave away the first part of *Doom* as shareware and sold the rest of the game directly. A long-lasting collaboration started between the company and the players' community that created **game modifications** and levels. id Software would later produce two sequels, *Doom II: Hell on Earth* (1994) and *Doom 3* (2004).

Following the success of *Doom*, using the same business model, id Software launched *Quake* (1996), another FPS and one of the first set in a real three-dimensional environment, which was also successful. After *Quake*, Romero left the team, but id Software continued to produce the multiplayer *Quake II* (1997), *Quake III Arena* (1999), and *Quake III: Team Arena* (2000), building improvements into the *Quake* engine. The

Quake engine was also used by other games such as the well-known *Half-Life* (1998).

id Software was also involved in the production of other games, including *Heretic* (Raven Software, 1994), *Hexen I* and *II* (Raven Software, 1995 and 1997), *Return to Castle Wolfenstein* (Gray Matter Interactive and Nerved Software, 2001), *Orcs & Elves* (Fountainhead Entertainment, 2006), and *Doom Resurrection* (Escalation Studios, 2009). In June 2009, ZeniMax Media bought id Software, and by late 2009 the company was working on *Rage* and *Doom 4*, which used a new game engine, *id Tech 5*, also developed by John Carmack.

Maude Bonenfant

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idea for home video games

As a TV engineer working on the **design** of a TV set at Loral in 1951, I suggested adding some form of interaction of the viewer with the screen. Management turned me down. I thought it was a good idea. They didn't, and that was that.

The idea didn't resurface until 1966. By that time, I had moved up the ranks from engineer to a divisional manager's job at Sanders Associates, then a very large defense electronics company in New Hampshire. We worked on radar-countermeasures and sonar systems in my division. **Television** technology wasn't involved. But my television engineering degree and my TV experience didn't just vanish.

The thought of some 40 or 50 million TV sets then in the **United States** alone kept bugging me to come up with something that could be attached to these TV sets, something that might be fun to use and low in cost—but what? In New York on business on the last day of August in 1966, I had an epiphany: How about attaching something to the antenna terminals of a TV set that would allow people to play interactive games? When I got back to my office in New Hampshire, I sat down and wrote a four-page Disclosure Document. In it I proposed building a small device that would allow people to play games by controlling very simple images, actually just small "spots" on the screen of their TV sets to play a variety of games. I listed some imitative of board games, others that involved "chases" where one player would try to have his or her spot catch up with and wipe out another player's spot. Car races and various **sports games** all were described in some detail.

I had one of my engineers sign and date each page. Little did I know that what had just transpired was the birth of the home video game **industry**. But still I was just at the "what if?" stage then.

Fortunately, I had some 500 engineers, technicians, and support persons working for me at the time. Putting someone, a technician or an engineer, to work on a skunk works project for a few weeks was no big deal; it wouldn't even ripple my division's overhead.

Bill Harrison, one of the technicians in my division, and I hooked up some circuitry and soon found inexpensive ways to build elementary games. Among these was a light gun for shooting at a target spot on the screen and wiping it off with a "hit"; we built some chase games—one spot chasing another and wiping it off the screen upon contact—and a few **board games**. That done, it was time to go "public" to get some official funding needed to carry on the development work. Video games had absolutely nothing to do with anything the company was doing. Convincing management to let me spend more money on that strange concept required a leap of faith on their part. They trusted me—grudgingly.

The demo went off well enough, and I got some conditional support to continue "working on this stuff." A couple of thousand dollars was all I received, but it made the work official. We went through a sequence of seven developmental models that gave us ever more capability for playing neat games. By November 1967, **ball-and-paddle games** were functional: ping-pong and handball games were working, and there was no looking back after that. We knew that we had broken the code. We had something that was a lot of fun. Having worked on the project only off and on, we were almost into 1969 by then. Unit No. 7, our multigame system, was called the Brown Box because we had covered the unit with walnut-decorated contact paper to dress it up it bit. Who could have known that the Brown Box would some day wind up on permanent display in the Smithsonian?

There was no way Sanders Associates could build and market consumer products, so licensing was the proper route for the home video game. We first tried to get TelePrompter, then the **United States**'s largest cable network, to put on interactive programming that could be accessed by our Brown Box. TelePrompter was enthusiastic, but the cable business was in deep trouble and our negotiations went nowhere. It finally dawned on me that TV set manufacturers like RCA, Philco, Zenith, Motorola, or Magnavox were our most likely prospects. They had the engineering, production, marketing, and distribution needed to carry this concept forward. And yes, we manufactured all of our TV sets in the United States back then.

Magnavox took the chance to spend a million dollars on production-engineering our Brown Box, conducting customer acceptance tests all over the country and committing the company to produce games for sale before and into the 1972 Christmas season. The game was called the **Odyssey**. Magnavox dealerships were shown early models in May 1972. **Advertising** started in the summer, and close to 100,000 Odysseys were in people's homes by New Year's Day of 1973. For the next two years, Odyssey was the only home video game in town. There was a video game industry now where none had been before.

In 1971, Nolan **Bushnell**, later the president of **Atari**, was working on ***Computer Space***, an arcade video game version of ***Spacewar!*** (1962). The game was not successful. He played the ping-pong game of the Odyssey at a Magnavox dealership demonstration in May of 1972. The simplicity and great game play of the ping-pong game motivated him to change gears. He brought Alan Alcorn on board to develop a coin-op version, which they named ***PONG*** (1972). It became very successful in 1973 and started the arcade video game industry.

So that's what happened to the idea of "What if we made a gadget that allows people to play games on their TV set?" Some 350,000 Odysseys were sold by early 1975. Millions of newer versions would follow. The rest is **history**.

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immersion

Commonly, dictionaries recognize two main uses for the term "immersion": the physical absorption of something into some substance and the more figurative use, in which absorbing involvement is concerned, such as in the learning of a language through immersion. The term is also an important concept in gamers' speech, where it gains several special meanings.

The experience of being immersed in a game appears to relate to both of these dictionary meanings of the term. Most contemporary digital games create an illusion of virtual **space**, in which players enact gameplay activities. This sense of being transported into "another place" while using digital technology has been studied in the fields of communication studies and human-computer interaction (HCI) under the concept of "presence." Such immersion can be examined by looking at the degree to which a player's perceptions are focused on the virtual **world** and the degree to which perceptions relating to the physical environment are "shut out" (Lombard and Ditton, 1997; Patrick et al., 2000).

Not all immersion is a direct consequence of being absorbed in sensory perceptions; even simple games without spectacular user **interfaces** can be very engaging because mental aspects of gameplay can also be immersive for players. Challenges and action are core elements of games (and indeed one of their defining characteristics), and engagement or absorption in action is an important part of game-related immersion. Studies based on game player interviews have tried to extract the meaning of "immersion" by asking what it means for players themselves (Brown and Cairns, 2004; Ermi and Mäyrä, 2005). Effort and attention directed toward a game appear to be important in keeping players involved. Immersive games absorb players completely, taxing their various faculties, ranging from motor skills, navigation, and cognitive problem solving to social and emotional involvement. Immersion, however, is not necessarily a measurement of how "good" a game is; some players prefer powerfully immersive experiences, whereas others prefer games that are **casual** and nonimmersive.

The phenomenon of enjoyable absorption in action, called "flow" by psychologist Mihaly Csikszentmihalyi, is an "optimal experience" that can occur at the moment of perfect balance between challenge of task and the skills of the person. Feelings of powerful gratification and losing one's sense of **time** are often associated with flow experiences. Because typical game play is not as free of disruptions and breaks as are the ecstatic performances that Csikszentmihalyi describes, immersive gameplay appears related to flow, yet also different from it.

Sweetser and Wyeth (2005), who have developed a model of "GameFlow," include in it eight elements that relate to player enjoyment: concentration, challenge, skills, control, clear goals, feedback, immersion, and social interaction. Thus, the experience of flow appears to be often a part of immersion, whereas immersion is also a part of "gameflow"; analyses of immersion seem to lead to circularity. Nevertheless, analysts seem to agree that immersion denotes the degree of player's involvement with the game. Ermi and Mäyrä (2005) have further divided gameplay immersion into three main dimensions: immersion into challenges and action, sensory immersion, and imaginative immersion. The experience of immersion in the playful challenge of a game appears unique to games, whereas sensory immersion also occurs in the visual arts and cinema, and imaginative immersion has long been known and studied as the kind of immersion that takes place while reading engaging literature (Ryan, 2001).

Frans Mäyrä

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India

Since the boom in its IT industry in the 1990s and its popularity as a location for foreign direct investment, India is now seen as a major potential player in the video game **industry**. However, despite its population of more than a billion, its rich ludic culture, its increasing number of computer users, and its prosperous entertainment industry, the inroads made by video games seem to be very minimal.

Because of the wide economic disparity, video games are restricted to the wealthier sections of society, although there are ongoing attempts to use games as an **education** medium for children from deprived families. Other problems are **piracy** and the relative youth of the IT industry. Despite this, the industry has shown great potential for growth with the recent surge in the number of Internet users and the amount of disposable income. The main market is PC- and mobile-based, but **consoles** are beginning to catch up. Indian game designers contribute to the worldwide industry working for such giants as Sony, Ubisoft, and **Electronic Arts**, but they have also started creating their own titles and studios.

A 2007 study by market researcher ICube revealed that only 5% of India's 42 million Internet users are active gamers. A report by Ernst & Young estimates a growth at a CAGR (compound annual growth rate) of 49% by 2012. According to *The Economic Times*, the typical Indian gamer is male, has an average age of 26, and belongs to an affluent family from the major metropolitan areas. **Casual gaming** is by far the most popular, and the community of hardcore gamers (defined as those gaming for more than 4–6 hours a week) is only about 2% to 3% of the gaming population. Home computers and mobile phones are popular gaming devices, but consoles such as the **Microsoft Xbox 360** and the **Sony PlayStation 3** are gaining popularity. Although the **Nintendo Wii** has not been officially released in India, the PlayStation Move was released in September 2010. Other systems, such as the low-priced **Zeebo** console, and gaming via set-top boxes are in the pipeline. Zeebo, described by its California-based developers as "the world's most affordable platform," is aimed at emerging markets such as Brazil, Mexico, India, and **China**; uses Qualcomm wireless technology and is advertised as being 20 to 100 times more power efficient than other consoles.

Indian places and characters have been featured in video games. For example, Dhalsim, the yogic fighter in ***Street Fighter II*** (1991) is Indian. Some of the action in *No One Lives Forever 2: A Spy in H.A.R.M.'s Way* (2002) takes place in the bylanes of Calcutta. In *Fallout 3* (2008), there are some Indian name references, and the "Brahmin" cattle is one of the more controversial ones (Microsoft did not release the game in India because of "cultural sensitivity" issues). There is also a growing market for indigenously developed games: Sony's *Hanuman: Boy Warrior* (2009) has provoked controversy among some religious groups; however, it is a novel attempt to bring Indian folklore into video games. Other games—mostly developed for **mobile gaming**—tap into Bollywood, such as *Dhoom 2.5* (2008) and *Ghajini* (2009), both created after blockbuster films of the same names. **Sports games** are also popular. Finally, there are some distinctly innovative games such as *Finger Footie* (2010) and *The Great Indian Arranged Marriage* (2007). Some of the leading development studios are FX Labs, Indiagames, Dhruva Interactive, Jump Games, and Kreeda. Bollywood giant UTV Studios has entered the global **game design** world with its release *El Shaddai* (2010), a game based on the Book of Enoch.

Gaming is fast becoming popular in India, and from gaming events hosted by corporations such as Gillette and Reliance India, to the games played in cybercafés in Indian suburbs, there is much excitement. Examples of popular gaming championships are the India Gaming Championship 2010, the Gamebox Championship 2007, and the *Skoar!* regional tournaments. *Skoar!* is India's only surviving printed gaming magazine, but IT magazines in general publish sections on video games. There are quite a few game-related webzines and blogs such as *Gamer's India*, *Game Guru*, and *Game Bashing*. On-line gaming portals such as Zapak and Games2Win are quite popular. Kreeda.com has launched a multi-player online **dance game** called *Dance Mela* (2007).

Game design is still new in the Indian academic **world**. Usually, leading design institutes such as the National Institute of Design offer courses. New institutions are up and coming, such as the DSK Supinfocom Pune, which promises to bring world-class game design education to India. Other academic disciplines in India are yet to forge links with **video game studies** in the same way as in countries with a developed video game industry. Leading game designer and writer Ernest Adams has also visited India and conducted workshops.

The video game industry is nascent but developing quickly. With a vast potential for growth and diversification, the video game industry in India can be seen as a sleeping giant. As Adams (2009) comments, "India has the talent, the resources, and the attitudes required to become a major player in this industry. All [they are] lacking is experience, and that will come with training and time."

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industry

Charted over **time**, the financial success and social prominence of the video game **industry** would look something like a roller coaster. Although some of the oldest video game companies have roots that reach back to penny **arcades**, pinball machines, and other early coin-op entertainments, what we think of as the contemporary video game industry has weathered a series of peaks and valleys through the 1970s, 1980s, and 1990s leading to the current moment in which video games are a significant and expanding segment of the economic and entertainment landscapes. Relying directly on the evolution of computer technology, video games have also played a significant role in driving hardware, software, and distribution innovations.

Although what is considered to be the first video game is subject to debate, two examples usually credited as the earliest are Willy Higginbotham's 1958 table tennis–like game played on an oscilloscope and Steve Russell's ***Spacewar!*** (1962), a spaceship duel game made on an MIT **mainframe**. Although rudimentary by contemporary standards, these two games established numerous trends that would play out over the course of video game **history**, both in terms of relying on the cutting edge of technology and in looking to contemporary sources for inspiration, be they existing games and sports such as table tennis or popular culture tropes like space travel and combat. With the rapid growth of public arcades and the home **console** market driving sales through the 1970s, early entrants in the video game industry raced to establish footholds in each market segment. Home video game consoles, such as the **Magnavox Odyssey**, differed significantly from earlier games in that they were compact and widely available to the consumer market compared with games requiring massive mainframe computers only available on university campuses or at large corporations. In the coin-op arcade space, **Atari**, **Midway**, **Namco**, **Capcom**, and others gained early success, with Namco's ***Pac-Man*** (1980) going on to become the most popular arcade game of all time, eventually selling more than 300,000 cabinet units (Kent, 2001, p. xiii).

As momentum shifted to the home console market in the late 1970s, Atari saw the success of the second-**generation Atari VCS 2600** console meet competition from new systems from the Magnavox Odyssey console line, the **Mattel Intellivision**, **Coleco**'s **ColecoVision**, and other home platforms. The rush to establish marketplace, however, also drove a glut of underdeveloped or derivative games and consoles, leading to a series of boom and bust cycles. In 1977, the overexpansion of home consoles led several manufacturers to sell off their console stock at a loss—for example, leading Fairchild to abandon its **Fairchild Channel F** console altogether and RCA to do the same with its Studio II console (see **crash of 1977**). Atari, Magnavox, and Coleco would emerge from the collapse as the major competitors in the market. However, their market dominance would prove short-lived as the home console market collapsed again in 1983, usually attributed to an overabundance of poorly developed games leading to consumer skepticism (see **crash of 1983**).

The falloff was dramatic. By 1983, Atari had been sold off from parent company Warner Communications, Mattel had closed its Intellivision division, and Coleco would start a decline that eventually ended in bankruptcy in 1988. A similar fate played out in the arcade market. In 1981, **United States** arcade revenues reached $5 billion (Kent, 2001, p. xiii), but by the middle of the decade, arcades were closing across the country.

Although the early days of the video game industry were dominated by the console and coin-op markets, the late 1970s and early 1980s also saw the birth of two other important segments of the industry: **home computer games** and **handheld games**. With the increasing presence of home computers, these games provided an entry point for small, independent developers and publishers to bring their games to market. Many of these games were made available through nontraditional venues such as direct sales through magazines and newsletters. At least one major publisher, **Electronic Arts (EA)** started as a home computer game developer and publisher before branching into console, handheld, and other platforms. Commonly credited as the innovator of handheld video games, Mattel released its first, *Auto Race*, in 1976, followed by a series of sports simulations and other straightforward action games. The success of the Mattel games led to numerous competitors, most using LED or LCD screens and containing one game programmed directly into the hardware. One exception was Milton Bradley's Microvision, the first handheld console to use interchangeable game **cartridges**. However, the console's success was constrained by a small number of games, small screen, and easily damaged cartridges. **Nintendo** also entered the handheld market with its Game & Watch series starting in 1980, featuring a game platform on one screen and a clock on another in a dual screen prefiguring the Nintendo DS. Despite these early entries into handheld gaming, the widespread commercial success of handheld games was yet to come in the form of the **Nintendo Game Boy** in 1989. Before that success would occur, the video game industry as a whole would undergo a series of major economic and technological shifts. By the mid-1980s, the Golden Age of video games was at an end. The major home consoles had all been discontinued or were struggling for viability. Coin-op video games were experiencing a similar decline, with arcades closing globally. Other platforms like handheld or home computer-based gaming were not yet well established enough to support an entire industry. Video games began to be seen as a fad. The stage was set for a major adjustment in the medium and the market.

In 1983, the Japanese company Nintendo successfully launched the Famicom console in Japan. Based on its success, in 1985 they released another version of the console outside of **Asia**, repackaging it as the **Nintendo Entertainment System (NES)** and bundling it with *Super Mario Brothers* (1985). The NES's instant success, due in part to the popular **Mario series**, drove the emergence of the third generation of home consoles (1983–1995), which led to the successful reemergence of the console market that drove subsequent generations of hardware, each delivering increased graphic and computational capacity. Importantly, the succession of console generations is delineated by the computer technology that drives the hardware, commonly expressed in terms of graphic capacity, and is considered complete only when active development and publisher support for that hardware has ended, meaning that console generations do not begin and end in neat bookends but instead tend to overlap by several years. The fourth generation of consoles (1987–1999) was dominated by the **Super Nintendo Entertainment System (SNES)** and **SEGA Genesis**, and the fifth generation (1993–2006) saw competition between the **Nintendo 64** and the **Sony PlayStation** with lesser market attributed to the **3DO Interactive Multiplayer**, **Atari Jaguar**, and **SEGA Saturn**. The dominance of the PlayStation console was solidified in the sixth generation (beginning in 1998) with the **Sony PlayStation 2**, competing with the **Nintendo GameCube** and later with the **Microsoft Xbox**. The failure of the **SEGA Dreamcast** in this generation would push **SEGA** out of the console hardware market altogether. By the seventh generation (beginning in 2004), the console market had narrowed to three main competitors: the **Microsoft Xbox 360**, **Sony PlayStation 3**, and **Nintendo Wii**. The same advances in computer technology that had made home consoles viable similarly drove an expanding handheld and home computer market, with publishers increasingly able to release ports or tailored versions of the same games for all three markets.

Entering the 21st century, the video game industry was in the midst of rapid economic, demographic, and technological growth. By 2005, U.S. retail sales of computer and video games exceeded $7 billion, with unit sales of video games rising from 74.1 million in 1996 to 250 million in 2006 (Siwek, 2007, p. 9). In May 2005, Microsoft initiated the seventh generation of console hardware with the official unveiling of the Xbox 360, shipped to initial markets in November of the same year. Sony's PS3 and Nintendo's Wii followed a year later in November 2006. Although many industry analysts and fans predicted a showdown between Sony and Microsoft in terms of hardware capacity and technological capability, it was Nintendo's sales that surged. The Wii was computationally less powerful than its direct competitors, but its success hinged on two elements: it offered **motion-control** based gameplay and appealed to a broader audience than the Xbox 360 and PS3, both initially targeted at a more traditional or "core" market of males under 35. Although motion-control devices had been released commercially in the past, Sony's EyeToy being one example, the Wii was particularly successful in appealing to women and older consumers, in part by offering games that were more casual and **accessible**. The success of Nintendo's motion-control technology led its competitors subsequently to announce their own motion-based devices, the Microsoft Kinect and the Sony Move.

The merit of expanding the market demographic rather than fighting for a larger percentage of the existing market became a key consideration during the global recession of 2008. Many industry pundits predicted that the video game industry would be "recession proof" similar to the film industry in the Great Depression, the argument being that as people had less money for entertainment, they would look for better return on their dollar and be more inclined to stay home and play games. Additionally, with the increasing age and **gender** diversity of the game-playing demographic, any particular demographic falloff should be offset by a larger economic pool overall. However, reality proved more complex. A more accurate depiction is that although certain areas of the game remained stable or grew significantly, other retreated considerably. The years 2008 and 2009 saw a series of layoffs, project cancellations, reorganizations, and closures across the industry. Some industry stalwarts struggled, most notably Midway, one of the oldest game publishers in the industry, whose financial troubles resulted in bankruptcy, partial acquisition by Warner Bros. and other parties in the summer of 2009, and eventual dissolution of the remaining branches.

However, the same technological advances that drove home computer sales and expanded the home computer game market also opened the door to new game industry markets, particularly in the form of on-line **casual games**, social games, **mobile games**, and **massively multiplayer online role-playing games (MMORPGs)**. Mirroring the success of the Wii, casual developers and publishers such as PopCap, Big Fish, and Game House, as well as browser-based social game developers such as Zynga and Playdom all saw significant growth driven to a large extent by appealing to a broader demographic of game players. In a survey by the **Entertainment Software Association (ESA)** across all game **platforms** and genres, video game players were 60% male, 40% female, and the average player was 35 years old, up from previous years (ESA, 2009, p. 4). However, on-line social gamers skewed significantly older and more female. In a study released by PopCap, researchers found that 54% of on-line social gamers were female in the United States, 58% in the United Kingdom, and that the average social game player was 43 years of age (PopCap, 2010, pp. 5–6). All three major console manufacturers appealed to a similar demographic by launching on-line marketplaces (Microsoft's XBLA, Sony's Home, and Nintendo's Wii Shop), where consumers can purchase games and downloadable content as well as arrange on-line matches, purchase streaming videos and music, and access numerous other services. Subscription-based MMORPGs were another area of reliable growth in the industry, growing by 22% in 2008 to a spending level of $1.4 billion in America and Europe (Harding-Rolls, 2009, p. 1). Although demographic surveys of MMORPG audiences have been somewhat contradictory to date depending on game and platform, the overall success of the genre has been remarkable, most notably shown by the success of Blizzard-Activision's ***World of Warcraft*** (*WoW*). Only four years after its launch in November 2004, *WoW* boasted more than 11 million monthly memberships (Cavalli, 2008). Although one survey suggested that *WoW* players were 84% men and 16% female, the average female player was older on average than her male counterpart, and the percentage of female players was significantly higher in older subsegments (Yee, 2009), suggesting on some level that a demographic shift was present in MMORPGs as well.

The scope of the video game industry has changed radically since its origins in coin-op and home video consoles. Advances in handheld computing devices such as the iPod pushed the boundaries of gameplay, and their ubiquity made games a common presence in everyday life, expanding notions of the video game industry beyond standard definitions. The diversification of the market has led to increasing specialization by publishers, studios, and individual developers. The days in which a single programmer would handle code, **graphics**, **audio**, and **design** are now reserved primarily for subsections of independent, experimental, and casual game developers, and it is not necessarily any longer the case that a game developer can smoothly move from one type of game development to another. The video games industry is a major participant in the global software and entertainment industries, making games accessible on a variety of platforms, targeting them at a broad spectrum of consumers, and making them available at nearly every moment in the average consumer's life.

Trevor Elkington

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Infocom

Infocom was a **computer game** publisher that brought text **adventure games** from giant university **mainframe** computers to the masses in the privacy of their own homes. Infocom dominated American software charts for half a decade and are mostly remembered for the popular *Zork* series of games.

Infocom appeared as a result of a project developed by Massachusetts Institute of Technology (MIT) students, primarily Dave Lebling and Marc Blank, both members of the Dynamic Modeling (DM) group within the Laboratory for Computer Science (LCS). Their initial endeavor never included plans for starting a business or creating a commercial product because they were motivated to improve upon the first mainframe interactive text adventure game, *Colossal Cave Adventure* (1976), also referred to as *Colossal Cave*, *Adventure*, or simply *ADVENT*.

Although *Adventure* proved to be addictive, players at LCS became frustrated with the limitations of the game. The command line **interface** was simple and could only process two-word inputs; many objects were introduced within the game that did not allow interactivity. Because the DM members were also computer programmers, they decided to try and improve upon *Adventure*. The team consisted of Blank and Lebling, in addition to Tim Anderson and Bruce Daniels. When their work concluded, the game *Zork* (1979) emerged and ran on Digital Equipment's PDP-10 mainframe computer.

Zork was different from its predecessor in many ways and had a more sophisticated English parser that allowed for more complex interaction. The two-word inputs had been replaced with more natural commands, such as "Hit the ugly troll with the double-bladed axe." The parser program running *Zork* would analyze the words in a sentence, identifying parts of speech such as nouns, adjectives, verbs, and other forms of grammar, making for a much more enjoyable and interactive interface.

Although *Zork* was fun, many of the members of LCS decided to work together outside of MIT, and on June 22, 1979, 10 LCS members became officially incorporated as a business. The Infocom name was chosen because it was determined to be the least offensive name to everyone involved. The newly formed Infocom wanted to release business applications similar to the popular and groundbreaking VisiCalc spreadsheet software; however, they realized that they would quickly be out of business without a product to sell and generate income to keep the business afloat. As a result, *Zork* was initially revived to generate revenue. It had already been written and tested and was nearly ready for release.

In the late 1970s, mainframe computers began to migrate from universities to personal computers in private homes. Personal computers at the time were very expensive, so only wealthy professionals could afford them, a well-educated demographic that enjoyed reading, making them a perfect market for literary text games. (Later, writer Douglas Adams contacted Infocom about giving his books an interactive treatment, leading to the release of *The Hitchhiker's Guide to the Galaxy* [1984], further merging the literature and software connection.)

The initial hurdle for Infocom was how to make the megabyte-sized mainframe program *Zork* run on a home computer with only a 32 kilobyte capacity. Some optimization was required, and the result was the Z-machine, a software application designed specifically for text-adventure games. Because the game in its entirety was not needed at all times, the Z-machine was in essence an example of an early virtual memory manager. The Z-machine would load only portions of the game at one time from the floppy drive into a computer's main memory and then only access additional information when needed. With this technique, *Zork* was made much smaller. The Z-machine also implemented other techniques such as compressing text. However, *Zork* was still too large to fit on a home computer floppy disk. Infocom then decided to split the game into three parts, releasing the game with two sequels, and in essence, tripling the sales opportunities. In the end, Infocom brought text adventures into the home, first releasing them on the TRS-80 Model 1 in 1980. The Z-machine was written to be portable to other **platforms**. As a result, *Zork* and future Infocom text games could be ported easily to other computing platforms of the time being sold by Amstrad, Apple, **Atari**, Commodore, IBM, Texas Instruments, and others.

Because Infocom titles were text-based, they were also sold by book retailers. With an additional market available to them that was unavailable to other software publishers, Infocom games dominated software sales charts from 1981 to 1985. Another reason why Infocom games outsold their competitors is their elaborate **packaging**, which made games more **immersive**, and **piracy** more difficult. Many Infocom games included extra props tied to the game that could not be easily duplicated and often contained clues or information required to clear certain parts of a game. These props were referred to as “feelies” and their origin was an accident. When Marc Blank, the designer of *Deadline* (1982), could not fit all the information needed to solve the case on the disk, the additional information was included in the game’s packaging. Rather than just use a printed **game manual**, an entire police dossier was included that contained detailed information needed to solve the game. For instance, *Deadline*’s feelies included a police memo, murder scene photo, lab report, plastic bag with three pills, the inspector’s casebook, the coroner’s corpus delicti, and police interview notes.

By 1982, Infocom was a proven success and decided to launch its business division. Although this was the initial intent of the company when formed in 1979, the transition proved harmful to the company as a whole. The rapid growth required the company to move to a larger and more expensive **space**, and additional resources were required such as the purchase of an expensive DEC system 20 to be used for development. More damaging was the cost of paying a workforce that tripled. The move also divided them into two distinct and different factions, the game developers and the business division. When profits from the games division were channeled to fund the business division’s relational database *Cornerstone* (1985), resentment divided the company further. Infocom spent over 2.5 million developing *Cornerstone*, but when it was finally released, sales were less than half of what the company projected, netting below $2 million.

Over time, as computer **graphics** improved, Infocom’s text-based game sales suffered. They were no longer selling more than 100,000 copies of each released game as before. *Cornerstone* sales were even worse, selling only 10,000 copies before Infocom shut down the business division entirely.

In June 1986, game developer and publisher **Activision** saved Infocom by purchasing the company for $7.5 million. To compete in a modern market, *Foolblitzky* (1986) was released and was the first Infocom title to leave the text-only format and feature graphics. *Beyond Zork* (1987) introduced a graphical user interface (GUI) to the *Zork* franchise and featured an interactive **map** and inventory menu. The final Infocom-released *Zork* title, *Zork Zero* (1988) debuted the following year. In 1989, when Infocom failed to reinvent itself, Activision dismantled the company.

Activision, holding all Infocom copyrights, released *The Lost Treasures of Infocom* (1991), which contained 20 Infocom titles bundled together for Amiga, Apple, and MS-DOS home computers. The instructions for all the games were bound together in a single volume. Sadly, the feelies were not reproduced for the set in their original format but reduced to photocopies or images of the actual objects for budgetary reasons. Activision later released a follow-up, *The Lost Treasures of Infocom II* (1992) reviving 11 more Infocom titles.

Although Infocom is gone, the *Zork* franchise lives on. Activision later released *Return to Zork* (1993), *Zork Nemesis* (1996), and *Zork: Grand Inquisitor* (1997). The most recent Zork title, *Legends of Zork* (2009), was not a retail release but instead a free browser-based **on-line game**.

Michael Thomasson

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interactive movies

The interactive movie genre holds a place in the **history of video games** for one main reason: its well-known failure. Made possible by the increased storage capacity used by **laserdisc games** and **CD-ROM-based games**, the idea was to take "video game" literally by combining full-motion video of live-action footage and cinematic techniques with a gaming experience. Interactive movies came to have a bad reputation because of the limited possibilities of their branching structures, their lack of interactivity, poor acting, and, in the case of early interactive movies, their low-**resolution** imagery and the dismal quality of their playback. The interactive movie was more concerned with questions of nonlinear storytelling and photorealistic imagery than the development of innovative gameplay. Considered the cutting edge of technology in the early 1990s and the future of the industry (mainly by those who were making them), interactive movies were rarely made by the end of the decade. Yet some interactive movies had quite an impact in their day.

Although the genre came to be associated with live-action video, its first occurrence was an animated interactive movie now displayed in the Smithsonian Institution alongside the only two other video games there, ***PONG*** (1972) and ***Pac-Man*** (1980). *Dragon's Lair* (1983) was one of the first analog **laserdisc**-based coin-op video games to be released. The gamer was indeed invited to play his or her "own" cartoon, embarking on a fantasy adventure as Dirk the Daring, a valiant knight rescuing the fair and voluptuous Princess Daphne from the clutches of Singe the Evil Dragon. The gamer's actual participation consisted of making decisions by using a **joystick** to give Dirk directions or hitting an action button to make him strike with his sword. The decision-tree branching gameplay of *Dragon's Lair* attracted a following and remains the basic **design** model of interactive movies, and the game's popularity encouraged the release of similar games like *Space Ace* (1983) and *Badlands* (1984). In the 1990s, **SEGA** Tru-Video Productions like *The Masked Rider: Kamen Rider ZO* (1994) and *Mighty Morphin' Power Rangers* (1994) even recreated a similar experience using footage from the popular **television** series. Nevertheless, those games never achieved the same success. The company American Laser Games revived the use of live-action in the **arcade** at the beginning of the 1990s with nine laserdisc. In games such as *Mad Dog McCree* (1990), *Who Shot Johnny Rock?* (1991), *Space Pirates* (1992), and *Crime Patrol* (1993), the gamer had first and foremost to draw his light gun before his rivals did. The simple plotlines were of course a pretext to stage many shoot-outs that took place in different locations.

It is really with the advent of CD-ROM-based games that movie-like gaming experiences arose. The introduction of the Multimedia PC (MPC) in 1990 and the release of the peripheral **Turbografx-CD** in 1989, the Philips CD-i system in 1991, the **SEGA CD** add-on in 1992, and the **3DO Interactive Multiplayer** console in 1993 marked the increased use of live-action video. Unlike **cartridges**, the CD-ROM's storage capacity allowed the storing of movie sequences that were even called "cinemas" at the time. Available only on CD-ROM, *The 7th Guest* (1993) was one of the three "killer applications" that launched the multimedia revolution along with *Myst* (1993) and *Doom* (1993). Inspired by the board game *Clue* (1949) and by David Lynch's television series *Twin Peaks* (1990–1991), *The 7th Guest* is mainly a puzzle-oriented game. By solving the brainteasers, exploring the **space**, and clicking on objects, the gamer of *The 7th Guest* is rewarded with sequences that uncover the secrets of the mansion. Unlike their **arcade game** progenitors, these games typically staged their actors in virtual settings. The huge success of *The 7th Guest* saw the release of similar games and of a sequel, *The 11th Hour* (1995). Rob Landeros teamed up with David Wheeler, the director of the film parts of *The 11th Hour*, to produce two of the last interactive movies on DVD: *Tender Loving Care* (1999) and *Point of View* (2001).

Made by Digital Pictures in 1992, *Night Trap* is one of the first live-action video games released on the SEGA CD, which became famous for the controversy it sparked. Playing an agent of the SEGA Control Attack Team, the gamer has to protect a group of five girls at a weekend house party from vampires by closely monitoring, through hidden cameras, eight rooms displayed at the bottom of the screen and capturing the hooded intruders with traps concealed in the house. Although the action is far from gory, the girls do not run naked in the house, and the goal is to save—not kill—the young ladies, *Night Trap* was, along with the **fighting game** ***Mortal Kombat*** (1992), the center of a congressional investigation regarding **violence** in video games. The hearings led to the development of a ratings system, at first SEGA's own Videogame Rating Council (VRC) in 1993, and the video game industry's **Entertainment Software Rating Board (ESRB)** the following year. Yet the release of *Voyeur* (1993) for the Philips CD-i did not bring as much political controversy, despite similar gameplay and content adult-oriented enough to receive an "18" certificate by the British Board of Film Classification. *Voyeur*'s gameplay consists of clicking on windows of a manor to read information, look at personal belongings, hear conversations, or witness some scenes between the characters staged in digital settings.

Interactive movies with mystery or detective stories are numerous and better described as **adventure games** in which the gamer works along with the investigator. *Sherlock Holmes Consulting Detective* (1991) is the first game of this kind and the earliest use of live-action video in a small window at the center of the screen. Various mysteries and detective movie games have been developed, such as *The Dame Was Loaded* (1995), *Ripper* (1996), *Black Dahlia* (1997; with a record 8 CD-ROMs), and *The X-Files Game* (1998). Hyperbole Studios made two early examples of "VirtualCinema movies": *Quantum Gate*

(1993) and *The Vortex: Quantum Gate II* (1994), but Access Software's *Tex Murphy* series (1989–1998) is the most well known of this type. From low-resolution talking heads that answer questions in *Martian Memorandum* (1991), to the film clips that appear with character interaction or the clicking on of objects in *Under a Killing Moon* (1994), to the full wide-screen imagery of *Tex Murphy: Overseer* (1998), one can see the evolution of the use of live-action video.

The attraction of live-action video inspired celebrated game designers to move in this direction. Although all games with live-action video were expensive to produce, Chris Roberts's *Wing Commander III: Heart of the Tiger* (1994) was marketed as a multimillion dollar production ($3.5 million) and had a cast led by Mark Hamill (Luke Skywalker of *Star Wars* [1977]) and Malcolm McDowell. Through conversations, the gamer has to choose between two options regarding a character or an event; decisions made by the gamer during conversations have an impact on what will happen in the galactic combats. The series was successful right from the start in 1990, and two subsequent games were made in the same way: *Wing Commander IV: The Price of Freedom* (1995) and *Wing Commander: Prophecy* (1997). Carrying on the Sierra On-Line tradition of point-and-click adventure, Roberta Williams and Jane Jensen created two classics of the interactive movie genre, *Phantasmagoria* (1995) and *The Beast Within: A Gabriel Knight Mystery* (1995). The third-person perspective *Phantasmagoria* takes place in a digitally rendered manor and town where Adrienne, the main character, has to discover the mystery of the manor and to fight an evil spirit she ill-advisedly released and who comes to possess her husband. The game contains a rape and several violent death scenes and was controversial enough to be banned by the **Australian** government. Jane Jensen's *The Beast Within* alternated between Gabriel Knight and his assistant Grace Nakimura as they tried to explain the mysterious existence of a werewolf. Praised as a great adventure, it was also considered to be one of the few successful examples of live-action video used over photographic backdrops.

As real-time three-dimensional graphics engines grew in image processing power during the mid-1990s and delivered a much more truly interactive experience, the production cost and the lack of malleability of the filmic image, coupled with limited gameplay, became less appealing for both designers and gamers. Thus the interactive cinema experiment in the 1980s and 1990s demonstrated that video games are not movies.

Bernard Perron

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interface

The concept of interface refers to the point of interaction between two different systems. In the study of human-computer interaction, it refers more specifically to any component that allows users to provide input into a system or get feedback about the system's state. According to this definition, any type of feedback—visual, aural, or tactile—is part of the general interface between the user and the system; many on-screen elements, such as resource indicators and menus, are known as the **graphical** user interface. In this entry, the focus is mostly on the physical devices used to provide input in video games. Following some general considerations, the basic components of the physical interfaces and their most common assemblages in video game **controllers** and **arcade** cabinets are introduced.

Many computer interfaces have been developed to aid the manipulation of symbolic information in the context of work (such as numeric keypads, keyboards, and mouse). The interfaces created more specifically for the enjoyment of video games were often inspired by control devices already found on other types of machines, such as buttons and knobs on radios and **televisions**, steering devices and levers used in vehicles, and guns. Before arcade video games, many coin-operated mechanical entertainment cabinets were already based on these controls.

Games of an **abstract** nature often integrate the physical manipulations at face value: users are required to type words or numbers or to displace objects using directional buttons or a mouse pointer. A significant number of games propose more complex make-believe scenarios, where the actual manipulation—or primary action (Grodal and Gregersen, 2009)—performed by the user is mapped into a virtual action depicted on the screen. The player's action and its in-game counterpart form a "dyad," and the accumulation of all these dyads form a repertoire of action that helps define the **avatar** in the game's **world**.

Many interfaces have been created with specific make-believe scenarios in mind, and the idea of a natural interface (like those associated with **virtual reality** apparatuses) has resurfaced since the release of the **Nintendo Wii**. Yet in practice, purely isomorphic action dyads are not the norm; they are associated first and foremost with the vehicular **simulation** genre. It should be noted that every technological device used as an input interface in the context of a video game implies its own affordances. Even the more versatile **motion capture** devices are more suited to very specific dimensions of human agency. At the same time, the **immersive** power of the video game medium is largely due to the possibility to bind a simple button to any imaginary action on the screen.

The most basic and enduring component used in the **design** of video game controllers is the digital switch, which is based on a simple ON/OFF logic. When a button is pressed, it becomes active on the electric circuit and can be registered by the system. Classic arcade cabinets, such as ***BattleZone*** (1980) and *Star Wars* (1983), often relied on a digital optical encoder; LEDs light up or turn off depending on the user's manipulations, and a phototransistor detects these variations which will be interpreted by the program. In 1962, the PDP-1 hackers created a dedicated control box for ***Spacewar!*** (1962). It included a button to launch torpedoes and two switches: the horizontal one controlled the rotation of the ship, and the vertical one could move the ship forward or initiate hyperspace. The configuration of switches according to a directional logic has been prevalent throughout the history of game controllers. The **Atari VCS 2600** had a four-way digital **joystick**, whereas the **Fairchild/Zircon Channel F**'s joystick could register eight positions. The small directional pad that became the norm with the **SEGA Master System** and the **Nintendo Entertainment System (NES)** is still featured on the **Microsoft Xbox 360**, **PlayStation 3**, and even the Wii controller. According to Marie-Laure Ryan (2006, pp. 118–119), the predominance of action and **adventure games** based on shooting and spatial exploration is due in part to the similarity between these imaginary actions and the manipulation of these interfaces.

Early in the medium's existence, digital switches coexisted with analog controls. Analog buttons or joysticks do not obey a binary, discrete state logic; they are built on the principle of the potentiometer (progressive voltage alterations) and thus are able to input incremental variations depending on the pressure applied by the user. Many early systems were bundled with paddles dedicated to playing ***PONG*** (1972) or its clones; the potentiometer controlled the movement and the speed of the paddles on the screen. Most game controllers since the **Nintendo 64** have integrated multidirectional analog sticks, and the dual stick configuration first seen in the PlayStation DualShock controller has been replicated in many contemporary interfaces. The first Xbox gamepad also integrated analog shoulder triggers. In contemporary console games, the speed of the avatar's movement or rotation of the virtual point of view is often mapped on the analog sticks.

On top of these basic components, a variety of devices have been developed to capture the motion of users more thoroughly. The **Nintendo DS**'s touch screen can register presses and wipes; the cameras in the EyeToy or Kinect can capture the movements of the whole body and display a moving image of the user on the screen; the infrared sensor of the Wii allows users to point anywhere on the screen, and the accelerometer integrated in the Wiimote can detect velocity variations on three axes. These motion-capture devices have proved successful for **sports games** and **minigames** based on a variety of situations (like *Cooking Mama* [2006] and *Wii Sports* [2006]). However, mainstream genres rarely incorporate perfectly isomorphic action dyads for fighting or exploration of **space**; simple hand gestures become the symbolic equivalent of a complex swordfight or other manipulations displayed on-screen.

To maximize the isomorphy between the actual manipulations and the fictive actions, game designers have created interfaces that mimic specific tools or real world apparatuses. Ralph **Baer** designed a light gun interface for the first home **console**; the Shooting Gallery sold for the **Magnavox Odyssey** included the gun toy and four additional acetate TV overlays for the system. The **arcade game** *Gran Trak 10* (1974) had players use a steering wheel to control a car in a race, and many **racing games** since have integrated the wheel and pedals. **Midway**'s *SeaWolf* (1976) had a periscope interface that users had to rotate to aim at enemy vessels. The cabinets of many **shooting games** integrated mounted guns, and joysticks similar to those of actual aircraft (as in *Star Wars* [1983] and *After*

Burner [1987]). Some versions of **SEGA**'s *Hang-On* (1985) even had a toy replica of an actual motorcycle that users would move to steer. Many variations of these mimetic interfaces have been released for major home entertainment systems by the console maker itself or by third parties; Saitek, for instance, specializes in the design of authentic aircraft controls to be used with popular flight simulation software.

Carl Therrien

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International Arcade Museum (IAM)

The International Arcade Museum (IAM) is the world's largest museum of the **art**, inventions, and **history of the video game**, amusement, and coin-operated machine **industries**. Its coverage includes video games, pinball, mechanical and **electro-mechanical arcade games**, slot machines, vending machines, trade stimulators, and all other coin-operated devices.

Based in Pasadena, Los Angeles County, California, the IAM is focused on providing content and community services relating to these machines, as well as protecting, researching, and disseminating related knowledge, educational research, and the interpretation of the same. To that end, it has assembled one of the world's leading archives covering the art, entrepreneurs, inventions, and history of the amusement and coin-operated machine industries.

One of the key offerings of the IAM is an extensive and growing physical library. Additionally, more than 120,000 pages of educational, research, and entertainment content are available on its website, including more than 100,000 pages of reference content in Acrobat .pdf format and more than 18,000 encyclopedia entries covering coin-operated arcade and amusement machines. Other on-line offerings include a "Machine of the Moment" as well as message boards where collectors and fans can ask questions and get answers from experts or buy and sell games, machines, and parts. Its website receives millions of page views each month. A video game division of the museum called the **Killer List of Videogames (KLOV)** has created the authoritative database on coin-operated video games with thousands of entries containing game descriptions, machine photos, trivia, technical data, and related information.

Via Penny Arcadia, the IAM's events and exhibitions wing, one of the museum's goals is to establish a definitive collection of important mechanical amusement devices, coin-operated machines, and video games for enjoyment and **education** purposes. The collection currently encompasses well over 500 machines and tens of thousands of location photos, catalogs, flyers, and items of related memorabilia.

The permanent collection of Penny Arcadia includes the three earliest coin-operated arcade games ever made, the world's first kiddie ride, numerous video game prototypes, and thousands of photos, flyers, catalogs, and related items of memorabilia. Its holdings include the only complete collection of ***Computer Space*** (1971) specimens, including the only white unit ever made. The Penny Arcadia collection started being assembled in the spring of 1970 by Jon and Patricia Gresham. These efforts culminated in its grand opening on July 17, 1982, in Pocklington, England, 12 miles east of York. It presented a unique combination of expo, museum, theater, **arcade**, and magic show. It quickly won a Certificate of Merit award from the British Tourist Authority in their "Come to Britain Competition." In 2003, the International Arcade Museum and its director Greg McLemore took over the operations of Penny Arcadia, moved the collection to Los Angeles, and combined it with the machines he had already assembled there. As Penny Arcadia develops special exhibits, it continues to have access to well over 500 machines, most made between 1883 and 1983.

The IAM also sponsors the International Arcade Museum Library, Inc., a 501c3 nonprofit research library that collects and makes available research material related to the amusement, arcade, coin-operated machine, and video game industries, both from its own collection as well as from other libraries and institutions and the collector community. The IAM Library's goal and purpose is to acquire, preserve, and present a leading archive of catalogs, flyers, photos, obsolete patents, inventions, media, general history, and artifacts about the amusement, arcade, coin-operated, and video game industries. The library works with both the public at large and other libraries, museums, and educational institutions to preserve artifacts and knowledge so that this history is better known, understood, and appreciated. It is currently expanding, preserving, and cataloging its holdings as well as presenting them to the public (both on-line and via a physical library) and working to develop educational programs. A pool of funds is also being developed to support a move to larger facilities to facilitate expanded presentation and research space and to support being open to the public at regularly scheduled hours. Donations to the library are tax deductible.

The IAM Library is a member and supporter of both the American Library Association (http://www.ala.org) and the on-line computer library center (OCLC; www.oclc.org). More than 71,000 libraries across the world use OCLC services to locate, acquire, catalog, lend, and preserve library materials, and the International Arcade Museum Library, Inc. is currently working to provide a catalog of key holdings to OCLC members. The International Arcade Museum Library is independent of, yet receives some sponsorship and support from, the International Arcade Museum.

Another institution sponsored by the IAM is the **Vintage Arcade Preservation**

Society (VAPS), also known as the Video Arcade Preservation Society), a leading association dedicated to the preservation of coin-operated games with more than 7,500 members in 71 countries who collectively own more than 67,000 coin-operated machines (over 4,300 titles).

Greg McLemore

Further Reading

International Arcade Museum Library website, available at http://www.arcade-museum.com/library.

International Arcade Museum website, available at http://www.arcade-museum.com.

Penny Arcadia website, available at http://www.arcade-museum.com/penny-arcadia.

International Center for the History of Electronic Games (ICHEG)

The International Center for the History of Electronic Games (ICHEG) at The Strong in Rochester, New York, collects, studies, and interprets video games and related materials to explore how electronic games are changing the way people around the **world play**, learn, and connect with each other.

ICHEG defines "electronic games" broadly to include video games, **computer games**, **console-based games**, **arcade games**, **handheld games**, and toys that combine digital and traditional play. By the start of 2012, ICHEG's rapidly growing collection of more than 36,000 items was one of the most comprehensive public assemblages of electronic games and game-related historical materials in the **United States** and among the largest in the world. In addition to games and the **platforms** on which they are played, the collections include game **packaging** and **advertising**, game-related publications, game-inspired consumer products, and other items that illustrate the impact of electronic games on people's lives, and personal and business papers of key figures in the electronic games **industry**.

The ICHEG collections are housed at The Strong's National Museum of Play, alongside and linked directly with a world-class collection of hundreds of thousands of **board games** and role-playing games, toys, and other artifacts of play, countless numbers of which have inspired and informed the creation and development of electronic games. ICHEG is additionally supported by The Strong's Brian Sutton-Smith Library and Archives of Play, a research library of more than 130,000 volumes.

ICHEG's collection is both broad and deep. For example, the collection includes more than 140 original **arcade** games, including the first arcade games, ***Computer Space*** (1971) and ***PONG*** (1972). The collection is particularly strong in games from the 1970s and 1980s, including more than a dozen of the most important vector-based games such as *Space Wars* (1977), *Asteroids* (1979), and *Tempest* (1981).

The thousands of games and systems in the collection cover every generation of console gaming, from the earliest systems such as the **Magnavox Odyssey** and *Home PONG* (1975) through the most recent systems from **Nintendo**, Sony, and Microsoft. The console-based games range from the mass-produced to the rare, such as a gray *NES Nintendo World Championship 1990* cartridge. ICHEG's collection also features a wide range of personal computer games from the 1970s to the present, including examples produced for the earliest home systems such as Apple II and Commodore 64, down to a wide variety of modern home computer games. Particularly notable is ICHEG's collection of more than 5,000 children's **educational** computer games and its collection of more than 1,000 games from the *Computer Gaming World* collection.

Mobile games are an important part of ICHEG's collection, including not only handheld systems with interchangeable games such as Parker Brothers's Microvision, the Atari Lynx, **Nintendo Game Boy**, and **Nintendo DS** lines, and Sony's **PlayStation** Portable, but also hundreds of dedicated handhelds of the 1970s and 1980s that companies such as **Coleco** and Mattel produced. These are augmented by a wide variety of electronic toys from companies such as Texas Instrument, VTech, and LeapFrog.

ICHEG has a wide range of archival materials that document the history of gaming. These include an extensive game magazine collection and more than 1,000 **game guides**, including nearly a complete run of guides produced by Prima Games. Perhaps most significantly, ICHEG preserves development documents, business records, and other papers from some of the industry's most important game designers such as Ralph **Baer**, Will **Wright**, Ken Daglow, Roberta Williams, and Dan Bunten (Dani Bunten Berry).

Beyond collecting and preserving such materials, ICHEG develops exhibits such as *eGameRevolution*, an exhibit on the **history of video games** on permanent display at The Strong's National Museum of Play. ICHEG also produces an array of on-line interpretive content and makes its resources available to scholars, people in the games industry, and others interested in the history of video games to encourage research and writing about the historical and cultural significance of video games and other electronic games.

Through all of these activities and more, ICHEG seeks to ensure that present and future generations can explore the history of electronic games, understand how they began and evolved, appreciate who played what roles in that evolution, and grasp the impact that electronic games have had on society.

Jon-Paul C. Dyson

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International Game Developers Association (IGDA)

According to their website, the International Game Developers Association (IGDA) "is the largest nonprofit membership organization serving individuals that create video games" (IGDA website, 2010), with more than 10,000 members as of late 2010. The mission of the IGDA is to connect game developers and build community among them, advancing their careers and professional development, and advocating on issues affecting the game development community, including business and legal issues, **censorship**, credit standards, diversity, and student and academic relations.

The IGDA also includes a Code of Ethics on their home page.

In early 1994, debates occurred in the United States Congress that resulted in the proposed Video Game Rating Act of 1994 (which was not passed), as well as the establishment of the video game **industry**'s own **Entertainment Software Rating Board (ESRB)**. Video game developers felt that they lacked a voice during the debates, which led the Computer Game Developers Conference (now **Game Developers Conference [GDC]**) to establish the Computer Game Developers Association in 1995, with Ernest W. Adams as its first president, to provide a professional organization for video game industry professionals. In 1999, the group's name was changed to the International Game Developers Association to reflect the international scope of the organization. Management of the IGDA was initially handled by Miller-Freeman (now CMP), the company that had bought the Computer Game Developers Conference in 1995, until 2004, when the IGDA took over the running of the day-to-day operations of the organization. It is now governed by an elected board of directors.

The IGDA currently sponsors a number of Special Interest Groups (SIGs), fora, wikis, and a monthly newsletter, as well as the IGDA Foundation, which supports the mission of the IGDA and offers scholarships, game industry research, and an eJournal. The IGDA also has local chapters across the **United States**, **Canada**, **South America**, **Europe**, **Asia**, **Australia**, and **India** and has partnered with other organizations to sponsor events such as the annual Global Game Jam.

Mark J. P. Wolf

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Internet games

See massively multiplayer on-line role-playing games (MMORPGs); on-line games; web-based games

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J

JAMMA standard

The JAMMA standard is a wiring standard for **arcade** video game machines, determining the specifications for the connection between the main system board and the various parts of the game cabinet, such as the power supply, the monitor, the speaker, and the control panel. It was created in 1985 by the Japan Amusement Machinery Manufacturers Association (JAMMA).

Before the introduction of the JAMMA standard, **arcade games** typically utilized custom circuit boards, power supplies, and wiring harnesses. Given the high cost of an arcade cabinet, it was not financially advantageous to replace the entire unit once the popularity of a given game waned. To avoid unnecessary expense, arcade operators often converted the cabinet to accommodate a newer, more popular title. However, because the components were not designed with interchangeability in mind, such conversions usually required performing some modifications to the hardware—from simple rewiring to extensive and complex alterations. Even though manufacturers followed their own internal standards, technology changed quickly, and it was not uncommon for two game boards released by the same company to be incompatible.

Under the new specifications, the custom components were replaced with interchangeable parts. JAMMA-compatible system boards feature a 56-pin (2×28 pins) edge connector, with a standardized layout of inputs and outputs. These include inputs for +5V and +12V power lines, coin slot mechanism, test and service switches, two start buttons (for the one-player and two-player version of the game), and two sets of controls (one 4-way **joystick** and three buttons per player), as well as outputs for RGB video signal and monophonic **sound**.

Adopted by most manufacturers, the standard assured that any JAMMA board would be compatible with any JAMMA cabinet. This greatly simplified the conversion process, as the replacement of the system board could now be performed on a plug-and-play basis. The specifications also limited the number of buttons to three per player, although some games utilized the unused pins to connect a fourth button. Any nonstandard inputs—for instance, for games supporting more than two players or using specialized **controllers**, such as analog joysticks, trackballs, or light guns—required additional connectors. An example of such a connector is the "kick harness" used in **Capcom**'s ***Street Fighter*** series cabinets to attach three additional buttons per player. The name derives from the fact that the extra inputs were used to control kick attacks in the game but is now used interchangeably with "extra harness" or "plus harness" to denote any auxiliary button harness. Although there is no official standard for such additional inputs, game boards that utilize them are commonly referred to as JAMMA+.

Approximately 400 game boards supporting the JAMMA standard are currently known to exist, produced between 1985 and 1997. The original JAMMA standard was eventually superseded by the newer JAMMA Video Standard (JVS). Introduced in 1996 to accommodate modern **peripherals**, it replaces the edge connector with an HD-15 video connector, RCA connectors for stereo sound, and a USB connector for I/O interface. The **SEGA** NAOMI arcade system (see **SEGA Dreamcast**) is an example of a JVS-compatible system. ***See also*** DECO cassette system.

P. Konrad Budziszewski

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Japan

Japan is one of the two most important countries producing video games, along with the **United States**. Since the late 1970s, it has been an important part of the video game **industry**, as much from an economic as from a cultural point of view.

Even though video games were invented in the United States, Japanese amusement companies soon took part in the industry's blossoming. Shortly after **Atari** (an American company despite the Japanese name) found success with ***PONG*** in the United States in 1972, some established companies started to import American **arcade games** and to create *PONG* clones and other innovative games to distribute it in Japanese "game centers" (*geemu sentaa* or *geesen* in Japanese). In 1975, Taito (founded in 1953 by a Russian businessman and specializing in importing and distributing vending machines) exported their first arcade game, *Western Gun*, which was renamed *Gun Fight* and distributed by **Midway** in the United States. In 1978, Taito released one of the most popular arcade games of all time (and by far the most successful in Japan), ***Space Invaders***, which began the huge contribution of Japanese creativity in the global video game industry. The company **Namco** (founded in 1955 as Nakamura Manufacturing Corporation) followed one year later with another huge success, ***Pac-Man*** (Japanese release, 1979; North American release, 1980). In the beginning of the 1980s, many Japanese **arcades** and video game companies became extremely successful, such as **SEGA** (a merging of Rosen Enterprises and Service Games, both founded by Americans but established in Japan after the **World War II** to import amusement machines), Konami (founded in 1969 as a jukebox rental and repair business that had its first arcade success in 1981 with *Frogger*, developed by Konami but distributed by SEGA/Gremlin), Jaleco (founded in 1974 as Japan Leisure Corporation), **Capcom** (founded in 1979 as Japan Capsule Computers), and especially **Nintendo** (founded in 1889 as a card-game company; they released *Donkey Kong* in 1981, introducing for the first time the iconic character Jumpman who soon became known as Mario, beginning the ***Mario* series** of games).

Nintendo, and their subsidiary Nintendo of America (founded in 1979 to distribute their games in the United States), helped to revitalize the American video game industry after the **crash of 1983** with their hugely successful home game console. Released in 1983 as the Famicom (Family Computer) in Japan, and then renamed **Nintendo Entertainment System (NES)** for its release in 1985 in North America, it went international in October 1986. Since the mid-1980s, Japanese console manufacturers have dominated the hardware market (in **console-based games** and **handheld games**), which have been marked by famous competitive economic battles and aggressive marketing campaigns (Nintendo versus SEGA in the late 1980s and the beginning of the 1990s; Nintendo and SEGA versus Sony since the mid-1990s, with the release of the **Sony PlayStation** in 1994 in Japan and 1995 in the United States and Europe; and after the 2001 demise of SEGA, competition continued with the release of the **Sony PlayStation 2** and **PlayStation 3** and the **Nintendo Wii**).

In software, Japan has also dominated the market, with creative and original games and series that have deeply imprinted the gaming culture of the 1980s and 1990s. Series such as Nintendo's *Mario* series (started in 1981), ***Legend of Zelda* series** (started in 1986), the ***Metroid*** series (started in 1986), SEGA's *Sonic the Hedgehog* series (started in 1991), the *Virtua* franchise (1992–2008), Konami's *Castlevenia* series (1986–2009), the ***Metal Gear* series** (started in 1987), Capcom's *Mega Man* series (started in 1987), ***Street Fighter*** series (started in 1987), just to name a few, as well as genres such as **role-playing games (RPGs**; known as JRPGs—"J" for "Japanese," or console-based RPGs), the two most famous series being Square Enix's *Final Fantasy* (started in 1987) and *Dragon Quest* (started in 1986), **fighting games** (with series such as Capcom's ***Street Fighter***, SEGA's *Virtua Fighter*, Namco's *Tekken* [1994–2008] and *SoulCalibur* [1996–2009], or series by the arcade company **SNK**, which has specialized in the genre), **shooting games** (mostly the "shoot 'em up," or "shmup," subgenre that is very popular in Japanese arcades), **survival horror games** (such as Capcom's *Resident Evil* series [1996–2009], Konami's *Silent Hill* series [1999–2009], and Tecmo's *Fatal Frame* series [2001–2008]), and other genres exclusively popular in Japan like visual or **sound** novels, *eroge* (erotic games), and dating sims, which have all helped to create a singular style for Japanese games, as well as a deeply involved following.

Among these very popular games, and often their even more popular characters (Mario, Sonic, Pikachu, and so on), which have served as cultural icons for Japan and the countries importing them, their creators (including Shigeru Miyamoto, Yuji Naka, Yu Suzuki, Hideo **Kojima**, Tetsuya Mizuguchi, Shniji Mikami, Fumito Ueda, and Suda 51) have become sometimes as famous as their characters, and often fully recognized as "auteurs" in Japan (and abroad), similar to the way certain directors are recognized in cinema (such is also the case for certain game music composers, like Nobuo Uematsu, composer for the majority of the *Final Fantasy* games, as game soundtracks sell extremely well in Japan, and have their own devoted section in music stores).

Japanese video games are generally characterized by specific aesthetic features. They are often associated with a propensity for audiovisual details and unbridled creativity. Consequently, they have very often been received outside Japan as curious (even inaccessible) demonstrations of oddness and craziness or, conversely, as interesting and exotic curiosities. The peculiarity of Japanese video games manifests itself in the large variety of themes, influenced as much from Japanese traditional and contemporary popular culture as from popular American and European culture but also in complex narratives, echoing ones found in manga (Japanese comic books) and animé (Japanese animation). These two very popular media have above all defined the caricatured or **comic book** representational style that we recognize in the vast majority of Japanese games. This *media mix* between animé, manga, and video games goes well beyond their hybridized aesthetic features and has helped to create a subculture in Japan and abroad.

The appeal of video games in Japan has led to a strong gaming culture, as much in arcades (game centers) as at home, with a strong level of **fandom** in each. This involving (if not obsessing) interest has been closely tied with the ones for manga and animé, and thus takes part in the encompassing "otaku" culture, which has now reached North American, European, and other **Asian** countries.

The Japanese video game industry has been in line with the rapid expansion of other industrial businesses in Japan (cars, electronics, etc.) since the earliest post-World War II times, and Japanese industries have consequently divided international markets into three zones (Japan, United States, and **Europe**), the same divisions the video game industry has consistently adhered to.

In the beginning of the 2000s, however, the American software giant Microsoft entered the hardware market, and as the global video game industry became efficiently transnational, the Japanese video game industry has had a hard time dominating the global market. Some even claim there is a crisis in the Japanese video game industry (indicated by a decline in software and hardware sales in Japan, as well as an overall disinterest by the once more deeply involved community of gamers), caused by many factors, such as a backlog in video game development technologies and studios' management (compared with the United States and Europe), a stubborn focus on once cost-effective series and clones, and difficulties in adapting rapidly to the evolving market—especially in on-line development and services—although Nintendo has had a great success in the casual market with their Nintendo Wii console launched in 2006. Nevertheless, whatever the future holds for the Japanese video game industry, it will surely remain a significant contributor to the video game field.

Martin Picard

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journalism

Formerly a niche area of coverage, video game journalism has come to include a diverse range of sources (including specialist print publications, **television** programs, websites, mainstream media outlets, and more grassroots on-line sources such as weblogs) that provide game previews, reviews, and news about the video game industry more generally. The recent expansion of video game journalism has been largely attributed to the immense growth and profitability of the game **industry** since the late 1990s, which has moved video games themselves out of a niche category and made them a medium deemed increasingly worthy of the scope of journalistic coverage given to literature, **film**, and television. Sweeping technological changes in media production and distribution have also played a key role in expanding the breadth and significance of video game journalism, particularly through the popularization of the Internet as a fast, inexpensive, and **accessible** means of both distributing and accessing journalistic content.

This growth of journalistic coverage has not been without problems, however. The legitimacy of video game journalism has been challenged on the grounds that video game publishers—the most frequent advertisers in games-focused enthusiast publications—exert too great a control over editorial practice. Furthermore, repeated criticisms of poor-quality reporting and writing have been leveled at those games writers and reporters who lack formal journalistic training, coming to their vocation instead through backgrounds as gamers and fans. This has led to recent attempts to establish style guides and codes of conduct designed to standardize and further legitimate video game journalism as both form and practice.

The prominence of video game journalism has always been strongly tied to the economic success and prominence of the games industry itself. The earliest journalistic coverage of video games coincided with the emergence and popularization of **arcade games** in the early to mid-1970s. However, this coverage was initially limited primarily to trade magazines, such as ***RePlay*** and ***Play Meter***, which covered the coin-operated entertainment industry more generally, including everything from pinball to slot machines. As the golden age of the arcade game continued into the late 1970s and early 1980s, the first publications dedicated solely to video game coverage appeared, but in the form of trade publications addressed this time to **arcade** owners. With the release of incredibly successful arcade games such as ***Space Invaders*** (1978) and ***Pac-Man*** (1980), however, video games began receiving a certain degree of coverage as a cultural phenomenon in mainstream media outlets, including *GQ* and *Time* magazine. After a false start in the early 1970s (followed by the first **console** market **crash of 1977**), the home gaming market experienced a strong resurgence in the late 1970s and early 1980s, and with it appeared several consumer-oriented games-focused publications, including *Electronic Games*, *Joystick*, *Video Games*, and *Computer Gaming World*.

However, most of these early specialist (or as they tend to be called within the industry, "enthusiast") publications would fold in conjunction with the major video game industry **crash of 1983**, brought about in part by a glut of console systems and poor-quality games hitting the market at the same time (many console manufacturers either filed for bankruptcy or left the games industry during the crash). It would take **Nintendo**'s resurrection of console gaming in the late 1980s and early 1990s, in conjunction with the growing popularity of PC gaming at the time, to bring a certain degree of stability to special-interest coverage of video games. Between 1988 and 1994 a second wave of successful video game-focused magazines—many of which still exist—were launched, including *GamePro*, *Game Informer*, *Electronic Gaming Monthly*, the United Kingdom–based *Edge Magazine*, and *Nintendo Power*, the one-time in-house magazine for Nintendo now independently owned by Future Media. Although the format and editorial content varies somewhat from one enthusiast publication to the next, most of these magazines include sneak previews of upcoming game releases, features that go behind the scenes during the development of a soon-to-be released major title, strategy guides, as well as critical reviews of new releases. Some titles (*Nintendo Power*; *PlayStation: The Official Magazine*; *Official XBOX Magazine*) specialize in the coverage of one type of console and its game titles, whereas others, like *PC Gamer*, focus strictly on PC gaming. At present, however, the majority of publications cover the industry across the spectrum of the console, PC, and **handheld** market. In 2002, G4TV, the first North American specialty television channel dedicated solely to video game-related programming was launched; however, by 2005, the channel had redefined its mandate so that its games coverage became just one facet of a broader focus on male-oriented general interest programming.

The scope and nature of video game journalism has continued to expand alongside the video game industry, which has more than quadrupled its earnings since the early 1990s, and grown from a niche market targeting (usually male) children and teens to one that addresses an aging and increasingly diverse demographic of players. This has especially been the case since the late 1990s and early 2000s, when hardware developers **Sony** and Microsoft introduced game **consoles** that combined increasingly photorealistic game **graphics** with broader functionality as all-in-one entertainment systems that could also access the Internet and play music and DVDs.

As video games steadily become a more mainstream entertainment form, so too does journalistic coverage of games continue to cross over into the mainstream media. This has been far from a seamless process, however, because much of the initial general-interest media coverage of games focused on the moral concern surrounding the potentially negative effects of realistic, violent games on children, especially in the wake of the 1999 Columbine shootings and the revelation that its perpetrators were huge fans of the first-person shooter PC game ***Doom*** (1993). This negative media attention toward video games continued throughout the multiple debates about games ratings and **censorship** surrounding the ***Grand Theft Auto* series** and continues to crop up periodically in relation to new, especially violent titles, or those games (particularly MMORPGs such as ***World of Warcraft*** [2004]) deemed so **immersive** that they are faulted for stealing players away from their real lives. However, this type of negative coverage is now far outweighed by the general interest media coverage of games as a medium in their own right—and indeed, because of the unique status of video games as an industrial **art**, this coverage often traverses the arts and entertainment, business, and technology segments of any given media outlet. Although regular game reviews aren't nearly so common as those long dedicated to newly released films and books, high-profile publications including the *New York Times*, *Newsweek*, the *London Telegraph*, the *San Jose Mercury News*, and the *Los Angeles Times* now have reporters and regular features dedicated solely to the coverage of video games. Due in large part to the increasing stylistic and narrative convergence of cinema and video games, even the Hollywood trade magazine *Variety* now features a section ("The Cut Scene") devoted to coverage of the video game industry. Significantly, our contemporary moment also features the first **generation** of journalists to grow up with video games reaching increasingly senior positions in the industry, which has been another factor pinpointed in the expanding nature of games coverage.

The rise of the Internet as a means of both distributing and accessing media content has had a dramatic impact on video game journalism in recent years. Dedicated gamers and hardcore fans who would have once needed either to get a job with the enthusiast press or create and circulate their own fanzines to get their voices heard can now easily create websites and blogs that can attract a mass readership in their own right. Although many such sites are derided by journalists and readers alike for poor-quality writing and biased opinions—often attributed to the lack of formal journalistic training of their creators—the Internet has also enabled the development of some of the most unique and highly respected voices within video game journalism. At the same **time**, the speed at which websites may respond to industry rumors, release advance screenshots and previews of upcoming games, and post game reviews, gives on-line sources certain distinct advantages over print publications such as magazines, which are hindered by long lead times before their stories are published. The recent demise of several long-running enthusiast magazines—including *Games for Windows* and *Electronic Gaming Monthly*—has been at least in part attributed to the speed, ease, and cost-effectiveness of accessing video game news and reviews on-line. At the very least, print publications are recognizing the necessity of developing websites to complement, expand on, and speed up their print coverage. Some of the most popular games enthusiast publications exist solely in on-line format, as is the case with *IGN* (owned by Fox) and *GameSpot* (owned by CNet). Meanwhile, many of the most popular "independent" blogs and websites have been acquired by major media companies seeking to expand and diversify their holdings, at the same time as their most talented writers are being seconded to positions within the mainstream press.

In an act that both recognized the significance of on-line media sources at the same time as it sought to bring these sources to a higher journalistic standard, in 2007 the International Games Journalists Association published the *Videogame Style Guide and Reference Manual*—a resource designed to provide a common, agreed-on style and language usage that would unify all games media. However, as the two-word version of the term "video game" in the title of *Encyclopedia of Video Games* suggests, agreeing on such common terms and usage can be a contentious matter at best. As Bernard Perron and Mark J. P. Wolf (2008) have suggested, despite the guide's best intentions to resolve disputes around terminology, some of its conclusions inevitably lead to further disagreement—for example, by somewhat arbitrarily choosing the one-word version of "videogame," the authors go against their own criteria for common usage and accuracy, because, as a survey of multiple Internet search engines reveals, "video game" is by far the more frequently used term.

Despite its growing ubiquity, video game journalism has repeatedly faced criticism and scrutiny over a perceived lack of editorial integrity. In 2002, *Los Angeles Times* reporter Alex Pham wrote a scathing account of the extensive promotional freebies and exotic trips lavished on journalists by video game publishers, prompting a larger discussion of whether such giveaways earned coverage of games that wouldn't otherwise be noteworthy and biased critics toward giving favorable reviews. (While the majority of games journalists insist that these perks do not infringe on their objectivity, most major media outlets now insist on covering their employees' travel expenses for press junkets.) Perhaps most problematically for the current and future credibility of video game journalism, there have been ongoing accusations that game publishers possess clear influence over editorial content, because they remain the primary source of **advertising** revenue within the video game enthusiast press, as well as the only source of advance production information, screenshots, and gameplay footage, and review copies of the games themselves. Blatant examples of this influence are difficult to substantiate, because most publications possess an editorial policy that explicitly states the clear separation of editorial and advertising interests. However, the extent to which such policies are actually enforced became a topic of public debate in the wake of the highly publicized firing of *GameSpot*'s editorial director, Jeff Gerstmann. Gerstmann wrote and published a negative review of the Eidos game *Kane & Lynch* (2007) after multiple advertisements for the game had been in heavy rotation on the site in the weeks leading up to its release. While *GameSpot*'s corporate owners at CNet staunchly denied that the firing was related to the review, games journalists and industry-watchers alike have cited the incident as a revealing window into the uneasy balance that must be struck between video game publisher interests and journalistic integrity (see Croal, 2007). ***See also*** Atari; careers; merchandising; violence.

Jessica Aldred

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joysticks

The joystick is a device for positioning and moving a cursor or **avatar** in a two-dimensional plane, which developed from existing one-dimensional control devices. Its roots are found in military applications; early interactive computers in the **United States** needed an input device for aerial surveillance programs. Through the SAGE project in the late 1940s, the existing *control stick* for vehicles was modified to become a computer input device, modeled on the **German** *Steuerknüppel* of 1942 for controlling guided missiles (the Ruhrstahl *Fritz-X* and Henschel *Hs 293 A*). The first recorded use of the term *joy-stick* occurs in the diary of the British aviator Robert Loraine in 1910 who used it to describe the aircraft's central lever or *cloche*. Since at least 1955, the term has been used in American patent specifications in connection with positioning devices (Peterson,1955).

While military use of the joystick continues, civil applications beside vessel control include the control of industrial machines and devices (especially automation systems for continuous path control and tracking control), cranes, freight elevators, electric wheelchairs, and airplanes (fly-by-wire systems). Medical uses include the operation of surgical instruments. Joystick-style *wobble switches* (or *wobble plates*) are used for device activation and other purposes by disabled users or those with poor motor control. Some mobile phones use navigational pads that function like joysticks. Early instances in toys are seen in the mid-1960s in remote-controlled (RC) airplanes, such as the Kwik Fly produced by Phill Kraft and in model vehicles. RC cars are usually controlled by two-channel RC sets (speed and steering), whereas airplanes use two (rudder and elevators), three (adding pitch adjustment), four (adding ailerons) or more channels.

The joystick's transition from toys to computers occurred at the beginning of the 1970s, when the *Alto* computer (developed at Xerox PARC) was designed to handle keyboard, mouse, tablet, and joystick input. Multiple applications were targeted, encompassing not only office tasks but also games, music, and children's **play**. This may be considered the start of the widespread use of the joystick as a common computer interface device. The *Star*, PARC's next commercial computer model, however, only had a keyboard and mouse.

The general public most likely first learned to use the joystick through playing **arcade games**, which proliferated on a massive scale following the unprecedented success of **Atari**'s ***PONG*** (1972). Although *PONG* only used paddle **controllers**, other **arcade** games had elaborate controls tailored to the needs of each game, such as an array of specifically arranged buttons (Atari's *Asteroids* [1979]) or one or two joysticks per player (Atari's *Space Race* [1973] and *Tank!* [1974] as well as **Cinematronics**'s

Space Wars [1977]). Other interface devices used by arcade machines in the 1970s include life-size electromagnetic force feedback rifles, flight yokes, steering wheels, foot pedals, and trackballs.

A plethora of dedicated systems quickly descended on the home video game market. The best known of these are the (analog) **Magnavox Odyssey** (1972), Atari's *Home PONG* (1975), **Coleco**'s Telstar Arcade (1976), and the **Fairchild Channel F** (1976), which featured two built-in or hardwired controllers with a number of buttons and knobs. Atari released its famous **Atari VCS 2600** in 1977, complete with two paddle controllers and two joysticks, connected by simple 9-pin D-Sub connectors that set the standard for home computers.

The joystick became the classic input device for games of the popular 8-bit home computers of the mid to late 1980s, including the Commodore 64, the Amstrad (Schneider in Germany) CPC, the Sinclair ZX Spectrum, and others. The improved 16-bit computers (like Commodore's Amiga and Atari's ST) made additional use of the mouse as a primary input device. The most famous joystick of this era (and probably of all time) is the iconic *Competition Pro 5000* by Kempston, although there were countless brands and models available, each appealing to different players' preferences. The first *Competition Pro* version, for instance, had a soft feel, because it used metal lashes to detect the movement of the stick, whereas the later and more expensive version featured micro switches with a more solid and sturdy feel. This version was also more precise and durable but needed a bit more effort to maneuver. Other notable joysticks at the end of the 1980s include the Konix *Speedking*, Powerplay *Cruiser*, Quickjoy *Turbo*, Spectravideo *Quickshot*, Suncom *Slik Stik*, and *TAC* as well as the Wico *Boss* and *Redball*.

The trend of **console-based games** to use joypads (or gamepads) instead of joysticks arguably started in 1982, when Atari released the **Atari 5200** console, which had four controller ports (instead of the usual two used by the competition) and offered a unique controller with an analog stick, numeric keypad, two fire buttons (one on each side), and three other buttons (start, pause, and reset). The Emerson Arcadia 2001 had very similar controllers and the **ColecoVision** (both 1982) featured a 5200-style controller but with customizable buttons. Coleco's Gemini (1982) was a 2600 clone which had two controllers, both with an eight-way joystick and a 270-degree paddle controller. Mattel's Intellivision II (1982) also had a similar controller design. Already in 1985, **Nintendo**'s famous **Nintendo Entertainment System (NES)**, first released as Famicom in **Japan**, introduced controllers that looked like modern joypads (with one digital pad on the left, two fire buttons, and two other buttons on the right side). Similar controllers were found on the Atari 2600 Junior and **Atari 7800** and the **SEGA Master System (SMS)**, both released in 1986. The 1989 release of the **NEC PC-Engine/Turbo Grafx-16** and the **SEGA Mega Drive** (Genesis in the United States) completed the development of the joypad.

The joysticks for the 8-bit computers were all digital, not analog: they featured a four-way stick and a fire button. Despite these limitations, many advanced technical

A joystick of the 8-bit and 16-bit era, which features an autofire function that can be continuously speed-adjusted, and a paddle feature in which the fire buttons act as left/right movement. The joystick is made with a solid metal housing, is quite large and heavy, has rubber suction feet, a 9-pin connector, uses micro switches, and can easily be opened and parts serviced. This model was made by several manufacturers (this particular device by Elite). (Daniel Cermak-Sassenrath)

features could be included, the most useful of which was autofire, which allowed the player to fire rapidly and continuously by holding the fire button instead of having to repeatedly push and release it. Some joysticks possessed an extra button with a fixed (often very fast) autofire rate (as found on the transparent-blue *Competition Pro Star*), whereas on other joysticks this feature could be switched on and off (as on the 1987 version of the *Speedking*). On others, it was even possible to set the rate via a potentiometer from very slow to nearly continuous firing (as on Elite's *Multi-Function 2002*). Whether this feature was worthwhile depended on the action of a game. Some games, such as *R-Type* (arcade version 1987, 8-bit and 16-bit ports 1988 and 1989), had different functions mapped to a short button press (like a shot) and a longer one (the charging the cannon for an especially powerful shot). In some games the player-character could not move as long as the fire button was pressed (as in *Gauntlet*; arcade version 1985, 8-bit and 16-bit ports 1986 and 1987). Some games featured software autofire if appropriate for the game (such as *Silkworm*; arcade version 1988, 8-bit and 16-bit ports 1988 and 1989), so as to not give an advantage to those players with autofire joysticks. Many joysticks were ambidextrous because they were symmetrically built (as the *Cruiser*). Most computer gamers of the 8-bit and 16-bit era were accustomed to handling the stick with the right hand and triggering the button with the left, as opposed to the other configuration.

When the shift in popularity from 16-bit home computers to IBM PCs (or clones) occurred (around 1990), analog joysticks were primarily available, the best of which were, arguably, made by Gravis. These connected to the computer via the 15-pin game port and were mainly used for flight and driving simulators. Many other **computer games** (jump-and-run games, **strategy games**, thinking and puzzle games) were played with the keyboard and/or the mouse. First-person shooters are still played this way today. The joystick became a specialized controller for the genre of flight **simulation games** (like the Thrustmaster *Afterburner 2* and the Logitech *Wingman Force*).

The joystick made a comeback as a general purpose interaction device in 1992 when Ted Selker introduced the *TrackPoint* to IBM's *Thinkpad* laptop series, which was an isometric joystick that reacted to pressure rather than displacement; this technology is only used in specialized applications. The increasingly popular *touchpad* (or *track pad*) was initially more expensive but soon became available at moderate prices on the mass market.

During the 1990s, further technical advances in home consoles included faster CPUs, better **graphics** and **sound**, different storage media, and Internet access. Joypads gained improved precision and durability, began to feature analog directional pads, and became wireless. Some consoles now even included motion detection. After **SEGA**'s unsuccessful SEGA Master System II (SMS II; 1990), **SNK**'s **Neo•Geo** (1990) was released, which had a high-quality arcade-style joystick and arcade-level graphics. Nintendo's **Super Nintendo Entertainment System (SNES**; released as the Super Famicom in Japan [1991]) was the first system to feature shoulder buttons on its joypad controllers, other systems such as the **Sony PlayStation** (1995, United States) followed suit. The **Nintendo 64** (N64; 1996) included joypads with vibration feedback and analog sticks. In 2003, Sony's EyeToy, a camera interface for the **Sony PlayStation 2**, did away with joypads and other controlling devices, opting to rely instead on movement detection as an interface technology. Nintendo took this approach one step further and used infrared sensors and accelerometers on the **Nintendo Wii** (2006).

From the 1980s onward, the joystick has been the ubiquitous input device for arcade games and home computer games, whereas home consoles primarily have used joypads. Today, joysticks for computers exist alongside a multitude of other input devices, and often joysticks feature eight or more often customizable buttons, a proportional four-directional stick, a throttle slider, and a digital four-way hat switch (or POV switch, a small four-way stick on top of the main stick). Some feature force feedback, and some are wireless. Joypads appear to be more popular than joysticks, as they have similar features and are smaller, light weight, and cheaper. Other commercial game controllers include steering wheels, guns, mats and boards, pseudo-musical instruments, fitness controllers, as well as themed joypads and Wii skins. Currently, high-quality joysticks for flight simulations are manufactured by Thrustmaster, and Speedlink reissued the *Competition Pro* with a USB connector in 2004.

Over the years, the joystick has undergone a tumultuous development, and its precision, durability, reliability, and ergonomics have improved substantially. Although technically simple, its applications have varied substantially, including vehicle control, military applications, military training, toys, industrial and medical applications, computer interfaces, mobile and communication devices, and game controllers. The first analog joysticks gave way to digital versions during the 1980s, and both types were popular in the 1990s. More recently, the joystick has lost its role as the preeminent computer game controller but, because of the **retrogaming** movement, it has remained in use, and specialized types of joysticks continue to appear for different genres and games. The joystick has been produced in a variety of shapes, with different button configurations, analog and digital sticks, mini sticks, hat switches, navigational pads, dials, sliders, throttles, lights, displays, and other elements. Later developments include force feedback, wireless connectivity, adjustable sensitivity, customization, and game-specific visual aesthetics. These have been seen as overkill by some gamers who remember the golden age of gaming, when simple joysticks like the *Competition Pro* were the dominant game controllers for the home computer.

Daniel Cermak-Sassenrath

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K

Killer List of Videogames (KLOV)

The Killer List of Videogames (KLOV) is the video game division of the **International Arcade Museum**. A key offering of the KLOV is an on-line coin-operated video game encyclopedia devoted to cataloging **arcade games** past and present. "KLOV" also refers to the name of an informal grouping of **arcade** enthusiasts (who refer to themselves as "KLOVers") who participate in a social network focused around this encyclopedia.

The Killer List of Videogames started out in the 1980s as informal and simple lists of coin-operated video games. These lists were distributed via on-line **bulletin board systems (BBSs)**, commercial services such as CompuServe, and via Usenet.

The name "Coin-Ops A Poppin'—Killer List of Videogames" was added in 1991 as the use of the word "killer" as an adjective and an adverb was becoming a hip way of saying excellent, complete, very cool, or extremely satisfying. The first KLOV list was maintained by Mike Hughey, who soon turned over management to Jeff Hansen. Also in 1991, a separate list entitled "The definitive arcade video game **cheat** sheet" was being maintained by Jeremy Radlow.

Jonathan Deitch took over both lists in 1992, combined them, and worked to expand them. Under his watch, the KLOV evolved from a simple list to one managed on a structured database. Each record could be up to 300 characters long. The encyclopedia added its 1000th entry in March 1993.

The first KLOV website arrived in 1994 as Brian Johnson took over the role of "KLOV Keeper" and presented it on his personal home page. It is through his countless hours of work that the KLOV evolved from a list to an encyclopedia and that "KLOV" has become a significant brand.

Greg McLemore, the founder of numerous Internet ventures including Toys.com and Pets.com, took over the KLOV in the middle of the dot com boom in 2000. An avid gaming enthusiast, he wanted the KLOV to enjoy the benefits of his experiences and resources for its further advancement. He registered the domain name "KLOV.com." The site was rewritten in PHP, and data was stored in an SQL database. Message forums were added, and a Palm Pilot KLOV application was released. As this encyclopedia grew to include coin-operated amusement machines other than video games, the International Arcade Museum was formed and the KLOV became a division of the larger museum in 2002.

The KLOV's on-line encyclopedia has extensive entries for approximately 5,000 coin-operated video game machines made from 1971 through the present. *Newsweek* magazine has called "klov.com, the IMDB [a leading movie database] for players, with titles, photos and dates." The encyclopedia has cabinet, control panel, and marquee images, screenshots, and even three-dimensional models of the machine in some cases. Entries provide machine technical information, game descriptions, cabinet information, cheats, tricks and bugs, and discussions of conversions and gameplay, trivia, and technical fix information. Legacy information (such as sequels or similar games a given game inspired) is also included.

Entries in the encyclopedia are heavily weighted for classic arcade games: that is, games released during the first 20 years of the **industry** (1971–1991). Most games have an entry, although entries for the early games tend to be more all-encompassing. The KLOV website also includes a video game "Machine of the Moment" and a "Top 100 Videogames" list. The site also hosts message boards where collectors and fans can ask questions and get answers from experts or buy and sell arcade games and parts. Today well over 100,000 video game enthusiasts generate millions of page views each month reading the KLOV's encyclopedia and message forums.

Although the KLOV has been part of the International Arcade Museum for many years now, hundreds of thousands of forum messages were posted on the KLOV site by active enthusiasts before this merging. Over a million more have been posted since, yet many in this community still refer to themselves as "KLOVers." These affiliations even follow members offsite. For example, there is an annual tradition at the California Extreme exhibition of classic coin-operated games in which dozens of participants take a break in the middle of the day for a "KLOV Group Photo" outside the show.

Further Reading

The International Arcade Museum website, available at http://www.arcade-museum.com.

Greg McLemore

KLOV

See Killer List of Videogames (KLOV)

Kojima, Hideo (1963–)

Hideo Kojima is a **game designer**, the founder of Kojima Productions, and the director of the ***Metal Gear* series**. He is a pioneer in the integration of cinematic techniques into video games.

Kojima was born in Setakaya-ku Tokyo, **Japan**, on August 24, 1963. During his elementary school years, he was fascinated with detective novels like those based on the TV series *Columbo* and later, various novel genres such as mystery, adventure, and science fiction. He eventually started writing stories on his own, and he was interested in filmmaking, influenced by his father. When he went to middle school, he shot his own short films with his friends. During his high school days, he dreamed of going to an **art** school to be an illustrator or screenwriter after graduating high school. However, he put that ambition aside because of the financial circumstances of his family and chose economics as his major in college. In his junior year, he became absorbed in **arcade games**, and especially Konami's games such as

Yie Ar Kung-Fu (1985). After graduation, he joined Konami at their office in Kobe, Japan, where he was originally assigned to the MSX game team. His real desire, however, was to make games for the **Nintendo Famicom** (the **Nintendo Entertainment System [NES]**), which had fewer technological limitations to develop compared with MSX games. He struggled to come up with novel game ideas that would enable him to overcome the limitations of the MSX development environment, and his first such game was *Metal Gear* (1987). He was next asked to design a **war** game; however, it was impossible to make an extravagant action game with multiple characters and bullets on-screen because of the MSX's limited performance. To solve this, he chose an espionage format in which a limited number of objects were shown, focusing on storyline and gameplay mechanics. *Metal Gear* was very successful in the MSX market.

In 1988, his first adventure game, *Snatcher*, was released. *Snatcher* was also the first game in which he used cinematic techniques, such as using **cut-scenes** and narrations that would come to characterize Kojima-styled games. After that, in 1990, *Metal Gear 2* was released and was Konami's last MSX game.

Policenauts (1994) was Kojima's second adventure title and was made for multiple **platforms** and used more sophisticated cinematic techniques than *Snatcher*, such as intro cinematic and various scene transition techniques. In 1995, he was designated as the director of Konami Computer Entertainment Japan (KCEJ) and moved to Tokyo. Three years later, he launched his first **Sony PlayStation** game, *Metal Gear Solid* (1998), using the full performance capabilities of the Sony PlayStation. The game was so successful that he was able to expand the *Metal Gear* franchise to the **United States** market, where *Metal Gear Solid* was even more successful than it had been in Japan, selling 6.6 million copies. In 2001, he launched a robot action game *Zone of the Enders (ZOE)* and *Metal Gear Solid 2*, which sold even more than its predecessor. On December 24, 2001, he was selected as one of the top 10 people by

Japanese game director Hideo Kojima arrives at Spike TV's Video Game Awards in Culver City, California, on December 10, 2011. (AP Photo/Joe Kohen)

Newsweek, and in 2004, he launched *Metal Gear Solid 3*.

In 2005, he started his own studio, Kojima Production, and three years later, his first **Sony PlayStation 3** game *Metal Gear Solid 4* (2008) was released. In 2010, he launched *Metal Gear Solid Peace Walker* for **Sony** PSP.

Taiyoung Ryu

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Korea

See South Korea

L

language

Some of the earliest research exploring individual and group-based use of computer-mediated communication and language was via text-based games such as **multi-user domains (MUDs)** and MOOs that featured cooperation, competition, and fantasy-themed settings. Researchers were often responding to popular early pronouncements that on-line, identity could be unmoored from the body, and that we were all free to be "whoever and whatever" we wanted via the Internet. In contrast, they pointed to very **gendered** as well as heteronormative uses of text-based language that appeared in spaces such as fantasy-themed MUDs and experiments such as the Turing Game. Likewise, players would use language in specific ways to mark—or make invisible—particular constructions of **race**, often leading to stereotypical representations as well as the inscription of whiteness as a norm for on-line **spaces**. More specific to games, researchers have explored several facets of language, including differences between voice and text-based language use, how talk contributes to the complexities of gameplay, and the challenges of decoding language that is specific to particular domains.

In relation to game-related talk, researchers have found that players are incredibly varied in how they use language in games—attending not only to the specifics of a game situation but also engaging in social exchange, in critiques of the gamespace and its rules, and in speculation about the larger culture surrounding games. Such components not only occur outside of the gaming situation but even within very fast-paced, competitive games that require singular attention. Facility with such language is often essential to successful gameplay and to the creation of expertise that is recognized by other players.

Of course, as higher reaction speeds are required in certain types of games, players also tend to favor voice-based communication over textual language because it is quicker and easier to use. However, researchers have found that although the use of voice has such utilitarian benefits, it can also exacerbate differences between varied types of players, strengthening some ties but weakening others because it can highlight differences as well as be used to create racist, homophobic, and sexist atmospheres that not all players welcome.

Other studies of language and games have investigated the rich vocabularies required of players of multiplayer on-line games in particular to become part of the game's community. Researchers have asked what kinds or levels of "fluency" in such lingo is required for players to feel they are competent at playing and also at feeling part of the community at large. Likewise, researchers have begun investigating how such language use indicates informal scientific reasoning at work, as players postulate hypotheses for desired actions, work through various alternatives, test their beliefs, and then communicate the results. Overall, language is a key element of gameplay, yet one that is not yet well studied or understood.

Mia Consalvo

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laserdisc games

The era of laserdisc games was short, lasting from 1981 to the mid-1990s. The laserdisc, an optical storage disc technology, was first commercially available in 1978 and used mainly for movies. Laserdiscs had several advantages over videotape, including better horizontal **resolution**, sharper images, and instant access capabilities. The technology was adapted to **arcade games**, and laserdisc games included the first appearance of full-motion video in video games.

In 1981, David H. Ahl, founder of *Creative Computing* magazine, programmed an Apple II computer to control a laserdisc and play scenes from the movie *Rollercoaster* (1975), demonstrating how the technology could be used in games. Electro Sport's *Quarter Horse* (1981) was the first game to use a laserdisc; it had two screens, one for computer **graphics** and one for video. Players placed bets and interacted on the computer graphics screen, and then the game would randomly select a winning horse and play a laserdisc video clip on the video monitor. Such usage was not very interactive, but others were conceiving ways laserdiscs could be incorporated into games.

Laserdisc games typically fell into two categories. The first used laserdisc imagery as a background and placed computer-generated graphics over it; in such cases, the background was a prerecorded sequence to which players coordinated their movements—for example, **racing games** in which players steered vehicles to avoid crashing. The game's video clip is the same every time, and players try to fly or drive as far as they can without crashing and ending the game. One such game, *Astron Belt*, was manufactured by **SEGA** and licensed to **Bally/Midway** and introduced in 1982. In it, the player steers a spaceship through

space, over land, through tunnels, and other locations seen in the video backgrounds, while shooting at enemy ships and avoiding computer-generated mines. Other games with overlaid graphics that came out in 1983 included Bally/Midway's space shooting game *Galaxy Ranger*, Funai's space shooting game *Interstellar Laser Fantasy* (also known as *Interstellar*), Mylstar's flying game *M.A.C.H. 3*, and Williams's *Star Rider*. The laserdisc imagery used in these games was typically live-action video or pre-rendered computer animation.

The other kind of laserdisc game used the technology's random access capability to create branching narratives that were steered by the player's input at crucial moments in the game. Instead of controlling overlaid characters, players played by making quick decisions and interacting with precise timing to avoid sequences ending in the player-character's death. This type of game is also sometimes called an **interactive movie**.

The most famous of these types of games was *Dragon's Lair* (1983) by computer consultant Rick Dyer, who had teamed up with **Cinematronics** and former Disney animator Don Bluth to create the game. *Dragon's Lair* featured a knight, Dirk the Daring, who fought various creatures and had adventures, the outcomes of which were partially determined by the player. With hand-drawn cel animation from Bluth, the game's graphics were far better than the usual arcade game imagery. The novelty interested players and arcade operators, who hoped laserdisc technology could revive the arcade game **industry**'s sagging profits. Other games with hand-drawn animation appeared in 1983; two animé-based games, Nihon Bussan/AV **Japan**'s *Bega's Battle* and Stern's *Cliff Hanger* both had action-packed **narratives** with branching storylines. Two other games of 1983 added another element of player choice: Bally/Midway's *NFL Football* and Stern's *Goal to Go*, both football games with live action video, had players select plays and then showed the teams running them.

During the video game industry **crash of 1983**, laserdisc games inspired hope, and more than a dozen companies produced games in 1984. Cinematronics, Dyer, and Bluth returned with *Space Ace*, a science-fiction themed game, and Dyer's own company, RDI Systems, also produced the adventure game *Thayer's Quest*. Other games of the year included **adventure games** (Funai's *Esh's Aurunmilla*, Universal's *Super Don Quixote*, and Taito's *Ninja Hayate*), **shooting games** (Laserdisc Computer System's *Atomic Castle*, Konami's *Badlands*, Nihon Bussan/AV Japan's *Cobra Command*, **Atari**'s *Firefox*, and Mylstar's *Us Vs. Them*), racing games (Taito's *Cosmos Circuit* and *Laser Grand Prix*, SEGA's *GP World*, and Universal's *Top Gear*), one **sports game** (Stern's *Gold Medal with Bruce Jenner*), and the only **abstract** laserdisc game, Simutek's *Cube Quest*.

Because of derivative games and expensive technology that frequently broke down, laserdisc games failed to revive the **arcade**. The games' limitations were also to blame; prerecorded imagery meant games could only vary slightly from one playing to another, if at all. Once players had seen everything, they lost interest, so the games had little **replay** value and no staying power.

For the same reasons, home laserdisc game systems also failed. In January 1985, RDI Systems released the Halcyon home system, which cost more than $2,000 and had only two games for it, an expanded version of *Thayer's Quest* and *Raiders Vs. Chargers*, which used real NFL game footage. Four more games were planned, but the company went bankrupt before their release. Microsoft's MSX home computer, released in Japan in 1983, used certain laserdisc players from Pioneer and Sony to play laserdisc games, and eleven games (*Astron Belt*, *Strike Mission*, *Badlands*, *Starfighters*, *Umi Yakuba*, *Interstellar*, *Cosmos Circuit*, *Esh's Aurunmilla*, *Rolling Blaster*, *Mystery Disc 1: Murder, Anyone?*, and *Mystery Disc 2: Many Roads to Murder*) were released for the MSX and available only in Japan.

The late 1980s saw only a few more games released, including SEGA's space game *Albegas* (also known as *Cybernaut*), Status's *Casino Strip*, Nihon Bussan/AV Japan's *Road Blaster* (also known as *Road Avenger*), and Taito's *Time Gal*, all from 1985, and Millennium Games's *Freedom Fighter* from 1986. From the late 1980s onward, raster games with three-dimensional graphics were improving and offering more variety than the limited pre-rendered sequences of laserdisc games in which players could not control their point of view.

However, laserdisc technology attempted a comeback in the early 1990s. **Namco** produced two games, *Galaxian 3* (1990) and *Attack of the Zolgear* (1994), both space shooting games that sat six players in front of an enormous image stretching across three giant projection screens placed side-by-side in an enclosed booth, giving players a unique arcade experience. *Dragon's Lair II: Time Warp*, a sequel begun in 1984, was finally released in 1991 by Leland Interactive. Nova Games released a driving game, *Street Viper* in 1993, Atari Games released a driving and shooting game *COPS* (1994) based on the **television** series, and SEGA released *Time Traveler* (1991), which reflected its laserdisc imagery in a parabolic mirror to simulate a **3-D** effect. A Spanish company, Web Picmatic, produced a few games, including *Zorton Brothers (Los Justicieros)* (1993) and *Marbella Vice* (1994), and in 1993, Pioneer Corporation even released the Pioneer Laseractive home laserdisc game system, although by this time **CD-ROMs** were replacing laserdisc as the technology for games using full-motion video.

The company most responsible for the attempted revival of the laserdisc game industry was American Laser Games. Started in the late 1980s, American Laser Games would use better computer technology and produce a series of laserdisc games with light guns and live-action video, including *Mad Dog McCree* (1990), *Who Shot Johnny Rock?* (1991), *Gallagher's Gallery* (1992), *Mad Dog II: The Lost Gold* (1992), *Space Pirates* (1992), *Crime Patrol* (1993), *Crime Patrol 2: Drug Wars* (1993), *Fast-Draw Showdown* (1994), *The Last Bounty Hunter* (1994), and *Way of the Warrior* (1994). A 10th game, *Shootout at Old Tucson* did not make it to the arcade but was released on CD-ROM instead.

Technologically speaking, the revival efforts were too late. By 1992, CD-ROMs were incorporating full-motion video in **computer games**, and in 1997, the first consumer DVD equipment became available, sounding the death knell for laserdisc technology. Probably the last arcade video game to use a laserdisc was Nihon Bussan/AV Japan's *Burning Rush* (2000), which used it only for its opening and closing sequences and **cut-scenes**.

Games using full-motion video, however, continued for home computers and **console** systems. In 1997, the company Digital Leisure, Inc. was formed for the purpose of rereleasing laserdisc games on DVD. They bought the rights to *Dragon's Lair*, *Space Ace*, and *Dragon's Lair II: Time Warp*, which they released over the next couple years on CD-ROM, DVD-ROM, and the **Sony PlayStation 2**. In 2000, Digital Leisure bought the rights to SEGA's *Time Traveler*, and in 2001 it acquired the rights to all nine arcade games made by American Laser Games, re-releasing them as well. Today a number of laserdisc games can be played on emulators, such as Daphne (see www.daphne-emu.com).

Laserdisc games had a brief history because of the quickly changing technology of optical storage media, but they introduced full-motion video into video games and are now fondly remembered by collectors, and the games themselves are still sold and played on other media.

Mark J. P. Wolf

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Latin America

In terms of game hardware development, Latin America has mainly focused on manufacturing and adapting foreign designs. One of the most important examples is Brazil, which has been a producer of both **consoles** and computers for the region. In 1985, Microdigital Electronica created the TK90X, a clone of the Sinclair ZX Spectrum, which was an extremely popular European **platform** in the 1980s. Tec Toy, another Brazilian company, manufactured all of **SEGA**'s consoles for the South American market, from the **SEGA Master System** to the **SEGA Dreamcast**. In 2011, Microsoft announced that it would start manufacturing its **Microsoft Xbox 360** systems in Brazil.

There are some examples of **modifications** and examples of existing consoles. Probably the first case (circa 1975) is the Argentinean Telematch—not to be confused with U.S. contemporary console Tele-Match—manufactured by Panoramic, a local maker of TV sets. The Telematch was basically a bare-bones clone of the **Magnavox Odyssey** (1972), which had been stripped down from its accessories and from many of its games. However, the Telematch was not just a copy: it was hacked to include two extra knobs for controlling a brand new game not included in the original Odyssey. The game was *Soccer*, a ***PONG***-like game with two paddles in which one paddle represented a player and the other the goalie. Goalkeepers were controlled by the extra knobs. Although this was one of the very first soccer console games, it was not the first; in 1974, Magnavox launched an export version of the Odyssey for the non-U.S. market that included soccer. However, it was different from the game on the Telematch.

In 2009, Tec Toy (later Zeebo Inc.) launched the **Zeebo**, a game console conceived for emerging markets. Even though it was a TV-based console, its basic technology was mobile and the games were distributed wirelessly through 3G. The machine included versions of hit game series such as *Resident Evil* and *FIFA Soccer*. According to the company's website, it was discontinued in 2011.

In terms of game software, there is not yet a comprehensive study of the continent's production. The high levels of **piracy** may be one of the main reasons a local game software **industry** took so long to take off. Few studios in the 1980s and 1990s managed to distribute their games in the **United States** and **Europe**, even though the situation has recently changed because of on-line distribution.

Gonzalo Frasca

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Latinos and video games

There seems to be no limit when it comes to video game content—except when content is placed under the headings of **race** and ethnicity. The presence of African Americans, Native Americans, Asian Americans, and Latinos remain few and far between. When they do appear, it is usually as a non-playable character, an obstacle to overcome, or simply part of the background—not just as bodies but also in the form of those **hip-hop** and rap soundtracks. When given a greater playable presence, they typically appear as fighters, athletes, gangbangers (African Americans and Latinos especially), model-minority nerds (Asian Americans), and preternatural vision questers; for example, the Cherokee Domasi Tawodi in *Prey* (2006) whose shamanic DNA saves the day—even in outer **space**.

Like other so-called racial groups, playable Latinos in video games remain largely fixed to their physicality; they are all body and no mind. They appear most abundantly in **fighting games** (**arcade games** later ported for game **console** play) and without much discrimination between country or region. Latinos either originate from the Iberian peninsula or from **Latin America**. Several such player-characters include Spanish-speaking (with an odd Japanese cadence) *luchador* (wrestler) Ramon as "El Diablo Amarillo" (or "The Yellow Devil") in *The King of Fighters 2000* (2000); the aspiring gourmet chef and luchador, "El Fuerte" in *Street Fighter IV* (2009); the Spanglish talking, hero-of-the-poor luchador, Tizoc in *King of Fighters* (2003); the masked, talon-wielding Ninjutsu *matador* warrior "Vega the Spanish Ninja" in ***Street Fighter II*** (1992) and *Street Fighter Alpha 3* (1998); and Brazilian Capoeira fighters Eddy Gordo and Christie Monteiro (turned Anglo in the 2010 **film adaptation**) in *Tekken 3* (1997) and *Tekken 4* (2002). There's also the matador-styled warrior Miguel Caballero Rojo in *Tekken 6* (2009), Pepe José Rodriguez in *Rage of the Dragon* (2002), and Ricky Ortiz in *Super4* (2010). Last but not least, there is the Charro-hat wearing, plant-shapeshifter fighter cactus "Anmigo" in *Marvel vs. Capcom 2: New Age of Heroes* (2000).

When not duking it out in the ring or dribbling soccer balls, Latinos typically appear as knife-wielding, ominously dangerous types. For instance, in Rockstar's *Warriors* (2005; an adaptation of Walter Hill's film *The Warriors* [1979]) players manipulate a multiracial cast of gangbangers whose biggest obstacle in returning home to Coney Island is to defeat a Spanish Harlem Latino gang called the Hurricanes. The win-or-lose deathmatch takes place against the gigantic gangleader, Diego.

When not a marauding gang in need of a good pummeling, urban-set, single-player and multiplayer video games typically place Latinos in the background streetscape for a verisimilar ghetto look. Rockstar's ***Grand Theft Auto*** *(GTA): San Andreas* (2004) was ahead of the curve here in terms of bringing Latinos and African Americans into the foreground. *GTA: San Andreas* introduced the playable African American character Carl Johnson from Grove Street, Los Santos. However, although Latinos do appear, they are members of his gangbang dream team and include Carl's sister's boyfriend, Cesar, and the Chicana gangbanger, Catalina. In *GTA: Vice City* (2002), designers include important Latino characters like Juan Garcia Cortez who helps mafioso Tommy Vercetti climb back into the cocaine trade business.

Of course, these are still negative representations of Latinos, but we see Rockstar moving Latinos out of the shadows, paving the way for a watershed in 2010. Rockstar designers introduced the playable Dominican American character Luis Lopez, in *GTA: Ballad of Gay Tony* (2010). Not only does Luis take the playable center stage, he does so as a cool-headed, smart character. Rockstar sheds yesteryear's Latino stereotype as sex-crazed thug and psychopath. Within the kill-or-be-killed dystopia of Liberty City, Luis is the only voice of reason—and it is his cool-headed, logical decision making that wins the game.

Much like *GTA: San Andreas,* Volition's *Saints Row* (2006) also brings to fore playable "racial" characters. Here, however, more choice is offered: the player can choose the character's ethnicity and **gender**, as well as facial flesh and bone structure, hair style, voice, clothes, tattoo art, and body piercing. Then the player-character escapes prison with Carlos Mendoza, a fellow inmate, and hits the road with all variety of weapons and chop-shopped vehicles. Like Rockstar's *Warriors,* as a member of the gang 3rd Street Saints, the player-character has to defeat all variety of Latino gangbangers such as the scar-faced drug kingpin Hector "Kimo" Lopez; the macho, hot-tempered younger brother Angelo Lopez; the pesky shoe-obsessed girlfriend, Luz Avalos; the Spanish-only speaking muscle, Victor "Tanque" Rodriguez; and the drug lord, Manuel Orejuela (voiced by Carlos Ferro). Despite nuances in the way one builds up the player-character's gangbanger look, ultimately once again Latinos are presented as obstacles to overcome; they must die to win the game.

Ghetto-set video games are not the only place for Latinos, playable or otherwise; several rural-set games feature Latinos with varying degrees of playability. For instance, Deadline Games's *Total Overdose: A Gunslinger's Tale in Mexico* (2005) requires the player to fulfill three missions, and all in the shoes of Latino characters: first, as Ernesto Cruz (father), the player has to take down the Los Toros' drug kingpin, Papa Muerte; second, as Ernesto's son Tommy, the player has to defeat the Virgillio gang; and third, as Ernesto's other son, Tommy's twin and DEA agent Ramiro "Ram" Cruz, the player has to outsmart and outmaneuver crazy *luchadores* (wrestlers), corrupt military, pimps, dealers, and banditos. The ultimate goal: to bring down the Morales Cartel. (The playable Latino father-and-sons triad appear, too, in the spinoff *Chili con Carne* [2007] for the **PlayStation** Portable.) And there are video games set completely in the rural regions with gameplay dependent on encounters with Latinos, such as HPS Simulation's *The Mexican American War* (2000). Set during various historic 19th-century battles with Mexico like that of San Jacinto, the player plays an Anglo foot soldier who has to strategize moves (like whether to blow up bridges) all with the goal of defeating the Mexican army. Rockstar's multiplayer *Red Dead Redemption* (2010) makes a similar move, albeit less historically; the player steps into the shoes of renegade Anglo cowboys or the Native American Shadow Wolf to save innocent townfolk under siege by a Mexican army. Finally, arguably at the farthest extreme of nonurban video games that portray Latinos one way or another, there's the playable Manny Calavera, a stilt-walking, Day of the Dead grim reaper in Lucas Arts Entertainment's *Grim Fandango* (1998). Manny lives in the Land of the Dead where he works as a travel agent for the Department of Death. The player's object: to overcome obstacles and use strategic thinking to get Manny to the Land of Eternal Rest.

On-line games feature Latinos, but do so at the extreme edge of the design representational spectrum. Created by self-proclaimed "anti-Mexican bigots," *Border Patrol* (2002) aims to open eyes to the everyday **violence** against Latinos, human-rights violations, and racist policy making behind anti-immigration laws. While a clock ticks, the player is put into the uncomfortable position of shooting border crossers, and the game's cartoonlike **graphics** and general design aims to caustically poke fun at racists. Breakthrough's *ICED* or *I Can End Deportation* (2007) is arguably meant to raise awareness by allowing the player to feel what it's like to live as an undocumented Latino. Ultimately, however, *ICED* falls back on racist stereotypes; you play an undocumented teen running from the migra but score points by *not* jumping subway turnstiles and *not* stealing from local *tiendas*. The points keep you from being deported. The expectation: that stealing and taking advantage of the system is in the Latino DNA.

Then there are games that don't pretend anything but to be racist. The use of caricature in Resistance Records's *Ethnic Cleansing* (2002) aims to feed bigotry. The game's stated goal: to kill "subhumans" such as African Americans who make monkey noises, Jews who cry "Oy vey!" and poncho-wearing Latinos who shout "Ay carumba!"

Latinos appear in **sports games**. Not surprisingly, given the strong interest in soccer or *fútbol*, you can now **play** games such as **Electronic Arts**' *FIFA 10* (2009) in Spanish and play a wide range of popular Mexican and Latin American teams; and *Madden NFL 08* (2007) and *Madden NFL 09* (2008) could be played in Spanish. The famed Latino BMX-er, Mike "Rooftop" Escamilla, is a character in **Activision**'s *Mat Hoffman's Pro BMX 1* (2001), *Mat Hoffman's Pro BMX 2* (2002), and *Shaun Palmer's Pro Snowboarder* (2001). Latinos are few and far between, but Latinas are nearly nonexistent. A rare playable Latina character, Lisa, appears in the beach-set sports game *Dead or Alive: Paradise* (2010); her background occupations include being a scientist, a stockbroker, and a *luchadora* called "La Mariposa."

Some sci-fi games contain an extrapolation of real life for Latinos, like the presence of the U.S./Mexico border. Gearbox Software's *Borderlands* (2009) is set on Pandora—a barren wasteland of a planet controlled by global mega-corporations (much like the *maquiladoras* along the Mexican side of the border) where its people scavange colossal trash heaps (like those in Tijuana) to survive. *Gears of War* (2006) features a playable Latino character: Dominic "Dom" Santiago (voiced by Carlos Ferro). Although he is born on the planet Sera and raised in Ephyra city in his homeland of Tyrus, his name and phenotypic look mark him as Latino. Dom, along with Asian characters Minh Kim and Tai Kaliso as well as African Americans like Augustus Cole, seeks revenge against the killers of his children, Sylvia and Benedicto, and his brother, Carlos, as well as to find and kill the torturers of his wife, Maria.

A staunch advocate for increased representation of Latinos in video games, David Leonard goes after the *GTA* series, sharply critiquing its "demonization of Latino immigrants as economic parasites" (Leonard, 2010, p. 93). Leonard identifies *GTA* as typical of video games that identify Latinos as the "evil" seed that has grown all the nation's social ills. Leonard even notes that when the radio station in *GTA: San Andreas* isn't blasting rap and hip-hop, it is announcing all variety of racist invectives: "Notice food lines are getting too long. Wonder why? Nineteen million illegal aliens are in this country. Most are in San Andreas."

In the same critical vein, scholars have considered the sociological and even biological impact of negative racial stereotyping in video games. Several working in the cognitive and neuroscience fields found that video game play can lead to (not necessarily as a strong causal correlation) the growing and solidifying of in-group and out-group appraisal schemas, so that playing video games in which Latinos are only represented as gangbangers or identified only as obstacles to be avoided, overcome, or destroyed can solidify exclusionary practices in the real **world**. For instance, research by John T. Cacioppo et al. using fMRI and ERP imaging technology to measure the emotional processing of different racialized facial expressions finds that anger expressed in racialized groups such as Latinos and African Americans triggers a negative and exclusionary evaluation in Anglos, whereas their responses to anger expressed in other Anglo faces solidifies positive in-group identification. Again, although cause-and-effect relationships are complex and strict correlations unlikely, video game design can and does have an impact on in-group and out-group emotion appraisal and identification.

The jury is still out on causal relations between media representations and real-world acts and identifications, but we can say for certain that video games that represent Latinos exclusively as athletes, fighters, or gangbangers are simply unimaginative. Beyond the fairness of balanced representation, when playing a video game or watching a film or reading a novel, variation is of the essence. **Game design** resorts to characterization, wordplay, types of action, point of view, and myriad other devices to furnish the brain the variety in stimuli it needs to remain awake and alert. Also, Latino game designers are few and far between. For instance, out of a team of 250 designers who worked on the video game adaptation of *Toy Story 3*, only two were Latino: Gabriel Ávila and Alex Olmos, although there are some well known and influential designers, such as John Romero.

Statistically, Latino children play more video games than Anglo children, yet only about 2% of video games include Latino characters. Some in the video game industry have already tuned into this, like the national video game chain GameStop. Its bilingual, "Viva GameStop!" ad campaign is spotted on Univision and Telemundo; and Standalone brought out *SingStar Latino* (2009) where you can have vocal showdowns singing along to Ana Torroja, Azcucar Moreno, Coti, Heroes Del Silencio, Jon Secada, La Oreja De Van Gogh, Patricia Manterola, or Paulina Rubio.

Frederick Luis Aldama

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Legend of Zelda series

The Legend of Zelda is a series of fantasy-themed action-**adventure games** created by designers Shigeru Miyamoto and Takashi Tezuka, and developed and published—with only a few exceptions—by **Nintendo**. As of 2011, the series included 15 major titles, as well as a number of spin-offs, remakes, and ports, spanning all of the company's major **platforms**. Alongside the ***Mario* series** and ***Metroid*** series, it is one of Nintendo's key properties, and, with nearly 60 million copies sold globally, one of the most successful game franchises in history.

Combining free-roaming exploration, questing, combat, puzzle solving, and light role-playing elements, the series has played a pivotal role in establishing and refining the hybrid design of the modern action-adventure genre. Most entries share the core cast of archetypal characters, setting, basic themes (coming-of-age, good versus evil), and ludo-**narrative** structure. The player takes the role of an Elven boy named Link and embarks on a quest to rescue Princess Zelda and restore order to the land of Hyrule by defeating the villainous brigand king, Ganon. The task typically involves the recovery of a number of magical artifacts, scattered throughout the game **world**. Central among them is the ancient relic Triforce, which bestows great power on its bearer. Although set in a single universe, the events of individual games often take place hundreds of years apart or in alternate timelines, with key characters' names and roles being passed down across generations (e.g., every female descendant of the Hyrulian royal family is named Zelda). Consequently, the exact chronology of the events taking place in the series has been the subject of much speculation and debate.

Released in 1986, *The Legend of Zelda* was developed as a launch title and "killer app" for the Famicom Disk System, a floppy disk drive peripheral for the Nintendo Family Computer (see **Nintendo Entertainment System [NES]**), exclusive to **Japan**. Developed alongside *Super Mario Bros.* (1985), the game reflected a radically different design philosophy. Taking full advantage of the increased size (compared with **cartridge** technology of the time) and rewritability of the floppy disk medium, it eschewed unidirectional progression through a series of levels in favor of largely nonlinear traversal of a sprawling open world, continued across multiple play sessions thanks to **save functionality**. Outside of the brief expository narrative provided in the **game manual**, which tasks the player with the recovery of eight pieces of the Triforce of Wisdom to save Princess Zelda and prevent Hyrule from falling under control of the evil Ganon, the game offers little guidance, instead encouraging—and rewarding—exploration and experimentation. Accomplishing the goal requires the player to navigate the sprawling "overworld" and nine labyrinthine underground dungeons (presented from a flip-screen top-down perspective) in search of Triforce shards and other items, interact with a number of **non-player characters (NPCs)**, solve puzzles, and battle a wide variety of monsters. For its 1987 North American and European releases, the game was ported to cartridge format. To retain the save game feature, the cartridge was equipped with battery-backed memory—the first NES title to utilize such a solution. *The Legend of Zelda* established the basic gameplay mechanics for subsequent games and introduced a number of elements that have since become staples of the series (like the overworld/dungeon structure or the "second quest," a more difficult version of the adventure, unlocked upon the completion of the normal mode). Moreover, the game had significant impact on the development of both action-adventure and action **role-playing game (RPG)** genres and is widely considered one of the most influential games in history.

Like its predecessor, *Zelda II: The Adventure of Link* (1987) was first released in Japan for the Famicom Disk System, and the following year, on cartridge, in **North America** and **Europe**. A direct sequel set several years after the events of the first game, it follows Link's quest to wake Princess Zelda from magically induced sleep while preventing Ganon's followers from bringing their master back to life. Created by a different development team (albeit still under Miyamoto's supervision), *Zelda II* features several design modifications. Perhaps the most obvious of these is the change in perspective: the majority of the gameplay (combat, dungeon exploration, character interaction) takes place in side-**scrolling** view, with top-down presentation retained only for travel through the (now much larger) overworld. The other major alteration is the addition of a number of elements characteristic of role-playing games, such as spells, experience points (used to increase vitality, combat prowess, and magical abilities), and increased NPC interaction (with characters now offering side quests). The simplistic hack-and-slash combat style of the original is replaced with a more strategic system. Although not all changes were well received, the game was commercially successful, and many of the new elements (including the Triforce of Courage, Dark Link, side quests, and magic system) went on to become permanent features of the series.

The Legend of Zelda: A Link to the Past began development as an NES game; ultimately, it was released in 1991 for the **Super Nintendo Entertainment System (SNES)**. Taking place centuries before the events of the previous titles, the prequel centers on Link's attempt to prevent the release of Ganon from a parallel dimension, the Dark World, in which he had been imprisoned for hundreds of years. Compared with its predecessors, *A Link to the Past* features a richer story, as well as a more detailed—and more densely populated—world. The game returns to the overhead perspective of the original, while introducing further additions and refinements to the formula: the alternate world, multilevel dungeons, new weapons and equipment (like the now iconic Master Sword and the hookshot), and Link's signature spin attack, to mention just a few. In 2002 (North America) and 2003 (Japan, Europe), the game was rereleased for the Game Boy Advance handheld as part of *The Legend of Zelda: A Link to the Past & Four Swords*.

Originally announced as a launch title for the **Nintendo 64** console, *The Legend of Zelda: Ocarina of Time* (1998) went through a long and rocky development period (at one point, the game was moved to the Nintendo 64DD, the ill-fated magneto-optical disk drive peripheral for the N64) before arriving at its 1998 release. Utilizing a modified *Super Mario 64* **game engine**, the title marked the franchise's transition into three-dimensional **graphics**. Once again dispatching the player on a quest to foil Ganon's plot to obtain the Triforce, *Ocarina* is set before all earlier installments and takes place in two separate time periods, allowing the player to control Link as a child and young adult. Because certain tasks in the game can only be completed in one of these incarnations (e.g., Child Link is able to tame Epona, the horse, but only Adult Link can ride her), progressing through the game often necessitates properly coordinating actions between the two. One of *Ocarina*'s distinguishing characteristics is its extensive use of music as a gameplay element, as the titular woodwind becomes instrumental to puzzle solving, exploration, and travel. It is also notable for its innovative control scheme, designed to make movement and combat in three-dimensional space more manageable through such features as target lock (whereby pressing the Z-button on the controller would "latch" Link on to the opponent, eliminating the need for manual aiming) and context sensitive buttons (allowing the same button to trigger different actions, depending on the situation). *Ocarina of Time* is often hailed as the definitive *Zelda* title and one of the greatest games ever made.

Picking up several months after the end of *Ocarina*, *The Legend of Zelda: Majora's Mask* (2000) sends Link to the parallel world of Termina, where he finds himself with just three days to save the land from imminent destruction by its own falling moon. Building on the time travel mechanic introduced in the previous game, *Majora's Mask* allows the player to return at will to the beginning of the three-day period, extending the window of opportunity to avert the cataclysm as needed. (Although extremely difficult, it is in fact possible to complete the game in just two cycles.) Because many of the character interactions—and the resultant side quests—are only available at specific hours, the temporal loop adds a time-management component to gameplay. Another new feature is the 24 magical masks, which transform Link into other characters or grant him special abilities. Uncharacteristically, the game features neither Ganon nor Princess Zelda.

Developed for the **Nintendo GameCube** and sporting a new, cel-shaded look, *The Legend of Zelda: Wind Waker* (2002 in Japan, 2003 in North America and Europe), returns to the familiar task of obtaining the Triforce and defeating Ganon. Its story begins more than one hundred years after the events of *Ocarina of Time* and takes Link on a journey across a series of islands scattered in a vast ocean. Like *Majora's Mask*, *Wind Waker* retains basic gameplay elements and controls from *Ocarina of Time* but, in keeping with the new setting, replaces horse riding with sailing as the primary means of transportation between locations. Music continues to play an important function as Link gains the ability to control winds by conducting appropriate songs with the eponymous Wind Waker, a magical baton.

The Legend of Zelda: Twilight Princess (2006) was Nintendo's last GameCube game and one of the North American launch titles for the **Nintendo Wii**. The plot—roughly contemporaneous with the events of *Wind Waker*, albeit set in an alternate timeline—revolves around Link's quest to save Hyrule from destruction by the forces of the Twilight Realm, a parallel world of shadows. Although using a modified *Wind Waker* engine, *Twilight Princess* features a more realistic, richly detailed visual style. In the GameCube version of the game, the control scheme introduced in the *Ocarina of Time* remains largely unchanged. The Wii port, on the other hand, takes advantage of the motion sensors and built-in speaker of the Wii Remote (for instance, allowing the player to aim Link's bow by pointing the controller at the target or perform a shield attack by thrusting the nunchuck attachment). Markedly more **violent** than previous games in the series, *Twilight Princess* is the first Zelda game to receive a Teen rating from the **Entertainment Software Rating Board (ESRB)**.

Beginning with the 1993 release of *The Legend of Zelda: Link's Awakening* for the **Nintendo Game Boy**, the franchise expanded onto portable platforms. Initially an unofficial side project, the game was conceived as a port of *A Link to the Past* before evolving into an original title. The player must assist the shipwrecked Link in seeking out the eight magical instruments necessary to orchestrate his escape from the mysterious Koholint Island. The game's surreal, dreamlike atmosphere was inspired (according to director Takashi Tezuka) by David Lynch's *Twin Peaks*. Several new gameplay additions appear, including the song-learning mechanic, the ability to bind inventory items to buttons, and the fishing **minigame**. In 1998, the game was remade in color as *Link's Awakening DX* to promote the launch of the Game Boy Color.

The GBC platform received two more *Zelda* games, *The Legend of Zelda: Oracle of Seasons* and *The Legend of Zelda: Oracle of Ages*, released simultaneously in 2001. Codeveloped by Flagship (a subsidiary of **Capcom**) and Nintendo, the games were planned as part of a trilogy; eventually, the scope of the project was scaled down because of production difficulties. Both share identical controls, graphics, and **sound** (similar to those of *Link's Awakening*), as well as basic premise (to rescue the respective oracle), but differ in focus and central mechanic. While the action-oriented *Oracle of Seasons* allows the player to manipulate the seasons, *Oracle of Ages* prioritizes puzzle solving, using time travel as the defining gameplay element. The two titles can be played independently of one another or linked (via a password system or direct cable connection between two GBC handhelds), in which case one becomes the sequel to the other. The linked mode alters the plot to connect the two stories and features an extended ending.

The next Flagship/Nintendo cooperation, *The Legend of Zelda: Four Swords* (2002 in North America, 2003 in Japan and Europe), marked the beginning of a new subcycle in the franchise: the Four Sword series. Combining the gameplay and presentation of *A Link to the Past* with the art style of *Wind Waker*, the three games focus on a new antagonist, sorcerer Vaati, and the legendary Four Sword, a magical blade capable of splitting its bearer into four individuals. *Four Sword*, the first multiplayer *Zelda* adventure, requires cooperation of two to four players, each controlling a different incarnation of Link. The game syncs the cartridge with a Game Boy Advance port of *A Link to the Past* and interacts with the latter via a common player profile (for instance, by allowing skills acquired in one game to be used in the other). Nintendo's *The Legend of Zelda: Four Swords Adventures* (2004 in Japan and North America, 2005 in Europe), although released for the GameCube, straddles the fence between home and portable systems. The game allows one to four players to use Game Boy Advance handhelds as controllers, supplanting and extending the main screen. Two independent **play** modes are included: cooperative adventure in the vein of *Four Swords* and competitive battle. (Exclusive to the Japanese version is a third mode, a stamp rally race.) Bringing the Four Sword cycle to an end, *The Legend of Zelda: The Minish Cap* (2004 in Japan and Europe, 2005 in North America) serves as a prequel to the previous two entries. It was the last joint project of Nintendo and Flagship, as well as the last *Zelda* game for the Game Boy Advance.

With *The Legend of Zelda: Phantom Hourglass* (2007), the franchise moved on to the **Nintendo DS**. A direct continuation to *Wind Waker*, *Phantom Hourglass* follows Link's efforts to rescue Tetra from the mysterious Ghost Ship and defeat its creator, Bellum. The game retains *Wind*

Waker's basic gameplay (split between sailing and on-foot exploration) and cel-shaded visuals but employs a new control scheme, taking advantage of the system's touchscreen and built-in microphone. The same features return in the 2009 *The Legend of Zelda: Spirit Tracks*, which, replacing *Phantom Hourglass*'s steamboat with a train, sends Link and Zelda on a mission to prevent the resurrection of the Demon King Malladus.

The franchise also spawned a number of spin-offs, including the ephemeral BS (Broadcast Satellite) games *BS Zelda no Densetsu* (1995–1996) and *BS Zelda no Densetsu: Inishie no Sekiban* (1997)—based on, respectively, *The Legend of Zelda* and *The Legend of Zelda: A Link to the Past*. Available only in Japan via the Satellaview, a satellite modem add-on for the Super Famicom, the games were broadcast in weekly episodes and accompanied by streaming voice narration. As such, they were meant to be played in real time. Also of interest is *Link's Crossbow Training*, a 2007 shooting game using assets from *Twilight Princess* and sold in bundle with the Wii Zapper.

Outside of the official canon, three Zelda-themed action-adventure games were released for the Philips CD-i. In 1991, Nintendo and Philips entered an agreement to jointly develop a **CD-ROM** add-on for the SNES. After the arrangement fell through, Philips was granted license to use five Nintendo characters (Link, Zelda, Ganon, Mario, and Luigi) in games for the CD-i platform. *Link: The Faces of Evil*, *Zelda: The Wand of Gamelon* (Animation Magic, 1993), and *Zelda's Adventure* (Viridis, 1994) were contracted out to independent developers and produced with minimal input from Nintendo. The games were supposed to showcase CD-i's multimedia capabilities (such as CD-audio playback and full-motion video) but were crippled by limited funding, rushed development, and technical limitations of a system not designed as a dedicated game machine. Although critical and commercial failures, the CD-i games are notable as the only Zelda titles to appear on a non-Nintendo platform and, in the case of *The Wand of Gamelon* and *Zelda's Adventure*, the only games to make Princess Zelda the protagonist.

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ludology

From the Latin root *ludos* meaning "**play**," the term "ludology" has two meanings. The first refers to the discipline that studies play and games. The term appeared as early as 1982 (Csikszentmihalyi, 1982) but seems to have gained popularity after a 1999 article by Gonzalo Frasca entitled "Ludology meets Narratology: Similitudes and Differences between (Video)Games and Narrative." At that moment, there were multiple approaches to game and play studies from multiple disciplines, but they did not form a unified field. Now that the field is well established, it is more commonly referred to as *game studies* even though the term ludology is frequently used in **languages** such as French and Spanish (*ludologie* and *ludología*).

The second and most frequent use of the term is for describing a school of thought that supposedly attempted to understand games by mainly focusing on their mechanics. This use of the term was common in the early 2000s within the debate known as “ludology versus narratology.” Such discussions have been seen as the growing pains of a new academic discipline trying to find a space of its own within more established traditions (Aarseth, 2001). However, the relationship between games, mechanics, and narrative predates this academic debate and has been part of the **game design** community since the early days of video games (Costikyan, 1994; Crawford, 1984). Although at its core it remains a valid discussion, the debate itself has since then lost steam in the academic world and is now seen as one of the foundational discussions of modern game studies. ***See also*** narrative.

Gonzalo Frasca

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M

machinima

Machinima is a form of digital **art** that uses game-based technology to create linear animations. In its most prominent form, it uses the animation technology of real-**time** render programs, mostly **game engines**, to generate animated video shorts. These shorts have spread across player communities and provide important insights into game culture. Machinima use games as tools to create animation sequences that will be shown to others. These shorts can document in-game situations and gameplay but can also manifest in many other genre forms, such as music videos, comedy, action, thriller, or any other cinematic genre. Some machinima, like Friedrich Kirschner's *The Journey* (2004), merely use games as virtual stages to develop their own **narrative**. The underlying game can become unrecognizable in the service of the machinima.

As a typical example of digital intermedia, machinima relate to a range of relevant fields including **film**, animation, puppetry, video games, **sound** design, and **performance**. Depending on how these influences are weighted in a specific machinima piece, the resulting piece can manifest as live performances, procedural animation, rendered video, or mixed media animation.

Machinima grew out of player-driven modifications, as well as out of commercial game development. As a player-driven form of emergent **play**, its roots reach back into the **hacker** community and the evolution of the demoscene; as part of cinematic development in commercial games, it runs parallel to the improvement of in-game animation and the **history** of **cut-scenes**.

Over time, machinima's evolution can be broken down into different technologically defined steps. Many early **arcade games** showed brief clips of gameplay when running in attract mode, trying to lure customers. Some, like ***Pac-Man*** (1980), contained short animated sequences as intermissions between levels. Because of the limitations of the underlying technology, these were procedural animations, rendered by the game engine in real time. Following improvements in computer **graphics**, these animations became more complex until they became part of the gameplay itself. *Stunt Island* (1992) allowed players to stage virtual stunts, set up a number of virtual cameras to document them, and distribute the resulting stunt performance to other players. Likewise, various first-person **shooting games** allowed players to log their game sessions, leading to recordings of in-game performances, called "demos." *Quake* (1996) appeared so prominently in this practice that the term "Quakemovies" was an early predecessor for the more inclusive "machinima." Depending on the game engine, these files can contain different information regarding the recorded game state, such as player input, position of the virtual characters, or triggered animation. Because they only contain the necessary seed data to procedurally re-create the game situation in the engine, demo files stay very small and easy to distribute. However, the file format also remains engine-specific, and a log file can only be played back in the same engine and game configuration it was recorded in. Demos, then, were recordings made by players for players. On the basis of that technology, the *Quake* Clan "The Rangers" produced *Diary of a Camper* (1996), which is widely seen as the first successful narrative player-produced machinima.

In parallel, the community of early game hackers developed their own version of real-time animations as self-promoting intro sequences added to games they had cracked. These intro sequences became competitive showcases of a hacker's own coding skills and evolved into more and more elaborate animations. Celebrating effective code to generate the most extraordinary visual spectacle, the demoscene branched off into its own community with festivals and competitions. Unlike Quake-movies, which relied on the underlying game engine to provide the necessary animations, rendering, and sound management, the demoscene focuses on individually optimized code.

The rift between these two approaches widened at the end of the 1990s when the demo files of titles such as *Quake III: Arena* (1999) became less **accessible** to the machinima artists. At the same time, screen capture techniques directly from the graphic card became available. Screen capture through software such as FRAPS changed machinima production and distribution significantly. It ended the phase of procedural animation and demo files but made machinima more accessible to a wider audience. Captured videos could be distributed through video sharing sites and did not depend on a preinstalled game engine.

Based on an e-mail exchange between Anthony Bailey and Hugh Hancock, the term "machinima" emerged as a portmanteau term (machine + cinema) describing this phenomenon that had spread to multiple engines and practices by the end of the 1990s. The name was popularized through institutions such as machinima.com, the Association for Machinima Arts and Sciences, and various film festivals, as well as through game-specific on-line portals. RoosterTeeth's *Red vs Blue* machinima series (begun in 2003) is a prime example of the increased popularity of machinima. In parallel, games supported the growing community of machinima artists. Titles such as *The Sims 2* (2004) and *The Movies* (2005) featured a wide range of machinima tools. On-line **worlds** like Second Life (2003) and ***World of Warcraft*** (2004) spawned machinima that, in some cases, like *Leeroy Jenkins* (2005) by Pals 4 Life, became legend among the player community. The success of *Leeroy Jenkins* illustrates machinima's cross-media potential: it not only became part of *World of Warcraft* lore but was cited in other game worlds, music, **comics**, and other media.

Although some machinima have become extremely famous and successful, the often-restrictive end user license agreement (EULA) regulations limit their commercial development. Derivative works based on a game developer's intellectual property often remain the property of the developer, which means that machinima artists can rarely market their work. Still, some machinima were commercially distributed and broadcast as music videos (Paul Marino's *I'm Still Seeing Breen* [2005]) commercials (Ethan Vogt's *Game On* [2004]), and part of TV shows (*South Park*'s "Make Love Not Warcraft" episode [2006]). Specific machinima engines, like iClone and Moviestorm, allow commercial production but lack most game functionality.

The key difference between video games and machinima remains: games encourage play. Machinima derive expressions from play and play environments. Machinima offer windows into video games' expressive qualities—as opposed to their ludic ones. As such, they can provide unique insights into how gamelike media reflect social conditions. This can be a simple documentation of play as in countless game movies but can also include social criticism as seen in Alex Chan's *The French Democracy* (2005) that commented on the French riots of 2005. Other pieces, like Chris Burke's *This Spartan Life* series (begun 2005) or the ILL Clan's live performances, experiment with media conventions as they combine game elements with live TV talk show settings; others, like Martin Falch's *Tales of the Past* trilogy, blend game and cinema in hybrid animations. To achieve their desired artistic impact, machinima often bridge between different media. Most often this includes references to traditional film making, as seen in Robert Stoneman's *War of the Servers* (2007) and Tristan Pope's *Not Just Another Lovestory* (2005), in which both artists apply narrative film techniques to game technology to comment on in-game conditions themselves. As an independent art form, machinima has developed into a distinct art practice that reflects social realities and media development inside as well as outside the underlying game worlds.

Michael Nitsche

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magic circle

To give a definition of **play** in his famous book *Homo Ludens: A Study of the Play-Element in Culture* (1938), Johan **Huizinga** distinguished the fundamental characteristics of what he considers a special and significant form of activity with a social function. Although "all play has its rules" and "is free, is in fact freedom" because no one is forced to play, it is "not 'ordinary' or 'real' life" because it is rather a stepping out of it "into a temporary sphere of activity with a disposition of its own." Play occurs in certain limits of **time** and **space**. For Huizinga, the last limitation is more striking than the former one:

> All play moves and has its being within a play-ground marked off beforehand either materially or ideally, deliberately or as a matter of course. Just as there is no formal difference between play and

> **ritual**, so the 'consecrated spot' cannot be formally distinguished from the play-ground. The arena, the card-table, the magic circle, the temple, the stage, the screen, the tennis court, the court of justice, etc., are all in form and function play-grounds, i.e. forbidden spots, isolated, hedged round, hallowed, within which special rules obtain. All are temporary worlds within the ordinary world, dedicated to the performance of an act apart. (Huizinga, [1938] 1955, p. 10)

Of all the identified playgrounds, and certainly because it itself stood out from the more "ordinary" and "real" examples, the magic circle was to become an important concept in game studies. This is largely because of the place given to Huizinga's term by Katie Salen and Eric Zimmerman in their seminal textbook on game design, *Rules of Play: Game Design Fundamentals* (2004). For Salen and Zimmerman, the magic circle becomes a "short-hand for the idea of a special place in time and space created by a game." A "finite space with infinite possibilities," it is especially seen as a closed circle in which the player enters and as a distinct space of meaning separated from the real world. Coupled with the idea that "there is in fact something genuinely magical that happens when a game begins," such conception has indeed been a great way to understand video games insofar as the majority of single-player off-line games and massively multiplayer **on-line games** takes place in a game **world**, be it considered fictional, virtual, or synthetic.

However, the concept has been criticized as much as it has been used, because the border between the "real" world and the "magic circle" is not clear-cut. For instance, as a form of human activity, work is equally separated in time and place as play. Within our digital and ludic era, the division between "work" and "play" is even more blurred. Some people now earn their living by playing games (as professional players or as players leveling up the status of **avatars** for others and earning in-game currency to be sold for actual money). As Salen and Zimmerman themselves suggest without going into the matter too closely, the magic circle might better be seen as a cognitive frame, since the player will always see and behave in games differently than in an ordinary-life psychological frame.

Bernard Perron

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Magnavox Odyssey

Designed by Ralph **Baer**, who produced a series of "Brown Box" prototypes during the period of 1966–1968, the Magnavox Odyssey (called the "Skill-O-Vision" during its development) was the first home video game **console**, and the first video game product available for consumers. It introduced a new use for existing **television** sets—video games—and the heavy **advertising** campaign used to promote it led to many preorders and success for the system, resulting in the sale of more than

130,000 units in 1972 (Winter, www.pongstory.com) and the beginning of the home video game **industry**.

The Odyssey was a dedicated system, which means that all games were preprogrammed into the system's hardware itself. The Odyssey's **graphics** were limited to two white squares representing the players, the "ball," and a vertical line extending across the screen. The system had no sound or on-screen scoring (players had to keep score). The Odyssey contained 12 games that were activated through the use of plug-in "carts" (short for "**cartridges**"), which completed different circuits when plugged in, resulting in different game variations; however, it was unlike later cartridge-based systems because all the games were hardwired in the console itself, with the plugged-in "carts" merely activating them. The system came with six carts used for 12 games: *States*, *Roulette*, *Haunted House*, *Analogic*, *Simon Says*, *Tennis*, *Table Tennis*, *Football*, *Hockey*, *Ski*, *Cat and Mouse*, and *Submarine*. Other "optional" game carts were also available for separate purchase, including *Volleyball*, *Fun Zoo*, *Handball*, *Invasion*, *Baseball*, and *Wipeout*. Another game, *Percepts*, was given free to customers who registered their Odyssey.

Because the graphics were very simple and **abstract**, color overlays were provided with the system, to be placed on the TV screen where they would provide a context for the action occurring on-screen. Other accessories that came with the system included playing cards, dice, and poker chips, which were used for the games. The first video game **peripheral** was also produced for the Odyssey, a light gun that had a photocell in its barrel that could detect the white squares on-screen (or any other light source). Four games used the light gun: *Shootout*, *Shooting Gallery*, *Prehistoric Safari*, and *Dogfight*.

The Odyssey was introduced to the public in May 1972 and initially sold for $99.95, with the light gun peripheral selling for $25; in early 1973, the price of the system was lowered to $79 (Baer, 2005, pp. 75–79). The original Odyssey continued selling until 1975, and some 350,000 Odysseys were produced and sold during that period. A number of other Odyssey models were also produced; the Odyssey 100 and the Odyssey 200 in 1975; the Odyssey 300 and the Odyssey 400 in 1976; the Odyssey 2000, Odyssey 3000, and Odyssey 4000 in 1977; and finally the Odyssey^2 in 1978. The Odyssey^2 was designed around an Intel microprocessor chip-set and played advanced games, using a full Qwerty keyboard and **joystick controllers**. It was especially popular in **Latin America** and in **Europe**. By 1978, second-**generation** consoles using ROM cartridges had become the industry standard, and Magnavox, primarily a television set manufacturer, was unwilling to compete with the newer generation of systems and left the industry.

The Odyssey line demonstrated the potential and the demand for home video games, paving the way for all the home console systems that would follow. The **idea for home video games** had taken hold, and through basic game licensing and patent infringement lawsuits alone, Magnavox and Sanders were able to collect close to $100 million (Baer, 2005, p. 88). The Odyssey also introduced video games to an international audience, as the system was exported to Mexico, Argentina, **Australia**, Belgium, **Canada**, Egypt, **Germany**, Great Britain, Greece, **Hong Kong**, Israel, Italy, **Japan**, Switzerland, and Venezuela. The Odyssey's international success inspired imitators and also encouraged other companies to join in the new market; for example, **Nintendo** entered the video game industry by distributing the Odyssey in Japan in 1974.

The Magnavox Odyssey was the start of the home video game industry and helped introduce video games all around the globe. Its games established video game conventions in genres including **ball-and-paddle games**, **sports games**, and **shooting games** and made video games a part of the home environment, which proved to be their most fertile venue.

Mark J. P. Wolf

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mainframe games

Video games have been a major cultural and economic phenomenon since the 1970s, but their origin as a uniquely expressive cultural medium lies outside of and prior to their nascence as consumer products. However one defines a video game, it is likely that the **first** artifact to fit that definition appeared on a mainframe computer housed at a research lab or university. Mainframe computing, generally speaking, involves large, powerful machines that are accessed via terminals, some of which may be remote. Mainframe gaming, here defined broadly to include games for both unique computational devices like EDSAC (1949) as well as for so-called minicomputers like DEC's PDP series (begun in 1960), made it possible for early pioneers to establish video game conventions that are still visible in today's games. Before the invention of home game **consoles**, **arcade** video games, and personal computers, **computer games** *were* mainframe games, and gaming culture included only those who had access to these systems. Likewise, mainframe games served as an essential **interface** between mainstream culture and computers, fueling public imagination and inspiring cultures of **hackers** toward the experimentation that would lead to foundational game innovations.

Before their arrival in arcades and living rooms, video games, like all early computing applications, generally followed one of two paradigms: special purpose machines (often unique devices built simply to play the game) and computer programs that could be executed on appropriately designated "general purpose" machines. Special purpose machines included complex devices like NIMROD (1952), which played a game of Nim, and simple electronics like Thomas Goldsmith and Estle Ray Mann's "Cathode Ray Tube Amusement Device" (patented in 1948 but never mass produced; see **patent #2,455,992**). General purpose machines like EDSAC (Electronic Delay Storage Automatic Calculator), first activated in 1949, allowed programmers to feed instructions to the processor. This distinction is important because programs written for mass-produced general purpose machines like the PDP series had the advantage of reproducibility. In this way, programmers could easily disseminate and share their work, and today, researchers and preservationists can **emulate** the function of these early games with a reasonable degree of accuracy. Obviously, clunky, fragile, single-purpose machines are more difficult to access and preserve.

Military and Business Applications

The first tasks assigned to electronic computers were **military** in nature. Specifically, Britain's Colossus machines, the German Zuse Z3, and the Mark 1 at Harvard were employed by their respective national intelligence agencies toward the complex calculations required in tasks such as cryptanalysis, ballistics, and logistics. Computer scientists and engineers were also working on general mathematical problems that would prove to be foundational in game programming design. Raymond Redheffer, a mathematician working at MIT conceived the designs for a computer that could play a game of *Nim* as early as the mid-1940s (Redheffer, 1948, p. 349) and a special-purpose Nimrod machine by Ferranti was first exhibited in 1951 (Donovan, 2010, p. 6). In this way, military intelligence demands and pure mathematical research led the way for the earliest uses of computers for playing games.

As early as the mid-1950s, however, computer gaming became serious business as other applications included large-scale **war** games or **simulations** such as *CARMONETTE* (1953) and *HUTSPIEL* (1955) developed by the Research Analysis Corporation under the domain of Operations Research (Harrison and Barrett, 1964, p. 6). These games simulated conflicts at different scales and on different geography, and the main task for the computer (a Goodyear Electronic Differential Analyzer or GEDA) was to store values for all units in **play** as well as their spatial relationships, targeting vectors, and firing doctrines (Harrison and Barrett, 1964, p. 9). Also in the mid-1950s, the American Management Association developed the first business simulation game, *Executive Decision Making Program* (Greenlaw, 1962, p. 15). Military and business applications for computer-based gaming grew rapidly in the late 1950s, with dozens of games in place by the early 1960s (Greenlaw, 1962). Other significant developments in this arena included the *Naval Electronic Warfare Simulator* (NEWS) as well as several projects by the RAND Corporation (Harrison and Barrett, 1964, p. 20).

Today, the most well-known computer game of the 1950s is perhaps *OXO* (1952), a tic-tac-toe game Alexander Douglas programmed for the EDSAC (Donovan, 2010, p. 6). This game is historically significant for being **experimental** but also entertaining. Moreover, the 3 × 3 game grid is displayed electronically on the machine's CRT monitor, a component that would normally be used to observe the progress of a program as it executed (Campbell-Kelly, 1980, p. 7). Players input their moves through a rotary phone dial and received instructions and other output through a teleprinter, but the theoretical magic circle of the game space coincides with the EDSAC graphical display. Other games quickly followed, including Claude Shannon's design of a computer for playing *Hex* (Ahl, 2007, p. 31), and information theorist Arthur Samuel's program for Checkers that would actually learn better strategy as it played (Montfort, 2005, p. 78; Ahl, 2007, p. 31). In 1956, engineers at the University of Michigan produced a pool simulation on their MIDSAC. This game generated imagery for the pool table, balls, and a cue stick on a CRT monitor, and when players took shots, the computer calculated the movement of the balls in real time (Goode, Pollmar, and Wright, 1956, p. 15).

Thus far, the few existing computer games and their predecessors were limited in scope and accessibility and thus had little influence beyond their specific fields or institutions. Game programs of Chess, Checkers, *Hex*, and *Nim* were valuable for their proof of mathematical or logical processes, and were accordingly of mainly academic interest. War games and business games, likewise, were of value for modeling very specific processes, and were, to some extent, developed in secret (Ahl, 2007, p. 32). However, at least one device in the late 1950s gave the general public a glimpse of the future of video games.

Tennis for Two (1958) was an installation created by William Higinbotham and Dave Potter at the Brookhaven National Laboratory that required two players who interacted by rotating a knob attached to a potentiometer that adjusted the position of an imaginary tennis racket. Pressing an adjacent button signified a hit and, hopefully, returned the ball over the net. The logic circuitry used was relatively simple, consisting of electronic relays, resistors, and capacitors, and a 5-inch oscilloscope used as a display. Although it was disassembled shortly after its demonstration and was not as directly influential on later games, the fact that Higinbotham created *Tennis for Two* to provide an easily accessible and entertaining demonstration of computers for a purpose that was not scientific, military, or economical is symbolic of how many early games would soon develop—as side projects or hacks devised during downtime when the real computer work was not being done.

The Arrival of Spacewar!

Spacewar!, completed in 1962 by a team of MIT students, was a game made as a hack. Not only was *Spacewar!* significant for creating a compelling interactive experience powered by a computer, it was also the first game to convey a completely fictional **space**. The game itself pitted players against one another in an outer space milieu loosely inspired by the *Lensman* series of novels (Graetz, 2001, p. 42), and it was significant not only for its innovation but also because of its portability. The programming for *Spacewar!* was written in PDP-1 assembly, so it was easy to reproduce on the PDP machines and was played at many research institutions, which is how it came to inspire ***Galaxy Game*** (1971), the first coin-operated video game, and Nolan **Bushnell**'s ***Computer Space*** (1971; Herman, 1994, p. 11).

Although *Spacewar!* and games it inspired were developed by hobbyists, cutting-edge academic research, conducted on mainframe systems, also led to significant advancements in computer gaming in the 1960s. *ELIZA* (1964) was a LISP program engineered on MIT's MAC system by Joseph Weizenbaum with one component, *DOCTOR*, intended to imitate the interaction between a psychiatric patient and a therapist (Weizenbaum, 1966, p. 36). Using simple language parsing, *DOCTOR* appears to respond appropriately to player input as the player tells the doctor about her problems. The trick, as one quickly finds, is that *ELIZA* simply takes key phrases from the input and poses them as follow-up questions. In this way, *ELIZA/DOCTOR* has been described as a parody of Rogerian therapy (Humphrys, 2009, p. 238), but the effect is compelling enough that its programming and behavior is a direct ancestor of modern chatterbot systems. *SHRDLU* (written 1968–1970), a natural language processing system completed a few years later by Terry Winograd, advanced language parsing even further.

Computer Space may have been inspired by *Spacewar!*, but its **design** and construction created a somewhat different game. *Galaxy Game*'s relationship to *Spacewar!* is quite clear, however, as it was a straightforward adaptation of *Spacewar!*, designed to run with up to eight players accessing consoles powered by a PDP-11/20 minicomputer. Unlike *Computer Space*, the first mass-produced coin-op game, *Galaxy Game,* was a unique device, installed in 1971 at Stanford's Tresidder Union, where it remained in operation until 1979. Programmer Bill Pitts and engineer Hugh Tuck never mass-produced their game, mainly because the cost of the equipment ran to $20,000 (Pitts, 1997).

PLATO and Other Systems

In the 1970s, while the arcade **industry** exploded and the home console industry went through its first two **generations**, a different culture of video gaming thrived on the mainframe systems now proliferating in universities and corporate research centers. The first version of PLATO (Programmed Logic for Automated Teaching Operations) came on-line in the early 1960s as a means for using computer technology to assist in **education**. PLATO's engineers, led by Don Bitzer at the University of Illinois, did conceive of games as one part of its pedagogical mission (Bitzer, 1973, p. 177), but it wasn't until the improved plasma displays, **graphics**, and connection speed of PLATO IV that interactive gaming became viable (Umpleby, 1971, p. 7). Users interacted with PLATO and, ultimately, one another, by typing at a terminal that sent and received input and output between the user and a mainframe computer (originally ILLIAC, and later, systems in the CDC Cyber series) some distance away. For PLATO IV, those advancements hosted arguably the first online community, which in turn saw the first instances of later computing practices such as instant messaging and message boards. Although games were occasionally part of the "courseware" developed for PLATO, real innovation in gaming came from students and hobbyists, who produced the first multiplayer video games and computer **role-playing games (RPGs)**. By the late 1970s, the game index for the CDC version of PLATO included more than 100 entries (Denenberg, 1978, p. 2), but chief among these games were the early iterations of game genres that would come to dominate video gaming. Games like *PEDIT5* (1975), *DND* (1975), *Oubliette* (1977), *Moria* (1975; which employed a first-person maze inspired by the earlier Imlac PDS-1 game, *Maze War* [1974]) and *Avatar* (1979) were all popular RPGs (Barton, 2008, p. 32). *Empire* (1973) and *Spasim* (1974) offered combat in space, and *Panther* (1975) featured a first-person view of a tank battle with vector graphics. All told, gaming accounted for about 20% of PLATO use from 1978 to 1985 (Woolley, 1994).

PLATO was not the only computer system or community in the 1970s. A similar pedagogical aim for computing motivated Don Rawitsch in 1971 to develop *Oregon Trail* (at first, entirely text-based) on an HP Timesharing Basic machine, late distributing it via MECC (Minnesota Educational Computing Consortium; Coventry, 2007). The growing user base of DEC PDP machines, along with the development of higher-level programming languages such as FORTRAN and BASIC, led to many new games and game genres. The *Star Trek* **television** series proved a popular source for many game adaptations, most notably including Dan Daglow's *Star Trek* (1972) for the PDP-10, Mike Mayfield's *Star Trek* (1972) for the HP2000C (later rewritten by David Ahl in BASIC as *Super Star Trek* [1978]), *Empire* (1973) for PLATO, William Char's *TREK73* (1973), and Daglow's 18-player *DECWAR* (1978) for the PDP-10. Daglow was also responsible for *Baseball* (1971), the first baseball computer game, also programmed for a PDP-10 (Maragos, 2004).

The BASIC (Beginner's All-purpose Symbolic Instruction Code) programming **language** and its community of authors were an important early gaming culture, centered around organizations such as People's Computer Company and publications such as *Creative Computing*, which fostered an ethic of sharing code. Thus, when Gregory Yob sought to improve the gameplay early text-based grid games like *Hurkle*, *Snark*, and *Mugwump*, he could produce the more complex dodecahedron-based *Hunt the Wumpus* in 1972 (Yob, 1976, p. 247). *Hunt the Wumpus* and similar games used a basic text parser in which users entered basic commands to move their character through a series of rooms toward an objective. This interface would see a much more elaborate implementation in Will Crowther's *ADVENT* (or *Colossal Cave Adventure*), which Crowther developed in 1976 using FORTRAN on a PDP-10. After Crowther made the game available via the Internet, Don Woods improved the code and added some features that would characterize the eponymous **adventure game** genre, of which the most well-known title is likely *Zork* (1977), which also began as a mainframe game. David Lebling, who had worked on *Maze War*, along with Tim Anderson, Marc Blank, and Bruce Daniels, created *Zork* on a PDP-10 after being inspired by the gameplay of *ADVENT* and the sense of spatial **immersion** of *Maze War* (Montfort, 2005, p. 97). *Zork* would eventually prove to be immensely popular in the burgeoning personal computer market but also directly inspired Roy Trubshaw's ***MUD*** (multiuser dungeon; 1978)—the ancestor of modern **massively multiplayer on-line role-playing games (MMORPGs)** and arguably the first virtual **world platform** to become widely popular—which he first began working on with a PDP-10 mainframe (Bartle, 2003, pp. 3–4).

Through the 1980s, mainframe computing remained an important aspect of video game production, even as arcade games, console games, and personal computers rapidly expanded the user base for video games. Still, some games that would become popular on other platforms first saw life on mainframes. Alexey Pajitnov, for example, first created ***Tetris*** (1985) on an Electronika 60, a clone of the PDP-11 (Donovan, 2010, p. 200). Mainframe gaming may no longer have a place in mainstream gaming culture, but the significance of mainframe computing is hard to overstate. Not only were mainframe computers the first platforms available for gaming, their characteristics and affordances gave shape to generic game aesthetics that remain relevant in modern game genres. Some authors have noted that the military and industrial primary applications for computing enabled gaming to develop in the wake of the "military-academic-industrial complex," but it is surely significant that communities of gamers and game developers frequently adopted postures of openness and sharing that stand in contrast to the secrecy and brinkmanship of military and industrial computing during the Cold War (Dyer-Witheford and De Peuter, 2009, p. 7). At the same time, as Stuart Umpleby wrote in 1971, "role-playing games . . . could become an important tool in the democratic operation of a technologically complex society" (p. 20). In other words, if mainframe games are a side effect of the Cold War, video games, especially those produced in the margins of mainstream gaming, could also help us look forward to a better future.

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manuals

See game manuals

maps

Even though maps in **computer games** are important and sometimes crucial for playing they are hardly recognized by game theory. Just as in everyday life, maps offer a different perspective on a **world**, albeit a virtual one. However, developments in **navigation** systems and application tools that use graphical and navigational conventions established by video game maps demonstrate that such maps were forerunners of the systems mapping real-world spaces.

Maps are related to video games in at least four ways: First, maps can appear within a game, either diegetically as part of the world of the game or nondiegetically as a **help** screen or display, or as a physical object included with the game; either way, they help the player visualize the game’s space. Therefore their size can vary; they could appear as an insert within the screen, an overlay, or a full screen. Second, a map is an equivalent to a level of a game, mostly used by players to address a certain ground on which they fight each other in the multiplayer mode (as in games like *Counter-Strike* [1999]). Thus, to consider this playground literally as a “map” is closely related to the design of games in which the spatial structure is based on a two-dimensional construction. From this perspective, the overhead view of the map and the player’s first-person perspective view are simply different renderings of the same data. Third, a map of a game also exists as a cognitive “mental map” of the game **space** that can be literally reproduced by players in physical form, either on paper, as used to be the case in text-based **adventure games** (some later adventure games included maps in their **packaging**, such as *Ultima IV: The Quest for the Avatar* [1983] or *The Elder Scrolls III: Morrowind* [2002]); or in digital form, as is the case with many **massively multiplayer on-line role-playing**

games (MMORPGs) today, where special-purpose maps are used by the players to communicate their spatial knowledge. Fourth, a map can appear as an introduction to the game: maps can provide a **narrative** context, as is the case in alternate history games, in which a scenario in the near future or in an alternative past or present is envisaged against the background of an existing geopolitical situation (Günzel, 2008). Different versions of maps can also coexist in games, as in *Tom Clancy's Ghost Recon* (2001), in which, in addition to a general introductory map to the historical context and a specific introductory map to the actual game space, there is an optional on-screen map, that could even be considered a diegetic map if the player does not identify himself or herself with one of the soldiers but with the squad leader.

A starting point for analyzing maps in video games is their structure, appearance, and usability. The function of a map depends on the **resolution** of the map: maps of lower resolution give players a rough estimate of where they are in the overall space of the game; that is, how an **avatar** or character is situated within the game world and where in relation to that location relevant objects or events can be found. Such maps are often constantly present like a heads-up display near the edge of the screen, and many are made to resemble a radar-screen, the earliest examples appearing in ***BattleZone*** (1980) and ***Defender*** (1980). Maps not only orient a player and highlight the location of in-game objects and enemies but sometimes also allow active navigation within the map. (This is again the case in *Ghost Recon* in which the user can switch to the map-mode and practically control the game completely on the map.) *Stellar Track* (1981) for the Atari 2600 was played entirely with maps and information screens, both of which represented all of the action of the game. Short-range scanners gave a map of the immediate sector, including ship positions, whereas long-range scanners gave a map of the entire quadrant; both could be destroyed by enemy fire, requiring the player to move and fire from memory.

A mixture of these two scales of maps are the so-called automaps that can be found in early three-dimensional **shooting games** such as ***Doom*** (1993) or *Descent* (1995; in which the map itself is three-dimensional). Such a map "automatically" adds to the map those parts of the game space that have been encountered, thereby revealing the space of a game bit by bit or room by room. (Although with the right **cheat**, the full territory can be displayed.) Although in *Doom* navigation by the map alone is possible, it is hindered by two obstacles: first, control is not adapted to the top-down view, so that pressing the button for "up" does not result in a movement "north" but rather in the direction the character is facing. Second, unlike most radar mini-maps, enemies are not displayed. The design tendency in respect to maps of the second kind is to show them as overlays, allowing players to see both renderings of the game space in the same size but with a different scale (as in *Diablo* [1997]). In more recent games, the map is presented as an augmentation in diegetic space (as is the case in *Dead Space* [2008] where, similar to *Descent*, the map is three-dimensional). The map thereby ontologically is on the same level as in-game orientation signs, like markings for pathways or direction indicators. These have appeared in video games since the late 1990s, as in *Counter-Strike* (1999) and *Call of Duty* (2003), in which the indicators for hits on player-character show not only an injury but also the direction from which it came, in the form of a compass that is not oriented to an absolute direction (like north) but to a relative one (the enemy in relation to the player-character's standpoint).

Video game maps as well as other forms of game spaces are a relevant topic to the study of media in both semiotic and pictorial respects because the criteria for a depiction to be considered a map or a representation of space cannot be derived from the *style* of the image only: an indicator of a hit can thus be (part of) a map, just like a pure plane depiction of game space (as in virtually all two-dimensional games) is not necessarily a map. Semiotically, maps in video games question the understanding of "representation," insofar as any depiction of a game space can be called a representation of space (Wolf, 1997) or its allegory (Aarseth, 2001). Thus, the specificity of a map derives from its *function*, which mainly is that of orientation and navigation, and not that of actual action. In consequence, the main screen in simulation games like ***SimCity*** (1989) is not a map, even though the space is seen in a simplified overhead view. In fact, *SimCity* has an additional onscreen representation of the overhead view of space in the upper part of the image, which serves the purpose of orientation, making this part of the picture a map and a representation of the game space itself. Hence, in general, maps can be addressed as "second spaces" in accordance to Edward Soja's (1996) reading of Henri Lefebvre's (1991) trialectic of space: they are representations of a perceivable space that reciprocally constitute the totality of experienced space, in Lefebvre's terms, "lived" space. This "third space" is a "representational space" (and not only a representation of space) as it is experienced by many users who share the same space already without being present there at the same time. This experience is not only limited to persistent worlds but is present in single-player games as different users experience the same map.

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Mario series

As **Nintendo**'s mascot, the Italian plumber Mario is a video game icon. According to IGN.com's "History of Super Mario Bros." Mario has appeared in more than 200 games and is said to have starred in six of the top 10 best-selling games of all time, with his core *Super Mario Bros*. games having sold more than 210 million games. Mario has starred in his own cartoons, a live action film, and has appeared on countless products ranging from breakfast cereal, toys, and even a "Super Mario Bros. Power Up!" energy drink.

Created by Shigeru Miyamoto, Mario first appeared in 1981's **arcade game** *Donkey Kong*. At the time, Nintendo was struggling in the **United States**, and when their arcade game *Radar Scope* (1980) flopped Minoru **Arakawa**, president of Nintendo of America, begged Nintendo of **Japan** to develop a new game from the *Radar Scope* machines.

This task fell to first time game designer Shigeru Miyamoto who, according to an interview with Miyamoto on the Wii website, began to create a Popeye-themed game. At the time, Nintendo had a license to produce playing cards featuring Popeye, Brutus, and Olive Oyl, but shortly after Miyamoto began to create the game, it was determined that Nintendo was unable to use those characters. Rather than start over, Miyamoto created the characters that would go on to be known as Mario, Donkey Kong, and Pauline.

In the early days, however, the main character was not named Mario but was first known as Mr. Video and then Jumpman. The Jumpman name was rejected by Arakawa, who did not think the name would appeal to Americans. The Mario name was chosen in honor of the landlord of the Nintendo of America offices, Mario Segali, who is alleged to have burst into the offices one day demanding rent money.

Just as Mario's name and existence is due to accidents and coincidences, so too is his iconic appearance as a mustachioed man wearing a hat, overalls, and gloves. In an interview on Nintendo's website, Miyamoto says that much of Mario's appearance was due to the limitations of the **arcade** machine hardware. For example, in *Donkey Kong*, the Mario character could only be 16 pixels wide and 16 pixels tall. Similarly, he was given a hat so they didn't need to animate hair. Finally, he was given gloves to make his hands visible and overalls to make his arms a different color than his body.

After appearing as the hero in *Donkey Kong* and the villain in *Donkey Kong Jr.* (1982), Mario then appeared in the arcade game *Mario Bros.* (1983) that introduced both his brother Luigi as well as the green pipes that would become synonymous with Mario's iconography. His next game, *Super Mario Bros*. (1985) for the **Nintendo Entertainment System (NES)**, would go on to introduce many of the plot elements that have become the basis for nearly all the Mario games since and make Mario world famous, such as running from left to right, jumping on enemies, smashing bricks, leaping over bottomless chasms, finding secrets and gold coins, eating mushrooms that made him larger, and finding flowers that allowed him to throw fireballs. Accompanying all of these were sounds such as jumping, smashing, and discovering coins that would also be in many future games.

Equally important was the soundtrack by Koji Kondo that has not only reappeared in Mario games but also has been used as cell phone ring tones and even performed by several symphony orchestras.

Released on September 13, 1985, in Japan and in March of 1986 in North America, *Super Mario Bros.* was bundled with the Nintendo Entertainment System (NES) and would go on to sell more than 40 million copies and helped to revive the video game **industry**, which was struggling to recover from the **crash of 1983**.

With the success of *Super Mario Bros*. a sequel was inevitable, but Miyamoto was busy working on the first **Zelda** game, so *Super Mario Bros. 2* (1988) was created with minimal input from him. The result was a game that was so difficult it was not released outside of Japan until 1993 when it was included in the **Super Nintendo Entertainment System (SNES)** game *Super Mario All-Stars* (1993). Faced with a game they thought too difficult for the United States, rather than release nothing and risk allowing the mania for Mario to die down, Nintendo instead took *Yume Kōjō: Doki Doki Panic* (1997), a game that Miyamoto had worked on, and replaced its characters with Mario-themed characters. This game was originally created to help promote a Fuji **Television** event; it had many similarities to *Super Mario Bros.*—including a theme composed by Koji Kondo, stars, coins, and level warping—and a similar style of play, but it also had many differences, including no secrets, no stomping enemies, and none of the turtle-like enemies of the first game.

Super Mario Bros. 3 would feature the return of Miyamoto's guidance and sold more than 7 million copies in the United States upon its 1990 release. This would mark the last appearance of a Super Mario game on the NES. Just as the NES included *Super Mario Bros.* when it launched in the United States, the SNES would include its own Mario game, *Super Mario World* (1990), when that system was launched in the United States in fall of 1991. This trend of launching a new Nintendo **console** with a new Mario game continued in the fall of 1996 with the release of the **Nintendo 64**, which came bundled with *Super Mario 64* (1996), a game with three-dimensional **graphics** instead of two-dimensional side-**scrolling**. Nintendo did not release a Mario game at the launch of either the **Nintendo GameCube** or the **Nintendo Wii**, but Mario did eventually appear on the systems in the form of *Super Mario Sunshine* (2002) and *Super Mario Galaxy* (2007), respectively.

In addition to his own titles, Mario has appeared as the main character in games such as **role-playing games (RPGs)** like *Super Paper Mario* (2007); **sports games** like *Super Mario Kart* (1992), *Mario Golf* (1999), and *Mario Tennis* (2000); and even **educational** games such as *Mario Teaches Typing* (1991). He has also made cameo appearances in games such as *GoldenEye* 007 (1997), *Animal Crossing* (2001), *Punch-Out!!* (1984), and *Wii Fit* (2007). With appearances in hundreds of games and on thousands of items of merchandise, there's no telling where Mario will appear next.

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massively multiplayer on-line role-playing games (MMORPGs)

A massively multiplayer on-line role playing game (MMORPG) is a type of video game that is played with many other players simultaneously in an on-line persistent game **world** where a player assumes the role of a fictional character. Most MMORPGs are played on a home computer, and with the evolution of video game **consoles** and Internet connectivity, several titles have been released for consoles with varying degrees of success. Early game titles often followed fantasy themes; however, since their inception in both text and graphical forms, there have been other successful subgenres based on science fiction and superhero themes, among others. As on-line virtual game worlds have expanded beyond the role-playing genre, MMORPGs are now often broadly referred to as massively multiplayer on-line games (MMOGs).

MMORPGs find their roots in table-top fantasy games such as TSR's *Dungeons & Dragons* (1974), as well in early text-based computer environments known as **multi-user domains** (or dungeons; MUDs) from the late 1970s. The first graphical MMORPG was *Meridian 59* (1995), although the first widespread and well-known one was *Ultima Online* (1997) by Origin Systems and **Electronic Arts**. The term "massively multiplayer on-line role-playing game" is said to have been coined by Richard **Garriott** in 1997 (Safko and Brake, 2009, p. 325) shifting the name of the genre from "graphical MUDs" to "MMORPGs." **Sony**/Verant's *EverQuest* (1999) pushed the boundaries of cooperative social gameplay, and as of 2010, the best-selling MMORPG is Blizzard's ***World of Warcraft*** (2004), which has thrust MMORPGs into the mainstream, with more than 12 million subscribers.

Most games require an initial software purchase (although there are now fully downloadable MMORPGs that do not require a CD-ROM for installation) and offer minor software updates that repair gameplay issues on a regular (often weekly) basis commonly referred to as "patching." For larger content additions, often referred to as "expansions," players must pay an additional one-time fee and install (or download) the expansion content to be added to their current game.

Many mainstream MMORPGs are based on a "pay-to-**play**" subscription business model with varying monthly rates and require high-speed Internet access as well as requiring up-to-date technical specifications such as a range of minimal and optimal processor speeds, video and **sound** cards, and so on. There are also many free-to-play MMORPGs that are often subsidized through third-party **advertising**, as well as other business models that include basic free access while enabling players to purchase in-game items and pay for additional game content.

All in-game player activity occurs in real **time** and requires the player to be logged in to the game world. To play, the player must connect to the game world through a host client, usually run by the publisher of the game, which also stores the **player-character** data. Once connected, players must select (or be assigned) a server, also sometimes referred to as a shard or real. These are parallel game worlds that are set to accommodate a particular amount of players (sometimes more than 2,000 simultaneously connected players). From a technical perspective, this is done so that players' gameplay is not affected by technical issues that arise from having too many people connected to the same network, such as a slowing down in performance (often referred to as lag) and disconnection. The number of servers is dependent on the amount of active players for any given game title. Traditionally, players could not communicate or play with players on other servers. However, there have been moves toward some games offering cross-server chat and even enabling players to search for group members for certain combat adventures.

Some MMORPGs focus on player-versus-player (PvP) combat that pits player-characters against each other in competition for resources and progression, whereas other games focus solely on player-versus-environment (PvE) gameplay in which players cannot combat each other and instead focus primarily on cooperation for success. There can still be competition for resources and progression in PvE style games, but the designed game goal is not to enter into combat with other players. There are also games that offer both PvP and PvE gameplay either on different servers or within designated areas of the game world such as battlegrounds and arenas.

Regardless of a game's specific genre, MMORPGs generally share several common characteristics or play mechanisms. It should be noted that this description is meant to be a general overview of gameplay mechanics in MMORPGs and not an exhaustive description of all play mechanics in all MMORPG titles. **Avatar** creation and customization is a dominant feature of all MMORPGs. Players are often able to select what **gender**, **race**, and occupation they want to play from a predetermined, and game-specific, selection as well as many other physical attributes such as eye color, hair color and style, and so on. As computer **graphics** improve, players have been able to select an increasing amount of personalized detail such as nuanced skin tones, height, girth, and more. In the nature of role-playing, players also choose their player-character's name. Customization continues throughout gameplay as players accumulate and upgrade their armor and weapons as player-characters increase in level.

MMORPG gameplay is predominantly centered on character progression, whether defined by character levels or the development of abilities. Character level progression is capped in all MMORPGs, but the level cap varies by title and can change even within a particular title through patches and expansions. Although level caps exist, new content and additional features are constantly implemented, often leading to the perception that MMORPGs have no real end.

Character progression is often accomplished by killing enemy **non-player characters (NPCs)** known as mobs; however, in some games, progression occurs through skills training as opposed to killing and questing. By doing so, a player accumulates experience points that are added to the player-character's current level. When a player accumulates enough experience points, the player-character can progress to the next level. By doing so, the player-character increases in strength and ability, enabling it to combat more difficult NPCs or work on higher-level skills training. Depending on the game, progression may also occur by completing various in-game tasks such as quests or missions. Successful completion of these tasks also gives experience points depending on the tasks difficulty level in accordance to the player-character's current level.

Through both combat and quests, players may also acquire various artifacts such as armor, weapons, and other trinkets that may be used or carried by the player-character, or sold to in-game vendors. In-game currency, which varies in name and value depending on the specific game, can also be accumulated through quests and combat, but often has no impact on a player-character's level progression (other than being able to buy better weapons, armor, and spells). The game world's economy is a very vibrant part of many MMORPGs in which players engage in active exchange of buying and selling in-game goods, whether player-created or found artifacts; each MMORPG title carries with it its own economic structure and value.

Although the in-game economy is designed to be developed and sustained by players, there has been a increasing growth of "gold farmers"—players (or automated scripted "bots") who collect in-game monies to be sold later on a third-party website. Players can use real-world currency to purchase in-game artifacts such as armor and weapons or in exchange for in-game currency. This goes against many game publishers' legal terms and is considered **cheating** by the publisher, as well as by other players within the game.

Social interaction is an integral part of the MMORPG game experience. Gameplay often requires cooperation with other player-characters, making gameplay a social activity as well. To complete many quests successfully and be victorious in combat and exploration, players must form groups that draw a balance between the various skill sets available in any particular game. From healers to damage dealers, each game often has some variation on the combination necessary to succeed, all requiring the player to cooperate with other players in some way. Players form small groups of often six to eight members (actual group size depends on the specific game) to accomplish smaller tasks and quests such as the repetitive NPC killing, often referred to as "grinding," necessary to progress the player-character's level, to the completion of in-game quests. These groups can be short term and temporary, sometimes drawing on the general population of the server. This type of group is known as a "pick-up group" or *PUG*. In PUG situations, commitment to each other is only tied to the task at hand. Players may also group with other players they know either through previous play experiences or in-game reputation.

Larger groups are necessary to accomplish more complex or challenging tasks, such as successfully killing a "boss mob," that may require 20, 40, or more people, depending on the game, to work together toward a common goal. For larger-scale combat, players often join guilds, also sometimes referred to as clans or kinships. Guilds allow players to interact with a group of players that have the same gameplay goals or share similar play styles and ideology. The two most common types of guild that have emerged are hardcore raiding guilds that focus on conquering high-level content with speed and efficiency and "family" guilds, which tend to be more socially oriented groups that focus on helping the members progress through a game in a more casual atmosphere.

For all types of groups and guilds, in-game communication is important for both socializing and coordinating adventures. All games use various types of chat that is specific to a particular need such as private messages between two players, group chat (where only members in your current group can read the messages), guild chat (which is limited to guild members), as well as broad range of other chat spaces that include raid chat (limited to all members in a particular raid), auction chat (which focuses on the sale and exchange of items across the server), and many more. More recent MMORPG titles also include various forms of voice chat, enabling players to communicate using programs such as Ventrillo or TeamSpeak.

Because of the social and cooperative nature of MMORPGs, player interactions and relationships are formed over time, often creating a game world that is built on social status, game play competency, and trust. Many MMORPGs develop their own social culture that includes informal rules of play as well as accepted rules of in-game behavior. It is not uncommon for players to play more than one MMORPG together over long periods of time.

Many games host external websites as a gateway of information for the player community concerning game-related information such as updates and upcoming expansions and technical issues. Many official websites also host discussion forums where players can interact with each other as well as offer a **space** where players can discuss game issues with customer service representatives and game designers.

A growing number of websites are hosted by players, guilds, fans, and interested third-party companies. Content can range from the sharing of in-game experiences, information pertaining to gameplay and progression, as well as the creation of fan fiction, artwork, and even gameplay movies. Many guilds have their own websites to maintain contact with players while outside the game world, as well as to share in-game knowledge and conquests outside of the game world.

MMORPGs have been increasingly used to explore traditional and emerging forms of education and learning skills that often occur in virtual game worlds including but not limited to communication skills, lessons in cooperation, cultural understanding, as well as task-based learning methods and problem-solving strategies.

MMORPG's are not without their controversies, both in and outside the game world. One of the most prevalent issues that surround MMORPG gameplay is **addiction**. Because of the time-consuming nature of MMORPG gameplay, companies have been accused with knowingly creating products that are difficult for players to leave or stop playing, not only because of the ongoing addition of game content, but also because of a sense of social obligation some players may feel is inescapable during MMORPG gameplay. Similarly, the repetitive nature of combat and killing in many MMORPGs has been cause for concern with regard to **violence** and desensitization in both youth and adult players.

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Mattel Intellivision

At the time of the Intellivision's release in 1979, the nascent video game **industry** was stumbling and trying to determine how to sell video game systems to the public: as toys, as computers, or as electronic home entertainment systems. Into this arena came Mattel, then the largest toy manufacturer in the world (Kent, 2001, p. 195), primarily known for its line of Barbie dolls named after founder Elliot and Ruth Handler's daughter Barbara. Mattel had originally bought into the video game craze with a line of low-end **handheld** electronic games including *Auto Racing* (1976), *Football* (1977), and *Hockey* (1978). The Mattel Electronics division grew considerably with the arrival of the Intellivision, Mattel's first foray into home game systems.

In direct competition with the **Atari VCS 2600**, the Intellivision was technologically superior to the 2600, with improved **graphics**, more memory, and a roster of more complex games. The Intellivision could display 16 colors on its 159 × 96 pixel screen (which displayed as 159 × 92 scan lines on a television set). Whereas the **Atari VCS 2600** ran off of an eight-bit processor, the Intellivision was the first system to have a 16-bit processor. Initially the system sold for $299, and *Las Vegas Poker & Blackjack* came as a pack-in cartridge. Game **controllers** for the Intellivision included a 12-button keypad with a more precise, directional disk. The Intellivision was first widely sold in the **United States** beginning in 1980 and is considered a second-generation console. Popular Intellivision games included *Sea Battle* (1980) and *Astrosmash* (1981). Game developer **Activision** also released titles for the Intellivision, and several notable **arcade games** of the time (*Donkey Kong* [1981], *BurgerTime* [1982], and *Dig Dug* [1982]) were adapted for the system. Like early Atari and **Magnavox Odyssey** games, some Intellivision games, such as the *Advanced Dungeons & Dragons* series (1981–1982) included plastic overlays that had to be placed on the television set while playing parts of a game.

In addition to releasing the Intellivision directly, Mattel also sold the unit to Radio Shack, Sears, and GTE-Sylvania to sell the console as a so-called rebadged unit under their brands. The Intellivision also distinguished itself from competitors through a series of additional **peripherals**, including its promised, but never delivered, keyboard component (canceled after the company was fined by the Federal Trade Commission in 1982), a music synthesizer keyboard, and the Intellivoice speech device released in 1982. In 1983, Mattel released a revamped and updated system as the Intellivision II. This new Intellivision was housed in gray plastic, as opposed to the "wood grain" and brown housing of the original model.

Perhaps one of the most memorable aspects of the Intellivision was its **television** and print **advertising** campaign starring pundit George Plimpton, who touted the system's superiority over Atari, claiming, "This is intelligent television." During its era, Intellivision was respected for its graphics, and eventually 115 games were released for this system by Mattel and other developers. The "intelligence" or "smartness" of this system is best understood through the enhanced gameplay it enabled through a faster processor, better graphics, and its unique game controller. Like most video game systems of its era, the Intellivision suffered major losses in the United States market following the video game **crash of 1983**. The system was eventually completely discontinued by 1991, long after newer systems such as the **Nintendo Entertainment System (NES)** and **SEGA Genesis** had taken command of the video game marketplace. Although Mattel continues to license software and games of its toy products and produce handheld electronic quiz games, the Intellivision was the company's only major video game system.

Sheila C. Murphy

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Maxis Software

Founded by Will **Wright** and Jeff Braun in 1987, Maxis Software is the game development studio best known for creating the ***Sim* series**, the franchise of **simulation games** widely credited with pioneering the **strategy** or "**god game**" genre. Maxis started as a small, independent studio, but after its initial success and a troubled growth spurt in the early 1990s (including the company's 1995 decision to go public), Maxis was acquired by **Electronic Arts (EA)** in 1997 and is now a wholly owned subsidiary of the major game developer and publisher. Wright, the acclaimed game designer considered the true creative visionary behind Maxis, left the company in April 2009 to start his own independent entertainment think tank.

Maxis was formed out of a chance meeting between cofounders Wright, a programmer and fledgling game designer, and Braun, an investor looking for an entry point in the games **industry** at a time when Wright was struggling to distribute his urban planning simulator *SimCity* (1989), which allowed players to manage the complex inner workings of their own, self-created cities from a somewhat removed or "godlike" vantage point. Wright had self-published a version of *SimCity* for the Commodore 64 home computer but was struggling to find an audience for the game, which, in its open-endedness and its non**violent** content, was a decided departure from the linear, quest-based structure of the majority of games that were highly popular at the time. However, Maxis struck a copublishing deal with Broderbund in 1989, at which point *SimCity* was rereleased. After sluggish initial sales due to its unconventional nature, *SimCity* would go on to achieve critical acclaim and vast commercial success, becoming one of the best-selling **computer games** of all time.

SimCity's success prompted Maxis to grow quickly for an independent developer and also gave way to a host of "Sim" spin-offs that allowed players to manage everything from an entire planet (*SimEarth*, 1990) to an ant colony (*SimAnt*, 1991), with all degrees of scope and complexity in between. None of these spin-offs were nearly as successful as the original *SimCity*, however; for another such success, Maxis had to wait for the release of a sequel, *SimCity 2000*, in 1994. Riding the financial high of *SimCity 2000*, Maxis went public in June, 1995 in a $38 million (USD) initial public offering. There was also a shift toward a more corporate leadership of the company, with Wright and Braun ceding their top management roles, as well as a new emphasis on producing a greater quantity of titles according to strict deadlines. This approach yielded decidedly mixed results. For example, in 1996, Maxis sought to ship four titles in the span of a year, resulting in *SimCopter*, Wright's biggest project at the time, being short-changed development time and resources and ultimately being shipped in what Wright considered an incomplete form. Maxis also sought and ultimately failed to diversify its game lineup so that it didn't rely so heavily on *Sim* titles, trying its hand at everything from children's software to more conventional action/adventure titles, almost all of which were considered failures.

Because of its lackluster performance after going public, Maxis was forced to consider acquisition offers and ultimately accepted a $125 million (USD) stock offer from the Redwood, California–based developer and publisher Electronic Arts in June 1997. Electronic Arts was primarily interested in Maxis for the remaining prestige of the *Sim* series brand and hoped to use the Maxis name in its pursuit of a greater share of the computer game market, shifting the studio's mandate even more decisively toward the creation of top-10 titles. Maxis's new parent company was initially somewhat skeptical of Wright's first major endeavor under the EA banner—a "virtual dollhouse" game called *The Sims* (2000), which allowed users to create and manage the lives of a family of simulated people or "Sims." However, despite EA's initial reluctance to release *The Sims* because of its seemingly mundane premise, *The Sims* quickly overtook even the *SimCity* franchise as the best-selling computer game of all time and would ultimately go on to spawn multiple expansion packs and sequels. Although Wright and Maxis initially maintained a lead development role in the *Sim* series following Maxis's acquisition by EA, more recent titles (such as *SimCity Societie*s [2007], the *MySims* series [2007], and *The Sims 3* [2009]) have been developed and published without the direct involvement of Wright or Maxis, with EA either developing new *Sim* projects internally or tasking them to other, external developers. The highly popular *Sim*s franchise, for example, is now fully under the purview of EA's in-house Sims Studio.

Maxis's and Wright's biggest project in recent years has been *Spore* (2008), a simulation game that allows players to create and control life from the level of a single-celled organism all the way up to the creation and management of entire solar systems—an ambitious endeavor somewhat jokingly dubbed "Sim Everything" by both industry pundits and Wright himself (Terdiman, 2005). Released in 2008 after a series of production delays, the *Spore* franchise (and its host of planned sequels and spin-offs) is now being managed by Maxis without Wright at the helm, since his departure to form the "Stupid Fun Club," an entertainment think tank dedicated to the creation and development of cross-media intellectual property in April 2009.

See also education; industry; Meier, Sid; Molyneux, Peter.

Jessica Aldred

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Mega CD

See SEGA CD/Mega-CD

Mega Drive

See SEGA Genesis/SEGA Mega Drive

Meier, Sid (1954–)

Sid Meier is one of the most prominent game makers in the video game industry, best known for his *Civilization* series. He was the cofounder of the prominent but now-defunct game developer and publisher **MicroProse** and was the cofounder of developer Firaxis.

Meier was born on February 24, 1954, in Sarnia, Ontario, Canada, but grew up in Detroit. He attended the University of Michigan in the 1970s, where he learned programming and started to create simple games on the university's **mainframe** computers. His first job was with electronics corporation General Instruments. In 1982, he and fellow employee J. W. "Wild Bill" Stealey founded MicroProse, which swiftly became successful enough to provide full-time work. Meier worked as the designer and Stealey as the business manager.

Meier's games in the 1980s typically focused on military subjects, including flight simulators like *Hellcat Ace* (1982), *F-19 Stealth Fighter* (1988), and *Gunship* (1989), as well as military **strategy games** such as *NATO Commander* (1983) and *Crusade in Europe* (1985). His first game to really break from this mold was *Sid Meier's Pirates* (1987), a historical simulation **role-playing game (RPG)** about 16th- and 17th-century Caribbean privateers. This game was also significant because it was the first of many to use Meier's name as a marketing tool, a technique more common in the **film** industry than in the video game **industry**.

In the late 1980s and early 1990s, Meier's game projects and Stealey's interests started to diverge. Meier sold out his share of the company to Stealey and stayed on as a contract worker. *Railroad Tycoon* (1990), Meier's first game that focused on building rather than fighting, was part of his inspiration to work on *Civilization* (1991), which did not receive a great deal of support from the company. The game was a surprise hit, but MicroProse still floundered financially, and Stealey sold it to Spectrum Holobyte in 1993. Meier stayed on for a few more years, working on a few more games but eventually left in 1996 to cofound Firaxis with Jeff Briggs and Brian Reynolds.

By this time, Meier's role in game production had shifted. Throughout the 1980s and into the early 1990s, he was not only the designer of his games but also the programmer and even did some of the artwork. He had a reputation for guarding his code carefully and being involved with every aspect of his games. By the late 1990s, however, he had moved more into the role of creative director, giving general direction and feedback as a kind of quality control. Firaxis has nevertheless made a point of attaching Meier's name to every title they have released.

After creating Firaxis, Meier released a few new games, such as *Sid Meier's Gettysburg* (1997), *Sid Meier's Alpha Centauri* (1999), and *Sid Meier's Sim Golf* (2002). Since then, however, his games have been remakes and sequels of previous titles, such as *Sid Meier's Pirates!* (2004), *Sid Meier's Civilization IV* (2005), *Sid Meier's Railroads* (2006), and *Sid Meier's Civilization: Revolution* (2007).

Meier has received numerous accolades for his work. He is one of the most decorated video game industry veterans; his most prominent recognitions include being inducted into the Computer Museum of America's Hall of Fame in 2002 and receiving the Game Developer's Choice Lifetime Achievement Award in 2008. Perhaps the only other designers in the industry with the same kind of stature are Shigeru Miyamoto and Will **Wright**. Although his titles are not all universally acclaimed (in candid interviews, Meier is sometimes quite critical of some of his titles, especially early ones), many of them have received positive reviews and end up as best-sellers. Numerous critics and fans consider several of his titles, such as *Civilization*, to be some of the best video games ever created.

Kevin Schut

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mental health

See health (mental)

merchandising

In the video game **industry**, merchandising refers to the practice of licensing the intellectual property of a given game (including, but not limited to, its characters, weaponry, iconography, and fashion) and spinning it off into ancillary products or merchandise that seek to extend the game's cultural reach and financial profit beyond its primary incarnation as interactive software. Typically, a third-party manufacturer or "licensee" acquires a license from the game publisher or "licensor" to make merchandise based on its game for a pre-established period of **time**, with most major game titles granting multiple licenses to produce a range of merchandise designed to take full advantage of the game's synergistic potential. The most common types of video game merchandise include action figures, dolls, toys, books, and clothing, although there has been a growing drive in recent years to innovate game merchandise beyond these traditional categories.

Once a relatively small, youth-focused marketing category within the entertainment industry—compared with the types of merchandising blitzes launched on behalf of major Hollywood blockbuster **films**, for example—video game merchandising has, in the past decade, become more pervasive and potentially lucrative. This growth can, in part, be attributed to the increased cultural and economic prominence of video games as a medium in their own right, as well as the expanded consumer base that can be appealed to through merchandising because gamer demographics now include a sizeable adult audience.

Video game merchandising has always relied heavily on strong, recognizable game characters whose distinctive images can be extracted and repurposed outside of the context of gameplay. Even some of the earliest forays into game merchandising—such as that commissioned by Taito for the **arcade** hit ***Space Invaders*** (1978) or, even more famously, by **Namco** for ***Pac-Man*** (1980)—demonstrated this reliance on character, with the tentacled alien attackers of the former and eponymous chomping yellow circle of the latter providing a stamp of brand identity to everything from plush toys to baseball caps to **board games** to bed sheets and even (in Pac-Man's case, at least) breakfast cereal and pasta noodles. Although these largely **abstract**, two-dimensional sprites may seem primitive by today's near-photorealistic standards for video game characters, given the relative **graphical** simplicity of these early digital **worlds**, characters provided the most identifiable means of extending a game into other types of merchandise. Characters are the primary means through which players identify with and become invested in a video game, so they provide one of the easiest ways to encourage fans to consume merchandise in addition to the game itself.

Nintendo's rise to dominance of the North American **console** market in the latter half of the 1980s was fueled in part by the Japanese console and software manufacturer's success in putting forth distinctive characters that translated readily into mainstream child and youth-targeted merchandise such as dolls and toys, including the mustachioed plumber Mario of the ***Mario* series**, as well as the elfin hero Link of the ***Legend of Zelda* series**. As Marsha Kinder (1993) has suggested, by situating the world of video games within other, more familiar contexts associated with children's culture, video game merchandise sought out a larger audience for the games themselves at the same time as they diversified revenue streams for the game company (p. 109). Children unfamiliar with the games (or video games in general) might seek them out after seeing or playing with their toy spin-offs; conversely, those players wishing to expand Mario's or Link's in-game adventures beyond the finite number of levels of their respective games could do so through imaginative **play** with the action figurines based on their favorite characters. Game characters became proprietary symbols, the recognition and value of which were maximized through licensed products. Nintendo's *Pokémon* franchise, launched in North America in 1999 three years after taking **Japan** by storm, still represents one of the most blatant and successful examples of character-driven merchandise designed to capitalize on all facets of the youth market. (At the peak of its popularity in 2000, *Pokémon* had more than 50 licensees producing hundreds of products; see Kline et al., 2003, p. 240.) With a **Nintendo Game Boy** game that necessitated the capture, collection, and training of various, adorable creatures called Pokémon (or "pocket monsters" in English) at its center, the *Pokémon* franchise created licensed merchandise that was tightly integrated with the game's focus on creature collection and reinforced by the emphatic franchise slogan, "Gotta catch 'em all!" For example, younger kids could collect the toys, move on to the trading cards, and then to the various video games in the series, and spin-off animated **television** shows and a *Pokémon* movie supported this exhaustive, cross-media consumption by emphasizing the name, identity, and importance of collecting each character—who, for example, tended to chant their own names repeatedly, so that children quickly figured out who was who (Chua-Eoan and Larimer, 1999).

The merchandising appeal and potential of video games has since come to transcend the boundaries of children's and youth culture. For example, Lara Croft, the buxom, gun-toting star of the *Tomb Raider* series, has yielded multiple action figures and collector's edition models, the appearance and steep price tag of which appeal more to the adult collector than the child gamer, as has the body-armored space warrior Master Chief of Bungie's *Halo* series. Because *Tomb Raider* and *Halo* are game franchises that have been bound to **platform** exclusivity agreements for the **Sony PlayStation** and the **Microsoft Xbox**, respectively, these "grown-up" examples of character-based merchandising reflect the older demographics of gamers that **Sony** and Microsoft sought to court with their game consoles and many of their exclusive titles.

Because major game releases are now thought of as entertainment "events" and the games themselves as potentially long-lasting franchises with multiple spin-offs and sequels, console manufactures and game publishers alike are increasingly being targeted by licensing companies and brand developers for their merchandising potential across a wider range of both products and consumer demographics. Now often referred to as "brand extension," contemporary video game merchandising seeks to contextually support the experience of the game, while ensuring consumer interest in the franchise before and between game releases (Scheiner, 2007). There has been a recent proliferation of online stores—such as that created for MTV Games' *Rock Band* franchise—that allows fans to create and customize their own game merchandise, including do-it-yourself T-shirts, accessories, and character figurines. Publishers now also frequently release their big-budget titles as part of special, premium-priced "collector's editions," which package game software for sale with merchandise tightly tied in to the brand identity of the game. Favorite items for inclusion range from seemingly authentic weaponry (for example, the working night-vision goggles in the Prestige Edition of *Call of Duty: Modern Warfare 2* [2009]) to character costumes and accessories (such as the black canvas duffle bag found in the *Grand Theft Auto IV* Special Edition [2008]) to custom lithographs and art books (such as that included in the *Mass Effect* Limited Edition [2007]). This special edition bundling ensures the purchase of additional game merchandise at the point of sale, with price tags for such packages usually starting at nearly double the cost of the game alone. Other franchises instead adhere more closely to the model of merchandise release laid out by the film industry in which at least several major items (soundtrack, clothing, action figures, etc.) are rolled out in the weeks before the game's debut as a means of building anticipation and buzz, with the bulk of the remaining tie-ins launched at the time of release.

For its part, the gaming community remains largely divided when it comes to the merchandising spin-offs of their favorite games; although some espouse the collecting of merchandise as an enjoyable and worthwhile extension of their enthusiasm for and engagement with their favorite games, others have dismissed it as mere frivolity that distracts from the achievement of hardcore game play (Ruberg, 2005). Henry Jenkins (2006) suggests that conventional licensing arrangements impose such limiting terms of use on a game's intellectual property that the resulting products are often viewed as cheap spin-offs that appropriate only the most superficial aspects of a beloved title. To counter this disillusionment, there has been a growing move toward developers, publishers, and licensees working together to **co-create** ancillary media—usually in the form of graphic novels, novels, **comics**, and films—that participate in expanding the fictional **world** of the game, a trend Jenkins terms "transmedia storytelling." (This is evident, for example, in **Electronic Arts**'s *Dead Space* franchise, which released graphic novel and animated film prequels to the game that established the backstory of the game world, without being redundant of the game itself.) By consuming these other media forms, players may learn new information about the game world and their opponents therein, which ultimately may assist with—rather than distract from—their gaming achievements. ***See also*** adaptation; advertising; art; packaging.

Jessica Aldred

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Metal Gear series

Metal Gear is a critically acclaimed series of stealth-action video games created by

Hideo **Kojima**. It was first developed and produced by Konami until Kojima Productions took over development in 2005.

The main series begins with *Metal Gear* (1987) and its sequel *Metal Gear 2: Solid Snake* (1990). The original versions of these games were distributed solely in **Japan** for use on the MSX2. The *Metal Gear Solid* subseries consists of *Metal Gear Solid* (1998), *Metal Gear Solid 2: Sons of Liberty* (2001), *Metal Gear Solid 3: Snake Eater* (2004), *Metal Gear Solid: Portable Ops* (2006), *Metal Gear Solid 4: Guns of the Patriots* (2008), and *Metal Gear Solid: Peace Walker* (2010). In addition, there exist noncanonical titles that are not considered a part of the series' ongoing narrative: *Metal Gear 2: Snakes' Revenge* (1990), a game designed without Kojima's consent and creative support, and a follow-up to the American port of the first *Metal Gear* on the **Nintendo Entertainment System (NES)**; *Metal Gear Solid: Ghost of Babel* (2002) released for the **Game Boy** Color; both *Metal Gear Acid* titles (2004 and 2005) playable on the **PlayStation** Portable; and *Metal Gear Solid: Touch* (2009) for the iPod Touch and iPhone. Also worth mentioning, *Metal Gear Arcade* (2010), a port of *Metal Gear Online* (2008), an on-line multiplayer mode initially included with *MGS4*, was released only in Japan. This version makes use of stereoscopic imagery.

As of April 2012, Konami has announced that another game is in development but has yet to provide the gaming community with an official release date. Titled *Metal Gear Rising: Revengeance* and developed by Platinum Games, this game will be the eighth title of the canonical series and, in addition to the **Sony PlayStation 3** version, the first title playable on the **Microsoft Xbox 360**. It will feature Raiden, the main player-character, and will take a step away form the **stealth** genre, with the usual tag "Tactical Espionage Action" replaced by "Lightning Bolt Action."

All *Metal Gear Solid* original releases are compatible with a **Sony platform**. However, some games were ported onto other **consoles**, like *Metal Gear Solid*, which was revamped by Silicon Knights for the **Nintendo GameCube** and published under the name *Metal Gear Solid: The Twin Snakes* (2004). *Metal Gear Solid 2: Sons of Liberty* was revised as well, providing over 200 new VR (**virtual reality**) missions. This edition, titled *Metal Solid 2: Substance* (2002), is playable on the Xbox, IBM PC, and **Sony PlayStation 2**. *Metal Gear Solid 3: Snake Eater* was also rereleased for PlayStation 2, as was *Metal Gear Solid: Subsistence* (2005). This iteration of the game includes both original MSX2 *Metal Gear* games, making them available to the North American market.

Konami also released the *Metal Gear* compilations, starting with *Metal Gear (20th Anniversary)* (2007), which includes every title from *Metal Gear* (the MSX2 versions ported on PS2) to *Metal Gear Solid: Portable Ops* (2006), and also contains *The Document of Metal Gear Solid 2*, an interactive "making of" of *MGS2* originally released in 2002. In 2008, before the release of *MGS4*, the *Metal Gear Solid* trilogy hit the shelves once again as *Metal Gear Solid: The Essential Collection*. Also worth mentioning is *Metal Solid: VR Missions* (1999), an add-on to *MGS* playable on the PlayStation. The *VR Missions* were originally released with *Metal Gear Solid*

Integral (1999), a version of *MGS* available only in Japan that eventually reached the American continent as the IBM PC version of *Metal Gear Solid*.

The series mainly revolves around the missions of three elite soldiers: Naked Snake (*MGS3*, *MGS: Portable Ops*, *MGS: Peace Walker*) who will later become known as Big Boss (the "genetic father" of Solid Snake, Liquid Snake, Solidus Snake, and the Genome soldiers), Solid Snake (*Metal Gear*, *Metal Gear 2*, *MGS*, *MSG2's Tanker Episode*, *MGS4*), and Raiden (*MGS2*, *MGS Rising*). Each mission ultimately implies finding and neutralizing the many iterations of the Metal Gear, a bipedal (Metal Gear TX-55, Rex, and Rey) or submersible (Arsenal Gear) tank with nuclear missile launching capabilities.

According to the *Metal Gear Solid 4 Database*, although the games take place between 1964 (*MGS3*) and 2014 (*MGS4*), the story's timeline begins in early American history, when the Patriots created the *Sons of Liberty*, a name that will later be used by Solidus Snake's terrorist group in the events of *MGS2*. The series' fictional events and the characters' backstories are often connected with actual historical events. The series also tends to blend real scientific facts and military technology with their fictional equivalents. For example, although the gamer might need to administrate diazepam, a real benzodiazepine derivative drug used for treating anxiety, insomnia, seizures, and muscle spasm, to stabilize the aim of his **player-character**, the protagonist's stamina, strength, and reflexes are also enhanced by injected (and fictional) nanomachines that can supply adrenaline, nutrients, and sugar, or restrict the host's actions. The same goes for the military and scientific organizations—such as the CIA, DARPA (real), and FOX HOUND (fictional)—involved in the series' conflicts. This mixture of facts and (science) fiction is one of the defining traits of the *Metal Gear* saga.

Initially designed to be an action **war** game, the technical limitations of the MSX2 forced Kojima to reconsider his overall gameplay stance. As he explained in a *Gamers Today* interview: "Creating a war game for MSX was a little difficult because of the limitation on the sprites. When you get four enemies or even four bullets on the screen at once, the screen starts blinking and it just doesn't work" (Kent, 1998). Therefore, the game designer decided to take another approach. Instead of fighting all the soldiers, the player-character would have to sneak past them and avoid being spotted. To evade confrontation, the games have a large inventory of infiltration tools, the most famous being the cardboard box, as well as many weapons that often serve more than offensive purposes. Although most of the gameplay mechanics were enhanced and/or refined through the course of the series, many were already present in the 1987 game. As a result, the original *Metal Gear* is identified as the game that introduced the stealth genre, whereas *Metal Gear Solid*, the first title of the series published worldwide, is widely recognized as the game which made the genre popular.

The *Metal Gear* series demonstrates Hideo Kojima's interest in filmmaking, through movie references and the series' general aesthetic. Each game begins with an opening title with the names of the voice actors and relies heavily on **cut-scenes**.

During gameplay, the games rely on an overhead or over the shoulder third-person point of view that, at certain points, changes to prescripted fixed camera shots, adding to the "cinematic feel" of the games. Most games of the *Metal Gear Solid* series also allow one to switch to a first-person point of view. This perspective is often treated as if the player-character had a camera instead of eyes, as seen in *MGS2* when droplets of rain accumulate on the screen. This tends to reinforce the feeling that the gamer's journey is mediated through a filmic apparatus.

The series is also renowned for its high degree of videoludic self-consciousness. At many points during a gameplay session, the gamer is reminded of his or her role within the simulation. Although this auto-reflexivity is constantly and subtly present under different forms within the games, it occasionally peaks by having the characters refer directly to the **interface** and game hardware. For example, in *Metal Gear Solid,* during the battle against Psycho Mantis, Roy Campbell—Solid Snake's commander—asks the gamer to plug the game **controller** in the second port of the console to prevent the psychic Fox Hound member from using his telepathic powers.

Although the series is widely acknowledged for its original and **immersive** gameplay, Hideo Kojima's vision as a video game author and the game's resulting intricate **narrative**—mostly delivered through lengthy noninteractive sequences (some can run up to an hour)—has received its just share of praise and criticism from the gaming community and academic circles. For Steven Poole: "the multiple twist and turns of the thriller plot are highly enjoyable, dropping little hints as to the true nature of your mission and the organisation you work for, keeping you guessing as to how it will all turn out" (Poole, 2000, p. 110). Whereas for Grant Tavinor, "[t]he tone of the games is widely erratic, with vulgar jokes placed alongside very stylish sequences intended to convey seriousness" (Tavinor, 2009, p. 113).

In an interview given to Adam Doree (for Kikizo) in 2008, Kojima expressed doubts about the effectiveness of a certain type of interactive storyline in which the gamer is free to select what he wants to see. While confessing that he chooses "the easy way" when using cut-scenes to carry the narrative of the games, he also stresses that doing otherwise might not get the gamer as emotionally involved. Therefore, while the sometimes unbalanced ratio between gameplay sequences and cut-scenes, combined with the occasional crude and misplaced humor, might be polemical, they remain a truthful reflection of Kojima's vision of storytelling and true to his style as a game designer.

Guillaume Roux-Girard

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Metroid series

Metroid is a single-player action-adventure game for the **Nintendo Entertainment System/Family Computer**. Released in August 1986 in **Japan**, August 1987 in North America, and January 1988 in **Europe**, it is the first game in **Nintendo**'s *Metroid* series. It was designed by Yoshio Sakamoto and Hirofumi Matsuoka and developed by Nintendo's famed Research and Development 1 (R&D1) division under the supervision of Gunpei **Yokoi**.

The game's backstory, inspired by Ridley Scott's *Alien* (1979), revolves around the titular metroids, mysterious life-forms endowed with highly destructive capabilities. Transported to Earth on board a Space Federation research vessel, the metroid specimens are captured by pirates and taken to planet Zebes. There, in the safety of their fortress, the pirates proceed to replicate the creatures with the intention of using them as a biological weapon. Following an unsuccessful assault on the planet, the Federation dispatches a lone warrior, cybernetically enhanced bounty hunter Samus Aran, to infiltrate the pirate stronghold and eliminate the threat.

Metroid's gameplay focuses on exploration and combat, as the player **navigates** the sprawling underground fortress, fighting assorted enemies along the way. The game takes cues from Nintendo's successful earlier titles, combining side-**scrolling** platform-based design popularized by the seminal *Super Mario Bros.* (see ***Mario* series**) with the open-ended world and nonlinear progression of *The Legend of Zelda* (see ***Legend of Zelda* series**). Unlike typical **platform** games of the time, which forced the player to traverse the world from left to right, one level at a time, *Metroid* allows movement in all directions. Its labyrinthine map, combining horizontally and vertically oriented areas, is designed with freeform exploration and backtracking in mind: scattered around the pirate fortress are a number of upgrades for Samus's combat suit. The player must locate and collect these permanent power-ups to reach previously inaccessible areas and progress in the game.

In addition to its intricate **map** design, *Metroid* has been often praised for its somber and claustrophobic atmosphere (especially compared with earlier NES titles), and Hirokazu Tanaka's haunting musical score. The game is also notable for its protagonist, bounty hunter Samus Aran. Created by Makoto Kanō and designed by Hiroji Kiyotake, she is one of the first video game heroines. Interestingly, her **gender** is not immediately obvious. The Japanese and English instruction manuals consistently refer to Samus using—respectively—non-gender-specific and masculine pronouns, and her bulky armor suit makes it all but impossible to determine whether the character is even human. Her true identity is only revealed once the game is completed in less than five hours, whereupon she removes her helmet, displaying a mane of long, auburn hair. The inclusion of multiple endings, dependent on the **time** and degree of completion (items collected, secrets found, etc.), has since become one of the staples of the series.

The game was originally developed for the Nintendo Family Computer Disk System—an external floppy disk drive that plugged into the Famicom cartridge port. Taking advantage of the rewritable medium, this version could save up to three games to the disk. In the **cartridge**-based conversion, released in 1987, this functionality was replaced with a password system, allowing users to resume play from a specific point.

The *Metroid* series is one of Nintendo's longest-running and most profitable franchises. The first game was followed by three direct sequels, *Metroid II: Return of Samus* (**Nintendo Game Boy**, 1991), *Super Metroid* (**Super Nintendo Entertainment System [SNES]**, 1994), and *Metroid Fusion* (Game Boy Advance, 2002), all developed by Nintendo's R&D1. In the early 2000s, the *Metroid* license was offered to the American developer Retro Studios. In a controversial but ultimately highly successful move, Retro departed from *Metroid*'s two-dimensional roots, creating instead a trilogy of first-person action-adventures: *Metroid Prime* (**Nintendo GameCube**, 2002), *Metroid Prime 2: Echoes* (**Nintendo GameCube**, 2004), and *Metroid Prime 3: Corruption* (**Nintendo Wii**, 2007). In 2009, all three games were rereleased as *Metroid Prime Trilogy* (Nintendo Wii). The limited edition compilation included new versions of *Prime* and *Echoes*, featuring updated **graphics**, **motion control**, and support for widescreen **televisions**. The latest entry in the series, *Metroid: Other M* (Nintendo Wii, 2010), has been developed by Team Ninja (of the *Ninja Gaiden* fame). Drawing on the two strands of the franchise's **history**, it combines third- and first-person perspective gameplay. An enhanced remake of the original game was released in 2004 for the GameBoy Advance under the title *Metroid: Zero Mission*.

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MicroProse

MicroProse was a prominent developer and publisher of **computer games** in the 1980s and 1990s, releasing long-running franchises such as *Civilization*, *X-Com*, and *Master of Orion*. Businessman J. W. "Wild Bill" Stealey and game designer Sid **Meier** were employees at electronics company General Instruments when they founded the game company in 1982 as a side venture. The well-propagated founding myth is that Meier, a rather reserved programmer, caught the attention of Stealey, a colorful ex-fighter pilot, in an **arcade game**–playing session in which the former won not through reflexes but by noting the game's predictable AI patterns. In more in-depth interviews, Meier has presented a somewhat less dramatic account, but it is a good characterization of the two's partnership. Stealey was the flamboyant promoter and managed all the business decisions, and Meier was the low-key game-making genius.

All of the company's offerings in the 1980s, such as *F-15 Strike Eagle* (1984), *Silent Service* (1985), and *Gunship* (1986), were focused on the new and steadily growing home computer market. Within a year of the founding, the company was successful enough that the cofounders quit their positions at General Instruments. MicroProse expanded into the distribution of other developers' games and also focused on European markets, an unusual emphasis in the early American computer game **industry**. Eventually, the company would have development studios in Chipping Sodbury, England; Alameda, California; Chapel Hill, North Carolina; and Hunt Valley, Maryland. In the early 1990s, Stealey decided to invest in arcade games and **console-based games**. Meier was uncomfortable enough with these moves that he sold his stake in the company to Stealey, continuing to work as a contracted game designer. The combination of the risky new ventures and the recession of the early 1990s put MicroProse in financial trouble, leading to an initial public offering (IPO) to raise cash. This did not solve the problems, and in 1993 Stealey persuaded Spectrum Holobyte to purchase MicroProse.

The change in management caused discontent, leading to a series of departures by key personnel. In 1995 Bruce Shelley left, eventually founding Ensemble (maker of the *Age of Empires* series). In 1996 Sid Meier, Jeff Briggs, and Brian Reynolds left to found Firaxis, which went on to make *Sid Meier's Alpha Centauri* (1999) and the most recent editions of *Civilization* (version III in 2001, version IV in 2005, and *Revolution* in 2007), *Sid Meier's Pirates* (2004), and *Sid Meier's Railroads* (2006) among other titles. With these changes and the acquisition of MicroProse/Spectrum Holobyte by Hasbro Interactive in 1998, the traditional identity of the company effectively disappeared. French game industry giant Infogrames purchased Hasbro Interactive in 2001, which ended the existence of MicroProse as a label. Some of the studios distributed by MicroProse lasted a few more years, but eventually these shut down as well.

MicroProse was an important force in video game **history** because of the well-known games it created and the influential people who worked for it. In its early days, the company focused on military simulations—either **arcade**-style, such as *Gunship* (1986), or strategic **map**-style, such as *NATO Commander* (1983)—which sold well but were neither huge hits nor deeply influential. The 1987 release of *Sid Meier's Pirates* was both a significant success and departure in style because it was a kind of **role-playing game (RPG)**; it also marked the first use of Meier's name as a marketing tool. Meier and Shelley continued to develop outside the purely military theme with *Railroad Tycoon* (1990) and the blockbuster hit *Civilization* (1991). Although Stealey was more interested in the purely militaristic games, it was the empire builder **strategy games** that became the distinctive hallmark of MicroProse in the 1990s, such as *Colonization* (1994), *Masters of Magic* (1994), and *Masters of Orion* (1995). Other prominent series include the tactical battle *X-COM* games (developed by Mythos Games), and a wide range of flight **sims**, like the *Stealth Fighter*, *Gunship*, and *Falcon* games.

Many MicroProse employees went on to successful careers elsewhere. In addition to Meier, the list includes Bruce Shelley, designer of *Age of Empires* (1997); Brian Reynolds, cofounder of Firaxis Games and later Big Huge Games; and Jeff Briggs, cofounder of Firaxis Games. Dani Bunten, designer of *Seven Cities of Gold* (1984) and *M.U.L.E.* (1983), also worked for MicroProse for a few years.

Kevin Schut

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Microsoft Xbox

The Xbox is a sixth-**generation console** produced by Microsoft. The console was first announced in 1999 and was released in November 2001 in North America and early 2002 in other markets. The Xbox was the first game console to be entirely produced by Microsoft. It takes its name from the DirectX software package developed for the use of multimedia (particularly games) on the various Microsoft Windows **platforms**. After the seventh-generation **Microsoft Xbox 360** was released in November 2005, the original Xbox was discontinued in 2006, and new software was gradually phased out of production; the last title was released in 2008.

The Xbox featured a significant number of technical innovations: a Pentium III microprocessor, **graphics** and **sound** processors codeveloped in a troubled partnership with graphics specialists Nvidia (the partners were involved in a legal dispute over the pricing and supply in 2002–2003), an 8-gigabyte hard drive, and an Ethernet connection for LAN and on-line **play**. From November 2002, its Internet connectivity was supported by the Xbox LIVE service, which allowed software and updates to be downloaded directly to the Xbox and stored on its hard drive. The Xbox LIVE service supported downloadable content and on-line multiplayer access for Xbox games until April 2010. Xbox LIVE subscribers had either a Silver membership (free but limited access) or a Gold membership (fee-paying but full access). Games and downloadable content were purchased with Microsoft Points, which could be added to a subscriber's account through store-brought prepaid cards or on-line via credit card. The service allowed for the publication of download-only games through the Xbox LIVE Arcade. This service proved popular, with more than 3 million games purchased by February 2006. Bizarre Creation's *Geometry Wars* (2003), originally included as a **minigame** in *Project Gotham Racing 2* (2003), was made available for individual download and became the Xbox LIVE Arcade's most popular title. Other popular downloadable games were puzzle games such as PopCap Games's *Bejeweled 2 Deluxe* (2005) and various repackaged **arcade games** from the 1970s and 1980s. By 2007, Xbox Live was available in 26 countries, primarily in North America (including Mexico), Western **Europe** and Scandinavia, and select parts of the Asia-Pacific: **Australia**, **India**, **Japan**, Singapore, **New Zealand**, **South Korea**, and Taiwan.

Like the **Sony PlayStation 2**, the Xbox has an internal **DVD-ROM** drive, although it could not be used to view DVDs without the additional purchase of a separately packaged, specialized DVD remote. The DVD-ROM drive was used to play games or music, the latter of which could also be "ripped" to the hard drive. This feature was explored in a number of games—including the launch title, Indie Built's *Amped: Freestyle Snowboarding* (2001)—that allowed songs stored on the hard drive to be used as the game's soundtrack. The original Xbox retail package also came with a single **controller**, which, as of 2010, is the bulkiest controller released for a console system. This controller was widely criticized and eventually replaced with a smaller, lighter controller that had originally only been included in the Japanese Xbox retail package.

The Xbox console developed a considerable modding community. Primarily, this was done to circumvent the digital rights management (DRM) systems that were built into the hardware and software of the console. Modders also experimented with developing other software for Xbox, including XBMC (Xbox Media Centre), which enabled the Xbox to act as the hub of a home entertainment system, and a port of Linux for Xbox that allowed the console to function like a desktop computer.

When the console was launched, Microsoft was criticized for the poor quality of several of the launch titles, particularly Adrenium Games's *Azurik: Rise of Perathia* (2001). Microsoft's successful acquisition in 2000 of game developer Bungie, who had developed successful games including *Marathon* (1994) for the Macintosh computer in the 1990s, meant that the studio's next title, *Halo: Combat Evolved* (2001), would be an Xbox exclusive. The popularity of the game ensured the success of the Xbox and the protagonist Master Chief (voiced by Steve Downes) became the console's unofficial mascot. The importance of the game series to the console's fortune was cemented with the release of *Halo 2* (2004). Promoted by the celebrated alternate-reality game, 42 Entertainment's *I Love Bees* (2004), *Halo 2* made more than $125 million in sales during its first 24 hours and went on to sell more than 8 million units, becoming the best-selling title for the console.

By the time its production was discontinued, the Xbox had sold approximately 24 million units: 16 million in North America, 6 million in Europe, and 2 million in Asia. It secured an impressive share of the local North American console market, overtaking **Nintendo GameCube** in sales and second only to the Sony PlayStation 2. The Xbox also met with some success in Europe but did not do as well as anticipated in Japan. Initially, Microsoft had difficulty brokering deals with established software producers, which meant that in the first few years of the console's production many key titles were released as **PlayStation** exclusives, or the Xbox version was only released after considerable delay. However, the Xbox versions of a number of multiplatform franchises sold over a million units, including Grey Matter Interactive's *Call of Duty 2: Big Red One* (2005), **Electronic Arts**/Black Box's *Need for Speed: Underground 2* (2004), and Ubisoft Montréal's *Tom Clancy's Splinter Cell* (2002). A number of Xbox-exclusive titles also garnered commercial and critical success, among them *Halo: Combat Evolved, Halo 2*, and the **role-playing games (RPGs)**

Fable (2004) and *Star Wars: Knights of the Old Republic* (2003).

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Microsoft Xbox 360

The Microsoft Xbox 360 is a seventh-**generation** home video game **console**. In development since early 2003, the system was officially unveiled during an MTV special event on May 12, 2005, and released in **North America** on November 22, 2005; in **Europe** on December 2, 2005; and in **Japan** on December 10, 2005. The second game system developed by Microsoft Corporation's Entertainment and Devices Division, the 360 is a successor to the original **Microsoft Xbox**.

The console's custom PowerPC-based "Xenon" CPU, designed and manufactured by IBM, is a triple-core processor, with each core operating at the speed of 3.2 GHz. Shared between the cores is 1 MB of Level 2 on-die cache memory. **Graphics** are handled by the 500-MHz ATI Xenos chip (also doubling as a northbridge). The system is equipped with 512 MB GDDR3 RAM, shared between the CPU and GPU. The Xbox 360 supports multichannel surround **sound** and widescreen high definition graphics, up to 1080p. Broadband connectivity is provided by the built-in 10/100 Ethernet adapter (or, for the S model, a built-in wireless network adapter). As the first high-definition (HD)-capable console on the market, the 360 set the unofficial standard for the current generation of high-definition gaming technology.

A **DVD-ROM** drive is the system's primary mass storage device. An external HD DVD drive was introduced in November 2006 but was discontinued in early 2008, a few days after Toshiba's decision to cede the HD optical disk market to the competing Blu-ray format. An optional detachable hard disk drive can be used to store games, media files, and downloadable content. In the absence of a hard drive, memory cards need to be used to save game data and system settings. Since December 2008, the Arcade units have been equipped with internal flash memory, eliminating the need for memory cards. Designed as a digital media hub, the Xbox 360 supports local playback and over-the-network streaming of multiple video, **audio**, and image formats.

The Xbox 360 was initially sold in two retail configurations, as a $299 Core system (equipped with a wired **controller** and a standard definition A/V cable) and a $399 Pro package (including a wireless controller, an HD A/V cable, a 20-GB hard drive, and a headset). By 2007, the lineup was expanded to include the black-cased Xbox 360 Elite (120-GB hard drive), and the entry-level Core model was replaced by the Xbox 360 Arcade. All these models were discontinued in 2010, following the release of the updated Xbox 360 S, which features updated internal architecture, expanded connectivity options (built-in wireless adapter, optical audio output, additional USB ports, as well as an auxiliary peripheral port, used by the

Kinect motion control sensor), as well as a redesigned, slimmer case. The Xbox 360 S is only available in two configurations: with a 250 GB hard drive or 4 GB of flash memory.

The system is partially backward-compatible with the original Xbox games. This functionality is achieved through software **emulation** and requires the system to be equipped with a hard drive. Emulation profiles are available for approximately 50% of Xbox titles.

Online gaming is supported through Microsoft's Xbox Live subscription service. In addition to providing multiplayer and community features, the service also gives access to the Xbox Live Marketplace, a virtual market giving users access to paid and promotional content, including downloadable games, demos, and **map** packs, as well as (through the Video Marketplace) movies and **television** show episodes.

Despite the one-year advantage, the Xbox 360 has lost its initial market lead to the **Nintendo Wii**. As of January 2011, the system is the second-best-selling seventh generation game console, with over 50 million units sold worldwide (Thorsen, 2011).

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Middle East

The fast progress of video game culture in the 1970s and 1980s reached Middle Eastern markets at about the same time that they were spreading through households in **Japan**, the **United States of America**, and **Europe**. Early game **consoles** were popular in the region, and the senior **generation** still refers to all kinds of video games as "**Atari**" games, a result of the dominance of **Atari VCS 2600** socially and commercially. Since the introduction of these game consoles and their succeeding 8-bit home personal computers such as the Commodore 64 and the ZX Spectrum, the demand for video game consoles with an Arabic-friendly **interface** grew to a high level, encouraging Al-Alamyyeh, a Kuwaiti company, to start producing an Arabic home computer called the Sakhr (which means "rock" in Arabic) in 1981, which was essentially based on the well-known Japanese MSX. The product was a success and became popular with middle-class families in the Middle East.

During that time, Al-Alamyyeh made an attempt to convert the BASIC computer language into Arabic, and many applications were developed to support domestic users; but in general, the software **industry** in the region was essentially targeting the corporate applications market. Hardly any of these programs were Arabic video games, and the reason was obvious: nobody would invest in a market flooded with cheap **pirated** games. Eventually it was up to the Indie developers to start video game production, such as *War73* developed by Radwan Kasmiya in 1999, and Mohammed Hamza's *Stone Throwers* in 2001. Both were two-dimensional **arcade**-style games for personal computers and were based on the Arab-Israeli conflicts.

In September 2000, *Under Ash*, a PC first-person shooter (FPS) game, was previewed to the public at a Damascus book fair, and it was considered to be the first commercial video game in the Middle East based on the Palestinian conflict. Created by Radwan Kasmiya and published finally by Dar Al-Fikr in 2002, *Under Ash* targeted Arab gamers, did not contain English subtitles, and was never sold outside the region (limited copies found its way to Europe unofficially). The game received a lot of praise, managing to sell more than 100,000 units within the first six months of release—a considerable quantity, even compared with internationally best-selling titles' sales in Middle Eastern markets. The success of the game naturally led to a sequel, and so Afkar Media was established and became the first independent game studio in the region.

Two years later, *Under Ash II* (also known as *Under Siege*) was released in 2004 but did not hit the retail shelves till late 2005 because the publisher was trying hard to access new markets with little experience in simultaneous releases. *Under Ash II* was received positively because of its realistic storyline, advanced **graphics**, and **artificial intelligence (AI)** for the time. The game has been described as a "docugame" because all the levels are based on actual events documented by the United Nations' records from 1978 to 2004. This time around, the game also supported English subtitles.

The publisher decided to split the game into two parts to graze more money from enthusiastic gamers, so they released *Under Siege: Path to Freedom*, and *Under Siege: Remnant of Human*. That said, the English version of this game, *Under Siege: Golden Edition*, was, as of late 2010, never released; a strange tactic that was repeated later with ***Quraish*** (2005), the first Arabic real-time **strategy** (RTS) game, also developed by Afkar Media. *Quraish* was highly anticipated by Arab gamers because it was based on actual historical (conquest) **wars** during the early Islamic periods, a highly revered period in the region. The game was finally released commercially in 2008, after spreading its four campaigns on four independent package designs and one "Golden Version" with all the features.

During that time, another Syrian company, Techniat3D, developed *Zoya: A Warrior from Palmyra* (2002), an **adventure game** inspired by the *Tomb Raider* series. Sadly, the game sold fewer than a hundred copies in the region, and many claimed that the "improper attire" of the female warrior featured on the cover was the reason players avoided the game. A revised version was made by Afkar Media, and the game was re-released as "Victory Castle"; however, this version didn't meet with much success either, selling just over a thousand copies. Consequently, Techniat3D was closed down in 2003.

On the edge of the Middle East, Imaginations FZ, LLC, was founded in Dubai

(United Arab Emirates) in 2003 and managed to create two games before it shut down in 2005: *Legend of Zord* (2003), featuring stories from the *Arabian Nights*, and *Wadi Basheer* (2005), a poor **racing game** with a Middle Eastern twist. A group of Lebanese developers came out with their first video game, *Special Force* (2003), which focused on Hezbollah military operations against Israeli occupation forces in Lebanon. The game was quickly adopted by Hezbollah and merged into its propaganda machine. The outcome was a short video game (three levels) with mixed messages of religion and politics. That attitude led to the ban of this game in many Middle Eastern countries; however, this led to greater media attention and developers were rewarded with more resources to come up with a sequel in 2007. The developers established their new studio, Might 3D, and created *Special Force 2: Tale of the Truthful Pledge* (2007), which was based on the 2006 Lebanon War between Hezbollah and Israel. It was presented less than a year after the actual war, and the game was in Arabic with an unofficial patch to add English language subtitles. Independent critics tend to compare these games with *America's Army* (2002) because both are funded by political parties to promote specific views (*America's Army* is funded by the Pentagon). Apart from the political background of the *Special Force* series, which was controversial but did not boost sales, credit should go to the series developers because they started using the Genesis 3D engine for their first game and then managed to develop their own **game engine** for *Special Force 2*.

In 2003, the game *Jenin: Road of Heroes* was published by Turath (a Jordanian e-book and software publisher) but didn't sell much (4,000–8,000 units), even though it copied the same political concepts regarding the Israel-Palestine conflict. The next game from same developer was *Wild Races* (2008), a funny animal racing game that featured bareback riding on eight animals at six tracks. It was published by Andalussoft but didn't sell well either, and both developer and publisher stopped venturing any further into hardcore video games. The Jordanian company Quirkat is set to become a main player in the Middle Eastern video game industry and has invested in the localization and refurbishment of well-known international video games. Their first product was *Arabian Lords* (2006), a city-building strategy game from BreakAway Games, published by RED Entertainment Distribution.

Ultimately, it seems that the home video game industry was not generating enough money. Quirkat's next ventures were in new mobile portals and **casual games**, including Al-Moosiqar (2009), a casual **on-line game** that lets players play oriental music on an Oud (an instrument similar to the European lute), and *Tariq's Treasure* (2008), a puzzle/strategy **mobile game**, published by BreakAway. Quirakat also developed an **advergame** for HTC Middle East to promote the release of a new handset model. The game, along with the strong HTC brand, attracted thousands of on-line players, according to their official website.

In 2007, the Egyptian studio Al-Khayal was established with support from Egyptian technology funds, and they created *Buha* (2006), a comical adventure game based on a popular movie character (Mohamed Saed); however, that game was the only one the company produced. In 2008, the Syrian company Joy Box was established, which targeted the casual games and mobile games market. Their website has many types of games, ranging from two-dimensional arcade-style games that are basically sold to Al-Majd (a local Quiz TV channel) to three-dimensional prototypes of adventure games and racing games.

During the 2009 global financial crunch, Afkar Media had to postpone some of their major game projects, although they did manage to finish *Road to Jerusalem* in late 2009, a comedy/adventure **computer game** published by Fares al Ghad, still unreleased as of 2012. In other markets, Maktoob, a successful Jordanian company, built its popularity through years of service and managed to get Yahoo! to acquire some of their shares (due to the huge user base). Maktoob has distributed free browser-based games to the Middle East, including *Khan Wars* (2009), neck-and-neck with the company Travian and made a good profit on it. Alongside localized browser-based games, such as *Damoria* (2009) and *Stardoll* (2009), Maktoob is running a dedicated website for casual games and on-line flash games, with thousands of original Arabic and Middle Eastern titles. Tahadi, based in Dubai UAE, is a major publisher of on-line games; they localized and operate famous **massively multiplayer on-line role-playing games (MMORPGs)** including *Runes of Magic* (2009), *Ragnarok Online* (2002), *Crazy Cart* (2009), and *Heroes of Gaia* (2010). Falafel Games, a new developer with studios in the Middle East and China, is planning to publish a series of local content games starting with *Knights of Glory* (2011), an MMO browser game about Muslim conquests.

What all the titles developed in the Middle East have in common is their release **platform**; most of them were made for the IBM PC. This is because PCs are a more affordable platform for publishers and also because of console manufacturers' attitudes toward the Middle East video game market; for example, Microsoft does not support Xbox Live services in the region, and although **Sony**'s consoles are popular, many Middle Eastern countries are not even included in their **PlayStation** Network list of supported countries. ***See also*** Quraish.

Radwan Kasmiya

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Midway Games

Midway Games, Inc. was an early American video game publisher and developer. The company developed notable titles such as ***Mortal Kombat*** (1992) and licensed many others including Taito's ***Space Invaders*** (1978) and **Namco**'s ***Pac-Man*** (1980). In 2009, Midway filed for Chapter 11 bankruptcy.

Midway Manufacturing was established in 1958. The company specialized in the manufacturing of amusement equipment, including pinball machines. It was purchased by **Bally** in 1969. In 1973, Midway became an early developer of **arcade** video games. Some of Midway's earlier titles include *Asteroid* (1973), *Paddle-Ball* (1973), *Ball Park* (1974), *Basketball* (1974), and *Gun Fight* (1975).

During the 1970s, Midway worked closely with Japanese game developer Taito, with both companies licensing each other's games to their respective countries. In 1978, Midway licensed and distributed Taito's *Space Invaders* to the **United States**, which proved to be a great success. In 1980, Midway followed with the release of two additional titles that proved to be greatly successful, **Williams**'s ***Defender*** (1980) and Namco's *Pac-Man*, which proved to be so successful that Midway produced an unofficial sequel the following year, *Ms. Pac-Man* (1981).

Midway continued to license **arcade games** throughout the 1980s, including titles such as *Galaga* (1981), *Joust* (1982), *Robotron 2084* (1982), *Tron* (1982), *Burgertime* (1982), *Gauntlet* (1985), *Rampage* (1986), and *Xenophobe* (1987). In 1988, Bally/Midway was purchased and reincorporated by Williams Electronics Games and its parent company, WMS Industries, Inc. Midway continued to produce arcade games under the Bally/Midway label, while producing pinball machines solely under the Bally name. In 1991, Midway absorbed Williams's gaming division and began marketing games without the "Bally" label. It was during this period that Midway published some of its most popular arcade titles, including *Terminator 2: Judgment Day* (1991), *Mortal Kombat*, and *NBA Jam* (1993). In 1996, WMS acquired Time Warner Interactive, which included **Atari** Games. Midway changed its corporate name from Midway Manufacturing to Midway Games, Inc. This change also marked Midway's entrance into the home **console** market.

During this period of time, Midway began to experience financial losses. By 1998, WMS had sold its interest in Midway's stock, making Midway an independent entity. In 1999, Midway left the pinball **industry** to concentrate fully on video games. In 2001, Midway closed its arcade division due to loss of sales.

In 2004, Midway began to purchase multiple independent video game studios, in an attempt to strengthen its development teams. The studio's purchases included Surreal Software, Inevitable Entertainment, Paradox Development, and Ratbag Games.

Midway continued to face financial hardship, with the company losing millions of dollars on sales in both 2006 and 2007. Afterward, the company began to finance its business with debt offerings. In February 2009, Midway filed for Chapter 11 bankruptcy. By May, Midway had received a takeover bid from Warner Bros. for approximately $33 million. On July 10, 2009, Warner Bros. purchased the majority of Midway's assets for $49 million. In August 2009, Midway's San Diego studio was purchased by THQ for $200,000. As of 2012, Midway's Chicago studio still exists as part of Warner Bros. Interactive Entertainment. It was rebranded NetherRealm Studios in June, 2010.

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Midwest Gaming Classic (MGC)

With its origins in a convention for fans of **Atari**'s last console, the **Atari Jaguar**, the Midwest Gaming Classic (MGC) was cofounded by Dan Loosen, Gary Heil, and Marty Goldberg in 2001 in the basement of Milwaukee's Boy Scout Center. From those humble beginnings, it has grown to become one of the largest fan-based electronic entertainment trade shows in the **United States**, drawing large crowds domestically and internationally.

Loosen, Heil, and Goldberg first teamed up for the Milwaukee, Wisconsin-hosted Jagfest 2K1, where they opened the formerly closed Atari-only format to one more inclusive of the **industry** fan base. When Jagfest moved on to be hosted in another city the following year, they decided to keep the format going under Midwest Classic and expand even further to include pinball as well. A formal name for the show was finally found after a contest to name it was held, with the winning name picked by future **modding** celebrity and fellow Wisconsin native Ben Heckendorn. The name change was joined by the final formula for the show: not intended to denote a "retro" orientation, the "Classic" in the title instead refers to the fact that any game can be considered a classic to someone. Whether released last week or 30 years ago, the games the MGC celebrates span the entire electronic entertainment industry from past to present.

Currently organized as a two-day show staffed entirely by volunteers, the MGC features a unique combination of events, contests, industry speakers, vending, and more from four main areas: **console-based games**, **computer games**, **arcade games**, and pinball. Being so close to Chicago, once the Mecca of the pinball and arcade industry, the MGC is particularly known for its strong community support in the area, which regularly features more than 200 pinball and coin-operated **arcade** machines, all on free **play**. The MGC also features the only known fully playable museum with an entire wing dedicated toward having every console and personal computer from 1972 to present on display, including imports, all coordinated by Goldberg and diehardgamer.com's J. D. Norman.

Martin Goldberg

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military use of games

The military use of games includes **simulations** for training, propaganda and recruitment, and gamelike **interfaces** that correspond to actual events or material. They typically, although not always, feature first-person perspectives, realistic physics, tactical information (the user's position on a **map**), and, increasingly, photorealistic **graphics**.

Militaries have primarily used games for training. This started with simple, networked 3-D **spaces**, such as the **U.S.** Army's *Panzer* (1977); various simulators developed by Ralph **Baer** in the late 1970s; *Military BattleZone* (also known as the *Bradley Trainer*), which was commissioned in 1980 and developed from **Atari's *BattleZone***; and SIMNET's *Close Combat Tactical Trainer* (1983–1990) (Halter, 2006). The 1990s saw the rise of aircraft, tank, infantry, and even maintenance simulators that were much more **immersive**. Training simulations are now widespread and can in some cases include **war** games that take place in entirely virtual realms or that integrate virtual elements with physical elements such as vehicles, aircraft, hired actors, and special effects such as injuries and pyrotechnics. Combat and surveillance operations have also been conducted through gamelike interfaces (light pens, **joysticks**, keyboards, televisual displays, etc.). Famous early examples are 1953's Project Whirlwind (Redmond and Smith, 2000) and 1966's Operation Igloo White (Halter, 2006). Current and upcoming uses of gamelike interfaces include systems for remote-controlled aircraft, submersibles, and robotic ground vehicles.

More recently, video games have been used for propaganda and recruitment purposes. The most notable example is the U.S. Army's *America's Army* series (2002, 2003, 2005, 2007, 2009), a free to download first-person **shooting game**, which is intended to promote the mission and values of the U.S. Army. A countervailing example is Hezbollah's *Special Force* series (2003, 2007; *see* **Middle East**). There are also nonsanctioned consumer games that are criticized for promoting the mission or cultural cachet of militarism generally and often the U.S. military in particular (Nieborg, 2006).

Although video games and military technologies have always been intertwined, this relationship has evolved in recent years to feature even more fully integrated goals, technologies, and personnel, such that it has warranted some analysts to refer to this relationship as the military-entertainment complex. Proponents argue that this nexus can reduce casualties and overall costs. Critics argue that simulations cannot effectively replicate combat, there may be antidemocratic implications to media industries directly profiting from war, and making war more virtual decontextualizes and inoculates against its destructive effects (Der Derian, 2009; Stahl, 2010).

Kyle Kontour

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Milton Bradley Vectrex

See GCE/Milton Bradley Vectrex

minigames

A minigame typically refers to a game nested or situated within another game of comparatively larger scope. Given their small nature, a minigame will often privilege one mechanic in the pursuit of having a player achieve a "parent" game's tertiary or voluntary goals. For example, *BioShock* (2007) features machines throughout the game's environment that require a player to hack their circuits should the player desire to compromise them. To hack circuits requires a player to play a game in which tiles are reorganized on a two-dimensional plane to reroute the passage of fluid in a timely manner. Successful completion of this minigame results in a successful "hack" and a situational advantage, the disabling of security.

Minigames such as these are often contextually situated in their "parent" game and thus represent a larger action in-game (such as **hacking**, travel between locations, completing a show of strength, and so on) that may or may not be required for progression along the parent game's critical path. A famous example of a "noncritical" minigame is the card game Pazaak in *Knights of the Old Republic* (2003). This card game can be played in nearly every major city in the game and allows the wagering of in-game credits on the outcome but has no effect on the end-game. Some games such as *Yohoho! Puzzle Pirates* (2003), *Rayman Raving Rabbids* (2006), and *WarioWare* games use a collection of minigames as the basis of their overall gameplay. The minigames in these collections can range in general **narrative** cohesiveness but such compilations typically employ a consistent theme, aesthetic, or presentation style.

Minigames also often encapsulate **unlockable games** that might be bonuses or **Easter eggs** achievable by a player. This would include such minigames as the "dream sequences" that can be unlocked in *Daxter* (2006) for **PlayStation** Portable. Such sequences allow the player to **play** through a series of Daxter's dreams between main missions. These sequences tend to use simplified mechanics, most typically quick-time events (matching on-screen button press patterns within a set **time** limit). Quick Time Events, made famous in games such as *Shenmue* (1999), are often considered to be reflex-based minigames in and of themselves. Unlockable minigames might also be previous full versions of games. For example, in *Ninja Gaiden* (2004) for the **Microsoft Xbox**, collecting enough scarabs and bringing them back to a store vender allows a player to play the original 8-bit version of *Ninja Gaiden* on an in-game **arcade** machine.

Finally, minigames are also deployed seasonally in a number of **massively multiplayer on-line role-playing games (MMORPGs)** such as *Guild Wars* (2005), in which events such as "Rollerbeetle Racing" allow players to play a simplified **racing game** against other players in pursuit of attaining in-game bonus items and points toward prestige-based titles. It is not uncommon to find small games that live outside of larger games to also be referred to as minigames. Such games usually only require a small investment of gameplay time to achieve the game's primary end state (for example, timed games that measure a player's high score such as Ferry Halim's *Hydrophobia* [2001] and *Bubble Bees* [2001] at www.orisinal.com).

Nis Bojin

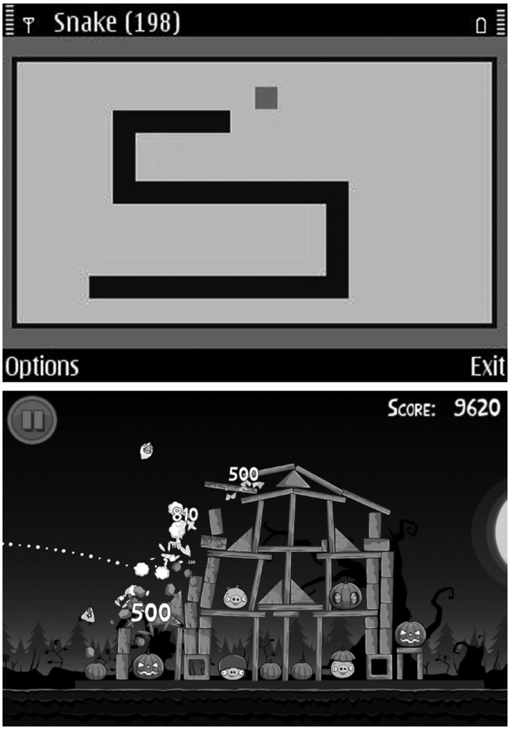
MMORPGs

See massively multiplayer on-line role-playing games (MMORPGs)

mobile games

Mobile games are games designed to be played on mobile phones or similar portable digital devices. Games designed for **handheld game consoles** are, however, generally not considered to be mobile games in this sense of the term. As media convergence and integration of technologies into small, multipurpose devices continues, games will move more freely from the screen of one device to another, and consequently it is likely that the term "mobile games" will grow even fuzzier in the future.

A mobile phone is effectively a small, network-enabled computer that users trust and carry around with them. Thus, the potential for original, on-line, and context-aware games implemented for mobile phones appears great, particularly considering that the number of mobile cellular subscriptions passed the six billion mark in 2012. Games have yet to reach that potential, however, and the most popular mobile game for over a decade was *Snake*, a simple **arcade**-style action-puzzle game, which has been included with Nokia handsets since 1997. As of 2012, the most popular mobile game of all time is *Angry Birds* (2009), which based its great success on innovative use of touchscreens. Technological restrictions, such as small screens and cramped keyboards, have kept mobile game design from reaching full maturity. Other



Snake (Nokia, 1997) [top] and *Angry Birds Halloween* (Rovio, 2010) [bottom]. (Frans Mäyrä)

challenges include the technological fragmentation of the marketplace, which limits business opportunities and the possibility of original or independent mobile games. Yet mobile **game design space** has nevertheless greatly expanded during the recent years, despite the lack of mobile broadband connectivity for many mobile phone users.

Platform fragmentation is another issue that has slowed the evolution of mobile games: differences in software and hardware can require game developers to implement hundreds of release versions of a game to reach a critical mass of customers. The mobile operators' role as gatekeeper is another source of fragmentation: customers usually get new games through their operator's portal (the "carrier's deck"), and consequently individual arrangements with numerous operators need to be made to have a wide distribution for a mobile game.

Several distinct mobile game ecosystems are currently in existence, each grown on top of a certain technology platform. The most popular systems include Java ME, Qualcomm's BREW, and dedicated smartphone operating systems, such as iPhone OS, Palm OS, Symbian OS, and Windows Mobile. Currently Java is the most open environment for a mobile game developer, whereas developing a native Symbian, iPhone, or BREW application involves going through a more strict screening and licensing procedure with the handset manufacturer, distributor, or operator. Online digital distribution is gradually opening up, and with a mobile web browser, it is possible to download and install Java game applications. Dedicated on-line "application stores" have also been released for different platforms, including Apple's App Store for iPhone, Nokia's N-Gage and OVI services, Blackberry App World, and Google's Android Market.

Many mobile games still look like scaled-down versions of established video games and game genres. Mobile **casual games** are a natural option for developers implementing gaming entertainment that is consumed in short breaks while commuting or otherwise filling in **time**. Many successful games are specifically designed to make best use of mobile phone **interface**, including using a simplified control scheme, and enjoyable and varied gameplay is possible using only one push button (Green, 2005). However, research and development done for mobile games goes beyond video games formulas and aims at exploiting the unique opportunities provided by mobile devices. Such "truly mobile games" include location-based games or games that otherwise exploit context awareness and thus can be equally termed as mixed-reality, hybrid, or **pervasive games**. Games created for smartphones have also made innovative use of their integrated cameras, Bluetooth capabilities, and built-in sensors to facilitate **augmented reality** gaming. Always-on mobile data connections in contemporary mobile phones allow interesting multiplayer interactions while roaming the city streets. *BotFighters* (2000), by the Swedish company It's Alive!, was one of the earliest commercial location-based multiplayer games, relying on GSM cell locations and SMS messaging. The potentials of GPS tracking have been exploited by mixed-reality games like Blast Theory's *Can You See Me Now?* series (2001–2004) and Newtgames's *Mogi-Mogi* (2004) in **Japan**. Nevertheless, the treasure-hunting style practice of "geocaching" remains the most popular type of "truly mobile" game today.

Frans Mäyrä

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modifications (mods)

See game modifications

Molyneux, Peter (1959–)

Peter Douglas Molyneux, OBE, is an English game designer and computer programmer. Molyneux holds the rank of Officer of the Order of the British Empire and is an Academy of Interactive Arts & Sciences (AIAS) Hall of Fame inductee. He was awarded the title of Chevalier de l'Orde des Arts et des Lettres in 2007 and received an honorary Doctor of Science from the University of Southampton in the same year. He is the founder of Bullfrog Productions and Lionhead Studios. He is currently the Creative Director of Microsoft Game Studios.

Peter Molyneux's career began by running a business that sold and distributed floppy disks in 1982. Later, in an effort to increase sales, he included software on the disks, composed primarily of video games for the **Atari** 8-bit family series of home computers and the Commodore 64. The positive response garnered from the included games piqued Molyneux's interest in the gaming **industry** and prompted him to try his own hand at **game design**.

His first effort, a business **simulation game** called *The Entrepreneur* (1984), failed to find an audience and sold only two copies. Confronted with this setback, Molyneux temporarily shied away from game design. He founded a new company called Taurus Impact Systems, with his business partner Les Edgar. Taurus was set up to design office database systems.

Due to a syntax error, Commodore International mistook Taurus Impact Systems for a more established company called TORUS. From this oversight, Molyneux's company obtained a contract with Commodore to redesign a database system for the *Amiga* computer. Commodore supplied Molyneux with eight Amiga systems to facilitate the redesign. The database program went on to become a financial success and allowed Molyneux and Edgar the capital they needed to found their own gaming company, Bullfrog Productions.

Under the management of Molyneux, Bullfrog Productions produced 10 games over the course of as many years (1987–1997). Molyneux's software credits at Bullfrog include *Fusion* (1987), *Populous* (1989), *Powermonger* (1990), *Populous II: Trials of the Olympian Gods* (1991), *Syndicate* (1993), *Theme Park* (1994), *Magic Carpet* (1994), *High-Octane* (1995), *Genewars* (1996), and *Dungeon Keeper* (1997). *Populous* stands as Bullfrog's most successful title and is regarded as the first computer "**god game**." In 1994, Molyneux became vice president of Bullfrog's Publisher, **Electronic Arts (EA)**, which acquired the studio and a significant share of the company in 1995. Molyneux left Bullfrog Productions in August 1997 to start Lionhead Studios.

Molyneux spent three years and $6 million dollars of his own money developing Lionhead's first title, *Black & White* (2001), a god game that combined elements of action, **strategy**, and artificial life. The title received critical praise for its programming ingenuity and game mechanics. Additional titles Molyneux designed at Lionhead Studios include *Fable* (2004), *Fable: The Lost Chapters* (2005), *The Movies* (2005), *Black & White 2* (2005), *The Movies: Stunts & Effects* (2006), *Black & White 2: Battle of the Gods* (2006), *and Fable II* (2008). *Fable* was the first game developed by Big Blue Box, a satellite studio of Lionhead Productions. The game was published by Microsoft and was available on IBM PC, Mac OS X, and the **Microsoft Xbox**. *Fable*'s sequel, *Fable II* was released exclusively for the **Microsoft Xbox 360**. Microsoft Game Studios acquired Lionhead Studios in April 2006.

In June 2009, Molyneux was promoted to Creative Director of Microsoft Game Studios. In March 2012, Molyneux announced plans to will leave Lionhead and Microsoft and work at 22 Cans, a company started by former Lionhead CTO Tim Rance.

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morality and ethics

Morality and ethics are closely related and overlapping concepts, often used interchangeably. However, morality tends to concern itself with standards and conduct, whereas ethics focuses more on systems and processes. Put simply, morality addresses the *content* of right and wrong, whereas ethics addresses the *way* in which right and wrong are determined. For decades, many theorists and researchers have debated the meaning of morality and ethics in video games. Some argue that video game **play** is of little moral consequence or influence in the lives of those who play them, but others contend that video games can and do affect the moral development of players.

Matt McCormick (2002) and Ren Reynolds (2002) suggest that the ethical assessment of video games should stem from the historic questions of moral philosophers: Aristotle (virtue ethics): What produces virtuous character? Can video games produce virtuous character? Does participation in simulated **violence** erode players' moral character or hinder players' flourishing and fulfillment? John Stewart Mill (utilitarianism): What causes the most harm or the most good? Do the consequences of video game play produce more harm or more good? Immanuel Kant (deontology): What is one's highest duty or moral obligation? Does video game play hinder players from performing those duties and obligations? Can video game play assist players to perform those duties and obligations in some way?

Many educators and psychologists argue that video games too often hinder the moral development and behavior of those who play them. Eugene Provenzo's *Video Kids: Making Sense of Nintendo* (1991) offers the first formal assessment of morality and ethics within video games, specifically **Nintendo Entertainment System (NES)** video games. Provenzo argues against the alleged neutrality of video game media. He contends that an alarming number of video games sponsor a curriculum of violence and sexism. Provenzo expresses particular concern about the deterministic influence that video games can have on children. Later, the American Psychological Association (APA) passed a "Resolution on Violence in Video Games and Interactive Media" (2005) condemning the violent, racist, and sexist influence of video games. The APA recommends a strategy of media literacy **education**, industry self-regulation, and the development of a more accurate, content-based rating system. In particular, the social science research of Craig A. Anderson, Douglas A. Gentile, and Katherine E. Buckley (2007) supports the APA's resolution. Their work links violent video game play with verbal and physical aggression, both in the short and long term. Anderson and his colleagues aspire to limit negative media effects on those who play video games. In summary, Provenzo, Anderson, the APA, and others argue that many video games exert an *immoral* influence on players.

In contrast, other researchers argue that video games can exert a *moral* influence on players. For example, Henry Jenkins proposes that critics take a more moderate view of media effects and the moral influence of video games. He discounts the deterministic perspective that violent video games must exert a negative influence on seemingly passive video game players. Instead, he maintains that violent video games constructively offer adolescents "a fantasy of empowerment" and "a fantasy of transgression, a chance to test the limits of their parent's culture" (Jenkins, 2000). In other words, video games provide players with a **platform** for expressing their feelings and working through their life concerns. Jenkins builds his argument on a humanistic perspective that video game players are free to engage in ethical reflection on the games that they play. He suggests that video game play is an active process in which video game players construct their own meanings. Similarly, Miguel Sicart (2009) argues that video games contain embedded values with which players may freely interact. To Sicart, video game players are moral beings who bring their own perspectives to bear on game play. Thus, he maintains that video games can empower players to develop a deeper capacity for ethical reasoning and reflection skills. Sicart suggests, however, that when video games measure and evaluate the players' ethical choices, the games tend to limit the moral development of those who play them. He argues that when video games explicitly reward in-game moral behavior, then that behavior becomes a strategy to win instead of an expression of ethical reflection. Sicart is a proponent for the kind of video game design that allows players the freedom to express their own values with authenticity and to shape virtual **worlds** in that light. In summary, Jenkins and Sicart argue that video games present players with a playful opportunity for ethical reflection and moral expression.

Mark J. P. Wolf (2003), Ian Bogost (2007), Harry J. Brown (2008), and Lars Konzack (2009) each argue that increased complexity in **game design** is indispensable if video games are to sponsor ethical reflection and moral thought. For example, Bogost suggests that video game procedures and rhetoric must present players with moral ambiguities which can elicit ethical reflection. However, Brown contends that most video games inevitably shield their players from difficult ethical dilemmas by situating moral decisions within simplistic categories of good and evil. Wolf also suggests that video games will remain unable to achieve ethical and moral depth until they elicit deep emotions and feelings from players. Konzack calls for open-ended video games within which players can experiment with and explore a variety of ethical processes and moral values.

In 1976, Exidy's **arcade game** *Death Race* gave players 99 seconds to run over elusive pedestrians in the style of a demolition derby. Dead pedestrians screamed as they were replaced by tombstones. The monochrome graphics were relatively simple. The game described the pedestrians as "gremlins." Nevertheless, *Death Race* is remembered as the first video game to arouse public moral outrage.

In the 1980s, video games saw innovations on both ends of the moral spectrum. In 1982 and 1983, Mystique published a trio of self-described "adult video game cartridges" for the **Atari VCS 2600**. The most notorious of the three is the simplistic *Custer's Revenge* (1982), in which the **player-character** dodged a hail of battlefield arrows before raping a bound female Native American. In contrast, Origin Systems published the innovative computer **role-playing game** *Ultima IV: Quest of the Avatar* (1985), in which players assumed the role of a hero in search of moral perfection. Along the way, the computer kept track of players' progress in each of eight virtues.

The 1990s stand out as a decade in which graphic violence in video games led to industry regulation. For example, **id Software** popularized the first-person shooter with its *Wolfenstein 3D* (1992),

Doom (1993), and *Quake* (1996) franchises. In 1992, **Midway Games** launched its ***Mortal Kombat*** franchise. The year 1994 heralded the establishment of the **Entertainment Software Rating Board (ESRB)**, a self-regulatory body that established general guidelines for labeling video games in terms of violence, profanity, and sexual content. As public concern about video games reached acute levels, the 1990s ended with the Columbine High School shootings in April 1999, which were blamed in part on the violent game play of *Doom*. Some critics contested this link (Jenkins, 2000).

More recently, moral ideas and ethical processes have moved closer to the forefront of video game design. The role-playing game *Deus Ex* (2000) engages players in critical ethical reflection on the moral implications of terrorism. Peter **Molyneux**'s real-time **strategy game** *Black & White* (2001) casts players in the roles of fledgling deities who shape the moral development of worshipful tribes through acts of divine benevolence and tyranny. The year 2001 also saw the release of the third game in the ***Grand Theft Auto* series**, a role-playing game in which players explore the relative degrees of morality within urban gang life. In 2002, the **Serious Games** Initiative began to issue proposals for video games that addressed global, social, and ethical issues. The year 2002 also introduced the first-person shooter *America's Army: Operations*—a strict military simulation that replicates the moral practices and ethical processes of serving in the **U.S.** Army. The **role-playing game** *Star Wars: Knights of the Old Republic* (2003) incorporates the moral contrast between the light side and dark side of the Force throughout gameplay. Another role-playing game, *BioShock* (2007), confronts players with a **narrative** series of ethical dilemmas and moral choices that reflect the philosophical framework of Ayn Rand.

See also censorship; education (religious); Entertainment Software Rating Board (ESRB); god games; spirituality.

Mark Hayse

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Mortal Kombat

Mortal Kombat is a **fighting game** developed by **Midway** Manufacturing. Designed by Ed Boon and John Tobias, it was released in arcades in 1992. *Mortal Kombat* was developed as Midway's response to **Capcom**'s highly successful ***Street Fighter II*** (1991). Although it brought some changes to the established fighting game mechanics—such as a dedicated "block" button or the ability to "juggle" the helpless opponent in the air with well-timed successive hits—it became famous primarily for its gratuitous, over-the-top **violence**. Not only would well-placed blows send geysers of blood across the screen, the game also introduced the concept of "fatalities"—spectacularly gruesome finishing moves. At the conclusion of the fight, while the weakened opponent swayed in stunned stupor, a special combination of **joystick** moves and button presses would unleash a character-specific deadly attack. These included the ability to decapitate, incinerate, or electrocute the rival. In addition, *Mortal Kombat* used digitized **graphics**, which, at the time, appeared highly realistic, especially compared with the cartoonish style of other contemporary fighting games.

Following the game's success in the **arcades**, *Mortal Kombat* was ported by Acclaim Entertainment for home **consoles**, **handhelds**, and home computers. The home console versions were released on September 13, 1993 ("Mortal Monday"), to the accompaniment of a $10 million **advertising** campaign—at the time, the most expensive promotional effort by an independent publisher. Flung into the public eye, the game instantaneously sparked great controversy. Even as some stores refused to carry the title, sales boomed and *Mortal Kombat* went on to become the best-selling game of the year.

Different ports of the game replicated the arcade original with varying degrees of faithfulness. Notably, the **SEGA** versions retained all the violence and gore, although the **Genesis** and Game Gear editions required the player to enter a **cheat** code to unlock these features. **Nintendo**, however, in keeping with its family-friendly policy, refused to allow the game on its systems unless a number of changes were made. Thus, the **Super Nintendo Entertainment System (SNES)** port replaced blood with gray "sweat" and removed or considerably toned down the fatalities (renamed to "finishing moves"). As a result, the game became a significant factor in the battle for market dominance between Nintendo and SEGA, with the "uncensored" Genesis version massively outselling the SNES one.

The **SEGA CD** edition also played a major role in the 1993–1994 **United States**

Senate hearings on video game violence that led to the formation of the **Entertainment Software Rating Board (ESRB)** and the creation of the video game rating system. Ironically, the hearings, during which *Moral Kombat* was held up as one of the prime examples of the game industry marketing mature content to minors, generated much additional publicity for the game, accelerating the already strong sales. As a sardonic commentary on the controversy, *Mortal Kombat II* (1993) supplemented the fatalities with "babalities" (turning the defeated fighter into an infant) and "friendships" (offering the opponent a token of friendship). Interestingly, the SNES version of *MKII* reproduced all the gore present in the arcade original.

The game spawned a number of sequels across all major gaming platforms, as well as three action-adventure spin-offs. It was adapted into two feature **films**, *Mortal Kombat* (Paul W. S. Anderson, 1995) and *Mortal Kombat: Annihilation* (John R. Leonetti, 1997). It also inspired the live-action series *Mortal Kombat: Conquest* (1998–1999), the animated series *Mortal Kombat: Defenders of the Realm* (1996), as well as a novel, several **comic books**, and a trading card game.

P. Konrad Budziszewski

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motion capture/motion control

Also designated as "motion tracking" or commonly "mocap," motion capture is the process of capturing and recording movements from a real, physical actor or element and then using the translated data to control a digital model. The movements are recorded or restituted in real **time** through other digital systems as three-dimensional data. This technique helps give an illusion of life to three-dimensional models or **avatars** by reproducing natural movement, complete with secondary motions that would be difficult to animate realistically by hand. Motion-tracking technology was initially developed in the medical world and by the military in the 1970s. During the 1980s, the field began to be combined with that of computer imagery as the technology's potential was explored, and in the 1990s mocap technology was progressively applied in **film** production.

Since the 2000s, motion capture applications have been used in video games in which three-dimensional **graphics** are involved, in **television** shows in which virtual settings include digital characters animated by real actors, in professional sports for performance analysis, or in the **art** domain from experimental dance or theater to digital puppetry. As current video game **consoles** offer significant processing power, players have come to expect believability and character models that accurately reflect their human movements and behaviors. Because of the need to record human movement, actors, stuntmen, and martial artists from the film **industry** have taken on roles in video games, and when motion capture includes face and fingers and records subjects' subtle expressions, it is sometimes referred to as "performance capture."

Three types of mocap systems are used in the entertainment industry: optical, magnetic, and electromechanical. Optical systems were primarily designed for medical applications (orthopedics, rehabilitation, traumatology, and, mostly typically, **biomechanics**) and usually involve four to 32 cameras controlled by a computer. Capture subjects wear markers that can either be reflexive (passive) or light emitting (active). Passive markers are usually spherical or circular and attached to the subject's skin or to a full-body mocap suit made from elastic materials. Cameras in a passive marker system are equipped with light-emitting diodes (LEDs), and the passive markers reflect their light. On the other hand, active markers are themselves LEDs. Some active systems make markers illuminate one at a time to avoid any identification problem, whereas others activate markers all at once, modulating the amplitude or frequency to identify markers. Optical mocap systems have accurate data and a high capture rate and allow a large number of markers on different subjects. Their postprocessing, however, is extensive, markers can be occluded (resulting in loss of data), and lighting must be controlled during capture sessions.

Electromagnetic motion capture systems are sometimes called magnetic trackers. They descend from the sensors placed on military aircraft pilot's helmet to track the pilot's head position. Magnetic systems are usually smaller than optical mocap systems and are less expensive. Position and orientation are available without post-processing, and they also have the advantage of allowing feedback through real-time applications. Tracking sensors are prone to interference, however, and their wiring and batteries also limit the subject's movements.

Electromechanical mocap systems, such as exoskeletons and data gloves, are articulated devices that directly measure joint angles on capture subjects. They work in real time and are relatively inexpensive, they are free of occlusions or electro-magnetic interferences, and they are highly portable. The disadvantages of electromechanical mocap systems are that they restrict capture movements, have fixed sensors or configurations, are breakable, and offer low sampling rates.

When motion-tracking is integrated into a cybernetic system that manifests change through feedback and **adaptation**, some control over that system becomes possible. The capture of finger and hand movement enables computer use, as in the case of the keyboard and the mouse. From classic **joysticks** and control pads to more sophisticated game **controller** devices, the video game industry has integrated a wide variety of motion-control devices into its systems.

In November 2006, **Nintendo** released the **Wii** Remote, a vertical control pad coupled with a duo of built-in accelerometers and infrared detection. The Wii bundle retail package also included the Nunchuck, which features an accelerometer, a traditional analog stick, and two trigger buttons.

The Wii MotionPlus expansion device of June 2009 granted a more accurate capture of complex motion and brought motion rendering close to real time. These devices allow position detection in three-dimensional space when directed at the Sensor Bar, which is, in fact, not a sensor but an infrared LED inductor allowing the controllers' triangulation.

Four years after Nintendo's Wii Remote, **Sony**'s **PlayStation** Move appeared in 2010, with its own duo of main motion controller and subcontroller. The device offers a set of small buttons similar to the ones found on the PlayStation Dual Shock control pad, and its main controller suggests a magic wand crowned by a glowing orb. The sphere is an active LED marker that emits colored light along a spectrum to contrast with its environment and allow position detection by the PlayStation Eye. The camera also adds a location-tracking feature and some visual recognition capability to a magnetometer, a combination that prevents confusion when the device is pointed off the TV screen or when the eye of the camera is blocked. As with the Wii Remote, PlayStation Move motion sensing is also based on accelerometers and Bluetooth information exchange with the console.

Microsoft joined the trend toward motion control through a controller-free entertainment system consisting of an add-on **peripheral** for the **Microsoft Xbox 360**: the Kinect. A camera projecting infrared light senses depth, and its sensors enable it to see in three dimensions under ambient light conditions, allowing software to perform advanced motion recognition, facial recognition, and voice recognition. The system creates a direct interaction between the users and the console through a natural user **interface**, spoken commands, or presented objects and images, eliminating the need for a handheld game controller.

Vincent Mauger

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motion control

See motion capture and motion control

MUDs

See multi-user domains (MUDs)

Multiple Arcade Machine Emulator (MAME)

The Multiple Arcade Machine Emulator (MAME) is an **emulator** application specifically aimed to emulate **arcade games**. MAME's official website states that it is a nonprofit organization with two main purposes: **education** and preservation. MAME is particularly useful for the study of arcade games, many of which are now difficult to find or no longer exist at all.

The first version of the MAME software was developed by Nicola Salmoria in 1996. By 1997, 346 games were supported by the application, and by 2008, there were 3,910 unique games emulated. MAME is an open-source project, which means that the code is **accessible** to every user who wants to work with it. Its license, however, still restricts any commercial usage of the code and the emulation of recent games. The philosophy behind MAME is to give access to games without competing with the arcade games that are still being sold by companies, and the license makes sure that this line of thought is respected. Furthermore, because each arcade game is unique, new versions of the software can change in such a way that previously supported games are not supported anymore. The MAME developer team supports DOS and Windows operating systems, although it has been ported to Mac OS and UNIX. As of April 5, 2011, Angelo Salese was the MAME coordinator.

Because the software is made of code, games can be charged in the application within the command lines; therefore, access may be difficult for the common user. However, MAME can be used with “front-end” applications, which offer a more user-friendly **interface** for the loading of games. Some, like *Arcade 3D*, depict a three-dimensional **arcade** environment, with virtual arcade machines. Others are more like an application menu, similar to an average emulator interface.

Not every arcade game is easily and legally available to a common MAME user. Some arcade games are distributed willingly by the owner of the copyright on the application’s or game developers’ websites within a noncommercial license, but for most of the games, the read-only memory (ROM) and basic input/output system (BIOS) parts are under copyright. The MAME website suggests creating ROM files directly from original printed circuit boards of arcade games with a hardware ROM reader.

Even though playing the games is necessary to test the emulation success or failure, it is only considered a “nice side effect” of the MAME project and is not its main goal. According to this line of thought, new features permitted by the newer operating systems, such as playing multiplayer games on-line or **modifications** to make games easier to use are not implemented in the official versions and are discouraged by the main team for third-party developers.

The preservation aspect of the MAME project is aimed at the video games themselves, the original context of gaming being necessarily omitted. However, fans and amateur archive curators build homemade MAME cabinets to recreate the original gaming interfaces, with **joysticks** and buttons. Although museums and galleries have made some effort to preserve arcade cabinets and games, it is often not easy for the common user to access them. Even for game historians and researchers, MAME is often the only way to play certain arcade games.

Simon Dor

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multi-user domains (MUDs)

Multi-user domains (MUDs), also known as multi-user dungeons or multi-user dimensions, are on-line **worlds** in which multiple users can interact together simultaneously, usually through text (MUDs differ from **bulletin board systems (BBSs)** because of their real-time nature). Although many MUDs are not games, their structure, which allows multiple-user interaction in real time, were sometimes used to build games, and these games became the starting point for the development of **massively multiplayer on-line role-playing games (MMORPGs)**.

In 1978, Essex University student Rob Trubshaw wrote the first MUD, *Multi-User Dungeon*, on a DEC PDP-10 mainframe computer. Trubshaw turned the program over to fellow student Richard Bartle who continued developing it, and in 1980 it became the first on-line **role-playing game** when Essex University became connected to ARPAnet. Other MUDs followed during the 1980s, including AberMUD (1987), TinyMUD (1988), LPMud (1989), and DikuMUD (1990). Many of these had "descendents," other MUDs that were variations using the same or modified software. A MUD in which object-oriented **programming** is used is called a MOO (MUD, Object-Oriented), and other terms playing on the original "MUD" also appeared, like MUSH (Multi-User Shared Hallucination) and MUCK (Multi-User Construction Kit). In some MUDs, like TinyMUD, users could build on to the MUD, adding rooms, although some MUDs only gave advanced users these capabilities.

As MUDs grew in popularity, some were set up as commercial **on-line games**. In 1983, Alan E. Klietz ported his game *Milieu* to an IBM XT and renamed it *Sceptre of Goth*, making it the first commercial MUD in the **United States**—and an influence on many other commercial MUDs that followed. The game combined single-player text **adventure games** with the *Dungeons & Dragons* (1974) tabletop game, resulting in a fantasy-themed text adventure world that up to 16 simultaneous users could play together. Around the mid-1980s some MUDs appeared that used **graphics**, like *Islands of Kesmai* (1985), which appeared on CompuServe, and Lucasfilm's *Habitat* (1986). Although mostly text-based, *Islands of Kesmai* included a small, scrolling graphical representation of a portion of its game world made from ACSII characters (for example, "[]" represented a wall, a backslash "/" represented a door, and alphabet letters represented the positions of player-characters). *Habitat*'s graphics were larger and pictorial, with **avatars** that looked like cartoon characters and rooms that cut screen to screen.

With the rise of home computers and more and more players coming on-line, the demand for **on-line games** grew, and after the appearance of large-scale graphical-based on-line role-playing games (beginning with *Meridian 59* [1995]) that could handle thousands of players, the majority of on-line RPG players moved to the increasingly larger worlds offered by MMORPGs. However, despite the popularity of MMORPGs and graphical games in general, an audience for MUDs still remains. As of early 2012, the MUD Connector website listed information on 1,203 MUDs, many of which can be still played on-line.

Mark J. P. Wolf

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music

See audio; sound

music games

See rhythm and dance games

Myst

Cyan's *Myst* (1993), a point-and-click **adventure game**, held the title of best-selling video game of all time from 1993 until 2001, when it was passed up by ***The Sims*** (2000). Not only was *Myst* responsible for a flood of imitations in the years that followed its release, it was also the game that inspired the sales of computers with CD-ROM drives, promoting the advance of **CD-ROM-based** games in general. *Myst* raised the bar for **graphics** (considered photorealistic at the time), **world** building, deep-**space** staging, location-based ambience, and **immersive** gameplay and was a crossover game appealing to men and women and audiences of all ages.

Myst's world was made up of more than 2,500 screens of pre-rendered three-dimensional graphics, representing the views of Myst Island and several "Ages" or lands that players traveled to through the use of linking books, which acted as portals from one location to another. With an unhurried, contemplative pace, players began on Myst Island with no objective other than exploration and learning how various machines worked. As players connected clues, they gained access to new locations, where details would reveal further information pertaining to the storyline embedded in the game. The locations also contained red and blue pages that could be collected and deposited in the Myst Island library, where two characters, Sirrus and Achenar, addressed the player from books, revealing more information about their situation and that of Atrus, their father. In the end, having collected information and pieced together the story of what had happened, players were faced with making a final decision that would determine which one of four endings would occur. Many of the puzzles in *Myst* were environmental in nature, requiring an understanding of the game world's geography, with actions that sometimes had consequences occurring in another area of the game. *Myst* was designed to take about 40 hours of playing to be solved.

Myst's success was followed by three novels, a board game, and a series of sequels, including ***Riven*** (1997), *Myst III: Exile* (2001), *Uru: Ages beyond Myst* (2003), *Myst IV: Revelation* (2004), and *Myst V: End of Ages* (2005). *Myst* would twice undergo revision and rerelease, appearing with enhanced graphics and **sound** and a "DigitalGuide" hints feature as *Myst Masterpiece Edition* (1999), and as *realMYST* (2000), which rendered its three-dimensional graphics in real-time as the player's point of view moved smoothly through its spaces and for which new models of everything were generated using the original *Myst* models for reference. Finally, *Myst* was rereleased again as part of the *Myst 10th Anniversary DVD Edition*. Today, *Myst* remains an influential game both in the adventure game genre and in the **history of video games** in general, showing that games need not be fast-paced or **violent** to be successful.

Mark J. P. Wolf

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N

Namco

In 1955, Masaya Nakamura set up the Nakamura Manufacturing Company to operate and maintain two secondhand coin-operated mechanical horse rides for children in the roof garden of a department store in Tokyo, **Japan** (Kent, 2001, p. 74). The company, the name of which was shortened to Namco, grew in the next two decades and manufactured and operated its own coin-operated amusement rides (Kohler, 2005, p. 15). Its foray into the video game **industry** began when **Atari** started shipping ***PONG*** (1972) machines outside of the **United States** in 1973. Atari opened up a Japanese branch to oversee importation and distribution of its **arcade games**, and Namco was among its Japanese clients. Because of market difficulties, the independently operated Atari branch was sold off to Nakamura in 1974, and Namco became Atari's chief distributor in Japan.

Atari's first major hit in Japan came in 1976 when Namco began distributing *Breakout* (1976). Wildly successful, *Breakout* became the subject of a counterfeiting ring operated by the Yakuza. A disagreement between Nakamura and Atari's Nolan **Bushnell** on how to respond to the illegal machines resulted in Namco terminating its relationship with Atari to go into business for themselves (Kohler, 2005, p. 77).

In 1979, Namco employee Toru Iwatani set out to make a nonviolent game centered around eating. Drawing his lead character from a pizza with a slice removed, and his enemies from cute ghosts designed to appeal to women, Iwatani and his nine-man team created a game about eating dots in a maze. Soon, ***Pac-Man*** (1980) became Namco's first global success and marked them as forerunners in the burgeoning **arcade** game industry. Other notable Namco games of the Golden Age include *Galaga* (1981), *Dig Dug* (1982), *Xevious* (1982), and *Pole Position* (1982).

Although the company changed ownership and subsidiaries numerous times over the three decades following *Pac-Man*, the Namco name remained a fixture of the industry. Namco continued to make arcade games throughout the 1980s and ported its most successful games to home **consoles**. In the 1990s, Namco reclaimed its spot in the popular imagination by bringing its games to the **Sony PlayStation**—the arcade hit *Ridge Racer* (1993) was one of the most popular early PlayStation games. The continued popularity of arcades in Japan led Namco to continue designing arcade games in the 2000s, and established series such as *Soul Calibur*, *Tekken*, and *Time Crisis* have spawned numerous sequels. Other popular Namco game series include the quirky ball-rolling *Katamari* games, the 12 releases in the *Tales* **role-playing game (RPG)** series, and fighter pilot *Ace Combat* games.

After a 2006 merger with Bandai, the two companies became the second largest holding company in Japan. Namco Bandai continues to publish games as Namco Bandai Games, Inc.

Bobby Schweizer

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narrative

Narrative theory grew to prominence with the rise of structuralism in the early 1960s, under inspiration from Russian formalists such as Vladímir Propp. In the traditional description, a *narrative* is the structured presentation of a *story* (a fixed sequence of events) by way of a *discourse* (Chatman, 1978). It is common for narratives to present their story events in nonchronological order, and to read a novel or watch a movie generally involves reconstructing a story on the basis of the discourse presented.

In terms of *content*, narratives tend to deal with human or anthropomorphic entities that have **emotions** and beliefs. The content of a narrative is usually governed by a principle of coherence and economy in which events follow causally from each other, and we expect the narrator to mainly communicate information that is relevant to the development of the story. Some contemporary writers use narrative in a very broad sense (Bhabha, 1990) or claim that narrative structures underlie all human thought (Schank and Abelson, 1977), but for the purpose of studying video games, considering narrative in a narrow sense is more productive because it yields more precise critical tools.

The relationship between video games and narrative has been the subject of continued debate in **video game studies**. The two extreme viewpoints on the issue are commonly referred to as the *narratological* argument that games are (or should be) narratives and the *ludological* argument that games are fundamentally distinct from narratives. On the far end of the narrative side of the spectrum, Janet Murray suggests that computers and gamelike structures are a new medium for storytelling (Murray, 1998, p. 11). At the other end of the spectrum, Markku Eskelinen claims that any association of video games with narratives is fundamentally flawed because people generally have no difficulty distinguishing between narrative and gaming situations (Eskelinen, 2004, p. 36).

There is a risk that such a discussion becomes too general to be useful, but from the distinction between discourse and story, it follows that the role of narrative in games can be examined in more detail from either the perspective of game structure or from the perspective of game content.

Game Structure and Narrative Structure

In the traditional sense of the term, a narrative presents a series of fixed events. This makes it straightforward to pose the fundamental argument that because games by definition must have variable outcomes, they are always nonfixed series of events, and therefore fundamentally nonnarrative (Juul, 2001). The simplest way of dealing with this contradiction in **game design** has been to develop branching narratives as found in the *Choose Your Own Adventure* book series (Packard and Montgomery, 1979–). From a theoretical point of view, this approach requires that we extend our concept of narrative to include some element of openness and nonlinearity, which raises the question of whether a branching narrative can maintain the coherence and economy of a linear narrative. From a practical point of view, it also threatens the developer with a combinatorial explosion of branching points to give players agency.

Although some modern video games contain branching narratives, video game **history** has led to the development of two central methods through which games can retain their interactivity while still presenting a series of predetermined events. First, many single-player video games let the player complete a predefined sequence of challenges. Within the individual challenge, the player is given some amount of freedom, but by completing the game, the player will traverse an overarching predetermined sequence of events. This is the most common method for representing a linear narrative in game form. Second, *environmental storytelling* allows a game to present narrative content by infusing story elements into the physical **space** of a game or alongside the actions of the players (Carson, 2004).

Game Content and Narrative Content

In game design literature, Chris **Crawford** has made the complementary argument that current video games present players with a very restricted amount of verbs (such as "run," "jump," etc.), whereas the protagonist of a proper story has access to thousands of verbs dealing with social interaction, human communication, and so on (Crawford, 2003, pp. 165–167). Crawford implores designers to expand the range of actions available to players, but this presents several technical and design obstacles, the main one being that although it is straightforward to implement spatial movement in game **rules** and computer programming, it is extremely difficult to implement social interaction and especially human **language** using the same tools. There are three common ways of working around the difficulty of placing story content in games.

First, the traditional method for dealing with the difficulty of implementing human interaction has been not to implement human interaction at all but rather to represent it in nonplayable **cut-scenes**. Second, *The* ***Sims*** (2000) avoids the problem of human language by having characters speak the nonsensical language of "simlish," thereby leaving it to players to imagine what is being said in the game. *The Sims* is not a narrative in terms of structure, but its content (the emotional state of characters) is quite similar to the content of many narratives and is easily retold by players. Third, some of the design issues and technical problems of creating character interaction can be circumvented by using settings that limit the player's expectation toward what characters could or should do, such as dealing with a couple's marital problems in *Façade* (Mateas and Stern, 2005).

There are substantial barriers to creating games with the typical story content of human behavior and interaction that we expect from traditional narratives. These barriers, however, specifically concern single-player games; multiplayer games are an entirely different matter. By involving humans as players, multiplayer games avoid the problem of implementing human interaction entirely; from a structural point of view, multiplayer games are rarely narratives, but because such games feature humans in the first place, it is easy for players to tell a story *about* a game session. Like in the previous example of *The Sims*, this shows the importance of distinguishing between narrative structure and narrative content.

Video Games and Narratives

The caveat of using narrative theory to examine video games is that it was developed for purposes other than studying video games and therefore does not say anything about video games specifically. Narrative theory can nevertheless be used with caution by identifying what the theory does not explain to see what is unique about video games.

In **abstract** games, gameplay can provide a type of interest that is independent of narrative, while at the same time the fiction of most contemporary video games helps players understand the affordances of the underlying rule system. For example, players tend to assume that an object that looks like a car can be used for driving (Juul, 2005, chap. 5). Finally, games have a unique capacity for building an emotional connection to game events and characters by sharing a journey over the course of a game such as in Jason Rohrer's *Passage* (2007) or *Ico* (2001) or by giving players a sense of *complicity* in unpleasant events in Brenda Brathwaite's board game *Train* (2009).

The discussion of whether video games are narrative was foundational for the field of video game studies. Although the debate occasionally reemerges both in academia and in the game industry, the question is no longer one of yes or no, but one that asks which components of traditional narratives work well in video games and which work less well, how games deal with the import of material from other media, and what video games can and cannot do.

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navigation (spatial)

The graphical nature of video games, combined with the tendency toward representational **graphics**, has resulted in the concept of video game **spaces** that are like miniature **worlds**. Many games have spaces so elaborate that spatial navigation becomes an important part of gameplay. Navigation is an interaction with space itself, a space through which one actively makes choices to find one's way around. Navigation involves freedom of movement and connected spaces, the connections of which are explored and learned through navigation.

To discuss spatial navigation, we can consider spaces as being made up of spatial cells, each of which is a continuous, Euclidean space that allows noncontingent two-way movement between all possible positions within that space, all of which is contained within boundaries (which may include a barrier regulating movement into and out of the space, such as a wall or doorway; a line of demarcation, like the line between two countries on a map or between squares on a chessboard; or a technical limitation, like a screen edge or a cut to another screen). Boundaries divide up the space of a game's world for the purposes of programming it: to separate locations and events; to help players to better conceptualize the game's spaces; and to give a sense of progress and accomplishment as the player moves through, conquers, or completes parts of the game. Such breaks also allow a player to rest between levels, view **cut-scenes**, **save** games, and so on.

Spatial cells are connected together in configurations that make up a game's world. Connections between spatial cells can be navigable, visible, both, or neither. Navigable connections allow the **player-character** to *travel* from one spatial cell into another, whereas visible connections allow players to *look* from one space into another; some connections, such as windows or locked doors, may allow a player to look into a space without being able to move into it. Likewise, the navigability and visibility of connections can be turned on and off, as connections are opened and closed or locked and unlocked. Movement and visibility between two spaces can also be two-way connections, allowing access in both directions, or one-way, in which access is available in one direction but not the other (for example, one-way mirrors or surveillance monitors that show another space). Connections between spaces can also be implied, without being navigable or visible, such as spaces shown on a **map** of the game's world.

Connections between spaces can also be contingent (based on a game's state) or noncontingent (always the same, regardless of game state). Connections may also be hidden and only revealed at a later point in the game, when an object, place, or **avatar** is in a certain state—for example, if a character has a key, if the lights are on, if secret passageways are open (as in the library in ***Myst*** [1993]), or if a vehicle is summoned (as in ***Riven*** [1997]). Such connections are not contingent if they always connect to the same place; only those that change their connectivity (what they connect to) based on various game states can be said to be contingent (for example, an elevator that opens out onto different floors, depending on the position of the elevator, or the user-created portals in ***Portal*** [2007]). Mapping out all the connections between a game's spaces can be difficult because of hidden and contingent connections and spatial configurations that change over time during gameplay in which connections appear and disappear.

Spatial navigation often relies on the experiences involved in navigating physical spaces, making navigation intuitive and logical. However, spaces may be connected to themselves or to other spaces in such a way that they result in non-Euclidean structures that are physically impossible. Due to their nonintuitive nature, such spaces can complicate navigation, and games that use them often position spatial exploration as an important part of gameplay. Even single spatial cells can be connected to themselves in such a way as to become non-Euclidean; for example, the wraparound screen used in *Asteroids* (1979) forms the surface of a 2-torus—a surface with curves that violates Euclidean consistency. Spatial cells that are themselves Euclidean in nature can also be combined in ways that make the resulting overall structures non-Euclidean, like the game world of ***Adventure*** (1979). Connections between spatial cells, however, are not Euclidean or non-Euclidean in and of themselves; only the structures that result from them are Euclidean or non-Euclidean.

In some games, spaces are experienced linearly, resulting in long, gradually revealed track-like spatial cells, as in many **racing games** and rail-based **shooting games**. These spaces may require *steering*, which differs from *navigation* in that the player is merely avoiding obstacles, shooting targets, or keeping to a course or route, whereas the overall direction of movement requires no way-finding or decision making. Such track-like spaces can themselves be spatial cells that are connected into larger structures. It is also possible to have spatial cells with boundaries that are constantly changing, which means the cells themselves could be growing and shrinking, and even coming into existence and going out of existence. In such games, players would have to continually relearn spaces to navigate them; in such cases, only navigation logic may help the player make sense of a game's spaces.

Navigational logic consists of three distinct things players must learn: what spaces exist, how spaces are interconnected (through the learning of boundaries and obstacles), and how interconnections work. In games in which spaces and their connections are changing, the process can be complicated, and a game may be designed to deliberately reject navigational logic, leaving no consistency on which a player can rely. Spatial navigation can also be made difficult by lack of a map, enemy characters who passively block connections or actively attack the player, obstacles that block movement or visibility, lack of **time** to complete navigational tasks, and **narrative** sequences that interrupt exploration. Regardless of the degree to which a game employs navigational logic, navigable space remains an important part of gameplay and an essential skill needed by video game players.

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navigation (temporal)

Although most video games involve aspects of **spatial navigation**, some also emphasize temporal navigation; in these cases, players must actively control time or maneuver through temporal structures within a game. Games may emphasize temporal navigation as a core game mechanic or merely a feature of **play**. They may permit players to perform a range of actions, such as slowing time's passage within the game's diegetic **world** or reversing time to undo mistakes made during gameplay. This ability to alter time is often incorporated into the game's **narrative**, characterizing the temporal control as a "special power" of the player's **avatar** or linking it to an object found by the player.

Spatial navigation is a central element of many video games because players must typically maneuver avatars through a game **space** (as in *Super **Mario** Bros.* [1985]) or manipulate game elements to achieve predefined results (such as directing the descent of tetraminoes in ***Tetris*** [1985]). Temporal navigation games often require similar aspects of spatial movement and place an emphasis on traversals and modifications of game temporality. Perhaps the most common adjustments and manipulations of time within a game occur when the player slows time to better navigate the game space in response to enemies and other challenges. The gameplay of Remedy Entertainment's *Max Payne* (2001) employs a feature called "bullet time," which allows the player to selectively slow the movement of time (and thus the movements of enemies) within the game, allowing the player to maneuver more easily and defeat enemies during gun battles. Providing the player with the ability to slow time is not limited to specific games; software "**cheats**" may allow such functionality. In a similar vein, **Nintendo** released the "NES Advantage" **joystick** in 1987 for the Nintendo **Entertainment System (NES)**, which featured a "slow" button that slowed many NES games through a pause mechanism by repeatedly suspending and resuming games.

Games may allow (and even require) players to maneuver through the temporal structure of the diegetic game world to accomplish specified tasks. Nintendo's ***The Legend of Zelda****: The Ocarina of Time* (1998) provides players with a musical instrument that permits them to play a number of musical tunes, some of which specifically allow for temporal movement. One song allows the player to switch the game world back and forth between day and night, and another permits the player's avatar to swap between childhood and adulthood (with the game worlds for each being distinct but intertwined spaces).

Other games incorporate temporal navigation as a core game mechanic, requiring the player to actively control and manipulate the passage of time during play to successfully complete them. Ubisoft's *The Prince of Persia: The Sands of Time* (2003) uses several such temporal mechanics, which operate as special abilities the player gains related to a weapon called the "Dagger of Time." This item allows the player not only to slow the passage of time, much like earlier games, but also to reverse its passage. Thus the player may essentially rewind time within the game, allowing him or her to revert (in limited fashion) to an earlier moment within the last few seconds of gameplay. This ability permits the player to correct mistakes made during play and is similar to functions found in other titles such as Artoon's platformer *Blinx: The Time Sweeper* (2002) and Saber Interactive's first-person shooter *TimeShift* (2007).

Number None's *Braid* (2008) employs temporal navigation and manipulation in even more complex fashions, furthering the role of time as a game mechanic. Like earlier temporal navigation games, *Braid* uses a mechanic of rewinding time, and subsequent levels in the game emphasize distinct temporal behaviors and manipulations that must be used to solve puzzles, such as linking the passage of time in the game to the player's movements. In this instance, game world time moves forward when the player moves the avatar left to right in the game, pauses when the avatar stops, and reverses when movement is made right to left. Such game mechanics thus expand on existing temporal navigation games, and similar games such as *The Misadventures of P. B. Winterbottom* (2010) also explore time-based play. Given the relatively recent emergence of games that emphasize temporal navigation, it seems certain that new ones with even more complex and nuanced uses of time will appear in years to come.

Christopher Hanson

NEC PC-Engine/Turbografx-16

The Japanese NEC PC-Engine—and its American incarnation, the Turbografx-16—was the technological brainchild of engineers working at Hudson Soft. It was one of the first home **consoles** to be marketed as a 16-bit machine and has been associated with many other technological breakthroughs. Its lineup of **shooting games** and **role-playing games (RPGs)** managed to capture the Japanese market, but the console ultimately failed on the American front and was surpassed by the **Nintendo Super Famicom** in its homeland.

In 1978, the founders of Hudson Soft were introduced to entertainment software by one of their own employee, Shinji Nakamoto; the Kudô brothers saw potential in this new market and started to produce games for personal computers. The response to the first Japanese-made entertainment software was overwhelming, and in 1979 the brothers decided to focus solely on this market and rename the company Hudson Soft. A few years later, Hudson Soft had become one of the most prolific developers for the **Nintendo Famicom**, creating or adapting more than 35 titles, including *Lode Runner* (1984), *Star Soldier* (1986), and a game based on the popular manga/animé character *Doreamon* (1986). However, Hudson's engineers soon felt limited by the technological restrictions of the Famicom, and in 1985 they started to design a new machine. In 1987 Hudson brought a prototype to NEC Home Entertainment, the largest manufacturer of Japanese personal computers at the time.

The PC-Engine's processor was based on the 6502 architecture used in many personal computers and game consoles since its introduction in 1975. The PC engine version ran at 7.16 Mhz (vs. 1.79 Mhz for the NES). In the **United States**, the console was marketed as a 16-bit contender on the basis of its graphical abilities: it featured a 9-bit color palette, but most significantly, it could display the majority of these 512 colors on screen at the same time. The graphical architecture could also handle up to 64 sprites on screen at once. On top of these cutting-edge specifications, NEC and Hudson decided to introduce the notion of expandability in the console **world**: the core system had an extension bay for **peripherals**. It was created to host the very first **CD-ROM** add-on ever released for a video game system (1988). The media used—HuCards or Turbochips—held up to 2.5 megabytes of data (20 megabits). The main performance bottleneck was the relatively low working memory (8 kilobytes and 64 kilobytes dedicated to the visuals); to handle the graphically intensive CD-ROM projects, NEC released multiple System Cards (HuCards that increased the total amount of RAM available) throughout the life of the system.

Many variations of the system have been released in **Japan** and **Europe**, such as the Coregrafx and the PC Engine Shuttle; except for the ill-fated Supergrafx, these systems were essentially the same. The PC Engine Duo (1991)/Turbo Duo (1992) merged the core system, the CD-ROM and the Super System Card in the same elegant console. NEC also released a portable version of its system, the PC Engine GT/TurboExpress (1990), which had the same specifications and could run all the HuCards on an impressive 2.6-inch color screen.

The launch of the PC-Engine in October 1987 was met with enthusiasm. NEC released a few titles during the launch window, including the technically impressive *The Kung-Fu* (with sprites taking up half the height of the screen) and a port of the popular **arcade game** *Bikkuriman World* (*Wonder Boy in Monster Land*). In 1988, NEC released a faithful conversion of Irem's *R-Type* on two HuCards. In 1989, *Gunhed* and *PC Genjin* hit the Japanese market; the cute prehistoric hero of the latter would soon become the console's mascot. Because **Nintendo**'s attitude and restrictive licensing fees had generated some frustration among third-party publishers in previous years, NEC and Hudson managed to interest many smaller studios as well as established players. After a public feud between Nintendo and **Namco**, NEC was pleased to announce that the developer would bring to its console near-perfect ports of its most popular **arcade** titles, such as *Galaga 88* (1987), *Dragon Spirit* (1987), and *Xevious* (1982). In between October 1987 and January 1988, one million units had been sold.

NEC redesigned the exterior of the console and its marketing strategy for the North American region. Major gaming publications ran enthusiastic cover stories just before the expected fall 1989 launch. Despite some of the better games being adapted (*Blazing Lazers* [1989], *Legendary*

Axe [1989], and *Bonk's Adventure* [1990]), the first year's sales did not meet expectations. Moreover, the expensive CD add-on ($499.99 USD) along with its few early titles (including *Fighting Street* [1989] and *Ys Book I and II* [1990]) did not find an audience. NEC's console lacked franchises known to Americans, and most of its prime titles were made to appeal to Japanese gamers and not exported to the United States. As a result, **SEGA** quickly captured 90% of the 16-bit market in America.

From 1990 onward, many impressive ports of arcade **Shooting games** were released in Japan both on HuCard and CD format, including *Darius* (1990), *Aeroblasters* (1990), *After Burner II* (1990), *Gradius* (1991), *1943* (1991), and *Forgotten Worlds* (1992). *Gate of Thunder* (1992) and its sequel *Winds of Thunder* (1993) have reached cult status among the genre's fans. Many mecha-inspired shooters were also released (such as *Maccross 2036* [1992] and *Spriggan* [1991]) and the late port of *Sapphire*, using the Arcade Card, was an outstanding technological achievement in 1995. The console also had an extensive lineup of Japanese **role-playing games**; on top of great HuCards such as *Dragon's Curse* (1990) and *Neutopia* (1989), many game series started to use the CD format more extensively to integrate animated **cut-scenes** and digitized voices, such as the pioneer *Tengai Makyou* (*Far East of Eden*) (1989), the four *Ys* games, and many games associated with the *Dragon Slayer* franchise. In Japan, popular manga and animé series, such as *Ranma ½*, *Sailor Moon*, and *Cobra*, were translated for the CD-ROM format into **adventure games** or digital **comics** with minimal interactivity. NEC put a lot of effort into expanding the variety of genres available on its console: pinball simulators (*Devil's Crush* [1990]), **strategy games** (*Nectaris/Military Madness* [1989], and *Vasteel* [1990]), multiplayer party games (many iterations of *Bomberman*), and even **simulation games** adapted from personal computers (*SimEarth* [1993] and *Falcon* [1992]) were released.

To this day, the Super CD-ROM's *Castlevania* game (*Akumajou Dracula X. Chi No Rondo*; 1993) is considered one of the best in the series. The crowning achievement of the console—and a testament to the success of its expandable architecture—came with the adaptation of **SNK**'s *Fatal Fury 2* (1994) and *Art of Fighting* (1994) games on Arcade CD-ROM; these versions were faithful to the originals and far superior to the Super Nintendo and Genesis ports. In the United States, however, the Turbografx-16 was doomed by the lack of known franchises, the release of mediocre games and ports (such as *Yo Bro* [1991], *Impossamole* [1991], and *Nightmare Creatures* [1992]), and NEC's inadequate marketing.

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Neo•Geo

The Neo•Geo was an **arcade** system and home video game system released in 1990 by the Japanese game company **SNK (Shin Nihon Kikaku)**. It was available in two versions, as the arcade-oriented MVS (multi video system) and the AES (advanced entertainment system) home **console**. Both variants were built around a 16-bit Motorola 68000 processor, operating at 12 MHz, and an 8-bit Zilog Z80 coprocessor, running at 4 MHz. The Neo•Geo's custom video chipset was capable of simultaneously displaying up to 380 hardware-scalable sprites in 4,096 colors (from a 65,536 color palette), at a resolution of 320 × 224 pixels. A dedicated Yamaha **sound** chip provided 15 high-quality sound channels. In both its arcade and home incarnations, the system used high-capacity **cartridges**. Although the original specifications capped the ROM size at 330 megabits, a number of second- and third-**generation** titles employed bank-switching technology to bypass this limit.

The Neo•Geo systems are notable for a number of technological innovations. Similar to the **DECO cassette system** and the Nintendo PlayChoice-10, the MVS's modular design allowed arcade operators to change games quickly and easily, and, at under $500 per new release cartridge, it offered a considerably cheaper alternative to $1,000+ dedicated circuit boards. In addition, available in 1, 2, 4, and 6-slot versions, the MVS motherboards accommodated up to six individual titles within a single cabinet for significant **space** savings.

Based on a modified single-slot MVS board (with unique cartridge pinout to prevent the use of the cheaper home cartridges in arcade machines), the AES was the first system to offer direct equivalents of popular arcade titles for at-home **play**. A two-dimensional powerhouse, it easily eclipsed the 16-bit home consoles of the time. It was also the first system to use memory cards. Interestingly, because the memory cards were also compatible with the MVS cabinets, it was possible to transfer game **saves** and high scores between home versions and arcade versions of the same title.

The AES was initially conceived as a rental system because of its high price. At launch, a bundle consisting of the console, two controllers, a memory card, and one game retailed for $649. In an attempt to reduce manufacturing costs and cut down the retail price, in 1994 SNK introduced a CD-based version of the system, dubbed Neo•Geo CD, followed in 1996 by the revised Neo•Geo CDZ. The games were identical to cartridge-based equivalents but suffered from long loading times (both versions used a single-speed CD-ROM drive).

The Neo•Geo's intended successor, the Hyper Neo•Geo 64—a 64-bit arcade platform with three-dimensional **graphics** capabilities—was a commercial failure. Introduced in 1997, the system was not backward-compatible and only received seven games before it was discontinued in 1999. SNK's two attempts to venture into the **handheld** market, the Neo•Geo Pocket (1998) and Neo•Geo Pocket Color (1999), were also unsuccessful.

Notable Neo•Geo titles include the **fighting game** series *Fatal Fury* (1991–1999), *Art of Fighting* (1992–1996), *Samurai Showdown* (1993–2004), and *King of Fighters* (1994–2003), and the run-'n'-gun series *Metal Slug* (1996–2003). The system also received a number of high-quality **scrolling shooting games**, including *Last Resort* (1992), *Pulstar* (1995), and *Blazing Star* (1998). The last Neo•Geo game, *Samurai Showdown V Special*, was released in 2004, marking the end of the system's 14-year life span.

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NES

See Nintendo Entertainment System (NES)/Nintendo Famicom

networked games

See on-line games

New Zealand

For a small country, New Zealand had an amazingly active early microcomputer scene in the late 1970s and early to mid-1980s, before the wave of global commercial games rolled in. Although it is difficult to determine the dates of release of many computer systems and **consoles** in New Zealand, they usually lagged behind the rest of the world by a year or more. For instance, the IBM PC was not yet available in 1982; the Sinclair ZX81, released in the United Kingdom in 1981, was still selling for NZ$199 in 1983 and for half that price in 1984 (Swalwell, 2007, p. 270); and the **Atari VCS 2600**, released in the **United States** in 1977, was presumably still sold in New Zealand (at a low price) in the mid-1980s (Swalwell and Loyer, 2006). The reasons for New Zealand's relative isolation might be found in the long distance from the rest of the world and the associated transport costs and import restrictions (finally lifted after 1984), together with tax incentives that invited local production (Kraemer and Dedrick, 1993, p. 20; Swalwell, 2005).

The majority of popular computer systems were released in New Zealand. Initially, due to high prices, computers were predominantly owned by companies and government institutions, not by individuals. Schools and high schools used a wide variety of systems, like the Macintosh Plus, different versions of the Apple II, and the Acorn BBC Micro, but also the basic Sinclair ZX81. The Australian retail chain "Dick Smith" sold a number of computers that were copies of other systems, most notable the System-80, a TRS-80 clone which retailed for NZ$1200 in 1980 (Stewart, *Classic Computers*). Popular home computers beside the TRS-80, and its clones were the Atari 400, 800, and XE, the Commodore Vic 20 and its successor, the Commodore 64, the Sinclair ZX81, and the ZX Spectrum (although the more advanced Commodore 64 proved more popular). The Acorn BBC and the Electron, which was a downgraded version of it, might be best known for *Elite* (1984) and *The Sentinel* (1986, released as *The Sentry* in the United States), which were originally written for them. New Zealand was one of the few places outside **Japan** where the **SEGA** SC-3000 (a SG-1000 console with an integrated keyboard) had a "wide and loyal following," with user groups and "locally published magazines" (Swalwell, 2005, p. 5) and many software titles and games. The Amstrad CPC competed against the Commodore 64 and the Atari ST against the Commodore Amiga.

Not all consoles popular in **Asia**, the United States, or **Europe** made it to New Zealand. Consoles apparently not available were **Coleco**'s **ColecoVision**, the **Mattel Intellivision**, and the **GCE/Milton Bradley Vectrex** (Davidson, *Obscure Pixels*). The Atari 2600 was still being sold in 1983 (Swalwell and Wilson, 2004), although "only a few" game **cartridges** were officially released and "hardly any third-party titles" were available (Davidson, *Obscure Pixels*). Its most popular clone was the Kingsway system with 64 built-in games (Davidson, *Obscure Pixels*). Other available consoles were the **Atari 7800**, SEGA's SG-1000, the SEGA **Master System**, **SEGA Mega Drive**, **Nintendo**'s Game & Watch, the **Nintendo Entertainment System (NES)**, and the **Super Nintendo Entertainment System (SNES)** consoles. Several consoles appear to be New Zealand made: the Sportronic (late 1970s and early 1980s, a ***PONG*** [1972] clone build by Osborne Professional Electronics for Sportronic TV, a division of The Spectrum Group of Auckland; Brown, 2003), the Tunix Home Arcade (possibly identical to the system known as the Leisure Vision, not an illegal clone but a licensed system; Swalwell, 2005, p. 5), the Fountain Video Game and Force II Video System (both licensed versions of the 1976 Radofin 1292 Advanced Programmable Video System), the Videosport made by C.V.T. Industries of Auckland (see Swalwell, 2006), and Grandstand's Database (which appears to be a local clone of the Emerson Arcadia 2001 console), and Mark III Video Game (sold in the UK as Programmable Game; for both consoles, eight game cartridges are known to exist; Davidson, *Obscure Pixels*). Grandstand also rebranded and sold Orbit Electronic's UVI Compu-Game as Video Master (also an Arcadia clone).

The **arcade** business was considerable in New Zealand, given the tiny size of its population. As many as a dozen companies might have been involved as manufacturers, importers, distributors, game producers, or local offices of larger companies (Swalwell, 2005, p. 3; Swalwell, 2006, p. 14). Kitronix (Kitset Electronics Limited) of Auckland, founded by Ralph Stevenson, was a game producer whose games included *GP Racer* (1974?), *Galactic Invaders* (1980), *Malzak* (1980, about 500 machines sold; **MAME**, *Malzak Driver*), *Malzak II* (probably released shortly after *Malzak* as a slightly different version of the game), and *Panix* (unknown year). Kitronix made their own metal 8-way **joysticks** and also exported arcade machines to **Australia** (Swalwell, 2005, p. 5). A number of companies were operating out of Christchurch, including George Rait's Rait Arcade Games, which produced games in the early 1980s (including *Azurian Attack* [1982]); Taito-tronics, a local office of Taito Japan, as Chris

Looman's Advance Automatics was for Atari, Stern, **Williams**, and Gottlieb (Swalwell, 2005; Swalwell and Davidson, 2010). Chris Chaston's Chastronics was one of the largest suppliers of **arcade games** in New Zealand in the early 1980s, although "most of the [game] boards appear to be bootleg versions" (Davidson, *Obscure Pixels*). Other companies focused on distributing computers, consoles, and writing and selling software for them. Among them were Scorpion Software/Flexisoft, Poseidon of Tokoroa, and Softtime. Les Kenyon's Grandstand was distributor for the SEGA systems SG-1000 and SC-3000 until 1986, when the company focused on Amstrad instead (Davidson, *Obscure Pixels*). Auckland's Monaco Distributors sold the Atari 2600 console and cartridges (a list from 1984 of 37 games is available at http://homepages.ihug.co.nz/~pinwhiz/nz2600.htm) and the Tunix console. The Australian-based company Home Entertainment Suppliers also distributed Atari cartridges in New Zealand (Davidson, *Obscure Pixels*).

Arcade machines were not only found in amusement arcades but also virtually every takeaway bar had a machine in the 1980s. These machines were called *Spacies* (from ***Space Invaders*** [1978]) by some, and children would spend hours hanging out at the local takeaway shop playing *Spacies*.

The overwhelming majority of magazines in New Zealand were (and still are) imported from the United Kingdom. There were, however, some local publications dealing with home computers and consoles. The Christchurch-based magazine *Bits and Bytes*, which published its first issue in September 1982, was the first magazine to focus on the developing microcomputer scene (Stewart, *Classic Computers*). NOMAC published *Computer Input* magazine beginning in October 1983, and *SEGA Computer—The Official Magazine of the SEGA User Club of New Zealand* was started by Grandstand in late summer 1984.

Given the initial and sometimes continued limited availability of software, many early computer games were written by amateur enthusiasts, given away, and copied freely, especially for computer systems used in schools. These games had only a limited distribution, and many titles are now considered lost. Games were also typed in from program listings published in magazines. As computers became increasingly widespread in the late 1980s and cassettes were replaced with disks for data storage, a lively demo and tracker music scene emerged in New Zealand. Because commercial games were copied and swapped, they began to feature copy protection, which was subsequently removed by cracking crews who branded the games with intros. The evidence of early computer games popular in New Zealand appears sketchy today. The singularity of many titles is now increasingly realized, but the collecting is left to private persons, and attempts to preserve the software are not undertaken. In 2004, the New Zealand government issued its Digital Content Strategy, "which contained provision for a National Digital Heritage Archive (NDHA), to be set up by the National Library of New Zealand" (Swalwell, 2009, p. 267). Digital Strategy 2.0 was launched in 2008, but many issues with the copyright of digital orphan

Young people hanging out at a so-called video game parlor in Porirua, New Zealand, in 1987. (The Dominion Post Collection, EP/1987/3423/6A-F, Alexander Turnbull Library, Wellington, New Zealand)

works still need to be addressed (Corbett, 2010, p. 14).

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Nintendo

Formed in 1889 by Fusajiro Yamauchi, Nintendo (roughly translated as "leave luck to heaven") has the distinction of being one of the oldest companies to produce video games. Most famous for its mascot, **Mario** the Italian plumber, Nintendo is a worldwide success, and for many, its name has become synonymous with video games.

The company was originally founded as manufacturer of Hanafuda playing cards, and by the mid-1930s, Nintendo was the largest card manufacturer in **Japan**. By the 1960s, however, the market for playing cards began to wane and Nintendo experimented with a wide variety of businesses including a taxi company, instant noodles, a **television** station, and even a "love hotel" that rented rooms by the hour.

Around 1970, Nintendo would release an extendable toy arm known as the "Ultrahand" that became a surprise hit for them and would chart the course for Nintendo's future. Invented by Gunpei **Yokoi**, the Ultrahand would sell 1.2 million units and led Gunpei to create a number of other toys including a periscope, a pitching machine that threw softballs that could be safely used indoors, a "love tester," at-home light gun games, *Color TV Game* systems that played ***PONG***-like games, and even "laser" shooting ranges in closed bowling alleys.

Although in an interview on Nintendo's Wii.com Shigeru Miyamoto credits *EVR Race* (1975) as being Nintendo's first video game, *EVR Race* was an **electromechanical game** rather than an electronic game, and although it was Nintendo's first entry into arcades, it is more in line with other electromechanical games like slot machines or pinball than video games and is therefore not Nintendo's first **arcade** video game. *EVR Race* was a horse **racing game** playable by up to six people. It was quite a large game that used a videotape system to show the "races" for which players would try to guess the winning horse. Because it was quite large and mechanical in nature, it was prone to breaking down and required a great deal of maintenance.

In 1978, Nintendo entered the arcade video game market in earnest with the release of *Computer Othello* and *Block Fiber*. The company then entered the **handheld gaming** market in 1980 with the Game and Watch series. Allegedly inspired by seeing a man on a train idly pressing buttons on a handheld calculator, which was at the time a fairly new device, Gunpei Yokoi created this precursor to the **Nintendo Game Boy**. The Game and Watch games were fairly primitive devices that had monochrome LCD **graphics** and did not have **cartridges** but were single-game devices. By the time the last Game and Watch game was released in 1991, Nintendo had released 59 games in the line in a number of form factors. In addition to being Nintendo's first handheld series, some of the Game and Watch games had features that Nintendo would reuse in the future, such the x-shaped directional thumb pad, which would appear on every subsequent **controller**; dual screens in a configuration similar to that of the **Nintendo DS**; and the form factor of the Game Boy Micro.

In 1980, Nintendo also founded an American office in New York to sell its **arcade games** (in 1982, it would move its headquarters to Seattle, Washington). It was during this time that the *Radar Scope* (1980) arcade game was released in North America. The first game to be released in the **United States** under the Nintendo name, *Radar Scope* was a commercial failure, but it is notable because its hardware would be reused for 1981's *Donkey Kong,* which was the first game by Shigeru Miyamoto and introduced the Mario character.

At the time Nintendo was not manufacturing a home **console** system, and therefore in 1982 it sold the rights to make a console version of *Donkey Kong* to **Coleco**, which released the game for the **Atari VCS 2600**, **Mattel Intellivision**, and its own **ColecoVision**. The decision to sell Coleco the rights for console versions of *Donkey Kong* would come back to haunt Nintendo in 1983 when Coleco would attempt to release a version of *Donkey Kong* for its own ADAM computer, which was an add-on to the ColecoVision. Nintendo had only sold Coleco console rights and had sold home computer rights to Atari, which had made a version of *Donkey Kong* for its own line of home computers. Although Coleco claimed that the ADAM was a computer with a video game system built inside, it soured Atari's relationship with Nintendo.

The effects of Coleco attempting to release *Donkey Kong* on the ADAM went far beyond that one game because at the time Nintendo was developing its own home console and was in negotiations to allow Atari to be the system's worldwide distributor. Although Nintendo did have an American company, it was hesitant to begin selling devices directly to consumers; because Atari's 2600 console was showing its age by that point, Nintendo began talks with Atari. When Atari found out about Coleco's version of *Donkey Kong*, the negotiations stalled, and soon after it became clear that Atari was in poor financial shape and would not have been able to afford to buy Nintendo's console. Therefore, in 1985, two years later, Nintendo released the console to the American market independently as the **Nintendo Entertainment System (NES)**.

This would not be the last time Atari and Nintendo would have tense business negotiations. The two companies tangled again when Atari attempted to bypass the copy protection system on the NES. This conflict came about when Atari attempted to make games for the NES without receiving Nintendo's permission. Unlike Atari, which did not have the foresight to include copy protection mechanisms in its cartridges, allowing anyone to make their own games, Nintendo's cartridges had copy protection. When Atari attempted to bypass this copy protection by releasing unofficial games such as ***Tetris*** under the Tengen label, Nintendo took Atari to court and won.

In the years since the appearance of the NES, Nintendo has released a number of video game systems including the Game Boy, Virtual Boy, the **Super Nintendo Entertainment System (SNES)**, the **Nintendo 64**, the **Nintendo GameCube**, and the **Nintendo Wii**. According to a press release put out by Nintendo, in 2009 the company was worth more than $20 billion; since 1983, it had sold more than 3.2 billion video games and more than 535 million hardware units globally. Since the release of the NES, Nintendo has been challenged by seemingly countless console manufacturers such as **SEGA** during the SNES and N64 era and to **Sony** and Microsoft during the GameCube and Wii eras. Although some of them have temporarily been more successful than Nintendo, none of them have been in the business as long, and none are as well loved as Nintendo.

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Nintendo 64

The **Nintendo 64** (N64) was a fifth-**generation** video game console. Released in **Japan** on June 23, 1996; in North America on September 29, 1996; and in **Europe** on March 1, 1997; it was marketed as the first "true" 64-bit system—Nintendo's superior response to the **SEGA Saturn** and **Sony PlayStation** (both 32-bit consoles).

Codenamed "Project Reality," the N64 was developed jointly by Nintendo and Silicon Graphics, Inc. At the heart of the system was a 64-bit NEC VR4300 MIPS central processing unit, operating at 93.75 MHz, and supported by a 64-bit Silicon Graphics "Reality Co-Processor." The 62.5 MHz coprocessor handled video and audio processing. The N64 could display **graphics** in 21-bit color, at the maximum resolution of 640 × 480 pixels, and supported hardware z-buffering, antialiasing, texture mapping, tri-linear filtered MIP mapping, and perspective correction. The system could theoretically produce up to 100 channels of 16-bit PCM **sound**, with a maximum sampling rate of 48 kHz.

The N64 had 4 MB of memory and was the first game console to use a unified memory subsystem (rather than dedicated main, video, and **audio** memory). In 1999, a 4-MB memory expansion unit was released that allowed for higher video **resolution**, frame rates, or texture quality in supported titles. A few games required it and would not work without it—notably, *Donkey Kong 64* (1999), ***The Legend of Zelda****: Majora's Mask* (2000), and *Perfect Dark* (2000; in single-player and some multiplayer modes).

The N64 was the last home console to use **cartridges**. Compared with **CD-ROMs**, cartridges offered very fast loading times and a significant measure of protection from **piracy**. This, however, was offset by limited storage space (up to 64 MB), a longer production cycle (with a lead time of weeks rather than days), higher production costs (approximately ten times those of CD-ROMs), and a lower profit margin for the developers.

The system, originally scheduled for release in 1995, was delayed several times. Entering the market 18 months after the PlayStation, the N64 found itself competing against a well-established platform, with a global user base reaching 7 million and a library of nearly 400 games. Despite this—and despite the fact that only three games were ready for the Japanese launch—the N64 debuted as the fastest-selling console of its generation. By the time of its North American premiere, approximately 1.2 million units had been sold in Japan. However, the sales soon slumped. Although the system went on to achieve moderate success in the United States, in Japan it remained a niche product.

The N64's primary weakness was limited third-party support. Although efforts from studios such as Factor 5 (*Star Wars: Rogue Squadron* [1998] and *Indiana Jones and the Infernal Machine* [2000]) and Rare (*Golden Eye 007* [1997], *Diddy Kong Racing* [1997], *Banjo-Kazooie* [1998], and *Donkey Kong 64* [1999]) pushed the machine to its limits, meeting or even surpassing the quality of first-party titles, many developers shunned the system because of the limitations of the cartridge format, choosing to create games for the PlayStation instead. This was the case, for instance, with Square and Enix, the developers of, respectively, the *Final Fantasy* and *Dragon Quest* series.

Nintendo attempted to provide an alternative to CD-ROM with its Nintendo 64DD (Disk Drive), a peripheral utilizing proprietary 64 MB writeable magnetic disks. First announced before the launch of the N64, the attachment was not released until December 1999, and then only in Japan. A considerable number of games were planned for the 64DD; eventually, only nine were released, with the remaining games cancelled or released in cartridge format (such as *The Legend of Zelda: Ocarina of Time* [1998] and *Majora's Mask* [2000]). The Nintendo 64 was discontinued in 2001, having sold just under 33 million units worldwide.

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Nintendo DS

The Nintendo DS is a **handheld** video game **console** that was released in 2004. It has gone through three stages of redevelopment: the DS Lite in 2006, the DSi in 2009, and the DSi XL in 2010. The DSi versions had hardware upgrades, including increased RAM and CPU. In March 2010, the next iteration of the console was announced: the Nintendo 3DS, which promises a visual display using **3-D hardware**. The DS is highly successful, having sold more than 125 million units globally by the end of 2009; making it, at that time, the best-selling video game console in history. Despite widespread software **piracy**, games and other software also sold well, with more than 55 titles shipping more than a million units by the end of 2009.

DS stands for "developer's system" or "dual screen." The console is characterized by its clamshell design featuring two LCD screens, the lower of which is a touchscreen operated by a stylus. The console has two microprocessors, one dedicated to **sound** and the other to **graphics**. Games are stored on ROM **cartridges** that are inserted into the console, and the original DS and the DS lite also has slots for Game Boy Advance cartridges. The DS has a "Download Play" feature that allows for multiplayer games using only one game cartridge; the feature works with local WiFi connections and allows other consoles to download the necessary data from the console with the game cartridge.

The DS can be networked with other DS consoles through its WiFi connection, either locally or remotely through the free **Nintendo** WiFi Connection, and many games made use of this feature. The DS featured its own chat program, PictoChat, that allowed communication between consoles. After 2006, it was also possible to connect a DS console to the Internet; at first this required the purchase of a separate accessory, the Nintendo DS Browser, but this was eventually made available for free through the DSiWare shop.

The DS was aimed at nontraditional markets. High-profile advertising campaigns prominently featured female celebrities—America Ferrera, Nicole Kidman, Beyoncé Knowles, Liv Tyler, and Carrie Underwood—endorsing the product. Some game software produced catered to and reflected the non-traditional demographic: *Brain Age: Train Your Brain in Minutes a Day* (Nintendo SSD, 2006), *Flash Focus: Vision Training in Minutes a Day* (Namco Bandai, 2007), and *Personal Trainer: Cooking* (Indies Zero/Nintendo NSD, 2008). Traditional Nintendo licenses also sold well, for example: ***Animal Crossing**: Wide World* (2005), ***The Legend of Zelda**: Phantom Hourglass* (2007), ***Mario** Kart DS* (2005), *New Super Mario Brothers* (2006), and *Super Mario 64 DS* (2004). However, the top-selling DS game, with more than 22 million sold by mid-2009, was *Nintendogs*

(2004), a new title specifically designed for the DS.

Thomas H. Apperley

Nintendo Entertainment System (NES)/Nintendo Famicom

Few home video game consoles have had such an impact on the video game **industry** as the Nintendo Entertainment System (NES). Released in the **United States** in 1985, it revived the market after the video game industry **crash of 1983**. American retailers that had sold video games in the last years had been stuck with large inventories of poor-quality **cartridges** made by soon-to-be-bankrupt game developers, which had to be cleared out at ludicrous sale prices. As far as they were concerned, home video game systems had been a momentary trend that had ended. Consumers had been burned by relatively expensive products that were often cheap imitations without much novelty, and confidence in **Atari** (the market leader) was low following the debacles of *E.T.: The Extra-Terrestrial* (1982) and ***Pac-Man*** (arcade version, 1980; **Atari VCS 2600** version, 1981) for the 2600 system. Many game developers either went under or focused on the personal computer or the **arcade** market.

Across the Pacific, however, video games were still highly popular in **Japan**, mainly in the form of arcades but also with home video game systems imported and distributed by Japanese companies. The first Japanese-designed home video game systems were **Nintendo**'s *Color TV Game* series, dedicated **consoles** that each played a single, built-in game. The first Japanese cartridge-based systems that offered multiple games were the Nintendo Famicom and the **SEGA** SG-1000, both released on the same day: July 15, 1983. Designed from the beginning as an inexpensive console to manufacture, the Famicom had its launch marred by technical problems and a high failure rate, limiting immediate success. After Nintendo issued a product recall and fixed its hardware, it steadily sold more and more through its first years, to the point where Nintendo's president Hiroshi Yamauchi envisioned exporting it to the United States. Minoru **Arakawa** and Howard Lincoln, heading the newly created Nintendo of America, presented the "Advanced Video System" at the 1985 January Consumer Electronics Show. At this point, the machine featured a keyboard, wireless infrared **controllers**, and a tape backup drive. Reaction to the system was lukewarm; the quality of its games was impressive, but merchants were not willing to take a risk on video games, especially given that the feature set of the AVS made it seem like the ghost of recent failures in the home computer market such as the Texas Instruments 99/4A and the **Coleco** ADAM. Arakawa and Lincoln had the system redesigned to focus solely on games and rechristened the machine the Nintendo Entertainment System.

It turned out that one of the biggest hurdles the Famicom had to overcome on its journey overseas was the resistance of retailers. To convince them to carry and sell the system, Nintendo had to redesign it to make it appear as something other than a "video game console." They developed the Zapper (a light gun) and

The Nintendo Entertainment System (Evan-Amos)

R.O.B. (the Robotic Operating Buddy), a robot toy that could "**play**" a few games specially designed for it. The main function of these two additional pieces of hardware was to create a shift in perception for retailers. The new name "Nintendo Entertainment System," together with the accessories, portrayed the machine as a technological toy for children and a home station for arcade **shooting games** such as *Wild Gunman* (1984) and *Hogan's Alley* (1984). The Zapper had a degree of success on its own, as 15 or so games were made compatible with it. R.O.B., however, was for all intents and purposes a stillborn, costarring only in two titles that were launched simultaneously with the console, *Gyromite* (1985) and *Stack-Up* (1985). Although the reenvisioned NES was a more interesting proposition, Nintendo still had to come up with no-risk policies to persuade retailers: the company would handle all in-store displays and buy back any unsold systems after 90 days. On these conditions, 500 retailers opted in for the test-marketing of 100,000 consoles on October 18, 1985.

Aided by an aggressive multimillion dollar marketing campaign from Nintendo of America, the test launch in New York City was successful enough to expand to Los Angeles. An enduring marketing and advertising campaign put NES sales beyond one million at the end of its first nationwide release year, and eventually made it "the best-selling toy in America" in 1988. Nintendo's market share of the video game business has been reported alternately as 83% of North America (McGill, 1988, p. 2), "somewhere between 86 to 93 percent" (Kent, 2001, p. 360), 90% of the Japanese market (Sheff, 1999, p. 147), and "85 to 90 percent on both sides of the Pacific" (Sheff, 1999, p. 223). Whichever number one holds to be true, the fact remains: "Nintendo power" was absolute. According to Nintendo's publicly disclosed historical data, lifetime sales of the Famicom/NES are tallied at 34 million units in the Americas and 61.91 million units worldwide. Its closest competitor was the **SEGA Master System**, released eight months after the NES in June 1986; its lifetime sales are estimated to 13 million units worldwide, the majority of which were in markets Nintendo had not entered into quickly enough, mainly Brazil, **Europe**, and Asia.

The 8-bit NES finally died out because of competition from the technologically superior 16-bit systems. In Japan, the Nippon Electric Company (NEC) released the **PC-Engine** as a response to the NES's monopoly and seriously threatened it. SEGA tried releasing its 16-bit **SEGA Genesis/SEGA Mega Drive** console in Japan and North America to expand its customer base, hoping its advanced hardware would sway consumers from Nintendo mania. Incidentally, SEGA's push also dug the grave for NEC's PC-Engine, which appeared in North

America as the TurboGrafx-16, but too late and without SEGA's arcade hits to make a serious impact on consumers and convince game developers to work on the console. The battles fought by the PC-Engine in Japan and the Genesis in North America prompted Nintendo to develop a follow-up, the **Super Nintendo Entertainment System (SNES)**. Released in 1990 in Japan and 1991 in North America, the SNES rendered the NES obsolete save for budget-conscious video game consumers. A new, redesigned version of the console dubbed the "New NES" or "NES 2" appeared in 1993 as a last-ditch effort to maintain consumer interest, but people had either adopted the Super NES or the Genesis by then, and it did not create much of an impact.

Marketing Strategy and Licensing Policies

Nintendo's approach to video game production marked a significant shift from its predecessors. Every prior game console, be it the **Magnavox Odyssey**, **Atari VCS 2600**, **ColecoVision**, or **Mattel Intellivision**, was initially envisioned as a closed system in which only the console manufacturer would develop games for its own machine. When dissatisfied Atari programmers left the enterprise to form their own game development studio (**Activision**), Atari sued to prevent them from encroaching on its market, but when it became apparent they would lose after two years of trial, they settled for a royalty arrangement. Soon many companies flocked to game development for the 2600, and the market was crowded with second-rate titles that contributed in creating the industry **crash of 1983**.

Perhaps because of his distant gaze on the situation, Hiroshi Yamauchi's market analysis was very different from American retailers and developers' knee-jerk recoil. First and foremost, he did not consider the market dead, but rather ripe for harvest. If he succeeded in exporting the NES to the United States, he would reign in Atari's $3 billion home video game market without any competitor. Yamauchi saw the proliferation of games from third-party developers for the Atari 2600 not as a problem but as an effective way of providing consumers with a vast selection of games. In his eyes, the North American home video game market was not killed solely by oversaturation but mainly by lack of quality control. With proper licensing policies, he believed a new business model was in order. Nintendo would develop a console and sell it cheaply for minimal profit to attain maximum penetration. Money would come from the sale of software, developed partly by Nintendo but also by numerous third-party developers that would enter licensing agreements in exchange for royalties. If Yamauchi's plan succeeded, the number of Nintendo system owners would be so high that game developers would be willing to sign restrictive contracts in exchange for a large installed base.

Taito, **Namco**, and Bandai—three Japanese game developers responsible for, among other games, *Space Invaders* (1978) and *Pac-Man* (1980)—were the first to be courted by Nintendo on amiable terms to build support for its console. As the Famicom's success grew, Nintendo licensed more developers and exported it to North America. Mindful not to repeat the flood of weak titles that caused the crash of 1983, strict licensing policies were introduced to developers willing to make the lucrative jump over the Pacific. The first of these was that a Nintendo of America licensee was required to submit every game it wanted to distribute through Nintendo for "quality control," and Nintendo had the right to demand any change it saw fit. A properly licensed game would receive the "Nintendo Seal of Quality," a device that aimed at inspiring confidence in customers that Nintendo had tested and approved this game. In practice, however, it merely meant that the licensee had paid the fees and done business according to Nintendo's terms. Nintendo was not providing testing services to developers to strengthen its games but monitoring its contents carefully to make sure nothing objectionable appeared.

More than anything, Nintendo did not want games such as *Custer's Revenge* (1982) and *Beat 'Em & Eat 'Em* (1982) (two pornographic titles that appeared for the Atari 2600, caused controversy, and ultimately tarnished Atari's image) damaging its efforts to market the NES to kids. The Nintendo of America reviewers examined each game and asked the developer to remove any content that did not fit with Nintendo's family-friendly policy, including illegal drugs; explicit or suggestive sexuality; alcohol; smoking materials; graphic depictions of death; gratuitous or excessive violence; foul language; and ethnic, religious, nationalistic, or sexual stereotypes in **language** or symbols. The censors' reach proved wide ranging, to say the least; because the image of the cross was taken to be a symbol of Christianity, it had to be removed from hospitals and tombstones, for instance. Such an alteration can be found in Capcom's *DuckTales* (1990), where the coffins in Transylvania bear a cross in the Japanese Famicom version but the letters R.I.P. in the American NES cartridge. (See Crockford, 1993, to get an overview of the relationship between game developers and Nintendo's regulators.)

Although **censorship** of content was an issue for many licensees, it was nothing compared to the economic structure involved in producing NES games. Licensees were restricted to developing a maximum of five games per year; Nintendo's rationale was that it would force them to commit time and resources to make each of these games good. In practice, two developers (Konami and Acclaim) circumvented this rule by creating subsidiaries (Ultra Games and LJN) that could also publish a maximum of five games. In addition to the five-games-a-year limit, every game published on the NES had to be exclusive to that console for a period of two years. In the video game landscape of the time, this usually meant not making another version at all, because in two years' time, a game would have been rendered obsolete by its contemporaries. Perhaps most decisively, however, Nintendo also held a patent for the physical game cartridges of the NES and was their sole manufacturer. Third-party developers had to buy a cartridge lot from Nintendo (with a minimum of 10,000 units), in cash, and in advance. The deal was as one-sided as can be conceived: "Nintendo was paid about 2,000 yen per cartridge by the licensees, about twice what it took to produce them. . . . Companies, particularly small licensees without deep cash reserves, had to risk perilous amounts of capital on large orders if they wanted to gamble on big successes. They shouldered all the risk while Nintendo collected obscene profits" (Sheff, 1999, p. 59). In 1991, the profits in question are said to have been $1.5 million—*per employee*.

As the NES's popularity—and number of third-party licensees—soared, manufacturing and supply issues began to appear. The company rationed its cartridges according to its supplies but also to its own releases. Many claimed Nintendo deliberately denied large quantities of cartridges to licensees when it was on the verge of releasing a big title, so that no competition would prevent Nintendo games from selling. Some of the other tactics coined as "inventory management" by Nintendo of America included withholding goods from retailers that sold Nintendo games and systems under the suggested retail price (causing devaluation of Nintendo's products in consumers' minds), as well as undersupplying merchants to keep demand artificially high. Eventually the U.S. Federal Trade Commission started an inquiry into allegations of price fixing under antitrust laws. Nintendo settled and managed to get away with what could very well be the most lenient sentence in video game corporate **history**: it would issue $5 rebate coupons to customers who had bought a Nintendo product between June 1, 1988, and December 1, 1990. The coupons could be redeemed on the purchase of a new Nintendo product, thus guaranteeing more sales and profits. Nintendo claimed its various policies on censorship, game release limits, exclusive cartridge manufacturing, and control of distribution were put in place to protect the market from oversaturation and poor-quality titles. This was certainly true to an extent, but many game developers saw them as bullying tactics to coerce them into disadvantageous deals based on Nintendo's iron grip on the home video game market.

Nintendo's enforcement of its regulations was ensured by three things: their patent and control on game cartridges, the "Official Nintendo Seal of Quality" (the absence of which signified to consumers that a title was not "official"), and more important, the 10NES lockout chip. This special chip that functioned as a "lock" is the chief difference between the Japanese Famicom and the Occidental NES. Nintendo had copyrighted a strip of computer code that constitutes a "key" and included it in every cartridge it manufactured. If a cartridge without this code (and hence manufactured independently by an unauthorized game developer) was inserted in the NES, the game program was not executed, the console instead entering a self-resetting routine (usually displaying a blinking blue or gray screen). Unfortunately, over the years the great majority of NES owners have grown accustomed to seeing these patterns on legitimate cartridges, for hardware degradation caused by dust, moisture, or rough handling often rendered the boot-up code difficult to read. Unless both the cartridge and console connectors were absolutely clean and properly aligned, the 10NES chip would refuse to launch the game. Compounding this problem, the nonstandard front-loading and push-down design of the cartridge port (that earned the NES its "toaster" moniker) meant cartridges could be slightly nudged (and misaligned) inside the console and made removing dust particles almost impossible without blowing in the port; yet in so doing, saliva oxidized the connectors and made the console even more difficult to operate afterward. The problem was so widespread that Nintendo marketed the "NES Cleaning Kit" to help consumers take care of their system. The 10NES chip turned out to be such a problem that Nintendo removed it from its NES 2—also redesigned with a standard top-loading cartridge port.

Game Library and Piracy

Although the 10NES created multiple additional issues for the NES over the Famicom, it served its primary purpose well. Few unauthorized games appeared for the NES, both because of the technical hurdle of overcoming the lockout chip and because of Nintendo's unrelenting legalistic pursuit of offenders. The most famous of these cases undoubtedly is the ***Tetris*** debacle, in which rogue developer Tengen (a subsidiary created by Atari) reverse-engineered the 10NES chip to input the key code in its own cartridges, entirely bypassing Nintendo's licensing process. Nintendo promptly sued, and the two parties settled—on the condition that Tengen recall its cartridges and refrain from selling them. One notable exception to escape Nintendo's wrath was Wisdom Tree, an unauthorized developer of Christian games such as *Bible Adventures* (1991) and *Exodus* (1991); Nintendo did not dare sue for fear of generating bad press in the United States.

In Japan and Asia, where the Famicom had no hardware measures of control, game **piracy** was a significant problem. Rogue developers would generally produce one of four types of products: multicart games, clones, "retroports," or original games. Multicarts (multigame cartridges) were collections of games (some of the most popular included 76 or 200 games); most of them were primitive arcade or Atari-era games, and the head count was artificially inflated by counting, for instance, three versions of the same game with different difficulty levels as three games. Clones were created by taking a whole, currently-sold game and changing a few minor graphical assets ("**graphics hacks**"). Today one can find on the Internet evidence of games such as *Mario 6*, a conversion of *Tiny Toon Adventures* (1991) in which Buster Bunny has been replaced by **Mario**, and *Mario 16* that repeats the experiment with *Joe & Mac* (1991). Retroports are a more interesting phenomenon; here the pirate game developer takes a next-generation game (destined for the 16-bit SNES or SEGA Genesis) and adapts them for the 8-bit NES, so that markets and consumers technologically left behind can still enjoy the newest games in some form—and the developer, of course, gets to make easy money. A few of the games to have received this treatment include SNES smash hits such as *Super Mario World* (1990) and *Contra III: The Alien Wars* (1992). Original pirate games are, compared with the other forms of pirate production, more uncommon, generally of subpar quality, and often reuse graphics from other high-profile games.

The NES's success is a result mainly of the restrictive and controlling licensing policies of Nintendo and the excellent quality of its game library, rather than technical superiority. The NES was an average-power console for its days; Yamauchi's primary directive—to have it *cheap*—was at odds with being state of the art. However, the NES was cleverly engineered by Masayuki Uemura; instead of a costly 16-bit processor, it used two 8-bit processors, one for handling data and player input, and the other solely for graphical output. In technical terms, the NES could display up to eight moving objects (sprites) per scanline and up to 64 at once on the screen. Each of these sprites could contain four colors taken from the console's impressive palette of 52, and 16 of them could be displayed at any one time on the screen. These significant capabilities resulted in vibrant, colorful graphics and smooth, fast action. The console was also designed to be expandable via the Zapper and R.O.B. peripherals mentioned earlier, as well as a music keyboard, computer keyboard, and disk drive among others (many accessories were released only for the Famicom in Japan). Most notable, however, is the fact that the cartridges themselves could contain expanded functions in the form of special chips designed by game developers called Multi-Memory Controllers. Nintendo's MMC1 chip introduced battery-backed **save** games, the MMC2 allowed the NES to portray larger moving objects than the console by itself, the MMC3 optimized split-screen **scrolling**, and so on. Finally, one of the NES's strong suits was **sound** and music. With its five sound channels, the console's hardware was leaps and bounds ahead of its predecessors (the Atari 2600 had only two, the Commodore 64 only three). Two square waves and a triangle pulse could simulate different instruments such as a piano, harp, or guitar, and a bass or flute, respectively; a noise channel was mainly used for percussions and sound effects; finally, the DPCM channel could play back sampled sounds—in very low fidelity, as the digitized speech in JVC's *Star Wars: The Empire Strikes Back* (1992) or Konami's *Blades of Steel* (1988) can attest. Using this channel for sampled drum sounds was a more popular alternative (most Konami games demonstrate this, as well as the bass drum sound in *Super Mario Bros. 3* [1988]).

The strength of the NES library can be readily assessed both in terms of games that sold more than one million copies (moreover at a time when the market was less sizable than in later generations) and games that have launched long-term franchises. According to Nintendo's official numbers, in total 500 million NES cartridges were sold. Million-sellers are, in quantity, chiefly games developed by Nintendo, including its "sports series" titles (*Golf, Baseball*, *Soccer*, *Tennis*, and *F1 Race*) and various others such as *Excitebike* (1985), *Tetris* (1989), *Dr. Mario* (1990), and *Kid Icarus* (1987). Third-party developers also contributed many games to that canon, including **Capcom**'s *Chip 'n Dale Rescue Rangers* (1990) and *DuckTales* (1989), and many more were adaptations from successful arcade games such as Konami's *TwinBee* (1985) and *Gradius* (1985), **Namco**'s *Xevious* (1982), and Capcom's *Commando* (1985) and *Ghosts n' Goblins* (1985). Numerous high-profile (and lucrative) game series debuted on the NES: Konami's *Teenage Mutant Ninja Turtles, Castlevania,* and *Metal Gear*; Capcom's *Mega Man*; Square's *Final Fantasy*; Enix's *Dragon Warrior*; and Hudson Soft's *Bomberman* and *Adventure Island* series. Of course, the real winner in this category of million-selling games is Nintendo and its franchises, which include *Super Mario Bros.*, ***The Legend of Zelda***, *Donkey Kong*, ***Metroid***, and *Punch-Out!!* Widening the scope of this overview beyond the purely arbitrary one-million-copies commercial considerations to include well-received and influential titles as well—games and franchises such as *Ninja Gaiden*, *Adventures of Lolo*, *Double Dragon*, *Blaster Master* (1988), *Bionic Commando* (1987), *Ice Hockey* (1988), *River City Ransom* (1989), *Crystalis* (1990), *StarTropics* (1990), and *Battletoads* (1991)—merely scratches the surface of the console's offerings.

Today, the NES's legacy lives on in a number of cultural practices. By virtue of its quasi-monopoly on the home video game market between 1985 and 1990, the NES is often held as the sole representative of third-generation home video game systems. This gives it the lion's share of the **retrogaming** current that has been growing in popularity since the beginning of the 21st century, in no small part thanks to **emulators**. The clearest sign of this can be found on the **Nintendo Wii**'s Virtual Console channel, where gamers can buy and download selected games from the NES library. Most significantly, Capcom's thriving *Mega Man* series that debuted on the NES had a follow-up in 2008, *Mega Man 9*, that was made exactly in the image of the original 8-bit games in its structure, general gameplay, graphical aesthetics, music, sound, and, most significantly, difficulty level—much to the joy of retrogamers, whose embracing of the title prompted the developer to release *Mega Man 10* (2010). The aesthetic practice of **speedruns**, in which expert gamers run through a game in the quickest possible way by careful planning, feats of agility, and by exploiting bugs, also prominently feature NES titles: at the time of this writing, one of the largest on-line speedrun archives, TASVideos, listed 264 movies of NES/Famicom games out of a total of 742, the rest being split among no less than 14 **platforms**. Finally, for chiptune scene musicians, the sounds from the NES occupy a place of choice, seconded by the Commodore 64 and the **Nintendo Game Boy**. Although official game development and first-party support for the physical 1985 hardware might be dead, the NES's conceptual existence is far from over.

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Nintendo Famicom

See Nintendo Entertainment System (NES)/Nintendo Famicom

Nintendo Game Boy

Since its introduction in 1989, the Nintendo Game Boy line includes seven different models, and, according to **Nintendo**'s investor relations documents, the Game Boy line has sold more than 200 million hardware units worldwide. The Game Boy was the successor of Nintendo's earlier Game and Watch series, which were small LCD games that each played only a single, built-in game. With the success of the **Nintendo Entertainment System (NES)**, Nintendo decided to make a more advanced **cartridge**-based **handheld game** system. The task of creating the new system fell to Gunpei **Yokoi**, the creator of the Game and Watch line, who would later go on to create the **Nintendo Virtual Boy** and had began developing the Wonderswan handheld game system for Bandai when he was killed in a car accident on October 4, 1997.

Although the Game Boy was not the first handheld game console to use interchangeable cartridges (that honor belongs to Milton Bradley's Microvision released in 1979), it was the most successful of all time. However, when it was released in **Japan** on April 21, 1989, and in North America on July 31, 1989, it was far from certain that it would be a success. Its two-inch black-and-white screen and Sharp-produced custom Z80 processor were inferior to other handheld **consoles** such as the **Atari** Lynx, the TurboExpress, and the **SEGA** Game Gear, which all had color screens and were released in the months after the Game Boy hit the market.

Despite its technological inferiority, the Game Boy had two things going for it: superior play time and superior games. Because the Game Boy had a black-and-white screen and an underpowered processor, its batteries lasted at least 10 hours compared with the two and a half hours of competing systems. Although this was important, perhaps more important was the fact that the original Game Boy came with one of the most popular games of all time: ***Tetris*** (1985). This addictive Russian game ensured the success of the Game Boy.

Although Nintendo playfully acknowledged players' desire for a color version of the Game Boy by releasing the original black-and-white Game Boy in different colored shells in 1995 as part of their "Play It Loud" campaign, the Game Boy remained unchanged until the following year when they released a smaller version known as the Game Boy Pocket, which featured a better, larger, but still black-and-white screen. The year 1998 would see the release of the third major revision of the system in the form of the Game Boy Light. Slightly larger than the Game Boy Pocket, the Light included an electroluminescent backlight but was otherwise identical to the Pocket. This system was only released in Japan and has become quite valuable to collectors.

The Game Boy would finally receive a color screen when the Game Boy Color was released in the fall of 1998. Although this system had the same processor as the original Game Boy, its clock speed was twice as fast as the original system. Using the original chip made it easy for the Color to play not only new color games but also the black-and-white games of the original Game Boy, which made it quite attractive to customers who could buy the system and have access to the large library of games made for the original Game Boy.

Although faster than the original Game Boy, the Color was still fairly underpowered. This was remedied in 2001 when the Game Boy Advance was released. The system featured a 32-bit ARM processor that was said to allow **graphics** similar in quality to **Super Nintendo Entertainment System (SNES)** games. Although the system was quite popular, it was criticized for its lack of a backlight, which made it difficult to play in dim lighting. This shortcoming was addressed in 2003 with the release of the Game Boy Advance SP, the fifth major revision of the line. In addition to the backlight, the SP had a new form factor that resembled the original Game Boy but was hinged in the middle so that it could fold in half when not in use.

The final model of the Game Boy was the Game Boy Micro. Released in September 2005, the Micro is only two inches wide by four inches long. While the Micro was an interesting system, it was released nearly a year after the **Nintendo DS**. Although Nintendo originally claimed that the DS would not replace the Game Boy, the sales of the DS proved to eclipse those of the Micro, and the Game Boy line is no longer being manufactured. The last game for the series was released in 2007.

Throughout its life cycle, the various incarnations of the Game Boy had many accessories released for them. In addition to countless carrying cases and lights, Nintendo also released a camera that took low-**resolution** black-and-white pictures, a small printer that could print the pictures, a device called the e-reader that read special cards that were swiped through it and would either unlock special features in some games or load small games, and even a multimedia player. Additionally, Nintendo released the Super Game Boy, which allowed the SNES to play Game Boy games, and the Game Boy Player, which allowed the **Nintendo GameCube** to play Game Boy games.

Although the Game Boy was not the first handheld system and was never the most powerful, it was the most successful. With more than 870 million copies of games sold, the Game Boy line of consoles was a worldwide phenomenon and popularized **mobile gaming**. The Game Boy may be gone, but it lives on through its spiritual successor the DS, which as of 2012 was the most popular handheld gaming console in the world.

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Nintendo GameCube

The Nintendo GameCube was a sixth-**generation** game **console**. A successor to the **Nintendo 64**, the system was **Nintendo**

Corporation's fourth entry in the home console market. First unveiled at Nintendo's Space World (now Nintendo World) event in 2000, it was officially released in **Japan** on September 14, 2001, in North America on November 18, 2001, and in **Europe** on May 3, 2002.

The GameCube's 486 MHz "Gekko" microprocessor was developed by IBM, based on custom-modified 32-bit PowerPC architecture. The system was equipped with 24 MB of main memory, as well as a 16 MB buffer for DVD operations and audio playback. An additional 3 MB of memory were embedded in the "Flipper" Graphics Processing Unit. Developed cooperatively by Nintendo and ArtX (soon thereafter acquired by ATI Technologies), the 162-MHz chip was capable of peak performance in excess of 20 million polygons per second. It supported hardware transform and lighting, full-scene antialiasing, bilinear, trilinear, and anisotropic texture filtering, multitexturing, bump-mapping, and 24-bit z-buffering. The custom audio processor was capable of producing 64 channels of CD-quality (16-bit, 48 KHz) **sound**. The system supported standard definition video output, both interlaced and progressive scan, as well as Dolby Pro Logic II–compliant stereophonic sound.

The GameCube was the first Nintendo console to abandon game **cartridges** in favor of optical medium, the Nintendo GameCube Game Disc—a mini-DVD-based proprietary format developed by Matsushita (now Panasonic). The eight-centimeter disk held approximately 1.5 GB of data. Memory cards, ranging from 512 KB to 4 MB, provided additional, rewritable storage.

Determined not to repeat the mistakes made with the N64, Nintendo consciously aimed to improve relations with third-party developers. Consequently, from day one, the GameCube enjoyed relatively strong third-party support, both in the form of exclusive and multiformat releases. Competitively priced at $199, the system launched to generally positive reviews. Nonetheless, the initial sales failed to reach the projected levels, in part because of timing. Released almost a full year after the **Sony PlayStation 2**, the GameCube found itself in a position similar to that of its predecessor: competing against a firmly entrenched rival with an already sizable software library. The situation was further exacerbated by the console's relatively lackluster launch lineup. Although games such as *Luigi's Castle* (2001), *Super Monkey Ball* (2001), *Wave Storm: Blue Storm* (2001), and *Star Wars Rogue Squadron II: Rogue Leader* (2001) were well received, they did not attain the status of must-own titles.

In mid-2002, in response to price drop announcements from **Sony** and Microsoft, the system's price was reduced to $149. Despite this, sales continued to lag. With GameCube's disappointing performance in the **U.S.** market and overseas sales deflating as the yen appreciated against the dollar, Nintendo posted its first loss in **history**, 2.9 billion yen for the first half of fiscal 2003. Facing considerable inventory backlog (estimated in millions of units), the company temporarily halted GameCube production and, in September 2003, slashed the price to $99. This finally brought the desired effect. The console continued to sell relatively well throughout 2004 and into early 2005, when interest began to dwindle again, this time because of anticipation of the release of its successor, the **Nintendo Wii**. Ultimately, the system proved profitable, thanks to low hardware costs and a strong lineup of first-party games. It was discontinued in 2007.

Although not the least successful system of its generation (that dubious distinction belonging to the ill-fated **SEGA Dreamcast**), with only 22 million units sold worldwide, the GameCube was Nintendo's second-worst-selling console, surpassed only by the Nintendo Virtual Boy. Its underwhelming market performance can be attributed to a number of factors. Perhaps most significant of these was the tremendous success of the PlayStation 2, which, by the time of GameCube's release, had already managed to establish a user base of approximately 20 million. Although first-party games sold well throughout the system's life, the same could not be said for third-party offerings. Multiformat titles in particular tended to sell significantly worse on the GameCube than on the **Microsoft Xbox** and PlayStation 2, leading a number of developers to withdraw their support for the platform. Compared with its competitors, the system lacked CD/DVD playback functionality, a direct consequence of Nintendo's decision to use proprietary optical drive technology. Moreover, on-line play support was extremely limited. Released in 2002, the GameCube Broadband Adapter and Network Adapter added on-line connectivity to the system's features; however, only four games (including one exclusive to Japan) took advantage of it.

An interesting variant of the GameCube hardware was released in December 2001 in Japan. Manufactured by Matsushita and officially licensed by Nintendo, the Panasonic Q was a hybrid game/multimedia system, capable of CD, **DVD**, and MP3 playback and fully compatible with GameCube software. Notable GameCube games include *Pikmin* (2001), *Super Smash Bros. Melee* (2001), ***Animal Crossing*** (2002), *Eternal Darkness: Sanity's Requiem* (2002), ***Metroid*** *Prime* (2002), *Super* ***Mario*** *Sunshine* (2002), ***The Legend of Zelda****: Wind Waker* (2003), and *Resident Evil 4* (2005).

P. Konrad Budziszewski

Nintendo Super Famicom

See Super Nintendo Entertainment System (SNES)/Super Famicom

Nintendo Virtual Boy

Hoping to cash in on the **virtual reality** craze in the late 1980s and early 1990s, **Nintendo** released the Virtual Boy. The Virtual Boy was a dual-monitor virtual reality (VR) headset. The headset itself housed all the working components such as the central processing unit (CPU) and sat atop a table on a bipod stand. To play, the user would peer through the neoprene eyepiece and operate a well-designed, six-buttoned, dual-directional control pad tethered from the headset.

Nintendo's 32-bit virtual reality machine was originally referred to as the VR-32.

After more than two years in development, it premiered at Nintendo's annual Shoshinkai software exhibit in **Japan** on November 15, 1994. It was released as the Virtual Boy in Japan the following July, followed by an August launch in the **United States**. The **European** release was pending but was later cancelled altogether because of failure of the unit in the Japanese and U.S. markets.

Longtime Nintendo employee Gunpei **Yokoi** designed the Virtual Boy. In earlier times, Yokoi's own research and development teams had developed the popular Game & Watch series for Nintendo, as well as the unparalleled **Nintendo Game Boy**. As a result, Yokoi's contributions to the company played a large part in transforming Nintendo from a hanafuda playing card company into a toy company. This maneuver eventually led Nintendo into the video game **industry**.

The glasses were the first of their kind on the marketplace. The primary technology implemented in the system consisted of twin mirror-scanning light emitting diode (LED) displays, used to create an impression of depth or **3-D** image. This technology was licensed from Reflection Technology, Inc., and it was the first time that Nintendo took an equity position in a U.S.-based, privately held, company.

The Virtual Boy's monochromatic game imagery was produced with red RTI light-emitting diodes (LEDs), which were chosen over other colors because they consumed less energy, a power saving maneuver to conserve battery life that was arguably one reason for the Game Boy's success over other handhelds in the previous generation.

The classification of the Virtual Boy is open to debate. Was it a portable gaming system or a home **console**? It was relatively lightweight compared with other home consoles, yet was not very portable because it could not be played without being placed on a tripod stand that needed to be sitting on a hard surface such as a table. It could be played with an AC adaptor plugged into wall, but Nintendo went to great lengths to make sure that it had a solid seven-hour battery life. Nintendo did announce a shoulder mount adapter to be sold separately that would remove the necessity of a table and certainly make it more portable, but this adaptor was never released.

The unit initially was priced at $180 with the game ***Mario** Clash* (1995) included. However, after very disappointing sales, Nintendo officially dropped the price to $160 after only being on the market for two months. Despite the new manufacturer's suggested retail price, many retailers reduced the unit even further to liquidate it from the shelves, some selling the game machine for as low as $50.

Many players complained that the unit gave them headaches, and even Nintendo placed a warning on the product that it was not recommended for children under age seven. Furthermore, the unit itself informs players to take a break to rest their eyes after 30 minutes of playing time. This was certainly cause for alarm for some consumers and did nothing to improve units sold.

Although Nintendo had usually found success with its video game products, the Virtual Boy turned out to be a disaster. To date it is the only Nintendo-released game platform considered to be a failure by both Nintendo and consumers alike, selling a relatively dismal 770,000 units.

As the industry leader, Nintendo was not prone to failure. When the system failed to excite the industry and received less than favorable reviews by the press, Nintendo insisted that Yokoi demonstrate the product himself at trade shows and other promotional events. This was not typically part of a supervisor's job and was intended to demean and insult the previously successful employee. As a result, and after decades of service, Yokoi left Nintendo. Soon after, working for Bandai, he designed the successful Wonderswan portable gaming unit, before his untimely death as a result of a car collision.

Fourteen games were released for the system in the United States before Nintendo ceased offering support for the system almost exactly a year after its debut in August of 1996.

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Nintendo Wii

The Nintendo Wii is a seventh-**generation console** that was announced by **Nintendo** in 2004 and released in November 2006; it had sold more than 65 million units by the end of 2009. The Wii quickly moved into a dominant place in the console market, surpassing the **Microsoft Xbox 360** and **Sony PlayStation 3** in sales within a year of its release.

The console was originally available only in white but was made available in black at the end of 2009. The Wii uses a Bluetooth wireless **controller** called a Wii Remote, which is motion sensitive and can be used as a pointer using infrared detection. The latter feature requires the attachment of an infrared Sensor Bar to the **television** screen. The Wii is packaged with an optional Nunchuk attachment to the Wii Remote that is also motion sensitive and is used in many Wii games. The Wii Remote and Sensor Bar were optimized by the 2009 add-on Wii Motion Plus that was also available bundled with *Wii Sports Resort* (2009). The Wii Remote came with an attachable wrist strap that Nintendo advised be worn around the players' wrists for safety reasons. Even so, numerous cases of injuries and damage to property were reported to have occurred during the course of playing Wii games, either due to overexertion or striking another object with or losing control of the Wii Remote.

The console's media drive could read Wii optical discs and **Nintendo GameCube** discs, but no other formats. The Wii is fully backward-compatible with Nintendo GameCube software, although the on-line capabilities of that system are not supported, and the games still require a Nintendo GameCube controller to work. The Wii connects wirelessly to the **Nintendo DS**, with several DS games utilizing this feature. This also allows console-specific content to be downloaded and stored on the Nintendo DS via the Wii. The Wii system has a hard drive with a 512-Mb capacity and an SD Card slot designed for external memory storage. Downloaded content can be stored in the internal hard drive or on SD cards. The Wii features free wireless and Ethernet connectivity and can be connected to other Wii systems for LAN play. The system has a parental lock that prevents children from viewing age-inappropriate content, and the rating of each game is encoded in the game's disc. Nintendo used the rating system set by the local regulations of each country where they released the game (in the **United States**, for example, they used the **Entertainment Software Ratings Board [ESRB]** ratings system). The system is also locked to a particular region and can only play discs of the same region.

The Wii system's **interface** is conceptualized as a series of television channels, with six channels appearing automatically: the Disc Channel (where the current game disc loaded into the Wii appears), the Mii Channel (where **avatars** are created), the Photo Channel, the Wii Shop Channel, the Forecast Channel, and the News Channel. Downloaded games appear as additional channels, and other channels—such as the Internet Channel—may also be purchased. Through the Wii Shop Channel, the Virtual Console and WiiWare services sell downloadable games. Virtual Console sells titles originally released on other consoles, primarily from Nintendo's own back catalog but also classic games from **SEGA** and other discontinued consoles, which were run through **emulators**. WiiWare sold original games that were often only available as downloadable content, such as the award-winning *World of Goo* (2008) and *Mega Man 9* (2008).

The Wii system was deliberately designed not to compete with other mainstream consoles (primarily the PS3 and Xbox 360); this was called the "blue ocean" strategy by Nintendo CEO Satoru Iwata. The strategy included targeting a broader audience that included people who were not generally considered gamers by having an interface, software, and **advertising** campaigns that appealed to the young, elderly, women, and casual gamers. The Wii was packaged with *Wii Sports* (2006). Nintendo (and Nintendo-owned subsidiaries) released several high-profile and critically acclaimed games from Nintendo's well-known franchises, including: ***The Legend of Zelda****: Twilight Princess* (2006), ***Mario*** *Kart Wii* (2008), ***Metroid*** *Prime 3: Corruption* (2007), *New Super Mario Bros. Wii* (2009), *Super Mario Galaxy* (2007), *Super Paper Mario* (2007), and *WarioWare: Smooth Moves* (2007). Nintendo also released several popular games that broadened the Wii's audience. Fitness games, *Wii Fit* (2008) and *Wii Fit Plus* (2009), utilized the Wii Balance Board to calculate the user's body mass index. Each game included a large number of activities with the intention of providing players a core workout.

Although the Wii had substantial third-party support, with third-party developers working with key Nintendo licenses such as *Mario Party 8* (Hudson Soft, 2007) and *Super Smash Bros. Brawl* (Game Arts/Monolith/Sora, 2008), only a few third-party-designed Wii games sold as strongly as in-house games: *Game Party* (FarSight Studios 2007), *Just Dance* (Ubisoft 2009), and *Sports Island* (Hudson Soft 2008). This is attributed to the proliferation of poorly designed, low- to mid-priced games—"shovelware"—for the Wii, which allegedly caused games celebrated by critics—like *A Boy and His Blob* (WayForward Technologies 2009), *Little King's Story* (Cing/Town Factory 2009), *MadWorld* (Platinum Games 2009), *Zack & Wiki: Quest for Barbaros' Treasure* (Capcom 2007)—to sell poorly. This was compounded by the family-friendly, casual orientation of the Wii, which meant that games aimed at adult audiences such as *House of the Dead: Overkill* (Headstrong Games, 2009) and *Manhunt 2* (Rockstar Toronto, 2007) sold poorly.

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non-player characters (NPCs)

A non-player character (NPC) in a video game is a character who is not controlled by the player. The term "non-player character" comes from the table-top **role-playing game (RPG)** *Dungeons & Dragons* (1974), in which NPCs are created and controlled by the game master (GM). These characters are either friendly or unfriendly to the **player-characters**, and a GM must prepare enough information about all NPCs to allow for both scenarios. Just as the GM in *Dungeons & Dragons* controls NPCs based on predetermined characteristics, NPCs in video games are generally controlled by the game's **artificial intelligence (AI)** system or, as in some **massively multiplayer online role-playing games (MMORPGs)**, by game moderators.

Making NPCs believable to the player through both narration and gameplay is one goal of **narrative** games. David Freeman lists seven narrative strategies among his 32 "emotioneering" techniques, including "techniques which make major NPCs . . . dimensional and fresh, and thus interesting . . . techniques which give major NPCs emotional depth and complexity . . . ways to make it feel as if major NPCs have an emotionally complex relationship with the player" and "ways to give the player emotionally complex relationships with major NPCs" (Freeman, 2004). Petri Lankoski and Staffan Björk address five aspects of NPCs in *The Elder Scrolls IV: Oblivion* (2006) as they are experienced through gameplay: "human body; self-awareness, intention states, and self-impelled actions; expression of **emotions**; ability to use natural **language** [and] persistent traits" (Lankoski and Björk, 2007, p. 417).

Players may deviate from a game's intended narrative, preferring instead to interact with NPCs in nontraditional ways. As a result, some games use mechanics to discourage players from certain NPC interactions. Some **shooting games**, such as *Area 51* (1995), punish the player with the loss of life or other points for shooting nonenemy NPCs. In **Nintendo**'s ***Legend of Zelda*** franchise, if a player attacks harmless chickens too many times in a row, a swarm of chickens appears and begins attacking the player. Rockstar's ***Grand Theft Auto*** franchise allows players to collect money by killing innocent NPCs; however, if there are police in the area, they will begin chasing the player.

The ways in which players identify with and interact with NPCs has been debated. For example, though Marsha Kinder famously wrote (1993, p. 107) that boys playing as the former NPC Princess Peach in *Super Mario Bros. 2* (1988) "risk . . . transgender identification," James Newman argues that during on-line or participatory gameplay, both playable and NPCs are experienced less as narrative or visual elements than sets of capabilities and actions (Newman, 2002). Thus, although narrative **game design** sometimes envisions NPCs as playing a similar narrative and identificatory role to characters in other media (print, **film**, and so on), video game theorists have argued that NPCs should also be studied on the basis of their behavior and functions.

NPCs can function as information sources for players. Suellen Adams discusses the function of nonplayer character "trainers" and "contacts" in *City of Heroes* (2004) as sources of both actively sought and passively received information (Adams, 2009, p. 289).

The presence of NPCs may change the overall structure of a game. Jesper Juul sees NPCs in *EverQuest* (1999) as part of the "embedded progression structures" in a "game of emergence," describing how NPCs may ask the player to perform certain tasks, leading the player to engage in sequentially progressing "quests" within an otherwise open-ended game (Juul, 2002, p. 328). Single-player "sandbox" games such as Rockstar's *Red Dead Redemption* (2010) use NPC-driven narratives to move the player toward an eventual goal, marking NPCs' locations on the game **map** so that the player knows where to go if he or she wants to continue that character's narrative.

Repetitiveness and Adaptability

Because there are often many more NPCs than player-characters, one aspect of NPCs is their repetitiveness. Different NPCs are often identical in appearance, and they may repeat the same actions and dialogue over and over again. In the single-player RPG *Final Fantasy IV* (1991), characters of the same type (soldiers, dancers, shopkeepers, healers) are all represented by the same **avatar**, with different clothing and hair colors. Moreover, not only do characters usually repeat the same comments every time the player talks to them, but some NPCs repeat the same dialogue. These limitations of early video game technology become a joke in the prologue to the game. As the player walks around a castle, several identical-looking soldiers seem startled when the player tries to talk to them, saying, "I'm not sleeping!"

Gail Shivel describes NPCs' repetitiveness as part of ***World of Warcraft*** (2004), writing, "a non-player character in Elwynn Forest will always ask you to carry a note to her lover if you have not already done so; a bounty on a gnoll named Hogger is collected a hundred times a day on every game server. . . . Every zone and every non-player character has a **history**—a backstory—and a desired outcome, which is repeated endlessly to every new player who comes along" (Shivel, 2009, p. 211).

Although the Digital Games Research Group at the University of Ulster in Northern Ireland suggests that the **adaptation** of NPCs over the course of a game is just one

In the prologue to *Final Fantasy IV* (1991), NPC lack of complexity is humorous, as multiple identical soldiers reply to the player with the same dialogue. (Diana Pozo)

strategy for adaptive game design, calling the modification of NPCs "the most obvious way to adapt a game" (Digital Games Research Group, 2005, p. 8), many scholars have proposed artificial intelligence models to increase NPC adaptiveness in games. In response to NPC repetitiveness in persistent MMORPG game worlds, Kathryn Merrick and Mary Lou Maher suggest the use of motivated reinforcement learning agents, through which NPCs "explore their environment and learn new behaviours in response to interesting experiences" (Merrick and Maher, 2007, p. 127). Brian MacNamee and Pádraig Cunningham propose programming strategies for "Proactive Persistent NPCs . . . NPCs that are always modeled (at least to some extent) even when the human player is not in their vicinity" (MacNamee and Cunningham, 2001, p. 221). Daniel Johnson and Janet Wiles discuss the advantages and disadvantages of several different AI systems for the behavior of NPCs, including neural networks and evolutionary algorithms, both of which are models for adaptive AI, and extensible AI, first used in *Quake* (1996), in which the player can control how NPCs react to enemies (Johnson and Wiles, 2001).

Becoming Playable Characters

In many single-player RPGs, characters that the player first encounters as NPCs later enter the player's party, becoming playable characters. In *Final Fantasy VI* (1994), the mercenary Shadow repeatedly enters and leaves the player's party, acting as both a playable character and an NPC. In the third-person shooter *Resident Evil 4* (2005), Ashley Graham, an NPC the player is trying to rescue through most of the narrative, briefly becomes a playable character.

NPCs that are popular with players may go on to become playable characters in future additions to a game franchise. Beginning with the introduction of Princess Peach and Toad as playable characters in *Super Mario Bros. 2*, Nintendo has built an extensive cast of playable characters from NPCs in the Mario franchise, allowing for multiplayer **racing game** (*Super Mario Kart* [1992]), **fighting game** (*Super Smash Bros.* [1999]), **sports game** (*Mario Tennis* [2000]), and even **board game** (*Mario Party* [1998]) incarnations of the series.

NPCs may also become playable characters through expansion packs that coexist in a single game **world**. **Capcom**'s first expanded version of ***Street Fighter II*** (1991), *Street Fighter II: Champion Edition* (1992), was virtually identical to *Street Fighter II—The World Warrior* (1991), aside from the addition of the four NPC "bosses" from the earlier game as playable characters. *Grand Theft Auto IV: The Lost and the Damned* (2009) is an episodic expansion pack that centers on the NPC biker gang The Lost from the original *Grand Theft Auto IV*, making their leader, Johnny Klebitz, the new playable character.

In *The* ***Sims*** (2000), almost any NPC can become a playable character and vice versa. The player controls only one character at a time while the computer controls other characters, and players can shift player characters within their household at any time or select other households from the neighborhood map. Even maids, firemen, and burglars, who often look identical and do not have houses on the neighborhood map can become part of the player's family through friendship or marriage, becoming playable characters.

Diana Pozo

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North America

See Canada; United States of America (USA)

NPCs

See nonplayer characters (NPCs)

O

Odyssey

See Magnavox Odyssey

on-line games

As the term "on-line" refers to the phone- and data-line connections through which networked computers communicate, on-line games refers to those video games that can be found and played on networked computers or computing devices and on the Internet, including its graphical **interface**, the World Wide Web. Used even more loosely, the term "on-line games" could apply to games on cell phones and other forms of **mobile games**, which also use telephone technology and connectivity to link players and games. On-line games are typically multiplayer games because the reason for being on-line is usually to allow multiple players at different locations to **play** together in the same game or game **world**.

The earliest games to appear "on-line" would be the **mainframe games** that were accessed remotely from computer terminals during the 1970s. These were typically available only on college campuses and in research laboratories and allowed only a small number of players. As microcomputer technology grew and home computers helped to decentralize computing power, ways of connecting personal computers via telephone lines and modems resulted in the rise of **bulletin board systems (BBSs)** and networked games, some of which contained games that players could log into and play, although generally no more than about 16 players could play simultaneously, as in, for example, *Sceptre of Goth* (1983). These developed around the same time as **multi-user domains (MUDs)**, and both of these types of on-line activities grew throughout the 1980s and helped to shape the **massively multiplayer on-line role-playing games (MMORPGs)** that would develop in the mid-1990s.

Home video game **console** systems first extended to the on-line world with the release of Mattel's PlayCable service in 1981, and two years later, the **CVC Gameline**, a device that plugged into the **cartridge** bay on the **Atari VCS 2600** and into a phone jack and allowed games to be downloaded and played, requiring a subscription to the service. The games, however, were not played on-line, and it would not be until the release of the **SEGA Dreamcast** in 1998 in **Japan** (1999 in North America) that a home console would come equipped with a built-in modem that would allow for Internet capabilities.

Since the appearance of the World Wide Web in 1993, **web-based games** have grown in number and popularity, both on personal computers as well as other devices, such as cell phones, iPods, and iPads used for mobile gaming. The ability to play games on-line has also led to the production of **advergames**, which are used to advertise products in a way that engages the user, and games designed for use with social media, like ***FarmVille*** (2009) and *Mafia Wars* (2009). With the growth of cloud computing, an increasing number of games can be leased on-line instead of purchased. As digital distribution and downloadable content (DLC) and the bandwidth of home Internet connections continue to expand, on-line games may one day begin to supplant home console and home computer gaming, becoming the dominant form of gaming.

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P

packaging

Video game packaging serves to promote and **advertise** games in retail stores by attempting to draw the consumer's attention and entice potential players to purchase the game. Early video game packaging often featured artistic conceptions of the gameplay of the packaged games or the themes suggested by the game's title or its **play** mechanics, sometimes resulting in imagery that had little to do with the game itself or its **graphics**. The packaging for two games for the **Atari VCS 2600** demonstrates this range of representational fidelity to the games themselves: while the box art for Activision's *Pitfall* (1982) depicts a cartoon approximation of the game's core elements and screen, the packaging for *Warlords* (1981) features a painting of a medieval knight swinging a sword and a catapult—quite removed from the gameplay, which involves the player rotating a shield around a collection of blocks in a corner of the screen to protect them from attacks from other players. Although more contemporary packaging still uses artistic renderings of the games themselves, screenshots of a game's graphics and covers that feature these elements more prominently are far more common, in part because of the dramatic improvements in the quality of video game graphics.

Packaging for video games varies between **console-based games** and home **computer games**. The packaging for video games made for console systems is often regulated into specific design templates by the console manufacturer for the purposes of uniformity and product recognition. For instance, almost all games made for the **Microsoft Xbox 360** console are sold in a green, hard plastic case with a label that includes a white portion at the top of the spine and on the top of the front cover that identifies the game as an Xbox 360 title. Similarly, games made for the **Sony PlayStation 2** and the **Nintendo Wii** feature similarly distinctive packaging. Packaging for computer games has historically been less restricted, resulting in more elaborate retail boxes and packaging materials; for instance, text-game developer **Infocom** often included supplemental material with its games and featured distinctive packaging such as round plastic disc encasement for *Starcross* (1982) and a plastic mask in the front of the original box for *Suspended* (1983).

Video game packaging generally consists of a retail box that contains the game **cartridge** or disc, sometimes in its own protective case, **game manuals**, and supplemental information such as **maps** and reference cards for game controls. Packaging for consoles may also include materials specific to that system, such as the translucent screen overlays included for games for the **GCE/Milton Bradley Vectrex** system or the plastic overlays used for the **controllers** of the **Mattel Intellivision** system.

Electronic Arts (EA) founder Trip **Hawkins** helped initiate the use of distinctive packaging with his company's first game releases in the early 1980s. Hawkins saw the marketing limitations of the labeled plastic bags in which many computer games were then sold and instead sold EA games in professionally designed custom packaging more akin to the professional packaging found in the music **industry**.

More elaborate packaging may be found in limited-edition or "Collector's" versions of games, which feature supplemental materials or unique elements; these special editions of games have grown more elaborate over time, including items such as maps, figurines, soundtrack CDs, supplemental game content, and more. The "Collector's Version" of the **Nintendo 64** game ***The Legend of Zelda**: The Ocarina of Time* (1998) features a gold cartridge instead of the usual gray color, and Microsoft released three different versions of *Halo 3* (2007): the standard version; the "Limited Edition," which was in a metal case and included a supplemental book and disc of bonus materials; and the "Legendary Edition," which included more supplemental disc material and a scaled plastic replica of the main character's helmet for the disc case. Similarly, four versions of *Call of Duty: Modern Warfare 2* (2009) were released, with the most expensive "Prestige Edition" including a set of functional night-vision goggles. Such limited-edition packaging or content is occasionally linked to the prepurchase of games with specific retail stores, to encourage consumers to pay for a portion of an anticipated game before its release to "reserve" a copy and thus be rewarded with special content.

Because packaging for video games typically involves a box that is considerably larger than the cartridge or disc the game contains, several companies and industry initiatives have recently pushed to reduce the amount of packaging involved. The growth of digital systems of game distribution such as Valve's Steam or Microsoft's Xbox Live services allow games to be sold over the Internet, eliminating the necessity for physical game packaging altogether.

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Pac-Man

Sometimes cited as the most popular and most successful **arcade game** of all time, *Pac-Man* was developed primarily by game designer Toru Iwatani, made in 18 months, and launched by **Namco** in **Japan** in 1979 (it was released in 1980 in North America). Initially the game was titled "Pakku-Man," meaning the sound of a mouth opening and closing rapidly and continuously. For the Western market, the title was originally supposed to be *Puck-Man*, which it was for **European** markets. However, for the North American market, **Midway**, who owned the *Pac-Man* distribution license for the **United States**, was afraid that players would scratch away at the "P" changing it to an "F" so the name *Pac-Man* was used instead.

The legend of Pac-Man's origin says that Iwatani's idea for the game came to him when a slice of pizza was removed from a pie, thereby inspiring his iconic shape. According to Iwatani himself, it was in this eureka moment that Pac-Man was born; but later he admitted that the Pac-Man figure was likewise based on the Japanese sign for mouth combined with eating movements.

The game took the game **industry** completely by surprise and turned out to be one of the best-selling games ever, taking in more than a billion dollars in revenue. *Pac-Man* has since become an icon of the 1980s and of video games in general. The game's design moved away from the macho themes of its time, showing that it was possible to make a nonsports and non**shooting game** that was compelling and fun, and one that men and women alike would **play**. *Pac-Man* turned out to be such an enormous success that it was followed with a number of sequels, including *Ms. Pac-Man* (1981), *Super Pac-Man* (1982), *Pac-Man Plus* (1982), *Jr. Pac-Man* (1983), *Pac & Pal* (1983), *Pac-Man & Chomp Chomp* (1983), *Professor Pac-Man* (1983), *Pac-Land* (1984), *Pac-Mania* (1987), and *Pac-Man VR* (1996), among others, and many unauthorized clones of the game appeared as well.

The Pac-Man character is a yellow circle with a mouth that opens and closes as he moves through a maze, eating dots and getting chased by enemies, referred to as "monsters" or "ghosts" because of their design, each of which has a personal name. In the U.S. version of the game, the red ghost is Blinky, the pink one is Pinky, the cyan one is Inky, and the orange one is Clyde. In Japan, the red one is Oikake (chaser), the pink one is Machibuse (ambusher), the cyan one is Kimagure (fickle), and the orange one is Otoboke (stupid). If Pac-Man is caught by one of these ghosts, a life is lost, and when all lives are lost, the game ends.

In each corner of the maze, there is a power-up pill that makes it possible to eat the ghosts and gain more points. When the power-up pill is eaten by Pac-Man, the ghosts turn blue for a short time and can be caught by Pac-Man. When caught, their eyes return to the starting point at the center of the maze, where they are reborn. When all the dots are eaten, a new level begins.

There are two well-known bugs in the game. A code bug occasionally allows Pac-Man to pass through a non-blue ghost without losing a life, and numerous player patterns have been developed to take advantage of this. It stems from problems with the game's collision detection logic, which goes by tile granularity; if Pac-Man and a ghost switch tiles at the same time, no collision is detected. Another bug is the Kill-Screen bug at level 256. The level is a dead end, even though *Pac-Man* was originally supposed to be a game with no ending. Consequently, it is not possible to go beyond level 256. On July 3, 1999, the first person to achieve the highest possible score at level 255 (3,333,360 points) was Billy

Mitchell from Hollywood, Florida, who completed the game in about six hours.

A Namco **Easter egg** also appears in *Pac-Man*. To get to it, one has to put the machine into service mode and wait for the settings screen to come into view, and then quickly toggle the service mode off and on. When an alignment grid appears on-screen, hold down the player 1 and player 2 buttons, while toggling service mode on and off again rapidly. If all of this is done correctly, the grid will remain on-screen. Finally, push the **joystick** up, left, right, and down, four times each, and the message "MADE BY NAMCO" will appear sideways on-screen, spelled out using power-up pills.

Pac-Man's legacy extends far beyond the game itself. First, there are dozens of sequels; according to mobygames.com at least 44 video game versions of *Pac-Man* have been released. *Pac-Man* became such a huge phenomenon in the 1980s that a hit song came out entitled "Pac-Man Fever" and reached #9 on the Billboard Hot 100 Chart. *Pac-Man* also spawned an animated **television** series, which ran from 1982 to 1983. Over the years, a wide variety of *Pac-Man*-themed **merchandise** also has been sold, including clothing, backpacks, school supplies, glasses, **board games**, playing cards, **handheld games**, and other toys, and even a specially shaped pasta. The game continues to be ported to an ever-increasing number of new **platforms** and systems, and thus *Pac-Man* remains a popular game decades after its release.

Lars Konzack

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Pan European Game Information (PEGI) system

The PEGI (Pan European Game Information) system is a European game content rating system that was established to help European parents make informed decisions when buying **computer games**. The system consists of an age rating indicating suitability by age (3+, 7+, 12+, 16+, or 18+) and content descriptors (Profanity, Discrimination, Drugs, Fear, Sex, **Violence**, and Gambling) that use easily recognizable icons to identify questionable material. Participation is voluntary for game developers, and to obtain game ratings, a developer completes a questionnaire, which is then evaluated and used to assign ratings.

PEGI was originally developed by the Interactive Software Federation of **Europe** (ISFE) and has been in use since April 2003. The PEGI system is based on the

Icons used for the Pan European Game Information (PEGI) game classification system. (Lars Konzack)

Dutch Kijkwijzer system and evaluated in the Netherlands Institute for Classification of Audiovisual Media (NICAM). As of 2009, PEGI was in use in 30 countries. In Portugal and Finland, there have been problems with integrating the system into already existing film classification systems. However, minor age rating adjustments specific to these countries solved the problems.

PEGI is organized into two boards and three committees. The Advisory Board is responsible for making recommendations for the continued updating of the Code of Conduct to ensure that social, legal, and technological developments are reflected in the PEGI system. The Complaints Board deals with any complaints regarding ratings and rating procedures. The Criteria Committee works on adapting and modifying the PEGI questionnaire and the underlying criteria to take into account content, technological developments, and recommendations made by the Advisory Board as well as circumstances brought to light by the Complaints Board. The Legal Committee advises the ISFE of any changes to national legislation within participating countries that could have an impact on the voluntary age rating system. Finally, the Enforcement Committee is charged with implementing the recommendations of the Advisory Board and, more generally, of ensuring the enforcement of the provisions of the PEGI Code of Conduct, including the conclusions of the Complaints Board.

An addition to the system, PEGI Online, was introduced in June 2007. Any online gameplay service providers that meet the requirements set out in the PEGI Online Safety Code (POSC) earn the right to display the PEGI On-line Logo.

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patent #2,455,992

The first patent for an electronic interactive game was **United States** Patent #2,455,992, "Cathode-Ray Tube Amusement Device," which was filed on January 25, 1947, and issued on December 14, 1948, to Thomas T. Goldsmith Jr. and Estle Ray Mann. It was for an analog device that controlled the electronic beam of a cathode-ray tube in an interactive fashion (it did not involve a video signal, however, and what it describes could therefore arguably be denied the status of a "video" game). The beginning paragraphs of the patent describe the proposed invention:

> This invention relates to a device with which a game can be played. The game is of such a character that it requires care and skill in playing it or operating the device with which the game is played. Skill can be increased with practice and the exercise of care contributes to success.
>
> In carrying out the invention a cathode-ray tube is used upon the face of which the trace of the ray or electron beam can be seen. One or more targets, such as pictures of airplanes, for example, are placed upon the face of the tube and controls are available to the player so that he can manipulate the trace or position of the beam which is automatically caused to move across the face of the tube. This movement of the beam may be periodic and its repetition rate may be varied. Its path is preferably caused to depart from a straight line so as to require an increased amount of skill and care for success in playing the game.
>
> The game can be made more spectacular, and the interest therein both from the player's and the observer's standpoint can be increased, by making a visible explosion of the cathode-ray beam take place when the target is hit.

After this introductory abstract, the patent goes on to describe the circuitry in detail, referencing diagrams included in the patent. Apparently, the patent's authors did not market or exploit their invention, nor did it appear to be an obstacle to later video game developments.

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pause function

See help function

PC-Engine

See NEC PC-Engine/Turbografx-16

PEGI

See Pan European Game Information (PEGI) system

performance

Digital performance has its roots in many overlaps between different—and relatively young—artistic and scholarly fields. Since the 1970s, Performance Studies has emerged as an interdisciplinary research field that expands from Theater Studies but concentrates on the analysis of performative actions and behaviors (Schechner, 2002). It includes aspects of more established fields such as anthropology, communication, psychology, **gender** studies, or theater studies but distinguishes itself from neighboring disciplines through its focus on the performance itself (instead of, for example, the written text). From the position of Performance Studies, Digital Performance has been defined as "all performance works where computer technologies play a *key* role rather than a subsidiary one in content, techniques, aesthetics, or delivery forms" (Dixon, 2007, p. 3). The increasing use of various media in experimental performance pieces that include not only video but also real-time three-dimensional imagery, robots, and hybrid stages, have strengthened connections between the development of performance **art** and **interfaces** of evolving new media (Chatzichristodoulou, Jefferies, and Zerihan, 2009; Dixon, 2007) and they have actively contributed to the intermediality of performances (Chapple and Kattenbelt, 2006) as well as their documentation and archiving. In return, as digital video, **motion capture**, and the Internet became available for performance artists, the media-driven and technological aspects played a growing role in the theory of Performance Studies (Auslander, 2008; McKenzie, 2001). Starting from the exploration of digital interactive technologies, Game Studies and Media Studies entered the same field from the opposite direction. They adapted approaches from theater and performance art to explore and describe the emerging expressive qualities of digital media such as video games.

The spotlight on performance as a process invited the connection to interactive media, which also highlights procedural qualities and forms of participation. "Computers as theatre" (Laurel, 1991) have been discussed in the field of interface design, and games have been presented as "cyberdramas" (Murray, 2004) that provide certain **narrative** and dramatic opportunities. References such as these see players as interactors, game **worlds** as virtual stages, and stress the value of dramatic structures for the design of interactive experiences.

The resulting influences of dramatic arts can be traced in human-computer interaction design, **artificial intelligence**, and virtual character and **game designs**, to name a few of the evolving connections. Interaction designers have cited scholars and performance artists from Aristotle to Brecht, Boal, and Kaprow, and many research groups have either hosted or collaborated with performing artists such as Laurie Anderson, Blast Theory, STELARC, or Char Davies to produce instances of digital performances (Giannachi, 2004). Performance Studies looks at digital technology as new expressive tools for a piece that "is" acknowledged performance, framed and situated as an artistic piece, game scholars, on the other hand, use references to theater and performances to look at games "as" performances to find a suitable critical frame for the emerging digital expressions available in games: based on Richard Schechner (2002, p. 38). The gap between the two narrows as both fields, Performance Studies and Game Studies, continue to evolve, and a definite categorization of the cross-references between the two is difficult, but basic questions of body/identity/ **gender**, **space** and **time** of the performance, role of the audience, and sociocultural context are overlapping research fields in both disciplines. Even more precise questions regarding the role of the automaton, the debate on live-ness, or the identity of a virtual character are part of the research and artistic practice in both fields.

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peripherals

Peripherals are devices that are connected (via a physical connection such as a cable or a wireless connection via an electronic signal) to a video game **console** or computer to provide extra functionality, and the term does not usually refer to media storage devices such as **cartridges**, discs, or memory cards. **Television** screens and computer monitors function as peripherals to video game systems because they are not usually included in the console itself, and **audio** speakers and headphones likewise could be included as peripherals.

Apart from screens and speakers, the most common peripherals are game **controllers**. Some of the earliest controllers were built into game consoles directly, whereas later ones were plugged into a console via cables. Today many controllers are wireless, allowing players more freedom of movement. Examples of game controllers that are peripherals include devices such as paddles (which are dials), **joysticks**, joyboards, joypads, trackballs, light guns, guitars, keyboards, drum sets, and motion-based controllers such as the Wii Remote (sometimes called the "Wiimote") for the **Nintendo Wii**.

Besides controllers, there have been a number of other peripherals used with video games to enhance gameplay while not always being necessary to it. For example, the **Atari VCS 2600** had keypads for entering numerical information, the Magnavox Odyssey^2 had a speech and **sound** effects module called "The Voice," and the **GCE/Milton Bradley Vectrex** had a light pen that could be used directly on the screen. The **SEGA Master System (SMS)** could be used with the SEGAScope 3D glasses, and other companies, like Stereographics Corporation and 3DTV Corporation, produce **3-D** glasses that can be used with some video games. The 3rd Space Gaming Vest, by TN Games, uses force-feedback technology to physically simulate the impact of bullet hits, grenade blasts, and other events to the player's torso. The vest uses eight pneumatic air pockets that inflate and deflate in various places around the player's chest and back to simulate directional impacts.

Some peripherals are used for data storage and work with programmable data storage media. The Famicom Disk System, released in 1986 for the **Nintendo Famicom/Nintendo Entertainment System (NES)**, connected first console to a proprietary floppy disk drive and used "disk cards" for storage. The **NEC PC-Engine/Turobgrafx-16** was the first console to have a **CD-ROM** peripheral, which was the Turbografx-CD. Other devices such as the **SEGA CD/Mega-CD** also allowed a game system to use a CD-ROM drive. The Nintendo e-Reader scanner, made for the Game Boy Advance and released in 2001, had an LED scanner that could read encoded data printed on paper cards, which were used by certain games to unlock items or play **minigames**.

One video game peripheral is not even sold commercially to consumers. The PediSedate, invented by medical doctor Geoffrey Hart, is a headset that attaches to the **Nintendo Game Boy** and is used to reduce the trauma children feel during medical or dental procedures. As the child plays, the system monitors respiratory functions and delivers nitrous oxide as needed, keeping the child distracted and sedated until the procedure is finished. As this peripheral demonstrates, as video games find new uses, new peripherals will continue to appear that adapt games even more to other tasks and purposes.

Mark J. P. Wolf

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persistent games

On-line gaming experiences taking place in a persistent-state virtual **world** may be referred to as persistent games. In their computer-based simulated environments that almost never stop, histories, challenges, and inhabitants are persistently there, 24 hours a day, seven days a week. Players interact together directly or through an **avatar**, with **rules** based on the real world, fantasy worlds, or hybrid variations. These games continually run on servers even if (hypothetically) no one is playing. Some of them keep evolving even when the player is disconnected as other users continue playing. Types of persistent games include "multiuser domain" or "multiuser dungeon" games (**MUDs**), massively multiplayer (MMP) games, massively multiplayer on-line games (MMOGs), and **massively multiplayer on-line role-playing games (MMORPGs)**. Persistent browser-based games (PBBG) are also accessed and played over the Internet directly through a web browser. Persistent game elements can be noticed in video games from as early as the 1980s, such as *Trade Wars* (1984) designed by Chris Sherrick or *Orb Wars* (1989).

Persistent games have qualities that single-player and session-based multiplayer games usually do not have: virtual societies partially defined by hundreds or thousands of users simultaneously joining in the same game **spaces**. This web of social relationships is a major factor in the success or failure of a persistent game, which is composed of many systems. Social systems imply communication, groupings, and often possibilities to participate in organized events and social rituals enacted by players. Several of these groups, like the worlds they flourish in, are persistent from one playing session to another. Developers give various appellations to these officially structured, usually large, player associations: organizations, allegiances, guilds, and so on. Political systems that manage voting mechanics may also be present in some persistent games such as *Dark Ages* (Nexon/KRU Interactive, 1999), as well as multifaceted economic systems, like that of *EVE Online* (CCP Games, 2000). Robust markets allowing in-game currency, goods, and character exchanges such as in ***World of Warcraft*** (Blizzard Entertainment, 2004) have also seen the rise of virtual goods sold for real money.

Although persistent game business is risky, especially for games presenting rich fictional worlds, it can be highly profitable if successfully handled. In this market, scale is a major issue in profitability, mainly because of the substantial fixed operating cost necessary to develop, launch, and run these operations. This is explained by persistent games' particular requirements, such as having (or connecting to) registration, authentication, and billing systems, a client/server networking system, servers with databases independent from the client software to run the game on, and security coding to prevent **hacking** and **cheating**. However, the value of the audience is more considerable than its size, as good role-players both encourage other players to act reciprocally and keep others in the **magic circle** longer.

Vincent Mauger

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pervasive games

Pervasive games combine actual and virtual **platforms** in their gameplay. In a narrow sense, their features are twofold. First, pervasive games are generally understood to be transmedial. They use one or more technological devices or on-line platforms combined with traditional environments. Second, they integrate actual spaces in the game experience, either by using players' locations for the game's progress or by contextualizing real-life settings as the game **space** (Benford, Magerkurth, and Ljungstrand, 2005). In a broader sense, the concept can refer to games and resulting player behavior that expand the "**magic circle**" and transfer the game space to an actual context, be it temporal, spatial, or social (Montola, Stenros, and Waern, 2009).

Historically, one of the oldest forms of pervasive gaming is scavenger hunting (Montola, Stenros, and Waern, 2009, pp. 32–34). An early example of this is letterboxing, which finds its origins in England in the mid-nineteenth century. In this game, players hide weatherproof boxes and distribute clues of their location across various media, for instance, by making use of postal services. Some more recent forms of pervasive gaming rely on similar principles, such as geocaching. Here players make use of GPS devices to locate coordinates and retrieve "caches," containers with certain objects in them. Recent pervasive games are rather hybrid forms of gaming that find their origins in playground games (such as tag), **role-playing games**, urban games, and mystery games.

The main genres of pervasive games are location-based games, augmented games, and alternate reality games. Location-based games actively use the player's location to progress the game by using displays, wireless communications, and sensing technologies (Benford, Magerkurth, and Ljungstrand, 2005, p. 56); geocaching is an example of this genre. Similarly, Blast Theory's multiplayer game *Can You See Me Now?* (2002) is a game of catch that requires actual runners to tag on-line players. Augmented games are traditional games effectively expanded through various technologies. The best example of this is *STARS* (Magerkurth et al., 2005), a table-top variation that uses a smart table, wireless communication, and game software (also see **augmented reality**).

Alternative reality games (ARGs) are interactive **narratives** staged in the real **world** that use various media to tell their stories (Montola, 2009, pp. 37–40). In this genre, players often cooperate to solve puzzles and challenges. Unlike the previous genres, ARGs are often used as a promotion tool by the media **industries**. The first ARG game was *Publius Enigma* (1994) published before the release of Pink Floyd's *The Division Bell* (1994), which was followed up by the more popular *Beast* (2001), the ARG related to Steven Spielberg's movie *A.I.: Artificial Intelligence* (2001). Since then, many ARGs have been created by player communities as well, such as *Unfiction* (2002). ARGs are still often used to promote new movies or **television** series or add content to existing ones (such as *Lost* [2004–2010] and *The Dark Knight* [2008]). They form a prime example of what Henry Jenkins (2006) describes as transmedia storytelling: the spread of narrative content across various media platforms.

As a type of game, pervasive games are still growing, but they are also growing more difficult to define. **Persistent games**, such as **massively multiplayer on-line role-playing games (MMORPGs)**, often have an impact on daily life in social terms (as in the establishing of friendships) and economical terms (for example, the selling of characters). However, they do not meaningfully integrate actual platforms from the real world in their gameplay. Still, some features, such as **advertising**, blur the boundaries between the virtual and actual. For example, in 2005, *EverQuest* (1999) included an option to order pizzas from Pizza Hut. Likewise, games that recontextualize real life are not always pervasive either. Urban games such as parkour, which views the cityscape as a set of obstacles one can use for free-running, transfer the actual environments to a game setting but do not use any media in addition to them. Similarly, it can be argued whether mimetic **interfaces** (such as **Nintendo Wii** applications and smart toys) blend the actual and virtual or only enhance existing games.

For players, pervasive gaming is attractive because it enables exciting new forms of **play** that use unexpected technologies and situations. In popular culture, the **film** *The Game* (1997) depicts the uncertainty and thrill these games can have for players. Because pervasive games entwine actual life with the play of make-believe, **immersion** in these games is especially strong (McGonical, 2006). These games also provide many opportunities for creative, emergent play. They often force players to join hands on-line and off-line, thus motivating **co-creativity**. Academically, pervasive games have not been very widely discussed. In player communities, however, we see these games and elements of them developing more and more. ***See also*** ubiquitous games.

Nicolle Lamerichs

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phenomenology

Phenomenology is a philosophical method used to describe phenomena the way they appear. As opposed to phenomenalism (for example, a “stream of consciousness” description in a novel in which *contingent* presence is given, that is, what a viewer perceives at a given moment), phenomenology aims at the very logic of phenomena, that is, the essential structure or *necessary* aspects of presence. Thus, among all media, video games are excellent objects for phenomenological analysis.

The term “phenomenology” for the description of phenomena as such was first used in the 18th century by Johann H. Lambert (1728–1777) and then became widely known through the book *The Phenomenology of Spirit* (1807) by Georg W. F. Hegel (1770–1831). However, it took until the early 20th century before the method was accepted as a philosophical approach, when Edmund Husserl (1859–1938) as well as his pupils, successors, or opponents—such as Martin Heidegger (1889–1976)—investigated the phenomenological structure of appearances. The phenomenological movement still persists and has followers all over the **world**, including the French philosopher Maurice Merleau-Ponty (1908–1961), who was heavily criticized by structuralists such as Michel Foucault (1926–1984) for an assumed/alleged subject-centric view. It is due to this critique that the notion prevails to this day that phenomenology always has to deal with how something appears to a particular subject. This notion was also supported by the fact that the basis for Husserl’s investigations in most cases was his own experience. One’s own experience indeed is a starting point for phenomenology, but not its aim (because this would lead into phenomenalism). Rather, the aim is to abolish anything that is not an appearance because there is the idea of the subject itself (which does not appear as a phenomenon). This so-called phenomenological reduction thereby leads to a crossing out of the subject from philosophy as it has been introduced by René Descartes (1596–1650) in his *Meditations on First Philosophy* (1641). If the subject can be perceived phenomenologically at all, it is the sum of all perceptions as David Hume (1711–1775) had already claimed in his *Treaties Concerning Human Understanding* (1739–1740).

Thus, in some cases, the phenomenology of video games is understood as the experience of a (bodily existing) subject that has to be taken into consideration when analyzing these artifacts (Mellon and Webb, 2006; Nielsen, 2010). Such an approach leads directly into a discussion of the question of **immersion** (Poulin, 2009), which is a contingent moment of getting lost in the game world and is phenomenalistic in approach, not phenomenological. In contradiction to this, a radical crossing out of the subject under phenomenological premise has been claimed by Ian Bogost

(2008), who argues that the phenomenology of video games has to be an "alien phenomenology" that describes the experience of the game itself—how it appears to the computer.

As **video game studies** show, the phenomenological method can be applied without explicit reference to the phenomenological tradition. For example, phenomenological approaches can be found in game classifications, in which games are grouped according to genre definitions or technical qualifications. This is especially the case when video games are addressed as imagery and when their pictorial structure is described. Furthermore, this means that whereas genre classifications describe the content of a game (such as "adventure"), and technical classifications refer to the material basis (such as "**arcade**"), phenomenological descriptions focus on the medial form of the game's image or the form of possible interactions within it; that is, in a phenomenological perspective, these forms are the main perceptual characteristics of the mediation process.

Examples are Mark J. P. Wolf's (1997) formal description of the relation between on-screen and off-screen spaces in games and Espen Aarseth et al.'s (2003) typology of games. Both approaches do not assign themselves to the phenomenological tradition explicitly, but they do describe essential structures of games as they appear, without supposing that the apparent structure is contingent (that is, subject to individual perception). Whereas Wolf's description follows a historical succession of forms, Aarseth et al.'s phenomenology is transcendental in the strict sense, which means that they do not only give (historical) examples for typical forms, but identify the possible realm of the appearance of games. In the case of the spatial appearance of games as phenomena, this means that they can vary within the range of a topological or geometrical gaming principle, as can be found in chess on one hand and a first-person **shooting game** on the other. For such a transcendental phenomenology, there do not have to be given examples that match the extremes—such as chess being purely "topological" and shooting games being purely "geometrical"—but it is only claimed that all possible games have to be in between these two poles. (For example, real-time **strategy games** can be topological in respect to **navigation** but geometrical in respect to combat.) Therefore, with Clara Fernández-Vara et al. (2005), it can be argued that the phenomenological description of video games also has to take into consideration the possible discrepancy between navigational **space** and visible space.

Transcendental phenomenologies have already been used in **art history** (and also without being named a phenomenology) to analyze paintings. An example is the Swiss art critic Heinrich Wölfflin (1864–1945) who in his *Principles of Art History* (1915) defined the (transcendental) principles of pictures (being the "condition of possibilities"), stating that the space of an image can either be "flat"—as in many paintings of the Renaissance—or "deep," as in many paintings of the Baroque. Flatness, according to Wölfflin, does not mean that there is no perspective with the illusion of visual depth (as was the case in medieval paintings) but rather that elements in the picture are all arranged in the same layer of the picture or that the walls have no textures and there is hardly any variation in illumination, as is the case in Leonardo da Vinci's *Last Supper*. In contrast to that is Velazquez's *The Fable of Arachne*, in which the walls have rich texture, the figures are arranged in different layers, and the **z-axis depth** is accentuated through shadow and light. This phenomenological approach can easily be applied to game genres themselves, for example, if early first-person shooting games are compared with later ones: the style of space in *Wolfenstein 3D* (1992) is flat compared with that of *Doom 3* (2004), which is deep. In early shooting games, the floor and ceiling had no textures, and non-player characters acting as opponents were limited to moving within a discrete set of planes set at different distances along the z-axis. The opposite occurs in "baroque" shooters a decade later: all rooms have texture-mapped surfaces, opponents can move freely along the z-axis, and the movement through the game space overall has a higher degree of freedom.

Because the subject (as the agent of experience) is reduced within a phenomenological description, the first person can nevertheless be described as a transcendental phenomenological subject. This is one of the reasons first-person shooters (FPSs) are, because of their structure, the best candidates for phenomenological description and also why they are, in turn, crucial for phenomenology itself: FPSs inherit a phenomenological structure known as an *ipseity*. Ipseity, or "selfness," is a term that was explored by the French phenomenologist Michel Henry (1922–2002) in his book *Incarnation: A Philosophy of the Flesh* (2000). The term "flesh," in turn, as a philosophical concept, was introduced by Merleau-Ponty to point out that the subject cannot be conceived as pure thought (as in Descartes's notion of the thinking essence or *res cogitans*), but that it does have perceptions, sensations, and feelings. In the early works of Merleau-Ponty such as *Phenomenology of Perception* (1945), those appearances were ascribed to the body or the corps one possesses (*corps propre*), which nevertheless is still an entity and finally a substitution for the Cartesian ego (and thus was justly criticized). In his later writings, especially in the posthumously published *The Visible and the Invisible* (1964), Merleau-Ponty introduced the concept of the flesh to point out that it is not about the body as a unity but about body in its sensitivity (flesh thus evokes a body that has even been deprived of its skin) and entanglement with the world. Even though the ego in a first-person shooter (FPS) is not presented as a full body, its sensitivity is depicted by simulating sensations (like dizziness of the screen or a reddish tinting of vision, both indicating a subjective state) as well as by the ability of the picture itself to relate. This approach, which considers the ego as an appearance with a structure that is of selfness can be also found in analytic philosophy or philosophy of **language**, as in the works of G. E. M. Anscombe (1919–2001), Hector-Neri Castañeda (1924–1991), and Roderick M. Chisholm (1916–1999), who come to similar conclusions, stating that the "I" is not an entity whose existence can be proven, but that there is the (perceivable) perspective of the first person, which cannot be deduced from another perspective (the second person or third person). First-person shooters thus explicate the phenomenological (as well as grammatical) structure of the first-person as ipseity (or a "Me") without claiming the existence of the ego (or an "I"). First-person shooters do this basically through the perspectival structure in which not only the objects of the image are depicted—as is the case in movies, which also offer a transcendental subjectivity (Crick, 2010; Sobchack, 1992)—but from which the main game principle is derived, which is the centralization of the pictorial objects at the vanishing point. In addition, the subject's sensitivity is exemplified through modifications of the pictorial style to indicate a subjective state, such as through coloration or blurring (when the subject of the first-person perspective gets shot). Philosophically speaking, video games can offer insight into theoretical problems regarding phenomenology because of their ability to instantiate an interactive, first-person perspective point of view.

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philosophical critique of games

See games, philosophical critique of

physical health

See health (physical)

pinball

See electromechanical games

piracy in China

As the largest producer and consumer of pirated video games in the **world**, **China** is facing a serious problem in game piracy. Since the introduction of video gaming to China in the 1980s, China has been a land of game piracy for almost three decades; from the **Nintendo Famicom** to the **Nintendo Wii** and the **Microsoft Xbox360**, from Game & Watch to the **Nintendo DS** and the **PlayStation** Portable (PSP), the condition remains unchanged. Piracy has dominated the home **console game**, home **computer game**, and **handheld game** markets. Foreign game manufacturers have great difficulties launching licensed games in China because of piracy and state **censorship**.

Game piracy in China exists in various forms, penetrating all game **platforms** and genres except **on-line games** and **arcade games**. There are four major forms of game piracy in China—namely, software piracy, hardware piracy, digital piracy, and game plagiarism.

Pirated game software has monopolized the home console game, home computer game, and handheld game markets. Made and marketed in China, pirated software, either in **CD-ROM** or **cartridge** format, is always in strong demand because of its low price. The majority of players in China have never purchased licensed games, using their home console or handheld console to play pirated software. Sometimes a chip has to be installed in a console to play pirated software. Usually when a customer buys a game console, the shopkeeper will insert the chip for free.

Pirated game hardware and **emulators** enable players to play games without purchasing licensed game consoles. China used to make pirated game consoles; for instance, in the heyday of the Nintendo Famicom, many unlicensed Famicom-compatible machines were manufactured in China and some even **advertised** publicly on **television**. Today, China is not making unlicensed new-**generation** game consoles, such as the Wii, PlayStation 3 or Xbox 360, partly due to technological reasons. Another reason is that there are many game emulator programs for people to download for free on the Web. People install the programs so that they can use their computer or handheld console to play games originally developed for other platforms.

Digital piracy, in place of software piracy, has become the most popular form of game piracy in China. There are many websites in China where people can download games for free. Many have impressive collections of games, and one can find hundreds of titles, old or new, imported or locally made. There are also unlicensed servers where people can play on-line games.

The plagiarism of game consoles and software is nothing new in China. In particular, the console design is most vulnerable to plagiarism. For instance, the Vii and the PXP800 look exactly like the Wii and the PSP, although they cannot play games designed for the Wii and the PSP. In addition, many Chinese games borrow the character design, story, or system from foreign games. For example, the first Saint Seiya on-line game was actually developed by a Chinese manufacturer without acquiring the copyright from **Japan**.

The prevalence of game piracy in China was at first caused by the gap between the price of licensed software and the purchasing ability of the people. A set of licensed game software may cost more than $100 RMB ($14.60 USD), but a pirated edition costs only a few RMB. However, following the rise of the standard of living among people in China, the price of licensed game software is no longer unreachable. Yet the problem of game piracy remains as serious as before. It is because licensed software can hardly survive in the piracy-plagued market, and as a result, many games are not available as legal, licensed software. Consumers are also so used to having a "free lunch" that they are not willing to buy licensed software. Also, Chinese authorities, regardless of the establishment of antipiracy regulations and agencies, have not been determined enough to crack down on game piracy.

The piracy problem has forced foreign game makers to refrain from entering the Chinese market, undermining the reputation of China in international trade and giving rise to on-line gaming, which is relatively piracy-free. ***See also*** Hong Kong; South Korea.

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platforms

Broadly speaking, a platform is anything built that makes it easier to build other things. "A platform in its purest form," write Bogost and Montfort, "is an **abstraction**, simply a standard or specification" (Bogost and Monfort, 2007, p. 2). In the digital realm, "a platform is a computing system of any sort upon which further computing development can be done" (Bogost and Monfort, 2009, p. 2). Platforms can be implemented as hardware or software but often involve both building on each other in layers. Platform Studies, an emerging discipline in computation, examines the architecture that enables the "creative works that have been produced on those platforms" (Bogost and Monfort, 2007, p. 176).

Unlike Atari's *Home* ***PONG*** (1975), which was designed specifically to play a single game, for example, the **Atari VCS 2600** was constructed to enable developers to write software on interchangeable **cartridges** that could be executed by the hardware. Understanding this hardware—the 6507 processor, Television Interface Adapter (TIA), ROM cartridges, and 8-pin **controllers**—reveals the constraints game programmers worked within. Because the

VCS had no frame buffer for storing video display information, developers had to write carefully timed code that would execute synchronously with the **television**'s electron beam. Familiarity with the hardware limitations of the VCS graphical display is central to understanding how sprites are drawn and updated, the rectangular shape of the "pixels" on the screen, and the number of processes that could be executed as a CRT television's electron beam raced across the screen (Monfort and Bogost, 2009, p. 28).

The hardware capabilities of the **Nintendo Wii**'s motion controller are another kind of platform. The Wii controller uses gyroscopes, accelerometers, and infrared receivers to accept user input. The gyroscopes and accelerometers measure rotational movement and acceleration along the controller's major axes while the infrared sensor maps the position relative to the television as a cursor on screen. The Wii could not interpret complex gestures, so games designed for the hardware could not implement subtle motion. Instead, games were designed to account for the limitations of the hardware. Swinging a racket, golf club, or baseball bat in *Wii Sports* (2006) does not need to **map** one-to-one with the physical motion of the player because the game does not require that level of fidelity.

Software is equally important to the study of platforms. Software platforms include programming **languages** like BASIC and C++, operating systems like Microsoft Windows and Mac OS X, multimedia platforms like Adobe Flash, and game **graphics** and physics **engines** like Valve's Source and Epic Game's Unreal Engine. Software platform studies differ from software studies or code studies in that the latter examines how the software was written rather than how others can use it (Monfort and Bogost, 2009, p. 147).

Platform studies is positioned by Montfort and Bogost as the lowest level of five tiers of digital media studies. Each level dives deeper into the object of study as the critical lens moves down through the reception and operation by the user, the **interface** between the user and object, the form and function of the processes and **rules** that govern the computational artifact, the code written to instantiate those processes, and the platforms that enable that code to run (Monfort and Bogost, 2009, p. 146). All of these are situated in the culture and context that informs decisions made at every level.

Bobby Schweizer

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play

Play scholar Brian Sutton-Smith claims that the task of defining play is "difficult, if not impossible" given how vast the concept is (1997, p. 217). He extends his warning by stating that "we all know what playing feels like," but "when it comes to making theoretical statements about what play is, we fall into silliness."

The concept of *play* goes hand-in-hand with *game*, and it is hard to imagine defining one without the other. Yet recent major efforts—notably Juul's (2005)—have focused the attention more on defining *game* rather than *play*. This seems reasonable, because games feel more concrete and specific than the multiple activities involved in play. Still, the challenge of better understanding the latter remains.

Defining *play* can be difficult for several reasons. One is context: the same activity could be perceived as *play* or not depending on the player's intentions. For example, I could enjoy myself solving cypher puzzles. However, if I were a spy, that same activity could be so serious that my life could depend on it. To make things even more complicated, a professional spy can spend her time solving puzzles, either for fun or as training or even as both at the same time.

And then we have the **language** problem. Whereas English makes the distinction between *play* and *game*, most Roman languages do not. However, the English language is not extremely precise either: both terms can be used both as nouns and verbs. To make things even more difficult, we also love to use these terms metaphorically in everyday talk.

Salen and Zimmerman describe this duality by pointing out that "games are a subset of play" but also that "play is an element of games" (2003, p. 303). In the first case, play is seen as a set of activities, whereas in the second, it is seen as an object, a characteristic of games.

Several non-English-writing scholars have felt the need to differentiate between two different categories for describing play, even though we should be careful not to assume that they were describing the difference between *play* and *game*. For example, French philosopher André Lalande differentiated between two kinds of *jeu*, describing one of them as a subset of the other, organized through victories and defeats, gains and losses. French scholar Roger **Caillois** (2001) also introduced two terms, *paidia* and *ludus*, as two extremes of a continuum where he located *jeux* (French for games and play activities).

So when reviewing a definition of "play" by a non-English-writing scholar, we have to pay special attention to how the work has been translated. One of the most famous definitions is that of Johan **Huizinga**; in his *Homo Ludens* (1938), he offers two definitions of *play.* Here's the broader one:

> Play [is] a free activity standing quite consciously outside "ordinary" life as being "not serious," but at the same time absorbing the player intensely and utterly. It is an activity connected with no material interest, and no profit can be gained by it. It proceeds within its own proper boundaries of **time** and **space** according to fixed **rules** and in an orderly manner. It promotes the formation of social groupings which tend to surround themselves with secrecy and to stress their difference from the common **world** by disguise or other means. (Huizinga, 1944, p. 13)

As Salen and Zimmerman point out (2003, p. 75), Huizinga's definition does not differentiate between *play* and *game* and has been heavily criticized in the recent decades for being vague and too broad (Frasca, 1997; Juul, 2005). The other classic definition is that of Roger Caillois, who describes *jeu* (was he referring to *play*, *game*, or both?) based on six main characteristics: free, separate, uncertain, unproductive, governed by rules, and involving make-believe.

A common trend in many studies on *play* and *games* is the idea that play activities do not involve rules or at least involve less strict rules than games. The problem here may be how we understand the concept of *rule*. Rules are generally understood as social rules that give value to a certain action: "if you steal you'll go to jail" or "if you score more goals than your opponent you'll win." However, not all rules are prescriptive. Some simply describe the inner workings of something or what is possible within a system. For example, imagine a maraca: a sealed container with small objects inside. The governing law of the maracas is that they emit sounds depending on how they are moved. A toddler can play the maracas according to a basic set of rules: if the maraca is still, there's no **sound**. If I shake the maraca slowly, there's a soft sound. If I shake it hard, the sound is louder. My maraca playing will be constrained by these rules. These are not, however, prescriptive social rules. If I'm playing my maracas in a music band, then there's a clear social rule: I must follow the rhythm or I'll be perceived as a lousy musician. Rather than saying that games have rules and play does not, it may be better to understand that there are different kinds of rules. For example, Piaget made the difference between *rules*, understood as social agreements, and *regularities* that influence play in presocialized children.

Elliot Avedon and Brian Sutton-Smith first defined play as "an exercise of voluntary control systems" (1971). This was later expanded by Sutton-Smith in his *Ambiguity of Play*, where he writes:

> Psychologically, I define play as a virtual **simulation** characterized by staged contingencies of variation, with opportunities for control engendered by either mastery or further chaos. (1997, p. 231)

Salen and Zimmerman defined play as "Free movement within a more rigid structure" (2003, p. 304). This is an elegant definition that can be particularly useful for designers to visualize the ambiguity between freedom and constraints that play imposes on players.

In my own definition of *play*, I have attempted to look further into the player's mind-set while focusing on its subjective nature: "Play is for somebody an engaging activity in which the player believes she has active participation and interprets it as constraining her immediate future to a set of probable scenarios, all of which she is willing to tolerate" (Frasca, 2007). The key words here are *every* and *tolerate*: players will not enjoy all consequences of their play actions, but at least they are willing to cope with them.

Near the end of the *Ambiguity of Play*, Sutton-Smith provides a meta-definition: a list of requirements that he thinks a good definition of play must include. These are summarized as follows:

1. play's definition must be broad rather than narrow . . .
2. . . . it should apply to animals as well as humans, and children as well as adults.
3. [play] should not be defined only in terms of the restricted modern Western values that say that it is nonproductive, rational, voluntary, and fun. . . .
4. . . . play is not just an attitude or an experience; it is always characterized by its own distinct performances and stylizations.
5. Play can be very narrow or very broad, both in spatial and temporal terms.
6. . . . play is like language: a system of communication and expression . . . (Sutton-Smith, 1997, pp. 218–219)

The fact that one of the most ambitious modern treatises on play finishes not with a clear-cut definition but rather with a blueprint for one is quite telling on how difficult the task of understanding play is.

Gonzalo Frasca

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Play Meter magazine

Play Meter magazine is a trade publication covering the coin-operated entertainment **industry**. Founded in 1974 by Ralph C. Lally II, *Play Meter* has published monthly for nearly 40 years. *Play Meter* offers news coverage at the regional, national, and international levels, as well as tournament and league news; coverage of major trade shows; industry trend reports; company profiles; and family entertainment center information. *Play Meter*'s target audience consists of members of the coin-operated amusement industry, specifically route operators and coin-op machine distributors.

Because of this industrial focus, the publication dedicates much of its space to news of specialized interest to these business sectors. The magazine offers new product descriptions and game reviews, intended to help operators decide which games to invest in. The magazine also accepts both display and classified **advertisements**, many of which are focused on specific games or on specific sales or distribution outlets for games. The publication also provides other information that may be of interest to owners and operators who work primarily with **arcades** or other dedicated gaming venues and has included extensive coverage of non-coin-operated amusements such as miniature golf and go-karts, among others, which are relevant to operators of family entertainment centers. *Play Meter* also provides tax advice and other content intended to assist in the development and operation of coin-op businesses.

Play Meter publishes monthly, which includes an annual directory issue that lists manufacturers, distributors, and suppliers. The magazine is available primarily through mail order, although issues are sometimes distributed at relevant trade shows and are routinely sent out to advertisers or other potentially interested parties. As of 2010, subscriptions totaled just under 3,000 with circulation totaling just under 5,000.

In addition to its print presence, *Play Meter* regularly posts industry news in digest form on its website, where the publication also maintains a listing of upcoming industry events relevant to its readers. *Play Meter* posts portions of its current issue for on-line reading.

Carly A. Kocurek

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Play Meter magazine website, available at http://www.playmeter.com.

player-character

See avatar

Playmore

See SNK (Shin Nihon Kikaku) Playmore

PlayStation

See Sony PlayStation

PlayStation 2

See Sony PlayStation 2

PlayStation 3

See Sony PlayStation 3

PONG

The **ball-and-paddle game** *PONG* (1972) is considered the video **arcade game** that launched a multibillion-dollar **industry** and a fevered excitement for high-tech entertainment. Although not the first video arcade game, *PONG*'s design and gameplay contained a formula perfect for the ideals of casual gameplay: curiosity, intrigue, amazement, and simplicity. The *PONG* prototype was built by Allan Alcorn, **Atari/** Syzygy's first engineer. Nolan **Bushnell** instructed Alcorn to build a tennis-type game, and Alcorn added the on-screen scoring and after probing the board, found the unique "Pong" **sound** that he added into the game. Also, a little-known feature of the *PONG* arcade game that Alcorn added is the "hole" in the upper corners of the playfield, made so that a player's paddle cannot fully reach to the top of each side of the playfield. This was added so that if two players were so good that they would never miss a shot, eventually the ball would slip though this "hole" ensuring that the two players could not play a never-ending game, essentially keeping others from playing it, and, more importantly, to get more quarters into the machine, further increasing profits.

PONG was first introduced in a test run at Andy Capp's Tavern in Sunnyvale, California, where patrons were greeted by a small brownish-orange box placed atop a wine barrel, plugged into a wall outlet and sitting there quietly waiting, with only the word "PONG" on the control panel to identify this unique device. Of note, the game had an "attract screen" to draw in the patrons; the ball bounces about the screen endlessly while the game awaits a quarter to be inserted. *PONG*'s designer Allan Alcorn explained that an "attract mode" was purposefully designed into *PONG* to show the ball moving about the screen, but that the paddles would not show so that people wouldn't just randomly play with the knobs (according to an e-mail from Alcorn to one of the authors, July 2011). Also, there would be no sound during the attract mode for fear that an annoyed bar owner would just go and pull the plug on the unit, defeating the point of it running and making money. Upon inserting a coin, *PONG* then resets itself, displaying player paddles on the left and right sides, as well as a score display.

The oft-told story of the "broken *PONG*" is in fact a truthful one and not just a by-product of the usual video game industry lore and marketing. Atari did in fact receive a phone call from the owner of Andy Capp's Tavern saying that the *PONG* test unit had stopped working. On the side of the orange test *PONG* was a coin mechanism that was used on commercial washing machines of the day. What had occurred to everyone's surprise is the type of "problem" desired for every newly tested product: the coin mechanism was jammed because it was completely filled with quarters.

After this initial test, Alcorn and Atari cofounder Ted Dabney went on to hand build 10 *PONG* boards to be installed into the full-sized and now-familiar yellow *PONG* cabinets that were also placed at various locations for testing. After the profit results started to come in, Nolan Bushnell and Ted Dabney faced a serious problem. They thought no one at **Bally**, the company they were actually contracted to deliver a video game to, would believe the profit results. They were just too good for such a new and unproven technology, especially compared with what new pinball and **electromechanical games** normally made at the time. When it was time to report to Bally, Bushnell and Dabney lowered the profit results by 25% per location, but Bally still responded saying that the results were not believable, that they were just too high.

Bushnell and Dabney were then faced with another dilemma—they saw that *PONG* was making money, a lot more than anticipated. So they had to consider changing their focus from entertainment engineering to becoming a video game manufacturer. If they were going to do this, however, they would need to convince Bally that they would not want *PONG* altogether. Atari's contract with Bally was to deliver a game to them, any game, so Bushnell and Dabney worked on a letter to send to Bally saying that *PONG* was not a viable

game design and that Atari would deliver a different game to them in its place. Bally accepted the change of game design freely and Bushnell and Dabney proceeded to go it alone and produce *PONG* machines directly. *PONG* machines would arrive at locations in all shapes and sizes from the most well-known upright yellow-faced cabinet to a cocktail table version, *PONG*s housed in used wine barrels, to even an experiment in putting *PONG*s into a doghouse-shaped cabinet with a familiar cartoon beagle sleeping on top. In total, 38,000 *PONG* machines (including follow-ups such as *PONG Doubles* [1973] and *Quadrapong* [1974]) would be produced and sold to **arcades** until 1975 when *PONG* would go home—to the living room, that is. The invasion of people's **television** sets would start a new chapter in Atari's history as the arcade game company began its entry into the consumer arena.

Curt Vendel and Martin Goldberg

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Portal

Valve's *Portal* (2007) is a single-player first-person shooter/puzzle game. It was originally released as part of the *Orange Box* bundle of games for Microsoft Windows, **Microsoft Xbox 360**, and **Sony PlayStation 3** and later became available as a standalone product, downloadable through Xbox live and through Valve's digital distribution program, Steam. *Portal* was also available for Mac OS X as of May 2010, and the sequel to *Portal* was *Portal 2* (2011). *GameSpot* contributor Chris Watters echoes the sentiments of many fans, praising *Portal* for its "unique gameplay" and "witty writing" but complained that "It's short. Like, real short" (Watters, 2008).

The game's protagonist, Chell, is a test subject for the Aperture Science Handheld Portal Device, a gun that can place a portal on any solid surface, allowing nonadjacent **spaces** to be linked together. Chell's guide to the experimental process, a robot named GLaDOS, begins by helping the player **navigate** the increasingly dangerous environments of the game, becoming less helpful and more menacing as the player completes more puzzles. The player's increasing proficiency with the portal gun and growing suspicion of GLaDOS's intentions reaches a climax as Chell must destroy GLaDOS to escape the testing facility.

Lucien Soulban and Harris Orkin term *Portal* a "modern classic" of the first-person shooter genre for its simple **narrative** "told through text, voiceover, and song" (Soulban and Orkin, 2009). The narrative song, "Still Alive," written by Jonathan Coulton, which accompanies the end credits of *Portal*, features GLaDOS taunting the player with her characteristic sarcasm, "I'm not even angry/I'm being so sincere right now/Even though you broke my heart and killed me."

Although the **interface** of *Portal* is similar to most first-person **shooting games**, with the player maneuvering their character's viewpoint and gun, *Portal*'s gameplay centers around spatial problem solving rather than fast-paced combat. Patrick LeMieux and Stephanie Boluk suggest a new genre label for *Portal* and other games that "feature the manipulation of space and **time** as their main gameplay mechanic," calling them "eccentric games" (LeMieux and Boluk, 2009). Each stage of the game requires the player to use the ability to create portals to successfully navigate a perilous three-dimensional environment. Earlier stages allow the player to explore rooms danger-free, whereas later stages feature deadly liquid, robots shooting at the player, and other obstacles. Nicolas Schiller argues that *Portal* serves as a model for successful pedagogy because of the way the increasing difficulty of its levels, and the decreasing guidance offered by GLaDOS over the course of the game, teaches the player how to use the portal gun and navigate the space of the game while playing (Schiller, 2008).

Portal is one of the few first-person shooters with a female protagonist. As in *Metroid Prime* (2002), in which the player can sometimes see Samus's face reflected in the inside of the helmet of her spacesuit, players learn they are playing as a female character through a mirror effect, looking through the portals they have created at their **avatar**. In fact, because GLaDOS only appears in the early part of the game as a disembodied feminine voice, *Portal* could be seen as having an all-female cast of characters.

Diana Pozo

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procedural rhetoric

"Procedural rhetoric" is a term coined by Ian Bogost to define a method of rhetoric that involves building and interacting with models rather than with words or images, "the art of persuasion through rule-based representations and interactions rather than the spoken word, writing, images, or moving pictures" (Bogost, 2007). Although not limited to video games nor even to computer software, Bogost suggests games as the best medium from which to understand procedural rhetoric. Furthermore, because video games are made from computer models, he argues that procedural rhetoric is the essential meaning-making function of video games, which separates them from all other expressive media. Bogost gives the name "persuasive game" to video games that mount effective procedural rhetorics.

Procedural rhetoric combines two concepts from the history of rhetoric and of computational media. As described by Janet Murray, "procedurality" is one of the key properties of digital media, a computer's "defining ability to execute a series of **rules**" (Murray, 1998). Bogost distances procedurality from Murray's other three properties (spatial, participatory, and encyclopedic) via an Aristotelian virtue argument. The latter three properties exist in other media, but procedurality is entirely unique to the digital medium. *Rhetoric* refers to the art of persuasion, a practice with a storied **history** in Western philosophy and creativity. Originally studied for oral communication only, the field of rhetoric was later expanded to include all media and manners of expression, not just those intended to change the opinions of others. The concept of procedural rhetoric stands as an argument against the colonizing efforts of structuralists and semioticians to apply the standards of written rhetoric to video games unthinkingly. Just as visual **art** requires a unique understanding of visual rhetoric, video games and other interactive software require their own form of rhetoric.

Bogost suggests that procedural rhetoric operates by means of an interaction model based on the Aristotelian enthymeme. An enthymeme omits one premise of an argument and expects the listener to fill it in. Bogost holds that a sophisticated persuasive game will be able to constrain a player's interactivity in much the same way, finding a game's expressive meaning by following its rules to a designer's premise. Procedural rhetoric can thus be seen as an author-centric **design** tool standing in opposition to Bogost's reader-centric interpretive tool of the "unit operation" wherein a player interrogates a "simulation gap" between a real-world system and its simulation model within a game to find and synthesize discrete units of meaning among objects, events, and actors (Bogost, 2006).

Bogost explores procedural rhetoric in a number of examples from mainstream, **educational**, political, **advertising**, and exercise games. In one game from a popular crime simulation franchise, ***Grand Theft Auto****: San Andreas* (2004), Bogost reveals how the need to eat food to restore health is coupled with the omnipresence of fast food to create a procedural argument about the rise of obesity in underprivileged socioeconomic classes (Bogost, 2007). Molleindustria's *McDonald's Game* (2006), in contrast, shows how the operation of a fast food conglomerate necessitates unethical business practices. The game's procedures for calculating rising costs quickly overwhelm players, forcing them to practice deforestation, targeted advertising, and cattle hormone feeding to maintain profitability.

The study of procedural rhetoric is closely affiliated with broader arguments about the importance of developing a "procedural literacy" in educational institutions. As literacy is the ability to read, write, and critique a cultural symbol system, procedural literacy deals specifically with skills for reading, writing, and critiquing computer code. Bogost, Ferrari, and Schweizer argue in *Newsgames: Journalism at Play* (2010) that the general **cognitive** strategies provided by procedural literacy can be applied, after specific training, to a variety fields such as **journalism**, politics, and economics. Their position is that **game design** stands as the best way for practitioners of any field to gain a basic competency in procedural literacy.

Another recent advance in the practical application of procedural rhetoric comes from an analysis of the relationship between processes and graphical skins in *Kaboom!* (1981), an **Activision** game for the **Atari VCS 2600**, about preventing explosives dropped by a "Mad Bomber" from reaching the bottom of the screen by catching them in baskets. Treanor, Mateas, and Wardrip-Fruin (2010) isolate the agents and collision objects of the game, then they show how the game's rhetoric changes after manipulating two types of values for each collision: whether a collision is good from the perspective of an object ("evaluative" manipulation) and whether an agent means to do what it does ("volitional" manipulation).

Once these values have been assigned, it becomes possible to reskin the assets of *Kaboom!* to create a virtually infinite number of games within different rhetorical archetypes. Treanor, Mateas, and Wardrip-Fruin (2010) prove that the semantic freight of a game's ruleset is both constrained and context-specific. Bogost refers to this phenomenon as the "tight coupling" of visual and procedural rhetorics. Designers that simply reskin a popularly recognized game, such as ***PONG*** (1972), to raise a political issue without regard for the template game's procedural affordances tend to produce ineffective procedural arguments (Bogost, 2007).

The designers of early **simulation games** can be seen as the forerunners of procedural rhetoric, inspiring many of Bogost's premises and design methodologies. The "mechanics are the message" school of design—personified by Brenda Brathwaite, Soren Johnson, and others—share Bogost's assertion that a game's meaning comes primarily from the interaction between its rules and its players (Johnson, 2010). Similarly, developers of "**immersive** realism" games, such as Patrick Redding, argue that games should allow players to engage with meaning as a lived, systematic experience rather than feeding players meaning through traditional storytelling methods (Redding, 2008).

Simon Ferrari and Ian Bogost

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psychodynamics

The psychodynamics of video game playing refers to the application of psychoanalytical theory and related concepts to the experience of playing a video game. This approach uses concepts of Sigmund Freud, Jacques Lacan, and others following in their footsteps. These theories offer a framework for analyzing the psychosomatic processes occurring during gameplay. Video game playing can be divided into three dimensions, using Lacan's distinctions between the "real," the "symbolic," and the "imaginary" (Lacan, 1997, pp. 7–15, 63). In the real rush of digital **play**, symbolic messages are exchanged between program and player that produce an imaginary illusion. The term "real" refers to the temporal and material dimensions of gameplay, the passage of **time**, and the stimulating progression of the digital simulation. The "symbolic" encompasses the structural logic of the binary code that defines everything in the game and that must be internalized by the player to play successfully. The "imaginary" is the dimension in which the player experiences the game and attributes meaning to it.

The temporal dimension of the real allows us to divide the process of video game playing into three fundamental phases: the learning phase, the fluid phase of gameplay in which the player dives into and focuses in on the experience of playing, and the resurfacing of the player from this intense involvement. Players have to first learn a game's controls and rule system, which are prescribed on the level of the symbolic. The symbolic is the dimension that defines what exists in a given game and which actions are possible within it. A game's events unfold along symbolic chains, series of zeros and ones; everything must be anchored in the program code. Human players can interact with video games because they partake in the symbolic as well; players always have to interact with the code of a game, engaging its particular system of **rules**, to act in it. The interactivity of video game playing is grounded in the circulation of symbols between computer and player. Every legitimate interaction is defined in the symbolic order—what Lacan calls "the big Other" for which he accordingly uses the notation "A" (for French "Autre") in his algebra of the unconscious (Žižek, 1999)—that is defined in the program code of a game. To play, the player must submit to a position that is prescribed by the program and differs from game to game. Success in the game occurs when the player's actions conform to the demands of the code.

From the perspective of cybernetic psychoanalysis, player and **computer game** form a unit, a "cyborg," short for a cybernetic organism (Haraway, 1991). Both participate in the same information circuit and are connected through the **interface** of the game system, which can be divided into two layers: the invisible symbolic processes and the multisensory contact surface (Pias, 2004). The symbolic processes take place within the computer as well as within the central nervous system of the player who has incorporated the rules of a game. They generally occur on an unconscious level—below the level of perception—and perform a twofold act of translation. The series of binary symbols connect the motor input of the player with the multisensory output of the program and create an information circuit in which both participate. The contact surface of the interface normally consists of a screen, loudspeakers, and **controller**. Players complement the visual, auditory, and haptic output of the game through their active imagination.

The imaginary is the dimension of the ego and the level on which computer game-playing is consciously experienced by the player. On the level of the imaginary—a dimension that computers do not have, only human players—games become meaningful experiences. The series of zeros and ones generate whole **worlds** that are absolutely meaningless on the level of the symbolic but offer intensely engaging experiences in the imagination of the players. It is common for players to actively imagine themselves into a game world, taking on the identity of their **avatar** and having highly meaningful experiences. The playful act of pretending is what allows the player to enter into the game world on the other side of the screen. Together, player and program project the game's **virtual reality**—understood as the multisensory interaction with data structures—into the realm of the factual. During intense phases of play, the player's sense of reality is reoriented toward the game world, creating an affective link with the avatar.

Video game playing takes place along an axis of disembodiment and reembodiment. The technological interface disappears during the course of play, and the player dives into the game world—a phenomenon called **immersion**. When a player submits to the rules of a game, "transference" occurs—the psychoanalytical term for the mobilization and actualization of unconscious wishes (Laplanche and Pontalis, 2006, pp. 455–462). A player successfully coupled to a video game dives into an illusion that unfolds itself between their imagination and the multisensory contact surface of the interface. The visual, auditory, and vibratory patterns act together with the interactive possibilities of a virtual embodiment to make players forget their immediate surroundings as well as their physicality. Players connect with the role the game offers, and the virtual world becomes meaningful. One way of understanding the relationship between players and avatars is as a process of identification; players enter into a "mirror relationship" with their game figure. The avatar takes the position of what Lacan calls "object petit a"—the external picture that the unconscious self needs to introject to form an imaginary identity (Lacan, 2006). And the player partakes in a real process of becoming whether the avatar is Lara Croft (*Tomb Raider* series), Niko Bellic (***Grand Theft Auto** IV* [2008]), or the Zerg swarm (***StarCraft*** [1998]) (Deuber-Mankowsky, 2005; Butler, 2010).

As soon as the controls of a game have been successfully mastered by the player, the experience of "flow" becomes possible, a term coined by the psychologist Mihalyi Csikzentmihalyi (2000) to refer to the phenomenon that an activity, which develops consistently out of itself, can take hold of the person performing the action and carry them away. People in this state of mind tend to forget themselves as their thinking and doing merge with each other. Self-reflexive thought patterns tend to disappear in the process of flow, the boundary between symbolic exchange and imaginary experience blurs, and a feeling of total control is experienced. The player's conscious ego—what Lacan calls "moi"—doesn't think about which buttons to push; rather the player's unconscious self—what Lacan calls "je" (Lacan, 2006)—dances with the computer game.

The state of flow only lasts as long as the player is successful. Equally, the immersion of the player and the player's identification with the avatar is not total; they only exist while the game is running. During gameplay, the player's psyche oscillates between closeness to their avatar, bordering on symbiosis, and a self-reflective distance that occurs, for example, when a player tries to do something that isn't anchored in the code, when his or her virtual embodiment dies, or when the gaming system malfunctions. In such moments, the interface stops being a connecting membrane between computer and player and makes its presence known as a border separating the two. Video game playing is, like every form of play, a schismatic experience that oscillates between the poles of intensive inebriation and reflexive awareness, between self-loss and self-reference (Butler 2010). The complementary experience to the imaginary immersion in a game is the moment when the symbolic underpinnings of the simulation are blatantly obvious. In the real process of game-playing, the virtual world is perceived alternately as an "imaginary illusion" and as a "symbolic fiction," to use a distinction made by Slavoj Žižek (1997, pp. 127–141). This doubling of the player into an involved actor and a distanced observer is constitutive for computer game-playing, which always ends with an abruption of the game-playing session, whereupon players not only emerge from their imaginary immersion but also become fully conscious of the time spent playing as well as bodily sensations such as hunger, thirst, and eventual aches.

Multiple partial drives are mobilized during video game-playing. First, a stimulation of the visual, auditory, and tactile senses takes place. The conjunction of eye-screen, ear-speaker, and hand-controller are "erogenous zones" (Freud, 2000), sources of pleasure, or rather "cyberogenous zones," erogenic zones that are part of a cybernetic loop. In the real rush of computer game-playing, desire is invested in the perception process itself (Deleuze and Guattari, 2004, pp. 312–313), in the sights, sounds, and sensations of the game world. Second, computer game-playing encompasses the desire to show. Players direct the action on the screen and gain pleasure from exhibiting their prowess to themselves and others. Third, the conjunction of hand and controller feeds into the drive for power and mastery. The practicing of the different control combinations to perfection as well as the successful mastering of the game's scenarios is a great source of pleasure for players. Fourth, the drive for knowledge and exploration is also fundamental for gameplay. Curiosity compels players forward because they want to know how a game will unfold. Finally, the desire for intense experiences is fundamental to gameplay, which always encompasses an anxious pleasure for the players. The uncertain outcome of the player's moves within the game feed into the heightened vitality of playing and is a fundamental component of all play. Regardless of which of these drives is most dominant in a given game, the libidinous configuration of gameplay strives for the establishment of plateaus, continuously flowing zones of vibrating intensity (Deleuze and Guattari, 2004, p. 24).

Another way of understanding the relationship between player and avatar or rather the one between player and game, besides seeing it as identification, is to conceptualize it as a rhizomatic connection (Deleuze and Guattari, 2004, p. 7); players deterritorialize themselves, dissolving their ego and its imaginary relationships, and reterritorialize themselves in the game worlds they partake in while playing. And the gaming systems they use simultaneously deterritorialize themselves, through the multisensory performance of the interface, and reterritorialize themselves in the imaginations and the bodies of the players. For example, reports from *SimCity* (1989) players describe how their perception of the nonvirtual cityscape changed after playing the game (Butler, 2007, pp. 148–149). Over the course of countless hours, in countless repetitions, players imprint the cognitive and sensomotoric structures demanded by the game on their bodies and imaginations. At the same time, players collect experience with the different facets of gameplay and gain increasing competency in dealing with the diverse psychodynamic phenomena described here.

Mark Butler

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psychological research on video games

Psychologists have long been interested in the effects media have on us. Decades before video gaming became the popular form of entertainment it is today, researchers were examining the impact media models had on behavior. In 1961, Albert Bandura conducted his famous "Bobo Doll" experiment. This study revealed that preschoolers who watched an aggressive adult model were two times as likely as the control group to display aggressive **play** behavior. Bandura's social learning theory (Bandura, 1973, 1977) paved the way in linking observation of **violent** media models on television, and later in video games, to aggressive behavior. A meta-analysis of 136 studies strongly indicated playing violent video games is a causal risk factor for aggressive thoughts, feelings, and behaviors (Anderson et al., 2010).

Impact of the media on behavior has been a hotly debated topic (Steinberg, 2008). There are three theories that can be applied to understanding video game influence and usage. The uses and gratifications approach purports that individuals' preferences shape their video game usage (Katz, Blumler, and Gurevitch, 1974). Cultivation theory proposes that the content of video games shape individuals' preferences and behaviors (Gerbner et al., 1994). Lastly, the media practice model suggests a reciprocal relationship between individuals' preferences and video game content (Steele and Brown, 1995). Most early research focused on the negative impact of video games; however, today many researchers are examining the benefits of video games.

Adults are concerned with the video game usage of young people. Parents and researchers believe that violent first-person **shooting games** have negative effects on children's **mental health**. Numerous studies (such as Anderson and Dill, 2000; Bartlett, Harris, and Baldassaro, 2007) show that violent behavior and aggression increases after playing these games. Other research indicates playing video games for more than one hour a day may increase inattention symptoms, like those associated with Attention Deficit Hyperactivity Disorder (Chan and Rabinowitz, 2006). In addition to increased hostility and inattention, video game usage has been correlated with obesity and low levels of physical activity (Koezuka et al., 2006). Moreover, it does not appear learning engagement or problem-solving skills gained from gaming transfer to classroom settings (Hoffman and Nadelson, 2010).

As the **world** becomes increasingly technological, video game usage continues to grow. Many researchers are looking for ways to use video games as tools to enhance mental health. For example, a three-dimensional first-person **shooting game**, *Medal of Honor: Pacific Assault* (2004), was used to enhance women's **spatial** abilities, like mentally rotating objects, which are **cognitive** abilities necessary to succeed in science and engineering fields. Feng, Spence, and Pratt (2007) propose video game training to increase the number of women in these male-dominated careers. Research is growing in the area of investigating the utility of video games in autism treatments. Blum-Dimaya et al. (2010) used *Guitar Hero II* (2006) to teach children with autism appropriate leisure skills. Leisure skills are believed to enhance quality of life and allow increased development of social skills, two things important to individuals with disabilities such as autism or mental retardation. Furthermore, playing video games fulfills socialization needs such as peer recognition and competitive discussion (Hoffman and Nadelson, 2010). Finally, playing active video games (such as on the **Nintendo Wii**) was significantly related to higher levels of physical activity (Leatherdale, Woodruff, and Manske, 2010). ***See also*** health (mental); health (physical).

Rachel F. Pickett

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Q

*Q*bert*

*Q*bert* hopped into **arcades** in 1982; it was Gottlieb's fourth game and its only coin-op hit. In the game, Q*bert, a round character with a tubular nose, giving his head a "Q" shape, must traverse a pyramidal playfield one cube at a **time**, changing the color of the tops of the cubes with every touch, until they all are one uniform color. Released at a time when many **arcade games** were **violent** by design, *Q*bert* had an innocent charm. Because the protagonist was unarmed and the playfield was filled with various enemies, Q*bert had to survive by his wits and dexterity.

In the beginning of the **game design** process, Q*bert shot projectiles from his nose; thus the presence of his extended snout. The working name for the game at one time was *Snots & Boogers* but was changed, according to *Q*bert* artist Jeff Lee, because the title was "considered too vulgar for a business in an **industry** which had always struggled against the taint of disrepute" (Thomasson and Lee, 2003).

Cube motifs from the art of M. C. Escher heavily influenced *Q*bert*'s **art** and design. Escher's *Relativity* (1953) set the stage for the unusual orientation of the characters Wrongway and Ugg as they travel on the pyramid. Similar to the groundbreaking arcade game *Zaxxon* (1982), *Q*bert*'s unique art style features an isometric view which offers a visual representation of a three-dimensional playfield in two dimensions.

The final name chosen for the game evolved from the random name "Hubert" from a brainstorming session, and the word "cube," taken from the design style of the shapes that make up the pyramidal playfield: Cube + Hubert = Cubert. The word "cube" was shortened to the letter "Q" for pronunciation, finally arriving at the final name for the game, *Q*bert*.

The arcade game's marquee exclaims "@!#?@!" implying that Q*bert is disgruntled. Amazingly, the console speaks its own unique **language**; the seemingly unlimited vocabulary of Q*bert is actually the machine's synthesizer generating random sounds. Audio Engineer David Thiel developed the technique that strung together random phonemes. As a consequence, the machine spits out a different string of gibberish each time the game is played and, on occasion, accidentally creates an actual, coherent word.

In the end, approximately 25,000 *Q*bert* coin-op machines were sold (Kent, 2001). The game became a household name, and as a result multiple licensing deals were negotiated. Q*bert could be seen gracing such products as **board games**, frisbees, lunch boxes, and more. Q*bert even had an animated Saturday morning cartoon, broadcast as part of CBS's *Saturday Supercade*. *Q*bert* was one of the few arcade games to also get a pinball treatment as *Q*bert's Quest* (1983).

The game spawned an additional arcade title, *Q*bert's Qubes* (1983). Numerous home **console** and home computer variations, as well as sequels, were released for dozens of home video game **platforms**. *Q*bert*'s legacy continues to grow, most recently being released on the **Sony PlayStation 3** console.

Michael Thomasson

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Quraish

Quraish is a real-time **strategy game** with three-dimensional **graphics** developed by AfkarMedia in 2005, designed by Radwan Kasmiya and published by Dar Al fikr in 2007. The name comes from "Quraish/Kuraish," a famous Arabian tribe whose descendents include the prophet Muhammad (A.D. 570–613) and the most famous Muslim leaders, the Omayyad and Abbasid caliphs. The game's story is spread over four historical successive campaigns, covering Middle Eastern **history** before Islam until early Muslim conquests (A.D. 600–638), with each campaign consisting of a number of levels. Players must finish each level to be able to play the next one.

The game's first level, "First Encounter," depicts life in Arabia before Islam, the first Arabian tribes' coalition, and defeating the Persian army at the battle of Dhi Qar in A.D. 609, and the appearance of Islam. The second level, "Apostasy Wars," is the story of the Wars of Apostasy and battles that reformed the Muslim State. The third level, the "Conquer of Persia campaign," follows the history of the Muslim conquests in southern Iraq, and battles with the Sassanid Empire. The fourth level, the "Conquer of Syria campaign," tells the story of Muslim armies sweeping north of Arabia and beating Byzantine armies at the doors of Jerusalem. The **narratives** of every campaign are performed by non-Muslim characters, allowing players to experience different opinions about Muslim conquest wars. Even though *Quraish* features real historical characters, many top characters were not shown directly due to the sensitivity of showing images of Prophet Muhammad and some of his major followers in media across the **Middle East**.

Players can play fictional and customized death matches, choosing from the main four factions of the game: Arabs, Bedouins, Byzantines, and Sassanids. Recommended system requirements for the game include Windows XP or Vista, a CPU speed of at least 1.8 MHz, 64 Mb of VGA memory, at least 512 Mb of RAM, and 1.2

Gb available on the hard disk. Multiple versions of the game have appeared, including four independent Arabic versions, each of which includes a single campaign, and the Golden version, which includes all four campaigns, and English and Arabic **interfaces**. The game is the first Arab/Muslim strategy game, and the first one to handle this period of history.

Radwan Kasmiya

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Quraish website, available at http://www.quraishgame.com.

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R

race

No matter how you parse it, race in video games remains a hot topic both inside and outside the gaming **industry**. With the advent of phenomenally popular game series, franchises and titles that feature must-play characters (MPCs) and playable characters (PCs) who are racially and ethnically diverse, it is clear that beyond the often rhetorical fever pitch, race matters in video games have undergone significant change. Among those games signaling a veritable paradigm shift in the medium's address to matters of race and difference are *Final Fantasy* (1987), *Prince of Persia* (1989), *Madden NFL* (1992), *Resident Evil* (1996), *Half-Life* (1998), *Tiger Woods PGA Tour* (1999), *Blade* (2000), *Halo* (2001), ***Grand Theft Auto****: Vice City* (2002), *Call of Duty* (2003), *Grand Theft Auto: San Andreas* (2004), *Men of Valor* (2004), *NBA Ballers* (2004), *NFL Street* (2004), *Afro Samurai* (2005), *50 Cent: Bulletproof* (2005), *Prey* (2006), *Gears of War* (2006), *Saints Row* (2006), *Mass Effect* (2007), *Def Jam: Icon* (2007), *Left 4 Dead* (2008), *Prototype* (2009), *StarHawk* (2012), and others. Most striking of the notable changes these games share in terms of MPCs are more black, brown, and other minority characters positioned as central narrative agents, who factor as essential elements in contemporary gameplay mechanics and strategies; game **world** designs; and gaming's favored genres that are especially pertinent for today's increasingly global, multiracial, and multicultural fan bases and intergenerational audiences.

As remarkable and welcome as this shift may be in the larger representational ecology of gaming's changing racial characters and **avatar** designs, at the same time, it is crucial not to lose sight of how much gaming's most successful narrative conceits and ludic gameplay procedures persist in replicating established and damaging discourses of race and difference so familiar in American popular cultural productions and entertainments such as **film**, **television**, and music. In fact, with gaming's growing market share of the larger global entertainment industrial complex, concerns and debates about race and representation in gaming abound, especially on-line and in digital media's proliferating gaming fora and websites, YouTube videos and other **platforms** devoted to games and their rhetorics involving race. In fact, any cursory review of these issues, either on-line or in print, reveals simultaneously progressive and regressive discourses about race in gaming. If we consider some of gaming's most iconic and emerging lead characters such as *GTA: San Andreas*'s African American character Carl "CJ" Johnson (the gang-member protagonist) and *GTA: Vice City*'s Italian American character Tommy Vercetti (the mafia protagonist), *Prey*'s Native American character Domasi

Tawodi—on the iconic side of the racial and ethnic MCP scale; and *Mass Effect*'s black soldier Commander John Shepard, *Men of Valor*'s black Vietnam veteran Dean Shephard, *Starhawk*'s black gunslinger Emmet Graves, and *Resident Evil 5*'s black African woman bioterrorism fighter Sheva Alomar—on the emerging side of gaming's MPC scale, we can grasp what is at stake in debates about gaming's powerful rhetorics where race and representation intersect.

I have argued elsewhere (Everett, 2005; Everett and Watkins, 2008) that much of gaming's representational economies are drawn from its literary, filmic, theatrical, and fine arts forebears. With whiteness as these media's racial default or norm for heroic character designs, it is hardly surprising that video games follow this successful binary normalization of heroic whiteness and its racial other in gameplay worlds and ludic practices. So honest appraisals of gaming's redolent discourses of race and difference continue to demand scrutiny and challenge. A key repository for such contemporary critical interrogations is the Internet with its rapidly proliferating websites, blogs, vlogs, and other on-line fora dedicated to games.

Exemplary in this regard is "Moving Forward on Race in Games: Manveer Heir Speaks," an on-line article in which gaming journalist Brandon Sheffield conducts a revealing interview with Heir (a major game designer with Raven Software and BioWare). This blunt conversation echoes some key points about race in gaming that I have stressed elsewhere. For instance, concerning the nation's denial of persistent structural racism as a feature of **United States** society and culture, Heir is quoted as saying, "in general, people don't want to deal with race." He continues, "First off, I don't think the game having a black character [should] be the selling point of the game. It needs to be an interesting game regardless of the protagonist. . . . So, I think that if you market your game as 'a game for black people' or 'a game for Asian people,' it is going to flop the same way most of the games for women flop" (Sheffield, 2010).

That this game designer views increased racial diversity in gaming's character designs not as tokenism but as central to the medium's future growth, development, and continued success is significant and portends well for new gaming design models and character development. Most striking in contemporary conversations about racially diverse MPCs constituting a necessary industry game changer is the realization that expanding stories and heroic characters, who better reflect all gamer communities and constituents rather than the dominant white male archetype is simply smart business sense. As Heir puts it, "It's not video game affirmative action. It's about actually pushing our medium to make better games, to tell better stories in our games" (Sheffield, 2010).

Not surprisingly, another key consideration that Sheffield and Heir explore is mainstream society's general disavowal or repression of how race and racism in gaming get maintained and manifested in other modes and codes of character differentiation. Heir remarks cogently on the types of race and ethnic displacement occurring in popular gaming narratives, observing, "You can think of fantasy games where the dark elves, you know, the Drow [in *Dungeons & Dragons*'s **massively multiplayer**

on-line role-playing games] MMORPGs, were always looked upon. . . . They were the black people of the fantasy world, right? And if you played the dark elves, you were treated like garbage by many of the townspeople. So, my only question is. . . . why can't we do that when we're actually talking about real people?" Sheffield gets to the heart of the matter when he acknowledges that game designers, gamers, and others can subvert the issue by resorting to fantasy and alien characters of ambiguous racial origin and background. As Sheffield points out, "It's an easier pill for everyone to swallow because it's like, 'well, I'm not saying this about any person.' It's so ambiguous. People are afraid to make any kind of direct statement about anything" (Sheffield, 2010).

Another particularly illustrative case is the phenomenally popular 2001 version of the 1994 *Warcraft: Orcs and Humans* fantasy MMORPG. Rebooted and renamed the *World of Warcraft* (*WoW*), here is a transformative game franchise that engages issues of race and difference indirectly although it foregrounds racial matters directly. After all, its fictional Azeroth game world is populated by an array of fantastic nonhuman MPCs—namely, the Orcs, Trolls, and Dwarves—and their missions entail joining forces with or combating MPC human characters in game quests between the game's warring Alliance and Horde factions. *WoW*'s striking appeal, arguably, trades largely on its not-so-covert racial discourse with Cold War and War on Terror militaristic overtones (the Allies versus the Axis). Updated to reflect the post–September 11 War on Terror Western response, it is not unreasonable to see *WoW*'s fantasy **war** genre game universe as a mythological fantasm conjoining U.S. **WWII** and Cold War mythemes and the 12th- and 13th-century religious crusades with a bit of colonial Orientalism added to encompass a consumable history of premodern and modern warfare, or good-versus-evil contest of wills. This is what is so insidious about the codification of race and racial difference in these hugely popular games about race.

We can see similar narrative trends in earlier game titles such as *Donkey Kong* (1981), to cite a classic game exemplar. Clearly based on the film *King Kong* (1933), this beloved game codifies socially agreed-on discourse about black males' rapacious desire for innocent and helpless white female sexuality. Although no one can miss the fact that Kong is analogous to those **African** states known as the Republic of Congo/Kongo, one can easily miss the fact that the term "Kongo" in Japanese refers to an indestructible one. That *Donkey Kong* is Japanese game designer Shigeru Miyamoto's creation clearly muddies the issue somewhat. Still, the fact that a gorilla, signifying Africanness or blackness, has captured the white princess who must be rescued by Mario, signifying Italianness or whiteness, patently trades on familiar racial scripts that should not be discounted or ignored. Games, like their narrative progenitors—literature, pulp fiction, theater, radio, and television, for example—draw from a history of racist and racialized narratives and representations that make gaming's **procedural rhetoric**, to borrow Ian Bogost's useful term, meaningful and intelligible.

Another familiar and abstracted racial script that informs gaming's popular narratives of conflict, death, and destruction is the fantasy character constructs of nonhuman or unhuman zombies, who make perfect evil antagonists for gamers to annihilate reflexively and pleasurably. And although game zombies may be MPCs as well as NPCs, they are often codified or marked as racially and ethnically diverse and Other; but in the main, they tend to signify racial blackness. Nowhere is this practice more clear than in **Capcom**'s *Resident Evil 5* (2008) with its zombie-like humanoid enemies called the Majini, a Swahili word meaning "evil spirit." This seventh installation of the lucrative *Resident Evil* game franchise stirred up a major controversy because of its blatantly racist depiction of a horde of man-eating black Majini, juxtaposed to the heroic white human MPC Chris Redfield and his bad-ass black human MPC sidekick of African descent, Sheva Alomar, and its setting in some African village. Websites such as GamePolitics.com, WallStreetJournal.com, BlackLooks.org, TheZombiephiles.com, and many, many others had a field day with the controversy when Capcom unveiled its game trailer at the 2007 E3 convention. Apparently no one was buying the company's good black scantily clad babe heroine as a sufficient counterbalance to the horde of bad black boyz in the jungle, to deflect charges of racism leveled at Capcom and *Resident Evil 5*.

Especially meaningful here are Manveer Heir's honest and informed observations about race and gaming from inside the industry's inner sanctum. Heir, who is of Indian descent, grabs our attention with such telling remarks as this: "I mean, it is an uncomfortable topic, especially in the U.S., where racial issues are always going to be a hot-button issue, from my perspective—just on the way the country was founded, right? . . . While I love plenty of games that use these alien and fantasy characters, I don't even think they go in saying, 'I want to make this commentary on this culture.' They're just like, 'We have these fantasy characters,' and once they've made those races or whatever they have, oftentimes, they just start making parallels to what you see in life. . . . Well, this race is like this race.' You know, 'This is the Asian race. Let's do it this way.' I think it's actually kind of accidental. I'm not really sure. I haven't been a creator of fantasy worlds, but that seems to be the way it always happens to me. . . . And often times it will feel like an entire race is pigeonholed." He adds further that "I don't personally believe your game is going to sell worse if the protagonist's skin color changes, and everything else in the game was the exact same. Nothing else changed about the game. All you did was default the white to the black guy [or any other race]—that's the easiest route."

Sheffield and Heir's conversation reflects well the discursive range of expressed concerns about race in contemporary gaming, from activist gaming journalists off-line and on-line eager to call out racist practices in the industry, to annoyed gaming fans—of all races—ranting and railing against the politically correct benighted fools who see racism everywhere, to the game industry writers and representatives who claim to "be afraid of putting characters of other ethnicities into their games because they don't want to get judged for it by the ethnic groups that they're representing" (Sheffield, 2010). On the one hand, perhaps some of the complaints about racism in gaming go too far, and on the other hand, it is absolutely the case the gaming industry's self-policing tactics do not go far enough to address this very real issue.

Our concern with race in gaming culture is not a trivial matter, far from it. We know that games are particularly adept at teaching all manner of lessons, both serious and innocuous alike. As Ian Bogost points out, games make an argument, "and players unpack that argument through play" (Bogost, 2008, p. 130). What we need to ask ourselves as a society is, "what kind of racial arguments do we want to unpack time and again in the games we play?"

Finally, since Michel Marriott's groundbreaking 1999 *New York Times* article exploring issues of race in computer games, there has been both progress and retrenchment where matters of race and gaming intersect. It is hardly surprising that discourses of race and difference in gaming have not veered too far from those highlighted in the *Times*, despite the fact that a significantly large fan base for games is constituted by gamers of color. Still, there has been progress in the years since Marriott wrote about the prevalence of high-tech blackface and Orientalism in gaming. Game designers are increasingly integrating their ranks with black and other minority programmers, game narratives, and characters are increasingly racially and ethnically diverse, and games feature many more MPCs in integrated game worlds and universes. At the same time, it is clear that the gaming **industry** and gamers ourselves need to do better because, after all, playing with race is serious business.

Anna Everett

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racing games

The term "racing games" generally refers to games that provide the player with competitive gameplay using vehicles involved in a race; players compare their speed against other players or **nonplayer characters (NPCs)** riding in similar vehicles as opposed to "driving games," which are more about vehicle control. Because racing games usually have a relatively simple game mechanic and often very intuitive gameplay, racing games were among the earliest video games developed; the first commercial racing games were **Atari**'s *Gran Trak 10* (1974) and its two-player version, *Gran Trak 20* (1974). The games adopted a top-down view and its sprites had simple shapes: a series of dots demarcated the racing track and a rectangle represented the player's vehicle. The games were released as **arcade games** and were among the first with read-only memory (ROM) data storage. In the games, the player controls his or her vehicle with a steering wheel, two foot pedals (an accelerator and a brake), and a gear shifter. Another early racing game, Atari's *Indy 800* (1975), was notable for being the first 8-player arcade game.

At first, the major game **platform** for racing games was the arcade machine. They were a relatively easy genre to develop because the **abstraction** and re-creation of the practical experience on which it was based required only a limited number of simple objects on-screen and no complicated game mechanics. Racing games were the first arcade games to offer a first-person perspective—for example, in *Night Driver* (1976), *Datsun 280 Zzzap* (1976), *Night Racer* (1977), and *Speed Freak* (1978)—making the experience more **immersive**.

In the beginning of the 1980s, the growth of the game **industry** and the advent of color-display arcade machines served as momentum for the rapid evolution of racing games. The evolution was set off by **Japanese** game developers, and **SEGA**'s *Turbo* (1981) and Atari's *Pole Position* (1982) were the first full-blown racing games, providing competitive gameplay and more sophisticated **graphics** than earlier games. After these two games, the development of racing games was mostly focused on the visual quality rather than new game mechanics. At that time, new advancements in the genre were found in arcade games because of the graphical and interactive limitations of home video game **consoles**. However, *Revs* and *Enduro* reenvisioned racing games for consoles. *Enduro* (1983), published by **Activision** for the **Atari VCS 2600**, had a weather system and leader boards. *Revs* (1984), developed by Geoff Crammond and published by Acornsoft for BBC Microcomputer System, is considered as the first serious driving **simulator**. Although the graphical quality of the game was not enough to compete with other arcade racing games, the game had realistic game mechanics and a user **interface** with various opponent drivers having different **artificial intelligence (AI)**.

SEGA's *Out Run* (1986), developed by Yu Suzuki, had impressive sprite-scaling graphics and animation implemented by the best graphic processing technology of the time, improved gameplay, and a force-feedback steering wheel. The game was successful worldwide and showed the future direction of innovation for racing games: better visual effects and more speed. *Final Lap* (1987), developed by **Namco** and published by Atari Games in 1987 for arcade game machines, was an unofficial sequel to *Pole Position*. In the game, up to eight players were able to participate in a circuit. It had relatively realistic formula machines and detailed depictions of Formula-1 team identities and billboards. *Hard Drivin'* (1988), developed by Atari Games for the arcade, was the first racing game with three-dimensional filled-polygon graphics. SEGA's *Super Monaco GP* (1989) and Papyrus's *Indianapolis 500, The Simulation* (1990) impressed racing game fans with the sophisticated control mechanics and detailed and splendid visual quality.

In October 1992, Suzuki released *Virtua Racing*, another monumental racing game, which was the first racing game with fully three-dimensional graphics. All objects, including the player's vehicle, were filled-polygon graphics, and the player could manipulate the camera view in the game. In addition, the game realized most of what makes a modern racing game. The game was a huge success globally and significantly influenced the racing games that followed.

Suzuki's next titles included the *Daytona USA* series and *SEGA Rally* series, which improved the game system and visual quality, while keeping the basic elements of *Virtua Racing*. The advent of 32-bit video game consoles equipped with an accelerating graphic chipset for three-dimensional graphics, like the **SEGA Saturn** and the **Sony PlayStation**, served as the momentum of the further evolution of racing games. Because these consoles' technological performance could equal that of arcade platforms, game developers left the declining arcade market and began targeting home systems for their releases. Namco's *Ridge Racer* (1994), ported from the arcade version and released on the same day as the PlayStation, is an early example. After the game's release, most arcade racing games started to be ported to consoles, such as SEGA's *Daytona USA* for the SEGA Saturn in 1995 and Namco's *Rage Racer* for PlayStation in 1996. By 1997, with the release of Polyphony Digital's *Gran Turismo*, the main platform for racing games had shifted over to home console systems. Since then, the evolution of racing games has been focused on graphic quality and more specialized gameplay for consoles rather than arcade-styled gameplay. For example, the *Colin McRae Rally* series deals with strategic and realistic tuning of rally cars, and in the *Project Gotham Racing* series, players can buy their cars and customize them with items purchased using in-game points, which are gained through repetitive gameplay; such gameplay examples were not found in arcade games.

After the mid-2000s, racing games have become even more realistic. The *Gran Turismo* series and the *Forza Motor Sport* series simulate driving with a full-blown physics engine, detailed tuning system, weather effects, and realistic graphics.

Since mid-2000s, racing games have been mainly categorized into two subgenres: racing simulators and casual racers. Racing simulators refer to racing games that focus mainly on detailed depiction of cars and environment, vivid weather effects, and realistic gameplay adopting advanced physics engines. The objective of these games is to recreate the driving experience as realistically as possible. With racing simulators, players can virtually experience the driving of their dream cars. In the gameplay of those games, almost all detailed driving maneuvers are implemented, and the player's driving technique is tested. Also, these games provide the player with very detailed and strategic customization systems including all interior parts and exterior accessories that influence performance of the car. The best-known example is the *Gran Turismo* series.

Casual racers refer to racing games that mainly focus on easy and entertaining gameplay rather than complicated customization and detailed driving skills. The objective of these games is to provide the player with an exciting experience in a short time. In these games, players can experience skillful driving and drive through exquisite scenery using simple controls without needing to spend much time learning the skills. Also, some casual racers include unique extra gameplay; for example, the *Burnout* series provides crash competitions, whereas in *KartRider* (2004), players can attack other players with various items gained through gameplay. Games in the *Crazy Taxi* series, *Burnout* series, and *KartRider* can be categorized as casual racers.

Taiyoung Ryu

reading video game imagery

Video games are a form of visual **art** and communication, and, as such, they tend to follow certain visual conventions that are often assumed to be understood by the player. Even the mere playing of a game requires certain reading strategies, most of which a player will have picked up from past experience.

First, a player must gain an understanding of the **world** of the game and its visual **space**: the dimensionality of the world being represented (which can two-dimensional, three-dimensional, or some combination of the two), and the division between the diegetic space of the game world and nondiegetic elements such as informational **graphics** (such as scores and lives remaining indicators), title screens, decorative graphics, and so forth. Some games, however, **play** with this distinction, including *Starhawk* (1977), in which attacking ships sometimes shoot away the digits in the player's score and *Eternal Darkness: Sanity's Requiem* (2002), which deliberately tries to confuse the player as a part of the horror effect it is trying to create (for example, the game might make it appear that bugs are walking across the screen).

The spaces of the game world, and how to **navigate** them, must be understood. The player must be able to identify the **avatar** that he or she is controlling or, in the case of multiple avatars, understand which one is being controlled and how to switch between them. Game world affordances must also be recognized—that is, which graphics represent the objects, devices, and vehicles that can be used by the player and how they are used. Identifying other characters, and distinguishing between those that help and those that hinder, is necessary, and players must often make such distinctions rapidly. In general, graphical configurations must be read for the player to understand what options and what kind of interactivity are available at any given moment during gameplay.

For games in which navigation is required, how to interactively change the point of view being presented to the player becomes important, as well as an understanding of how spaces change as one's point of view changes. Most three-dimensional games construct a standard Euclidean space that behaves similar to the lived-in spaces of the physical world, but games can play with such notions of space and construct counterintuitive structures that players must first learn to identify and then to navigate. Finally, the visual interpretation of the game's spaces and even dimensionality may change during gameplay, requiring the player to learn how and why such changes occur and to recognize them when they do. For example, the graphics in *Echochrome* (2008) require players to alternate between interpreting spatial structures in three dimensions globally (for the turning of structures in three-dimensional space) and interpreting the same structures two-dimensionally locally (points that look like they connect actually do connect, so far as the movement of the avatar is concerned).

As video game graphics grow more complex and experimental, recognition of such elements as foreground, background, usable objects, passageways, and the avatar may become part of a game's challenge, in addition to all the usual challenges involving speed, timing, and skill. Although well established, the graphical conventions of video games are still evolving, and **game designs** can always make use of the assumptions they generate to either help players play or make a game more challenging by breaking these conventions.

Mark J. P. Wolf

Reception Theory

Reception Theory provides a methodology for understanding the relationship between media content and audience. The concepts of Reception Theory have been developed in departments of Communication, **Film**, Media Studies, Sociology, Anthropology, Rhetoric, and Comparative Literature. In each of these fields, Reception Theory has been used to explain the effects media content has on audiences. Reception Theory proposes that a media text's aesthetic characteristics and production circumstances are not solely responsible for its effect, and that the reception context is also a key factor in determining the meaning of media content.

For video games, Reception Theory is called on to explain the effects that games have on their players—particularly children. Moments of moral concern have often provided the motivation for this type of research. Thus Reception Theory has been used to address concerns that video games incite **violence**, **addiction**, and social anxiety. The theory has also been used to consider the positive impact of video games. For example, research on the potential of video games for **education** has relied on Reception Theory to determine the effectiveness of video games in classroom or on-line settings. Whatever its purpose, Reception Theory research has relied on two approaches for understanding media effects: the psychological and the sociological.

Psychological Factors

The move to develop psychological explanations for Reception Theory emerged as a reaction to the invention of cinema. At that time, religious groups and advocates for censorship believed that movies corrupted the minds of impressionable audiences. In some extreme cases, mass media texts were blamed for **race** riots. Researchers thought that the movies injected messages into audiences and inspired lewd behavior. Similar reasoning inspired claims that video games were responsible for the violent shootings at Columbine High School in 1999 and at Virginia Tech University in 2007. In both cases, pundits and politicians looked to blame media companies for human tragedies. The research of scholars like former Lieutenant Colonel Dave Grossman and Gloria Degaetano provided a link between violent video games and behavioral conditioning. Grossman and Degaetano have argued in their book, *Stop Teaching Our Kids to Kill* (1999), that the experience of playing a first-person **shooting game** is similar to the experience of military training. Claims like this, although helpful for politicians and **censorship** groups, assume that all audiences experience the effects of video games in the same way. Focusing on effects often ignores the more complex cultural meanings of video games.

Other cultural critics have argued that media texts such as video games can be used to teach moral lessons and influence audiences positively. For example, Kurt D. Squire in his article, "*Civilization III* as a Geographical Simulation for World History **Education**," argues that video games can teach social studies concepts in an interactive framework that students find engaging. James Paul Gee has written extensively about the educational potential of video games and has argued that the experience of **navigating** a game stimulates different types of learning. Gee's critics argue that the intense **graphic** spectacle of video games detracts from this navigational learning. Despite this disagreement, both sides of the debate contend that the mind of a video game player is affected by media stimuli. According to this idea, media texts work with the viewer's natural mental processes, mediating their worldview and triggering associative learning.

Sociological Factors

The emphasis on sociological factors for Reception Theory began with the establishment of the first sociology department at the University of Chicago in 1892. The early research of the Chicago School looked at social groups, such as urban juveniles, and attempted to understand how media texts reinforced or mediated their social interactions and community standards. Explaining the function of media within a social group became known as functionalism. Video game research still relies on this concept when considering the social interactions between groups of players in massive multiplayer environments and other gaming communities.

In opposition to functionalism, there is conflict theory, which looks at groups that have social structures posed on them by institutions of power. Beginning in the 1960s, the Frankfurt School, with scholars such as Theodor Adorno and Max Horkheimer, was influential in using traditional Marxism to expand Reception Theory to account for the impact of institutions of power. Scholars of the Frankfurt School were concerned that the economic context of market capitalism influenced audience reception of media content. They warned that popular culture created an illusion of choice and active engagement. Unlike previous work on Reception Theory, the Frankfurt School targeted the mode of production and the reception context as its areas for reform. Nick Dyer-Witheford and Greig de Peuter's book *Games of Empire* (2009) is engaged in a similar project by considering the economic lessons that video games present to their players. The authors examine a variety of games and the video game **industry** as whole to understand the medium's ideological implications. The Frankfurt School brought this emphasis on economic analysis to Reception Theory and raised important issues about the influence of political economic power in the reception process.

In England in the late 1960s, the Birmingham School of Contemporary Cultural Studies inspired a paradigm shift through the work of Stuart Hall, Richard Hoggart, and E. P. Thompson. The research from these scholars was largely a reaction to the Frankfurt School and focused on individuals and small groups that actively used mass culture as part of their everyday lives. In England at this time, several groups of working-class youth began to reappropriate cultural objects (like safety pins) to signify their own frustrations with the political climate. Research on these groups demonstrated that audiences made informed, even political, decisions about their cultural choices. Hall showed that audiences use cultural objects in ways that the producers of those objects never intended. Using the language of semiotics, he described a process of encoding/decoding in which a cultural object, like a video game, is first created with a particular ideological framework then received in an ideological context that is further contextualized by the receiver's cultural experiences. For example, the video game *America's Army* (2002) was created by the **United States** military as a recruitment and public relations vehicle. In 2006, media artist Joseph DeLappe logged on to the game and created a character with the name "dead-in-iraq" and began posting names of the soldiers killed in action during the second Gulf War. His decision not to use the game as it was intended reflected his interest in the game's potential for protest. DeLappe's reappropriation of the game demonstrated the Birmingham School's belief that the audience has control over the meaning of their mass media consumption. The work of the Birmingham School complicated Reception Theory and insisted that researchers delve deeply into the meaning making processes of audiences. ***See also*** addiction; censorship; education (general); education (religious); morality and ethics; phenomenology; procedural rhetoric; violence; visual literacy.

Ethan Tussey

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repetition

See replay and repetition

replay and repetition

Replay and repetition function as core gameplay elements in most video games, including helping the player to learn **play** mechanics of a given game and extending a game's long-term play value by allowing for predictability and variability between multiple game sessions. Aspects of repetition in gameplay predate video games; nondigital games often place an emphasis on the player's replaying of a game as a means of learning the rules of play. However, video games often emphasize aspects of repetition and replay even more than traditional games for a number of reasons beyond those of traditional games, including using high scores to encourage mastery of a game through its repeated play and rewarding players who replay a level or entire game after they have been successfully completed. More recently, some video games have begun incorporating aspects of repetition into their gameplay mechanics by allowing—and even requiring—the player to manipulate the passage of **time** within their structures, further emphasizing replay.

Traditional games such as basketball and chess often require players to play them a number of times to fully grasp the **rules** and play mechanics of each game. Each time a player replays a game, she may learn new rules or more effective play strategies that will help her to become a more effective player. Game theorists including Jesper Juul refer to games as "state machines" (a term taken from computer science) to help describe the changes in state which are essential to the play of games. For example, each time a player performs an action such as moving a piece in chess, the game's state transforms as the other player's possible moves may change; for instance, the first player's move may block potential movement of the second player's pieces. **Board games** particularly emphasize replay because it is possible to replay the exact same events if the same moves are made each time; in chess, for instance, two players may reproduce a famous historical match by making the exact same moves as were made in the original game.

Almost all video games similarly emphasize their repeated replay to help the player learn their play mechanics. Early video games introduced entirely new modes of play by requiring players to manipulate an **interface** such as a dial or **joystick** to control a sequence of events on an electronic screen. Games such as **Atari**'s ***PONG*** (1972) also featured few, if any, instructions to help the player understand their rules and effective play strategies. Video games often require skillful manipulation of game elements, such as moving the paddle in *PONG* to bounce a ball to score points and complete game levels.

A first-time player of a coin-operated game is likely learning many of that game's play mechanics while in the process of playing, and thus the possibility of player frustration may be high because the player may be unaware of how the game operates and thus might make repeated mistakes. The designers of **arcade games** must balance this potential frustration with the need to generate revenue by encouraging players to continue to deposit coins in the machine; game companies adopted the industrial strategy of often giving the player a set amount of time, or a few tries or "lives" in which to play the game. This allows players to make mistakes while learning the game but still continue to play, thus allowing the player several replays of a game in each game session. Video games such as **Midway**'s *Ms. Pac-Man* (1981) reward players who achieve specific point scores with an additional life within the game, providing another opportunity to replay the game.

Replay is also emphasized in video games by requiring players to observe and learn patterns of movement to successfully complete levels within the game. Platform games (also known as "platformers") such as **Nintendo**'s *Donkey Kong* (1981) and *Super* ***Mario*** *Bros*. (1985) oblige the player to maneuver through increasingly complex levels, avoiding obstacles and jumping between **platforms** to successfully complete a level. Through these core gameplay mechanics, players must learn the patterns of movement of enemy characters and features of the game levels through processes of trial and error. These games thus emphasize the repeated replaying of game levels (and portions thereof) to gain a degree of familiarity over their associated patterns of movement for their successful completion. Because the enemies and patterns of movement in platform and other similar games are often pre-programmed, players may memorize or pre-program **controller** inputs on a computer to complete a game in as brief a time as possible and share videos of these so-called **speedruns** with other players. This mastery based on repetition rewards players through replay much like a high-score table, albeit offering players new modes to challenge other players into communities built around the repeated play of specific games.

Some home video games may encourage players to replay the entire game after its successful completion by offering players incentives such as new costumes, equipment, or abilities for their **avatar** that were not available on the first play-through of the game. Silicon Knights's *Eternal Darkness: Sanity's Requiem* (2002) prompts the player to replay the game several times, rewarding the player in each iteration with more of the game's backstory before revealing the "true" ending of the game after several such playthroughs. Much like the economic strategy of **arcade** games offering players several lives, this encouragement to play through a game that a player has purchased increases its so-called replay value, a term used by game reviewers, marketers, and consumers to assess a game's potential for continued play value after its completion. Games may also increase replay value by randomizing level layouts, objects, and enemy characters encountered each time the game is played, essentially creating new game situations or scenarios with every session of gameplay. For example, the game *Rogue* (1980) was first developed for computer mainframes by Ken Arnold, Michael Toy, and Glenn Wichmann and employs simple **graphics** based on the symbols found in character sets common to computer systems to represent the player, dungeon **maps**, and various creatures and objects. Each game session of *Rogue* randomly generates these map layouts and elements, creating a unique game experience each time.

More recent **temporal navigation** games such as Ubisoft's *The Prince of Persia: The Sands of Time* (2003) and Number None's *Braid* (2008) require the player to rewind and similarly manipulate time while playing and incorporate replay to correct mistakes and solve puzzles to successfully complete them. Such games use replay as a core mechanic of the games themselves, further emphasizing forms of repetition within video games. Although replay and repetition have long functioned as key aspects of learning and mastering all forms of games, they play a central role in an increasing number of video games and the ways in which they are enjoyed, experienced, and shared by players.

Christopher Hanson

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RePlay magazine

RePlay magazine is a trade magazine covering the out-of-home amusement and family entertainment industries. Eddie Adlum founded *RePlay* in 1975 after leaving his position at *Cash Box Magazine*. (*Cash Box* covered the music and coin machine industries in the **United States** from 1942 to 1996, relaunching as a web-only publication in 2006.) *RePlay* began publishing monthly in October of 1975, and the magazine's name was selected because it bore meaning for the jukebox industry and for the amusement industry, and is a pun on "regarding **play**."

RePlay's subscription base peaked at 6,500 during the video game boom of the early 1980s, declining with the coin-operated video game **industry**, eventually settling at a subscription rate roughly half that during the boom. Most copies of *RePlay* are sent to subscribers in the United States with just a tenth shipping internationally.

RePlay targets business owners who have a vested interest in industry news; the readership includes operators, **arcade** owners, and game manufacturers and distributors. Types of amusements covered by *RePlay* include coin-operated video games, pinball machines, crane machines, jukeboxes, pool tables, and others.

Historically, *RePlay* has covered numerous emerging trends of interest to its readers, including the automated teller machine (ATM), the addition of upscale attractions to family entertainment centers, and, of course, video **arcade games**. As a trade journal, the focus of *RePlay* is directly shaped by shifts in the industry and often responds to trends or perceived threats, ranging from legal regulation to moral concerns. Coverage in the magazine generally includes corporate profiles, interviews with game company executives, notices of relevant court cases and challenges to the amusement industry, as well as editorial responses to public issues. Regularly included sections of the magazine include a news section, "Hot Off the Press!"; a chart of most-played games called "Players' Choice"; and classified ads for the sale of used machines labeled the "Buyers' Bulletin."

RePlay publishes several special editions a year such as the ASI (Amusement Showcase International) issue, the AMOA (Amusement and Music Operators Association) Expo showbook issue, and an annual industry directory. Back issues of *RePlay* often include editorial responses to contemporary issues of concern to arcade owners and operators. City and state efforts at governing distribution of and access to video games have received significant coverage, as have official statements on the value of video games. *RePlay* has responded to legal battles faced by the industry and has also offered responses to negative publicity from major figures such as C. Everett Koop and Ronald Reagan.

Although *RePlay* has covered a range of amusements, during the late 1970s and early 1980s it included extensive coverage of coin-operated video games. In the years directly preceding the industry **crash of 1983**, the bulk of the articles addressed the video game industry. Since the crash, *RePlay* has continued to offer significant coverage of coin-operated video games. The magazine is particularly useful for those interested in the marketing and distribution of coin-operated games. *RePlay*'s corporate profiles can also be helpful in identifying key players in the production of certain games, many of which have partial credits, if any credits are available. *RePlay* magazine is headquartered in Tarzana, California. ***See also*** arcade games; journalism; *Play Meter* magazine.

Carly A. Kocurek

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RePlay magazine website, http://www.replaymag.com.

representations of video games in Hollywood cinema

As video games have become increasingly popular in American culture and the **industry** has established itself as a major contender for media audiences and the financial capital they wield, video games have progressively influenced and appeared within the **narratives** of Hollywood **films**. Since the 1970s, filmmakers of both major blockbusters and smaller films targeted at niche audiences have incorporated the visual style of video games into their films, constructed narratives specifically representing video game and **arcade** culture, and utilized the concept of virtual **worlds** to inspire both utopian and dystopian science fiction fantasies. Hollywood filmmakers have also adapted individual games and game franchises into films and used the play of specific video games to situate their stories within a cultural milieu unique to the time period of film production.

Multiple histories highlight Walt Disney Productions' *Tron* (1982) as the initial crossover between video games and high concept Hollywood filmmaking. *Tron*'s narrative revolves around computer programmer and game designer Kevin Flynn (Jeff Bridges), who, due to corporate maneuvering and intrigue within the software manufacturer ENCOM, now manages a game arcade after witnessing the video games he designed wrested from his control. As Flynn attempts to hack into the ENCOM security system, ENCOM's nefarious Master Control Program digitizes and transports him into the company's computer mainframe, where he must actively play his own games against his ENCOM adversaries from within the system itself. Not only does *Tron* position the protagonist as an enthusiastic video game programmer and a talented game player, but it also features computer-generated imagery that replicates the visual style of games from the time period, most notable in the Light Cycle race that opens the film, foregrounding bravura digital visuals that evoke the vector **graphics** common in many early video games. While the Light Cycle race specifically replicates **racing games**, other sequences, such as a battle in which Flynn must target and evade airships through a heads-up display during close quarter combat, reference other game genres popular at the time, in this case vector-based **shooting games** such as ***BattleZone*** (1980). In *Tron*, Flynn's proficiency at actual video game play and knowledge of **game design** allow for his successful negotiation of a digital game system within which he is truly **immersed**, resulting in the narrative's triumphant conclusion. Importantly, the game company **Bally/Midway** adapted *Tron* into a successful arcade game in 1982, recasting the film's game sequences, such as the Light Cycle race, into a series of increasingly difficult levels.

Although *Tron* is certainly an inarguable touchstone in the history of Hollywood's representation of video games, the incorporation of the computer graphics common to **arcade games** in major Hollywood films, and the virtual worlds they signify, predates *Tron*'s 1982 release. In George Lucas's groundbreaking *Star Wars*, released by Twentieth Century-Fox in 1977, both the Rebel forces' three-dimensional **map** of the Death Star and the piloting system Luke Skywalker (Mark Hamill) and other X-wing pilots use to aid their attack on the imperial fortress evoke the wireframe graphics of **vector games** that were introduced that same year. The latter targeting system's display specifically implies the visual construction and functionality of arcade **shooting games**, and the appearance of the onscreen display, coupled with the **joysticks** and push-buttons the X-wing pilots use to maneuver their small spacecraft as they near the Death Star's single weak spot, brings to mind the **interfaces** of early arcade cabinets and the design of early arcade games. Similarly, the opening credit sequence of Disney's *The Black Hole* (1979) is composed on a three-dimensional vector display grid, mapping the descent into the titular spatial anomaly that is the focus of the film's entire narrative. Although not overtly referencing specific video games themselves, these spectacular, digitally constructed sequences from 1970s Hollywood films emphasize the visual style of many arcade and home **console-based games** of the time, uniting a fidelity to the period's game graphics with narratives revolving around interstellar warfare, itself the narrative basis of such games as ***Spacewar!*** (1962), ***Space Invaders*** (1978), and *Galaxian* (1979).

Much as *Tron* situated a video game designer as the hero in a **war** against both malicious software and corporate intrigue, Hollywood films of the early 1980s positioned youthful video game players as protagonists fighting powerful enemies. Teenager David Lightman (Matthew Broderick), the central character of John Badham's popular film *WarGames* (1983), is both a computer hobbyist and a game enthusiast; when not **hacking** into his high school's server with his IMSAI microcomputer and modem to alter his own grades or those of Ally Sheedy's Jennifer, Lightman plays the digital games he encounters on early local area networks and servers. Accidentally engaging a U.S. Air Force supercomputer, known by both the acronym WOPR (War Operation Plan Response) and the code name Joshua, in a game of "global thermonuclear war," Lightman must break into an Air Force base to prevent the beginning of World War III. Unable to hack into the supercomputer and gain control directly, Lightman instead engages the computer in a digital game of tic-tac-toe, thus teaching the computer the concept of a stalemate from which neither side can win. Averting a nuclear holocaust through a children's game, *WarGames* contrasts the video games increasingly present in early 1980s suburbia with the Cold War, a potentially devastating game of political posturing and military strategy. The film professes a fear that intelligent machines and their programmers, in control of the United States' nuclear stockpiles, are ignorant of the real-world consequences of their actions, although it nonetheless positions a video game player's ingenuity as the solution to global annihilation.

During the 1980s, Hollywood's willingness to represent video games and specifically arcade culture became increasingly prominent. *The Bishop of Battle* (the third in a series of four short films released theatrically as the horror anthology *Nightmares* in 1983) and *The Last Starfighter* (1984), although eventually conforming to the respective genres of horror and science fiction that structure their narratives, feature protagonists who obsessively play arcade games. *Battle*'s J. J. Cooney (Emilio Estevez) hustles arcade attendees in downtown Los Angeles by downplaying his own gaming skills, and *Starfighter*'s Alex Rogan (Lance Guest) escapes the travails of family and trailer park life by playing the only arcade game that stands outside the trailer park's office, aptly titled *Starfighter*. Both teenage boys with exceptional gaming skill, Cooney and Rogan are also similar in that issues of familial domesticity trouble their lives, as Cooney's beleaguered parents worry about his declining grades and Rogan must continually negotiate his role as the oldest child in a single-parent household. Both *Battle* and *Starfighter* represent video game players similarly, but their narratives bespeak opposing views on video game's effects on youth culture. In *Starfighter*'s science fiction narrative, Rogan becomes a celebrated intergalactic hero because of his gaming proficiency, whereas *Battle*'s horrific cautionary tale leaves Cooney trapped within the very video game he champions.

The debate over the potentially deleterious effects of video game play on youth culture is indeed the narrative foundation of the 1980s teen sex comedy *Joysticks* (1983), in which a video game arcade becomes the focus of a political battle waged between the arcade's teenage owner Jefferson Bailey (Scott McGinnis) and upstanding parent-activist Joseph Rutter (Joe Don Baker). Aside from the less-than-subtle sexual innuendo that infuses the film, from the title itself to the conflation of video game "scoring" with sexual proficiency, *Joysticks* creatively depicts the generational divide palpable to youthful video game enthusiasts during the 1980s, particularly in a humorous subjective sequence that contrasts both Bailey and Rutter's fantasies about the unmasked video game arcade. Whereas Bailey fantasizes about a venue of youthful freedom, sexual liberation, and self-expression, Rutter fears a hellish, shadowy den of moral vice. Even the editing of *Joysticks* is overtly inspired by video games, as the transitional wipes that separate the film's individual scenes are of an intrusive yellow orb, clearly resembling **Pac-Man**, eating its way through the *mise-en-scène*.

Video games both inspired Hollywood's science fiction fantasies and influenced the teen sex comedy and cautionary horror genre during the late 1970s and early 1980s, but they also appeared in films to situate the viewer within the film's narrative world. Watching a character play a particular video game could speak volumes about his or her interests, socioeconomic status, and favorite hobbies. Rob Reiner's self-aware swashbuckling fantasy *The Princess Bride* (1987) opens with a screen shot from Accolade's *Hardball*, released for the Commodore 64 in 1985, played by Fred Savage during the film's opening sequence. The on-screen virtual world contrasts strongly with the literary world Savage's character discovers in the pages of a book ("When I was your age, **television** was called books," says the character's grandfather, played by Peter Falk), and the opening shot of the video game works to define Savage's character as hip, computer savvy, and upper-middle class, as he has both a game system and television in his spacious bedroom. Other examples of video games situating film characters include the montage sequences that establish a romantic relationship between Daniel Larusso (Ralph Macchio) and Ali Mills (Elisabeth Shue) in *The Karate Kid* (1984), all of which take place at the local high school hangout, an overcrowded arcade; the continual play of games such as *Double Dragon* (1987), *Rad Racer* (1987), *Ninja Gaiden* (1988), and *Super* **Mario** *Bros. 3* (1990) in *The Wizard*

(1989), a film that functions as much as an **advertisement** for **Nintendo** games and **peripherals** as it does as a coming-of-age adventure; and scenes of skilled children playing arcade games proficiently in *Toys* (1992), while the villainous General Leland Zevo (Michael Gambon) is unable to distinguish between the reality of warfare and the designed fantasy of war games, establishing Zevo as an obsessive and ignorant character.

Although Nicholaus Goossen's film *Grandma's Boy* (2006) would return to video game culture as a theme, its narrative focusing on the shenanigans of a group of game testers and programmers grappling with middle age and their own juvenility, the 1990s and 2000s experienced a far more literal translation of video games into Hollywood cinema. Beginning in 1993 with Annabel Jankel and Rocky Morton's *Super Mario Bros.*, and continuing with *Double Dragon* (1994), *Street Fighter* (1994), ***Mortal Kombat*** (1995), *Lara Croft: Tomb Raider* (2001), *Resident Evil* (2002), ***Doom*** (2005), *Silent Hill* (2006), *Max Payne* (2008), and most recently *Prince of Persia: The Sands of Time* (2010), among numerous others, extremely successful video games have been directly adapted for movie theater screens. Frequently panned by critics but nonetheless achieving popularity with audiences, the direct adaptation of popular video games into Hollywood films predominantly takes the game's narrative world as a basis for melodrama nonexistent in the games themselves, while translating the game's core mechanics into scenes of visual spectacle. Some examples include the first-person perspective that popularized the first-person shooter genre in the game *Doom* (1993), the mapping and exploration of an underground laboratory in *Resident Evil* (1996), and the use of player-activated slow-motion during gun fights in *Max Payne* (2001), which became the focus of special effects sequences within the games' film adaptations, specifically hailing audience members who had actually played the games while being of little relevance to the film's stories.

During the 1990s and 2000s, the science fiction and horror cautionary tale of both video game **addiction** (evident in *The Bishop of Battle*) and a societal overdependence on computer technology also witnessed frequent reiteration. *The Lawnmower Man* (1992) features a scientist who, while experimenting with **virtual reality** software, creates a super-intelligent, malicious digital monster out of an autistic groundskeeper, while *Brainscan* (1994) depicts a teenage voyeur and horror enthusiast enacting murderous fantasies due to a **survival horror game** that hypnotizes and brainwashes him. Horror films such as *Gamebox 1.0* (2004) and *Stay Alive* (2006), in which players respectively become trapped inside game worlds or die when the game world and the real world begin to merge, continued this cautionary trend into the 2000s. Higher budget, critically successful films also critiqued the potential entrapment of game players inside expansive virtual worlds, with 1999 alone seeing the release of David Cronenberg's *eXistenZ*, Josef Rusnak's *The Thirteenth Floor*, and the Wachowski's blockbuster hit *The Matrix*. A decade later, Jonathan Mostow's *Surrogates* (2009) and

Mark Neveldine and Brian Taylor's *Gamer* (2009) returned to the subject of entrapment in virtual worlds. In the 2000s, the visual style of video games also influenced particular sequences in major Hollywood films, with specific scenes in *Crank* (2006), *Fantastic Mr. Fox* (2009), and *Avatar* (2009), respectively, replicating 8-bit arcade games, **platform** jumpers, and first-person shooters through their *mise-en-scène*. Edgar Wright's *Scott Pilgrim vs. the World* (2010) incorporated video game visuals, soundtracks, and references to specific games such as ***The Legend of Zelda*** (1986) and *Tony Hawk's Pro Skater* (1999) into a movie that uniquely hybridizes elements of film form, graphic novel artwork, and video game design while depicting a generation well-versed in all three media.

Academic research on Hollywood cinema's representation and incorporation of video games focuses on multiple issues present in the filmic **adaptation** of games and game narratives. Such issues include how films depict game hardware and software interacting with the human body (Keane, 2002); how spectacle functions differently in games and film (King, 2002); how the relationship between narration and emotional evocation differs depending upon the medium (Weise and Jenkins, 2009); contrasts between subjective and first-person perspectives in film and games (Galloway, 2006); interrelationships between the computer and entertainment industries (Ruggill, 2009); and how the different media inform one another in the age of technological convergence—specifically, how convergence relates to the narrative construction of franchises and world-building designed to inform both game and film properties (Jenkins, 2006).

Harrison Gish

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resolution

The concept of resolution is used in computer **graphics** and is therefore applicable to video game imagery. Resolution refers to the number of discrete units (such as pixels, frames, available colors, or polygons) used to represent (or resolve) a portion of an analog spectrum, in particular, those of **space**, **time**, color, or geometry. Because of memory limitations, processing speed, and monitor capabilities, these four types of resolution are always limited in some way, requiring graphic designers and game designers to take them into consideration, to some degree, especially in projects encountering more restrictive limitations regarding resolution.

Spatial resolution is measured in pixels per inch and refers to the amount of detail possible in a digital image. The more spatial resolution that is available in an image, the smaller the detail that can be represented in it (although processing power and software-related restrictions can also limit resolution, as in early home video games, like those of the **Atari VCS 2600**). The lower an image's spatial resolution, the more apparent the edges of individual pixels will be, resulting in a jagged appearance referred to as *aliasing*. The effects of aliasing can be lessened by using rows of pixels of interpolated colors or tones at boundaries between different colors or tones, to make the transition between them more gradual; this process is called antialiasing.

Temporal resolution refers to the number of frames per second used in time-based media. The more frames per second used in moving imagery, the smoother apparent motion can appear within the imagery. Temporal aliasing, known as *strobing*, occurs because a frame rate is too low to convey a sense of smooth motion, and moving objects appear to jump from one position to another rather than moving smoothly between them. The effects of strobing can be lessened through the use of *motion-blurring*, which simulates the blur that an object would have passing through a given span of space in a given span of time, all within a single image. The addition of motion blur to a moving object fills in the gaps between the object's positions from one frame to the next, smoothing the overall appearance of the motion.

Color resolution (or in the case of grayscale imagery, tonal resolution), is measured in bits per pixel, and refers to the number of colors available for use in an image or series of images (for n bits there are 2^n possibilities). When the color resolution of an image is low, the jump from one color to another along a gradient is more abrupt and noticeable, resulting in color aliasing or *mach banding*, also known as *posterization*. This can be alleviated through the use of *dithering*, in which pixels of different colors are mixed in changing ratios across the boundary between colored areas, allowing one color to increase while another decreases, simulating a gradient between different colors or tones when the image is viewed from a distance or if the spatial resolution is high enough.

Geometric resolution, when applied to three-dimensional graphics, refers to the number of polygons used to resolve a three-dimensional shape within a three-dimensional space. Low geometric resolution, in which the individual polygons are discernable, results in a blocky or faceted appearance, whereas higher resolution allows for smoother curves and flowing forms. Naturally, simpler objects require fewer polygons, and increasingly complex ones require more. One of the challenges of computer modeling is to represent the object being models with as few polygons as possible while still maintaining as realistic an appearance as possible. Low-resolution models can be aided by certain shading techniques, such as Gouraud shading or Phong shading, which apply color or tonal gradients across polygons so that their boundary colors match, making the boundaries between them less noticeable and smoothing their appearance. Other computer graphics processes, like NURBS, non-uniform rational basis (or Bézier) splines, allow geometric resolution to change dynamically based on the apparent distance from the viewer, to save calculation and rendering time when objects take up less on-screen space (Polevoi, 2000).

Different types of resolution can affect and compensate for each other's limitations. For example, the aliasing in an image with low spatial resolution can be eased with higher color resolution that allows antialiasing to be done. Higher color resolution also makes motion-blurred imagery possible because blurs require gradients, and smoother gradients, used by shading techniques, can reduce the effects of limited geometric resolution. Higher spatial resolution can make up for low color resolution by making dithering less noticeable and color gradients appear smoother. The quality of grayscale imagery is also perceived differently from color imagery, with a wider dynamic range of color making up for lower spatial resolution, so a designer wishing to save memory should reduce the tonal resolution in grayscale imagery while leaving the spatial resolution unchanged; in contrast, for color imagery, the spatial resolution of color images should be reduced while the color resolution is left unchanged (Ester, 1990).

Even as screen resolutions, memory, and processing speeds increase, the need for economy and continual pushing of boundaries ensures that issues related to resolution will need to be taken into consideration for some time to come.

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resurrection

See death and resurrection

retrogaming

Retrogaming is a hobby of playing older **console-based games**, **computer games**, and **arcade games**. Although there are no universally accepted criteria for inclusion in the "retro" category, the label is typically used in reference to discontinued **platforms** and software developed for such. According to this convention, a game such as ***The Legend of Zelda****: Ocarina of Time* for the **Nintendo 64** is considered "retro" (because the system is no longer manufactured or supported), but Windows-bound *Half-Life* is not, regardless of the fact that both titles were released in 1998. By the same token, the category also encompasses new games—including original works, as well as remakes and de-makes—created by **homebrew** communities organized around consoles such as the **Atari VCS 2600** or the **GCE/Milton Bradley Vectrex**. In a broader sense, the term can also be applied to so-called retro-throwbacks—releases bringing play mechanics and aesthetics reminiscent of earlier eras of **game design** to modern platforms (for example, the 2-D platformer *Cave Story* [2004] or the twin-stick shooter *Geometry Wars: Retro Evolved* [2005]).

The emergence of retrogaming subculture has been attributed to a variety of factors, from general interest in the **history** of the medium, to nostalgic desire to relive personally meaningful gaming experiences, to growing dissatisfaction with the perceived creative crisis of the modern game **industry** (especially overreliance on licenses and sequels as risk-avoidance strategy in the face of rising development costs). Although personal motivations vary widely, the movement provides a much-needed counterpoint to the forward-looking mind-set and rapid pace of change characterizing gaming culture. Perhaps most crucially, it keeps the medium's past alive, testifying to the continued relevance of technologies, design principles, styles—even entire genres—which, over the years, have undergone dramatic changes or been altogether cast aside. Moreover, because the hobby is typically associated with hardware and software **collecting**, retrogaming plays an important curatorial function, preserving and protecting aspects of game culture increasingly threatened by obsolescence (as a result of lack of support for discontinued hardware, software, and storage formats), "bit rot" (irreversible degradation of optical and magnetic media, as well as decay of data contained in EPROM chips), malfunctions, and physical destruction (both accidental and, as has been the case with a number of **arcade games**, intentional; *see* **suicide batteries**). A similar role is played by a number of community-driven **emulation**, documentation, and preservation initiatives—most notably the **Multiple Arcade Machine Emulator (MAME)** and its derivative, the Multi Emulator Super System (MESS). This is especially noteworthy given that organized, institutional efforts of this kind are still relatively rare.

Retrogaming's gradual movement from the fringes toward the mainstream has been, unsurprisingly, accompanied by growing commercial interest. The industry has been quick to capitalize on the "retro revival" with remakes and rereleases of older titles for modern systems. Because their small size makes such offerings well suited for digital distribution, in recent years they have become virtual staples of platforms such as the **PlayStation** Network, **Xbox** Live Arcade, and **Wii** Virtual Console. In addition, some of the more popular vintage titles from such publishers as **Namco**, **SEGA**, and **Atari** have found their way into a number of low-cost, dedicated consoles. The trend contributes significantly to increasing the visibility and **accessibility** of retrogaming, but, with the likelihood of rerelease directly proportional to a given game's commercial viability, it also prompts questions about potential distortion of the history of the medium. Furthermore, the use of software or hardware emulation in "retro" products raises concerns regarding the authenticity of the resulting **play** experience (as games are taken out of their original social and technological context) or even its basic accuracy (due to emulation errors, altered controls, and so on).

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rhythm and dance games

Rhythm and dance games are video games that fall under the category of what could be termed the "rhythm-action genre" (Collins, 2008). Gameplay is primarily focused on players repeating or coordinating rhythmic audiovisual cues in unison with the game through the use of either traditional **console** controls or additional **peripheral** devices. **Avatars** are usually of secondary importance in most rhythm and dance games. With the **scrolling** of rhythm and dance moves taking center stage, avatars are often relegated to background characters and rarely influence gameplay in any way.

One of the first rhythm-action electronic games is often said to be **Atari**'s *Touch Me* (arcade version, 1974; handheld version, 1978; Collins, 2008), but it was Milton Bradley's *Simon* (1977) that first saw broad commercial success. Gameplay is centered around a circular electronic device with four colored buttons (red, green, blue, yellow), each with its own harmonic tone. Players observed the audiovisual pattern displayed on the device and then attempted to repeat the pattern correctly by pushing on the appropriate button, matching color and tone. The patterns became increasingly difficult with each turn. Although seemingly rudimentary compared with current rhythm-action video games, the basic premise remains constant in today's rhythm and dance games.

In 1988, **Nintendo** released the "Power Pad" floor mat to accompany the **Nintendo Entertainment System (NES)** console to be used with games such as Bandai's *Dance Aerobics* (1989) and Nintendo's *Short Order/Eggsplode* (1989). Containing more sensor spots in its dance mat than Konami's ***Dance Dance Revolution*** (1998), the Power Pad can be seen as an important early technical precursor to incorporating full-body movement in video game **play**. Another early predecessor to contemporary rhythm-action games, NanaOn-Sha's *PaRappa the Rapper* (1996) uses a similar observation/repetition gameplay technique as *Simon* but also requires the player to successfully match the timing of the **repetitions**.

The shift to peripheral-led music gaming is attributed to Konami's Games & Music division (later renamed the "Bemani Division"), with *Beatmania* (1997), a DJ-style video **arcade game**, later ported to home consoles in **Japan** and North America, which led a series of 34 games released between 1998 and 2007. *Beatmania* can be said to be a direct predecessor to **Activision**'s *DJ Hero* (2009). Konami's *GuitarFreaks* (1998) soared in popularity with the release of 14 games over the period 1998 to 2006 (Wolf, 2007). However, it is Konami's *Dance Dance Revolution*, with 16 versions of the game released over the period of 1998 to 2006, that is often cited as being largely responsible for the increasing popularity of rhythm-action games globally (*Edge Magazine*, 2010). There are several variations on rhythm and dance gameplay mechanics such as a memory "observe and repeat" format in which players watch a sequence, and then perform it from memory; to testing coordination skills with scrolling images such as arrows or music notes that the player has to push with the corresponding buttons on their **controller** in unison with the images on the screen; to freeform gameplay, in which players are free to create music or dance moves without any gameplay restrictions. Most rhythm and dance games base progression solely on the successful completion of songs which increase in difficulty level as the player progresses. However, there are a few exceptions, such as *PaRappa the Rapper*, which is essentially a **narrative**-based video game with rhythm-action elements within it.

Although rhythm and dance games can often be played with a standard controller for console versions, most games require specialized peripheral controllers such as a range of musical instruments for games like Harmonix's *Rock Band* (2007), Red Octane's *Guitar Hero* (2005), and Nintendo's *Donkey Konga* (2003); dance mats for games such as *Dance Dance Revolution* and Codemaster's *Dance Factory* (2006); and headsets and microphones for karaoke style games such as Konami's *Karaoke Revolution* (2003) and London Studios/ Sony's *SingStar* (2004). These peripherals plug into the console and can often fully replace the traditional controller for **interface navigation** and gameplay.

Although video game interfaces vary depending on the title, many games show a variation of the peripheral controller on the screen. For example, *Guitar Hero*'s interface shows the image of a guitar neck with frets displaying the scrolling notes and chords players must match in sync with the game. Notes and chords are color-coded to match the console's standard controller (green, red, yellow, blue, and orange). Although the video game chords often reference "real" chords, they are often simplified for the sake of gameplay and therefore cannot be considered a guitar simulation game in the true sense. This is similar to *Dance Dance Revolution*, where the rhythmic sequences of steps are not directly correlated to actual dance moves.

Through technological development, video game controllers have shifted from game-specific devices such as *Simon* to peripheral-centric games such as *Rock Band* and *Dance Dance Revolution*. In an attempt to move away from any physical controller (console or peripheral) in favor of the body, **Sony** released the *Eye Toy* (2003), a peripheral console attachment for their **PlayStation 2** that included a digital camera and motion sensor, allowing video games to be controlled by the player's body movement alone. Games such as *Eye-Toy: Groove* (2004) encouraged players to move their entire bodies as they stood in front of their **television**, their body appearing on the screen, attempting to hit targets that were positioned on the edge of the screen according to the rhythm of the music playing.

Newer variations of **gestural interfaces** include Nintendo's *WiiMusic* (2008) in which players use the **Wii** Remote and Nunchuk to control a band on the screen (playing a possible 66 instruments, including both traditional and nontraditional ones). Although players must use the controllers to play, they are not required to press specific buttons at certain times like older rhythm-action games; instead, they must move the Wii Remote and Nunchuk as if they were playing the instruments on the screen. Gameplay varies from free-form jam sessions to structured **minigames**.

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ritual

Games and rituals are both millennia-old human activities infused with human meaning-making, and because many rituals have historically taken place in religious contexts, rituals and games manifest a surprisingly deep kinship. Some ancient games, like the Mesopotamian divination game Ur, were both religious and playful. Indeed, the function of these activities so overlaps that the difference between them is perhaps more a matter of perspective than of form or function. Because rituals and games are both contested terms that exhibit immense diversity of practice, all comparative observations must be generalizations. But even the most obvious comparisons reveal that both video games and ritual may be doing some similar things for the people who use them, performing what David Chidester (2005) calls "religious work" whether or not they are explicitly labeled as "religious." As Ronald Grimes observes, "meaningful ritual-and-media discussion becomes possible when the two domains are neither equated nor segregated but rather differentiated and conceived as sharing a common boundary" (Grimes, 2006, p. 229).

Both rituals and video games are often concerned with storytelling. Scholars have long noticed the close relationship between myth and ritual in religious contexts, as when sacred stories are recited in a ritual context or when rituals are themselves dramatic reenactments of these stories. In such cases, there is a deep connection between the story and its ritual **performance**, such that the story can best be appreciated *only* in its ritually performed context. Similarly, video games are often infused with a deeply complex mythology that is revealed and enacted via the player's performance of it. Most players would be less than satisfied with mere **walkthroughs** or descriptions of a game's mythology. They want to perform the story, to enact it.

Rituals and video games are deeply *interactive*. Despite the contested nature of the concept of interactivity, few would deny that both games and rituals draw people in and create a feedback loop of experience. Rituals and games both depend on people *doing* them for them to be meaningful. Rituals are often driven by liturgy, or scripts of how the ritual is to unfold. Similarly, many video games are scripted via the programming and writing behind the scenes. Both, however, require human interaction and performance for meaning to arise and for the "script" to become something more than the potential for experience. And both, one could argue, shape the performer through his or her movement through the scripted experience. Thus both video games and rituals are "emergent" in the sense that meaning arises via **play/** performance and depends on the inputted actions of the player-performer.

This idea of *performance* is an important one for game-players and ritual theorists and is of course deeply tied in with storytelling and interactivity. For some ritual theorists, the term "ritual" is replaced by the term "performance" or "ritualization" as a means of emphasizing the interactivity—the configuration or procedurality—involved in a ritual. As ritual theorist Roy Rappaport notes, "performance as well as formality is necessary for ritual" (Rappaport, 1996). That is, *doing* as well as scripting is required. For many ritual theorists, it isn't a ritual if it isn't being performed. Video game players and designers could similarly argue that it isn't a game until someone is playing it. This comparison raises the question of what we should call a video game when it is not being played or while it is in development. Is it still a game? Or is it merely a script, liturgy, or potential performance?

Some scholars of ritual are concerned with whether rituals *convey a message* to people, either to the performers or to those watching the ritual. This concern echoes similar questions in video game theory about whether games "teach" us how to view the world or what to do in it, or if they "teach" us anything at all. The "arena" of ritual, interestingly, is often viewed as imbued with deep meaning with consequences beyond the ritual itself—even if the impact is simply the maintenance of societal status quo. Rituals are believed by many, scholars and ordinary folk alike, to "tell" us something about how the **world** works, to help us learn foundational stories, or to reaffirm some sense of cosmic structure and order. The "arena" of gameplay, however, is often seen by players as having little to no meaningful effect on life beyond the game, apart from perhaps some sense of cathartic purging of **emotions** or an appreciation for camaraderie achieved in multiplayer games. Yet both rituals and video games are performative, they invite our investment in a sort of "what-if" scenario that shapes our investment in a given worldview; and both invite us to *do* things.

It seems hard to deny that both rituals and video games, then, have *some* effect on how we see ourselves and the world. So do games and rituals communicate anything to player-performers or observers? This argument is far from settled, but the comparison of rituals and games invites new consideration of how such "messages" may be delivered through performance and through play.

Both rituals and games are defined by ***rules***, or structures that regulate and limit performance, shaping the player-performer's experience. Ritual theorist Stanley Tambiah points out the formalized structure of many ritual experiences, describing rituals as "constituted of patterned and ordered sequences of words and acts, often expressed in multiple media" (p. 128), with content that is arranged with differing degrees of formality, stereotyping or fixedness, fusion of disparate elements, and **repetition** (Tambiah, 1985). Rules, in this sense, are the structure-providing mechanisms that shape experience. Ritual theorists typically don't use terms like "rules" to apply to the ritual performance, preferring rather to think about "formality" and "repetition," but in a performative sense, both games and rituals indeed set limits on what we can do and what we cannot to give shape and structure to the emerging experience. Both also draw on previous stereotypes or genre specifications, creating expectations and familiarity in performer-players, who know what to do in new manifestations of the game or ritual because they have seen this kind of thing before. Rules tell us how to see things by telling us what is and is not possible. If there is anything to the claim that both rituals and video games can shape our view of the world, then looking at what the rules are in any ritual or gaming experience could tell us something about what we are meant to derive from the experience. This, in turn, should enable us to be critically aware participants in *any* rule-based environment.

Some important things are gained by a comparison of rituals with video games. Both experiences are concerned with storytelling and are interactive, performative, communicative (perhaps), and defined by rules. This means that both can also be viewed as mere forms of "play" or as serious shapers of our worldviews. We can also note that although it may seem to some that "religion" is on the decline, human beings are notoriously creative, imaginative creatures and will find ways to craft meaningful experiences whether or not we feel comfortable labeling them "religious."

Rachel Wagner

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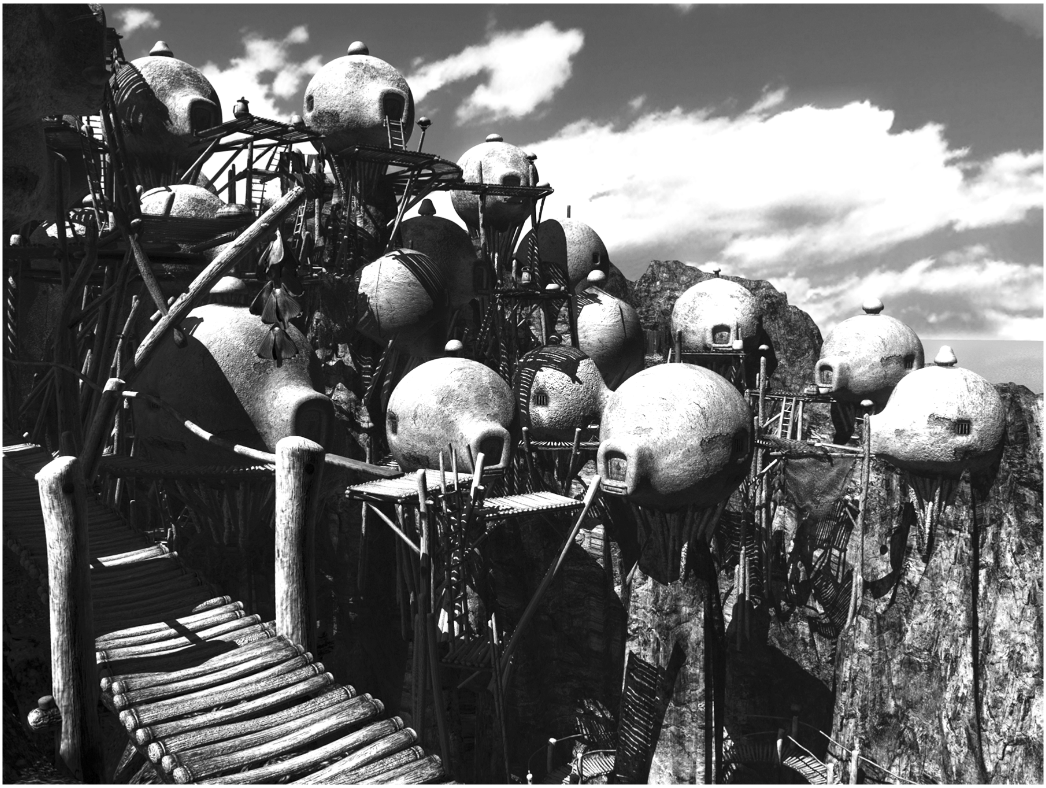
Riven

Cyan's game *Riven: The Sequel to Myst* (1997) surpassed its predecessor ***Myst*** (1993) in size and scale, containing more than 4,000 screens of **graphics** on five **CD-ROMs**. It was the best-selling game of 1997 but did not pass up *Myst*. *Riven* is notable for the beauty of its **design**, the integration of puzzles into its **world** and storyline, and the mood and atmosphere of its various locations, all of which demonstrated that video games could be **art**.

Riven continues the story of *Myst* and begins with Atrus sending the player to Riven, where his father Gehn has imprisoned Atrus's wife Catherine. Gehn is himself imprisoned on Riven, although he can travel to the smaller worlds, or "Ages," for which he has written descriptive books and linking books. Riven is itself one of Gehn's worlds, and its design reflects his personality and ambitions. Atrus gives the player a linking book, which is really a one-man prison that can be used to capture Gehn. Thus, unlike *Myst*, the player begins the game with two objectives: capture Gehn and free Catherine. Once the player arrives on Riven, however, the prison book is stolen by one of Gehn's guards and then restolen by a member of the Black Moeity, a rebel



The huts of the villagers on Jungle Island in *Riven* (Cyan Worlds, 1997).

group fighting against Gehn that is composed of the indigenous Rivenese villagers. This gives the player a third objective that must be completed before the other two can be—the retrieval of the prison book.

Much of *Riven*'s gameplay involves exploring the five islands that make up Riven and learning their geography, as well as learning to operate the machinery and gain entry into various buildings and locations. Many small details are significant as clues in *Riven*, and scenery is often staged in depth, allowing a distant view of places and things that tantalize the player into finding a way to get to them. As in *Myst*, important clues can be found in such things as characters' journals, geographic layouts, **maps**, and other devices, and deciphering several connected layers of clues is sometimes necessary to solve puzzles. Along the way, the player learns more about Gehn, who becomes more than simply *Riven*'s villain, and there is also a visit to Tay, the rebels' own Age, and the 233rd Age, where Gehn has his office and bedroom.

The smooth integration and diegetic motivation for *Riven*'s puzzles, the care given to the design and rendering of all its details, the engaging storyline that slowly reveals character and backstory, and the attention paid to lighting, **sound**, composition, music, mood, and atmosphere all position *Riven* at the pinnacle of contemplative single-player **adventure games** and result in an artistic work that has yet to be surpassed. *Riven* was followed by three more *Myst* games, *Myst III: Exile* (2001), *Myst IV: Revelation* (2004), and *Myst V: End of Ages* (2005), as well as the multiplayer *Uru: Ages Beyond Myst* (2003).

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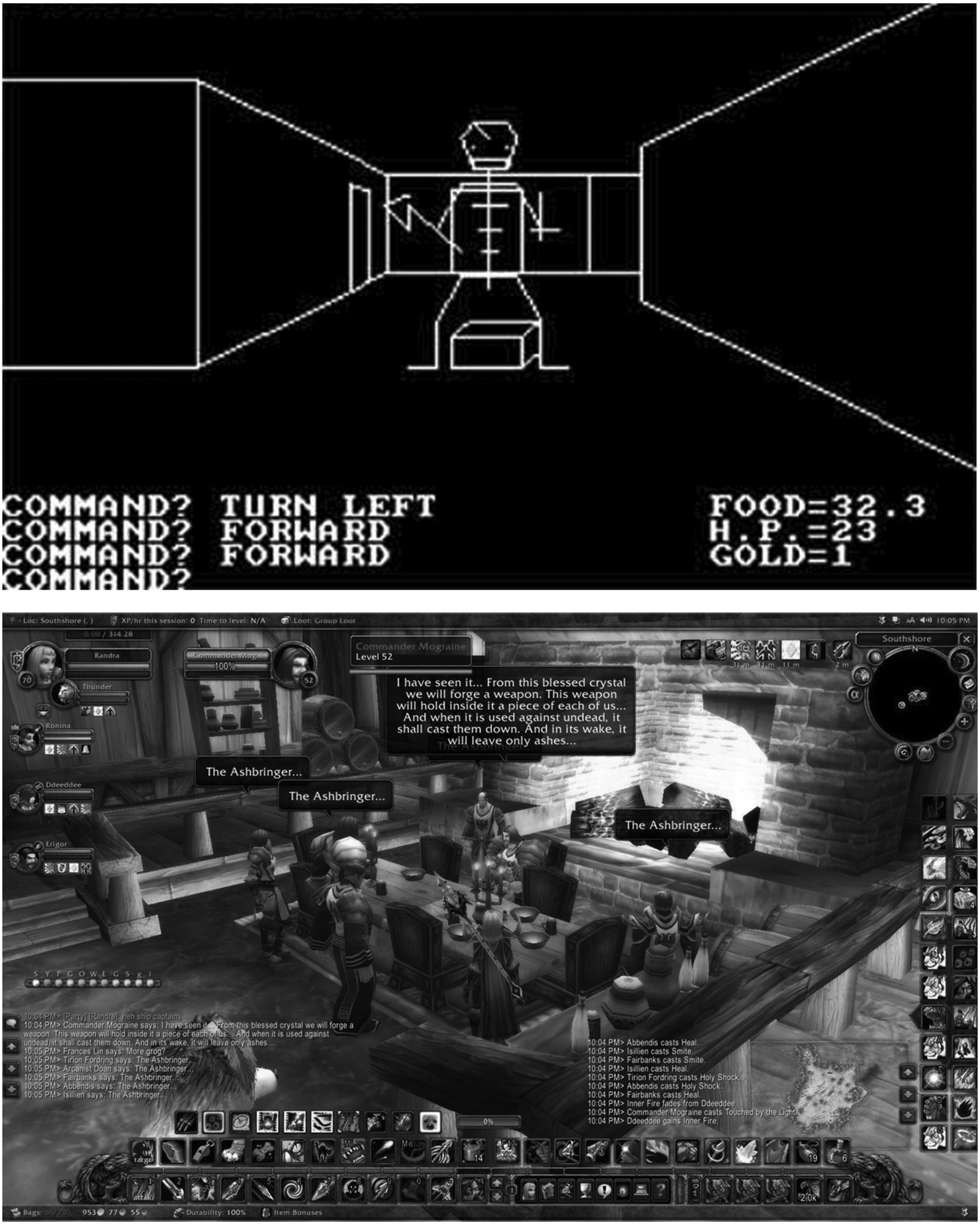
role-playing games (RPGs)

Role-playing games (RPGs) have a complex history rooted in fantasy literature, interactive storytelling, and miniature **war** games. The first role-playing games were of the tabletop (also known as pen-and-paper) variety, meaning that they are typically played together by a small team, headed by a game-master. *Dungeons & Dragons* (*D&D*; Gary Gygax and Dave Arneson, 1974) was the first commercial role-playing game and a major influence on the development of the genre. In role-playing games, players each adopt the roles and control the actions of their own fictional characters (player-characters [PCs]), living in a fictional game **world**, and the game-master describes the world and the actions of **nonplayer characters (NPCs)**. Much of the conflict **resolution**, such as battle events or tests of skill, is conducted according to a set of **rules** and a random element, arbitrated by the use of many-sided dice. Character sheets, rulebooks, and other materials may be used to facilitate **play**, and there are many individual styles of role-playing, some of them more free-form, some more rules oriented. There also exists a version of RPG known as "larp," or live action role-playing, which might involve acting in character, wearing period costumes, and doing more or less location propping.

Computer role-playing games were partially derived from tabletop RPGs, although there were also other influences and close ties to the development of such game genres as text adventures and computer **strategy games**. It is somewhat debatable what makes a "genuine" computer RPG; one feature that is commonly considered a defining one is that all RPGs have player-characters with quantifiable features (digital equivalents of the character sheets used in tabletop style RPGs), and character progression is used as a central measurement of success. Traditional RPG rule systems often include "experience levels," meaning that successful advancement in games translates into "experience points" through which a PC can "level up" to new powers and skills. Other skill and training systems may be used, but the focus on improving one's PC nevertheless remains one of the typical features of computer and **console** RPGs. Regardless of formal similarities, a single-player digital RPG is a very different experience from that provided by traditional tabletop RPGs. The element of "playing a role" or acting in character is largely lost, and instead various puzzles or quest structures (tasks assigned to a player-character) are used to guide the player through plot-driven gameplay.

Some of the most popular computer RPG series include the ***Ultima* series** (started with *Akalabeth*, 1979), *Wizardry* series (1981–2001), and *Might and Magic* series (1986–2002). These were preceded in the 1970s by early "dungeon crawl" style games that were often created for university computer systems, like *dnd* (Gary Whisenhunt and Ray Wood, 1974–1975) for PLATO at the University of Illinois, and *Rogue* (1980). Mostly text-only, these games were implemented as a digital translation of the core elements in *Dungeons & Dragons* gameplay: a player creates an adventuring character and then proceeds to explore some caves filled with monsters and treasure. Computer RPGs became increasingly complex during the 1980s and 1990s, with expanding game worlds and improving graphical as well as audio features. These increasingly complex computer RPGs provided players with richer interaction options by handing them an entire team of adventurers to control, rather than a single player-character. Video games spun off on their own evolutionary track in the early 1980s, with the release of console RPGs, such as *Dragonstomper* (1982) for the **Atari VCS 2600** and *Dragon Quest* (1986) for the **Nintendo Entertainment System (NES)**, with gameplay based on models set by early *Ultima* and *Wizardry* games, combining turn-based battles with a heavy emphasis on **narrative** and character development. There exist today several national or cultural varieties of RPG **game design**, of which the contrast between the linear Japanese RPGs and Western open-ended RPGs is a prominent example.

Multiplayer computer RPG gameplay was first implemented in early multiplayer dungeon crawls, such as *Avatar* (1977–1979) in the PLATO system. The first multiplayer RPG with a persistent virtual world was *MUD* (Multi-User Dungeon) created by Roy Trubshaw and Richard Bartle in 1978–1980. Combined with a graphical interface, MUDs later evolved to massively **multiplayer on-line role-playing games (MMORPGs)**, of which ***World of Warcraft*** (2004) is the most popular contemporary example. A subgenre of action RPGs has also evolved in which all game events are acted out in real time. For example, in



Akalabeth (Richard Garriott, 1979) [top] and *World of Warcraft* (Blizzard, 2004) [bottom]. (Frans Mäyrä)

Diablo (1996), the debt to early *Rogue*-like dungeon games is clear, the most important shared element being the randomly generated dungeon levels. When adapted into a multiplayer game, this kind of action RPG is also suitable for competitive tournament play. Single-player RPGs still remain popular, including several game series with richly detailed fictional and narrative worlds, including *Fallout* (1997), *Baldur's Gate* (1998), *Neverwinter Nights* (2002), *Star Wars: Knights of the Old Republic* (2003), *Fable* (2004), and *The Elder Scrolls V: Skyrim* (2011).

The essence or "true" character of RPGs is frequently debated by fans of the genre. Some emphasize the primacy of role-play; some, the gameplay element. Already the early *D&D* adventure scenarios were often designed and played out in a conflict-oriented "hack-and-slash" style, where the battles were the core element, and **immersion** into player-character was considered secondary. Some players had different priorities, and thus potential for disagreement existed as to what the goal and purpose of role-playing games was. One prominent formulation of these views was developed by the RPG community in an on-line discussion (in the rec.games.frp.advocacy Usenet news group) and later published by John H. Kim as "The Threeway Model" (1998). This model distinguishes between three popular styles of role-playing: a "dramatist" is playing the game to produce a satisfying storyline; a "gamist" player is focused on overcoming satisfying challenges; and finally, a "simulationist" is someone who emphasizes the internal consistency of events within the world of the game. This last RPG player category later became known as the "immersionist," where the emphasis is on the player getting involved with the lives of fictional RPG characters, even feeling their characters' feelings. In comparison, Richard Bartle (1996) has analyzed how the main player types in MUDs form four distinctive categories: achievers (who play to master the game), explorers (who play to experience the game world), socializers (who play to interact with other people), and killers (who want to use their powers to humiliate other people).

The designers and producers of computer RPGs can be seen to cater to this diversity of player preferences in various ways. The *Diablo* (1997) style of action RPGs focuses on battles and equipment and thus best serves players with "gamist" or "achiever" priorities in gameplay. Most of the popular computer RPGs such as *Mass Effect* (2007) and the other popular single-player RPG series mentioned earlier combine action, puzzle, and narrative elements in a manner that makes them appeal to a broad range of different kinds of players. In addition, as genre features have started to mix, RPGs often have the traits found in many kinds of games, rather than those of a separate genre of its own. For example, the popular "sandbox" style games such as the ***Grand Theft Auto* series** also include evolving player-characters, rich interactions with numerous NPCs, and quest (task) structures much in the style of single-player RPGs. There are some clear overlaps or mutual influences as well when the development of strategy games is considered, with *Warcraft III: Reign of Chaos* (2002) an example of a war game that includes individual, evolving "hero" characters as well as nonindividualized troop units. **Adventure games** also continue to have many similarities with RPGs in the story-driven character of gameplay in particular, but, however, they do not focus on player-created characters to the same degree. It should be noted that the on-line RPG space has also continued to expand with the introduction of virtual worlds such as Second Life (2003) or *Habbo Hotel* (2000; now *Habbo*). Many of these environments do away with gameplay elements entirely, becoming purely graphical chat services. The combination of gameplay challenges, fictional worlds and characters, plus on-line social interactions with real other people nevertheless provides a rich blend of attractions helping on-line role-playing games remain popular. Another contemporary development is the expansion of RPG style features into social networking services such as Facebook, where casual versions of RPGs have been released and marketed as "social games."

Frans Mäyrä

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RPGs

See role-playing games (RPGs)

rules

Linguistically, the word "rule" has three meanings in relation to play: that of a guideline, standard, or regulation (mostly directive of actions); that of a rational regularity (mostly directive of thought); and that of a predictable, periodic recurrence of phenomena (mostly directive of perception). Rules of video games fall into the first category and are therefore close to regulations and standards for social behavior such as traffic rules or etiquette. Rules of a game can be seen as a set of recurring instructions, the validity of which appears to be set but that can be terminated, changed, or overruled at any **time**, as long as these changes occur by mutual consent of all participants. However, at the same time, the rules of a game are interwoven with the general idea of gaming. Depending on the general conceptualization and definition of "game," the significance and evaluation of rules change. In German idealism (such as Schiller or Kant), free **play** (without rules) is perceived as emancipatory, because people are able to interact playfully with the world through trial actions without fear of consequences. The absence of rules during free play, and the self-referentiality of the game, amount to its significance. This concept of the ideal and liberating game is opposed to the functional idea of the game. This concept of game questions the idea of trial action without consequences (Bateson, 2000; Dewey, 1916). This aspect of the interrelation between games and rules has especially inspired Juul's work *Half-Real* (Juul, 2005). Juul argues for an ambivalent status of the video game between "real" and "fictional," whereas the "real" is represented more or less through the system of rules. However, the variable functionality of rules is guaranteed by the fictional projections of video games. Juul's concept points to an important difference, which can be condensed by the term "**magic circle**."

The magic circle points back to Johan **Huizinga**'s theory of games. For Huizinga, the magic circle describes the border within which a game is played as well as what is outside the context. This characterizes our current understanding of rules. His anthropological theory of "homo ludens" sees the game as a voluntary activity within certain boundaries of **space** and **time** following voluntarily accepted yet binding rules. Although his emphasis on the observation of rules in his definition of "game" was criticized, it has subsequently gained recognition as an important criterion for the definition of "game." Rules not only confine competitive games in space and time, they also determine the course and character of the game. Rules constitute the requirements for winning and the space of action. They limit the actions of the playing subjects, are set, fixed, and can be reproduced. Nevertheless, the supposedly mandatory necessity of rules is often in conflict with the element of contingency in games—the true cultural and philosophical value of games may lie in this dichotomy. However, this strict separation leads to a problem because it upholds the difference between real and fictional (as mentioned by Juul); the rule seems to be part of both worlds. Rules are, on the one hand, part of the "real world," and, on the other hand, they help build the fictional worlds of video games.

Philosopher John R. Searle's classification of rules differentiates between *constitutive* and *regulative* rules. Constitutive rules are those that enable actions. In the case of the rules of video games, it at first appears that this type of rule is the most important. Without these rules, the game and its competition could not exist: if the ball hits the goal, you get a point. Constitutive rules are therefore negotiated, based on agreement, and overt in form. Regulative rules, on the other hand, are the sometimes ambiguous and explicit standards and agreements that structure intersubjective societal cooperation. They are closely connected to a society's common sense and for the most part appear to be invisible and naturalized.

One issue in video game debates regarding rules is whether games can be functionally defined based solely on regulative rules. Video games are unique because of the technical ability of programs and algorithms to enforce rules (both constitutive rules and regulative rules) automatically during gameplay. This also makes it appear that the rules of a video game cannot be broken by the player (apart from such things as **cheat** codes and **hacking**), especially in single-player games where there is no social contract between players. According to Huizinga, games thrive from the coexistence of obeying constitutive rules and the purposeful breaching of those rules. But the breach of constitutive rules does not lead to the end of the tacit agreement needed for the game; it can be part of the enjoyment of the game. In a way, cheat codes and **walkthroughs** seem constitutive of the gaming experience. Breaches of the regulative rules, on the other hand, lead to the sport being spoiled, so to speak. A good example may be the strategy of "camping" in multiplayer **shooting games** such as *Counter-Strike* (1999), a tactic in which a player obtains a strategic position anywhere on the **map** and waits for other players to arrive and be killed. It is a legitimate style of play but often discussed in player communities as unsportsmanlike.

It is necessary, then, at least to differentiate between the regulative rules of the game itself, which differ from the technological rules of the game. The latter are rules that are inscribed in the instrument itself as part of its workings and therefore do not appear as explicit instructions (such as the way the **game engine** simulates the laws of physics and that are defined by the program code of the game engine). Thus the rules represent at least a link between the game itself, the software application, and the hardware on which it runs. In video games, it does not seem possible to break the regulative rules and technological rules. Cheat codes and hacking may sometimes be partially breaking the technological rules—but in most cases of cheating, the possibilities of the cheat are intrinsic parts of the game codes themselves.

Because of the communication between players present in multiplayer games, constitutive rules can also be in effect in video games. In this case, the strict determination of the game's outcome by regulative rules and technically implicit rules, respectively, would partially dissolve. The suggestion that the rules of video games leave no room for (intersubjective) negotiation and flexibility leads to the conceptualization of video games as a system of dominant rules. Although it is easy to focus on the regulative rules of video games, the presence of constitutive rules in multiplayer games reveals that the playing of such games involves more than simply the implicit, technical rules of the game programming. Such things as **game modifications**, cheating, **machinima**, and so forth, should be seen as places of negotiation regarding the constitutive rules of video games. ***See also*** "beating" a game.

Rolf F. Nohr

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S

Saturn

See SEGA Saturn

save function

The save function allows players to record their current progress and position in a video game to allow them to return to this point the next time they **play**. Save functionality did not exist in early arcade video games but became a common feature of video games in domestic spaces on home game consoles and personal computers. **Arcade games** have historically encouraged a shorter total playing time by requiring the player to insert a coin to initiate a game session and then generally limiting the player to a few opportunities or "lives" for each such session; in a sense, a player "rents" an arcade game by inserting a coin. This **design** characteristic maximizes profitability of a given arcade unit by essentially forcing players to regularly insert more coins to continue play or start a new game. The economics of home **console-based games** did not require the game maker to encourage shorter playing times; because consoles and their games were sold outright, the length of playing time for a given game was no longer directly linked to its potential revenue. Thus, although arcade games continued to employ the same basic economic model, home games could encourage longer playing times, and save functionality emerged as a means to allow players to continue play from an earlier session to reduce player frustration.

The game dynamic in arcade games of multiple tries or "lives" per play session can be traced to mechanical coin-operated games such as pinball or Japanese pachinko machines. These mechanical precursors to electronic video arcade games would give the player a predetermined number of chances to play the game in exchange for the deposit of a coin, often supplying the player with a few metal balls. Using paddles and other methods of control, the player would then manipulate and maneuver these metal balls one at a time across an enclosed playing board. These games featured areas of the board that would reward players with differing amounts of points for rolling the ball into particular regions of the board. Other areas would remove the ball from the playing board and thus eliminate one of the player's "tries" on the board. Much like these mechanical precursors, early arcade video games similarly required players to start the game from the beginning each time they were played and allowed a player only a few tries or lives per game session. Exidy's *Star Fire* (1979) introduced the high-score table, which rewarded more skilled players by allowing those with the most points to record their initials or name on the game. This effectively encouraged players to challenge the scores of other players and generate more revenue in the process. But although *Star Fire* and subsequent titles allowed players to save high scores on the machine, arcade games have typically not allowed players to save and continue their progress within a game at a later point.

Because arcade game revenue depended on the number of times the game was played, arcade games often accentuated skill and speed, placing little emphasis on **narrative** development or world-building. In contrast, home games could develop narrative and the game's **world** in a more complex fashion, allowing for the emergence of longer-form game structures such as those of **adventure games**. The longer amount of time required to successfully complete such home games encouraged a change in gameplay mechanics that allowed players to save their progress after each session of play, rather than starting from the beginning each time the game was played. Whereas personal computers allowed game data to be saved to a floppy disk or hard drive, home consoles initially lacked the capacity to easily save such information. For example, **Nintendo**'s ***The Legend of Zelda*** (1986) for the **Nintendo Entertainment System (NES)** was released on a specially designed **cartridge** that included a battery to store this data while the system was turned off. This allowed players to save their progress, accumulate possessions in the game, and resume the game later. Subsequent game consoles would offer the ability to save games to memory cards (like the **Sony PlayStation**) or to hard drives built into the console (like the **Microsoft Xbox**).

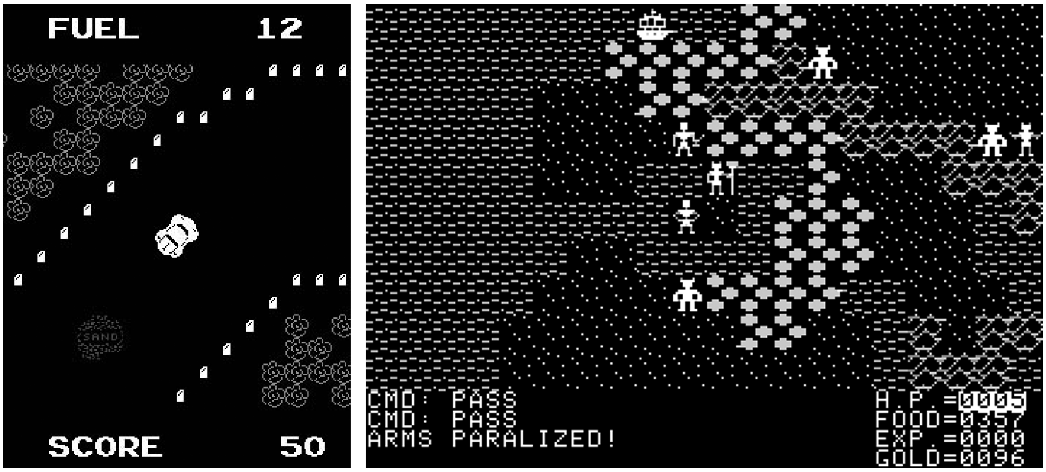
Early save game functionality in console and **computer games** was frequently cumbersome to access or use, requiring players to access a specific game menu to save. Some later games would intentionally limit the number of times a game could be saved to make the game more challenging, such as **Capcom**'s *Resident Evil* (1996, also named *Biohazard*). Other games simplified the saving process; for example, Valve's *Half-Life* (1998) uses a "quick save" feature, allowing the player to press a single button to save the game. Save functionality has become a common feature of home video games, and games that use a save function often employ an "auto-save" feature that will automatically save a player's progress at predetermined intervals or portions of the game, much like the similar use of **checkpoints** in games.

Christopher Hanson

scrolling

Scrolling was important to the development of video games because it meant that screen edges no longer had to be the boundaries where a game's playing field ended; spaces could continue off-screen and be brought on-screen through the process of scrolling, making the discovery of the playing field a part of the game.

The patent for scrolling (United States Patent #4,445,114, "Apparatus for Scrolling a Video Display") was filed by **Atari** on October 3, 1980, and listed David R. Stubben as the inventor. Scrolling had appeared a few years before, first in *Super Bug* (1977) by Kee Games (a subsidiary of Atari), which



The first video game to feature scrolling was Kee Games's arcade game *Super Bug* (1977) [left]. The first home computer game with scrolling was Origin's *Ultima* (1980) [right]. (Mark J. P. Wolf)

featured four-way scrolling (horizontally and vertically), and two-way scrolling appearing in Atari's *Football* (1978), the graphics of which provided the example used in the patent. The first home **computer game** to feature scrolling was Richard **Garriott**'s ***Ultima*** (1980), which used a tile-based system, such that a new row or column of tiles would be added as the screen scrolled from one position to the next.

Eight-way scrolling involves a background that can scroll horizontally and vertically at the same time, so that the player-character can move northwest, northeast, southwest, and southeast, in addition to the north, south, east, and west movement found in four-way scrolling. Games with eight-way scrolling include the **arcade game** *Aztarac* (1983) and home console game *Mega Man 3* (1990). Other variations on scrolling continue to appear. For example, in Jason Rohrer's *Passage* (2007), as space scrolls by horizontally, it does not move on-screen and off-screen at the screen's edges but rather compresses or decompresses horizontally on either end, so that all the horizontal space is represented on-screen at all times, albeit sometimes in highly compressed form.

Although originally patented for use in video games, scrolling became a common element of the graphic user interface (GUI) of home computers during the late 1980s, with on-screen scroll bars to control the scrolling. Scrolling is now common enough so that hardware is designed with it in mind, and computer mice now often feature a wheel allowing the user to scroll the screen directly from the mouse itself. On touch screen devices like the iPhone and iPad, scrolling is accomplished simply by flicking the screen with one's finger, an intuitive **gesture** that seems to move the screen's image manually. New patents that involve scrolling continue to appear, for example, patent #5,877,760, "User Interface for Synchronously and Independently Scrolling Windows" (filed 1996), and patent #7,428,709, "Multiple-panel Scrolling" (filed 2005).

Mark J. P. Wolf

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United States Patent #7,428,709, "Multiple-panel Scrolling," available at http://www.freepatentsonline.com/7428709.pdf.

SEGA

The company that would become SEGA began in the 1940s. Martin Bromley, with partners James Humpert and Irving Bromberg, started a company, Standard Games, in Honolulu. Bromley managed several game rooms on the U.S. Territory of Hawaii that featured slot machines, pinball games, and various other coin-operated amusement appliances.

In 1951, when new gambling legislation was passed, the company purchased confiscated slot machines from the government and shipped them overseas for use by servicemen stationed in **Japan**. At this time, Bromley decided to move the company to Tokyo. In May 1952, he partnered with American businessmen Dick Stewart and Ray Lemaire and began importing musical jukeboxes; they renamed the company Service Games of Japan, or the Japanese equivalent, Nippon Koraku Bussan. The company became one of the three largest coin-op companies in Japan, competing with Taito and Rosen Enterprises Ltd., with mechanical devices placed in more than 5,000 locations on the Japanese islands.

During this same period, Dave Rosen, operating under the name of Rosen Enterprises Ltd., was importing art and other items such as coin-operated instant photo booths into Japan. Although very successful, Photorama technology was not patented, and other competitive franchises began to sour the market. Rosen began looking for an alternative luxury product to import. In 1956, Rosen began importing **electromechanical games** (such as *Deluxe Baseball* [1953]) primarily manufactured stateside by **Midway** and **Williams**, which became very popular. In time, **arcade** parlors began to emerge in Japan.

By the mid-1960s, a large portion of the electromechanical games that were being manufactured were very similar to, or improved updates of, other available games. Rosen recognized that more diversity was needed within the industry and in 1965 merged with Service Games to create SEGA Enterprises Ltd. The combination of the first two letters of each word in the company's name—"SE" from Service and "GA" from Games—create the name "SEGA" that is now known as one of the pioneers of the video game **industry**.

The new company's focus was to create original games to be placed in their established locales. Within five years, SEGA was creating approximately 10 new games a year and even exporting them to the **United States**. SEGA's first release was *Rifleman* (1967), a target-shooting game that featured a rifle mounted to a cabinet. SEGA's first hit was *Periscope* (1968), a submarine simulator that featured a periscope apparatus that allowed the player to aim and fire torpedoes at targets.

In 1969, the oil giant Gulf+Western acquired SEGA Enterprises, and the SEGA brand became part of the Paramount group, with Rosen remaining CEO of the SEGA division. With new backing, which included a new infusion of cash, SEGA began to grow even larger and faster. SEGA then gained control of Gremlin, a proven American arcade company that had a highly regarded manufacturing division. The Gremlin acquisition allowed SEGA to become a major supplier of games across the United States and **Europe**. By 1979, SEGA had released more than a hundred electromechanical games, including *Jet Rocket* (1970), a flight simulator regarded by many as one of the finest electromechanical games ever designed.

In the early 1980s, SEGA made the transition into the electronic gaming industry. Examples of early SEGA coin-op video games are raster-based titles *Astro Blaster* (1981), *Space Odyssey* (1981), and *005* (1981). SEGA also released five **vector games**, *Eliminator* (1981), *Space Fury* (1981), *Star Trek* (1982), *Tac/Scan* (1982), and *Zektor* (1982). SEGA began to license, produce, and publish games for home **consoles** like the **Atari VCS 2600**. SEGA arcade titles such as *Buck Rogers* (1982), *Congo Bongo* (1983), and *Star Trek* (1982) were all released for the Atari 2600. Several SEGA brand games including *Carnival* (1980), *Turbo* (1981), and *Zaxxon* (1982) were also released for the **Mattel Intellivision**, the **ColecoVision**, and other home video game systems and home computers.

In 1982, SEGA's revenues reached $214 million. As a pioneer in technology, SEGA released several groundbreaking titles such as *SubRoc-3D* (1982), the first coin-op game with **3-D hardware** that delivered a separate image to each eye, creating a stereoscopic effect. SEGA also released the game *Astron Belt* (1982), the first developed arcade **laserdisc game**.

In July 1983, SEGA entered into the home video game console market in Japan with the release of their SG-1000. Releasing mostly scaled-down ports of their arcade games, the SG-1000 was a modest success, and the slightly modified SG-1000 Mark II was subsequently released. SEGA also released the SC-3000 series of home computers in Japan.

During the video game industry **crash of 1983**, Gulf+Western split SEGA and sold it to two groups: The U.S. commodities were sold to pinball manufacturer **Bally**, and the Japanese assets were sold for $38 million to Dave Rosen; Hayao Nakayama, the Japanese head of operations; and multibillion-dollar Japanese conglomerate CSK chairman Isao Ohkawa. This new company structure placed Nakayama as company president and Ohkawa as chairman; Rosen took control of the new American division. In 1984, Japanese giant CSK purchased SEGA.

In Japan, a new SEGA system, the SG-1000 Mark III, was released in 1985. That same year, **Nintendo** successfully launched the **Nintendo Entertainment System (NES)**, filling the void left empty by Atari in North America, Europe, and **Australia**. SEGA recognized the opportunity and moved into the console market in the United States for the first time. As a result, the SG-1000 Mark III was renamed the **SEGA Master System (SMS)** and launched in the United States in 1986 via a distribution deal with Tonka Toys. The SMS reached European shores the following year. By 1986, SEGA stock was being traded on the Tokyo Stock Exchange. Hit titles, which later became SEGA franchises, were born, including *Shinobi* (1987), *Phantasy Star* (1988), and the *Alex Kidd* (1986) series, and the main character of the latter, Alex Kidd, became the unofficial SEGA mascot.

SEGA released the **SEGA Mega Drive** in Japan in 1988, and in the United States in 1989 with the name changed to the **SEGA Genesis**, due to a trademark dispute. SEGA initially negotiated with Atari to market the console in the United States, but, failing to come to agreeable terms, successfully released the Genesis in North America themselves, **packaged** with a copy of the popular arcade game *Altered Beast* (1988). The initial marketing campaign against rival and market share leader Nintendo involved personality licensing. SEGA positioned themselves against the competition with the likes of Evander Holyfield, Michael Jackson, Tommy Lasorda, Joe Montana, Pat Riley, and other well-known sports figures and celebrities. It also launched the successful "Genesis Does What Nintendon't" campaign.

SEGA also chose to challenge the **Nintendo Game Boy** portable **handheld game** system. In 1990, the SEGA Game Gear handheld console was released in Japan; most other regions saw a release the following year. Unlike the Game Boy, it had a color screen. The Game Gear was very similar in design to SEGA's own Master System home console. As a result, many SMS games were converted for play on the Game Gear, and a device called the Master Gear Converter allowed for actual Master System **cartridges** to be played on the Game Gear. Although more successful than other handheld competitors of the time such as the Atari Lynx or NEC's TurboExpress, the Game Gear still failed to capture the market from Nintendo's Game Boy.

Nintendo had **Mario** to market its brand, and SEGA needed a similar mascot, because Alex Kidd and other SEGA franchises could not compete. SEGA, realizing that Nintendo's initial demographic was aging, in 1991 created Sonic the Hedgehog, a new character aimed at the teenage market, and a game with Sonic was bundled with the new system. Within a year, Sonic the Hedgehog became so popular that he became the first and only non-Disney character at Disney theme parks. SEGA started screaming their brand name at the end of every advertisement, and the "SEGA Scream" was born.

SEGA reached its peak in the early 1990s. The arcade market was profitable, *Sonic the Hedgehog 2* (1992) on the SEGA Genesis sold more than six million copies, and in North America SEGA controlled 65% of the video game market (GamertechTV, 2010). In 1992, SEGA introduced new **peripherals** for the SEGA Genesis, the **CD-ROM-based** Mega CD, also known as the **SEGA CD**, which paired an additional CPU with a CD-ROM drive. With the SEGA CD, the Genesis could play full-motion video, perform scale and rotation effects to sprites, provide a larger color palette, play CD-quality audio and CD+G-enhanced audio CDs, and store massive amounts of data compared to cartridges. SEGA touted its technology advancement with their "Welcome to the Next Level" campaign.

But the introduction of the SEGA CD split SEGA's user base, brand focus, and resources. At $300, the SEGA CD was relatively expensive, and most developers at the time were unprepared and ill-equipped to deal with the new technology. As a result, few developers took advantage of the second CPU and mainly just ported previously existing software over with minor upgrades such as improved **audio** or inserted full-motion video (FMV) **cut-scenes**, most of which failed to improve gameplay.

In 1994, SEGA launched the SEGA Channel, a cable **television** network. Subscribers were supplied with an adaptor that fit into the SEGA Genesis cartridge slot by their local cable company. This adaptor allowed users access to 50 games, some unique to the service, and was unavailable in retail outlets. The SEGA Channel, at one time, had a quarter million pay subscribers.

Also in 1994, the **SEGA Saturn** was released in Japan, and its release in the United States was planned for Saturday, September 2, 1995, dubbed "Saturnday." However, that date was a ruse, and the SEGA Saturn was actually launched on May 11, 1995, for $400. The announcement occurred during the Electronic Entertainment Expo (E3) to the surprise of the industry, including up-and-coming competitor **Sony**. It was so much of a surprise that many retailers such as Wal-Mart and KB Toys were left out of the early launch. Angered by this exclusion, many vendors refused to carry the system. Game publishers were also caught off guard by the revelation and as a result, little software was available for the Saturn release. Despite having a four-month lead over the **Sony PlayStation**, the Saturn only sold 80,000 consoles before Sony's release date. The PlayStation sold 100,000 consoles at launch, partially because of its cheaper price point, which was a full hundred dollars less than the Saturn.

While the Saturn was just as powerful as Sony's machine, it was more difficult for developers to program with since it had two separate central processing units (CPUs) and six other processors. The initial **design** for the system only had one CPU, but when SEGA learned of Sony's PlayStation specifications, they added a second processor to try and leapfrog the competition technologically. In the end, the move to make a better console resulted in lower quality software and longer development times leading to delays. As a result, Sony became the market leader as the Saturn slowly lost ground.

Following the hey-day of the Genesis, patrons began to lose confidence in the SEGA brand. Although the last three **generations** of SEGA platforms (SEGA CD, 32 X, and Saturn) were not exactly failures, they were not as successful as hoped by any means in the eye of SEGA or consumers. In late 1998, SEGA launched its final hardware platform, the **SEGA Dreamcast**, which was the first console to include a built-in modem supporting online play, which included voice chat. When the Dreamcast launched in the United States on September 9, 1999 (9/9/99), it sold more systems in 24 hours than any game platform in history with a staggering 225,132 units sold. Within two weeks, it more than doubled that number to over half a million units, a milestone for the time, making it the most successful hardware launch in history.

The Dreamcast held its own for two years until Sony launched the **Sony PlayStation 2** in the winter of 2000. Although SEGA continued to support the Dreamcast until 2002, it announced that it was leaving the hardware industry and becoming a third-party software publisher. To date, SEGA brand games are available for most gaming platforms including the **Microsoft Xbox 360**, the **Nintendo Wii**, and the **Sony PlayStation 3**.

Michael Thomasson

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SEGA CD/Mega-CD

The SEGA CD was an add-on **peripheral** that allowed CD media software to **play** on a standard **SEGA Genesis cartridge**-based **console**. It premiered in **Japan** as the Mega-CD in December 1991, connecting to the Japanese Genesis equivalent, the **SEGA Mega Drive**. It was originally designed to compete with the **NEC PC-Engine** (named the **Turbografx-16** in the **United States**) CD unit, a popular **platform** in Japan. However, after reaching the market, its primary competition became the **Super Nintendo Entertainment System (SNES)**, especially in the Western Hemisphere.

The SEGA CD was released in the United States beginning in late October and early November 1992. Priced at $299.99, the SEGA CD unit was more expensive than the SEGA Genesis unit itself. SEGA sold all 50,000 SEGA CD units produced in the first run within three weeks, selling out just before the Thanksgiving holiday. The second run of 150,000 units was released just in time for Christmas on December 22. To put this in perspective, the Japanese Mega CD sold about 100,000 units in its first year; the U.S. release had doubled the Japanese sales in a quarter of the time. The initial success of the SEGA CD in America looked promising for SEGA and their CD-based device.

The advantages gained by connecting the SEGA CD unit to the SEGA Genesis were many. Graphically, it allowed the Genesis to perform such computations as ultra-smooth scaling and biaxial rotation of sprites using an ASIC **graphics** processor. It also made **interactive movies** possible by allowing the Genesis to run full-motion video (FMV). Greatly improved **audio** was also an obvious benefit of compact disc (CD) media.

CD-ROMs could also hold much more data than the traditional cartridges of the time. Most cartridge games were 1 to 4 megabytes in size, whereas a SEGA CD-ROM could hold more than 650 Mb of game data. Expanded memory **space** meant more features and game improvements. Memory in the early 1990s was very expensive, so CD-ROM manufacturing, even though it was relatively new to the **industry**, was substantially cheaper than manufacturing a cartridge.

The technology behind the SEGA CD consisted of its own central processing unit (CPU), the Motorola 68000. This CPU ran parallel with the SEGA Genesis 68000 CPU, combining both CPUs to perform functions. It doubled the Genesis system memory and enabled larger color palettes (128 using hold and modify [HAM] techniques or 256 colors for FMV content) to be used above the regular Genesis 64 color palette.

Two models were released over the SEGA CD's life span. The initial model released in November 1992 featured a front-loading door and mounted below the Genesis unit, connected via the **interface** slot located on the right of the console. A second model was released in 1994 for $230. This unit was designed to connect to the second Genesis console that was smaller in size and positioned itself to the right of the Genesis unit. This model also replaced the front-loading interface with a manually opened door.

Other devices that would play SEGA CD games included the JVC X'Eye (WonderMega in Japan) and SEGA's own CDX, both of which were stand-alone units that would play SEGA Genesis and SEGA CD software. Pioneer released the LaserActive platform, which was modular in **design** and would allow SEGA software to play on the device with the insertion of a SEGA Module. This module also allowed special **laserdisc games** to be played using the SEGA hardware. Perhaps the most unusual and most rare of the SEGA CD units is the Aiwa CSD-G1M Mega Drive boom box, released only in Japan. This portable stereo could play audio CDs, radio, and cassette tapes in addition to Mega Drive and Mega CD video games.

The SEGA CD came bundled with the full-motion video (FMV) title *Sherlock Holmes Consulting Detective*, a space shooter called *Sol-Feace (1992)*, a compilation disc with four classic SEGA titles (*Columns*, *Golden Axe*, *Shinobi*, and *Streets of Rage*) and two CD+G music sampler discs. The short-lived CD+G format, short for CD+Graphics, was a format that played **graphic** images while playing music from the CD, similar to the traditional slideshow.

The SEGA CD had support from many third-party developers and publishers, including such proven companies as Data East, Konami, Vic Tokai, and Working Designs. Even **Sony** Imagesoft and Psygnosis, supporters that later became SEGA's rivals in the industry, created content for the SEGA CD. Two publishers, Digital Pictures and **Midway**, thrust the SEGA CD into the limelight unwittingly. Unfortunately, the publicity was negative and affected sales of the SEGA CD to some degree. **Violence** in gaming had become controversial since the release of Exidy's *Death Race* (1976), but with the advent of FMV gaming, a new level of realism had entered into the industry. Digital Pictures revived an old project originally created for Hasbro's unreleased Project NEMO for the SEGA CD under the name of *Night Trap* (1992). Because the game had some questionable material, it became one of the centerpieces of a Congressional investigation concerning violence in video games. Paired with the negative press concerning Midway's ***Mortal Kombat*** (1992), also available for the SEGA CD, the hearings that began on December 9, 1993, scared parents just at the height of the Christmas shopping season.

Night Trap was not the only FMV title released for the SEGA CD. In fact, the SEGA CD became known as the system for FMV games. Digital Pictures also resurrected another old NEMO game, *Sewer Shark* (1992), and created new FMV content. Many companies believed FMV to be the future of gaming and invested heavily into the new technology. SEGA was so involved that it created its own movie studios to create FMV gaming content. The market behaved differently, and after poor reviews of FMV-style games by trade and consumer magazines, followed by poor sales, the fanfare quietly died, taking the SEGA CD along with it.

Production of the unit was suspended in December 1995. After four years on the market, the SEGA CD sold 2.5 million units in the United States and approximately six million units in total worldwide. Because the Genesis sold approximately 29 million consoles, it is evident that about 20% of Genesis/Mega Drive owners chose to upgrade their Genesis console with a SEGA or Mega CD. More than 150 games were released for the SEGA CD platform. *Shadowrun* (1996) was the final official game released for the Mega CD, until Good Deal Games revived publishing on the SEGA CD platform in December 2000.

Michael Thomasson

SEGA Dreamcast

The SEGA Dreamcast was a sixth-**generation** 128-bit home video game console. It was released on October 27, 1998, in **Japan**; on September 9, 1999, in North America; and on October 14, 1999, in **Europe**. A last-ditch effort to reinvent the company image and distance itself from the earlier string of failures—specifically, the abandoned **SEGA Genesis** add-ons, **SEGA CD** and 32X, and the poorly selling **SEGA Saturn**—the system was SEGA's final foray into the home console market.

The Dreamcast featured a Hitachi SH-4 CPU, operating at 200 MHz. Its NEC PowerVR2 128-bit graphics chip offered a peak rendering rate of 3 million polygons per second, maximum **resolution** of 640 × 480 pixels, 24-bit color, and hardware support for alpha blending, perspective correction, anisotropic, bilinear and trilinear mip mapping, Gouraud shading, bump mapping, z-buffering, and antialiasing. The system had 16 MB of main memory, 8 MB of video memory, and 2 MB of sound memory. The Yamaha AICA Sound Processor provided 64 **sound** channels, with 3-D sound support. Software was distributed on GD-ROMs, **SEGA**'s proprietary high-density optical discs, with a capacity of 1.2 GB. The Dreamcast was the first console to provide out-of-the-box on-line connectivity with a built-in modem (which was later superseded by a broadband adapter).

The system received a wide variety of **peripherals**, including a mouse and a keyboard, as well as a number of specialized **controllers**, such as a fishing-rod controller (supported by several fishing games), motion-sensitive maracas (for use with *Samba de Amigo* [2000]), and dual analog **joystick** (bundled with *Cyber Troopers Virtual-On: Oratorio Tangram* [1999]).

Of note was the Visual Memory Unit (VMU). Essentially a 128-KB memory card, it also featured a small 48 × 32 monochromatic LCD display, a speaker, a directional pad, and four buttons. A number of Dreamcast titles included **minigames** that could be downloaded into the unit, which could then be used as a simple **handheld game console**.

SEGA allocated a $500 million budget for the development and marketing of the console; in an effort not to repeat the mistakes made with the **Saturn**, approximately half of that sum was directed toward the promotion of the new system. In Japan, after a strong launch, sales dropped off quickly, especially after the announcement of the **Sony PlayStation 2**. In the wake of PS2's release, the system was largely ignored. The Dreamcast's **U.S.** debut, however, was a spectacular success. With more than 225,000 units sold within the first 24 hours, it was considered the most successful launch in video game **history**. But SEGA was not able to sustain the initial momentum. Its track record of prematurely discontinuing support for its consoles fostered wait-and-see attitudes among buyers and third-party developers alike (for example, **Electronic Arts**—a major contributor behind the success of the SEGA Genesis—declined to support the **platform** at all). Other contributing factors included SEGA's continued reliance on **arcade** ports and underutilized on-line connectivity (although the SEGANet service was operational since launch day, the software was delayed, and the slow speed of the built-in modem was also a problem). Finally, Sony's strong brand name and the hype surrounding the PS2 also served to divert attention away from SEGA's console. Interest in the Dreamcast waned despite price cuts, and in mid-2000 SEGA dropped the system's price to $149 and, shortly thereafter, offered a $150 mail-in rebate with 2-year SegaNet subscriptions. Sales spiked but did not substantially increase the system's market share.

With the discontinuation of the Dreamcast in 2001, SEGA withdrew from the home console market and shifted to third-party game development. Independent games for the Dreamcast are developed to this day. Notable Dreamcast games include *Soul Calibur* (1999), *Shenmue* (1999), *Samba de Amigo*, *Phantasy Star Online* (2000), *Rez* (2001), and *Ikaruga* (2002).

An interesting outgrowth of the Dreamcast technology was the SEGA NAOMI (New Arcade Operation Machine Idea) arcade system board. Unveiled in 1998, this low-cost alternative to expensive arcade platforms was effectively a Dreamcast with expanded main memory and video memory. Hardware similarities made conversion between the two platforms simple, with popular titles ported to Dreamcast after a successful arcade run. As of 2009, the NAOMI board is still in active use.

P. Konrad Budziszewski

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SEGA Genesis/SEGA Mega Drive

The SEGA Mega Drive was a fourth-**generation** video game **console**. It was released in **Japan** on October 29, 1988; in North America (as SEGA Genesis) on August 14, 1989; and in **Europe** on November 30, 1990.

Positioned as a direct competitor to the **Nintendo Entertainment System (NES)** and **NEC PC-Engine/TurboGrafx–16** and marketed as the first "true" 16-bit console (a jab at the latter's hybrid 8/16-bit architecture), the Genesis/Mega Drive was SEGA's attempt to bring **arcade** quality games to a home system. The hardware

design was based on the company's successful System-16 arcade board. The similarities between the two **platforms** allowed for easy conversion of existing arcade titles, giving the system access to a considerable library of popular, recognizable games.

The system was based on a 16/32-bit Motorola 68000 CPU, operating at 7.67 MHz, and was equipped with 64 KB of main memory, 64 KB of video memory, 8 Kb of secondary memory, and 8 KB of **sound** memory. The Zilog Z80 chip served as the primary sound **controller** (providing up to 10 sound channels) and provided backward-compatibility with the **SEGA Master System (SMS)**. The dedicated Video Display Processor (VDP) could display **graphics** in up to 64 colors from a 512-color palette, at the maximum **resolution** of 320 × 224 pixels. Games were distributed on **cartridges**.

Although it was not very successful in Japan, the system became a great hit in the **United States** and Europe, where it was marketed as an "edgy" and "cool" alternative for older consumers. Under the "Genesis does what Nintendon't" slogan, the American advertising campaign emphasized the software library aimed at a more mature audience, including numerous arcade-quality games, as well as **sports games** endorsed by popular athletes (for example, *Tommy Lasorda Baseball* [1989] or *Joe Montana Football* [1991]).

It was not until the 1991 release of *Sonic the Hedgehog*, however, that the system finally received its "killer app" (an application that consumers buy a system to obtain). The fast-paced platform game was SEGA's response to **Nintendo**'s **Mario series**, its eponymous character designed to provide the company with an instantly recognizable corporate mascot. *Sonic* proved highly popular and soon replaced the arcade port *Altered Beast* as the system's pack-in title. This move, in combination with intensified **advertising** efforts, led to an exponential increase in sales. By 1992, SEGA held a 55% share of the U.S. 16-bit market. The console enjoyed similar popularity in Europe; in Japan, however, it remained at a distant third place behind the **Super Nintendo Entertainment System (SNES)** and the PC-Engine.

The Genesis/Mega Drive received a number of accessories, most notably the Power Base Converter (an adapter for SEGA Master System cartridges), the **SEGA CD/Mega CD** add-on, and the 32X expansion unit. Initially conceived as an entirely new platform, the 32X was eventually adapted into an expansion pack intended to fend off competition from the SNES and extend the market life of the system until the **SEGA Saturn** gained sufficient momentum. Equipped with two 32-bit RISC processors, a more powerful VDP, and an additional 512 KB of memory, the unit added support for three-dimensional graphics and increased the number of on-screen colors to 32,768. However, developers quickly abandoned the 32X in favor of the Saturn. Only about 40 games were released, many of them enhanced ports of existing titles. Despite price drops, the expansion was a commercial failure. It was discontinued along with the SEGA CD in 1995.

In addition to SEGA's original Genesis/Mega Drive and the slightly revised Genesis 2/Mega Drive 2, the system was also available in a wide variety of variants and derivations, manufactured by SEGA or its licensees (including, for instance, the

SEGA Multi-Mega/CDX, the handheld SEGA Nomad, Majesco's Genesis 3, the JVC Wondermega/X'eye, and the Amstrad Mega PC).

The Genesis/Mega Drive was discontinued following SEGA of Japan's decision to focus attention on the SEGA Saturn. The system was supported in Europe and Brazil until 1998. With approximately 30 million units sold worldwide, it was the second best-selling console of the fourth generation (following the SNES) and SEGA's most popular home system.

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SEGA Mark III

See SEGA Master System/SEGA Mark III

SEGA Master System/SEGA Mark III

The SEGA Master System (SMS) premiered in **Japan** as the SEGA Mark III in 1985. The machine was intended only for the Japanese market, until **Nintendo** successfully launched the **Nintendo Entertainment System (NES)** in North America. Seeing the success of the NES overseas, **SEGA** decided to compete, and in June 1986 the SMS debuted in the **United States** with a $200 price point.

Games for the Master System were available in two formats. The traditional media of the time for **console** gaming was the **cartridge**, and that was also the primary software delivery format for the SMS. A typical SMS cartridge could hold up to 4194 Kb of memory. However, cartridges were expensive to manufacture, so for simpler titles that required less data, a cheaper alternative was available. This format, which could hold a maximum of 256 Kb, was referred to as a "SEGA Card" because it resembled the approximate size and shape of a credit card.

Although the Master System had the usual lot of accessories, such as a sports pad roller **controller**, light phaser, and alternative controllers, SEGA also issued the SegaScope 3-D Glasses, which were very high quality and offered quite an **immersive** experience for the six games that were compatible with the device. It was far superior to the anaglyphic 3-D system that used red and blue filtered lenses commonly used for 3-D movie viewing since the 1950s (see **3-D hardware**). The SegaScope 3-D accessory actually used a shutter system synced to the **graphics** presented on the **television** screen.

One Master System strength was the ports of popular SEGA arcade titles such as *After Burner* (1988), *Hang On* (1986), *Shinobi* (1988), and *Space Harrier* (1986).

SEGA's unofficial mascot of the time was Alex Kidd, which appeared in four separate games for the SMS, before making the transition to the **SEGA Genesis** and being retired and replaced with Sonic the Hedgehog. The Master System also launched one of SEGA's most beloved franchises by releasing *Phantasy Star* in 1988. The *Phantasy Star* series has since spawned more than a dozen games and continues to receive new iterations almost annually.

A SEGA Master System II was also released. This console was not an entirely new system but a cosmetically redesigned SMS created to lower the unit cost and allow the system to be marketed for a longer period of time. The SMS II's compatibility with cartridge media was excellent, but the new hardware lacked the ability to play the "Sega Card" software (which was rarely used), as well as other minor changes or omissions.

The SEGA Master System was unable to compete against the Nintendo Entertainment System in America. Nintendo's dominance was roughly 90% of the video game **industry**, with only 10% remaining for the SEGA Master System and the **Atari 7800** to share. There are many possible reasons why the Master System failed to compete in the United States. Distribution and marketing was initially done by Tonka; although this move was originally done to try and help the Master System reach the public, it is possible that it actually hindered its availability and hurt retail sales. In 1990, SEGA of America reacquired the SMS rights, but promoting the Master System became less of a priority for SEGA with the new **SEGA Genesis** console on the market which was performing strongly.

Lack of third-party support certainly harmed the Master System. Nintendo had exclusive contracts with most software developers at the time, which prevented them from making software for rival companies, including SEGA. Because many of these contracts were signed before the Master System even hit the market, and because the SMS had such a small market share, few third parties even took notice. A console is only as good as its software; with the SMS library paling in comparison to the massive Nintendo library, it was definitely debilitating.

Although the Master System did not fare well in the United States, it was much more successful in other markets such as **Europe**, **Australia**, and Brazil. The United States only received a fraction of the games for the SMS; domestically, 114 titles were released, whereas an additional 232 games were released overseas. Thus, less than half of the 346 available games were released in America.

When SEGA retired the SEGA Master System in 1992, the hardware and some games lived on. The Power Base Converter was a device that allowed SMS games to be played on its bigger brother, the SEGA Genesis. The legacy continued when SEGA released its first portable system, the SEGA Game Gear. The Game Gear was basically a portable SMS with minor enhancements, and the Master Gear **peripheral** allowed Master System games to be played on a Game Gear.

Although the SEGA Master System never reached its full potential, it did pave the road for SEGA to infiltrate the market and transition from a software company making software for other home hardware manufacturers to a consumer electronics hardware company. The Master System certainly taught SEGA many lessons that proved fruitful when launching its next hardware platform, the SEGA Genesis, which became their most successful console.

Michael Thomasson

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SEGA Mega Drive

See SEGA Genesis/SEGA Mega Drive

SEGA Saturn

The SEGA Saturn was a fifth-**generation** 32-bit home video game **console**. Released on November 22, 1994, in **Japan;** on May 11, 1995, in North America; and July 8, 1995, in **Europe**, the system was SEGA's attempt at securing an early hold on the emerging 32-bit market and regaining advantage over **Nintendo**.

Originally envisioned as a two-dimensional-oriented machine with secondary three-dimensional capabilities, the Saturn was radically redesigned in response to the announcement of the **Sony PlayStation**. The system was built around two Hitachi SuperH-2 32-bit RISC processors, operating at the speed of 28.63 MHz. Its dual custom Video Display Processor chips could render up to 500,000 polygons per second, at the maximum resolution of 704 × 480 pixels, and could simultaneously display 32,000 colors from a 24-bit color palette. The Saturn Custom Sound Processor, controlled by Motorola 68CE000 chip, provided up to 32 channels of PCM playback (CD quality **sound**) and up to 8 channels of FM synthesis. The Saturn had 2 MB of main memory, 1.5 MB of video memory, and 512 KB of sound memory and was equipped with a double-speed **CD-ROM** drive. The system's complex architecture, with two CPUs and six other processors, made it notoriously difficult to program, especially since the twin processors did not operate in parallel but rather competed for memory access.

The Japanese launch was a success, with approximately 170,000 units sold on the first day alone. The North American release date, however, was rescheduled from September to May to gain market advantage over the coming PlayStation. Rushed to the market, with its early surprise release date, the Saturn received virtually no promotion. To make matters worse, few games were available at launch because many third-party titles, developed with the original timeframe in mind, were still unfinished. The relatively strong initial sales tapered off quickly. By the time of PlayStation's September 9 launch, the Saturn had sold only around 80,000 units—a number Sony's console easily surpassed within the first week.

Launched at $399, the system cost $100 more than the PlayStation. The complex hardware made cost-saving revisions difficult; as a result, the Saturn's price was not lowered in pace with those of the competing 32-bit systems. In addition, the game offerings were perceived to be out of touch with the market. Playing to its perceived strength, **SEGA** continued to rely heavily on **arcade** ports rather than console-specific titles. Moreover, the reluctance of the company's American branch to release **role-playing games (RPGs)** and games with two-dimensional **graphics** assured that many of the most successful Japanese titles never made it to the **United States**. SEGA's ailing reputation, heavily undermined by the **SEGA CD** and 32X (see **SEGA Genesis**) fiascos, and Sony's aggressive promotion of the PlayStation also contributed to the Saturn's weak market performance. Throughout its life, the system remained at a distant third place behind the PlayStation and the **Nintendo 64**.

The announcement of the **SEGA Dreamcast** at the 1997 Electronic Entertainment Expo was widely received as the Saturn's death knell. Hardware and software sales dropped sharply. As a consequence, a number of third-party titles, planned or already in development, were cancelled, further contributing to the system's decline. The Saturn was discontinued in the United States in 1998; in Japan, a stronger customer base kept it alive until 2000. Notable Saturn releases include *NiGHTS: Into Dreams . . .* (1996), *Shining Force III* (1997, 1998), *Guardian Heroes* (1996), *Virtua Figher 1* and *2* (both 1995), *Virtua Cop 1* (1995) and *2* (1996), the *Panzer Dragoon* series (1995–1998), *Radiant Silvergun* (1998), and other 2-D **shooting games**, as well as a number of two-dimensional **fighting games**.

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7800

See Atari 7800 Prosystem

serious games

A serious game is a game that has been designed for a reason other than to just entertain. The term "serious game" has been applied to game development in fields such as business, **education**, medicine, science, and the **military**. The term itself has been credited as far back 1970 to Clark Abt who wrote a book called *Serious Games*. There were no commercial video games in 1970, but Abt used the book to argue for games that had specific, educational goals but were not intended primarily as amusement.

The term regained prominence in 2002 when the *Woodrow Wilson Center for International Scholars* created the Serious Games Initiative. Shortly thereafter, the term was picked up by multiple authors. For instance, Zyga (2005) defined a video game as "a mental contest, played with a computer according to certain rules for amusement, recreation, or winning a stake" (p. 25). He differentiated a serious game as the same mental contest, but one that used the entertainment to further specific objectives (such as **health**, education, or communication).

There is not one clear definition of serious games. As authors attempt to further define serious games, they often end up creating new terms based on the context of use. For instance, ***advergaming***, *edutainment*, and *exergaming* refer to the use of games beyond simple entertainment in the respective fields of **advertising**, education, and health and wellness. *Gamification* refers to the notion of applying game mechanics to nongame settings for the purpose of improving outcomes. *Smart gaming* can be defined as the use of higher-order thinking and strategies, both individually and in multiplayer games, to achieve game objectives. *Social impact gaming* is the use of games to achieve a desired social change.

Given this variation in definitions, there is also great variability and argumentation as to when serious games first appeared. Arguably, serious game development began in earnest in the mid-2000s, timed with the rise in popularity of both the ideas and the terms. One example of a serious game is *Darfur Is Dying* (2006); in the game, participants must find ways to keep their refugee camps running. Along the way, they learn about the genocide in Darfur and ways to help humanitarian efforts. A second example is *Re-Mission* (2006), a game that teaches people about cancer. Researchers (Kato et al., 2008) found that playing *Re-Mission* increased adolescent and young adult treatment adherence, self-efficacy, and knowledge about cancer. A final example is *Our Courts* (2009), a web-based project to teach civics and democracy to children. Game developers argue that children have fun while learning how to think through complex problems.

Recent research has provided evidence for the importance of serious games in learning and teaching. For instance, there is recent evidence that the use of serious games stimulates brain activity. De Freitas described one study in which game players had whole-brain activity compared with formal learning in which only limited brain activity occurred. "Other studies are showing how mirror neurons (premotor neurons) fire both when a person acts and when that person observes the action performed by someone else. In this way, the neuron mirrors behavior as though it were doing the action itself, which might help to explain why simulation and imitation with an emphasis upon visual data are such powerful learning tools" (De Freitas, 2009, p. 26).

Richard E. Ferdig

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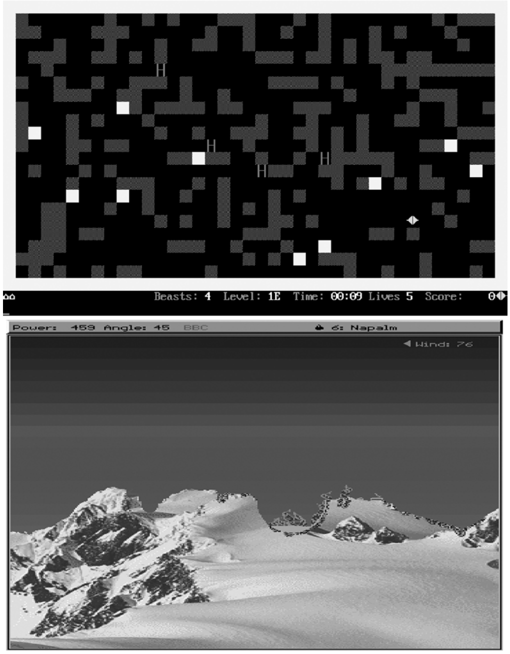
shareware games

With the widespread arrival in the early 1980s of personal computers—the IBM PC, Apple II, Commodore 64, and others—home **computer games** became a burgeoning commercial **industry**. It was an acutely entrepreneurial period, and many hobbyist programmers were curious about selling their games, or showcasing them in an effort to land a full-time job in the new industry. Several groundbreaking games of the period that we know as commercial titles actually began as amateur efforts, including *Rogue* (1980), *Lode Runner* (1983), and the *Zork* series (1977–1980). Along the road from amateur to professional came a new pit stop known as "shareware," a distribution method that encouraged players to pay through a mixture of community goodwill and "try before you buy" up-sell **advertising**. With an air of the communal camaraderie that characterized early software development in the university time-sharing labs of the 1960s and 1970s, shareware attracted hobbyist developers ambivalent toward the business of professional software and distribution. Shareware developers sought commercial compensation for their work, but for the vast majority, these proceeds would not be (nor were they intended to be) a primary source of income.

Shareware distribution entails the release of two variants of a program: the "free" (or "demo") version, which is available without payment and encourages its own copying and redistribution by users, primarily relying on word-of-mouth marketing; and the "registered" (or "paid") version, which usually improves upon the free with additional features or documentation. Shareware's free distributions often exhort the user to register for the "full" version by sending payment directly to the author. In the pre–World Wide Web of the 1980s and early 1990s, most shareware (both games and more general applications) could be registered for anywhere between $5 and $50, a fee commonly delivered as a check or even cash via postal mail. Diskettes, a **game manual**, or a registration code for the full program were delivered in return. Shareware up-sell "marketing" ranged from amateur salesmanship promising more advanced capabilities, to appeals to the user's desire to contribute to a community of grassroots software development, to outright pleas for compensation. Shareware's cousin, "freeware," indicates that the "full" version of the program is available without a registration fee, and payment, although often requested for goodwill, is even more discretionary. Shareware and freeware are often discussed together, but freeware retains a greater association with hobbyists, whereas shareware is considered entrepreneurial. The shareware concept is generally attributed to a trio of developers, each of whom created important early business programs: Jim Knopf's database software *PC-File* (1982); Andrew Fluegelman's *PC-Talk* (1982), a networking program for using dial-up modems; and Bob Wallace's *PC-Write* (1983), a word processor. Despite its office-software roots, however, PC game programmers quickly took up the form and began releasing shareware and freeware in the mid-1980s.

David Clark's *Sopwith* (1984) for the IBM PC is illustrative of shareware's tenuous commercial status. Clark was a programmer at BMB Compuscience, a Canadian database and networking company, when he wrote the popular World War I–themed game that was influential in establishing the side-**scrolling** aviation subgenre. He included a multiplayer mode alongside the four-color CGA **graphics** to demonstrate BMB's just-developed PC networking technology, "Imaginet." Although for-profit, BMB was not a game company, however, and *Sopwith* was given away for free to promote Imaginet at trade shows. Decades later, the game has maintained a devoted following—Clark released a definitive "author's edition" in 2000—whereas the proprietary Imaginet is an obscurity known only from the **history** of the game. *Sopwith* is a lesson in the difficulty of technological prediction, and the influence of programmers' personal interests on the products of their employers.

An early freeware highlight is *Beast* (1984), developed by Dan Baker, Alan Brown, Mark Hamilton, and Derrick Shadel, an elegantly simple action game in which the player manipulates a dense playing field of green blocks, pushing and pulling apart walls in an effort to crush the enemy "beasts" between them. Using the technique of ASCII "text graphics" established by *Rogue* and others, *Beast* achieves a level of animated fluidity that is unexpectedly effective for an early PC with limited graphics hardware. *Beast*'s title screen reads: "This is a free copy of BEAST. You may copy it and give it away. If you enjoy the game, please send a contribution ($20) to Dan Baker." Another example is Wendell Hicken's turn-based tank fighter *Scorched Earth* (1991), one of the best-loved PC shareware games of all time, and particularly well-known for its "hot-seat" multiplayer mode, in which players alternate turns in front of a single computer. Like many popular shareware and freeware titles, *Scorched Earth* succeeds by limiting its ambitions, catering to the particular (and often restrictive) capabilities of the early PC, opting for a stripped down graphical style: a single-screen, side-view mountain range done up in a handful of bright, saturated colors.



Top: *Beast* (1984), a surprisingly fluid action game, given its ASCII text-based graphics. Bottom: The turn-based tank game *Scorched Earth* (1991–1995) is best known for its "hot-seat" two-player mode. (Brett Camper)

Without an established retail infrastructure, shareware relied on informal trading and distribution through word-of-mouth networks, both digital and social. For PC shareware and freeware, the predominant distribution channel was the dial-up modem **bulletin board system (BBS)**. These pre-Web communities were typically hosted on individual home computers, which other modem-equipped PCs could network with by dialing in over a standard phone line. This reliance on the landline phone network made most BBSs local in scale, although some did achieve regional or national reach via long-distance calls. As the name indicates, BBSs began as sites for discussion, providing a semipublic forum in which users could share knowledge and software. Because they were usually hobbyist projects themselves, the BBS phenomenon provided a natural affinity with shareware and freeware games. In addition to acting as way stations for the trading of game files, many BBSs also hosted their own games. BBS "door games" (so-called because of the manner in which the BBS host software ran additional programs "on the side") like *Solar Realms Elite* (1990) and *Trade Wars 2002* (1986) pioneered multiplayer networked **play** long before other **platforms**.

In the 1980s, most shareware was created and distributed by individual programmers at home, on evenings and weekends, or on borrowed time from work or school. Registration fees were a friendly way for players (themselves sometimes hobbyist developers) to support each other, even if modestly. By the early 1990s, however, shareware had spawned its own "big business" wing, with enterprising companies that assisted with payment collection (adding conveniences such as toll-free ordering by phone), large-scale floppy diskette duplication, and postal exchange. The two most prominent of these full-service shareware publishers were Apogee Software and Epic MegaGames. Initially each company simply extended the reach of its founders' own games: Scott Miller of Apogee's *Kingdom of Kroz* (1987) and Tim Sweeney of Epic's *ZZT* (1991). But as they began ramping up their publishing operations, Apogee and Epic established a regimented distribution framework far more organized than those of solo developers. Apogee released popular side-scrolling platform games, including *Duke Nukem* (1991), developed in-house, and *Commander Keen* (1990) from **id Software**, an up-and-coming shareware developer founded by four friends from Texas and a client of Apogee's distribution services that would go on to create the blockbusters ***Doom*** (1993) and *Quake* (1996). Epic countered with the *Jill of the Jungle* series in 1992.

But one game published by Apogee in May of 1992 changed shareware—and the entire game industry—forever. *Wolfenstein 3D*, id Software's **World War II**–themed, Nazi-hunting, verging-on-camp breakthrough that single-handedly popularized modern three-dimensional gaming and helped establish the first-person shooter (FPS) genre that has been a staple ever since. With the shareware model thrust into the limelight by *Wolfenstein 3D* and its successor *Doom*, 1994 was a bumper year; Epic released a string of home **console**-style action titles: *Jazz Jackrabbit*, by Dutch graphics programmer Arjan Brussee, made PC side-scrollers respectable, and *One Must Fall: 2097* did the same for 2-D **fighting games**. Apogee followed a similar tack with the vertical shoot-'em-up (or "shmup") *Raptor: Call of the Shadows*.

Tellingly, these games were predominantly published—rather than developed—by Epic and Apogee. That such "middlemen" companies could not only support themselves but indeed thrive through the shareware model signaled a continuing loss of meaningful distinction between shareware and the mainstream commercial games industry. These publishers themselves drifted from their shareware associations and became fully integrated into the larger industry. Apogee changed its brand name to 3D Realms in 1996 and subsequently developed the successful *Max Payne* series (2001–2003), and Epic is responsible for the *Unreal* series (1998–present) and 3-D technology **engine**. As home Internet access rapidly increased in the mid-1990s, commercial game companies began offering extensive "demos" of upcoming or newly released games, a free source of entertainment that drew attention and viability away from the remaining shareware developers who had not already gone to larger distribution houses. By the final years of the decade, the shareware model had fallen from favor.

The "shareware era" of the 1980s and 1990s was neither the beginning nor the end of games produced and distributed by individuals. Strains of the shareware method have reemerged in recent years, with the establishment of the indie gaming community on PCs and the web and the prevalence of the "free demo" and "try before you buy" model on Apple's App Store for the iPhone. Yet although "shareware" originated as a descriptive term that defined a distribution and business model, it has become an associative one, attached to the specific cultural and historical situation of 1980s and 1990s home computing. For many curious users, shareware and freeware were their first chance to find and play video games—commercial or otherwise—on the new personal computers, and the form was a significant (and often underappreciated) force in the growth and "mainstreaming" of game development, playing habits, and culture.

Brett Camper

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Shin Nihon Kikaku

See SNK (Shin Nihon Kikaku) Playmore

shooting games

One of the most common types of video games, shooting games, often colloquially called "shooters," are games in which the main objective of the game involves shooting, the act of which usually requires either aiming, timing, or both, sometimes repeatedly in quick succession. Shooting games can further be defined by the player's point of view or perspective, the **avatar**'s movement restrictions, ammunition restrictions, whether opponents can return fire, what you are shooting at, and how the shooting occurs. As shooting games evolve, additional features and considerations continue to be added.

The Player's Perspective

Shooting games are most commonly categorized by the player's perspective of the game's action, which is typically either a third-person perspective or a first-person perspective. Earlier games were typically third-person perspective, because a first-person perspective requires a three-dimensional setting that in turn needs more computational power to achieve.

In third-person perspective games the player's avatar is visible on-screen and can be seen shooting and getting shot. The avatar can be a player-character that shoots (as in *Gun Fight* [1975]) or a vehicle with the capability to shoot, such as a tank, boat, airplane, or spaceship (as in *Combat* [1977], *Air-Sea Battle* [1977], or *Space Duel* [1982]), or a crosshairs used as a gun sight that the player moves about the screen (as in *Missile Command* [1980]). Third-person shooting games can be further divided according to the on-screen arrangement of the player's avatar and enemies; vertical shooters limit the player's avatar's movement to the bottom of the screen and allow the avatar to shoot upward (as in ***Space Invaders*** [1978] or *Centipede* [1980]), whereas side-**scrolling** shooters typically base their action horizontally (like ***Defender*** [1980] or *Sea Dragon* [1982]). Other games allow free movement all over the screen and shooting in multiple directions (like *Berserk* [1980] or *Robotron 2084* [1982]).

In first-person perspective shooting games (also known as first-person shooters [FPSs]), the perspective is from the avatar's point of view. The avatar is therefore not present on-screen, although a hand or weapon may extend into view from the bottom of the screen. The first-person point of view may be fixed, as in most shooting gallery games, or in motion, as in games such as ***BattleZone*** (1980) or ***Doom*** (1993). Games with moving first-person perspectives may also require the player to watch for attacks coming from behind and may provide radar scopes or other such devices that allow the player to monitor enemies in off-screen **space**. Since their earliest incarnations, such as *Maze War* (1974) and *BattleZone* (1980), first-person shooting games have evolved into a large subgenre with a wide variety of examples, ranging from single-player games to multiplayer games to **massively multiplayer on-line role-playing games (MMORPGs)**, and many games in other genres that feature shooting capabilities, even if they are not the focus of the game, contain situations not unlike first-person shooting games. First-person shooters have also been studied from the point of view of **phenomenology**.

One type of shooting game arguably falls between first-person and third-person shooting games. These games involve the use of a light gun or other kind of gun-shaped **peripheral** device, which allows the player to shoot directly at objects on-screen, such as *Qwak!* (1974), *Bullet Mark* (1975), and *Outlaw* (1976). Because the player may look along the length of the gun to aim, such games are similar to first-person shooting games, yet the graphics in some of these games remain relatively flat and may have more in common with the graphics of third-person shooting games. A similar effect occurs in such games as *Missile Command* (1980), in which the player moves a crosshairs of a gun sight around on-screen and fires when it is placed over targets.

Challenges and Skills

Shooting games can be designed to pose different challenges that test a variety of skills. First, there is the nature of the shooting mechanisms used; weapons may be used to fire bullets, missiles, grenades, laser bolts, a variety of other projectiles, or even other things such as the holes that the player uses to connect spaces in ***Portal*** (2007). Some games will limit the speed at which shots can be fired; for example, after firing, a player may have to wait before the shot leaves the screen or hits something before another shot can be fired. Other games may limit the amount of ammunition a player has or, in a two-player game, provide each player with the same amount of ammunition (as in the **Atari VCS 2600** version of *Outlaw* [1976]).

Aiming is one of the skills most often required and may be done through the positioning of a weapon (as in *Space Invaders* [1978] or *Doom* [1993], or the direct position of a gun sight or crosshairs (as in *Missile Command* [1980] and *Star Wars* [1983]). Some games may also provide the player with a choice of weapons, each with different capabilities, and require the player to choose between them and change from one to the other as the game progresses (as in *Halo: Combat Evolved* [2001]).

Timing is almost always required as well and is needed for shooting enemies and targets that appear and disappear or those which are moving, which require the player to compensate for their distance and speed of movement. Timing also includes shooting things quickly, especially when they are returning fire, and shooting things in the right order, with threat assessment determining which targets need to by fired on first. In games in which weapons need to be reloaded, reload time may need to be worked into the timing of a game.

Other skills include the careful use of limited resources (such as ammunition that runs out or batteries that need recharging), knowing when to use different types of ammunition or weaponry, and avoiding shooting at things or characters that should not be fired on (such as civilians or assets that a player needs). Players will frequently need to choose between shooting and other activities such as evasion, the finding of objects (including additional ammunition), the healing of wounds, and interactions with other players and game characters.

History

Shooting games can be traced back to their military roots, and commercially back to shooting galleries and electromechanical games, such as *Automatic Shooting Range* (1895), *Target Practice* (1922), *Sharpshooter* (1935), *Safari Gun* (1954), and *Apollo Moon Shot Rifle* (1969). From their earliest conception in the late 1940s, video games have typically included shooting as an activity (see **patent #2,455,992**), so it is not surprising that the **first video game**, ***Spacewar!*** (1962) was a third-person shooting game, as were the first two commercial video games, ***Galaxy Game*** (1971) and ***Computer Space*** (1971), which were both versions of *Spacewar!*. The first shooting games to feature a first-person perspective were the **mainframe games** *Maze War* (1974) and *Spasim* (1974), and the first commercial FPS was ***BattleZone*** (1980).

The 1970s saw the release of such **arcade games** as *Tank!* (1974) (similar to certain mainframe games like *Panther* [1975]) and

Space Invaders (1978), and numerous home video games that used "player-missile graphics" programming designed with shooting games in mind. Shooting games rose in popularity and number, and by the decade's end, they had surpassed **ball-and-paddle games** as the dominant type of video game.

With the rise of three-dimensional **graphics** during the 1980s and 1990s, first-person shooting games grew alongside third-person shooting games, and each developed into dozens of variations, with such features as limited ammunition, different types of weaponry, and games specifically designed to test different skills such as aiming, timing, precision, strategy, and quick decision making. Although most games were representational to some degree, other shooting games were **abstract** in design, like *Tempest* (1981). Games that introduced new technology to players, such as the **virtual reality** game *Dactyl Nightmare* (1992), which used a head-mounted display, often were shooting games so that their gameplay would be intuitive and familiar to players, even when their hardware was not.

Other technologies of the 1980s and 1990s, such as improved graphics, faster CPU speeds, and more sophisticated gameplay mechanics, helped boost the popularity of the genre, whereas networked games and other **on-line games**, and eventually MMORPGs, meant larger groups could play together, providing more intelligent opponents than the **artificial intelligence (AI)** that the games of that time could provide. Companies such as **id Software**, producers of the *Doom* and *Quake* series, specialized in shooting games and helped bring the genre to maturity during the 1990s (Rehak, 2007).

By 2000, shooting games and their various subgenres had well-established conventions as well as technologies that could heighten the gameplay experience, including peripherals especially designed for shooting games. One such device, the 3rd Space Gaming Vest by TN Games, uses force-feedback technology to physically simulate the impact of bullet hits, grenade blasts, and other events to the player's torso. The vest uses eight pneumatic air pockets that inflate and deflate in various places around the player's chest and back to simulate directional impacts. As 3-D televisions come on the market, 3-D shooting games will not be far behind.

The great diversity and popularity of shooting games makes the genre one of the most widespread and growing, and to some extent, the shooting game genre is perhaps the one used most often to represent video games in the mind of the general public, for better or for worse.

Mark J. P. Wolf

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Sierra Entertainment

Sierra Entertainment (formerly known as Sierra On-Line) was one of the earliest publishers of home **computer games** and one of the biggest game companies of the 1980s and 1990s. It was initially known primarily for its graphic **adventure games** like *King's Quest* (1984) but eventually branched out into many other kinds of games. After a series of mergers and acquisitions, the company shed all of its development studios and effectively became a defunct brand by 2008.

The history of Sierra On-line can effectively be divided into three eras: the period when it was owned and run by its founders, Ken and Roberta Williams, the period in the late 1990s when it was no longer independent but still a major publisher of a wide diversity of games, and, finally, the period of deterioration and effective dissolution in the years following 2000.

Ken Williams founded On-Line Systems in 1979 to create software for business applications. His spouse Roberta convinced him to try releasing computer games instead, and in 1980, they released *Mystery House* for the Apple II, a game that is often described as the first home computer-based adventure game with **graphics**. The Williams quickly followed with other titles and swiftly became a major force in the fledgling computer game **industry**. They moved to Oakhurst, California, near the Sierra Mountains and Yosemite National Park, and changed the company name to Sierra On-Line in 1982 to avoid confusion with another company of the same name.

Sierra created a fairly diverse set of offerings, making its own games, publishing titles developed by other companies (like Sydney Development's *BC's Quest for Tires* in 1983), and porting the popular **arcade game** *Frogger* to home computer systems such as the **Atari** 400 (1981) or IBM PC (1983). For a brief time, it even entered the **console** game market but focused exclusively on home computer games after losing money in the video game market **crash of 1983**. Sierra built its reputation primarily on its significant range of graphic adventure game series. Their Hi-Res Adventure series, including *Mystery House* and *The Wizard and the Princess* (1980), generated significant profits, and in the mid-1980s, the company established a string of hits in the genre. Roberta Williams's own *King's Quest*, released in 1984, was the most well known and longest running—the series eventually included eight titles, the last of which was released in 1998. Other popular series included the *Space Quest* games by Mark Crowe and Scott Murphy, the *Leisure Suit Larry* series by Al Lowe, the *Police Quest* games, Lori and Corey Cole's *Quest for Glory* series, and Jane Jensen's *Gabriel Knight* games.

In the early to mid-1990s, Sierra embarked on a series of acquisitions of other developers. Two of these were particularly notable. The first was Dynamix in 1990. This studio produced several popular Sierra titles, including flight simulators like *Red Baron* (1990), family-oriented titles like the puzzle game *The Incredible Machine* (1992), vehicle combat simulators like the *Earthsiege* games, and the first-person shooter *Tribes* titles. In 1995, Sierra acquired Impressions Games, which released many popular strategy series, like *Lords of the Realm* (1994) and the *City Building* series, including titles such as *Caesar III* (1998) and *Pharaoh* (1999).

Sierra was an early pioneer in **on-line gaming**. In 1991, it launched The Sierra

Network, which was dedicated to game-playing via modems. Although early offerings were mostly **board game** remakes, the company introduced *The Shadow of Yserbius* in 1992, which makes it one of the earliest graphical multiplayer on-line **role-playing games**. In mid-1993, AT&T paid for a 50% stake in the network and renamed it the ImagiNation Network. AT&T purchased the rest of the network in 1995. Sierra then went on to publish *The Realm Online* in 1996, one of the earliest Internet-based **massively multiplayer online role-playing games (MMORPGs)**. In 1999, this game was sold to Codemasters.

By the mid-1990s, Sierra was a giant in the games industry. Consumer-marketing corporation CUC International, looking to expand into software development, purchased Sierra and **educational** software company Davidson & Associates (which owned developer Blizzard Entertainment) for nearly $2 billion worth of shares in 1996. Ken Williams stepped down as CEO of Sierra and by 1998 had retired. In late 1997, CUC in turn merged with HFS, a company known primarily for hotel chains and real estate, to form Cendant. Only a few months after the creation of this new entity, Cendant revealed that its executives had engaged in significant accounting fraud, sending the corporation's stock value into the tank. In the fall of 1998, Cendant sold its entire software division, along with Sierra, to Vivendi.

During this period of corporate tumult, Sierra continued to score successes as a publisher. In 1997, after acquiring Berkeley Systems, Sierra released multiple editions of the quiz-game *You Don't Know Jack*. In 1998, it published Valve's hit *Half-Life* and continued this relationship until Valve successfully sued Vivendi for unauthorized distribution of software to cyber cafés, a lawsuit initiated in 2002 and concluded in 2005. Despite these strong ventures, however, Sierra was failing to produce sufficient profits for Vivendi. In February 1999, the company laid off many employees and shut down several developers, including Sierra's historic Yosemite studio in Oakhurst, California.

By this time, Sierra no longer had much of a connection to its past and effectively functioned as an administrative division of Vivendi. It continued to lose money, and when Vivendi, facing significant financial pressure, sold its games unit to **Activision** in the summer of 2008, the newly formed Activision Blizzard, Inc. effectively—although without announcement—retired Sierra, merging all its operations into other parts of the corporation.

Sierra developed or published some of the most well-known and profitable games of the 1980s and 1990s, and many prominent game makers started their careers or spent part of them with the company. In addition to the adventure game makers discussed above, the list includes Richard **Garriott**, who published ***Ultima II*** with Sierra in 1982; Jeff Tunnell, who founded Dynamix and is credited in dozens of games, including *Starsiege* (1998) and *Tribes 2* (2001); and David Kaemmer, who has created multiple racing simulators, including *NASCAR Racing* (1994) and iRacing.com.

Kevin Schut

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silent film

Silent **film** has been an essential source of inspiration for game design, both consciously and unconsciously, nourishing the video game medium with the visual freedom, the attractional quality, and the kinetic wonders of early cinema. A close study of the aesthetics and forms of silent film can help video game developers in their creative choices, as in the case of designer Warren Spector and titles such as *The Misadventures of P. B. Winterbottom* (2010), revealing at the same time a history of hidden influences between both media: from Buster Keaton's slapstick to the universe of *Super Mario Bros.* (1985), from the action-adventure sequences of *The Thief of Bagdad* (1924) to the gameplay of *Prince of Persia* (1989).

The images of early cinema shared with first video games a number of stylistic patterns. The absence of synchronized dialogue and the supremacy of visual attractions pushed creators—both early filmmakers and game designers—toward truly imaginative ways of relating the moving image to its audiences. Researchers such as Tom Gunning and Henry Jenkins have studied how playfulness, spectacle, and sight transformation bridged the practices of film with those of magic, circus, music hall, and vaudeville, just as **arcades** merged with other forms of public entertainment and body **performance**. As Mark J. P. Wolf (2003) has noted, the visual freedom of early video games opened the path for a certain **abstract**-motion expression, concerned with gameplay visuality and not necessarily sacrificed to verbal storytelling, a path shared by cinema during its first decades. Such coexistence of images without words, movements without plots, and attractions without boundaries questions our assumptions about film and game culture, proving that the richness, multiplicity, and differential nature of both media goes way beyond the restrictions of allegedly cinematic techniques such as **cut-scenes**, verbal dialogue, and hyperrealism (that make games look more like talkies but not necessarily like films).

Visually enclosed by what Noël Burch called the "autarchy of tableau," Méliès and Pathé Frères fantasy reels shared with early games an aesthetic awareness of the frame. Acts of gameplay were literally portrayed, as we can see when the children of *Le théâtre électrique de Bob* (1906) connect a couple of electrical marionettes and start a screen fight like the ones in *Street Fighter* (1987) and ***Mortal Kombat*** (1992). Within the determined, magical **space** of the frame, a path was open for visually stunning effects and changes in shape, form, and motion. Humans became geometrical figures like the ones in *Les Kiriki, Acrobates Japonais*

(1907), game pieces whose movements and combinations resemble the legendary gameplay of ***Tetris*** (1985). Early mischief gags in comedy reels like *Pickpock ne Craint pas les Entraves* (1909) soon started to work around chases, jumps, and visual transformations, perfecting a system of vertical and horizontal interplay between the main character, his antagonists, and the surrounding space. Connecting floors (***Pac-Man*** [1980]), stairs (*Donkey Kong* [1981]), passageways (*Bubble Bobble* [1986]), and magic vehicles (*Paperboy* [1984]) engaged a certain development in early film montage before they became conventions of video game **history**.

The discoveries of early film were gradually reinterpreted and systematized, crystallizing throughout the silent masterpieces of the 1920s. In the realm of slapstick, the stunts, jumps, and chases of Mack Sennett's Keystone Kops were refined in the creations of Charles Chaplin, Buster Keaton, Harold Lloyd, Larry Semon, and other silent clowns, just like the primitive moves of *Jumpman* (1983) evolved through the **platforms** of *Super **Mario** Bros.* (1985). Among those masters of the gag, Keaton was probably the one who brought his obsession with motion, interfaces, and Rube Goldberg machines to a higher degree of visual lucidity (sublimating Henri Bergson's mechanics of laughter). The development of sight gags—based on the creation, repetition, and variation of a kinetic pattern through **time**—resembles the way game designers conceive certain interactions between a moving figure and the surrounding spaces. As in the early *Super Mario* and *Sonic* sagas, slapstick reels captured a screen trajectory by reconstructing the trace of a character's action (jump, chase, pie in the face) and its physical interactions (platform, rotor, slide, cliff, pendulum, pulley, seesaw, zip-line, lever). Classic sequences of the silent era like the final chase of *Seven Chances* (1925) and the dream sequence of *Sherlock Jr.* (1924) can be regarded as creative tools for designing imaginative gameplay, while connecting with the glitches and silent ruptures of Samuel Beckett's *Film* (1965) and the playful sensibility of contemporary game shows such as Takeshi Kitano's *Takeshi's Castle* (1986).

The echoes multiply if we compare the canon of Hollywood's silent adventure genre with its equivalents among early video games. The jumps and stunts of Douglas Fairbanks in *The Mark of Zorro* (1920) bring to mind the hanging vines of *Pitfall!* (1982) and *Jumpman* (1983), just like the climbing and sliding between walls and ladders evoke the levels of *Mega Man* (1987). Distinctive action sequences, like Fairbanks running through the drawbridge in *Robin Hood* (1922), foreshadow memorable moments in games such as *Castlevania* (1986) and *Kid Icarus* (1986), and the final boss structure in the caves of *Metroid* (1986) is literally contained in the catacombs of *The Thief of Bagdad* (1924). Aside from the recurrence of visual motifs, silent film shared with the first video games the use—and triumph—of printed title cards. In the early years, both media shared the necessity of narrating without synchronized dialogue, a technical requirement that encouraged the creation of memorable visual texts: from the revenge island in *The Black Pirate* (1926) to the revenge parody in *Monkey Island 2* (1991), not to mention the unforgettable title cards of ***The Legend***

of Zelda (1986), a saga that still relies on the wonder of silent words.

These hidden influences are finally amplified by the conscious inspiration on silent film that certain game designers have proved and vindicated. Warren Spector, trained as a film critic before becoming the creator of *Deus Ex* (2000), has publicly praised the imaginative powers of early film to inspire compelling video games, from his evocations of David W. Griffith to the cartoon gameplay of *Epic Mickey* (2010). Even more, silent film aesthetics merge literally with gaming in games like *The Misadventures of P. B. Winterbottom* (2010), a work that embraces—and turns into specific, brilliant gameplay—sequences from silent milestones such as *Le Voyage dans la Lune* (1902), *Safety Last* (1923), and *Metropolis* (1927), proving that the visual freedom of silent film can distill revolutionary, fascinating video games.

Manuel Garin

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Sim series

The *Sim* series is a successful franchise of **simulation games** created by designer Will **Wright** and **Maxis Software** and subsequently taken over by major games publisher and developer **Electronic Arts (EA)**. Rather than **immersing** players directly in first- or third-person gameplay directed toward a linear, mission-based structure, the series is credited with pioneering the "**god game**" genre, which allows players to oversee the creation and maintenance of a larger, simulated system from a somewhat-removed, godlike vantage point. Although the scenarios that inform each *Sim* title vary considerably, most of the series' games have in common their rejection of fantasy settings in favor of scenarios with origins in the real world, which players may, in many cases, relate to their everyday lives.

The *Sim* series launched in 1989 with the release of *SimCity*, an urban planning simulator that allows players to design, develop, and maintain their own cities. In contrast to training-based computer simulators with their origins in the military, which approximated the experience of flying or driving, *SimCity* was one of the first **computer games** to perform the type of simulation that dynamically models an entire system. Along with roughly contemporaneous simulation games such as *Populous* (Peter **Molyneux**, 1989) and *Civilization* (Sid **Meier**, 1990), *SimCity* would revolutionize the game experience and **industry** by helping popularize the new genre of god games and laying an enduring foundation for the rest of the *Sim* series to build on. Rather than adhering to the quest structure most common to video games at the time and placing the player in control of an individual player-character, *SimCity* put players in charge of an entire population whose development and well-being depended on the player's strategic decisions. It also featured an isometric perspective that introduced a new way of looking at gameplay—that of the third-person total overview of an expansive landscape, the scale of which gave the "godlike" impression of observing a vast game **world** in its entirety. Both of these innovations made the player feel, quite literally, like a god in the game world. "Mayor," players are presented with an empty landscape that they must clear, plan, and develop according to a range of competing economic, political, and human factors. Players spend their mayoral budget installing power plants and police stations; subdividing residential, commercial, and industrial zones; and creating transportation networks using the editing toolbar that partially frames their god's-eye view. If enough Sim-citizens like the city the player has built, the population thrives, and so do tax dollars for further development; if they don't, the budget runs dry and the Mayor loses office—in other words, the system, and thus the entire simulation, will fail.

In the wake of its unanticipated success, *SimCity* produced multiple expansion packs and sequels, including *SimCity 2000* (1994), *SimCity 3000* (1999), and *SimCity 4* (2003). Each of these subsequent games takes advantage of the increased processing power of the hardware on which they are played, for example, by offering enriched **graphics**, more editing tools, and the enhanced ability to zoom in and out of the simulation so that cities may be examined as closely as street level. However, the games' fans and critics alike have suggested that for all that the visual experience of *SimCity* has changed in later iterations, the nature of its gameplay remains quite faithful to that laid out in its original version.

In addition to achieving critical acclaim and unexpected commercial success, *SimCity* was one of the first computer games to be put to use in **education**, and by the early 1990s, it had been adopted in more than 10,000 schools in the **United States** alone to teach everything from urban planning to geography. However, it has also been argued that the educational value of *SimCity* isn't found in how it teaches players simulated skills that they can then apply in the real world, but rather in how it teaches players to think like the computer running the simulation. Ted Friedman (1999) suggests that god games like *SimCity* teach users to internalize the logic of the computer program; to win, you must figure out the **rules** of the game, predict consequences, and anticipate the computer's responses, until your decisions become as smoothly mechanized and intuitive as those of the computer—which, he suggests, is one of the true pleasures of this type of gaming experience.

SimCity's success prompted Maxis to create a wide range of *Sim* spin-offs, allowing players to simulate everything from the minutia of an ant colony (*SimAnt* [1991]) to the expansiveness of an entire planet (*SimEarth* [1990]), with every degree of scope and complexity in between. The diversity of *Sim* spin-offs is evident in their titles, which include *SimFarm* (1993), *SimTower* (1994), *SimIsl*e (1995), *SimTown* (1995), *SimGolf* (1995), *SimCopte*r (1996), *SimTunes* (1996), *SimPark* (1996), *Streets of SimCity* (1997), and *SimSafari* (1998). These latter spin-offs generally proved less commercially and critically successful than the *SimCity* games, and, indeed, the lukewarm sales and reception of most of these titles were believed to have factored into Maxis's 1997 sale to Electronic Arts. However, there was one notable exception to the lackluster performance of non-*SimCity* spin-offs: *The Sims* (2000), a "virtual dollhouse" (in designer Wright's words) that allows users to create and manage the lives of a family of simulated people or "Sims."

Electronic Arts was initially reluctant to release *The Sims* because of its seemingly mundane premise and finally did so with minimal fanfare or promotion. Despite this, *The Sims* quickly became one of the best-selling computer games of all time, spawning multiple expansion packs and sequels, including *The Sims Online* (2002), *The Sims 2* (2004), and *The Sims 3* (2009). As with *SimCity*, these later titles have been viewed as innovating the visual aspects of the original game and the degree to which users may customize their Sims and surroundings, rather than departing from the original in terms of gameplay. The one sequel that did drastically alter the single-player, off-line format of the *Sims* games—the **massively multiplayer online role-playing game (MMORPG)** *The Sims Online*—was considered a costly disappointment. (Subsequently rebranded as *EA-Land*, it was shut down and taken offline in 2007.) Some of the most recent *Sims* and *SimCity* spin-offs, meanwhile, such as *SimCity Societies* (2007) and *MySims* (2007) for the **Nintendo Wii** and **Nintendo DS**, combine certain elements of *SimCity* and *Sims* gameplay by allowing players to manage both their Sims *and* their larger urban environment.

Within the Sim series, *The Sims* games in particular have been credited with attracting a more diverse demographic of players—especially female players—to video games. *The Sims*'s success in broadening gamer demographics has been attributed to the ways in which it deviates from the predominantly masculine **gender** positioning of video games, creating a game world where crucial decisions revolve around human relationships and the management of domestic **space** rather than weapon selection or fantastical feats of strength. Players create and customize their Sims in terms of appearance and personality traits, as well as building, customizing, and furnishing their home environments to help meet (or, in some cases, thwart) their various needs. Sims respond to player input, but they are not wholly **avatars** that do the player's bidding. They are also directed by **artificial intelligence (AI)**, creating responses and situations that are semi-autonomous of the player's control. Just as the Mayor of *SimCity* must balance the competing demands of an urban environment, *The Sims* players must juggle the human needs of their Sims, ensuring they receive adequate food, sleep, socialization, employment, and shelter, right down to such minutia as properly timed bathroom breaks. Although players quickly become engrossed in these tasks, some complain that their mundane realism makes them feel like an "underpaid virtual housemaid," in Gonzalo Frasca's (2001) words.

The Sims and its sequels are ostensibly open-ended; players don't work toward a preset endpoint but rather operate according to the broad goal of keeping their Sims content and alive. Because one of the easiest ways to make your Sims happy is to buy them what they want, the game's depiction of consumerism has been greatly debated. Although one side of the debate contends that the tongue-in-cheek nature of *The Sims* actually critiques or at least allows an exploration of excessive materialism (see, for example, Herz, 2000), the other side faults it as a kind of yuppie-training simulator that suggests success is equated with acquiring more and better objects (Kline et al., 2003).

Creator Will Wright has described the *Sim* series as being more "software toys" than actual games because of their open-endedness and lack of a clearly goal-oriented structure. Unlike titles that lead players toward a singular experience of winning or **beating the game**, the *Sim* games ostensibly allow players to set their own goals and decide for themselves when they've achieved them. This permits players to engage in a variety of **play** styles and produce a wide range of possible outcomes within the simulated environment. For example, in the *SimCity* games, players may construct their ideal cities in a variety of ways, differently prioritizing such elements as industrial development, residential growth, and urban renewal (to name a few), thus producing a wide range of economic and social landscapes, or they may choose to construct their cities only to obliterate them with a tornado or tidal wave conjured by the games' assorted disaster modes. Similarly, the virtual dollhouse format of *The Sims* games means that players may pursue the more obvious objective of meeting their Sims' needs with a wide variety of consumer purchases and basic life maintenance tasks; however, they may also choose to neglect their Sims' needs and torture them in a variety of ways.

Wright has suggested that his overarching goal for the series was to create game worlds that provide as big a "solution space" as possible, wherein no two players may problem solve in exactly the same way, suggesting the possibility of seemingly infinite solutions and, thus, a gaming experience unique to the player (Pearce, 2002). On these grounds, the series has been praised for its success in creating "emergence"—complex, varied results in gameplay emerging out of seemingly simple interactions. Although there are still limits to this emergence enforced by the **design** and technical constraints of the game software, the *Sim* series has been widely credited as one of the most successful examples of emergent gameplay in video game **history**.

The *Sim* series has also been cited as evidence that video games can lack any discernible **narrative** or story, a view commonly espoused by games scholars associated, for a time, with the **ludology** movement within game studies and its advocacy for studying games as games, not stories. However, the counter-argument has been made by Wright himself that the *Sim* games can actually function as a kind of authoring tool in which players can produce their own uniquely personal narratives through their interaction with the simulation. Henry Jenkins (2004) terms these types of narratives “emergent” because they are not prestructured but rather take shape through gameplay specific to the individual player. Players can then share these narratives with the active on-line community Maxis has cultivated for further engagement with and interest in the franchise—for example, by posting user-created scrapbooks or virtual novels about their Sim characters, storyboards, and urban design plans.

Electronic Arts acquired the franchise rights to the *Sim* series in 1997 when it acquired Maxis. Wright and Maxis initially maintained a lead development role in the series; however, more recent titles (such as *SimCity Societie*s, The *MySims* series, and *The Sims 3* have been developed and published without the direct involvement of Wright or Maxis, with EA either developing new *Sim* projects internally or tasking them to other, external developers. The highly popular *Sim*s franchise, for example, is now fully under the purview of EA’s in-house Sims Studio.

Over its long life span, the *Sim* series has diversified from being played solely on computers to being ported across a wide range of console platforms, including the most recent generation of systems (the **Microsoft Xbox 360**, the Nintendo Wii, and the **Sony Playstation 3**).

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simulation games

Simulation games generally refers to video games that involve the player in controlling several elements of a dynamic system that is modeled by the video game. The distinction being made in this widespread sense of the term would be between games in which the player plays principally through a position situated within the game's **world** or arena—for instance, through an **avatar** in a first-person **shooting game**—and games in which the player spends a significant amount of time operating **interface** controls that affect the game's world from a position "above" or outside it. In Sid **Meier**'s simulation game classic *Civilization* (1991), for example, the player manipulates a range of variables concerning the ongoing progress of his or her civilization in relation to that of competing ones (run by the game's software or by other players in later versions offering multiplayer gameplay). These include the direction of scientific research and technological advance, city building and infrastructure choices, diplomatic relations with other civilizations, and military operations and strategy. The player must also respond to environmental variables such as weather, resource availability, and natural catastrophes. A range of interfaces are used in managing all of these tasks, from windows with lists and tables, to dialogue boxes in which either-or choices are made, to a first-person interface with the leaders of foreign civilizations, to the most characteristic "**god game**" perspective looking down on the simulated territory held by your civilization to move units around, develop resources, and conduct military operations.

Although it is always difficult to posit with certainty the first instance of a type of game or indeed any cultural form, *Utopia* (1982) is often taken to be the first video game involving this kind of combination of resource management and strategic turn-based **play**, although *Stellar Track* (1981), a text-based game published by Sears for the **Atari VCS 2600**, is another contender for this status of an original strategic simulation, as it was both turn-based and involved limited resource management of weapons, damage, and fuel of the player's Starship avatar. Developed for the **Mattel Intellivision**, *Utopia* was a two-player turn-based game in which players competed for economic and military supremacy against each other. *The **Sims*** (2000), designed by Will **Wright**, part of the best-selling video game franchise as of 2011, is the most well-known simulation game in this sense of the term. Likened by Mary Flanagan to playing with a dollhouse, the game involves the player in managing the everyday activities of a group of simulated human characters, including eating, sleeping, working, and socializing. The player creates the characters' physique and ethnicity, dresses them, manages the household budget, builds and renovates their house, guides them through social and work and study activities in various add-ons, and so on. Will Wright was also the designer of *SimCity* (1989), *SimEarth* (1990), and *SimAnt* (1991). More recently he designed *Spore* (2008), a game in which players experiment with a model of genetic evolutionary processes to create their own creatures and compete for galactic supremacy against other species. Another notable simulation game designer is Peter **Molyneux**, whose *Black and White* series (beginning in 2001) has the player running a "primitive" civilization both from a god's-eye view and as a godlike figure whose controlling moves inspire "belief" in the game world's simulated people.

Understood in this way, simulation games are a subset of **strategy games**, another common generic classification of games. **Video games studies** researchers such as

Espen Aarseth have pointed out, however, that, in a way, all video games are simulation games. This is because, first, all games can be approached as simulations that model a system or scenario in an artificially circumscribed zone of playful activity (Johan **Huizinga**'s idea of the "**magic circle**" of play is influential here). Second, the digital electronic computer that is the basis of most video games is in essence a simulation machine. The computer simulates other machines along with established techniques and procedures of all kinds. Software configures hardware and **interface** technology to operate as if it were a typewriter, musical instrument, video editing suite, digital calculator, telephone, and so on. As a **computer game**, a video game is always a simulation game of one kind or another.

From this perspective, it is clear that simulation games can also refer to all kinds of other games such as the **sports games** that provide the player with a playable model of golf, football, soccer, basketball, tennis, snowboarding, baseball, cricket, and so on. Similarly, flight and vehicle simulation games model the experience of operating a vehicle in its environment, whether that is air, earth, or water. These games usually emphasize audiovisual **immersion** in the simulated game **world** as in aerial combat simulators and **racing games**. Sophisticated submarine simulations such as *Sub Command: Seawolf-Akula–688(I)* (2001), however, tend more toward a systemic mode of engagement with the environment and its threats through the submarine's instrumentation, imitating the crew's tasks and limitations in a real submarine.

In the 1950s and 1960s, cybernetics and systems theory were significant in the development of both the digital computer and the simulations that were designed with it to model and experiment hypothetically with all manner of cultural and natural phenomena. Flight simulation and the strategic-political modeling of thermonuclear conflict were two of the most significant of these simulational developments for the subsequent development of simulation games in both senses of the term described earlier. Researchers such as Ted Friedman, Henry Lowood, and Tim Lenoir have considered how video games reflect the influence of these theories and technical developments, many of which emerged out of the enormous economic and political investment in military research and development in the anxiety-inducing Cold War climate. Cybernetics conceived of all complex phenomena as a communication system of elements networked together with key points or nodes in which controlling messages could be sent around the network to influence its operation. Systems theory emerged out of statistical methods of analyzing military operations to look for the most successful patterns and the key variables in complex operations such as antisubmarine warfare. It became popular in conjunction with cybernetics as a method of understanding complex phenomena and processes of all kinds with a view to predicting their outcomes and exploring potential technological and procedural innovations for ensuring control over those outcomes. Simulating the process or phenomena by modeling selectively the salient features of the system with the aid of a computer was a central plank in this method. The computer's calculative power could then be used to run the simulation, modifying the variables and experimenting with different control inputs into the system to gauge their hypothetical effect. As an important element of contemporary computer-based technoculture, video games have profited from these major techno-scientific advances well beyond the confines of the **military use of games**.

Approaching simulation games in a way that incorporates but also extends beyond the reference to strategic and systemic simulations run from a position of oversight, we could categorize simulation games along two axes. One of these would consider the positioning of the player in relation to the system or phenomenon being simulated and the other the context or expectation of the users. In regard to the first axis, distinctions could be made, for instance, between games that simulate the dynamics of an environment or sphere of activity, such as a civilization, city, anthill, or a business enterprise in games such as *Theme Park* (1994) and those that situate the player in a scenario with **narrative** features recognizable from **film** and literary media. In the former, which is essentially the more narrow sense of the term "simulation games," the simulation models the interaction of diverse elements at the level of the environment or whole system that these interactions influence and constitute. In *Theme Park*, the player manages several variables in attempting to run a successful park: park staff and amenities, types of rides and amusements, pricing, consumer engineering of the **space** to maximize the flow of the simulated paying customers, weather conditions, and so on. The game is about successfully controlling the development of the amusement park entity at a global level. Success is measured by the sale value of the business, and, having made the sale, the player moves on to a new location to build a better park.

More narrative-based scenario simulations position the player within the game world with an interface that is more about utilizing the world's conditions and reacting to their challenges than managing their overall development. **Adventure games**, **role-playing games (RPGs)**, the many shooting games and tactical team shooters, as well as vehicle simulation could generally be understood as scenario simulations. From a **game design** perspective, as Diane Carr pointed out about playing Lara Croft in the game *Tomb Raider* (1996), a first-person interface is another kind of vehicle the player "pilots." In these kinds of games, one operates in a simulated space more from an immersed, inhabitant perspective. Marie-Laure Ryan's distinction between objective and removed versus immersive and engaged kinds of player involvement in virtual worlds is relevant to understanding the difference between scenario and systemic/environmental simulation. In these kinds of games players have intraworldly abilities and technologies at their disposal, such as movement (walk, crawl, duck, jump, swim, operate a vehicle), techniques, or other actions (open a door, start a fire, administer first aid treatment, radio for an air strike or team extraction, and use weapons and attacks). This list includes virtually embodied or "kinesthetic" interaction as well as other kinds of play "in" a simulated space.

Virtual life simulations, from *The Sims* to massively multiplayer on-line worlds such as Second Life (2003), model a version of everyday living rather than a specific scenario or a discrete environment or system.

For some games theorists, these are not really "games" because they do not have goals and rules like a game but rather virtual spaces for imaginative play and for interacting with others socially. This latter can take the form of social networking, virtual communications, and the creation of virtual objects for display, trade, and cultural and political activity. Second Life, along with other virtual worlds, has attracted much interest for the way in which these activities in a simulated space have come to resemble and have an impact on "real-world" society, economics, and politics.

In relation to the second axis along which we could distinguish different kinds of simulation games according to their context of usage and development, entertainment, **education**, and training would be the principal categories of use covering most games. We should note that games, like other media forms, can be adopted for purposes their creators did not anticipate. For example, there was considerable controversy when information surfaced that the alleged perpetrators of the 9/11 terrorist attacks had used flight simulation software as part of their preparation for piloting their seized aircraft to their targets in the **United States**. These "safe" forms of entertainment now seemed sinister and in need of closer scrutiny.

More generally, the popularity of video games as entertainment forms has stimulated widespread research and development in educational games and simulations. So-called **serious games**, however, should be understood in terms of the longer **history** of video gaming technology's expansion from the original military technoscientific context of simulation development for the serious purposes of training, systems analysis, and strategic simulation. In this regard, 1990s military appropriations of commercial off-the-shelf games such as the second release in **id Software**'s influential ***Doom*** series, *Doom 2: Hell on Earth* (1995), and Spectrum Holobyte's fighter jet simulator, *Falcon 3.0* (1991), led the way in showing the potential of commercial video games for serious gaming. The "operational games" used widely across social science, urban planning, education, and other disciplines since the 1960s had already established, however, a solid tradition of systems analysis-based gaming in government and other nonentertainment contexts.

Real Lives 2004 (2004) is an interesting educational use of games because of the way it draws on the potential of simulation to project hypothetical events from initial known conditions. It simulates individual existences across the globe in a turn-based game form. Aimed at high school social science students, the game puts the player in the position of having to make important decisions for their given life as they mature from child to adult. The game is not immersive but informational. It presents the player challenges based on projected political, socioeconomic and **health** factors affecting people in different parts of the world. These are drawn from statistics and databases such as the World Health Organization, "Human Development" and economic indices, and so on. The player deals with problems facing children growing up in Somalia, Pakistan, or wherever the accident of birth places one at the start of the game.

A less common but nonetheless significant adaptation of video gaming's simulational potential is its use in critical and **artistic** registers. Artistic or **experimental**

games is a broad category but can include games that use simulation of space, systems, or phenomena in critical and creative ways. In the witty *Kafkamesto* (2006), the player has to try to exit an urban environment from "1922. Somewhere in Prague. Mid-winter" by negotiating ominous bureaucratic obstacles derived from Franz Kafka's novels and stories. More explicitly critical or activist games, such as *September 12th* (2002), use simulation to pose questions about the procedures through which a simulation comes to model a more complex phenomenon. Ian Bogost calls this the "**procedural rhetoric**" of simulation, arguing that critical work on and in games as simulational forms must focus on this process of making assumptions about how the simulated world or system works and can be "played." The risk of the Bush administration's "war on terror" strategy—and the way this political logic inhabits the preponderance of military combat video gaming—is the target of *September 12th*'s simple but elegant simulation of a preemptive missile strike against potential terrorist threats that only serves to exacerbate the original problem.

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SNES

See Super Nintendo Entertainment System (SNES)/Super Famicom

SNK (Shin Nihon Kikaku) Playmore

SNK Playmore is a software (and former hardware) developer from **Japan** known for its high-quality two-dimensional games, particularly **fighting games**, numerous **arcade games**, and the **Neo•Geo** home **console** system. The company was founded by Eikichi Kawasaki under the name "Shin Nihon Kikaku" (Japanese for "New Japan Project") in 1978. Initially begun as a hardware and software company providing business solutions, SNK soon shifted its focus to producing games for the **arcade** soon thereafter, starting with *Ozma Wars* (1979). Over the next decade, the company released numerous arcade games, several of which were ported to the **Nintendo Entertainment System (NES)**.

In 1990, SNK introduced the Neo•Geo Multi Video System (MVS), a modular arcade system. The MVS functioned like a home console system in that the games were contained in **cartridges** that could be easily changed. The cabinets could contain as many as six cartridges at a time, allowing the player to select which game to **play**. The MVS thus had three major advantages over other contemporary arcade hardware. First, new games could be easily installed. Second, new games were much cheaper than games from other manufacturers because operators only needed to purchase a small plastic cartridge, as opposed to a new standalone cabinet. Third, having multiple games in one unit saved valuable floor space. Although other modular arcade systems did exist at the time, notably Data East's **DECO cassette system** (1980) and **Nintendo**'s PlayChoice-10 (1986), these were aging and lacked the computational power of the MVS. Furthermore, the DECO system's cassettes were famously fragile, and the PlayChoice-10 only offered games already available on the Nintendo Entertainment System. In 1990, one of the major draws of arcade games was their technical superiority to home consoles, and arcade operators relied on a steady influx of new games to bring in customers. Although the MVS was based on old ideas, the advantages it offered over other systems were substantial.

After the success of the MVS, SNK decided that there might be a market for a high-end home game console powerful enough to compete with arcade games. At the time, home consoles were much less powerful in terms of **graphics** and **sound** quality. Porting arcade games to consoles such as the NES and **SEGA Genesis** meant making significant cuts, leading to noticeably inferior products. As such, SNK decided to release a home version of the MVS, known as the Neo•Geo AES (for "advanced entertainment system").

The AES debuted in the **United States** in 1990, with a launch price of $650. This system included two **joystick controllers** identical to those used on the MVS cabinet. Games were sold for $200 or more, making the system drastically more expensive than its contemporaries. However, the superior hardware of the AES meant that the games released for it were identical to their arcade counterparts. Despite the system's price tag, SNK continued to manufacture AES units until 1997, and the last official game released for the platform was *Samurai Shodown V Special* (2004), making the AES the longest-running officially supported video game console to date. It should be noted that the AES was designed before games with three-dimensional graphics became mainstream, and its lack of three-dimensional capabilities had a direct impact on the system's gradual decline.

With the arcade market declining, and the market for three-dimensional graphics booming, SNK began experiencing financial difficulties in the late 1990s. In 2000, the company was purchased by Japanese pachinko manufacturer Aruze and later went into bankruptcy in 2001. In the meantime, founder Kawasaki and several executives had left the company to found BrezzaSoft. Kawasaki also founded another company known as Playmore. After SNK's bankruptcy, the company's intellectual property was sold to a variety of Japanese companies, including BrezzaSoft. Playmore then acquired the former SNK properties and purchased BrezzaSoft outright, reforming as SNK Playmore.

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Sony Corporation

Sony was founded on May 7, 1946, in Tokyo, **Japan**, by Akio Morita and Masaru Ibuka and was originally known as Tokyo Tsushin Kogyo Kabushiki Kaisha (Tokyo Telecommunications Engineering Corporation). The name Sony wasn't used until 1955, and it was only in 1958 that the company officially changed its name to Sony. Tokyo Tsushin Kogyo originally began using the name Sony for its products when it introduced them to the American market. Concerned that Westerners would have difficulty pronouncing either their full name or the shortened name "Totsuko," the word "Sony" was chosen not only for its ease of pronunciation and its short length but also because is it similar to the Latin word "sonus," the root word of "sonic" and "**sound**," and it sounds like the word "sonny," which they hoped would connote a young, energetic, and friendly company.

The company that would become Sony was established in the aftermath of World War II when Ibuka had founded a company that repaired radios that had been damaged in the **war**. Morita was about to accept a job as a lecturer at the Tokyo Institute of Technology when a newspaper published an article featuring his old friend Ibuka's company. Morita wrote Ibuka to congratulate him on his success, and Ibuka wrote back urging Morita to join him. Morita turned down the lecturer job, and a few months later the new company was formed.

Early Sony products included seat warmers, rice cookers, and voltmeters. The product that would be their biggest hit at the time was record player needles that were manufactured from steel recovered from buildings that had been bombed during the war. This product would lead to other products in the field of sound reproduction and recording, including the first tape recorder made in Japan and one of the first transistor radios.

Before the invention of the transistor, radios were made with heavy glass vacuum tubes. Transistors were much smaller and much less fragile. Although Sony did not invent the transistor, it was the first Japanese company to make them and the first Japanese company to make transistor radios. Although American company Industrial Development Engineering Associates was the first to release a transistor radio, it bought the transistors from another manufacturer. Sony was the first company in the world to make a transistor radio from the transistors on up. This radio, the TR-55, could fit in a shirt pocket and was at the time the world's smallest radio. Its success meant that not only was radio suddenly everywhere, but so was the Sony name.

The fact that the radios, sold not only in Japan but also the **United States**, had the Sony name is notable because at the time Japanese products were seen as inferior. Sony had offers from Western companies to sell the radios, but all of them wanted to sell the products under their name rather than the Sony name because it was unknown. Sony refused to take its name off its products, which led not only to the building of the Sony brand but also to improving the reputation of Japanese-made electronics. Soon the name "Sony" became known for quality, and even in Japan the Sony name became more well known than the company's actual name. Therefore, in January 1958, Tokyo Tsushin Kogyo Kabushiki Kaisha officially changed its name to Sony.

Sony's strong eye for branding and its desire to **design** and manufacture a product's base components (as in the case of the transistor radio) were both traits that would define Sony for the next several decades. Not content to follow other companies, Sony has a long history of researching and developing its own formats and technologies. Among them are such successful products as the Trinitron television, the Walkman, three-and-a-half inch floppy diskettes, the compact disc, the **DVD**, Blu-ray technology, and the **PlayStation** systems. Of course, this impulse for developing its own technologies has also resulted in some well-known failures, such as Betamax, which was successful within the broadcast **industry** but lost to the VHS format in the consumer market; the MiniDisc, which was popular among musicians and audio enthusiasts but not among the public (and was made largely obsolete by solid-state and hard drive–based devices such as the iPod); the Memory Stick, Sony's own solid state memory, which is rarely used by companies other than Sony; and the UMD, which is used for games and movies in the PlayStation Portable but is apparently being phased out by Sony in favor of downloadable content.

Sony is, of course, a major player in the video game **industry** with not only its PlayStation line of consoles and **handheld gaming** devices but also with its Sony Online Entertainment division, which has released numerous **massively multiplayer on-line role-playing games (MMORPGs)** including *EverQuest* (1999), *Star Wars Galaxies* (2003), *PlanetSide* (2003), and several others.

In addition, Sony is a multinational company worth more than $84 billion (as of 2008) and is currently involved in practically every aspect of the entertainment industry from manufacturing televisions, surround-sound home theater equipment, and portable MP3 players to **film** studios such as Columbia Pictures, **television** production companies responsible for such shows as *Seinfeld* and *Who Wants to Be a Millionaire*, and music studios who release music from a large number of musicians ranging from Aerosmith to Will Smith and from Santana to Lady Gaga. Sony Corporation has a tradition of making innovative and unique products, and there is every indication that tradition will continue through the 21st century.

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Sony PlayStation

The Sony PlayStation was a CD-ROM-based **console** that served as **Sony**'s first entry into the home video game market. Although the Sony PlayStation was released in **Japan** on December 3, 1994; and in North America on September 9, 1995; its history stretches back to 1989 when the system was originally conceived as an add-on device for Nintendo's **Super Nintendo Entertainment System (SNES)** console. Known as the "Play Station" (two words), the device would allow Nintendo to make **CD-ROM-based games**. The PlayStation was only conceived as a stand-alone gaming system in 1991 when, after relations between Sony and Nintendo broke down, Nintendo announced that Philips would be creating the CD-ROM add-on for Nintendo.

It was logical for Nintendo to choose to work first with Sony and then Philips because both companies had been influential in the creation of the technologies that would make the PlayStation possible. In October 1982, Sony and Philips released the first compact disc, which would not only revolutionize the music **industry** but would go on to be the storage format that made possible not only the PlayStation but other disc-based video game systems. Although the compact disc was originally released as an **audio**-only format, Philips and Sony began to extend the format, resulting in the CD-ROM format in 1985, which allowed the disc to contain data, and the CD-i format in 1986, which allowed the discs to contain interactive multimedia content.

Although Sony did release one early CD-i player in 1991, it was around this time that the relationship between Sony and Philips began to sour, and Philips became the main manufacturer of CD-i units. Originally marketed as an **educational** system, Philips soon attempted to reposition the system as a video game console. Although the CD-i format is generally perceived to be a failure, it is important to the history of the PlayStation's development not only because the CD-i technology was one of Sony's first forays into interactive media but also because Philips's role in creating this technology was the reason Nintendo chose this former rival company as a partner

The Sony PlayStation (Evan-Amos)

in developing the Super Nintendo CD add-on when the Sony-Nintendo deal fell apart.

The driving force behind the creation of the PlayStation was Sony executive Ken Kutaragi who first became interested in working with Nintendo in 1986 when it released its Famicon Disk System, a proprietary floppy disk-based expansion system for the original Nintendo console. At the time, Sony had already released the widely used three-and-a-half-inch floppy disk. Perplexed as to why Nintendo would use an inferior format instead of Sony's, Kutaragi began to try to interest Nintendo in a joint venture with Sony. It was these talks that would lead to the development of the "Play Station" add-on for the Super Nintendo Entertainment System (SNES) console. Nintendo was concerned that **SEGA**'s imminent release of a CD-ROM-based **peripheral** for their **SEGA Genesis** would put SEGA ahead of Nintendo, and so Nintendo was eager to release its own CD-ROM-based add-on. The name PlayStation was picked with the reasoning that if a person worked at a "workstation" it seemed to make sense that a person would **play** at a "playstation." The idea was that Sony would make a CD-ROM-based adapter that would plug into the Super Nintendo console, but Sony also planned to sell a stand-alone device that would play both CD-ROM and **cartridge**-based games.

On June 1, 1991, at the Consumer Electronics Show, Sony announced their deal with Nintendo to the world. The very next day Nintendo took the stage and stunned Sony by announcing that it had entered a deal with Philips to create the CD-ROM-based SNES peripheral. Although the exact reasons for Nintendo breaking the contract with Sony have never been revealed, it seems likely that it was Sony's ownership of the CD-ROM-based technology that would be used and its plan to release its own unit that made Nintendo afraid that Sony had too much control and that the deal was not in Nintendo's best interests. In the end, Nintendo's deal with Philips also broke down, and Nintendo would not release a disk-based system until the **Nintendo GameCube** in 2001, but Nintendo's betrayal spurred Sony to continue working on the PlayStation on its own.

When Sony entered the video game market, it was dominated by Nintendo and

SEGA, and its success seemed anything but assured. Even many within Sony were skeptical and thought that Sony should stick to more "serious" products and not enter the video game market. The PlayStation's eventual success in the marketplace was due not only to its technology but also to Sony's aggressive marketing and licensing deals. The use of compact discs rather than cartridges not only allowed Sony to utilize the larger 650-Mb storage space of the discs but also to lower the price it charged other companies to make PlayStation games because compact discs were much cheaper to manufacture than cartridges.

What really set the PlayStation apart from the cartridge-based **Nintendo 64** and even the disc-based **SEGA Saturn** was the PlayStation's emphasis on three-dimensional filled-polygon-based games instead of two-dimensional sprite-based games. Other gaming systems used flat, two-dimensional game characters and objects known as sprites, but the PlayStation was able to use filled-polygon **graphics** to create characters and objects that had depth to them and could be seen from any angle. This made the games seem more lifelike and advanced than the visuals of two-dimensional games. Although both SEGA and Nintendo's consoles could do this as well, they were seen as less powerful and did not emphasize polygonal graphics from the start.

The PlayStation firmly established Sony's place in the gaming **world**, leading to the **PlayStation 2** and **PlayStation 3**, as well as the PlayStation Portable. By the time the PlayStation was discontinued in November 2006, Sony had sold more than 102 million consoles and nearly 8,000 games had been released for it, and consumers had purchased nearly one billion discs. Its success led to the death of cartridge-based home video game consoles, eventually forced SEGA to stop manufacturing hardware, and popularized home gaming with three-dimensional graphics.

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Sony PlayStation 2

More than simply a newer version of the original **Sony PlayStation**, the PlayStation 2 (PS2) has sold more than 140 million units making it the most successful video game **console** ever made. First released in **Japan** on March 4, 2000, and in North America on October 26, 2000, the PlayStation 2 was the original platform for such landmark games as ***Grand Theft Auto III*** (2001), *Katamari Damacy* (2004), *Guitar Hero* (2005), and *God of War* (2005). Remarkably, as of 2010, other systems such as the **Microsoft Xbox**, **SEGA Dreamcast**, and

Nintendo **GameCube**, which were all first released around the same time as the PS2, have left the market, but the PlayStation 2 still continues to be sold. Even though the **PlayStation 3** was released in November 2006, new PS2 games are still being released. Originally launched in the **United States** with a price of $299, Sony has lowered the price of the unit to keep it attractive to new buyers, and in 2009 it reached the price of $99.

Although the first PlayStation used **CD-ROMs** as the medium for its video games, the PS2 used **DVDs**, which not only allowed for much more information to be stored on a single disc but also meant the system could play DVD movies. When the PS2 was first released, DVD players were still fairly expensive and were not as ubiquitous as they are now and so the PS2's ability to play DVDs was a strong selling point. The heart of the PlayStation 2 is a custom processor codeveloped by **Sony** and Toshiba that they dubbed the "Emotion Engine." Containing 10.5 million transistors and eight separate processing units, this processor is capable of 6.2 billion floating point operations per second. Although processors used in computers are designed to be general purpose in nature, the Emotion Engine is designed solely to make high-quality three-dimensional video games. This made the PS2 so powerful that scientists at the U.S. National Center for Supercomputing Applications combined 70 of them to create a supercomputer, and when Iraq was rumored to have imported thousands of PS2s, there were speculations that the country would soon be launching PlayStation 2–powered missiles. All of this processing power did not come without a price, however, and that price was complexity. Some said that the PS2 was so complex and unlike traditional computers that programming it was very difficult, and many game delays were blamed on the complexity of the Emotion Engine.

One of the more remarkable aspects of the PlayStation 2 was the number of add-ons and **peripherals** that were released for the system and perhaps even more remarkable was that so many of them were so successful. One of the most popular add-ons for the PS2 was the PlayStation Network Adapter. When the PlayStation 2 was released, it did not come with Internet connectivity, but in 2001 the network adapter was released and allowed players to connect to the Internet and play on-line with and against other players. This add-on also allowed players to install a hard drive into the PS2. Although few games used the hard drive, it was an ability that brought the PlayStation 2 into parity with the Xbox that had Internet connectivity and a hard drive as standard features. When Sony released the "slim" version of the PS2 in 2004, it integrated the Ethernet port, making the add-on unnecessary, and eliminated the expansion port that allowed a hard drive to be installed.

One of the most groundbreaking peripherals for the PlayStation 2 was the EyeToy. Released in 2003, the EyeToy was a camera with 640 × 480 **resolution** that allowed the PS2 to "see" the player and allowed the player to interact with on-screen game elements by moving his or her body. This technology would continue to be used on the PlayStation 3 under the name PlayStation Eye. The PlayStation Eye and the PlayStation Motion Controller are the basis of the PlayStation Move technology, which is a **motion controller** technology similar to that used by the **Nintendo Wii**.

Another highly successful peripheral that was first released for the PlayStation 2 but would later be released for practically all video game systems is the guitar-shaped controller used by the *Guitar Hero* series of games. Released in 2005 in North America and 2006 in **Europe** and Japan, the original *Guitar Hero* game came with a **controller** roughly three-quarters the size of a real electric guitar. While there were earlier guitar-inspired arcade games and *Guitar Hero* sequels and spin-off games would be released for other systems, it was the PS2 that first brought the instrument-based **rhythm games** to popularity in North America.

When the PlayStation 2 was released in Japan and then in North America, the demand far exceeded the supply. With stores quickly selling out, units could be found for sale at on-line sites such as eBay for as much as $1,000. There was even a report that one boy in Japan was so disappointed he could not get a PlayStation 2 that he committed suicide (Kent, 2004). Although SEGA hoped that it could capitalize on the PS2 shortage by selling more of the Dreamcast consoles, they were unable to do so. The success of the PlayStation 2 (as well as the Xbox and GameCube) came at the expense of the Dreamcast, and on January 31, 2001, SEGA announced that they would stop making gaming hardware. Whereas the Microsoft Xbox and the Nintendo GameCube have been replaced by newer systems from those companies, Sony did not stop selling the PS2 when it released the PlayStation 3. The PS2 continued after its competitors had died.

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Sony PlayStation 3

Sony Computer Entertainment's (SCE) PlayStation 3 is part of the seventh **generation** of video game **consoles**, alongside the **Nintendo Wii** and the **Microsoft Xbox 360**. SCE released the PS3 in 2006, on November 11 in **Japan** and November 17 in North America. Because of a shortage in the materials required to produce the newly developed **Blu-ray** optical drive, not only were these release dates much later than originally anticipated, but the number of units produced fell short of SCE's target by 50% (1up.com, 2010). Consequently, the releases for **Europe** and Oceania would only begin in March of the next year. Although shortages are common among hardware releases, the Xbox 360 sold 75% more consoles during its initial launch. Worldwide, the PS3 has sold more than 35 million consoles, roughly 5 million less than the Xbox 360, although this margin has been narrowing.

Sony Corporation (SCE's parent company) promoted the optical drive as part of its professed strategy to promote high-**resolution film** and gameplay, eventually leading to the development of its **3-D hardware** equivalents. Sony, meanwhile, would capitalize by synergistically selling high-definition **televisions** and eventually 3DTVs (Greenfeld, 2010). Without the drive, the data transfer from disc to screen would be too slow and require too many discs. However, given the relative cost to produce the drives—in materials, delays, and sales—a heavy burden was placed on Sony, which priced the PlayStation 3 at $399 and $499 (the latter sold at more than $300 below cost), while still charging $100 more than the Xbox 360 (Quilty-Harper, 2006). To compare, Blu-ray players without the hard drive, **graphics** processor unit (GPU), and central processing unit (CPU), were sold for the same price.

The reason for this discrepancy, beyond the Blu-ray drive, is the CPU. Developed by Sony, Toshiba, and IBM, the PS3's Cell Processor boasts a unique and costly architecture. Both the PS3 and Xbox 360 have a core processor based on IBM's 970 PowerPC, but the PS3's is purposed to delegate tasks to eight other processors, the Synergistic Processing Elements. Although the GPU, the RSX: Reality Synthesizer, is somewhat inferior to the Xbox 360's GPU, it can still render HD images and outperform the Xbox 360 by unloading its processing burdens to the Cell Processor. This new architecture was projected to be useful in the future of programming, allowing for a comparatively high number of calculations per second but consequently stunted the early development of games because of the increased difficulty to optimally program it, a problem furthered by Sony's latter admitted lack of available programming libraries ("Q&A: Shuhei Yoshida," 2010). In addition to forcing an advancement in software design, the processor has been used to exemplify "the boundaries in computer technology that are being pushed by the demand for video games" (Crandall and Sidak, 2006). To mitigate the perceived cost, SCE designed the PS3 to act as a multimedia computer, enabling Blu-ray and DVD film viewing, web browsing, music and photograph display and storage, and on-line video chat. What is more, it enabled the PS3 to be backward-compatible, able to **play** games from the **PlayStation** and the **PlayStation 2**, and work as a Linux machine. With Linux installed, the PS3 could additionally work with scientific research by contributing remote processing power. With time, however, SCE removed the backward-compatibility for PS2 games and other operating systems, going so far as to release a firmware update stopping any Linux-installed machine from working. Although its hardware has changed during its operational lifetime, varying its size and hard drive space, its processing power has remained stable, ensuring that all versions of the PS3 can play the same PS3 games.

The PS3's game **controller**, dubbed the DualShock 3, looks nearly identical to its predecessor the DualShock 2 but features accelerometers capable of detecting movement on six axes, providing opportunities for game developers to have players produce different trackable gestures. In addition, the PS3 is able to handle seven operational controllers at once; however, at this time, there are fewer than a dozen games that allow for more than four local players. With the release of the PS3, Sony launched the PlayStation Network, from which players could download games, updates, extra content, and play with others on-line. Unlike the Xbox 360's network, there is no monthly fee, ultimately resulting in less functionality and fewer services.

The initial set of games released alongside the PS3 total a dozen because many were delayed and one, *NBA Live 07* (EA Sports, 2006), was cancelled. Of these releases, only four were PS3 exclusive: (*Genji: Days of the Blade* [SCEI, 2006]; *Untold Legends: Dark Kingdom* [Sony Online Entertainment, 2006]; *Mobile Suit Gundam: Crossfire* [Namco Bandai Games, 2006]; and *Ridge Racer 7* [Namco Bandai Games, 2006]). These fared somewhat poorly, and because of the delay in the PS3's release, the cost of its hardware and competition from the Xbox 360, SCE lost a large portion of the market share it had previously taken from **Nintendo** and **SEGA** in 1994 with the PSX, and again in 2001 with the PS2. Its sales would recover in 2009 with its redesigned hardware, nicknamed the PS3 "Slim," its $200 price reduction, and critical mass of high-budget proprietary releases such as *Little Big Planet* (Media Molecule, 2008), *Metal Gear Solid 4* (Kojima Productions, 2008), *Demons' Souls* (From Software, 2009), *Uncharted 2* (Naughty Dog, 2009), *Final Fantasy XIII* (Square Enix, 2010), and *God of War III* (Santa Monica Studio, 2010). Critically, these have been able to place the PS3 as the console with the most exclusive titles having won Game of the Year from nearly all video game reviewing websites and magazines. With this shift toward profitability came a new logo and the slogan "It Only Does Everything." From this campaign, a second slogan would emerge with the announcement of the Playstation Move at the 2010 Entertainment Electronics Exposition: "This Changes Everything."

The Playstation Move is a new controller meant to provide physical affordances otherwise untracked by the DualShock 3. The Move resembles most closely Nintendo's Wiimote—but with fewer buttons—with an analog trigger and a glowing LED orb capable of being tracked by the PlayStation Eye (SCE's previously released Webcam). Because of its distinct spherical object, the PS Eye can track the Move in three dimensions, correlating the captured size with a distance from the camera. This tracking is doubled by an internal gyroscope and embedded accelerometers, enabling new forms of precision which the Wii is currently incapable of. In addition, SCE has announced the Subcontroller which will supplement the PS Move, much like Nintendo's Nunchuk does for the Wiimote. Although the PS Eye has been used for **gestural interfaces**, it has seen limited success, although with the coming of the Xbox 360's Kinect, a motion-sensing set of cameras used for gestural interfaces, it seems to have found a small resurgence with full-body tracking for *Kung-Fu Live* (2010) and head tracking for *Gran Turismo 5* (2010).

The addition of **motion control** in console gaming has been touted as a means to further extend the life cycles of the PS3 and

XboX 360. Although console generations have historically lasted only five years before being replaced by newer models, the current generation is thought to break that pattern and continue past a seven-year mark (Ivan, 2009).

William B. A. Robinson

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Sony vs. Bleem

The outcome of the 2000 court case ***Sony** vs. Bleem* is useful for the video game **industry** as well as scholars and publishers who publish work about video games. The case established that the use of screenshots from video games falls within the boundaries of fair use even when that use is *commercial*, and even when that use is *hostile*. Thus, scholars and publishers need not ask for permission to use screenshots in their work.

The case arose when Bleem, a company that produced emulation software for playing games for the **Sony PlayStation** on personal computers, released **advertising** in which it compared screenshots from the PlayStation with imagery of the same games from its **emulator**, hoping to demonstrate that the increased **resolution** available on a computer produced a game image better than the PlayStation itself did. Sony sued Bleem for intellectual property violations, one of which was the claim that using Sony's imagery in their advertising violated the copyright on those images. Bleem maintained that comparative advertising fell within fair use.

The court looked at the four factors established in the 1976 Copyright Act: "(a) the purpose and character of the use, including whether such use is of a commercial nature or is for nonprofit **educational** purposes; (b) the nature of the copyrighted work; (c) the amount and substantiality of the portion used in relation to the copyrighted work as a whole; and (d) the effect of the use upon the potential market for or value of the copyrighted work." In the end, the court found in Bleem's favor, ruling that the use of a screenshot (which it refers to at one point as "an inanimate sliver of a game") does not require permission.

The case ended with the court concluding that "it is a fair use for Bleem to advertise comparatively only between what PlayStation games actually look like on a **television** and what they actually look like on a computer when played with the **emulator**. It is in this context alone that the comparison is necessarily Sony-specific. Otherwise, Bleem must be content to make its comparison without using another's copyrighted material. We are persuaded by the need for Bleem to impose minimally upon Sony's copyright with respect to these screen shots because there is no other way to create a truly accurate comparison for the user. The way of **simulations** is a slippery one for Bleem and if it chooses to embark upon it, it must do so without the support of Sony's copyright. With that limitation in mind, we conclude that Bleem's use of Sony's copyrighted material was fair."

Although Sony lost on all counts to Bleem about the use of Sony screenshots on its packaging, the legal fees involved in the litigation were too much for the small company to bear and apparently the cause of Bleem's filing for bankruptcy and going out of business.

Mark J. P. Wolf

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sound

Along with **graphics**, sound provides information needed for gameplay, creates or reinforces **immersion** as well as agency, and participates in the induction of a vast spectrum of **emotions**. Therefore, a game's sonic aesthetic results from the need to support gameplay and often toward the eliciting of a strong feeling of presence within the game **world** (Jørgensen, 2008). Nevertheless, many other internal and external factors intervene in the creation of a sonic aesthetic.

From the simple sounds of early **arcade games** (which often used sound to attract players) to the most sophisticated Digital Signal Processing (DSP), sound has always been constrained by technology. Yet, according to Karen Collins, the sonic aesthetic of video games is not purely a product of hard technological determinism; the relationship between technology and games should be envisioned as an ongoing mutual influence (Collins, 2008, p. 5). Designers work around technological constraints as technology continues to develop. For instance, in the 8-bit era, music looping was one method used by designers to circumvent memory limitations; but today it is considered an outdated way to score a video game. Other techniques in interactive and adaptive music have thus been developed to address the growing expectations of designers and the gaming community (see **audio [dynamic**, **interactive, and adaptive]**). In 1991, for example, LucasArts's Michael Land (collaborating with Peter McConnell) developed iMUSE, an interactive music system that allowed closer synchronization between musical cues and in-game events. Land wanted music to respond to unpredictable interactive events and transition more subtly between themes. The desire for better game audio has motivated technological development, which in turn has helped sound evolve; at the same time, technological constraints have often given games a unique sound aesthetic.

Economical and ideological factors have also come into **play**, as games' budgets, development time, and the creativity of designers vary. The sound of a low-budget game might be done by a single person (in the early days of video game **history**, all sound was done by the game programmer), whereas the sound department of a big budget game might include a sound director, sound designers, composers, and audio programmers as well as dialogue and voice-over artists.

Market demands and demographics also factor in: differing age groups, casual versus hardcore gamers, male versus female audiences, and so on. The cultural context in which a game is designed, and the impact of international distribution, cannot be overlooked. Eastern and Western games tend to differ on many points, starting with the type of gameplay and fictions they propose. Accordingly, sound has to fulfill different tasks.

For a meaningful experience, audio must supply feedback on the game state and stimulate the gamer's listening strategies. In ***PONG*** (1972), the characteristic "ping" was used to indicate that the ball had rebounded off either the gamer's paddle or one of the horizontal walls delimiting the game's boundaries. While helping the gamer to better evaluate how to react in a given situation, it also provided a sense of rhythm to the game, making it more enjoyable. Most games require sound to fill similar functions, and in the extreme case of audio games, sound structures the whole gameplay experience.

Of course, not all video games are as abstract as *PONG,* ***Tetris*** (1985), or *Lumines* (2005); many take place in rich, vast, and complex virtual worlds. Therefore, sound must contribute to construction of the game world and the gamer's immersion. Genre, then, will considerably influence a game's sonic aesthetic; for example, in the fast-paced action sequences of first-person **shooting games**, sound must quickly provide information about the player-character's surroundings, locating enemies and environmental hazards. Sound must therefore be designed to fulfill forewarning as well as spatial and localization functions (Grimshaw, 2008). In **survival horror games**, sound is used to elicit fear and feelings of dread and uneasiness; and because fear is often induced through the unknown and the uncertain, sound design is conceived so the forewarning and localization functions of sound seem unreliable.

On the other hand, **role-playing games (RPGs)** do not rely as much on forewarning; for example, in the *Final Fantasy* series and *Dragon Quest* series, combat is often kept separate from the exploratory sequences of gameplay and is triggered randomly. In turn-based games, gamers have more time to evaluate moves and plan attacks, and with the extended timeframe, there is often a richer and more varied score; avoiding **repetition** is very important to maintain gamers' interest.

The sound aesthetic of video games is also quite specific to the properties of its medium. Interactivity achieved through play is the distinctive feature that separates video games from other media. Consequently, the dynamic nature of video games considerably modifies the relationship gamers maintain with sound. As Karen Collins explains, "Unlike the consumption of many other forms of media in which the audience is a more passive "receiver" of a sound signal, game players play an active role in the triggering of the sound events in the game. . . . While they are still, in a sense, the receiver of the end sound signal, they are also partly the transmitter of that signal, playing an active role in the triggering and timing of these audio events" (Collins, 2008, p. 3). Indeed, listening to a video game is in many respects different from listening to a movie. For example, a game's listening point is almost always fixed within the perception of the player-character or based on the distance between the player-character and the virtual camera. Indeed, a listening point anchored within the subjectivity of a player-character is essential to the interaction and identification between the player-character and the gamer, facilitating the transmission of affects and emotions.

Interactivity also has a considerable impact on the construction of the on-screen and the acousmatic zones (off-screen and off). According to Michel Chion, in movies there are six circuits through which the sound can travel: from on-screen to off-screen; from on-screen to the off; from off-screen to off; and the three opposite routes. Whereas the location of sounds in film are determined and fixed by the director, in games the circuit between on-screen and off-screen is significantly altered by the gamer's control of his or her player-character and, consequently, of the game's virtual camera. Depending on the sound and context, the gamer might decide to go find the sound's source or avoid it. Sound designers must therefore strategically use sounds to properly stimulate gamers' listening strategies so as to simplify or complicate their decisions.

Of course, this does not imply that the sonic theory developed in music or **film** studies is irrelevant but rather that it should be used with caution when it comes to games. Cinematic sequences in games, for instance, make use of cinematic conventions. Also, although the relationship between the medium and the audience is considerably modified by interactivity, some of the connections between the images and sounds remains like that of film; they are tightly linked, producing an effect of *added value*. This is described by Michel Chion as a "sensory, informative, semantic, narrative, structural, or expressive value that a sound heard during a scene leads us to project on the image, creating the impression that we see in this image what in reality we 'audio-see'" (Chion, 2003, p. 436, freely translated). However, the synchronization points responsible for this effect must establish a feeling of causality not only among the image, sounds, and game events but also between the actions performed by the gamer and those performed by the player-character within the game's world. In video games, synchronization points are not only aesthetic but also pragmatic.

Also, as with film, the rendering of the sounds must create the necessary degree of plausibility for the sound to seem "real, efficient, and adapted" to "recreate the sensation . . . associated to the cause or to the circumstance evoked in the [game]" (Chion, 1990, p. 94, freely translated). The audiovisual nature of the medium is thus greatly responsible for the games' general aesthetics.

Overall, the many factors that influence a game's sonic aesthetic are not independent but must be understood as an interdependent whole. The sonic aesthetic of video games is ultimately tied to the properties of the medium and is the direct consequence of the different choices made in regard to the context in which games are designed, toward creating the best possible video game experience.

Guillaume Roux-Girard

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sound technology

Sound technology in video games consists of both hardware and software. The **sound** hardware sets the limitations in terms of sound synthesis types, stereo and digital signal processing effects, and simultaneous channels, and the associated computer hardware (such as RAM) sets the limitations in terms of how this sound will function in real **time** in the context of the game and its associated requirements for memory. The software receives information from the game and/or its **interface** controls and sends calls to the hardware to activate the sound.

In the very early days of **arcade** sound technology, the hardware was analog, although this sound was typically controlled and manipulated digitally. Analog sound technology records and produces the electrical output of sound waves as they occur, whereas digital sound technology breaks the information down into binary digits and stores that numerical information so that it can later reproduce the sound.

Analog sound was generated using the speakers, which were "on-board," meaning they were attached directly to the motherboard. These would usually be piezoelectric or electromechanical speakers, colloquially referred to as "beepers," because a "beep" was about all they could handle. Piezoelectric speakers generated sound using a small diaphragm, which consists of a small ceramic plate with electrodes on both sides, attached to a metal plate. A DC voltage was applied between the electrodes on the diaphragm, causing a mechanical distortion and bending the diaphragm back and forth, creating a sound wave. Sound can therefore be generated by turning the piezoelectric speaker on and off in rapid succession, bending the diaphragm many times a second. An 11-KHz tone, for example, requires the speaker to be turned on and off 11,000 times per second. Electromagnetic speakers worked in a similar way, using two magnets to create a repulsion and attraction, pushing and pulling the speaker cone, with the frequency and amplitude of the input wave dictating the rate and distance that the speaker voice coil moves and therefore the frequency of sound.

This sound-producing capability could be improved slightly by using what is known as pulse width modulation, which controlled the analog circuit with the digital computer timer. In other words, it was possible to digitally encode the analog sound through the use of high-**resolution** counters. Since the speaker could produce two sound levels (on and off), it was possible to carefully time the pulses of sound waves so that the speaker was left in the "off" position for a fraction of a millisecond, making it possible to emit sounds in between those two on/off levels and thereby increasing the possible frequencies.

By the late 1970s, however, dedicated sound chips became incorporated into the hardware of video games. These sound chips have developed over time, incorporating a variety of synthesis technologies. The earliest dedicated sound chips were known as programmable sound generators (PSGs) and used subtractive synthesis, in which an oscillator creates a waveform and then uses a filter to subtract frequencies from that waveform until the desired frequencies remain. These waveforms were then passed through an envelope generator that would dictate the amplitude shape of the waveform. Many video game PSGs were created by Texas Instruments or General Instruments and contained three-tone generators and one noise generator. Some companies, such as **Atari** and Commodore, designed their own sound chips. The most popular was the AY-8910 series of General Instruments chips that found its way into a variety of home computers and game consoles including the Sinclair ZX Spectrum, Amstrad CPC, **Mattel Intellivision**, Atari ST, and **SEGA Master System**.

By the arrival of 16-bit technology in the late 1980s, many companies were licensing Yamaha's Frequency Modulation (FM) synthesis chips, although many continued to also use PSG chips for sound effects, as with the **SEGA Genesis**, which used both an FM (the YM2612) and a PSG (Texas Instruments SN76489) sound chip. FM combined sound waves, using a modulating wave signal to change the pitch of a second sound wave. Many FM chips used four or six different oscillators for each sound, to generate more complex sounds and realistic sounding instruments. These chips found their way into many of the **arcade games** of the mid to late 1980s and most computer sound cards of the era.

Add-on third-party FM sound cards began to develop in the mid 1980s, notably the AdLib Multimedia card in 1986. AdLib based their card on the nine-channel Yamaha FM chip, YM3812, which was a later version of the popular YM3526 used in many **arcade** games. Soon after the development of AdLib sound cards, Creative Technology (now Creative Labs) entered the market with their own sound cards, including Sound Blaster, essentially a copy of the AdLib card, using the same FM chip but with added digital **audio** capabilities for sampling and, most importantly, a game port. Sound Blaster quickly became the standard for game sound after a drop in price but was soon followed by a flood of sound cards entering the market. With such a variety, programming music for games became more problematic. By 1989, at the behest of Microsoft, Yamaha made their FM chips available on the open market, so that a standard sound format for PCs could be created.

Also introduced in the 16-bit era, *wavetable synthesis* used preset digital samples of instruments (usually combined with basic waveforms of subtractive synthesis) and was therefore closer in sound to real instruments than FM synthesis. Wavetable synthesis formed the basis of the Sony SPC-700 sound chip in the **Super Nintendo Entertainment System (SNES)** and also found its way into Roland's popular MT-32 gaming and music sound card, released in 1987.

By the early 1990s, most home computers had FM or wavetable sound cards supporting MIDI, the Musical Instrument Digital Interface protocol. MIDI was a standardized data format for representing audio, which allowed game composers a simple way to create music and then provide programmers with the raw data dumps of that music. When **CD-ROMs** became popular by the early 1990s with the **SEGA Saturn** and **Sony PlayStation**, allowing for sampled audio, MIDI in games was for a large part abandoned in favor of more realistic but less dynamic music and sounds. Because the audio was not reliant on a sound card's synthesis, CD-ROM technology ensured that composers and sound designers could not only know how the audio would sound on most consumer configurations but could also now record sound effects, live instruments, vocals, and in-game dialogue. Most consoles still continued to offer MIDI support with dedicated sound chips.

The **Nintendo 64** surpassed the PlayStation in technical capabilities in many respects. The main processor controlled the audio and was capable of producing 16-bit stereo sound at a slightly higher sample rate than CD quality (48 MHz). Digital signal processing (DSP) filters and effects such as chorus, panning, and reverb could also be implemented in the internal CPU, or in the software, in real time. Some games supported surround sound, and this was further enhanced by the third-party add-on release of RumbleFx 3D Sound Amplifier, a device that could help to mimic surround sound on a stereo system. This surround capability was expanded upon by the release of the **Sony PlayStation 2** in 2000, which supported surround-sound standards AC3, DTS, and Dolby Digital, offering up to eight separate speaker channels. However, limitations still meant that sound quality had to be compressed to save space, with the result being that **cut-scene** sequences typically had high-quality full surround sound, but when the player began to use other resources requiring real-time processing, the music and sound would take second place and often drop down to two-channel stereo.

Since the release of the **Sony PlayStation 3**, the **Nintendo Wii**, and the **Microsoft Xbox 360**, sound capabilities continue to increase in terms of access to RAM, 3-D surround technologies, DSP effects, and simultaneous audio channels. Increasingly, full orchestras are used for recording game music, and ongoing experimentation with algorithmically generative or procedural audio continues to expand the options that composers and sound designers have to create realistic yet dynamic audio.

Karen Collins

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South America

See Latin America

South Korea

On-line gaming has been identified by the South Korean government as a national core **industry** to support. With government's strong backing, Korean on-line games have become one of the most globalized and lucrative sectors in Korean cultural industry. In the whole **world**, one can rarely find people more enthusiastic, committed, and professional about on-line gaming than Koreans. Why do Koreans focus game development on **on-line games**? How did South Korea become an on-line game superpower in such a short time?

The success of Korean on-line games is no accident, and everything has worked out according to an official plan. South Korea used to be a consumption market for foreign games and only became a major game exporter since about 2000. Until the overturning of the ban on Japanese cultural products in 1998, Japanese games were popular in Korea underground. Around this time, the Korean government promulgated the policy of building Korea into a cultural empire by providing investment and logistics support, as well as policy and legal backup. Because of the problems of **piracy** and the dominance of Japanese games in most existing platforms, the Korean government and game manufacturers decided to focus on on-line game development.

In 1999, the Korean government established the Korea Game Development and Promotion Institute (now renamed as Korea Game Industry Agency), a semiofficial organization to provide strategic planning and support for the Korean game industry. It is actively involved in professional training, direct investment, technological development, **game design**, purchase of equipment, and overseas promotion.

The pace of Korean on-line game development has been astonishing. In less than a decade, South Korea has become an on-line game giant, exporting its products to every corner of the world. South Korea is itself a large consumption market for its own on-line games. The playing of on-line games is now a national pastime, with 35% of the entire population participating in on-line games. *Crazyracing Kartrider* (2004), a car-racing on-line game, has been patronized by one-third of the entire population. Online game centers (PC Bang in Korea) are everywhere, and their number is estimated at around 30,000, about six times more than that of convenience stores. Korean on-line games such as *Legend of Mir 2* (2001), *Lineage* (1998), and *Ragnarok On-line* (2001) created a commotion in Asia. In July 2002, there were 500,000 simultaneous users playing *Legend of Mir 2*, and in 2004, *Lineage* had 350,000 simultaneous users at its peak; the game has 6 million users in Korea and more than 10 million users in the world.

The Korean government and game manufacturers have made on-line gaming a respectable profession. Game tournaments with enormous cash awards are organized to nourish professional game players in South Korea and to attract top-tier players from all over the world. Large-scale game tournaments are usually held in a stadium or concert hall. The most important one is **World Cyber Games** (WCG), the world's largest e-sports tournament, held annually since 2000. In gaming circles, the winner of WCG is comparable to an Olympic gold medalist. Professional game players are licensed by the Ministry of Culture and Tourism of the Korean government. National team members are national heroes and public icons. Seo Ji-hoon, the former WCG champion, is one such example; more than 700,000 people have joined his fan club, outnumbering the fans of his counterparts in the singing or acting business. He makes appearances on TV programs and commercials as well as at public functions and was invited to visit Taiwan to see his fans there. To further enhance the status of professional game players, the Korean government revised its ordinances in 2006 to reduce or exempt them from national service.

The Korean model, which puts emphasis on the role of government, has had a very strong impact in Asia. Mainland **China**, for instance, is adopting the same model to develop its on-line game industry. Today, South Korea is facing competition from new on-line game powers such as Mainland China, Taiwan, the **United States**, and **Japan**, while South Korea's market share overseas is shrinking. South Korea's market share in the on-line game market of Mainland China has dropped from 70% to 30% and in Taiwan from 80% to 40%. The future of Korean on-line games has challenges ahead. ***See also*** Hong Kong; piracy in China.

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space (narrative)

Narrative space is an academic concept within **video game studies** for researching game space. The visual space (see "**space [visual]**") in combination with **narrative** elements forms the narrative space. These narrative elements can be divided into three categories: narrative sequences, exploration, and mapping.

Narrative sequences form the main storyline of a game. This can be done in various ways, for example, through the use of **cut-scenes**, dialogues, and quests. A cut-scene is an animation that is meant to convey certain information to the player. It can be used as a tool to develop the plot of the main narrative of the game. Cut-scenes mean a break in gameplay, whereas a "dialogue" forms a narrative sequence that can be used during gameplay. In *Grand Theft Auto IV* (2008)—the fourth game in the ***Grand Theft Auto* series**—players can still control their **avatar** while listening to dialogues that provide background information on the main storyline. Quests, as embedded in ***World of Warcraft*** (2004), offer another way of presenting narrative information to players. A quest is a task given to a player who receives a reward upon finishing it successfully. Often quests form chains, meaning players start with one quest, which upon completion is followed by another quest, thus forming storylines. Quests can also be used to guide players through the narrative of the game.

Exploration of a game's visual space by the player also forms an important narrative element of the narrative space. At the start of any game, players need to explore the space to learn how to progress and function within the **world** of the game. Exploration then entails the discovery of the game world but also the **navigation** of space. The ability to navigate through a space can create dramatic experiences (Murray, 1998). A space that a player has visited then becomes a space where narrative events have taken place. Previous to the players' interference the space could be defined as a **map**—an objectified spatial relation—whereas after the players' interference, it can be defined as a tour that represents the personalized journey through space (Newman, 2004). An example of games in which exploration forms the narrative space can be found in **shooting games** such as ***Doom*** (1993). In shooters, the game space is usually structured like a maze, wherein players have to navigate their way from one place to another. During their journey, they explore the space and create a narrative tour.

Players construct a mental map of the game while they piece together the narrative sequences and explore the space (Jenkins, 2006). This mental map changes and adapts every time players come upon new information and consequently players act on this mental map. The game space can then provide narrative descriptors (Salen and Zimmerman, 2004) that will assist the player's process of mapping. Narrative descriptors are objects visually present within the game world that give a narrative explanation. Through their use, narrative information does not have to be given directly in exposition, because players can draw their own conclusions and obtain information indirectly from the narrative space. Examples of the use of such narrative descriptors can be found in ***Myst*** (1993). In this game, players enter what appears to be an uninhabited game world in which they will have to gather clues to solve puzzles. At most locations, players can get a sense of what took place by reading the narrative descriptors, such as abandoned weapons that would explain the intentions of the owners. Players then use the information from the narrative descriptors to adjust their mental map accordingly to function within the game world—for instance, by considering the weapons' owners as evil and performing actions against them.

Narrative sequences, exploration, and mapping are also interconnected. A game can open with a cut-scene and through this narrative sequence the setting of the game is explained on which players can base their process of mapping. Players consequently act on this map by exploring the space, during which they stumble on new narrative sequences that influence the mental map. The way narrative space is constructed often depends on the type of game. In first-person **shooting games**, the emphasis lies usually on the exploration of space, whereas in many **role-playing games (RPGs)** narrative sequences can predominate, and almost all types of games require mapping by the players.

In **game design**, space—and thus narrative space—plays an important role in the construction of the game world and the player experience. Narrative space can give meaning to players' actions and provide them with more **immersion** and pleasure. Narrative space is often implicitly defined when mentioned in academic writing and is used in various ways dependent on the academic discipline using it; **ludology**, for example, focuses more on gameplay than narrative and thus would be more likely to examine exploration than narrative sequences. Even though there are a range of implicit concepts of narrative space used, there has been relatively little academic debate about the topic.

Judith Dormans

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space (visual)

Because of their nature as visual media, video games always involve some sort of **graphics**, which are usually used to represent some form of visual space in which the games' events take place (see also **space [narrative]**) and may also include nondiegetic spaces such as high-score screens or game instructions. Space in video games is different from that in **film** or **television** because of the interactivity available to the player, who often is able to determine which spaces are seen on-screen by moving the player-character and its point of view. An examination of game space, then, should consider how spaces are represented, their dimensionality, their connectivity, and whether they require **navigation**.

At any given point in a game, its spaces are either on-screen or off-screen. On-screen spaces are those visible to the player (representing the player-character's point of view or a third-person perspective of the player-character) and are usually those in which players are active. Off-screen space is often implied: by visible spaces that move on and off-screen (as in games with **scrolling**); off-screen sounds, events, or information (for example, in the radar scope in ***BattleZone*** [1980]); or with **maps** that reveal areas that the player has not yet seen. As in film, off-screen space is important in establishing a game **world** that is much larger than what appears on the screen, encouraging speculation and exploration.

Dimensionality refers to the fundamental structure of the space and may range from simple two-dimensional spaces that consist of a single game screen (like that of **Atari**'s *Tank!* [1974]), to so-called two-and-a-half dimensional spaces made up of layers of independent but overlapping planes (as in *Super* ***Mario*** *Bros.* [1985]), to games set in a computationally true three-dimensional space rendered in real time as the player-character moves through it (as in *Tomb Raider* [1996] or *Halo 2* [2004]). Some games simulate a third dimension through pre-rendered graphics (such as those using an axonometric perspective in *Zaxxon* [1982] and *SimCity 2000* [1993] or the first-person perspective imagery in ***Myst*** [1993]), lines or objects that suggest a first-person perspective (as in *Night Driver* [1976] and *Speed Freak* [1978]), scaling sprites that imply **z-axis depth** (as in *Pole Position* [1982] or *Space Harrier* [1985]), or objects redrawn in such a way that they appear to be turning in space (as in *Nebulus* [1987]). Other games using full-motion video (FMV) clips look three-dimensional (such as *Star Trek: Borg* [1996]), but as pre-rendered graphics they allow little or no interaction.

Games can also have spaces of mixed dimensionality. Different levels of the same game can have different dimensionality; for example, in the three-stage **shooting game** *Tac/Scan* (1982), the first stage is two-dimensional, similar to games such as *Galaxian* (1979) and ***Space Invaders*** (1978), but its second stage, "3-D Armada Attack," has players firing into the screen instead of up or down it. Mixed dimensionality can occur within a level as well, as in ***Doom*** (1993) and *Super Paper Mario* (2007), in which two-dimensional characters and objects move through a three-dimensional space. Games can even play with the notion of dimensionality, as in *Echochrome* (2008), in which players rotate objects in three dimensions, while reading them in two dimensions for the connections that the player-character uses to make sense.

The spaces of games can also be non-Euclidean in nature. Even the simple, single-screen wraparound space of *Asteroids* (1979) represents the surface of a non-Euclidean 2-torus. Other games link screens in such a way as to make their space non-Euclidean (such as ***Adventure*** [1979]), while others are designed in such a way that two or more different spaces seem to occupy the same space, depending on how they are entered (as in *Duke Nukem* [1996] and *levelHead* [2007]). Such games demonstrate the malleability of space available to the video game designer, who can connect spaces in ways that are nonintuitive and physically impossible.

Whether spaces are Euclidean depends on how they are connected to themselves or other spaces, and connectivity determines how spaces are structured. Connections between spaces can be indicated by the ability to move from one space to another, the ability to look into another adjacent space (as through a window) or by implication through the arrangement of spaces as on a map. Players often need to be able to identify which spaces are navigable by learning how to move and testing areas to see whether they can be entered. Even spaces a player-character cannot enter can be important because the player may be able to influence events there—for example, by shooting (as in *Space Invaders*, where the player-character is limited to moving across the bottom of the screen).

Finally, game spaces can be overlaid over physical spaces, as in games involving **augmented reality**, such as *Ghostwire* (2008) or *Sky Siege* (2009), which position game elements virtually in the space around the player, who must turn around and use a mobile device as a window to see what is occurring in the game. Pattern recognition and motion detection software will allow more augmented reality games to become available on systems with built-in cameras, such as the **Nintendo** DSi, the **PlayStation** Move, and the Kinect for the **Microsoft Xbox 360**.

Space, or the implication of space, must precede temporality and narrative because both require events and events require space. Thus, our awareness of space in a game comes before the temporal and narrative aspects (unless these are acquired through materials outside of the game itself, as is often the case). Spatial design usually gives the player some sense of the temporal and narrative structures of a game as well. These can be expanded through both innovative software and hardware designs that experiment with the representation, manipulation, and navigation of space. Questions regarding the design of video game spaces, how those spaces are connected, and how they are experienced are essential to video game studies and the study of the human experience of spatial representations in general.

Mark J. P. Wolf

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Space Invaders

Designed and programmed by engineer Toshihiro Nishikado, *Space Invaders* (1978) was the first **arcade game** released by the popular pachinko machine manufacturer, Taito. Interestingly, *Space Invaders* originated from an evaluation tool to test computer programmers' skill with hexadecimal mathematics. Because it was politically incorrect to harm humans in games at the time, the army onslaught was replaced with alien aggressors looking for global domination. Despite a lukewarm response from company executives, the game emerged and was released to little fanfare, at least initially.

After a few months, however, *Space Invaders* became so popular in **Japan** that it caused a shortage of the 100-yen coin, the coin needed to play the game. This shortage affected several other aspects of Japanese life including the heavy disruption of the primary form of transportation, the subway. *Space Invaders* had brought Japan to its knees and the government was literally forced to quadruple the production of the yen coin to meet the new demand.

Because of its intensifying popularity, entire **arcades** were opened in Japan specifically for *Space Invaders*, many of which held dozens of *Space Invader* games and no others. As hysteria concerning the game mounted, a number of shop owners abandoned their goods and converted their stores to video arcades, some complete with booming **audio** systems broadcasting the "thumping march" of the invaders into the streets. With the ever-growing demand, other venues starting hosting coin-operated machines, and *Space Invaders* had found a habitat everywhere—from pizza parlors, restaurants, and bars, to drug stores, laundry mats, roller rinks, grocery stores, and even such unlikely locales as funeral homes.

Before *Space Invaders,* a good run for a coin-op release was a few thousand machines. For *Space Invaders*, a staggering 500,000 plus coin-op machines were sold worldwide in the first year, 70% of which remained in Japan. In time, more than 100,000 *Space Invaders* games had been distributed, and more than 300,000 were built (if counterfeit versions are included). Billions of coins were pumped into the machines for the first few years, amassing more than $500 million in revenue for Taito, making the entire entertainment **industry** sit up and take notice.

A large portion of these coins came from teenagers eager to **play**. Unfortunately, many of them engaged in theft, robbery, and panhandling to acquire coins to get their fix. As a result, these inappropriate actions led to the first of what would become a trend of public outcries against the video game industry. In the **United States**, groups of concerned parents and government organizations that feared games tainted the minds of their school children worked their case to ban the machines all the way up to the United States Supreme Court (DeMaria and Wilson, 2002, p. 46).

The concept behind *Space Invaders* was simple in design; it was an **adaptation** of carnival shooting galleries. The player would guide a laser cannon located on the bottom of the screen from left to right to shoot down wave after wave of marching alien raiders. The laser cannon could hide behind four bunkers that served as obstructions, defending the laser cannon from the aliens' rays and bombs. The bunkers, and the player-controlled laser cannon, would eventually be destroyed by the relentless alien invasion that slowly advanced from the top of the screen to the bottom. On occasion, an alien spaceship, which could be shot down for bonus points, would fly across the top of the screen.

One factor that added to the hopeless tension created while playing the game was the increasing speed of the game as more invaders were destroyed. The aliens would move faster and faster, and the audio, reminiscent of the thumping sound of a beating heart, became more rapid during their descent. Although many identify this rapid increase as one of the greatest **game design** scenarios of all time, it was a result of hardware technicalities and not of intentional devising or fancy programming; the processor was able to update the screen more frequently as the number of enemies decreased. This resulted in the ramped-up speed of the aliens and the soundtrack.

Midway licensed *Space Invaders* from Taito and released the game in the United States. Although it did not create a quarter shortage, it was unparalleled in popularity. In a good location, the game could pay for itself in less than a month, placing video games among the most lucrative equipment a merchant could possess.

Atari, the American company with a Japanese name, recognized the opportunity and licensed the game for release on the **Atari VCS 2600** console. Whereas ***PONG*** (1972) was the first coin-op game to appear in the home in the form of a stand-alone unit, *Space Invaders* was the first video arcade game to be adapted to a home **console** on a physical, interchangeable **cartridge**. The VCS release of *Space Invaders* was also historical because it was the first game to be licensed by another company and adapted for play on a home console. The VCS conversion also expanded on the coin-op version by offering 255 different game play variations. Atari even focused its **advertising** budget and marketing efforts to sell *Space Invaders* the game, instead of the VCS console itself. As a result, sales of the VCS spiked, and *Space Invaders* became the first "killer app" (a must-have application that causes many people to buy a new system).

The Atari VCS 2600 had been released back in 1977, but it wasn't until consumers starting to purchase it with an accompanying copy of *Space Invaders* in 1980 that Atari's unit sales skyrocketed and the company began to empty their warehouse and excess stock of the 400,000 units (Herman, 1994, p. 38). Demand had become so high that the VCS had to be rationed out to retailers, and manufacturing production had to be stepped up. In addition to the system sales, the game sales of Atari's home version of *Space Invaders* grossed more than $100 million for Atari (Santulli, 2002, p. 72) and, combined, Atari's gross income reached $415 million. As a result, Atari's gross income more than doubled, leading its operating income to rocket to a third of its parent company Warner Communications. This in turn caused the stock to rise 35% resulting in Atari becoming the fastest-growing company in history (Herman, 1994, p. 43).

The crude sprite graphics of *Space Invaders*, although simplistic by today's standards, were groundbreaking at the time. The alien aggressors were the first characters to have individual animation while moving horizontally and vertically within the playing field. The creatures have also become icons for the industry and are widely recognized symbols of video gaming. *Space Invaders* is among the most influential video games ever created and took the world by storm, contributing to a video game craze that continues to this day.

Michael Thomasson

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Spacewar!

Spacewar! is a two-player space combat game originally created for the DEC PDP-1 minicomputer. Written during the winter of 1961–1962 by a group of students at the Massachusetts Institute of Technology, it is one of the earliest known graphical **computer games**.

The game was first conceived by J. Martin Graetz, Stephen Russell, and Wayne Witanen. Strongly inspired by contemporary science-fiction cinema and the space opera novels of E. E. Smith, it was designed as a "**hack**" demonstrating the capabilities of the computer and its cathode-ray tube (CRT) screen. The development began in December 1961. The core program was written by Stephen Russell, with assistance from Robert Saunders. The initial version was completed by February 1962. The game featured two spaceships, each with a limited supply of fuel and missiles. Using the switches on the computer's front panel to control rotation, thrust, and fire, the players attempted to destroy the opponent's ship. The combat was rendered across a randomly generated star field and limited to a single wraparound screen (objects travelling beyond the edges of the screen would immediately reenter on the opposite side, at the same angle and velocity).

With basic gameplay in place, the hacker community thriving around the MIT computer lab immediately proceeded to introduce various modifications to the program. Peter Samson integrated his *Expensive Planetarium* into the game, replacing the random background with a realistic representation of the night sky as seen from Cambridge, Massachusetts. Dan Edwards introduced a central star with a surrounding gravity well, putting the ships at constant risk of being pulled in and destroyed. This increased the overall difficulty of the game and introduced an element of strategy into gameplay, as skilled players were able to use the gravitational pull to gain speed and perform advanced maneuvers. Finally, Graetz added the "hyperspace jump"—a chance to escape perilous situations by warping the ship to a random destination on the screen. The game was finalized by April 1962.

Although the earliest known attempts to create a computer game date back to the early 1950s, *Spacewar!* differs from these early attempts in two significant respects. The earlier efforts typically consisted in adapting traditional **strategy games** (such as chess, nim, or tic-tac-toe) for computer play and were tied to unique, custom-built machines. In contrast, *Spacewar!* was designed from the ground up as a computer game and developed for a standardized hardware platform. With approximately 50 PDP-1 units in existence, the game was able to circulate (free of charge) between commercial and academic computing centers across the **United States**, gaining widespread popularity. It was also often modified and ported to other systems.

In the early 1970s, *Spacewar!* provided the template for the first coin-operated video game machines: ***Galaxy Game*** (1971), the earliest known coin-op video game; and ***Computer Space*** (1971), the first mass-produced **arcade** video game. The latter was designed by Nolan **Bushnell** and Ted Dabney, of Syzygy Engineering (incorporated the following year as **Atari**, Inc.), and distributed by Nutting Associates. The first arcade game utilizing **vector graphics**, **Cinematronics**'s *Space Wars* (1977), was also a *Spacewar!* clone.

P. Konrad Budziszewski

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Spain

Although Spain's **arcade game** production during the 1970s amounted to only a few electromechanical **games**, such as *Monza* (1977) and *Rally Cross* (1977), by the mid-1980s Spanish software finally emerged from the cave. This splendid period (1983–1989), known as "the golden age," arose through the efforts of a group of young freelance programmers who founded and established, for the first time in Spain, a rich ensemble of software companies, like Opera Soft, Indescomp, Made in Spain, Dinamic, Topo Soft, Zigurat, and Aventuras AD. Most of their games were developed for ZX Spectrum Sinclair, MSX, and Amstrand CPC. In terms of turnover, the Spanish video game **industry** became the second most important in **Europe** during the late 1980s, only surpassed by the United Kingdom. Spain's international success was due to games such as Indescomp's *Bugaboo* (1983), Topo Soft's *Survivor* (1987), and Dinamic's *Navy Moves* (1988).

The man who epitomized this golden age of Spanish software was Francisco "Paco" Menéndez (1965–1999), unanimously considered the best Spanish video game creator. Menéndez began his creative career with the adventure game *Fred* (1983) at Indescomp, and its sequel *Sir Fred* (1986) at Made in Spain, the latter being one of the most innovative games of that year. For his first solo project, Menéndez conceived of an ambitious unauthorized adaptation of Umberto Eco's celebrated novel *The Name of the Rose* (1980). Influenced by the games created by the Stamper brothers for Ultimate (especially *Knight Lore* [1984] and *Pentagram* [1986]), the game, eventually named *La Abadía del Crimen* (1988), is a deep and complex adventure, gorgeously designed by Menéndez and his collaborator Juan Delcán. The game was a milestone, still considered the best Spanish video game ever created, and one of the best games of all time for 8-bit machines.

In the 1990s, however, the Spanish video game industry collapsed. The companies were unable to adapt their production standards toward 16-bit platforms and succumbed. Only Dinamic survived thanks to their *PC Futbol* franchise of football management **simulation games**, which were massively successful in Spain. Another exception was Gaelco, one of the few Spanish companies to emerge during the 1990s, which specialized in arcade games like *Radical Bikers* (1998). Meanwhile, Bit Managers surfaced, developing a number of Infogrames titles like *Asterix & Obelix* (1995) for the **Super Nintendo Entertainment System (SNES)**. The most successful Spanish game of the decade, however, was the remarkable *Commandos* (1999) by Pyro Studios, a real-time tactical game conceived by Gonzo Suárez, a distinguished and veteran creator who debuted in Opera Soft during the "golden age" (in fact, *Commandos* is explicitly dedicated to the memory of his friend Paco Menéndez, who passed away that same year).

After another lost decade (of the 2000s), two new Spanish companies make up the center of attention: Akaoni Studio, whose *Zombie Panic in Wonderland* (2010) for WiiWare became the most downloaded game in **Japan**; and Mercury Steam Studio, with its excellent *Castlevania: Lords of Shadow* (2010), published by Konami for the **Microsoft Xbox 360** and the **Sony PlayStation 3** and supervised and supported by the great Hideo **Kojima**. Perhaps these developments herald the coming of a new golden age.

Alberto Flores del Río

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spatial navigation

See navigation (spatial)

Spector, Warren (1955–)

Warren Spector is a designer of **role-playing games (RPGs)** and **computer games**. He is notable for his work on the game *System Shock* and the ***Ultima***, *Wing Commander*, *Thief*, and *Deus Ex* game franchises. He holds a bachelor's degree in communications from Northwest University, Illinois, and a master's in **Television**, **Film**, and Radio from the University of Texas in Austin. Spector is married to fantasy writer Caroline L. Spector.

Spector began his professional career as a college professor. After teaching several undergraduate courses at the University of Texas and working a stint as an archivist at the Harry Ransom Center, Spector was offered a position at *Space Gamer Magazine*. In 1983, Spector was initially employed as an editor for the magazine but soon became the editor and chief of the company that owned the magazine, Steve Jackson Games. Spector began creating role-playing games for Steve

Warren Spector, role-playing and computer game designer, poses on October 27, 2010, in Paris during Paris Games Week. Spector designed the Disney game *Epic Mickey* (2010), which was developed by Junction Point Studios. (Franck Fife/AFP/Getty Images)

Jackson Games, his most noteworthy title being *Toon* (1984), a cartoon role-playing game that parodies many of the conventions of more standardized tabletop RPGs.

In 1987, Spector was hired by TSR Inc. where he helped develop titles such as *Top Secret/S.I.* (1987) and *Spelljammer* (1989), a *Dungeons & Dragons* campaign that features an outer space environment. He also cowrote a novel for TSR titled *Double Agent: Royal Pain/The Hollow Earth Affair* (1988).

Shortly after his work with TSR, Spector entered the computer game **industry**. Working with game developers Origin Systems, Looking Glass Studios, and **Electronic Arts (EA)**, Spector helped develop many popular software titles. Spector's game credits include *Wing Commander* (1990), *Wing Commander: The Secret Missions* (1990), *Ultima VI: The False Prophet* (1990), *Bad Blood* (1990), *Wing Commander II: Vengeance of the Kilrathi* (1991), *Wing Commander: The Secret Missions 2—Crusade* (1991), *Ultima: Worlds of Adventure 2: Martian Dreams* (1991), *Ultima Underworld: The Stygian Abyss* (1992), *Shadowcaster* (1993), *Ultima Underworld II: Labyrinth of Worlds* (1993), *Wing Commander Privateer: Righteous Fire* (1993), *Ultima VII, Part Two: The Serpent Isle* (1993), *Ultima VII, Part Two: The Silver Seed* (1993), *Wings of Glory* (1993), *System Shock* (1994), *Cybermage: Darklight Awakening* (1995), *Crusader: No Remorse* (1995), and *Thief: The Dark Project* (1998).

Spector is known to include cameos of his likeness in the games he works on.

In 1997, Spector founded the Austin branch of Ion Storm Inc. While at Ion Storm, Spector developed the titles *Deux Ex* (2000), *Deus Ex: Invisible War* (2003), and *Thief: Deadly Shadows* (2004). He left Ion Storm in 2004 to establish a new company, Junction Point Studios. Disney Interactive acquired Junction Point Studios in 2007. In 2010, his first project with Disney Interactive, *Epic Mickey*, was released. The game is set in a steampunk environment and was developed exclusively for the **Nintendo Wii**.

Aaron D. Boothroyd

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speedruns

A speedrun is a popular method of game **replay** in which the goal is to achieve the quickest possible completion time for a level, quest, or the entire game regardless of the intended gameplay, **world** exploration, and in-game accolades. It is dissimilar from time-based speed challenges found within designed games as speedruns emerge from gaming communities as alternative modes of competitive **play**. The rapid replay is meant to showcase a player's skill and memorization of a game environment, proving gaming prowess through a record speed finish. This mode took place in some early game playing (for example, ***Doom*** [1993]), but it is most visibly displayed and shared at on-line video sites like YouTube with the help of recording software and **game engine emulators**. Beyond individual player status and community rivalry, speedruns reveal game mechanics and its software complexity as the technique subverts intended game paths.

Speedruns are typically attempted with classic games without evolving **artificial intelligence**–programmed computer enemies and environments, both outside early technical software abilities, making memorization easier to achieve. Games relying on **repetition** rather than randomization provide players the opportunity to replay for speed rather than experience. Although there are speedruns performed for contemporary games, their completion times are significantly longer than their classic generic game counterparts. Moreover, speedruns can expose the inability for many game structures to provide multiple alternate replay experiences based on how quickly players can complete their speedruns. The speedrun replay is an alternate path to game completion meant to act as a challenge and therefore, operates differently from other replay modes emerging from gaming circles such as the **walkthrough** or the long play, both meant to preserve play while relaying game mechanics and strategies to fellow players.

Racquel M. Gonzales

spirituality

Spirituality is a broad category that generally refers to the personal experience of a religious tradition or other sacred phenomenon. Put another way, spirituality tends to emphasize the subjective qualities—such as feeling, attitude, perception, value—that arise from an encounter with the transcendent. In some cases, video games attempt to simulate or facilitate a form of spiritual experience.

The interdisciplinary study of spirituality emerged as an academic pursuit throughout the 20th and into the 21st century. In 1902, William James suggested that religious (or spiritual) experience was heterogeneous, expressing itself in a rich variety of emotions and behaviors as a response to the mystical and transcendental. Later, Rudolf Otto described spiritual experience in terms of the "numinous"—a nonrational sense of fascination and awe, of solemnity and longing that manifests itself in an encounter with the "wholly other" (Otto, [1923] 1958; cf. Jung, 1938). In a 1999 meta-analysis, researchers suggested that spirituality could best be understood as the integration of traditional religious categories with personal and social phenomena (Zinnbauer, Pargament, and Scott, 1999). Other researchers have suggested that spirituality may be linked to a neurological impulse arising from "the brain's ability to transcend the limited self and perceive a larger, more fundamental reality" (Newberg, D'Aquili, and Rause, 2001, p. 175). More recently, a wider range of researchers (Benson et al., 2003) have also suggested that spirituality is "hardwired" in the brain—that the need for transcendence and moral meaning is intrinsically located within close, deep, social connections.

Interestingly, technology theorists suppose that computer technology may foster an experience of self-transcendence. Norbert Wiener (1964) suggests that self-transcendence is a by-product of creating various forms of artificial life. Bruce Mazlish (1993, p. 195) concurs, suggesting that the quest for self-transcendence through the creation of computer technologies and simulated **worlds** appears to be "one of humanity's deepest aspirations." Michael Heim notes that **virtual reality** can set the stage for "an experience of the sublime or awesome" (1993, p. 137). He links this experience with *eros*—"a drive to extend our finite being" and "to heighten the intensity of our lives" (1993, p. 87).

Some video game theorists and researchers also suggest that video games may be able to foster a form of spiritual experience. For example, James Paul Gee suggests that video games may be good for the "soul." Gee identifies the soul with "our **emotions** and imagination" (Gee, 2005, p. 7). He theorizes that video games possess the capacity to feed the soul with meaning and significance along the way to human growth and development (Gee, 2005, p. 119). Edward Castronova argues that "synthetic worlds" present players with transcendent vistas that evoke a sense of longing, mediate a sense of sublimity, and inspire a sense of reverence (Castronova, 2005, pp. 106–112; Castronova, 2007, pp. 206–207). Christopher Scholtz (2004, 2005) speculates that video games may evoke an experience of joy and fascination that compares favorably to spiritual experience. More recently, Kutter Callaway (2010) imagines that video game **play** through systems such as the **Nintendo Wii** may facilitate a form of experiential integration—sensual, somatic, affective, and holistic—that supports spiritual experience.

Richard **Garriott**'s ***Ultima** IV: Quest of the Avatar* (1985) stands as one of the earliest attempts at integrating spirituality with video **game design**. In *Ultima IV*, the player seeks moral perfection on a spiritual quest to save the world. In fact, "spirituality" is one of the eight virtues that the **Avatar** must contemplate and practice. Although Garriott remarks at one point that *Ultima IV's* aims are philosophical, not religious (Addams, 1990, pp. 40–42), elsewhere he remarks that the player is the "spiritual essence" of the Avatar (Herz, 1997, p. 157), and that spirituality, religion, and **morality and ethics** lend "credibility and completeness" to game worlds (Bub, 2002).

Other historic examples exist in which video game designers experiment with in-game spirituality. Peter **Molyneux** designed *Populous* (1989)—an ancestor of many **god games** later to come—as a playful **simulation** of divine-human relations. Wisdom Tree Games published a series of religious video games for the **Nintendo Entertainment System (NES)** including *Bible Adventures* (1991) and *Spiritual Warfare* (1992). Rand and Robyn Miller created ***Myst*** (1993) and its sequels as an aesthetic expression of their Christian faith and worldview (Swain, 2010). More recently, the work of Tracy Fullerton (2005) at the **Electronic Arts** Game Innovation Lab at the University of Southern California seeks to construct a **procedural rhetoric** of spiritual perception—particularly contemplation and mystical experience. In contrast, the real-time **strategy game** *Left Behind: Eternal Forces* (2006) attempts to construct a procedural rhetoric of spiritual indoctrination from a fundamentalist perspective.

Patrick Slattery ([1992] 1999, 2006) suggests that spiritual experience is often mediated through a proleptic moment—a moment in **time** when personal awareness of the past and future powerfully converge in the present, overwhelming the subject with insight and revelation. A few current video games effectively utilize the proleptic moment as a means of simulating and facilitating spiritual experience for the player. Drew Davidson's *Well Played 1.0: Video Games, Value and Meaning* (2009) recounts a wide range of autobiographical narratives in which players occasionally describe the power of in-game proleptic moments—moments when time, meaning, and contemplation converge. The player narratives about *Mines of Minos* (1982), *Shadow of the Colossus* (2005), and *Passage* (2007) bear particular weight. The **platform** game *Braid* (2008) also structures a proleptic moment through its **narrative** and **ludological** qualities.

Finally, some video game designers seek to incorporate an aesthetic of transcendence in video game play as a means to meditation and relaxation. *Journey to Wild Divine* (2003) uses biofeedback fingertip monitors to assist players into contemplative peace throughout gameplay. *Cloud* (2005) enables the player to lazily fly and gather clouds over a series of islands and landscapes from a bird's-eye view. *Flower* (2009) invites the player to control the wind from a first-person perspective, floating over pastoral vistas, gathering petals, and restoring color to the countryside. *Guru Meditation* (2009) uses either the Amiga Joyboard or iPhone accelerometer to monitor "legitimate zen meditation" (Bogost, 2009).

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sports games

Sports games are one of the most popular types of video game on the market. A sports game may be defined as a game attempting to simulate an activity akin to real world sport. Different sports games will simulate sport in different ways and in varying degrees of realism, but all sports games provide some approximation of sport to their players. Sports games have also played an important role in the **history of video games**.

History

Some consider a simulation loosely based on sport, Willy Higginbotham's *Tennis for Two* (1958), to be the very first video game. Like *Tennis for Two,* many of the oldest sports games enabled gamers to bring their experience of real world sport to the simplistic **graphics** of these early games. Sport provided an easy way to make sense of blocky pixels bouncing around the screen. In 1966, Ralph **Baer** began creating a ping-pong-like game for use with a **television**, and he invented a hockey game for television one year later. In 1972, Nolan **Bushnell** adapted Baer's game into ***PONG***, the first widely played sports game and video game, and many other imitations appeared in the home game market. Other early sports game titles included *World Cup Football* (1974) and *Grand Track 10* and *Grand Track 20* (1974). **Atari**'s *Football* (1978) introduced gamers to two-way **scrolling** and helped popularize the trackball **controller** mechanism.

During the 1980s, sports games were released for home **consoles** such as the **Atari VCS 2600** and the **Mattel Intellivision** and for computers such as the Commodore 64, Amiga, Apple II, and the IBM PC. Varying television-style camera angles debuted during this period with *World Series Baseball* (1982) for the Intellivision. In a push to make sports games more realistic, sports game developers struck licensing deals with professional athletes, teams, and sports organizations (discussed below). Some sports game developers consulted coaches and placed them on their covers to promote and legitimize their games as viable **simulations**. Examples of these games include *Earl Weaver Baseball* (1987) and *John Madden Football* (1988) from **Electronic Arts (EA)**.

In 1993, Electronic Arts established a unit exclusively devoted to sports games, EA Sports. Since then, EA Sports has created and published some of the most successful video game franchises ever. These franchises include the *NBA Live* basketball series, the *FIFA* soccer series, the *NHL* hockey series, the *Tiger Woods PGA Golf* series, and, most famously, the *Madden Football* series. Although other sports game developers had created games stressing realistic statistics, player physics, and **graphics**, EA Sports oriented its entire marketing and development focus around a commitment to realism in every area of its simulations. EA Sports also began the practice of releasing a new version of a sports game with the opening of each real-**world** sports season. Over the course of its history, EA Sports has published games based on auto racing, baseball, rugby, cricket, Australian **rules** football, boxing, tennis, and personal training.

Although other companies competed with EA Sports throughout the 1990s and into the 21st century, Take Two Interactive's daughter company, 2K Sports, and first-party companies like **Sony** and **Nintendo** presently exist as its primary competition. 2K Sports and Sony have created games that rival EA Sports, and Nintendo has used its **Wii** motion controller to promote its popular *Wii Sports*.

Game Types

The sports game genre can be divided into various subcategories that lie on a simulation continuum. Games that attempt to realistically simulate outcomes exist at one end and games that have little interest in realistic outcomes are at the other (Conway, 2007).

The first category of sports games features those that attempt to simulate the outcomes of real-world sport to the greatest degree. Conway (2007) calls these games "management **simulations**." Typically, players call these types of sports games text sims (short for "simulations") and **play** them predominantly on the personal computer. They are often geared toward players who want to manage or coach a team rather than control its players. As a result, the text sim emphasizes strategy and planning more than quick reflexes. The text sim label has been applied to this type of game because much, if not all, of a given game's action occurs via text. The player does not see his or her team move around a virtual field or stadium. Instead, the player reads the outcome of a specific play in game reports or learns what has occurred through statistical information. This statistical information serves as the key focus of the text sim. Text sims strive to achieve realistic statistical outcomes. As such, the computer's power is dedicated to complex calculations to generate plausible results. Recent titles in this subcategory of sports games have begun to integrate simple graphical representations of in-game action, but many text sims still leave these graphics out of gameplay. Because they do not emphasize graphics that require large development teams, these games are often developed independently by individuals or small studios. Examples of text sims include the *Football Manager* series, the *Out of the Park Baseball* series and the *Front Office Football* series.

At the opposite end of the spectrum are a subcategory of sports games that make no attempt to achieve realistic statistical outcomes. Conway (2007) labels these games "extreme simulations." Extreme simulations are played predominantly on home consoles. They are intended for the player who has little or no interest in whether a virtual athlete performs at the same level in the game as in real life. In contrast to text sims, these games are not concerned about accurately simulating games, seasons, or careers. Instead, extreme simulations emphasize a fast pace and exaggerate the most exciting elements of the sports they represent. As players control their teams, the athletes in these games can perform actions they could never perform in real-world sports. One of the first widely popular extreme simulations was the **arcade** hit *NBA Jam* (1993) from **Midway Games**.

The most prominent publisher in this category is EA Sports Big. Examples of games in this category include the *NBA Street* basketball series, *The Bigs* baseball series, and the *SSX* snowboarding series.

In between these two extremes of dedicated statistical realism and little, if any, focus on believable outcomes are those sports games that attempt to simulate real-world sports but allow the player to directly influence results. Conway (2007) calls these types of games "action simulations." Action simulations are most often played on home consoles but are also played on personal computers. They are intended for players who want to take control of their favorite teams and athletes to see if they can do better than their squad's real-world performance. Like management simulations, these games aim for statistical plausibility. Like extreme simulations, these games allow for players to control the athletes on the screen. However, games in this category differ by providing a middle ground between realistic statistical outcomes and the actions players can control on-screen. Unlike management simulations, action simulations do not demand realistic statistical outcomes. Unlike extreme simulations, action simulations do not allow players to move in physically unrealistic ways. As a result, these types of sports games provide a middle ground between the other two categories, through detailed graphical realism that replicates the nuances of stadiums as well as athletes' appearances, equipment choices, and athletic movement. In action simulation games, players see something similar to what they would see while watching a sporting event on television. Examples of action simulations include the *Madden Football* series, the *FIFA Football* series, and the *NBA 2K* series.

Licenses

One of the most important issues in the history of the sports game has been that of licenses. Professional sports leagues and organizations recognized that additional revenue could be gained from sports video games and subsequently began selling licenses to game developers. Game developers realized that sports game players would be more likely to purchase games featuring real teams and athletes. These licenses allowed developers to use real team names and logos and the names and likenesses of real players.

The first licensed sports game appeared in 1983 with the release of EA's basketball title, *Dr. J and Larry Bird Go One on One*. Over the course of the next 20 years, licensing became quite commonplace. However, in 2004 the licensing landscape changed considerably. Throughout the late summer and early fall of 2004, rival game publishers, 2K and EA Sports, fought a battle for consumer loyalty over their football titles. 2K's *ESPN NFL 2K5* (2004) competed against EA Sports's *Madden Football 2005* (2004). 2K had sold its game for $19.99, well below that of EA's offering. *ESPN NFL 2K5* sold well enough that it began to bite into EA's considerable *Madden* customer base. On December 13, 2004, EA announced that it had signed an exclusive five-year deal with the National Football League, making them the only company that would be allowed to produce football games featuring NFL teams, logos, stadiums, and players. On February 12, 2008, EA extended the agreement through the

2012 season. Although EA had negotiated exclusive deals with other less popular professional sports organizations before, the magnitude of this agreement was a watershed in sports game history.

In 2005, rival publisher, Take Two, struck a similar deal with Major League Baseball (MLB) that provided them exclusive rights to MLB and its associated properties. This agreement did allow console makers to develop MLB games, but prevented other developers and publishers (like EA) from making games using professional players and teams.

To take advantage of these exclusive deals, sports game developers have increasingly begun to release licensed titles in each of the three subgenres outlined earlier. For example, after EA Sports's agreement with the NFL, the company not only continued publishing the action simulation *Madden Football* but also developed the extreme simulation *NFL Street* and the management simulation *NFL Head Coach*. In a similar way, 2K expanded its action simulation *MLB 2K* baseball series into the extreme simulation, *The Bigs*, and the management simulation, *MLB Front Office Manager*.

These exclusive licensing deals were not welcomed by all. In September 2008, former NFL players successfully sued EA and the NFL Players Association for failing to share revenue deriving from the lucrative licensing agreement (Sinclair, "Madden Suit Sacks Players Union," 2008). In 2009, a similar lawsuit was filed against EA and the National Collegiate Athletics Association (NCAA) by former Arizona State quarterback, Sam Keller. Keller charged the company with failing to compensate him and other collegiate football players for using his likeness in their game (AP/ESPN, 2009). Some gamers have also had problems with these exclusive licensing deals. Less than six months after EA extended its agreement with the NFL, two gamers filed a class-action lawsuit against the company charging it with anticompetitive activity (Sinclair, "Gamers Sue," 2008). As of this writing, both lawsuits remain unsettled.

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StarCraft

StarCraft is a real-time strategy (RTS) **computer game** designed by Chris Metzen and James Phinney, developed by Blizzard Entertainment, and released March 31, 1998. Its expansion, *Brood War*, came out in 1999. The game was adapted for the **Nintendo 64** in 2000 under the name *StarCraft 64*. The *StarCraft* universe was further developed in novels and *mangas*, and the first episode of its sequel, *StarCraft II: Wings of Liberty*, was released in 2010.

StarCraft has a science-fiction setting; three species are fighting each other in a sector of the galaxy. The Terrans are humans, criminals exiled from Earth a long time ago. The Zergs are giant, insectlike creatures of various forms morphed from larvaes and controlled by a central brain. The Protoss are thin aliens that gain their power from psychic capabilities and robotic technologies. Not only is each species fighting the others, but there are internal struggles within each species for different interests in the galaxy.

The game follows most of the genre's conventions of the **time**. Players must establish a base and collect resources (minerals and vespene gas) to build military units and lead their armies into combat. The game uses a mouse and keyboard, and players click on units or buildings to issue orders, which will be carried out automatically. Units and buildings have different characteristics (hit points, attack score, armor, and so on) and special abilities that influence the results of combat. Each power-up in the game is ordered in a "tech tree": in addition to an amount of resources needed, the construction of certain buildings is a prerequisite for new units, buildings, technologies, and upgrades. Collecting resources implies that the player constructs and defends new bases all over the **map**. Standard games are over when a player (or a team of allied players) destroys all of its opponent's buildings.

The narrative consists of six single-player campaigns—three in the original game and three added with the expansion. Each campaign is an episode of the whole storyline and allows the player to gain control of a specific faction (Terran, Zerg, and Protoss). The player has to fulfill the objectives of a scenario to move on to the next, objectives that could be as diverse as "survive for 30 minutes," "bring a unit to a specific location," or simply "destroy the enemy camp."

The first drafts of the game were very similar to Blizzard Entertainment's precedent work in the RTS genre, *Warcraft II: Tides of Darkness* (1995). In 1998, *StarCraft* still used two-dimensional **graphics** even though other RTSs had already begun using three-dimensional graphics in 1997 (in *Age of Empires* and *Total Annihilation*), and it borrowed many gameplay elements from its predecessors. Nonetheless, *StarCraft* raised the standards in several ways.

First, as in the already established *Command & Conquer* series, the story was delivered through deep character development and impressive voice acting. Most storylines in RTSs at the time were given between scenarios—sometimes as text only—and could be easily skipped without losing the overall feeling of the game. However, at the core of its narrative and campaign gameplay, *StarCraft* featured "heroes" who were characters as well as in-game units and who talk to the player and to each other between the scenarios and during the game, resulting in gaming sequences that are more involved in the campaign narrative.

Second, *StarCraft* is considered one of the most balanced multiplayer RTS games, meaning that the unique characteristics of each faction do not give them advantages over the other factions. This balance is asymmetrical: each of the three races has a different set of units, buildings, technologies, and special abilities, as opposed to other RTS games of the time that had very similar factions, making the "art of balance" an easier task. Twelve years after the original release, the three races were still balanced, though *StarCraft* had an expansion and was patched many times to maintain this balance.

Third, in terms of gameplay, the importance of micromanagement is one of *StarCraft*'s defining characteristics; unit control is an important factor in the result of a combat and is essential for most of the special abilities. This micromanagement requires a lot of execution skills, which was seen as a lack in the **interface** by some but considered an interesting challenge by others.

Moreover, the *StarCraft* "campaign editor" had functionalities that made it possible for players to create scenarios where the **rules** of the game are changed. The Battle.net server, Blizzard Entertainment's gaming network, hosted custom games with special rules that changed the gaming experience. Hardcore players preferred the "ladder" side of the multiplayer games, a mode using only a set of approved maps, where the game keeps score of the players' results. Although Blizzard does not support a ladder system anymore for *StarCraft*, elite players can still challenge each other within a similar system through third-party servers, such as ICCup.com.

South Korean gamers compete against each other during a TJB *StarCraft* cyber game tournament in Taejeon on August 18, 2001. (Kim Jae-Hwan/AFP/Getty Images)

What makes *StarCraft* unique, though, is the fact that it gained the status of an "e-sport" (electronic sport) and saw the emergence of a professional gaming scene in **South Korea**. Television channels broadcast games and hosted leagues, such as the Ongamenet Starleague (OSL) and the MBCGame Starleague (MSL). South Korean companies sponsor professional teams, such as Samsung KHAN and SK Telecom T1, and some *StarCraft* players are even seen as celebrities. The e-sport's integrity was even hurt in 2010 when match-fixing and an illegal gambling scandal surfaced, demonstrating that the e-sport scene faces problems similar to those in traditional sports. Although other games are played in competitions all over the **world**, *StarCraft* is one of the first and most long-lasting of them, officially in competition in the **World Cyber Games** since the beginning in 2000.

If the RTS is sometimes thought to be a genre in stagnation, *StarCraft* was released at the pinnacle of its golden age. Even though other RTSs have a certain audience in the professional gaming scene, *StarCraft* already has a place in video game **history**, for its exemplary use of the conventions of the genre and for having held gamers' and spectators' interest for more than a decade.

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stealth games

Stealth is a gameplay style that involves sneaking, subterfuge, and secrecy as opposed to direct assault. The main player activity usually involves **navigating** an **avatar** around an environment full of dangerous opponents, all of whom are initially unaware of the player's presence. The player attempts to maintain this secrecy for as long as possible while engaged in other activities. What these activities are depends greatly on the game, but common ones include theft, sabotage, or escape. The ease with which these goals can be achieved can often be strategically adjusted by eliminating opponents. The most typical form of elimination involves sneaking up behind opponents to subdue them, often referred to as a "stealth kill" or "stealth takedown" depending on whether the move is lethal or nonlethal. If the player makes a mistake and is discovered, gameplay usually switches to some sort of action-based schema involving gunplay or mêlée combat. Depending on the game, the player's avatar may be weak in combat or strong, making the penalty for mistakes very different. In some games, the only course of action in the event of being discovered is flight. In others, it may be possible to take out all opponents in a head-on confrontation. The avatar's combat prowess often determines to what extent stealth is a necessity or a choice, making the centrality of stealth to a game's generic identity somewhat flexible. A game can emphasize stealth as a major style of **play**, a minor style of play, or on equal footing with direct confrontation. Some games emphasize stealth as a major style of play, even with a combat-ready avatar, by punishing the player for being seen by means other than death (such as a bad "stealth rating" or loss of resources). The natural rhythms of stealth gameplay are essentially the sustained tensions of a game of hide-and-seek, with long periods of silence and secrecy punctuated by quick bouts of frantic action.

The history of stealth in games might be described differently whether one is talking about stealth as a gameplay style or stealth as a genre. Stealth as a gameplay style appeared to a lesser or greater degree in many games before it became recognized as a genre, and it still crops up in games even if the genre is not exclusively stealth. The earliest example of stealth gameplay is arguably *Castle Wolfenstein* (1981), a top-down shooting game in which it was advantageous to shoot Nazis from behind. ***Metal Gear*** (1987) is another, more complicated example of early stealth gameplay, with a fully developed military espionage setting that gives context and coherence to its gameplay. Because of *Metal Gear*'s great emphasis on stealth (sneaking was, in fact, not just the best strategy but the only strategy) it has been retroactively labeled a stealth game by some, even though the term was never applied to *Metal Gear* by its own makers. The third *Metal Gear* game, *Meta Gear Solid* (1998), coined the term "tactical espionage action" in reference to the fact that the gameplay alternated between sneaking and spectacular action set-pieces. This combination kept *Metal Gear*'s relationship to the emerging stealth genre ambiguous, even though it pioneered much of the genre's foundational concepts. Other games emerging around the same time, such as *Thief: The Dark Project* (1998), *Tenchu: Stealth Assassins* (1998), and *Hitman: Codename 47* (2000), were more visibly laying the groundwork for stealth as a genre, given that they relied almost completely on sneaking and offered far more brutal consequences for failure. Such games were successful in their employment of stealth gameplay but also were somewhat **experimental**. It wasn't until around the time the Tom Clancy-licensed espionage game *Splinter Cell* (2002) was released that the phrase "stealth game" began to emerge as a descriptive phrase for what had already become an obvious trend in **game design**.

Since then there have been many game series that self-identify as stealth (such as *Manhunt* [2003]), as hybrids of stealth and some other gameplay genre (such as the *Sly Cooper* series), and some that do not self-identify as stealth but include stealth gameplay elements regardless (such as the *Tomb Raider* series). Stealth continues to be an important gameplay style today, consistently appearing to a lesser degree in many games across many genres, but stealth as a genre in and of itself is not as prominent as it once was. Many of the franchises that helped define stealth as a genre—*Hitman*, *Splinter Cell*, *Metal Gear*, *Tenchu*, and so forth—have enjoyed less popularity and number of releases in recent years, and the ones that have remained popular have experimented with adding more action-based mechanics, subtly diluting their identities as explicitly "stealth" games. The future of the stealth genre thus remains uncertain, although it seems to have left enough of an impression on general trends in game design to remain a recognizable gameplay style for future developers to employ for whatever purpose they choose.

Matthew Weise

strategy games

A strategy game is one that emphasizes thoughtful and planned use of resources to achieve victory. The genre has a long history, was a prominent part of the early **history of video games**, and is still a significant part of today's video game **industry** and culture. Because strategy games typically demand extended **play** sessions, they were better-suited to the early **mainframe** and home computer **platforms** than the quarter-swallowing, short-play action games of the **arcade**. The genre is still strongly associated with personal computers. There are numerous varieties of strategy games, and many other genres, such as **role-playing games (RPGs)**, platform games, and even action games incorporate strategy elements.

Within the domain of video games, the term "strategy" usually applies to things such as the management and development of in-game resources, such as the wood and gold of *Warcraft III* (2002); the judicious timing of combat or other kinds of conflict, such as taking an opponent's piece in *Battle Chess* (1988); and the exploration of game **worlds** to gain advantages, such as sending scout units to discover the world **map** in *Civilization II* (1996). All of these actions have costs and potential benefits. Exploration in the *Civilization* games, for example, requires the player to spend build points creating scout units and requires tasking those units to exploration when they could be doing something else. These costs are balanced by opportunities to find valuable resources to exploit, scouting enemy military forces, and finding new locations to build cities. The player therefore must make strategic decisions about the amount, speed, and kind of exploration to engage in. Inevitably, different kinds of strategic decisions have an impact on each other: creating exploration units has an impact on economic planning and military options.

Video games that are called strategy games always emphasize deliberate planning of gameplay decisions. This often means these types of games place little or no emphasis on the motor-skills of a player, such as the turn-based game *Panzer General: Allied Assault* (2009). Many strategy games, such as *Company of Heroes* (2006), are indeed fast-paced, but whatever benefits a player's speed and reflexes grant, intelligent play is crucial to beating an opponent of a similar skill level. In addition, many games that are *not* called strategy games incorporate video game elements that are typically part of the strategy genre. For example, most games labeled "**simulations**"—such as *SimCity 4* (2003)—involve careful strategic management of resources. Even action and role-playing games like *Fable II* (2008) allow for strategic investments and character developments that are reminiscent of strategy gameplay.

The line between strategy and tactics in video games is a contested one. Typically, the word "strategy" applies to decisions that affect the global state of gameplay (such as which technologies to pursue in *Rise of Nations* [2003]) or games that focus on high-level decision making (such as Chris Crawford's *The Global Dilemma: Guns or Butter* [1990], which has a player determine whether a country should invest primarily in military might or economic development). "Tactics" usually apply to decisions that affect only parts of the game (such as orders given to units in combat in *Starcraft* [1998]) or to games that focus on unit-level decision making (such as the action/role-playing/strategy hybrid *The Valkyria Chronicles* [2008]). In other words, strategy games will typically focus on things such as geopolitics, management of economic systems, or the movement of entire armies, whereas tactical games might look at managing an individual political campaign or controlling a limited number of units on an individual battlefield. In practice, however, the terms are often used interchangeably.

Strategy games have a very long history. Arguably, most of the classic **board games** existing before the video game era—like the ancient Egyptian game Senet, chess, or *Monopoly*—are strategy games. However, most of today's strategy video games find their roots in some way, shape, or form in modern war-gaming, which dates back to military training games developed in the 1800s. Although armies continued to train officers this way in the 20th century, small groups of war-gaming enthusiasts played similar battle and **war** simulations for entertainment. These board games ranged from simple ones like *Risk* (1959), to complicated, detailed recreations of war, like Avalon Hill's *Blitzkrieg* (1965). This gaming culture gave birth to role-playing games (via *Chainmail* and *Dungeons & Dragons*) and set the style and tone for early strategy games.

The mainframe computer culture of the 1960s and 1970s produced a number of text-based strategy games whose program code circulated freely and constantly morphed as programmers modified the games. *Civil War*, for example, was a 1968 game that simulated high-level strategic approaches to Civil War battles. *Empire* (usually attributed to Peter Langston) is a multiplayer conquest game from the early 1970s and *Hamurabi* [*sic*] (widely attributed to Richard Merrill) is an extremely influential economic management game set in ancient Sumer that dates back at least to 1969. Other early games with strategic elements include Gregory Yob's maze puzzle game *Hunt the Wumpus* (1972) and the pioneer travel game *The Oregon Trail* (1971).

Most of these games were ideal for the new home computer market of the 1970s and early 1980s, as the programs required few graphic capabilities and little processing power. Text-based strategy games were released as line-by-line programs in computer enthusiast magazines such as *Creative Computing*, but by the 1980s, some games were marketed as a manufactured product, usually featuring at least rudimentary **graphics** and were sometimes almost as visually advanced as home computer action games. Examples include the space colonization management simulation *M.U.L.E.* (1983), the New World conquest game *The Seven Cities of Gold* (1984), and SSI's space empire-builder *Imperium Galacticum* (1984). More action-oriented games had significant strategic elements, like the cartoon combat game *Spy vs. Spy* (1984) or medieval knight simulator *Defender of the Crown* (1986).

Several important subgenres of strategy games became industry standards in the 1990s. The release of *Sid Meier's Civilization* (1991) helped to create the "4X" (eXplore, eXpand, eXploit, eXterminate) subgenre, a term coined by Alan Emrich in 1993 and widely used today by gamers and the game industry. These games are typically highly complex, large-scale games that require players to explore worlds to find resources necessary to grow their power and defeat their enemies. Games explicitly identified as 4X are typically turn-based strategy games. Whereas *Civilization* was hardly the first game to incorporate these gameplay elements—some aspects of the subgenre clearly date back at least as far as *Hamurabi*—its success encouraged the publication of a spate of similar games, such as *Masters of Orion* (1993), *Masters of Magic* (1994), and *Colonization* (1994). These games are also often called "**god games**" because they give the player god-like powers over vast territories, cultures, and stretches of **time**.

A larger, commercial subgenre (and one that is well defined and recognized in the gaming industry and community) is the real-time strategy (RTS) game that effectively started with *Dune II* (1992). These games, like many 4X games, typically emphasize the accumulation of resources and production of combat units. However, game action is real-time (the games are not turn based, as discussed below), and most RTS games require the construction of buildings in a base to progress and create units. Again, several games with similar gameplay elements, like *The Ancient Art of War* (1984), preceded *Dune II*, but the latter game very quickly inspired a large group of similar titles, such as *Warcraft: Orcs & Humans* (1994), *Command and Conquer* (1995), *Age of Empires* (1997), and ***StarCraft*** (1998).

Strategy games fall into a number of categories (beyond the well-defined subgenres listed earlier). One of the big division lines among strategy games is whether they are turn based, such as the fantasy war-game *Heroes of Might and Magic* (1995), or real-time, such as *Syndicate* (1993). The former waits for players to complete turns before the game proceeds, and the latter allows activity to continually occur, whether the players act or not.

Another distinguishing characteristic that separates many strategy games is whether they are real-world simulations. Strategy classics such as the *Civilization* or ***SimCity*** series attempt to model actual history, economic development, and political systems, whereas digital versions of games such as Go or backgammon are clearly **abstract**, and many strategy video games simulate fantasy worlds like the space conquest game *Galactic Civilizations* (2003).

Strategy games also vary in terms of the number of players involved and to what degree **artificial intelligence (AI)** is involved. Many strategy games are single-player games in which the player struggles against the computer, such as the original *Civilization*. Other games, like *Warhammer 40,000: Dawn of War* (2004) feature both single-player campaigns and multiplayer styles of play. Multiplayer games can allow for "hotseat" play (multiple humans taking turns on the same computer, such as in *Gold of the Americas* [1989]); play over the Internet or local networks, such as *Empire: Total War* (2009); or the computer taking the role of players via AI, such as in *Battle for Middle-Earth* (2004).

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Street Fighter II

Street Fighter II refers to a subseries of six (excluding **hacks** and nonofficial modifications) **fighting games** developed by **Capcom** for the **arcade**. The first iteration, *Street Fighter II—The World Warrior* (1991) was built on several conventions established in the earlier *Street Fighter* (1987). In *Street Fighter II*, two characters engage in one-on-one combat using a variety of punches, kicks, and special attacks to deplete each other's **health** meters. When a character runs out of health he or she is knocked out and the opponent wins the round; the first to win two rounds wins the match. Rounds are also timed: if both characters are still standing when **time** runs out, the round goes to the player with the most health remaining.

The game is played with an eight-way **joystick** and six attack buttons, corresponding to three punches and three kicks of varying strength and speed. Each character also has a variety of "special moves," which are performed by inputting a series of directions and then pressing an attack button.

Street Fighter II—The World Warrior is often credited with sparking the **fighting game** craze that swept the **United States** in the early to mid-1990s. At the peak of the craze, *Street Fighter II* cabinets could be found in many retail locations, including liquor stores, bowling alleys, and convenience stores, in addition to traditional video **arcades**. In the game, there are eight characters players can choose from and four unavailable "boss" characters. In the single-player mode, the player chooses a character and then fights the seven other characters, followed by the four boss characters. The single-player mode also includes bonus rounds, including the now-iconic game in which the player must destroy a car. In the two-player version, each player picks a different character and they **play** against each other. The winner stays in the game, and the loser must insert another coin to continue play.

Street Fighter II eventually went through five revisions. Although each featured numerous minor changes and balance adjustments, only the major changes will be noted here. *Street Fighter II'—Champion Edition* was released in April 1992 and allowed players to choose from the four boss characters, bringing the available character count up to 12. *Street Fighter II'—Hyper Fighting* (December 1992) is widely believed to be a response to the growing number of hacked *Street Fighter II* cabinets. This revision drastically increased the speed of the game and introduced new special attacks for several characters. The fourth installment, *Super Street Fighter II—The New Challengers* (October 1993), added four new characters and returned game play to its original speed. This latter decision was widely unpopular. *Super Street Fighter II Turbo* (March 1994) increased the game speed again and added "super combos." Characters now had a meter at the bottom of the screen that filled as they performed attacks. Once full, the character could unleash a powerful super combo attack. The final arcade release, *Hyper Street Fighter II* (December 2003, **Japan** only), allowed players to choose characters from any *Street Fighter II* version and fight against a character from any other version. For example, Ken from *World Warrior* could fight Cammy from *Super*. This version eventually saw release in the **United States** as part of the *Street Fighter Anniversary Collection* on the **Sony PlayStation 2** (2004) and **Microsoft Xbox** (2005).

Jason Scott Begy

subcreation

The term "subcreation" refers to the building of imaginary diegetic **worlds** within and across a variety of media. Originally coined by J. R. R. Tolkien, the term "subcreation" is used to distinguish human creation from God's *ex nihilo* creation, as well as to indicate its reliance on the latter through the use of the "sub" designation (the term literally means "creating under"). "Subcreation" also refers both to the process and product of world building, while avoiding philosophically slippery terminology such as "real" and "imaginary," which tend to be seen as mutually exclusive domains. Unlike other approaches that are medium- or **narrative**-specific, the study of subcreation is concerned with the world itself, in which multiple narratives can occur and be viewed through a variety of media windows (such as **film**, **television**, **comic books**, novels, or video games). This approach is particularly well suited to video games, where diegetic worlds, unlike those of other media like film, television, or print, contain an interactive element that often allows for **navigation** and exploration of the world under the player's control. Some video games are also part of larger, transmedia worlds and thus must be considered with the rest of the world in mind, whereas others are self-contained and exist on their own within a single game or game series.

The study of subcreated worlds looks at each world as a whole and is concerned with the world's inner consistency, as well as its global structures and the way in which they relate to the local smaller-scale structures within the world. Global structures include those of **space** (**maps**, layouts, connections between places), **time** (chronologies, histories, the timing of events), the genealogies, **languages**, and cultures of the world's inhabitants, and narratives that incorporate all of these. The worlds of video games, which range from simple single screens of flat **graphics** to elaborate three-dimensional on-line worlds populated by millions of characters, can also contain various ontologies and **rules** by which they operate, which players must learn when they vicariously inhabit these worlds through the use of **avatars**. Examining video games through a subcreative approach produces a more holistic view of their diegetic world, and one which is not limited by medium or narrative, but rather looks at a world as a whole and something worthy of analysis in itself. As the diegetic worlds of video games grow larger and more detailed and complex, such an approach grows in relevance and provides a way to discuss the design of the world in such a way as to make it distinct from the **design** of the game, as well as to discuss it in comparison to other subcreated worlds or to the appearances of the same world in other media.

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suicide battery

"Suicide battery" is the term used by collectors to describe a small battery found in certain **arcade games**. This battery sends a current to RAM (random-access memory) that holds a decryption table. The decryption key is used to decode the program code in the game's ROM, so when the battery dies, the RAM is erased, and without the decryption key, the game can no longer run. In certain **Capcom** games, the suicide battery powers a custom chip that handles game **graphics**, which will not display correctly when the battery runs out.

Presumably installed to fight **piracy**, these batteries also limit the life of an **arcade** machine, leading many collectors to believe that the batteries were installed to require operators to buy more units as the old ones expired. Several companies used suicide batteries in their arcade games, including **SEGA**, which began using them around 1986; Capcom, whose system used them from 1989 onward, and Gaelco, an arcade game manufacturer in **Spain**. According to "The Dead Battery Society" webpage, SEGA games using a suicide battery include *Action Fighter* (1986), *Alex Kidd and the Lost Stars* (1986), *Alien Syndrome* (1986), *Out Run* (1986), *Altered Beast* (1988), *Gain Ground* (1988), *Crack Down* (1989), *Golden Axe* (1989), *Laser Ghost* (1989), *Line of Fire* (1989), *Super Monaco GP* (1989), *Turbo Out Run* (1989), *Aurail* (1990), *Bloxeed* (1990), *Clutch Hitter* (1991), and *Desert Breaker* (1992). Capcom games using suicide batteries include *Adventure Quiz Capcom World* (1989), *Capcom Baseball* (1989), *Dokaben* (1989), *Super Buster Bros.* (1990), *Captain Commando* (1991), *The King of Dragons* (1991), *Three Wonders* (1991), *Adventure Quiz Capcom World 2* (1992), *Cadillacs and Dinosaurs* (1992), *Knights of the Round* (1992), *Warriors of Fate* (1992), *The Punisher* (1993), and *Saturday Night Slam Masters* (1993). Gaelco games using suicide batteries include *TH Strikes Back* (1992; also known as *Thunder Hoop II*), *Glass* (1993), *Alligator Hunt* (1994), *Touch and Go* (1995), *World Rally 2* (1995), and *Maniac Square* (1996).

To preserve the lives of their machines, some collectors have published instructions on the Internet that describe how suicide batteries can be removed and replaced without losing the current to the RAM holding the decryption key and also how to reprogram the EPROM, eliminating the need for a suicide battery altogether. In some cases, the encryption on the code ROMs has been broken, allowing the ROMs to be reprogrammed even if the battery has died and the decryption table is erased.

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Super Mario Bros

See Mario series

Super Nintendo Entertainment System (SNES)/Super Famicom

Nintendo released the Super Nintendo Entertainment System (SNES) in 1990 in **Japan**, 1991 in North America, and 1992 in **Europe**. There is little doubt that the naming choice was intended to leverage the widespread success of its predecessor, the **Nintendo Entertainment System (NES)**, which had dominated the home video game markets of North America and Japan after its release. That dominance was slowly eroding in 1989 due to the **NEC PC-Engine console** in Japan (later released in North America as the **TurboGrafx-16**), and from the **SEGA Genesis** in North America (known as the **SEGA Mega Drive** in all other markets). The SNES was Nintendo's response to the threat that these more advanced systems posed. Its technical capabilities were unusually strong when compared with Nintendo's usual strategy of implementing low-cost and comparatively low-powered systems.

The SNES is a 16-bit console that, in keeping with the general architecture of its predecessor, houses a central processing unit (CPU) and a Picture Processing Unit (PPU) dedicated to graphical operations. The SNES can display up to four layers of **scrolling** backgrounds and 128 moving objects (sprites), each at a maximum size of 64 × 64 pixels and drawn from up to 16 colors from the system's palette of 32,768. In absolute comparative terms (although by no means an automatic measure of graphical superiority), the SNES had four times the backgrounds and colors per sprite, more than fourfold sprite size and twice their on-screen number, and 630 times the number of colors compared to the NES. A number of visual effects can be achieved, including parallax scrolling with the background planes, a pixilation mosaic effect, and the "mode 7" effect that allows a 2-D plane to be scaled and rotated to simulate a three-dimensional perspective. The SNES also benefits from 128 Kb of general random access memory (RAM), 64 Kb of dedicated video RAM, and an extra 64 Kb for audio, compared with the NES's measly 4 Kb total. More important, however, the SNES was technically comparable to the Genesis and TurboGrafx-16, with each console having advantages and disadvantages that balanced out.

A level playing field meant the battle would be won on another terrain: the size and quality of the consoles' game libraries, where Nintendo held a real advantage, both because it was such a popular household name and because of the number of high-quality game developers that had made the NES successful. Nintendo had lost a court lawsuit with **Atari** and **SEGA** for antitrust practices, mainly for the two-year console exclusivity clause for third-party game developers and for price-fixing intimidation tactics used in dealings with resellers. In theory, game developers were free to make games for the SEGA Genesis; but, in practice, the NES still had a large installed base and was a well-known **platform** with a development process that had been mastered. Most developers were not willing to risk wetting their feet on the new, unproven consoles from SEGA and NEC and instead adopted a "wait-and-see" approach. As soon as the Genesis started picking up momentum, Nintendo wisely announced they were developing a 16-bit console, thereby securing the support of their established game development partners. SEGA still managed to seriously threaten Nintendo's market share and the Genesis engaged the SNES in one of the most abrasive "console wars" in video game **history**.

More important, the competition forced Nintendo to soften its restrictive policies, particularly after the ***Mortal Kombat*** (1992) fiasco. Although the Genesis port of the highly **violent** arcade title kept all the blood and gore that contributed to its appeal, Nintendo forced Acclaim to tone down the SNES version, having characters lose gray "sweat" instead of blood during combat and similarly limiting the "fatality moves" to less gory variants. This version of the game was largely derided and tarnished Nintendo's image as a "kids' games" company, which played right into SEGA's marketing strategy. Although the Genesis did not outsell or surpass the SNES (except in **Europe** and **Latin America**), Nintendo's public image was as damaged as its reputation among game developers that considered its policies overbearing. When **Sony** moved in with its **PlayStation** in 1995, many gamers and game makers felt they were ready for more. Nintendo went from a totalitarian grip on the home video game console market with the NES to a modest lead with the SNES. This slow erosion would later continue with the **Nintendo 64** and **Nintendo GameCube** systems.

The Super NES honored the NES's legacy of housing a wide variety of high-quality games and franchises. Worthy of mention are Nintendo's first- and second-party games *Super* ***Mario*** *World* (1990), *F-Zero* (1990), ***The Legend of Zelda****: A Link to the Past* (1991), *Super Mario Kart* (1992), *Star Fox* (1993), *Super* ***Metroid*** (1994), *Donkey Kong Country* (1994), and *Super Mario World 2: Yoshi's Island* (1995). While **fighting games** and **arcade** ports were the Genesis's *forte*, the SNES had its share with ***Street Fighter II*** (1992), *Fatal Fury* (1992), *Killer Instinct* (1994), and the previously mentioned *Mortal Kombat*. One of the console's strong suits was **role-playing games (RPGs)**, the bulk of which were developed by Square or published by Enix, rival companies that later merged. Notable games include Square's *Final Fantasy 2* (1991), *Secret of Mana* (1993), *Final Fantasy 3* (1994), *Chrono Trigger* (1995), and *Super Mario RPG* (1996); Enix's conceptual Action-RPG series of *ActRaiser* (1990), *Soul Blazer* (1992), *Illusion of Gaia* (1993), and *Terranigma* (1995; released in Japan and Europe only), as well as other stand-alone titles such as the strategy-RPG

Ogre Battle: The March of the Black Queen (1993) and *The 7th Saga* (1993); finally, **Capcom**'s *Breath of Fire* franchise also originated on this system with *Breath of Fire* (1993) and *Breath of Fire II* (1994). Action and platform games are numerous, but some of the more-recognized classics include Konami's *Super Castlevania IV* (1991), *Contra 3: The Alien Wars* (1992), and *Teenage Mutant Ninja Turtles IV: Turtles in Time* (1991), as well as Capcom's *Mega Man X* series. The total number of games released, give or take five for all territories, amounts to 535 in Europe, 720 in North America, and 1,440 in Japan. As with all platform lists, the exact count depends on whether one includes special pack-in titles, altered rereleases, combination and special-event **cartridges** such as *Super Scope 6* (1992), *Donkey Kong Country Competition Cartridge* (1994), or *Super Mario All-Stars + Super Mario World* (1993). Eager fans have translated many of the Japan-exclusive games in recent years, particularly RPGs and games from known franchises, such as *Mystic Ark* (*The 7th Saga 2*; 1995) and *Seiken Densetsu 3* (*Secret of Mana 2*; 1995).

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survival horror games

The horror genre's main objective is scaring the audience, and it has found an excellent niche in video games because fear has a strong action tendency and is clearly object-oriented. A frightened person commonly chooses between freezing motionless in hope of going unnoticed, fleeing from the danger, or fighting the threat; compared with a novel reader or **film** viewer who can only witness a character choosing between these alternatives, the gamer is often forced to make such a choice. Consequently, early in its history, video games have maximized the potential of scary situations and scenarios. From *Haunted House* (1981) for the **Atari VCS 2600** to the PC text **adventure game** *The Lurking Horror* (1987); from the **adaptation** of *Friday the 13th* (1989) on the **Nintendo Entertainment System (NES)** to the multiple windows text-and-graphic adventure *Uninvited* (1986) and *Shadowgate* (1987) for the Macintosh; and from *Project Firestart* (1989) for the Commodore 64 to *Sweet Home* (1989) for the Nintendo Famicom, gamers have found themselves plunged into typical horror stories, confronting the usual bestiary and evil of horror fiction.

Although early video games might have been considered frightening in their time, their depiction of horror was, if not textual, rather **abstract** with limited effects. By the 1990s, the technical capacities of home computers and home **consoles** (particularly the **Sony PlayStation**) had evolved enough to enable a *mise-en-scène* of fear similar to the horror film, raising the genre's popularity and identifying it specifically as *survival horror*. The term was coined for the Japanese game *Biohazard* (1996, known as *Resident Evil* overseas) for the Sony PlayStation. The formula, however, comes from both *Resident Evil* and the French game *Alone in the Dark* (1992) for the PC, which were in turn both inspired by George Romero's zombie movies. Associated with the work of H. P. Lovecraft for commercial sake, *Alone in the Dark* was the first horror game to display three-dimensional polygonal characters and objects in two-dimensional pre-rendered backgrounds. The action is depicted from a variety of fixed camera angles that serve as much to conceal as to reveal the **space** of the game **world**. Choosing between two player-characters (one of whom is the private detective Edward Carnby, who will become the main character in the subsequent four games of the series), gamers have to stay alive and escape from a mansion in which they have been trapped. To do so, they need to find various helpful documents, manage a limited inventory and scarce resources, solve many puzzles, and fight zombies or other dreadful monsters. *Resident Evil* follows the same framework as *Alone in the Dark* and has trapped two playable members of a Special Tactics and Rescue Squad in a mansion filled with zombies and various mutated creatures. The game called attention to the genre by welcoming the gamer to "the world of survival horror." Played on the PlayStation, the game cannot be saved at any point; to save the progress, the gamer must find ink ribbons to be used in typewriters that are located in only a few rooms, adding to the tension. *Resident Evil* has become the most prolific horror series of all time with more than 15 games (although not all of them are survival horror games).

Alone in the Dark and *Resident Evil* set the conventions of the genre. From a videoludic perspective, survival horror games remain action-adventure games that develop a specific storyline that draws on common horror themes and is told through **cut-scenes** as well as various written or **audio** documents. Although survival is the principal issue in a majority of video games, it is emphasized by the vulnerability of the player character who, without the gun power and the supply of ammunition found in **shooting games**, has to face or run away from monstrous foes while finding his way out of labyrinthine spaces, gathering various items, solving puzzles, and overcoming obstacles. Survival horror games are also notorious for their clumsy controls, which make the game even more difficult—for both combat and movement through the game world. From a horror perspective, the genre is defined by the use of all the horror film tropes, such as an eerie atmosphere in dark or claustrophobic spaces. To take advantage of the camera work and montage, the games show the player-character from a third-person perspective (a feature somehow excluded from the genre horror first-person perspective games such as *Clive Barker's Undying* [2001], *Condemned: Criminal Origins* [2005], *Call of Cthulhu: Dark Corners* *of the Earth* [2005], and the *Penumbra* Trilogy [2007–2008]. Predefined camera angles transform the off-screen space into a blind one where monsters hide and from where they can come out anytime to startle and to kill the player-character. **Sound** is exploited to **immerse** the gamer in the horrific universe, enabling threats to be sensed, suspected, or anticipated through forewarnings of the coming monsters.

Like any genre, survival horror has changed and evolved. *Silent Hill* (1999) replaced pre-rendered realistic backgrounds with a real time three-dimensional dark and foggy resort town. With a more psychological approach to horror that explores the tortured mind of the player-character, and with more imaginative and subtle anticipatory fright, *Silent Hill* has expanded the domain of survival horror to one of terror (it could even be called *survival terror*). Two devices, a flashlight illuminating the way and a pocket radio emitting white noise when dangerous creatures are nearby, help to elevate the level of dread. Among the subsequent games in the series, *Silent Hill 2* (2001) is considered to be one of the landmarks of the genre. *Fatal Frame* (2002; known as *Zero* in **Japan** and *Project Zero* in **Europe**) has carried on in the same vein. In a truly Japanese tradition, the player-character is young girl who has to fight ghosts in a mansion. The originality of the game and of the series (of the four installments *Fatal Frame II: Crimson Butterfly* [2003] is considered the most accomplished) comes from the weapon employed within the game; it is not with a gun but with a camera obscura that the gamer has to destroy the spirits, waiting for the ghosts to get as close as possible before pressing the trigger to cause the most damage. In *Siren* (2004; two other *Siren* games came out in 2006 and 2008), gamers play 10 characters and use a "sightjack" system that enables them to see through the eyes of the zombie-like enemies and to learn how they move with the aim of steering clear of them. Avoidance and escape are at the core of games like *Haunting Ground* (2005) and the *Clock Tower* series (1995–2003), in which young girls spend most of their time running away from assailants and hiding in various places until the threat is gone. In the former, the main protagonist Fiona Belli is helped by a dog, and in the latter, a panic meter needs to be tended, otherwise the player-characters become difficult or even impossible to control. *Eternal Darkness: Sanity's Requiem* (2002) has a sanity meter which, once emptied, produces a range of disturbing effects: sounds of someone being tortured in another room, rooms turned upside-down, a player-character transformed into a zombie, a "disk error" message, and so on.

Finally, as games like *Resident Evil 4* (2005), *Dead Space* (2009), and *Resident Evil 5* (2009) increasingly focus on action and demonstrate more accurate player-character control, the survival of the survival horror genre is in itself coming into question among specialists and gamers. Ironically, the genre itself might soon be among the "living dead."

Bernard Perron

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T

television

Television receivers, more commonly referred to simply as TVs, have historically been used to receive broadcast, cable, or broadband programmed content, but television plays a key role in the **history** and culture of video games as well. Early video game innovator and inventor Ralph **Baer** was inspired to begin work on the first commercial home video game system because of the lack of compelling television programming available. Baer thought the technology could be used to do more and in more innovative ways. In this way, television gave rise to home video games and it still remains a common venue for video games. Television also shares its technological structure with the infrastructure of **arcade** video games: the cathode-ray tube. Whether sunk into a wood-grained home case made to look like living room furniture, or encased in a futuristic fiberglass cabinet (like ***Computer Space*** [1971]), both television and video games rely on video technology and, historically, cathode-ray tubes as the basis for their display of images.

Using standard **audio** and video connector cables, so-called **console** video game systems are designed to connect with television sets and must be played in some proximity to the television itself, so that **handheld game controllers** can connect physically or via wireless connection to the system and back to the television. This puts the gamer and gameplay in a limited physical **space** often defined by the placement of the television in a room. Often the **advertising** and press kits accompanying game systems—from the **Atari VCS 2600** to the **Nintendo Wii** and the **Microsoft Xbox** Kinect—promote the space around the television set as a zone for the shared familial pleasures of multiplayer gaming. As an "electronic hearth," like radio before it, television inscribes video games into the domestic space of the home. Recent systems, from the Xbox on, include **interface** components that allow gamers to switch easily between passive television programming, **films**, and gaming content. Some television programs even adapted games as narrative content, as in ***Pac-Man****: The Animated Series* (1982–1983) and the *Super* ***Mario*** *Bros. Super Show!* (1989–1991). Of course game **adaptations** of television programs are also common, especially games based on children's programming such as *Dora the Explorer: Journey to the Purple Planet* (2005) and *Spongebob Squarepants: Creature from the Krusty Krab* (2006). Adult-themed game adaptations of television programs run the gamut from *Home Improvement: Power Tool Pursuit* (1994) to *Buffy the Vampire Slayer* (2002) and *The X-Files: Resist or Serve* (2004). As this transposition of content across forms reveals, the shared space of the television screen has led to two distinct but complementary forms of entertainment.

Despite all of these technological and cultural connections between video games and television, video games are often overlooked within the academic field of television studies, which focuses on television programming and **industry** rather than pursuing, like Baer, other uses of television for interactive entertainments. Recent work by video game scholars offers a corrective in this regard, resituating television in the history of video games as a crucial part of the video game system apparatus that includes game hardware, software, controllers, and audio and video elements. These last two, audio and video, are provided by the television set (possibly with the addition of ancillary sound systems incorporated into the setup as gaming systems and sound became more complex). Although home **computer games** are often reliant on a high-quality video card as part of a computer system, console-based home video games instead work with and on television's graphic capabilities. TV's influence in this regard is tremendous, from video game designers working with the graphic limitations of game hardware and 1970s television sets to design games that produced compelling **graphics** despite extreme technological constraints, to the emergence of games designed to maximize the high-definition pleasures of contemporary television screens and the home theater audio systems that often accompany them.

Sheila C. Murphy

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temporal navigation

See navigation (temporal)

Tetris

The falling block puzzle game known as *Tetris*, world-famous for its simple but addictive gameplay, is among the most popular games ever released. Around 1985, Alexey Pajitnov, a computer engineer from the Computer Center of the Russian Academy of Sciences, developed the game on an Elektronika 60 terminal computer. His colleague Dmitry Pavlovsky assisted him, and Vadim Gerasimov, a teenage student at the time, ported the game to the IBM PC. From there, a PC version burst into popularity and began spreading around Moscow and then Western **Europe**.

At the time, *Tetris* was not patented. In the former Soviet Union, intellectual property rights were not established for private individuals and private business was prohibited. This situation eventually generated considerable profits for various businesses and people, which caused a number of conflicts. In 1986, before any legal rights were established, Spectrum HoloByte released an IBM PC version of *Tetris* in the **United States**. Their license was obtained from a London publisher, Andromeda, who was licensing rights that were unofficially acquired by Novotrade, a company from

Budapest. Other versions flourished as well before 1988, when the Soviet government began to market the *Tetris* trademark and granted Pajitnov paternity over it. A year later, licenses were signed over to **Atari**, for the **arcade** version, and to **Nintendo**, who soon bundled *Tetris* with every **Nintendo Game Boy console**.

Up until 1996, Pajitnov had made almost no money from the game, despite Nintendo's commercial success with it. Because of the nature of communism, Pajitnov had to wait until the rights were fully returned to him from the Russian state to collect money for his achievement. Today, the Tetris Company cofounded by Pajitnov owns the trademark and maintains the "Tetris guidelines." It standardizes basic parameters, such as the size of the playfield and the control keys and the hues, which vary from monochrome or grayscale **graphics** to several colors for each of the distinct shapes present in the game.

Tetris's seven game pieces are tetrominoes, each composed of four adjoining squares arranged in a different way, and the game's name comes from combining the word "tetromino" and "tennis" (even though it sounded somewhat strange in Russian, Pajitnov insisted on it). The seven tetrominoes are identified by their shapes: O or square, J or leftgun, L or rightgun, I or dash, Z or leftsnake, S or rightsnake, and T or tee.

Tetris's core gameplay involves rotating the falling tetrominoes and fitting them together in rows. Points are awarded when rows are completed, and completed rows disappear, allowing the other rows to drop down and giving the player more room to manipulate the falling tetrominoes. The tetrominoes enter from the center of the upper boundary of a rectangular grid 10-bricks wide by 20-bricks high. Some versions of the game feature a window showing what kind of piece will appear next, allowing players to anticipate what moves to perform. Each tetromino can be pivoted in 90-degree increments, translated horizontally, or "dropped" hastily. As players react by reorienting falling pieces in search of the best positioning, they mentally represent the shapes using both mental rotation skills and spatial visualization skills, both of which improve over **time**.

The game's difficulty results from the pieces piling up, as well as the increasing rate at which they fall, both of which reduce the amount of time the player has to manipulate and position the pieces. Although every piece can complete one or two rows when it is the last to be added to a row, the "I," "J," and "L" pieces, which all have at least three blocks in alignment, are able to clear three rows. Only the "I" tetromino is capable of clearing four lines simultaneously, and this action is referred to as a tetris. Many versions of the game also award additional points based on the height and speed of the falling piece.

When a finished row disappears, the stacks above it cascade and fill the newly created negative space as well as other possible openings under it. Traditional versions of the game move the piles of blocks down by a distance equal to the exact height of the cleared lines below them, and often rows must be cleared to reach the unfilled gaps beneath them.

The player's objective is to maximize the number of points gained over the course of the game. Doing so demands clearing as many rows as possible, to open the way for the never-ending fall of new blocks and to avoid running out of space vertically. When this happens, it is the end of the game, known as "topping out."

Tetris has also been a prevalent subject in academic research. Vladimir Pokhilko, a friend of Pajitnov, was the first clinical psychologist to conduct experiments using the game, only a few years after its creation. Since then, it has been used in several fields including the theory of computation, the algorithmic theory of games, and cognitive **psychology**. It is also a widely used example in new media and game studies, where different readings of *Tetris* also gave birth to a classic conflict between **simulation** and **narrative**. Gonzalo Frasca sees the game as entirely nonrepresentative, an abstract environment where players test their skills (Frasca, 2001). In contrast, Janet Murray sees a specific narrative: "a perfect enactment of the overtasked lives of Americans in the 1990s" (Murray, 1997). However, according to Marie-Laure Ryan, that narrativity is of the lowest degree because it is "hardly interpretable as the pursuit of human interests in a concrete situation" (Ryan, 2001).

Vincent Mauger

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3-D hardware

Video game **consoles** and personal computers use internal 3-D visual effects cards and external 3-D devices to create increased depth of field within game **spaces**. This entry focuses on the external forms of 3-D hardware that create stereoscopic 3-D images. The term "stereoscopic" comes from the word "stereopsis," which refers to the visual effect that occurs when two corresponding images are simultaneously presented at strategic angles and decoded through special frames to create the illusion of **z-axis depth**.

The stereoscopic 3-D process makes images appear in front or behind a screen despite their projection or presentation on a screen. This process is possible because of the distance between the viewer's eyes. Each eye has a different perspective on the **world**. Differences between the two views work as depth cues for our brains, which automatically convert this information into a focused image. One's eyes perform two essential tasks as part of this process. They focus and converge on objects by turning at complimentary angles. The stereoscopic 3-D process disrupts this activity by providing different depth cues for each eye. The brain compensates for this difference and brings the image into focus at an illusory point of convergence.

Stereoscopic 3-D hardware produces two corresponding images on a screen in different formats or presents separate images for each eye, side by side. There are a number of ways that hardware for 3-D video games can combine the separate input images into one stereoscopic image.

The anaglyph 3-D model creates a stereoscopic 3-D picture when images are presented in two colors (usually red and cyan) and glasses with corresponding colors are used to decode those images. The anaglyph mode of 3-D was one of the most common types of 3-D hardware throughout the 1980s, 1990s, and 2000s. The only hardware required for this 3-D process is a pair of anaglyph 3-D glasses and a game which presents its images in an anaglyph form. Examples include *3-D Worldrunner* (1987), *Rad Racer* (1987), and *JJ* (1987), all produced by Square for the **Nintendo Entertainment System (NES)**. Other anaglyph games include *Magic Carpet* (1994), *Descent* (1995), *Duke Nukem 3D* (1996), *Sly 3: Honor Among Thieves* (2005), *G-Force* (2009), *Toy Story Mania!* (2009), and *Skate 2* (2009). The anaglyph 3-D process never attained widespread popularity because the 3-D images are rarely sharp enough to sustain prolonged viewing.

Another way to achieve the stereoscopic effect is to present the right and left images in an alternating sequence that is synched to the separate right and left eye shutters on the viewer's glasses. The earliest 3-D video game to appear in arcades was **SEGA**'s *SubRoc-3D* (1982), and it used a shutter mechanism to achieve the stereoscopic effect. To experience the 3-D effect of *SubRoc-3D*, the user placed his or her face into a "periscope" eyepiece. The eyepiece partitioned the player's view and delivered individual images to each eye. Inside the eyepiece a mechanism controlling two synchronized disks modified the flickering images on the screen to create a shutter-based 3-D illusion.

During the early part of the 1980s, shutter-based 3-D video game hardware began making its way to the home entertainment market. In 1983, the **GCE/Milton Bradley Vectrex** video game system developed a peripheral device known as the Vectrex 3-D Imager. The 3-D illusion was created by an eyepiece similar to the "periscope" of *SubRoc-3D*. The eyepiece plugged into the Vectrex system and synchronized a spinning disk inside the eyepiece to correspond with the images on the screen. In 1988, SEGA released the SegaScope 3-D, which, like the Vectrex 3-D Imager, was a peripheral eyepiece that operated by plugging into a console. Inside the SegaScope 3-D eyepiece, liquid crystal lenses were darkened and lightened to correspond with the alternating images on-screen, which separated the images sent to the player's eyes and created the stereoscopic effect. In 1995, **Nintendo** developed its own 3-D eyepiece shutter system in the form of the **Nintendo Virtual Boy** portable system. Advertised as "so advanced it can't be viewed on conventional screens," the Virtual Boy system displayed a monochromatic red 3-D image. The 3-D illusion was produced by separating the player's eyes inside the eyepiece. Each eye was given its own view of a red LED screen regulated by oscillating mirrors. The movements of the mirrors were coordinated so that the two images could be used to create a 3-D illusion.

A third way to achieve a 3-D effect is to present two images in different types of polarized light that can be interpreted by corresponding polarized lenses on the viewer's glasses. Polarized 3-D hardware has become a popular means for creating the 3-D **film** experience. The mass production of polarized **television** screens is often cost prohibitive and thus most 3-D hardware for video games uses the alternating shutter 3-D process. The newer models of 3-D shutter glasses are known as "active glasses," which are opposed to "passive" polarized glasses because they are battery powered and require an extra calibrating device called an emitter. The emitter sits on top of the 3-D television and syncs the shutter speed of the dual image presentation to the shutter speed of the two lenses on the glasses via radio waves or infrared. The glasses contain a small electronic device that regulates the opacity of the lenses. The lenses open and close at a shutter speed that corresponds to the alternating images on the screen, separating what each eye sees and creating the 3-D illusion. The "active" glasses process is reputed to be the most comfortable way to experience 3-D. Games such as *Gran Turismo 5* 3-D (2010), *James Cameron's Avatar: The Game* (2009), *Super Stardust HD* (2-D verison, 2007; 3-D version, 2010), and *Wipeout* (2010) featured this hardware at the 2010 Consumer Electronics Show.

The first ever 3-D gaming summit was held in Los Angeles in 2010; 3-D hardware presented at the conference included technology that would make glasses unnecessary. The process is known as auto-stereoscopic 3-D, and it works through the inclusion of an additional screen in front of the television known as a "parallax barrier." The parallax barrier separates the image for the viewer and creates the 3-D effect without the assistance of 3-D glasses. The process is best viewed from directly in front of the television, which is a drawback for multiplayer 3-D video games. The video game industry's investment in 3-D hardware suggests that the future of the video game experience may soon require "active glasses" and a 3-D television. ***See also*** graphics; immersion.

Ethan Tussey

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3DO Interactive Multiplayer

Trip **Hawkins** founded **Electronic Arts (EA)** in 1982. As the chairman of the most powerful entertainment software publisher at the beginning of the 1990s, he was well aware of the challenges faced by the video game **industry** and sought to alleviate the development process and reduce confusion for prospective buyers. He proposed a new vision for the industry: the creation of a single technological standard that could be licensed to many manufacturers. At the same time, Hawkins wanted to create a cutting-edge multimedia system that could play games with three-dimensional **graphics** and video, along with educational software, movies, and music CDs. In 1992, Hawkins introduced this ambitious vision of convergence to the public: the 3DO Interactive Multiplayer was being sketched, and a new company was founded to develop the project.

Along with Commodore's CDTV and Philips CD-I, the 3DO was one of the first entertainment units to feature a built-in **CD-ROM** drive. When it launched in October 1993, it was the most powerful gaming system available. The console was based on a 32-bit RISC (reduced instruction set computing) processor running at 12.5 MHz, assisted by two video coprocessors running at 25 MHz. On top of the two megabytes of system RAM, another megabyte was dedicated to graphics, and its 2X drive could transfer up to 300 kilobytes of data per second. The system was able to display 24-bit color images (16 million colors) at a maximum resolution of 640 × 480 pixels. With the help of the graphical processors, these images could be made transparent, warped, or applied as a texture on a three-dimensional surface. The 3DO was also proficient with full motion video (FMV), and an extension, the Digital Video Module released in 1994, allowed the playback of movies on CDs.

In the early 1990s, Hawkins managed to create a lot of enthusiasm for the 3DO. Major manufacturers like Matsushita/Panasonic, Goldstar, and AT&T were willing to invest in the venture, with each planning to develop their own version of the system. Hawkins also convinced over 50 companies to sign developing agreements by loosening the restrictions and fees ($3 licensing fee per game sold, vs. $9 or $12 for the competition). However, the suggested price of Panasonic's FZ-1 ($699.95), the first 3DO to be manufactured, tainted this early confidence with doubt. Few consumers were willing to pay the price, and very few games were available upon release; Hawkins's venture was awarded "worst system launch" in *Electronic Gaming Monthly*'s annual contest. In 1994, the console received the "best product of the year" award by *Time* magazine. But growing notoriety, the release of quality games, and a price cut down to $399 were not enough to make the sales explode. As John Markoff of the *New York Times* observed, at the end of 1994, the 3DO was already facing a make-or-break season (Markoff, 1994). Production of 3DO hardware and games stopped after 1996.

The console was at the forefront of the short-lived **interactive movie** craze. Many of the full-motion video (FMV) games, such as *MegaRace* (1994), *Microcosm* (1994), *Night Trap* (1994), *D* (1995), and *The Daedalus Encounter* (1995), were technically superior on the 3DO. Several space **shooting games** were released throughout the system's three-year life span, either shooting galleries relying heavily on pre-rendered courses (such as *Star Wars: Rebel Assault* [1994] and *Novastorm* [1994]), or real three-dimensional games such as *Wing Commander III: Heart of the Tiger* (1994), *Total Eclipse* (1994), and the *Shockwave* series made exclusively for the console. Crystal Dynamic's *Gex* was proclaimed 3DO's mascot upon its Christmas 1994 release, but the title would later be ported to other systems. In 1994, the sport **simulation** genre started a successful transition to three-dimensional graphics and TV-style presentation with EA's *John Madden's Football '93* and *FIFA International Soccer*. The console's most praised titles were **racing games**: the first in the *Need for Speed* (1994) series, and a port of *Road Rash* (1994). Despite some truly impressive titles, the 3DO company's liberal licensing policy ended up diminishing the overall quality of the software library.

Carl Therrien

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time

Theories of time in video games can roughly be divided into two categories (Nitsche, 2007, p. 145). Formalist time encompasses timers and timing mechanisms, the time it takes for game events to occur, and the passing of the player's time. Experiential time takes into account the player's perception of the passing of time based on the formal properties of time in the game.

The role of countdown timers has changed in scope as games have evolved, but their purpose is largely the same. Time limits add additional pressure to actions by threat of terminating play (Wolf, 2001, p. 88). Some timers are visually displayed on-screen. The timer in the upper right hand corner of *Super* ***Mario*** *Bros.* (1985) quickly counted down to zero to hurry the player through the stage. Players of **Activision**'s *Pitfall* (1982) had just 20 minutes to find the 32 treasures scattered around the jungle. Other timers tick away the seconds without visual display. Although it is never explicitly stated, each round of *Freeway* (1981) is limited to 136 seconds. Clocks can also measure performance—the "high score" is often the time it takes players to complete a level or race (Wolf, 2001, p. 89).

Juul established a framework for the **mapping** of **play** time onto event time (Juul, 2004, p. 131). Each game comprises a sequence of events that are supposed to have unfolded in some order as governed by an underlying logic (state changes, the **simulation** of some processes, changes in the visual display, the passing of a **narrative**). These events need neither be experienced in a set sequential order nor at the same rate. A *Quake* (1996) death match unfolds with a direct mapping of play time to event time. In ***SimCity*** (1989), on the other hand, the passing of two minutes of play time might equal one year of event time in the simulation. **Cut-scenes** in games suspend play time entirely in favor of event time. Pausing your party to select an attack strategy in *Knights of the Old Republic* (2003) pauses event time while sustaining play time.

The relationship between play and event time can also involve other changes in the game state such as resetting, loading, and saving. Dying in *Halo: Reach* (2010) resets the game state to a previously saved checkpoint in which event time is rewound but play time continues. As a new area of City 17 loads in *Half-Life 2* (2004), visual cues signal both play time and event time have been suspended. Game saves, according to Juul, are "manipulations of game time" that not only let a game be broken into multiple play sessions but also allow ways to roll back event time if players are unsatisfied with choices made during play time (Juul, 2004, p. 138).

These formal properties are useful for understanding the structure of time but do not describe how a player experiences time. This perspective "tries to describe a player's comprehension of temporal situations in games" (Nitsche, 2007, p. 146). Continuing play after death, for example, can pose different interpretations based on how the game state is altered. If players restart from a checkpoint, they might resume with a snapshot of the game that was taken at the point progress was saved. They would have lost their progress and therefore be resuming with the same **health**, equipment, or statistics. Some games save this kind of statistical progress, treating the player's time as external to the event time of the game. They would have to repeat the same tasks but may find themselves better equipped to do so.

Some games persist even after the player has turned them off. Massively multiplayer on-line games are set in **worlds** that continue on the server for other players. MMOs blend this continuous time with instanced events—dungeons that are created at the player's request and can exist simultaneously with other instances of the same **space**. Other games, such as ***Animal Crossing****: Wild World* (2005) and *Nintendogs* (2005), use the **Nintendo DS** system clock to judge how much time has passed since the game was last played and resume as if the game world had continued in real time while the system was off. In *Animal Crossing* certain events occur only on specified days of the week, in-game holidays are marked on a real calendar, and events in the world have a day-and-night cycle. Additionally, if the player doesn't turn on the game for a few days, weeds will have sprouted around the town and relationships with the other townsfolk may suffer from inattentiveness.

Nitsche advocates for the essentiality of space in the understanding of time in video games. A player's movement through space maps to a temporal shift that involves play time, event time, and experiential time. The clock ticks away as a player moves forward through a level toward an objective, but it continues to tick if the player gets sidetracked and decides to explore an empty house along the side of the road. Because many games want to give players the freedom to proceed to a destination at different rates, many events in games are triggered only once a location is reached. Tasked with hurrying to the next location, players might spend 20 minutes getting somewhere that should only take five. Unless programmed to keep track of this time, the game state is indifferent to the play time—the woman giving the next mission makes no mention of your tardiness.

Understanding the space of a game can have a temporal impact. According to its creator, balancing the popular *Counter-Strike* (1999) map "de_Dust" involved the careful timing of where the two sides would meet at the beginning of a round (Nitsche, 2007, p. 147). A game world that doesn't allow players to teleport or fast-travel across an expansive map may feel larger than one that does because all the space in between two locations must be experienced as play time. The same is true for games with distinct levels that take place in different locations. Although no play time has passed, J. C. Denton in *Deus Ex* (2000) is assumed to have experienced diegetic progress in game time when traveling from New York City to Hong Kong.

Time in video games results from the negotiation of the formal properties of passing time and changing game states as encoded into the game and the player's experience of the time spent playing. ***See also*** navigation (spatial); navigation (temporal).

Bobby Schweizer

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Treasure Co. Ltd.

Treasure Co. Ltd. is a small **Japanese** video game developer known primarily for its innovative action titles and unusually high-quality licensed games. Treasure's games (excepting licensed titles) typically feature a high degree of difficulty, large-scale boss fights, technical aptitude (particularly *Sin & Punishment* [2000] for the **Nintendo 64**), and an odd sense of humor. These features have garnered the company a dedicated following.

The company was founded on June 19, 1992, by Masato Maegawa, a former programmer at Konami. Although reasons for Maegawa's departure are unclear, it is commonly believed to have been motivated by a desire for greater creative freedom. This led to a pervasive, although now provably false, rumor that Treasure had an internal policy forbidding the development of sequels.

Creativity is a key theme in Treasure's games and in its development practices. Most of their major successes involve innovations in established genres. Their first and possibly best-known title, *Gunstar Heroes* (1993) for the **SEGA Genesis**, takes the classic run-and-gun **platform** genre and adds several twists to the formula, along with a sense of ironic humor. *Mischief Makers* (1997), for the Nintendo 64, is a platform game in which the core mechanic involves grabbing objects, characters, and enemies to shake them. The more recent **arcade** hit *Ikaruga* (2001) blends the classic **scrolling** shooter genre established by *Space Invaders* (1978) and *Galaxian* (1979) with a color-matching puzzle game.

In terms of their development process, Treasure's games are developed by small teams, usually ranging from 3 to 10 members. Team members are given a high degree of creative freedom. In a 2010 interview with **Nintendo** president Satoru Iwata, Maegawa (who at the time of the interview was president of Treasure) said that "Even today it's normal for three people to be a team at our company. That way they can do what they want and really make it stand out." Throughout the interview, Maegawa emphasized that Treasure employees are given creative freedom, leading to the unique nature of their games. In earlier interviews with gaming and media news website IGN (2005) and gaming news website 1up.com (2007), Maegawa further emphasized that the teams decide what they want to design and the platform they are designing for. From the 1up interview: "Treasure supported N64 (Nintendo 64) because the team wanted to work on the system. I always listen to the team and they basically chose the N64 because they thought it would be easiest for them to create games on. That was the same reason we decided to work on the **Xbox 360**." Although Treasure's first seven games all appeared on **SEGA** hardware, the company has since diversified, creating titles for a wide range of platforms from SEGA, Nintendo, **Sony**, and Microsoft.

As of 2012, Treasure is still active, having just released *Guardian Heroes* (2011) for the Xbox Live Arcade. In addition to full retail titles, the company has taken to digital distribution to rerelease their older titles via the **Nintendo Wii** Virtual Console and the **Microsoft Xbox 360** Live Arcade.

Jason Scott Begy

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TurboGrafx–16

See NEC PC-Engine/Turbografx–16

TV

See television

2600

See Atari VCS 2600

Twin Galaxies

Twin Galaxies is the officially recognized worldwide authority on all video game scores and world records. The organization tracks player rankings, gaming statistics, and regulates gaming contests and championship tournaments, with information dating from the 1930s and video game statistics from the early 1970s. As the electronic gaming **industry**'s premier statistician, Twin Galaxies preserves the **history** of gaming in their database, which documents the historical milestones of the electronic gaming hobby as it evolves into a professional sport.

Founded in 1981, Twin Galaxies grew from modest origins as a video **arcade** to gain recognition as the "official scorekeeper for the world of video game & pinball playing," vested with the authority to verify "official" world record high scores and crown new **world** champions. The Twin Galaxies Scoreboard was the creation of Walter Day, Twin Galaxies's founder, who, on June 6, 1981, embarked on a series of business trips that took him through 15 U.S. states in four months. Although his role as a traveling salesman was the focus of his trip, Day's real passion was to visit as many video game arcades as possible and record the high scores he found on each game. Ten thousand miles and 100 arcades later, Day, on November 10, 1981, opened his own arcade in the sleepy midwestern town of Ottumwa, Iowa. He named his arcade *Twin Galaxies*, a name that simply sprang out of his head one day. The name rolled off the tongue so easily and felt so familiar to Day that he actually thought he must have heard it somewhere being used as another company's name. Not so, it was simply an inspirational thought, and the name has stood ever since.

Twin Galaxies's tranquil existence was altered when, on February 9, 1982, Day's growing database of high score statistics were made available to the public as the Twin Galaxies National Scoreboard. In the coming years, the Twin Galaxies arcade and the town of Ottumwa in general, was considered to be the number one hot-spot for competitive video gaming, as many significant tournaments and world record gaming attempts were performed there. As the organizational center of competitive video game playing, Twin Galaxies received immediate recognition from the major game manufacturers of the day: **Atari**, **Midway**, **Williams** Electronics, Universal, Stern, **Nintendo**, and Exidy, in addition to support from ***RePlay* magazine** and ***Play Meter* magazine**, the two premier coin-op publications of that era.

Twin Galaxies's role as the scorekeeper grew in importance as "player-rankings" became a major focus of the media. As the pioneer in ranking the top players, Twin Galaxies was called on to bring the superstar players together for many well-publicized contests and media events. For example, on November 7, 1982, *LIFE* magazine visited Twin Galaxies to capture 16 of North America's best players in a group photograph. On November 30, 1982, the mayor of Ottumwa, Jerry Parker, declared the hometown of Twin Galaxies to be the "Video Game Capital of the World." That month, Ottumwa hosted the first North American Video Olympics, and two months later, on January 9, 1983, ABC-TV's *That's Incredible* came to Ottumwa, Iowa, to **film** 19 of the world's best players competing in the first-ever video game world championship. On March 19, 1983, players from around North America came to Twin Galaxies to join representatives of Atari, the

Amusement Game Manufacturers Association (AGMA), *RePlay* magazine, and *Video Games* magazine as Iowa Governor Terry Branstad acknowledged Twin Galaxies's role as the official scorekeeper and crowning Ottumwa, Iowa, as the "Video Game Capital of the World."

As Twin Galaxies continued to rank top players, the first national video game team was formed to represent the **United States**, made up of a select cadre of the very best talent. Called the U.S. National Video Game Team, Day was the founding team captain and issued international video game challenges to **Japan**, the United Kingdom, and Italy, even hand-delivering proclamations to their respective embassies in Washington, DC. Eventually, the team toured the United States, **Europe**, and **Asia** during the 1980s.

By 1985, Twin Galaxies had enjoyed major media coverage in *LIFE* magazine, Marvel Comics, *The Wall Street Journal*, *USA Today*, *Stern* magazine, *The Washington Post*, and had nearly 100 TV appearances, including ABC-TV's *Entertainment Tonight* and *NBC Nightly News*. As Twin Galaxies's fame spread further, Walter Day was designated an assistant editor in charge of video game scores for the 1984–1986 editions of the U.S. edition of *The Guinness Book of World Records*. After Guinness World Records decided to cease coverage of video game scores in their books, Twin Galaxies, under Day's direction, wrote the first official rulebook for playing electronic games and established the rules and standardized settings for each game. Today, this rulebook has evolved into Twin Galaxies's most well-known product: *Twin Galaxies' Official Video Game & Pinball Book of World Records*, a two-volume edition totaling 1,500 pages, containing scores from players in 31 countries compiled since 1981. Guinness World Records officially recognized Twin Galaxies as the authority on all video gaming scores and records, and in 2008 began importing their database of champions into the annual book, the *Guinness Gamer's Edition*, highlighting myriad video gaming scores and achievements.

By the turn of the millennium, Day would find himself considering retirement, as well as attempting another passion of his, creating his own music. In 2006, successful business owner Pete Bouvier became involved with Twin Galaxies, and, at the start of 2007, he became the CEO and owner operator of the company under its new name, *Twin Galaxies International*. Bouvier has transformed the company into a professional services organization, called on to adjudicate video game world records and facilitate contests and tournaments for major gaming companies. The company employs a worldwide staff of referees and writers, allowing them to cover video gaming events happening all over the globe.

Today Twin Galaxies International is recognized as the world's premiere electronic games referee providing governance for the video gaming industry. It covers arcades, home **consoles** new and old, computer games, pinball, **handhelds**, and portables, and will be tracking mobile phone gaming in the near future. Twin Galaxies International sets and enforces the **rules** for gameplay, validates and retains the scores and achievements, and maintains the integrity of fair **play** across the sport of competitive video gaming.

In the foreseeable future, Twin Galaxies International has plans to release the first trading card set of video gaming champions from across the globe. It will begin issuing licenses to gaming establishments, enticing players to visit and attempt world record scores. As noted earlier, it will also begin tracking scores on one of the newest video gaming platforms that has really gained a foothold in the market: mobile phones. The company will also continue to have a major presence at the *Big Bang* event held annually at the *International Video Game Hall of Fame* located at Twin Galaxies's birthplace, Ottumwa, Iowa.

David Nelson

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U

ubiquitous games

Ubiquitous games extend the alternate **worlds** of video games into the physical world by taking the gaming experience into everyday **spaces** and contexts. Players interact with ubiquitous games across multiple media **platforms**, from clue-embedded websites and documents hidden on servers to mobile phones, global positioning systems, phone booths, classified advertisements, billboards, and so forth. Rather than the space of the game being confined to a computer-generated world, ubiquitous games consist of both virtual and actual locations that the game's designers may or may not designate in advance as the playing fields. The designers may limit the **time** of **play** to a certain period, or the game may have no set temporal parameters. These types of games are related to, and sometimes synonymous with, **pervasive games** and alternate reality games; ubiquitous games, however, take explicit cues from the philosophy of ubiquitous computing.

Some examples of ubiquitous games include *Can You See Me Now?* (2001) from Blast Theory and Mixed Reality Lab, *Pac-Manhattan* (2004) by Frank Lantz and his students, and *I Love Bees* (2004) by 42 Entertainment. In *Can You See Me Now?* participants from around the world played the game in an on-line virtual version of the city of Sheffield, England, although other participants used **handheld** computers to track the locations of the on-line players and to chase them through the actual streets of the city. The on-line players used GPS technology to evade the runners in the streets. In 2004, Frank Lantz and his students at New York University's Interactive Telecommunication graduate program designed a version of the iconic ***Pac-Man*** (1980) video game that would take place on a grid of streets around Washington Square Park in New York City. In *PacManhattan*, a player dressed like Pac-Man runs through the streets attempting to collect all of the "dots," while four players dressed as the ghosts are in pursuit. The players, equipped with mobile phones, keep in contact with a person in the control room who updates the location of the player through mapping software. *I Love Bees* was created for Microsoft's launch of the video game *Halo 2* in 2004, and the URL ilovebees.com appeared in theatrical trailers for *Halo 2*. When players visited the site, they found what appeared to be a website about beekeeping that had been hacked by **artificial intelligence (AI)**. Following clues that were released over a few months on the website, players were directed with GPS coordinates to pay phones where they listened to chapters of a *Halo*-related **audio** drama that eventually revealed more clues and the solution to the mystery.

Although ubiquitous games can range from **art** projects to viral marketing campaigns, they all share the common theme of finding pleasure in interweaving the game world into the physical world. Similarly, ubiquitous computing seeks to decentralize the personal computer as the site of computing and to extend the **interface** into unexpected and everyday objects, like clothing, buildings, and items in the supermarket. Transforming the banal into the fantastic, ubiquitous games follow this logic by embedding game elements into nongame objects and into the everyday lives of players. Ubiquitous games also share similarities with urban games played by the Situationists, an international group of writers, artists, and theorists associated with **European** avant-garde art movements and Marxism. In the mid-20th century, the Situationists played elaborate games in public urban places to create alternative spaces in everyday life for the articulation of desires that countered capitalist conditions. The deliberate amplification of gaming beyond the **magic circle** in ubiquitous games emphasizes the idea that we already live in a game-infused culture and speak of many aspects of life as games to be played.

See also augmented reality; virtual reality.

Aubrey Anable

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Ultima series

One of the longest-running **computer game** franchises of all time, the *Ultima* series consists of both single-player fantasy role-playing games and the **massively multiplayer on-line role-playing game (MMORPG)** *Ultima Online* (1997), as well as their multiple expansion packs. Launched by then-fledgling game designer Richard **Garriott** in 1980 when Garriott was still a university student, the series is now owned by major game developer and publisher **Electronic Arts (EA)**. Although the single-player *Ultima* games were widely credited with pioneering the computer game genres of the **role-playing game (RPG)** and the graphical **adventure game**, *Ultima Online* has been lauded for popularizing the MMORPG, and, in so doing, introducing an entire generation of players to the experience of residing in and navigating a **persistent**, multiuser virtual **world**. On the whole, the series has been acclaimed for the open-endedness of its gameplay, the degree of choice it allows players in terms of customizing character appearance, capability, and **morality**, and the detailed expansiveness of its game world. Although a new single-player version of the series hasn't been produced since 1999, at the time of writing EA has continued to maintain and update *Ultima Online* through multiple expansion packs and client upgrades, and, despite having been surpassed by more recent MMORPGs in terms of popularity, *Ultima Online* still retains a dedicated user base.

From its inception, the *Ultima* series was instrumental in adapting the **rules**, gameplay, and fantasy settings of the tabletop role-playing game (embodied most famously at the time by *Dungeons & Dragons* [1974]) to the realm of the computer game, helping to shape the role-playing game into one of the most robust computer game genres of all time. (Although their specifics vary from game to game, computer role-playing games typically allow players to create and customize a developed character persona defined by such traits as species, **race**, **gender**, and occupation, as well as abilities, such as strength and dexterity, which tend to be highly relevant to gameplay (see Wolf, 2005, p. 202). Following the success of the first graphical adventure game ***Adventure*** (1979), the *Ultima* series was also one of the first graphically-based adventure game series, wherein player-characters may move somewhat freely through the (usually fantastic and/or historic) settings of the game world, pursuing multistep objectives typically more complex than simply shooting, evading, killing, or catching one's opponent (Wolf, 2005, p. 196). Unlike text-based adventure games that relied on written description to convey the action of gameplay, *Ultima* utilized **graphics**, including on-screen controllable characters and **navigable** digital **spaces**, which, despite their initial simplicity, heightened the player's sense of immediacy in the game action. It was also the first home computer game to permit **scrolling** in both vertical and horizontal directions, allowing players to move through a larger playing field than what could be viewed on-screen at any given time (Wolf, 2007, p. 83).

The first *Ultima* (California Pacific, 1980) set the basic template for the series by enabling a high degree of flexibility for players creating their characters, allowing them to choose different fantastical "races" and "classes," each with its own special abilities and shortcomings. Player-characters moved through the game's fictional medieval world, gaining character-enhancing experience points through successful battles and ostensibly moving toward the goal of defeating an evil warlord who had enslaved the kingdom. However, rather than being forced to adhere to a strictly linear quest structure, players could go about achieving this goal in different ways and had some freedom to explore the various landscapes and dungeons of the game world. Players also had to manage such mundane resources as money and food in the process. On the whole, Garriott has described his **game design** philosophy as being world-focused rather than story-focused, suggesting that the story of each of the games in the single-player RPG series is meant to showcase the world of the game rather than a specific sequence of **narrative** events. Garriott has cited J. R. R. Tolkien's exhaustively realized Middle-earth as one inspiration for this approach (Kolbert, 2001).

Ultima II: Revenge of the Enchantress (Sierra On-Line, 1982) innovated gameplay by allowing player-characters to talk to **non-player characters (NPCs)**, and its packaging also featured a detailed cloth map of the game world, which would become a trademark of subsequent *Ultima* releases. Garriott and his brother Robert used the money earned from the first two *Ultima* games to create Origin Systems, which would publish *Ultima III: Exodus* (1983), as well as all the remaining titles in the series until Garriott sold Origin to EA for $30 million USD in 1992. Besides introducing the ability to create and guide a multiperson party through the game, *Ultima III* was also noteworthy as the last game in what had been dubbed the "Age of Darkness" trilogy in the series. The subsequent three games (*Ultima IV: Quest of the Avatar* [1985]; *Ultima V: Warriors of Destiny* [1988], *Ultima VI: The False Prophet* [1990]) would make up the highly successful "Age of Enlightenment" trilogy, which refocused the role-playing elements of the series somewhat to facilitate a greater emphasis on morality, with players able to choose a player class that reflected their own moral views and possessed different virtues (including compassion, honesty, and justice) that would be mobilized in the course of gameplay. The acclaimed, two-part *Ultima VII* (*Part I: The Black Gate* [1992], and *Part II: Serpent Isle* [1993]) shifted the series toward real-time combat on the battlefield (versus the turn-based combat of its predecessors), with the last two games in the series (*Ultima VIII: Pagan* [1994] and *Ultima IX: Ascension* [1999]) downplaying role-playing elements somewhat in favor of foregrounding action-based combat and adventure game mechanics. The long-delayed *Ultima IX* was widely considered a costly failure and has been blamed as a contributing factor in the demise of the single-player facet of the series.

Although the single-player *Ultima* games wound down in the late 1990s, *Ultima Online*—the fantasy MMORPG launched by Origin and EA in 1997—moved the series into an entirely new realm of both commercial popularity and cultural significance. *Ultima Online* took the vast medieval storyworld of the single-player series and moved it into a visually lavish, persistent, on-line multiuser environment. Although it maintained the series' role-playing roots, as per the new demands and possibilities of its persistent, on-line nature, gameplay became decidedly more open-ended and directed toward a greater diversity of tasks, ranging from heated player-versus-player (PvP) confrontations and real-time combat, to the minutia of decorating an **avatar**'s home and wardrobe. As such, it demanded a high degree of personal investment from players, fostering a greater sense of immersion in (and commitment to) the game world. For many players, this commitment entailed spending more time in the *Ultima Online* game world than they had in that of any previous game and, in some more extreme cases, becoming almost as invested in their virtual lives as they were in their real ones.

As T. L. Taylor (2006) has pointed out, while *Ultima Online* was not the first graphical multiuser game world to blend the long tradition of text-based on-line multiplayer games such as MUDs with graphical visual spaces—*Meridian 59* (3DO, 1996) and *Diablo* (Blizzard, 1996), for example, allowed users to enter into a graphical **space** and **play** with others in real **time**—*Ultima Online* tends to be seen as the breakthrough game of the MMORPG genre because of its intense and almost immediate popularity, its success in creating a rich and fully realized game world, and the lively player culture it cultivated. Despite struggling with multiple system crashes during the initial mass influx of players, it quickly reached and surpassed the 100,000 subscriber mark, far surpassing the player populations previously seen in **multiuser domains (MUDs)** and other graphical worlds. In addition to their investment in the original game software, each player paid $9.95 USD per month to maintain **access** to the game, demonstrating to other game companies how the on-line subscription model of the MMORPG could be highly lucrative.

Ultima Online also raised and confronted many of the key issues still faced by MMORPGs to this day, including community management, mass player protest, and "griefing," as well as the challenges of managing a "real" economic system in a virtual world. For example, *Ultima Online* was the first MMORPG to allow players to buy and sell virtual in-game objects for real money, a practice which has continued and flourished in persistent on-line worlds such as Second Life (2003) and ***World of Warcraft*** (2004). Julian Dibbell (2006) has chronicled his efforts to make a living through such transactions, contending that MMORPGs like *Ultima Online* demonstrate how the boundaries between "work" and "play" are being blurred in our increasingly-networked society.

The success of *Ultima Online* spawned multiple imitators, the most famous of which, **Sony's** *EverQuest* (1999), quickly surpassed its predecessor in terms of both subscriber numbers and critical acclaim. However, *Ultima Online* still maintains a dedicated user base, with EA continuing to commission expansion packs and client upgrades. For example, in 2007, on the 10-year anniversary of its release, EA launched the ambitious *Ultima Online: Kingdom Reborn*, which expanded game content and sought to make its interface and graphics comparable to those of contemporary MMORPGs, while maintaining the consistency of the *Ultima Online* world. ***See also*** immersion; packaging; subcreation.

Jessica Aldred

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unit operations

"Unit operations" is a term coined by Ian Bogost (2006) to describe how the component functions of systems produce meanings. According to Bogost, "units," a nonspecific term for any discrete instantiation of some material form, are building blocks that construct a system. These units can be as minute as the binary circuit in a light switch or as broad as an entire city power grid to which that switch is attached. Packet-switching protocols and fiber optic lines are both units of the system of the Internet. Historically received racial prejudices and statist legislation establishing racial discrimination each act as units in the apartheid system. "Operations" are any processes that perform transformative work, generating new output from input. Balancing a chemical equation, releasing a car's handbrake, apologizing to a friend, and appropriating money for health care are all operations. An operation is the logic that underlies a unit, the way it behaves.

As a framework for studying video games, unit operations offers a model for how individual components of the system that comprises the game produce meaning, both individually and together. Methods of analysis that embrace unit operations focus on the relationships between inputs, processes, outcomes, and interpretations to explain what a game is doing; "unit analysis" is the term for this practice (Bogost, 2006). When we play a game, we do not discuss it in terms of a single synthesized result but rather the processes we engage with—and particularly how the processes in the game relate to processes outside of it.

SimCity (1989) offers an example. A high-level explanation of the game as a "city planning simulator" offers little in the way of saying what it means to **play** or what "city planning" means in *SimCity*'s case. However, by engaging the system closely at the level of discrete units in relationship to one another, we can better understand the game. Furthermore, by understanding the game's unit operations in relation to those outside the game (such as actual city planning practices, lived experiences in cities, and so on) we can draw conclusions about the way *SimCity* works representationally.

For example, many of the **rules** that govern the game's mechanics are derived from Jay W. Forrester's book *Urban Dynamics* (1969). When he created the game, Will **Wright** implemented a simulation of a specific operational model of the city structure embedded in the software code. Understanding the individual elements—the bonuses given for building mass transit, citizen happiness, and the tax rate—determines meaning and success. The game responds as the player makes changes: sometimes hidden transparently in the underlying dynamics and other times presented opaquely in the **interface**. The unit operations of cellular automata and urban dynamics are related through the work that is *SimCity*.

Unit analysis can also help us understand supposedly **narrative** games. ***Grand Theft Auto****: Vice City* (2002) is not simply a playable story with a climactic ending in which Tommy Vercetti defends his position at the top of the southern Florida crime scene. Rather, it's a game of crime missions and open-**world** play, both of which can be broken down even further into the mechanics that define them in relation to the worldly processes they depict.

The software-based unit operations in *GTA: Vice City* include the ability to steal cars, the rules that govern the use of weapons, the algorithms that determine police warning levels, the choice of historical and geographic setting, the relative freedom the player has to drive around the city, the need to accept missions from characters to progress the game, pedestrian **artificial intelligence (AI)**, the inclusion of unmarked stunt ramps, the player's inability to swim, the day-night cycle, the in-game radio stations, and so on. The configuration of these units—both within the game and in relation to external references or interpretive acts—exemplifies an analysis built on unit operations.

Hardware and software are often important when considering the meaning of a software artifact. *GTA* uses an algorithm that determines the draw distance of objects and buildings and produces a hazy landscape beyond said radius. The spawning of pedestrians and cars is governed by this distance, which means players cannot stand atop a building far away and use a sniper rifle to complete all their kill-based objectives. Likewise, the division of the game into islands is a **design** strategy to limit the player's mobility, but also to overcome the memory limitations of the disc-based **Sony PlayStation 2** hardware. The designers implemented loading screens between the eastern and western islands so that information could be read from the disc and stored memory. The code need not worry about having to draw more than a cursory skyline of Downtown when the player was roaming Vice Point and more processing power could be devoted to immediate needs. Rather than freeze the game on-screen, the developers chose to create "Welcome to Vice City" postcards for the loading screen, which provide further character to the colorful city. Because this hard stop created a break in the action, most missions do not require crossing the loading boundaries.

Bogost details first-person **shooting game engines** as vivid examples of unit operations influenced by hardware and software (Bogost, 2006). In making *Doom* (1993), **id Software** created not only a wildly successful game but also a framework for making the genre of game *Doom* had popularized. The technical accomplishments of *Doom* exist both inside and outside the game; id Tech 1, the engine that powered the three-dimensional drawing of *Doom*'s world and object interactions, became the basis of a handful of other id Software games. While creating their next game, *Quake* (1996), id Software set out not only to design a game but also to build an engine to be licensed to other developers that consisted of core operations. This codebase enabled the critically acclaimed *Half-Life* (1998), for example. An analysis of either game would not only take into account the operations of the core functions but what these operations enable.

Bobby Schweizer and Ian Bogost

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United States of America (USA)

As the birthplace of video games and the major producer of them (along with **Japan**), the United States has had a great influence on the **history of video games**, which have been shaped by American culture since their inception; thus, a detailed summary of video games in America would be a reiteration of much of that history. Since their beginning, the large domestic audience of the United States has provided enough support for the existence and growth of video game **industry**, which can be divided into **arcade games**, **console-based games**, **computer games**, **handheld games**, and **on-line video games**. Although video game production companies can be found across the country, they tend to be more numerous in larger cities like Los Angeles, New York, and Chicago, as well as other areas such as Silicon Valley in California, and Austin, Texas, where game production has grown into a subculture. Many large video game–producing companies from other countries, such as **SEGA**, **Sony**, and **Nintendo**, also have divisions or subsidiaries headquartered in the United States.

The United States in Video Game History

The 1880s through the early 1900s saw the rise of **arcades** as places of entertainment through the introduction of coin-operated amusement devices, including strength testers, slot machines, card machines, racing games, and other "trade stimulators" as well as the coin-operated mutoscopes and kinetoscopes that paved the way of the cinema. Early arcade video games were simple, based on action, and inexpensive to **play**, making them similar to much early **film**, which appealed to a wide mass audience of limited means and education that made up a significant percentage of the American public around the turn of the century. One of the most popular types of games to emerge from the arcade was pinball, which became electrified and grew in popularity from the 1930s to the 1950s. Other **electromechanical games**, housed in upright cabinets, would provide the format that would be adopted by arcade video games.

Advances in computer technology after **World War II** led to many universities housing mainframe computers on their campuses, and experiments on these led to **mainframe games**. By the 1960s, when the children of the postwar baby boom were reaching college age and experiments in **art** and computer technology had spread to many campuses, the stage was set for the emergence of video games on mainframe computers, and games like ***Spacewar!*** (1962) arose as the result of **hacking**. During this time, American inventor Ralph **Baer** received a patent for the idea of home video games, resulting in the production of the **Magnavox Odyssey** in 1972. Also in the early 1970s, *Spacewar!* and Baer's tennis game were adapted by other parties into arcade video games (such as ***PONG*** [1972], the first hit arcade video game), which were housed in upright cabinets and used arcades as their main venues. The large number of baby boomers, responsible for the growth of youth culture during the 1960s and afterward, and the **generation** that followed them, became the main audience for video games and encouraged their growth in arcades and in the home during the 1970s, when the American game company **Atari** became dominant in the industry.

Home computer technology of the late 1970s and early 1980s resulted in the rise of home computer games, amateur computer game programming and **homebrew**

games, as well as networked games on **bulletin board systems (BBSs)** and **multiuser domains (MUDs)**. The rise of blockbuster cinema during this time, along with the development of the franchising and merchandising of popular film and **television** shows, led to video games that were **adaptations** of content from other media, and in the 1980s video games would themselves become the source of character-based franchises that would spread to other media (such as those involving **Pac-Man**, **Mario**, and **Zelda**).

After the video game industry **crash of 1983**, Japanese video games gained prominence with Nintendo of America's introduction of the **Nintendo Entertainment System (NES)** in 1985. The NES was a version of Nintendo's Famicom system released in Japan, which Nintendo reworked specifically to appeal to American retailers, who were wary of new game systems after the crash. The United States would continue to be the leader in the area of home computer gaming, thanks to the domination of IBM, Microsoft, and Apple in the computer industry, although these, too, would find growing international competition. The late 1980s saw the growth of on-line games, which were becoming available for more and more participants and blossomed into **massively multiplayer online role-playing games (MMORPGs)** a few years after the World Wide Web went worldwide in 1993.

By the early 1990s, advances in computer technology led to, and were encouraged by, the use of computer **graphics** in all areas of American visual media. Three-dimensionally rendered graphics and photorealistic textures and lighting allowed computer-generated imagery (CGI) to be integrated into live action, bringing video games and other media ever closer together. Other rapidly growing technologies like cell phones and handheld computing devices opened up new venues for video games, as Americans spent more time commuting and on the move. Most of these venues would be exploited by the following decade, resulting in the popularity of **mobile gaming** in the 2000s. By the 2010s, the original generation of video game players were nearing retirement age, and video game players could be found across all demographics, which was reflected in the enormous variety of games and game venues.

The Character of American Video Games

With the wide variety of video games in existence, it is difficult to argue for a cultural resemblance among them all that stems from American cultural values; however, a few broad generalizations can be suggested. First, the highly competitive nature of American society makes for fertile ground for competitive gaming, and it should be no surprise, then, that the majority of video games are competitive ones (as opposed to other styles of play, like **cooperative play** or sandbox-style play, which could have become the dominant one but did not). Competition is often involved with the acquisition of goods, property, and position (which at various levels in American culture has resulted in consumerism, materialism, and imperialism), and equivalent activities in video games include the collecting of objects or points and the attaining of high scores or higher levels within a game. Other noted aspects of American culture, such as its relative extroversion, inventiveness, pioneer spirit, and appetite for novelty, are also apparent in many of the games developed in the United States, as well as in the way American game companies are run. Besides competition and acquisition, other themes—such as cultural conflict and development of identity—could be said to correspond to similar concerns in American society. The growing variety of video games and venues for them assures that video games will find ways to connect to the culture they are embedded in, and it seems likely that video games will remain an integral part of American culture.

Mark J. P. Wolf

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unlockable games

Unlockable games are those made available to a player within a "parent" game through the satisfying of one or more particular conditions within that game. Such conditions can include completing the parent game once or more, achieving a certain level of competence, collecting a certain number of in-game bonuses, or even just discovering an **Easter egg** that makes the unlockable game available for play. Unlockable games typically pay homage to the parent game or the company responsible for the parent game's creation. As such, newer iterations in particular game franchises will often offer unlockable versions of their predecessors.

Examples of games that house unlockable games include ***Animal Crossing*** (2001) for the **Nintendo GameCube**, which contained a series of **Nintendo Entertainment System (NES)** games such as *Balloon Fight* (1984) and *Ice Climber* (1985; see **retrogaming**) that a player could make available through a number of methods such as entering an in-game lottery to "win" the games as prizes. A more straightforward example, **id Software**'s *Return to Castle Wolftenstein* (2001) made the original classic, *Wolfenstein 3D* (1992), available for **play** after a player finished the parent game.

Unlockable games can either be games that are smaller in scope than the parent title (see **minigames**) or full-featured, previously stand-alone games. However, older games included as unlockables games are frequently considered minigames simply because of the relative difference in scope, length, style, and difficulty of play compared to more contemporary titles.

Unlockable games are similar to but should not be confused with unlockable "modes"—levels, difficulties, or minor variations on a game's preexisting goal structure that are made available to a player after they meet certain conditions in the game. An ideal example of an unlockable mode is the "Challenge of the Gods" in *God of War* (2005), which changes the linear scenario presented by the game's core mode of play and instead pits a player against several rounds of oncoming enemies in an enclosed arena. This mode is only made available after the game has been played through once.

Finally, a game demo might allow the unlocking of its full version after the input of a purchased key or some other form of purchase validation. Game demos such as those downloaded on a downloadable content (DLC) network (for example, Xbox Live) often allow a user to download all of a game's files while only having time-restricted or feature-limited access to the game's content. Full **access** to such games only becomes available for feature-complete play after purchase validation, thereby "unlocking" the remainder of the game's content. One example of this would be Runic Games's *Torchlight* (2009), which allowed the free download of the game for all users but only permitted an initial two hours of play. Only the entry of a purchased serial key by a user could unlock the game for restriction-free play.

Nis Bojin

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See United States of America (USA)

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VAPS

See Vintage Arcade Preservation Society (VAPS)

vector games

The era of vector arcade video games was a short one, beginning in 1977 and lasting less than a decade. Invented during the 1950s, vector graphics displays (also known as XY monitors) created their imagery differently from raster monitors, like those used in **television** sets. Whereas the electron beam covers the entire screen in raster-scan monitors, in vector-scan monitors it draws only the line segments that make up the image and leaves the rest of the screen black. With less to draw, vector **graphics** could be displayed faster, with thinner, sharper lines that could be moved smoothly across the screen, as opposed to the solid, blocky graphics of raster games for which movement was more difficult to program. Because objects were drawn individually, more moving objects were also possible, and even early vector games could have as many as 40 independent objects, compared with only 10 or so in raster games (Kent, 2001, p. 130). The main disadvantage of vector graphics was that bitmaps were not available; everything was constructed from a series of line segments, so creating small, detailed graphics for game characters or objects was more difficult than it was in raster graphics. As a result, vector games tended to be less character-based and mainly consisted of wireframe imagery on a black background.

Vector graphics came to the **arcade** when Larry Rosenthal, who had done a master's thesis on the **mainframe game** ***Spacewar!*** (1962) at MIT, developed vector technology that could be used in **arcade games**, which he called the **Vectorbeam** monitor. Rosenthal licensed his Vectorbeam equipment to the game company **Cinematronics**. After a dispute, Rosenthal left the company and created his own, which he also called Vectorbeam. Both companies produced games based on *Spacewar!*; Cinematronics's was called *Space Wars* (1977), and Vectorbeam's was called *Space War* (1977). (Rather than license technology from Vectorbeam, Cinematronics later bought the company in 1979.)

Cinematronics's next release was *Starhawk* (1978), which had visuals inspired by the Death Star trench scenes in the film *Star Wars* (1977). Vectorbeam's next game *Speed Freak* (1978) was a driving game with a first-person perspective. *Speed Freak*'s oncoming cars were three-dimensional and resized smoothly as they approached. When the player crashed into an oncoming car, it exploded into line segments that scattered across the scene, adding a more dynamic feeling of a crash, making *Speed Freak* the best driving game of its day.

In **Atari**'s first vector game, *Lunar Lander* (1979), players tried to fly and land a spaceship without crashing it. That same year Atari also released *Asteroids*, which became one of the best known vector games, exceeding 70,000 units produced, and arcade operators had to make larger coin boxes because the game was taking in so much money. Other games of the year included Cinematronics's *Sundance*, in which players opened panels in grids to catch bouncing suns; Vectorbeam's *Warrior*, in which two knights seen in overhead view engaged in a sword fight, one of the first one-on-one **fighting games** (along with SEGA's *Heavyweight Champ* [1976]); and *Tail Gunner*, a space **shooting game** that began development under Vectorbeam and finished at Cinematronics after they bought Vectorbeam. *Tail Gunner* was different in that its starfield movement was reversed; instead of flying into the depicted space like other games, the viewer was moving away from it, looking out the back of a spaceship at the ships chasing it; hence the name *Tail Gunner*. Exidy purchased the rights for a cockpit version of the game, and released *Tail Gunner II* in 1980.

Other games of 1980 included Cinematronics's *Star Castle*, in which players fired at an enemy ship surrounded by rotating rings that could be destroyed; *Rip Off*, a tank shooting game where pirate tanks are stealing the player's fuel canisters and hauling them off-screen; and *Armor Attack*, which featured jeeps, tanks, and helicopters from a bird's-eye view. Also released that year was Atari's ***BattleZone***, probably the best-known vector arcade game of all time. *BattleZone* had a first-person perspective view and hardware that could do real three-dimensional computation.

Atari's *Red Baron* (1981) was essentially a flying version of *BattleZone* with biplanes, with rounds of shooting in the air as well as from on the ground. Another Atari vector game of 1981 was the arcade classic *Tempest*, an **abstract** game with shapes moving up a well that the player had to shoot at and stop before they got to the top, an idea that began as a first-person version of ***Space Invaders*** (1978; Kent, 2001, p. 164). The scaling imagery used in *Tempest* was easy for vector graphics and was something that could not be done well in raster games. Vector games made good use of scaling and quick, smooth movement, and around 1981 they began to appear in color, including *Tempest*. Games before 1981 were typically either black and white or monochrome (*BattleZone*, for example, had green lines on a black background). Some games, like *Star Castle*, had color overlays on the screen to make the game's lines appear to be different colors, but the monitors themselves were not color.

SEGA released two vector games in 1981, *Eliminator* and *Space Fury*. Like *Star Castle*, *Eliminator* had its enemy spaceship situated inside a circular enclosure, although *Eliminator*'s enclosure had a narrow tunnel that the player could try to shoot down to destroy the enemy ship. *Eliminator* was released in a one-player upright version, a two-player cocktail version, and a four-player version, making it the only four-player vector game ever made. *Space Fury* was another space shooting game, known mainly for its attract mode, which featured a one-eyed alien commander that taunted players in synthesized speech. Other games of 1981 were variations of shooting games, including Cinematronics's *Boxing Bugs* and *Solar Quest* and Midway's *Omega Race*.

The year 1982 was another big one for vector gaming, with at least six new arcade games appearing along with the only vector home **console** system. Three arcade games were from Atari: *Space Duel*, *Gravitar*, and *Quantum*. *Space Duel* was Atari's only vector game that two players could play simultaneously and was similar to *Asteroids*, but with three-dimensional color asteroids and either competitive or **cooperative gameplay**. *Gravitar* combined skills from *Asteroids* and *Lunar Lander* and was made up four "universes" (with gravity that was either negative or positive, and landscapes that were either visible or invisible); each "universe" had three solar systems; each solar system had four or five planets; and each planet had its own unique terrain to navigate, giving players several dozen screens to see. *Quantum*, inspired by particle physics, was an abstract game in which players used a track-ball controller to encircle particles (capturing them) while avoiding hitting other particles.

SEGA also had three new vector games in 1982: *Zektor*, *Tac/Scan*, and *Star Trek*. *Zektor* involved freeing eight cities from waves of attacking enemy fighters and "roboprobes." *Tac/Scan* was a three-stage space shooting game in which the player controlled a squadron of seven ships that all flew in formation and moved as one. A unique feature of the game was its change in perspective. *Tac/Scan*'s first stage was two-dimensional and similar to games like *Galaxian* and *Space Invaders*, but its second stage was three-dimensional, with players firing into the screen instead of up or down it. SEGA's *Star Trek* had 5 controls to learn, 6 enemies, and 40 simulation levels of play, making it one of the most elaborate vector games ever made (along with possibly *Gravitar*).

The **GCE/Milton Bradley Vectrex**, the only home game system with vector graphics, was released in 1982. Because television sets used raster graphics, the Vectrex came with its own vector monitor. The screen was monochrome, and colored overlays were used to color games' graphics. Games released for the Vectrex included original games (*Bedlam*, *Blitz!*, *Fortress of Narzod*, *Minestorm*, *Hyperchase*, and others), **adaptations** of Cinematronics' vector arcade games (*Space Wars*, *Starhawk*, *Star Castle*, *Armor Attack*, *Rip Off*, *Solar Quest*, *Cosmic Chasm*), adaptations of raster arcade games (*Berzerk*, *Pole Position*, *Scramble*), games that used a light pen (*AnimAction*, *Art Master*, *Melody Master*), and even some **3-D** games (*3D Crazy Coaster*, *3D Mine-Storm*, *3D Narrow Escape*), which involved an additional special 3-D viewer. Since the system has ceased production, Smith Engineering has allowed Vectrex materials to be copied for noncommercial purposes, allowing a community of Vectrex fans to continue creating **homebrew games** for the Vectrex.

A few more vector games appeared in 1983: GCE/Cinematronics's *Cosmic Chasm*, Centauri's *Aztarac*, and Atari's *Black Widow*, *Major Havoc*, and *Star Wars*. In *Cosmic Chasm*, the player had to fly through tubes inside a space station to fire at its core and then fly out again before it blew up. *Aztarac*, another space game, had players defending a starbase from attacking ships. In *Black Widow*, players controlled a spider on a spider web that it defended from invading bugs by shooting at them. *Major Havoc* was a detailed multistage **adventure game** that involved shooting enemy ships, landing in a space station, and navigating a **scrolling** maze of hallways with a variety of objects (such as robot guards and electrified barriers) that the player passed through on the way to destroying the station's reactor. Finally, the best-known vector game of 1983 was Atari's *Star Wars*, a colorful, three-dimensional take on the space battles and Death Star trench chase scenes from the film and even included digitized voice samples from the film's soundtrack.

The year 1983 was the last year Cinematronics would produce vector games. That same year, it released their first **laser-disc game**, and its success redirected their efforts to the new technology. No company appears to have released vector arcade games in 1984, although work on a few games continued. In 1985, another *Star Wars*–based game, *The Empire Strikes Back*, was released by Atari Games and was the last major vector game released. (Only one other game may have been produced that year, Exidy's space game *Vertigo* [1985].) Probably the last vector arcade game ever made, which may or may not have actually been released, is Exidy's *Top Gunner* (1986), a sit-in game that is said to be a modification to *Vertigo*.

By the late 1980s, sprite technology had improved greatly, and three-dimensional filled-polygon graphics were beginning to return to the arcade after their failed debut in Atari's *I, Robot* (1983). Raster games had improved graphically, the rise of three-dimensional raster graphics games in the 1990s was just around the corner, and the era of vector games was over. The unique look and playing experience of vector games, however, has attracted a following, and vector games live on as arcade collectibles and in adaptations for emulators. They are remembered as an important part of the Golden Age of arcade video games.

Mark J. P. Wolf

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Vectorbeam

Larry Rosenthal's company Vectorbeam was the first company devoted to the production of **vector games**, which used vector **graphics** instead of raster graphics and thus could provide games with sharp wire-frame graphics and smooth motion that was new to the **arcade**.

In the late fall of 1976, Larry Rosenthal, a graduate of MIT, along with his business associate, Bill Cravens, set up shop in Union City, California, to begin a business venture based on Rosenthal's video game success, *Space War* (1977). Before this endeavor, both men had been employed by the struggling video game company **Cinematronics** with Cravens as the company's sales representative. Cinematronics was a small company located in an industrial strip mall in El Cajon, California, struggling to get by with whatever video games they could acquire and manufacture, and already beginning to feel what was to come, an almost-assured bankruptcy.

After graduation from MIT, Larry Rosenthal acquired the rights to build and sell his own commercial version of MIT's laboratory pastime, ***Spacewar!*** (1962) and turned it into a coin-operated ("coin-op") game that he called *Space Wars* (1977). His obsession with the game began in 1973, and by 1976 he was ready to put a prototype in a friend's arcade. When he returned from a short trip, Rosenthal found that *Space Wars* had taken in more than $500 in six days, evidence that his obsession with vector displays could pay off. His next challenge was to manufacture and market his game. Rosenthal took his prototype to every established video game manufacturer that he could find, hoping one would agree to his demand for a 50-50 split of the revenues from his game. Larry's faith in *Space Wars* (1977) might have appeared hubristic, but he was one of the few persons who had seen and played the original game at MIT. In an era when computer graphics were blocky and slow to refresh, vector graphics were lightning fast, faster than the flicker fusion rate, the frame rate at which sequences of moving images combine to present the illusion of continuousness. However, even with innovative features such as multiplayer gameplay, unlimited buy-in, and the allure of the game's smooth vector graphics, *Space Wars* was hard to sell to manufacturers. Even though the game was testing well, no game company was willing to split revenues with Rosenthal except for one small, desperate company, Cinematronics. Desperation, in this case, became a bonanza for Cinematronics. *Space Wars* was the hit of the 1977 AMOA show and went on to sell at least 10,000 units with some sources putting the figure at three times that. Sales records of *Space Wars* put it at number one for almost two years.

With statistics like these, it was inevitable that salesman Cravens would find a way to exploit the *Space Wars* bonanza. Rosenthal was the owner of all rights to his game, complete with patents, and his share of the revenues had become substantial thanks to the two-way split with Cinematronics. Regardless of the damage that would be done to that company, it made sense for Rosenthal and Cravens to found their own video game company, Vectorbeam. Their company did not last long, perhaps only from September 1978 to August 1980 as recorded by Vectorbeam programmer and game designer Dan Sunday. Even so, the games created there were innovative and fun to **play**, exploiting Rosenthal's mastery of vector graphics. The company bootstrapped itself by manufacturing its own clone of *Space Wars*, now slightly renamed as *Space War* (1977). Another slight, but significant, difference was the quality of the two company's game cabinets. Unlike the Cinematronics cabinets, which were prone to fall apart in shipment, Vectorbeam's cabinets were much more solid. Nothing significant to the players of the game, but a touch that helped determine which of the two versions would most likely be purchased by vendors.

The first original game from Vectorbeam was *Scramble* (1978), not to be confused with the later 1981 video game of the same name. Few ever played or even saw *Scramble*, an unusual and somewhat difficult-to-play vector version of a pinball game. Without the bells and flashing lights that a pinball machine offered and a playfield made up only of squared-off white lines on a black background, *Scramble* had no chance of matching the fun and excitement of a tangible pinball game. Even so, Vectorbeam managed to sell enough units to keep its new company alive. Vectorbeam programmer Dan Sunday remembers, "It was the very first game for Vectorbeam. So, when the company first started things, it was really hectic, a scramble. We were trying to get our new business off the ground and get a game to the annual AMOA show in Chicago. We managed to quickly put together the video pinball game *Scramble* and actually got it there in time for the trade show."

Next would be a landmark driving game, Larry Rosenthal's *Speed Freak* (1978). Unlike most driving games at the time, *Speed Freak* took advantage of vector graphics to display geometrically true wireframe depictions of oncoming cars, twisting roads and various other obstacles and scenic embellishments. To optimize the number of lines that had to be scanned across the vector display tube, Rosenthal placed most objects on only one plane, X, Y, or Z. This established the true three-dimensional quality of the game without squandering precious computation and line-drawing time. He did, however, include one stunning animation that used all three dimensions. The biggest thrill in *Speed Freak* was rewarded not for staying on the road but for crashing the player's car in a head-on collision. To do that, Rosenthal used all three axes to create the first true three-dimensional explosion in a video game. Because of the computation time required to rotate objects on all three axes, Rosenthal and Sunday chose to display a pre-rendered animation of pieces of the player's car tumbling away. Even though the explosion was not interactive, it was still a landmark in video game graphics. Because of the popularity of seeing this explosion during tests, players were allowed to crash the car without penalty until their time ran out, if they chose to do so. Many did, but most eventually went back to avoiding collisions so as to get a high score. It was customary for rival companies to play the games of other companies, and back at Cinematronics playing *Speed Freak* became a favorite pastime.

Even though Cinematronics could still manufacture games based on Rosenthal's hardware, Vectorbeam could still become a powerful rival. Worse for Cinematronics, the El Cajon–based company still had to pay royalties to Rosenthal for every game that used his technology, which, of course, was the only technology Cinematronics had at that time. It became obvious that Cinematronics's best solution was to buy Vectorbeam outright. As it turned out, *Speed Freak* did well, but Rosenthal's company was still struggling. To keep product moving on the assembly line, Bill Cravens purchased a game from Cinematronics that had been only a training exercise for novice programmer Rob Patton. At various times, it was known as *Blitz* or *Barrier* (1978), and it was never popular. In the end, Cinematronics bought Vectorbeam for $2 million USD and removed their primary competitor, receiving the patents to the technology as well. This enabled the Cinematronics executives to pay themselves all related royalties, funds that would have otherwise gone to Rosenthal as part of his original agreement; not an insignificant amount.

One new Vectorbeam game, almost finished at the time of the takeover, was *Tail Gunner* (1979). This game did quite well and was eventually licensed to another manufacturer who wanted to build a sit-down version of the game. The name Tail Gunner was suggested by Vectorbeam's new top executive, Tommy Stroud, the son of Cinematronics co-owner "Papa Tom" Stroud. Tommy felt that reversing the movement of the animated star field gave a greater sense of urgency to the game. He reasoned that a retreating position created greater anxiety in the player, heightening the thrill of the game. *Tail Gunner* appeared to be a certain success, but the game's **joysticks** had a fatal flaw. At first, the sticks appeared to be ideal; they were small, rugged, and not too expensive. What remained unforeseen was that the joysticks soon stopped working after a certain number of movements. That amount was acceptable for their original purposes, but they were nowhere near good enough for video games. Changes were made, but the damage was done as far as vendors were concerned. Later, in 1980, the game company Exidy licensed and sold *Tail Gunner* as *Tail Gunner II* (1980), a cockpit version using joysticks which did not have the earlier problem.

For a short time after Cinematronics's buyout of Vectorbeam, the company name became "Vectorbeam, a Cinematronics Company." Release dates determined which manufacturing facility would build a particular game, regardless of where it had been developed. For instance, the Cinematronics game *Warrior* (1979) was conceived and programmed in El Cajon but was manufactured and sold from the Vectorbeam facility. The reverse was true for *Tail Gunner*, which was conceived at Vectorbeam but built and shipped from Cinematronics. This was temporary. Once Cinematronics had taken inventory, El Cajon once again became Cinematronics's only base of operations and Vectorbeam was no more.

The last game to be associated with Vectorbeam was *Star Castle* (1980), a successful title that was a collaboration of rivals. When Cinematronics purchased Vectorbeam, Cinematronics took inventory of its rival's assets. One particular title revealed to Cinematronics was the strangely named "Oops!"; Larry Rosenthal had begun working on this game, which was originally to be a game with the theme of birth control. Vectorbeam programmer Dan Sunday describes the origin of this oddity:

> Yes, OOPS existed. Part of its inspiration was that Larry was obsessed with a very attractive young lady who was playing around with him (maybe trying to dump him, but that only made Larry more obsessive about her). Anyway, he sometimes seemed more concerned about winning her than making Vectorbeam work. OOPS came out of this obsession. Larry had dreamed up this game where an egg was in the center of the screen, and sperm were coming on from all directions. One player controlled the sperm, and turning left caused them all to turn left, so the other player didn't really know which one you were steering. The other flew a syringe around which, when fired, would send

out foam that killed the sperm. Initial tests indicated that the syringe almost always won. So, we fixed the syringe in the center of the egg and allowed the player to only rotate.

When the delegation from Cinematronics reviewed the game that Vectorbeam had been developing, it was clear that it had potential. However, it was still a long way from being a testable title. *Star Castle* was a hit title for Cinematronics, but primarily because of the ingenuity and development design skills of Scott Boden, the programmer of the game as released.

Tim Skelly

Vectrex

See GCE/Milton Bradley Vectrex

Video Arcade Preservation Society (VAPS)

See Vintage Arcade Preservation Society (VAPS)

video game studies

Video game studies is multidisciplinary, combining elements from many fields, although the majority of them come from media studies and traditional game studies. Although game studies in general looks at **play** and games in the broadest sense of the term, video games studies looks more narrowly at video games and must take video game technology and conventions into account.

Because video games are also an **industry**, a technology, an **art**, a form of communication, an **educational** tool, and a social tool, video game studies tries to encompass all these things and examine how they are related. The academic study of video games began slowly, arising first in the 1970s as the subject of discussion for **homebrew** electronics hobbyists who built their own computers and programmed their own games. During the 1980s, video game designers began writing about their ideas and work, occasionally theorizing about video games, perhaps most notably in Chris **Crawford**'s *The Art of Computer Game Design* (1982). The 1980s and 1990s also saw the rise of academic interest in video games from a psychological perspective, particularly in the areas of aggression and socialization and other **health** issues. In the late 1990s and early 2000s, video games began to be addressed from the perspective of media studies and were compared with other media such as **film**, **television**, and interactive fiction or hyperfiction. During this time, video game studies concentrated on demonstrating the unique qualities of video games as media objects and argued that a new field of study was needed to take these aspects into account. Only once the field became more established late in the first decade of the 21st century could books and writings take for granted that video game studies had become an accepted area of study unto itself. This same decade also saw the increase of conference papers, on-line journals like *Game Studies*, and finally entire conferences devoted to video game studies, and today video game studies has become one of the fastest-growing branches of media studies.

Because "studies" is a broad term, "video game studies" includes not only theory but history as well. Video game history began with historical summaries found in magazines, such as the multipart "Electronic Games: Space-Age Leisure Activity" by Jerry and Eric Eimbinder, which began in the October 1980 issue of *Popular Electronics*, and later in early books such as George Sullivan's *Screen Play: The Story of Video Games* (1983), which was intended for a juvenile audience. Interest in video game history picked up during the 1990s, with Leonard Herman's *Phoenix: The Fall & Rise of Videogames* (1994), the first **history of video games** written for an adult audience, and in the next two decades, a number of books on video game history would appear, from books on individual companies to more general histories, written from popular, **journalistic**, and academic perspectives, and a variety of websites on video game history exist as well.

Video game studies also brings video game history and theory together in the examination of how video **game designs**, genres, and conventions grew over time and how these were affected by such things as programming languages, available technology, business practices, popular culture and cultural norms, and exchanges and influences from other media and media forms, including film, television, computers, **role-playing games (RPGs)**, **board games**, sports, and puzzles. The form, content, and context of video games and how they are related are also subjects of study.

In addition to being a branch of media studies, video game studies has renewed interest in traditional game studies, which has provided concepts and tools useful to the study of video games. In this perspective, it is significant to establish exactly what a game is (see **game, definition of**) to understand games in regard to criticism, analysis, and design. Other overlapping areas and issues shared by video game studies and traditional game studies include the study of play and players, game structures, game aesthetics, and game culture.

Although video game studies is new enough that various "schools" have not yet coalesced, some have suggested that early on a debate existed between narratologists, who argue that video games should be analyzed as **narrative** forms, and ludologists, who argue that games should be analyzed from the perspective of game studies; yet in the end, these two positions were not seen as being irreconcilable but rather complementary aspects. Today video game studies is incorporating an ever-widening set of approaches, using analytical tools from a diverse range of fields, including art and aesthetics, artificial intelligence, business and industry, communication and social science, media studies, game studies, computer graphics and programming, education, philosophy, semiotics, psychology, human-computer interaction, and many more. Each of these fields has its own discussions of the capabilities and uses of today's video games as well as what they could become in the future. For example, social scientists have studied the communal aspects of **MMORPG**s; in the field of psychology, much discussion has occurred regarding the connection between video games and aggressive behavior; in the field of education, video games are studied as educational tools, and so forth. Video games studies can therefore be seen as a nexus where all these questions and concerns intersect and interact.

Mark J. P. Wolf and Lars Konzack

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Videotopia

Videotopia is a traveling exhibit dedicated to the **art**, science, and technology of video games. It was designed and assembled by Keith Feinstein with the help of a large advisory board made of game historians and key **industry** figures and is managed by Electronics Convervancy, Inc. It was first presented in 1996 at the Carnegie Science Center in Pittsburgh and has been showcased in many major science museums since, including the Franklin Institute Science Museum in Philadelphia and the Singapore Science Center. In its complete form, it features more than 100 **arcade** machines, a variety of home **console** systems, interactive touch-screen kiosks, and numerous information pedestals.

Many of the **arcade games** featured in the exhibit represent a technological or commercial breakthrough in the **history of video games**. Some of the earliest coin-operated machines (***Computer Space*** [1971] and ***PONG*** [1972]), the first game to store **graphics** on a ROM chip (*Tank!* [1974]), the first to use a microprocessor (*Gun Fight* [1975]), and the first to feature a two-way **scrolling** playfield (*Football* [1978]) are all on display. The full exhibit also includes **laserdisc games** (*Dragon's Lair* [1983]) and a section on the evolution of three-dimensional graphics, including

BattleZone (1980), ***I, Robot*** (1983), and *Virtua Racing* (1992). Many genre-defining blockbusters are featured: ***Space Invaders*** (1978), *Asteroids* (1979), ***Pac-Man*** (1980), *Donkey Kong* (1981), *Centipede* (1981), *Joust* (1982), *Tron* (1982), and *Gauntlet* (1985), to name just a few. The exhibit has been updated on several occasions with more recent games, such as the **rhythm game** *Hip Hop Mania Complete Mix* (1998). On its showing at the Mary Brogan Museum of Art and Science in Tallahassee, Microsoft's Kinect **peripheral** for the **Microsoft Xbox 360** was installed and ready to play.

At the entrance of the Videotopia arcade, there is a two-sided kiosk entitled "That was then . . . this is now." On one side, an **Atari VCS 2600** is connected to a **television**, and the other side features a more recent console. The exhibit seeks to introduce visitors to the creative process and the technological aspects that are essential to the video game experience and its evolution. The "Look Inside" section includes blown-up **design** documents, a display that reveals the inner working of typical **interfaces**, and two interactive information kiosks operated by touch screen. Through these, users can learn about the different steps of the creative process—from the initial idea to **rules**, character design, and story—and the major technological components: raster and **vector** displays, transistors, microprocessors, RAM and ROM chips, and so on. Additionally, many pedestals are positioned next to specific games or groups of games to give information about the design process, gameplay mechanics, or to explain the evolution of a game genre (for instance, the evolution of "slide and shoot" games with *Galaxian* [1979], *Galaga* [1981], and *Xevious* [1983]). The pedestals also provide contextual information about what was happening in other cultural domains (such as the news, television, and in movie theaters) when the games were released. More than 100 machines of the original collection have been bought by the Strong National Museum of **Play** in Rochester, where the exhibit was featured during the last half of 2009. It is unclear (as of early 2011) whether the rest of the exhibit will continue to tour museums and if its content will be updated any further. As it stands, Videotopia has already played a significant role in making the most significant arcade cabinets accessible to younger **generations** of players.

Carl Therrien

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Videotopia website, available at http://www.videotopia.com.

Vintage Arcade Preservation Society (VAPS)

The Vintage Arcade Preservation Society, also known as the Video Arcade Preservation Society, or VAPS for short, is a leading organization dedicated to the preservation of classic **arcade** and video games. As of summer 2011, more than 7,500 members in 71 countries have worked to preserve classic arcade machines and their history. Collectively these members hold more than 65,000 classic coin-operated machines.

Just as the **Killer List of Videogames (KLOV)** started out as an informal list of coin-operated video games distributed via on-line **bulletin board systems (BBSs)** and CompuServe during the 1980s, the Video Arcade Preservation Society (VAPS) began as an informal list of dedicated collectors distributed on those same systems. Both the KLOV and VAPS launched websites in 1994. A key part of VAPS was, and continues to be, an extensive and constantly updated on-line census of surviving coin-operated machines. VAPS used the official list of games from the KLOV to determine what games could be added to its census database, and VAPS members entered in each game in their game holdings.

In 2006, leadership of VAPS was handed over to the **International Arcade Museum (IAM)**. In 2009, VAPS's website was moved to the site of the International Arcade Museum (www.arcade-museum.com) so that functions from each site could be better integrated, as well as to reflect the fact that many members of VAPS were members of the KLOV and used a single social and machine preservation message forum system offered by the International Arcade Museum.

As the KLOV's and IAM's on-line encyclopedia began to cover more and more non-video game coin-operated machines, so did VAPS. Thus, in 2010, the Video Arcade Preservation Society was renamed the Vintage Arcade Preservation Society to better reflect VAPS's expanded mission. Today the VAPS census project has been expanded to cover machines and parts owned, for sale, and wanted. Interpretation of census data through reports and graphs are available on-line, and new features are added on a regular basis.

Greg McLemore

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violence

Research on violence in video games is typically explored in two ways: through "media effects" models inherited from studies of violent content in **film** and **television** and through sociocultural models arguing that video games and "violent game content" must be contextually situated within a broader culture of media and everyday violence.

In popular media, the relationship between violent action and violent video game content has been widely sensationalized through stories about violent and aggressive actions resulting from video game **play**. One of the most highly reported-on stories that linked "learned behaviors" in video games with violent real-world action was the Columbine shootings in April 1999. However, sensationalist media attempts to pinpoint a causal link between video game play and the shooting of fellow students was subsequently dismissed by an FBI report (Toppo, 2009), which insisted on a fuller contextualization of the shooters' sociopsychological alienation and dysfunction. Video games, just like other media, rely on and reproduce cultural norms with regard to violence, and first-person shooting video games have remained popular since their inception, despite their controversial content.

Unlike other screen-based media, however, video games uniquely position their players in active roles in relation to violent behaviors in a game; players have control over considerable violent action within the game and typically must choose violent means for conflict resolution as well as seek to be successful at it. For some researchers (Anderson, 2004; Anderson, Gentile, and Buckley, 2007), this "active" engagement with violence (instead of merely "viewing") increases violence-related "effects" on players. That said, whether it is the activity of the player's engagement with violent media that *produces* either temporary or longer-term violent effects, or that there are such effects—whether cognitive, behavioral, or affective—is no longer questioned by media effects researchers, who have consistently been able to document a causal relationship between viewing/playing with violent media content and inducing violent effects (Anderson et al., 2003; Bushman and Anderson, 2009).

With respect to aggression specifically, the violent video game effects literature has successfully demonstrated that there is a causal link between playing violent video games and the inducement and reinforcement of aggressive feelings and behaviors. Work by Barlett, Anderson, and Swing (2009) in a review of violence effects literature and video games divides the wide range of literature available on the topic into three categories: aggressive cognition, aggressive behavior, and prosocial behavior. In the first, studies have demonstrated that there is indeed a relationship between violent video game playing and "aggressive priming, activation of aggressive scripts and knowledge structures and a hostile attribution bias compared to non-violent video game exposure" (Barlett, Anderson, and Swing, 2009, p. 382). Aggressive behavior has been measured using a variety of methods and tools including observations, self-reports, standard laboratory tests, and so on, and has shown, through numerous comprehensive reviews, that violent video game exposure leads to increased violent behavior (Anderson et al., 2003; Anderson and Bushman, 2001; Anderson et al., 2004, 2007; Barlett, Anderson, and Swing, 2009). Prosocial behavior, which includes empathy and the helping or rewarding of others, has also been shown to decrease with exposure to violent video games (Bushman and Anderson, 2009; Funk et al., 2004). Meta-analytic reviews of studies have continued to show that regardless of the **design** of the research (experimental, cross-sectional, or longitudinal), it is possible to correlate video game violence exposure to aggressive behavior, hostile affect, psychological arousal, and decreases in prosocial behavior (Anderson, 2004; Anderson and Bushman, 2001; Anderson et al., 2010). Other studies have shown that playing violent video games desensitizes players to representations of violence in terms of psychophysiological responses such as heart rate, blood pressure, and brain activity (Bartholow, Bushmand, and Sestir, 2006; Weber, Ritterfield, and Mathiak, 2006).

As a response to this psychological effects literature, as well as to the intense media pressure resulting from reports of violent video games leading to violent actions, the video game **industry**'s **Entertainment Software Ratings Board (ESRB)** has produced a rating system for violent content, similar to that of the movie industry, by which violent content is reviewed and rated. North America, **Europe**, **Japan**, **Australia**, the United Kingdom and Finland have ratings systems in place (for example, the **Pan European Game Information [PEGI] system**), in part to make consumers aware of violent content and to indicate the age group for which the game is appropriate.

Complicating any attempt to demarcate and rate media by reference to their levels and kinds of violence, however understandable its appeal, is the very meaning of "violence," when its referent is a programmed play mechanic. No less troubling is the real/play distinction, illustrated by Bateson's "nip" versus "bite" distinction and Johan **Huizinga**'s "**magic circle**," that always inadequately seeks to demarcate "real violence" from "just playing." And not all ways of playing with "violence" are the same: the ways player agency is implicated and involved in (virtual) violent behaviors in games within the "horror" genre, which has more than its share of "video game violence," may be positioned in opposition to (game) violence, playing not for the sake of engaging in violence but rather playing defensively, protectively, or self-protectively (Perron, 2010). The appeal of such unabashedly violent games are the feelings of suspense, anticipation, dread, shock, and terror that such games are more or less ingenious at inducing in their players.

So although effects researchers are well able to show positive correlations and to reproduce their findings, the difficulty in this approach to the question seems not to be reproducibility but deep unreliability at the level of context: what is the relationship between experimental context and aggressive behavior in the world writ large? Media scholars and socioculturalists continue to insist that linking violent video game play to "real-world" dispositions, behavioral outcomes, and antisocial actions misses the wider sociocultural context in which video games are played (Jenkins, 2006; Tappan and Kita, 1999). These counterarguments to psychological studies that reproduce violent effects in their research participants are not research-based but instead contribute to these debates a crucially important theoretical consideration: what do we really know about the relationships between (sometimes) violent content in video games and the larger meanings both adults and children make in relation to that content? This theoretical position views the psychological effects literature as **abstracting** the question from its larger situation, simplifying it, at times, beyond any usefulness in terms of individual meaning-making. The "meanings not effects" model asks the question of a wider range of distributed and dispersed, networked sociocultural actions and events. This position does not discount the psychological effects literature but rather asks how it can disambiguate simulated aggression and player excitation from the larger sociocultural complexities of everyday life, a question that has not yet, however, stimulated the research needed to persuade those for whom a compelling, if simplistic, causal model has the final word.

Violence sells in all media and video games are no exception, although many best-selling games (such as ***Pac-Man*** [1980], ***Super Mario Bros.*** [1985], ***Myst*** [1993], *The Sims* [2000], and Wii *Fit* [2008]) are relatively nonviolent games. Whether and how playing violent video games over time in a context of media and cultural violence can be disambiguated from that context remains, "effects" research notwithstanding, very much open to debate.

Jennifer Jenson and Suzanne de Castell

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Virtual Boy

See Nintendo Virtual Boy

virtual reality (VR)

The term "virtual reality" (VR) is often defined according to the context in which it is used. Virtual reality to an artist might have a different connotation than it would for a fiction writer or a computer scientist. However, in the case of video games, the term most notably refers to the use of computer-based simulations to create a perceived experience in real or fantasy **worlds**. Michael Heim (1993) lists various characteristics of virtual reality, but interaction, immersion, telepresence, and artificiality are the concepts most closely associated with VR. Virtual reality is often used interchangeably with words such as immersive environments, **augmented reality**, simulated reality, and interactive three-dimensional worlds. Perhaps the biggest challenge for defining virtual reality is defining what it is not. When virtual reality becomes every experience that is generated with and through technology, the term in and of itself becomes meaningless. As such, authors who use the term often then proceed to provide additional qualifications to their definitions.

Some video game enthusiasts suggest that every electronic game is an instance of a virtual reality. Others focus on the creation of games in virtual worlds. For instance, a video game designer might create a game that others could play inside of Second Life (2003). Other groups might define virtual reality games as only those that are experienced using hardware or software that can produce three-dimensional graphics. Perhaps the most recent and pervasive use of virtual reality with video games relates to haptics, or the use of objects and devices that let users participate more directly in games. Examples would include playing a guitar in a real band, as in *Rock Band* (2007); using the **controller** to swing a golf club, as in *Wii Sports* (2006); or using a controller to dance, as in ***Dance Dance Revolution*** (1998).

Given its various definitions, there is some debate as to when the term first appeared. Many attribute it to the French playwright Antonin Artaud. Antonin first used the term in his book *The Theatre and Its Double* (1938). Myron Krueger is also credited for using the term artificial reality in his creation of *VIDEOPLACE* (1970). However, the concept attained significant attention in the late 1980s and early1990s, due in part to Jaron Lanier who founded VPL, the first company that sold virtual reality products (http://www.jaronlanier.com). Credit for its rise in popularity is also attributed to Howard Rheingold's 1991 book *Virtual Reality*.

Early work in virtual reality often centered on hardware. Developers created body suits, head-mounted displays (HMDs), and CAVEs (Cave Automatic Virtual Environment) in which participants would interact with virtual worlds or virtual objects. This was due, in part, to the high technological demands of virtual environments. There were a few virtual reality video games developed at this time, like *Dactyl Nightmare* (1991), *Virtual Combat* (1993), and *Dactyl Nightmare 2* (1994). However, the cost of head-mounted displays and an attendant to run the game led to a cost of $4 for four minutes of game play, so the game never went much beyond a novelty. With the advent of faster processing speeds, smaller-sized storage devices with increased capacity, and innovative programming, the focus on virtual environments now concentrates on software as well. Researchers and inventors still focus on hardware such as stereoscopic **3-D**; however, development software like OpenSimulator (2007) and OGRE (2005) as well as synchronous environments like Active Worlds (1995) and Second Life (2003) helped redefine virtual reality as a software-based experience.

Virtual reality applications are used widely in experiences ranging from **education** to health care to military training; for instance, flight simulators used to train pilots. Virtual reality applications are also being used to cure people's fear of heights (Rothbaum et al., 1995), train surgeons (Seymour et al., 2002), and explore mock crime scenarios (Mertens and Allen, 2008). New explorations into virtual reality games are investigating the exploration of gaming environments with **sound**, smell, and touch.

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visual literacy

Visual literacy is the ability to critically consider, analyze, and judge the value of visual information such as pictures, graphs, images, and illustrations. The concept, originally coined by John Debes in 1969, was then defined as "a group of vision-competencies a human being can develop by seeing and at the same time having and integrating other sensory experiences" (Avgerinou and Ericson, 1997, p. 280). Explicit strategies may be taught to help increase awareness of how to interact with various types of visual data. Previously, educators have focused mainly on teaching individuals how to interact with textual data; to develop text-based literacy, individuals are taught the conventions of how to read and engage with the written word. As text-based data evolves into more multimodal presentations of information, current trends stress the additional importance of considering the value, source, and authenticity of the visual information with which we are presented. There are commonalities between text-based and visual literacy and general **rules** to follow depending on the interaction type. For instance, written **languages** such as Hebrew and Arabic are read from right to left, whereas Germanic languages are read from left to right. Punctuation informs the reader in terms of prosody, offering cues such as when to pause or break. These conventions are taught, accepted, and followed when interacting with respective texts to help the reader capture the author's intended meaning.

Compounding on text-based rules, additional considerations apply when interacting with visually rich media such as **comics** and **graphic** novels, popular forms of entertainment coupling text with illustrations and images to deliver story content. A reader engaged with such a text should adhere to the previously mentioned rules of text while considering additional ones regarding imagery—namely, interacting with image panes from left to right and from top to bottom. This process is similar to the textual conventions of interacting with Germanic and Romance texts; however, image panes may be presented in an infinite array of artistic formats. For example, many Japanese manga (oversimplified in English to mean "comics") are read from right to left. Awareness of these differences and interaction protocols is critical, and knowledge of how to interact with image-rich media can help maximize what the reader takes away from the story. In addition to comics and graphic novels, other visually rich media including painting, photography, **film**, **television**, video games, and the World Wide Web are important in modern culture. One popular method critics have used to teach about and discuss **art** with a common vernacular is known as the Feldman Method. For more than 50 years, this four-step process has encouraged individuals to *describe*, *analyze*, *interpret*, and *judge* works of art with which they may interact. Applying this type of concrete methodology to an **abstract** concept such as evaluating art has provided for rich discussions and appreciation of visual media.

The other forms of aforementioned media also stress the value of visual literacy as they are globally ubiquitous and insatiably consumed. Persons savvy in visual literacy skills are more able to **navigate** and process the data transmitted by these sources. There was a time when the printed word was viewed as irrefutable fact; however, the advent of the printing press and the more recent segue to current technologies such as Web 2.0 self-publishing have made people more critical of the information they consume. Likewise, pictures and videos were once considered examples of undeniable truth, yet this trend has also changed and continues in flux given the ability and relative ease with which we can manipulate visual imagery. For instance, Adobe Photoshop is arguably the industry standard software application for editing visual content; referring to an image as "Photoshopped" is common vernacular, suggesting an image is a fake or has been edited or altered. There are Internet sites and on-line communities centered on fostering the exploration of and continuing the discussion about image editing and manipulation.

One need look no further than the supermarket checkout lane or local bookstore for examples of magazine covers rife with altered images and unrealistic presentations of the human form, possibly raising issues of self-esteem or negative self-image for individuals with poor visual literacy skills. To complicate matters even more, the meaning of an image may also change based on the context or setting in which it is used even if the original image remains unaltered. As highlighted by Richard Dawkins's concept of the *meme*, a sort of cultural gene, the use of images or visual data may have an impact on our perceptions of their meaning. Websites such as *4chan*, *reddit*, and *Canvas* are hotbeds of memes in action as users develop, alter, and share personalized interpretations of images. These communities have created Internet sensations such as *Lolcats* and *Rickrolling*, and, given the rate of dispersion made possible by the World Wide Web, images are quickly shared and consumed, often going viral at breakneck pace.

Of perhaps greatest interest and import in terms of visual literacy application is the synthesis of text- and image-based evaluation methodologies, protocols, and rules in relation to video game technologies. Borrowing much from conventional literacy theory, film and television theory, art appreciation, and the interpretation of comics and graphic novels, video games are an art form of their own unique accord. Even in their simplest forms, video games introduced new reading requirements, for example, the need to identify and locate the graphical representation of the avatar controlled by the player (see **reading video game imagery**). Akin to theories of art critique and evaluation, the appreciation of imagery and importance of quality graphics relies heavily on subjective factors; some users may prefer realism, and others may be drawn to more stylized graphics. Finally, artistic presentation of video game technologies may find users needing to draw from comic book or graphic novel conventions in terms of following stories presented through storyboards or other types of story panels. However, gameplay often requires that one must possess skills and knowledge known only to those who interact within gaming or virtual **worlds**. Given the dynamic nature of these environments, there are skills of visual literacy that either must be learned or experienced to truly appreciate them. There are clearly qualities and factors of *je ne sais quoi* at **play** that future research may help better define, but the process is as complex as positing what makes someone a great athlete or musician. For example, what issues of visual literacy are at play that allow some *StarCraft* (1998) players to perform more than 300 actions per minute?

Being able to separate wheat from chaff and fact from fiction in visually rich media environments is necessary given their prevalence in modern society and the general lack of content policing conducted by various media outlets. The consumer becomes the ultimate judge of what is worthwhile and what is not in the realm of visual literacy, and the analysis and evaluation of visual elements is a deliberate and explicit process. Intelligence in all areas of information consumption is critical in postmillennial society. Given our ties to, dependence on, and general saturation of visual data in modern culture, visual literacy is equally (if not more) important as textual literacy. As more and more mobile media devices permeate our culture and daily lives, visual literacy skills will increase in importance, making the end user the ultimate judge of credibility and merit in regard to content. Acknowledging the importance of visual literacy and fostering its development are critical discussions, we must continue having these discussions as our daily lives continue to be inundated with visual media.

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VR

See virtual reality (VR)

W

walkthroughs

A video game walkthrough tells a player, in detail, how to complete a game. This usually consists of directions on how to progress that can include movements (which way to turn, what door to open, and so on); solutions to puzzles needed to continue forward, locations of crucial objects or areas; and revelations of traps, enemies, or other obstacles that will impede the player. At its core, a walkthrough is mostly concerned with forward progress, guiding a player through the game world or narrative threads that need to be pursued to reach the end of the game. Other elements are often included within a game walkthrough: tactics to combat enemies, instructions on how to improve a player's character, or statistics for a piece of game equipment can appear. These elements can be extracted from a walkthrough section without compromising its utility, although regularly they will have separate sections earlier in a **game guide**.

Walkthroughs can follow a critical path or cover every possible event and location in a video game (the 100% walkthrough). A critical path walkthrough focuses on the most direct way to get to the end of a game. It will eschew side-quests, noncritical areas, or any other aspect of the game that is unnecessary to simply reach the end. A complete or 100% walkthrough will cover every secret and location, even those that are not essential to finishing the game. A complete walkthrough is an effort to ensure that a player knows every aspect of the game **world**. Many video games have multiple end scenarios that are revealed depending on the actions of a player (either the order in which they are taken or the manner in which encounters are dealt with, and so on). A critical path walkthrough will usually only address a single ending, whereas a 100% walkthrough will reveal the different prerequisites for different end scenarios.

A video game with a linear progression (such as those of the *Halo* series) has less need of a walkthrough than games with worlds that can be freely explored, such as *Borderlands* (2009) or those of the ***Grand Theft Auto* series**. A linear game has few choices for the player to make, and the path forward is the only one available; consequently, a walkthrough for such a game is mostly useful for revealing what challenges lie ahead for the player. How many and what type of opponents are in the next area, for instance, is of much greater interest than where to find that next area.

Players in an open-world (or "sandbox") game will be served well by a walkthrough that details the interactions that await them in the various locations available as well as what opponents they may face. This information can be accompanied by suggestions as to what order to attempt these interactions (especially if it is a critical path walkthrough), although the structure of the game may be such that the order bears little consequence on the overall gameplay.

It is difficult to track down the first publication of a walkthrough for a video game, but the walkthrough was undoubtedly pioneered in one of the early video game magazines. A likely candidate is *Computer Gaming World* (*CGW*), which appeared in 1981 and was geared toward PC games, changing its name to *Games for Windows* in 2006 before stopping its printed format in 2008.

In the first issue of *Computer Gaming World* there is a review/guide for the game *B-1 Nuclear Bomber* (1980), a two-page article that includes tips for not only how to play but also how to re-program the game to make it harder. The second page provides a **map** to help players plan better routes to targets. Although extremely basic, this can be considered an early walkthrough with its information provided to help a player succeed more efficiently.

A more explicit example of an early walkthrough is the first issue of *Nintendo Power* magazine, published in 1988. The pages include a game guide to *Super Mario Bros. 2* (1988) for the **Nintendo Entertainment System (NES)** that is almost indistinguishable from its modern counterparts. Maps, moves, items, enemies, tips, and secrets are all included in a very visual format akin to the strategy guides that came after it. The same issue also details the "second quest" of ***The Legend of Zelda*** (1986), a harder version of the game that is available after **beating the game** once. Again, there are maps and walkthrough information to guide a player through the game areas, and it points out problem areas and routes as well as where to pick up various items.

With the advent of published strategy guides dedicated to single video games, walkthroughs became more robust. As games have become more complex, walkthroughs have had to keep pace. The open-world game *Fallout: New Vegas* (2010) has a game guide published by Prima Games that is 448 pages long and covers in detail every one of the game's hundreds of missions and unique locations.

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war

War is a conflict between at least two groups that is carried out through **violence**. The conflict aids the groups in solving, clearing, or overcoming differences between them. The measures of violence employed are of nonsymbolic nature and are targeted at the individuals of the group conceptualized as the enemy. Because war as a form of action and its **narrative** is so substantially interwoven with subject, society, and politics, it is natural that reflections on and interpretations of culture are closely connected to the discussion of war. Thus the history of games in a broader sense is permeated by a metaphorical or comprehensive discussion of war, and it is moot to consider whether the competitive nature and the oppositional principle of a game reproduces the martial structure or whether the opposite is true and the principle of playful dispute in competitive games culturally and historically preceded martial conflict.

In this sense, many of the oldest known **board games** (such as Wéquí, Go, Senet, Mehen, The Royal Game of Ur, and, of course, chess) must be interpreted ambivalently. They may be seen as **abstract** exercises with the goal of building personality, in which the playing subject trains his abilities in anticipatory and planning actions in a situation of competitive character in which two parties acting opposite to one another are in the center of the game metaphor. This conceptualization of games leads historically to a modern understanding of video games. Their ability to represent and simulate as well as their often narrative settings refer back to the concept of an abstract, symbolic, and binary opposition. At the same time, all games may also be seen as abstract models of martial actions, in which tactical, strategic, and operational knowledge is chosen or simulated.

In many traditional and mythological tales (as well as in video games), war functions as a form of dispute: war is seen as a cosmic, archetypal, or natural principle of the different, oppositional, and antagonistic. In contrast, there are positions that see war as a disruption of natural harmony, as an unnatural, abnormal condition of society and subjects. Consequently, one's view of war is highly dependent on a general perspective of **world** order—is war a natural condition (according to Thomas Hobbes) or is peace (according to John Locke)? A change of perspective consequently shows that war is not a condition of the subject and its community but rather an operational condition that is part of policies of control and order (according to Jean Jacques Rousseau).

One change in the conceptualization of both war and games is connected to the beginning of the Enlightenment. Because of the beginning of "rationalization," the perspective on war also changed. One significant position is that of Carl V. Clausewitz, who reasons that war is no longer based on Natural Law or an atavistic cultural formation that "culturally shapes" humans. From Clausewitz's perspective, war cannot be seen as detached from (national and state) politics. Here, war is conceptualized as a political and rational act of violence in which one's own political will is forced on the opponent, at the same time recognizing that the opponent is fighting with the same motivation. The decisive point in this rationalization of war is the change from the "art of war" to the "science of war." Here, warfare is changed into a rationally operated, rule-governed, and functionally logical practice. As a consequence, the conceptualization of the game also changes. Games are seen more and more as arenas of action within which postulates of the science of war can be reproduced or internalized as didactical trial actions. In video games, we can find both of these conceptualizations: at the level of narration, there are often "mythological" as well as "rational" conceptualizations—on the level of the program, game mechanics, or the algorithm, war is a scientific, rule-based, and knowledge-based series of events happening in the tradition of the board games and war simulations of the early 17th and 18th centuries.

The most well-known examples (apart from the reevaluation of chess in European cultural history) are the war board games that were developed in the mid-17th century. Early examples are Christoph Weickhmann's *New-Erfundene Große König-Spiel* (The Newly Invented Great King's Game; 1650) and the game by Johann Christian Ludwig Hellwig, *Versuch eines aufs Schachspiel gebaueten taktischen Spiels von zwey und mehreren Personen zu spielen* (Attempt at a Tactical Game for Two and More Persons, Based on Chess; 1780). Although these games were based heavily on chess and relied on the playful internalization of military scientific paradigms during training, they were followed by a transformation from chess to war simulations as seen in the war board game developed by Leopold Georg Baron von Reiswitz and his son Georg Heinrich Leopold Freiherr von Reiswitz, *Anleitung zu einer Mechanischen Vorrichtung um taktische Manoeuvres sinnlich darzustellen* (Instructions for a Mechanical Device to Portray Tactical Maneuvers Sensually; 1812 to 1824). These games not only successively integrate coincidence and probability into their simulation of war, they also increase the complexity of the **rules** and the degree of detail in the reproduction, add limitations to the visibility of the opponent's lineup and movements, and encourage the flexible reproduction of real scenarios. More important, these games need to be interpreted as scientific and rational didactic model areas of the new science of war.

This trend grew in the 19th century. War board games increasingly lost their playful or didactic character and more and more became simulations with reference to the real world. In **Europe**, war games were employed in the logistical and strategic planning of actual wars, for example, during the German-French war of 1870–1871 as well as in preparation for World Wars I and II. These simulations were also the predecessors of today's tabletop games, war games made of tin soldiers, model landscapes, and differentiated rules.

From World War II until the mid-10th century, another surge of rationalization unleashed a fresh differentiation and increase in the complexity of so-called "conflict simulations" (cosims). Driven by the development of computers, the establishment of a mathematically founded game theory, the expansion of the strategic-tactical-operational war paradigm with logistical and economical functions (operation research), and more complex decision models (for example, by cybernetics), war games became informative, dynamic simulations of possibilities. This development can also be seen in the civil sector. Fed by strategic board games (such as Charles S. Roberts's *Tactics* [1954]) or pen-and-paper **role-playing games** (for example, Gary Gygax and Dave Arneson's *Dungeons & Dragons* [1973]), different **computer game** genres were developed.

In video games, the **strategy game** genre was present early on and follows the tradition of the war game (for example, Chris Crawford's *Tanktics* [1978]). Together with the tactical **shooting game** genre that arose during the 1990s, they exemplify the merging of science and war as theorized by Clausewitz and Edward Luttwak. They portray strategic (strategy games) and operational (development **simulations**) as well as tactical (tactical shooting games) types of action. Yet the portrayal of war in video games is more than an extension of the science of war model areas. As war games are also narratives with cultural interpretations, it is not surprising that they use war as mythical narratives beyond concrete or operational functions. ***See also*** World War II in video games.

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web-based games

Web-based games can broadly be defined as either games that use an Internet connection to update gameplay and provide interaction with other players or games that are delivered through an Internet browser. They are a quickly evolving and ever-dynamic genre of digital entertainment, and, as technological breakthroughs continue, more and more titles are being created and lumped into this category. What once was limited to programmers and high-end computer users has now been opened up to the most ubiquitous of devices; social networking sites, modern cell phones, and even **handheld gaming** devices incorporate elements of web-based gaming. This broad classification of video games includes but is not limited to **on-line games** like MMORPGs, browser-based games, certain **console-based games**, and even some titles ported to handhelds and mobile devices.

Dating back to the mid-1970s, **multiuser domains (MUDs)** laid the foundation for modern web-based games. MUDs allowed would-be adventurers to embark on epic adventures and slay digital beasts in fantastic text-based worlds. MUDs predated the graphical-based World Wide Web we know today; as such, users were connected to these games and each other via the ARPANET or through other large scale computer networks. MUDs continued to evolve, and the mid–1990s saw the advent of the text-based MOO, or *MUD, Object-Oriented*. These games combined the popularity of text-based MUDs with object-oriented programming providing unique end-user experiences.

The popularity and rapid growth of Internet-based technologies exposed a variety of users to MOOs and related games. The term "World Wide Web" was coined around 1990 (Fischetti, 2009), and the true genesis of web-based games may be traced to this time. As graphics technologies increased, more familiar MUVEs (multiuser virtual environments) such as ***Ultima** Online* (1997) and *EverQuest* (1999) were created. The term "**massively multiplayer on-line role-playing game (MMORPG)**" now includes a large percentage of web-based games, with titles such as ***World of Warcraft*** (2004) claiming more than 12 million global users in 2010. Another popular and less system-intensive form of web-based games are browser-based or plug-in games. Browser-based games require users to install simple plug-ins such as *Java* or *Flash* and are used in tandem with web-browsing software.

Web-based games have transitioned from personal computers to console systems over the past few years. The three console systems of the seventh **generation** (the **Sony PlayStation 3**, **Nintendo Wii**, and **Microsoft Xbox 360**) are all Internet-ready and afford gamers the opportunity to play with others from around the world without leaving the comfort of their homes. Increased access to networks and cheaper WiFi access are possible factors spurring on increased usage of these types of games. The recent trend finds web-based games expanding even more quickly as handheld gaming devices and cell phones are able to connect gamers to one another and web-based gaming content.

Web-based games have been presented both positively and negatively in the media. From a negative perspective, in the extreme, some people have played MMORPGs literally until their death. In 2005, a man in Taegu, South Korea, played for 50 straight hours until he died of exhaustion, and in 2007, a Chinese gamer, Xu Yan, died after playing on-line games for 15 straight days. Finally, some have argued that the availability of on-line games has reduced worker productivity. Other reports contradict these claims and suggest that playing on-line games help sharpen and refocus workers' minds. Research also suggests that on-line games can lead to intrinsic motivation (Dickey, 2007), collaboration (Papastergiou, 2008), and the skills, behaviors, as well as strategies necessary to live in a complex world (Schrader and McCreery, 2008).

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Wii

See Nintendo Wii

Williams

Williams Manufacturing Company was established in Chicago in the early 1940s. Founded by Harry E. Williams, the company initially specialized in **electromechanical games** and pinball conversions before expanding to pinball manufacturing. In 1964, Williams was purchased by the Seeburg Corporation, a jukebox manufacturer, and reorganized as Williams Electronic Manufacturing Division. In 1973, it made its first foray into the arcade video game market with *Paddle-Ball*—a ***PONG*** (1972) clone. The company was incorporated in 1974 as Williams Electronics, Inc., a wholly owned subsidiary of Seeburg. Following the latter's bankruptcy in 1979, Williams was spun off as an independent entity. By 1981, it was the leading manufacturer of pinball machines in the **United States**.

In 1980, the company released Eugene Jarvis's ***Defender***. The fast-and-furious side-**scrolling** shooter quickly went on to become one of the most popular games of the time. It was followed up by such titles as *Stargate* (1981)—Jarvis's sequel to *Defender*—and later by *Joust* (1982), *Sinistar* (1982), and *Robotron: 2084* (1982). To accommodate the rising demand for video games, Williams cut down its pinball production. However, by late 1982, the **arcade** video game market slowed considerably and eventually crashed the following year (see **crash of 1983**). The company posted losses for the next few years, but, thanks to renewed public interest in pinball machines, management turned the tide in 1986. In 1988, Williams's parent company, WMS Industries, Inc., purchased its main competitor, Bally/Midway, the pinball and video game division of **Bally Manufacturing Company**. The production of pinball tables continued under the Williams and Bally names, and **Midway** developed video games for the home and arcade markets.

In 1991, Midway absorbed Williams's video game division and WMS Industries created Williams Gaming, which manufactured pinball tables and slot machines. Throughout the 1990s, casino equipment was steadily becoming the company's focus, until it decided to leave the video game business in 1998. At that time, Midway Games, Inc. was spun off and became an independent company. Williams Gaming made a final attempt to revitalize the dwindling pinball sales with the hybrid Pinball 2000 platform, combining pinball tables with video game elements. In the face of rapidly dwindling sales, the company discontinued its pinball business in 1999 and, under the name WMS Gaming, focused exclusively on slot machines.

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world (of a video game)

Many video games, like novels and **narrative film** and **television** shows, can be said to have a diegetic world, that is, the imaginary or fictional world in which the work's characters live and where events take place. Usually such worlds are made in support of a narrative, although worlds do not necessarily have to contain stories, and not all of them do. Video games like those of the ***Sim* series** and other sandbox games allow players to build imaginary worlds, but there is no predetermined narrative that occurs there, although the player's experiences and interaction within the world may constitute something like a narrative.

Video game worlds are necessarily composed of several things: some kind of geography, inhabitants, action, and logical consequences that are the outcome of actions. Every game world has some kind of **space** in which the game's action takes place, from simple blank playing fields that are a single screen in size (as in many early **arcade games**), or a verbal description (in the case of text adventures), to the vast, elaborately detailed worlds with hundreds of thousands of players (as in **massively multiplayer on-line role-playing games (MMORPGs)**. These areas are displayed on-screen, and many games, especially **adventure games**, require exploration of the game world, where other characters are encountered, objects are found, and quests are completed. Sometimes the revelation of game world space is the game's main objective, although it is more likely to be a subgoal required by other game goals. In many games, especially those with three-dimensional **graphics**, there is usually some sense of what lies beyond the game world space that the player's **avatar** can actually visit, conveyed by backdrop imagery (depicting an extension of the game world out to a distant horizon) that is placed around the edges of the active game area.

The inhabitants of the game world include the player's avatar (or avatars), the avatars of other human players, and the **nonplayer characters (NPCs)** controlled by the game **programming**. All characters, whether avatars or NPCs, usually have some kind of purpose, motivation, and goal-oriented behavior, which may help or hinder that of the player's avatar (or the player's intervention, as in the case of sandbox games in which the player does not control an avatar directly). The characters initiate action within the game world, although action can also be initiated by the game program's direct control of the game world itself—for example, changing weather conditions, a diurnal or seasonal cycle, or events like earthquakes or tornadoes (as in *SimCity* [1989]). Quite often the action of the game world's characters directly affects the state of the game world itself, and a particular game world state may even be the game's objective.

Finally, a game world will operate according to some logic that it uses to assign consequences to actions taken by the game world's characters. These consequences usually are consistent and can be expected in advance once the player learns how the world works. Through knowledge of these consequences, players can make gameplay choices that move the game world's state in a desired direction. The game world's logic determines much of the gameplay experience, and it may also shape the look and feel of the game world itself, suggesting guidelines for **design** aesthetics. Other aspects of the game world controlled by the **game engine** include the physics of game events, the automatic positioning of the implied camera that controls the player's point of view, **artificial intelligence (AI)** controlling NPCs, and the player's interaction with the world.

Although text adventure games created their worlds through words, similar to literature, fast action and a feeling of **immersion** and immediacy require a visual representation of a game's world. Over time, video game worlds' visuals grew from the single-screen games of the 1970s to scrolling screens that revealed a much larger world beyond the edges of the screen (beginning with *Super Bug* [1977]), to worlds made up of multiple screens that cut one to the next (beginning with ***Adventure*** [1979] for the **Atari VCS 2600**), to three-dimensional worlds with **z-axis depth** that extend into the screen (as in *Maze War* [1974], ***BattleZone*** [1980], and ***Myst*** [1993]). With greater memory available in computer discs and diskettes, and the move from **cartridges** to **CD-ROM-based games** in the late 1980s, worlds were able to become even larger and more detailed, allowing more player involvement and engagement. Finally, as **on-line games** developed into **multi-user domains (MUDs)** and later **massively multiplayer on-line role-playing games (MMORPGs)**, their game worlds were inhabited by an increasing number of player-characters, and many became **persistent** worlds, operating continuously, 24 hours a day. The size and complexity of these worlds is so vast that no one person can experience more than a small fraction of the events occurring in them. The ongoing existence and high degree of interactivity of these worlds, as well as the necessity of choosing what is seen or experienced from myriad simultaneous events, creates an experience quite unlike that of the imaginary worlds experienced through traditional media like books, films, and television shows.

Often in traditional narratives involving imaginary worlds, the main character is a traveler to a new world, through whom the audience experiences the world vicariously. In earlier worlds, the main character tended to be a traveler and observer, as time went on, and especially into the 20th century, main characters became more actively involved in the imaginary worlds they visited, even becoming agents of change in those worlds. Video game worlds can be seen as extending that interactivity to the audience members, and thus, can be seen as another advancement of the imaginary world tradition begun thousands of years ago. ***See also*** navigation (spatial); navigation (temporal); space; time; subcreation.

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World Cyber Games

World Cyber Games is an international professional competitive gaming (or e-sport) tournament sponsored by Samsung and Microsoft. Beginning in **South Korea** in 2000, the WCG has grown to become the largest yearly e-sports event in the **world**, boasting several hundred participants, over a million spectators, and offering $470,000 in prizes in 2008 (World Cyber Games Web site, 2011). Unlike e-sports tournaments that focus on only one type of game, the WGC features a rotating crop of new games and popular standbys from the real-time **strategy games**, first-person **shooting games**, **racing games**, **fighting games**, **sports games**, and music performance genres. The three near-permanent entries on the schedule, enduring a decade of changes in taste and technology, are *StarCraft: Brood War* (1998), *Counter-Strike* (1999), and *Warcraft III: The Frozen Throne* (2003). The South Korean government provides ample support for the festival, both in prize money and through recognizing competitive video gaming as an official sport within the country (Donovan, 2010, p. 313).

The festival's design draws inspiration from the Olympic Games, rotating host cities each year and calculating an overall score for each participating country. For each game in the schedule, the WCG hosts a "group full league" and a single-elimination tournament. Competitors enter the hosted tournament through subsidiary competitions in their own countries or regions. Group drawings prevent two competitors from the same country of origin being pitted against each other. The number of groups may vary from 2, 4, or 8 for any individual game. Each group consists of an equal number of competitors (individuals or teams), 1 or 2 of which are selected by a seeding committee that takes into account exemplary previous records (up to a total of 8 seeded competitors per game). The top two competitors from each group competition advance to the single elimination brackets (World Cyber Games website, 2011).

In 2008, WCG **Australia** tournament director Alex Walker admitted to being aware that a number of competitors engaged in recreational drug use. Although recognizing its potential for abuse and performance enhancement, Walker asserted that "nobody has the budget to bring in any form of anti-doping agency" (Burns, 2008). Nicholas Taylor has criticized the WGC and other e-sports venues for positioning women primarily as "cheerleaders," "booth babes," or "*Halo* hoes." Taylor argues that, despite the presence of competent female competitors, the idea of virtual athleticism frames the skills required for competitive **play** as "the exclusive domain of male bodies" (Taylor, 2008). Males continue to comprise an extreme majority of the festival's spectators and competitors.

The WCG has also spawned ancillary media, including a documentary **film** and reality **television** series. *Beyond the Game* (2008), directed by Jos de Putter, focuses on *Warcraft III* champion players Li Xiaofeng, Fredrik Johansson, and Manuel Schenkhuizen. It documents a WCG 2007 finals match between Xiaofeng and Schenkhuizen, highlighting the impact of the competition on their lives outside the game. *WGC Ultimate Gamer*, a Syfy channel reality competition, pits 12 gamers from a variety of specialties against each other in a mix of video game challenges and real-world tests of skill derived from the mechanics of popular games.

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World of Warcraft (WoW)

World of Warcraft (*WoW*), developed by Blizzard entertainment, is a **massively-multiplayer online role-playing game (MMORPG)**, one of the most popular **on-line games** of its genre, and one of the biggest successes of the video game **industry** with around 12 million subscribers as of 2010. *WoW* was officially launched on November 23, 2004, in **North America**, **Australia**, and **New Zealand**, and in **Europe** and **Asia** in 2005 and is distributed in seven languages. The game takes place in a persistent **world**, with anywhere from 5,000 to 30,000 players on-line simultaneously at any given time on each of the servers (or "realms") hosted by the company. The game's main goal is to increase the power of the player's character. Progression is calculated with experience points (Xp) between the levels 1 to 80, but players can evaluate their progression by the value of the equipment they own, their skill points, their reputation within different factions, honor points, and so on. Players are invited to undertake quests, complete dungeons, kill monsters and other players, make money, discover the world, and interact with other players. When characters reach the highest level, in what is called the "End-game" (also known as the "Elder game"), players usually concentrate their activities on raiding or completing top-tier dungeons and fighting in arenas or battlegrounds. In an arena, a team of 2, 3, or 5 players has to kill another team in hand-to-hand fights, while in a battleground, one team of more than 10 players has to attack or defend specific spots, capture the flag or control bases and resources.

WoW is based on the *Warcraft* series of real-time **strategy games**, extending their world into an MMORPG. *WoW* features three modes of gameplay: *Player versus Environment* (PvE), *Player versus Player* (PvP), and *Role-playing* (RP). The game's logic and vocabulary are inspired by the medievalist fantasy genre and the *Dungeons & Dragons* tabletop **role-playing games (RPGs)** created by Gary Gygax and Dave Arneson, but also by previous MMORPGs, especially *EverQuest* (1999). A vast mythology has been created for *WoW* to explain the history of wars, alliances, leaders, and so on, and it defines the spatial and social organization of the game.

To **play** the game, players choose an avatar in one of two factions, the Alliance or the Horde, and between **races** in each faction: the Alliance includes Human, Dwarf, Night Elf, Gnome, and Dranei, and the Horde includes Orc, Undead, Tauren, Troll, and Blood Elf. Characters in each race can be divided into 10 classes: Druid, Hunter, Mage, Paladin, Priest, Rogue, Shaman, Warlock, Warrior, and Death Knight. The choice of class has a big impact on the player's role during combat, such as causing long-distance damage, tanking or fighting, healing, or crowd controlling. Players also must select their character's **gender** and some physical features, and, once in the game, they can choose up to two specific professions per character and build a talent tree.

Part of the game can be played alone, but it is also based on social interaction between players who are invited to gather together in temporary groups or more permanent groups called "guilds." Guilds are managed by players and are more or less organized, populous, and regulated, according to their leaders who determine the type of guild, and its rules and goals. Two classical oppositions are the raiding guild, based on hard progression, and the casual guild, based on socialization. The game has also an economic system principally dependant on trading between players. The currency is called "gold" and some players, who specialize in collecting gold to sell for real-world currency, are called "gold farmers." Gold farming and selling characters are forbidden by Blizzard Entertainment, although a large market for it exists on the Internet, which is difficult to police because of the scale of the game and its on-line culture.

Developer and publisher Blizzard Entertainment, the maker of *WoW*, is headquartered in Irvine, California, and was founded in 1991 by Allen Adham, Michael Morhaime, and Frank Pearce under the name Silicon & Synapse, which was changed to Blizzard Entertainment in 1994. Before *WoW*, Blizzard developed a number of games including *Warcraft: Orcs and Humans* (1994), *Warcraft II: The Tides of Darkness* (1995), and *Warcraft III: Reign of Chaos* (2002), as well as *Diablo* (1997) and ***StarCraft*** (1998), which both began series of their own.

Blizzard released *WoW*'s first expansion, *World of Warcraft: The Burning Crusade*, in January 2007, and the second expansion, *World of Warcraft: Wrath of the Lich King*, in November 2008. According to the company's official statistics, the second expansion sold four million copies in its first month. Blizzard Entertainment is also developing a movie based on the *Warcraft* universe to be directed by Sam Raimi and produced by Legendary

Pictures. Blizzard also produces derivative products of *World of Warcraft* such as tabletop games, collectible card games, books, and **comics**, and a forthcoming expansion, *World of Warcraft: Cataclysm*, has been announced.

Maude Bonenfant

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World War II in video games

World War II, a multinational armed conflict that lasted six years, from September 1, 1939, until September 2, 1945, has influenced the **design**, subject matter, and **narrative** content of video games since the mid-1970s. Early examples of video games set during World War II include *Desert Fox* (1976), *Sea Wolf* (1976), *M-4* (1977), and *M-79 Ambush* (1977), their titles respectively referring to the German Field Marshal Erwin Rommel, the World War II USS *Seawolf Sargo* class submarine commissioned in 1939, the M4 Sherman Tank predominantly used by the **United States** during the conflict, and an iteration of Japanese military aircraft. These early games were exceedingly minimalist, presenting the player with undifferentiated depictions of land, sea, or air where point-and-shoot battles occur.

More complex representations of World War II released in the 1980s and 1990s would foundationally structure an array of game genres including flight simulators, real-time and turn-based **strategy games**, and first-person and third-person **shooting games**. Shooting games predominantly place the game player on the side of the Allied powers during the conflict, requiring players to **play** as infantry fighting for the United States, the Soviet Union, the United Kingdom, or **France**, combating the Axis-aligned countries of **Germany** and **Japan**, whereas flight simulators and strategy games frequently allow players to operate as pilots and commanding officers fighting on both sides of the **war**. Of the numerous individual battles that occurred during the war, World War II video games frequently focus on major military conflicts such as the Pacific Theater, the Eastern Front, and the Battle of Normandy, representing these conflicts differently depending on the genre and the technical capabilities of the individual games and the **platforms** on which they are played. Many World War II video games emphasize an attention to historical detail on multiple tiers, foregrounding the factual fidelity of both the battles in which players participate and the weapons they employ during the conflict, promoting these games as accurate representations or simulations of actual historical occurrences. Other games, such as **id Software**'s first-person shooter *Wolfenstein 3D* (1992), actively intertwine history and fantasy, eschewing historical accuracy in the construction of horrifying game **worlds** where players explore the depths of Nazi villainy.

World War II flight simulators, video games that feature simulated aerial combat based on actual missions flown during the war, achieved early prominence within video game **history**. Capcom's *1942*, released in video game **arcades** in 1984 and later ported to the Commodore 64 and the **Nintendo Entertainment System (NES)**, stands as an early popular example of a flight simulator based on World War II; in a vertically **scrolling** shooting scenario, the player must guide a "Super Ace" plane, designed to resemble a Lockheed P-38 Lightning aircraft, over Tokyo, attempting to destroy the Japanese air fleet during the war's Pacific Theater. Although *1942*'s simulation of aerial warfare is inherently limited because of the technological restrictions of early arcade and home **console** systems, later flight simulators incorporate far greater attention to detail in terms of the plethora of controls available to players and the visual representation of the areas over which they fly. Dynamix's *Aces of the Pacific* (1992) allows players to operate multiple types of aircraft flown during the Pacific Theater and choose to play historical missions based on specific conflicts, notable in that the player can play as either Japanese pilots attacking Pearl Harbor or American fighters defending against the attack. MicroProse's computer game *1942: The Pacific Air War* (1994) expands gameplay beyond the shooter style evident in the aforementioned titles, allowing the player to participate in a "tour of duty" mode in which they are required to not only fly and fight in singular missions but also manage the entire aerial fleet through a campaign **map**. Microsoft's *Combat Flight Simulator WWII Europe* (1998) and its sequels provide players with databases of aircraft, scenery, and statistics, which they can reprogram, allowing user-generated content to enliven the game's replay value.

In contrast to World War II flight simulators, strategy games emphasize the tactics and minute operations of military combat, avoiding the player-orchestrated participatory shooting action of the flight simulator genre, allowing the player to oversee large-scale military fronts. Strategy games, such as Strategic Simulations, Inc.'s 1994 *Panzer General*, feature multiple maps, frequently viewed from an aerial perspective, in which players control a diverse array of military units as they advance on the enemy. Players must leverage health statistics, weaponry, and supplies against one another, applying each element differently to the diversified military units under their control, to effect victory.

World War II first-person shooting games popularized the genre in the 1990s, with id Software's 1992 release of *Wolfenstein 3D*, in which players must fight their way out of a Nazi castle in the heart of the Third Reich from a first-person perspective. Although *Wolfenstein* features horrifying representations of Axis powers, with the player having to defeat a monstrous, mechanized Hitler to win the game, later shooters, such as Treyarch's immensely popular *Call of Duty* franchise (begun in 2003) and **Electronic Arts**' *Medal of Honor* franchise (begun in 1999), emphasize historical fidelity. These games, which rely on the inherently repetitive core mechanic of aiming and firing, nonetheless lay claim to a strong sense of historical realism. This sense of realism is evoked through the interactive first-person representation of individual battles, such as the Battle of Peleliu Island and the Battle of Stalingrad in *Call of Duty: World at War* (2008), the increasingly accurate depiction of World War II–era weaponry, such as Thompson submachine guns and Mosin-Nagant rifles, and the incorporation of **cut-scenes** that provide the player with relevant dates, statistics, and archival footage concerning the forthcoming conflicts. These shooting games are thus able to intertwine a high degree of factual information with fictional character biographies so as to position their digital, interactive representation of war as a more accurate replication of the conflict.

Criticism of World War II video games, beyond highly politicized debates concerning the effects of video game **violence**, has considered both the ideological effects and historical value of contemporary representations of the war. Multiple scholars criticize World War II games as paeans to militarist ideologies and nationalist jingoism, understanding such games to function as recruitment tools for the U.S. military, imbuing players with a chauvinistic national outlook that supports the military-entertainment industrial complex. Other scholars discuss World War II games as promoting an exploration of the concept of history itself, allowing players to openly explore and alter static, totalizing histories of World War II, the narratives of which frequently remain unquestioned. To these critics, the interactive ability to alter the outcome of major historical events allows the player to investigate and understand the multivalent nature of the history of World War II in particular.

Harrison Gish

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(*WoW*)

See World of Warcraft (WOW)

Wright, Will (1960–)

William (Will) Wright is an American game designer best known for his ***Sim* series** of games. Wright was born in Atlanta and at age 9 moved to Louisiana after the death of his father. Wright graduated from high school at age 16 and then, over the course of several years, attended Louisiana State University and Louisiana Tech, finally moving to New York where he enrolled at the New School in Manhattan. His topics of study were varied and included architecture, engineering, computers, and robotics. In 1981, Wright returned to Louisiana without earning a degree but continued to follow his personal passions and interests.

His earliest **design** work was completed in 1984 on a **war** game for the Commodore 64 home computer system. The game, *Raid on Bungeling Bay*, afforded Wright the opportunity to build **maps** and create levels. In an interview, when questioned about his experience working on this game, he recalled how building those maps and levels—along with his interest in urban planning—gave him more enjoyment than actually playing the game. Wright formed a company called **Maxis Software** with game producer Jeff Braun, and in 1989 the world was introduced to *SimCity*, which gave players the opportunity to build and run cities. Newer versions of the game allow players to sculpt mountains and even plan disasters for their cities, but the primary focus of the game centers on direction and management rather than destruction or **violence**.

SimCity was the first in a series of **simulation games** including *SimEarth* (1990), *SimAnt* (1991), *SimLife* (1992), and the very popular franchise simply called *The Sims* that launched in 2000. Wright's most recent project, *Spore* (2008), is a game that allows players to develop highly complex creatures from microscopic organisms. These titles are some of the highest grossing of all time and the original *The Sims* game remains in the global top 20 list, boasting more than 16 million copies sold.

Although the *SimCity* franchise did well for Maxis, Wright and his partner thought the company couldn't survive on its own, and they sold Maxis to **Electronic Arts (EA)** in 1997. Wright worked at EA until 2009 when he opted to leave and found *Stupid Fun Club*, a joint venture think-tank between himself and EA, which claims on their website to be "an entertainment development studio" focused on "video games, online environments, storytelling media and fine home care products."

Will Wright is known for having a keen eye on the gaming **industry**. For instance, in a 1994 interview with *Wired* magazine, he predicted that by 2009, **on-line games** would be the norm. His visionary contributions to the **god game** genre are immeasurable, and his style of blending role playing with real time **strategy game** techniques is used to this day.

Richard E. Ferdig and
Joseph C. DiPietro

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X

Xbox 360

See Microsoft Xbox 360

Xbox

See Microsoft Xbox

XNA

Microsoft XNA is a software **platform** created to ease the development of video games for the Windows Operating System, the **Microsoft Xbox 360**, and other Microsoft platforms. XNA provides a set of tools, services, and resources designed to help simplify game creation for professional, student, and hobbyist developers. XNA is typically used to refer to several elements: the XNA Framework, XNA Game Studio, and the XNA development community. XNA was announced in 2004 at the **Game Developers Conference (GDC)** and was released at the 2006 GDC. XNA is a recursive acronym, standing for "XNA's Not Acronymed."

XNA marks a deviation from historically restricted development for other game **consoles**, which have typically required developers to buy more expensive development console systems and specialized tools directly from the console manufacturer. In contrast, XNA developers may test their games on retail consoles.

The production of unofficial content for a console system is often prohibited by the console manufacturer, which seeks to regulate content and license game production to share in a game's potential profits. Such noncommercial games for console and **handheld** systems are called **homebrew games**, and although consumers have produced such content for other console systems, XNA is the first homebrew development platform sanctioned by a console developer.

The XNA Framework is a Software Development Kit (SDK), which is a collection of programming elements for routine functionality that can be combined to make more complex programs. For instance, XNA streamlines the processes for displaying **graphics** on the screen, playing **sounds**, and other commonplace game functions. In this way, XNA functions as an application programming interface (API), serving as a software framework to facilitate and speed game development by simplifying the software code in which the games are written. Programs in the XNA Framework are primarily written using Microsoft's XNA Game Studio software, using the C# language.

The XNA Game Studio software is a development environment specifically designed for the creation of XNA content, built on top of Microsoft's Visual Studio development environment. The first version, XNA Game Studio Express, was made available in 2006, with XNA Game Studio 2.0 released in 2007 and subsequent versions similarly titled.

Microsoft operates XNA Creators Club Online, an official XNA community website, through which XNA developers may submit and share their own games, as well as play and review the games of other XNA content creators. Games made with XNA can be easily ported between multiple Microsoft platforms, and game creators can also sell their games for the Xbox 360 via the Xbox Live Indie Games on-line service.

Christopher Hanson

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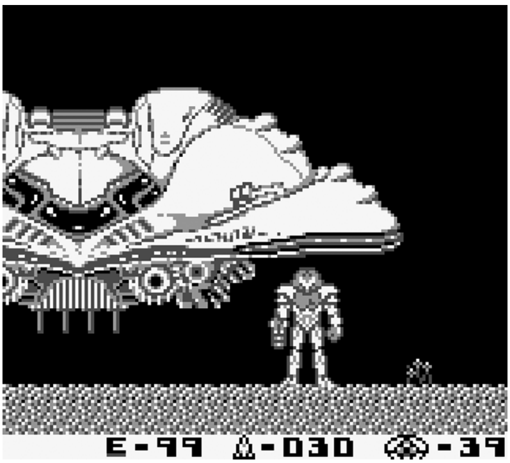
Y

Yokoi, Gunpei (1941–1997)

Born September 10, 1941, Gunpei Yokoi was one of the architects of **Nintendo**'s dominant position within the video game **industry** during the late 1980s and early 1990s. He is most frequently associated with the creation of both the company's seminal **handheld** gaming device, the **Nintendo Game Boy**, and of one of its flagship game franchises, ***Metroid***.

Upon his graduation from Doshisha University in 1965 with a degree in electronics, Yokoi took a position at the then-toy manufacturer, where he would devise numerous mechanical toys, tools, and novelties before creating Nintendo's first handheld video game device, the Game & Watch LCD game, in 1980. Conceived as a low-cost alternative to direct competition with dominant **console** manufacturers such as **Atari** and Mattel, more than 60 *Game & Watch* models were produced over the following decade, a period that also saw the debut of Nintendo's Famicon (1983, rechristened the **Nintendo Entertainment System (NES)** for its 1985 Western release). The console was designed by Masayuki Uemura, a personal hiree of Yokoi, who himself developed a successful peripheral for the NES, the R.O.B. (Robotic Operating Buddy). The appeal of Yokoi's device helped assuage American consumers' skepticism in a new video game console following the industry **crash of 1983**. Yokoi would also personally spearhead the development of two of the NES's most beloved games—*Metroid* (1986) and *Kid Icarus* (1987)—as producer.

With Nintendo's place in the home console market firmly secured, Yokoi's most famous creation, the **Game Boy** (1989), would ensure the company's dominance in the handheld sector for decades to come. The Game Boy, which boasted a 2-inch monochrome screen and mono **audio**, could be played for up to 35 hours on four AA batteries and was sold bundled with Alexey Pajitnov's addictive puzzle game, ***Tetris*** (1985). This sensation, along with Yokoi's own handheld iteration of



Two of Yokoi's most enduring creations: bounty hunter Samus Aran appears in Yokoi's *Metroid II: Return of Samus* (1991) for the Nintendo Game Boy, which was also designed by Yokoi. (Ben Gill)

Nintendo's flagship character, *Super* **Mario** *Land* (1989), drove sales of the original Game Boy to more than 50 million units. Yokoi would develop two *Mario Land* sequels—*Super Mario Land 2: Six Golden Coins* (1992) and *Wario Land: Super Mario Land 3* (1994)—for the Game Boy, as well as a sequel to his second most famous creation with *Metroid II: Return of Samus* (1991, with *Super Metroid* following on the **Super Nintendo Entertainment System (SNES)** in 1994). However, in 1995 Yokoi's next invention, the ill-fated **Nintendo Virtual Boy**, was widely regarded as a colossal failure; its stand-mounted visor design and red monochrome screens prompted complaints of physical discomfort among the gaming press and complete indifference from the buying public. With the lion's share of Nintendo's resources focused on the higher-profile launch of the **Nintendo 64** console in 1996, the Virtual Boy became an embarrassing albatross around Yokoi's neck, and he left the company later the same year. Forming a new company under the name Koto Laboratory, Yokoi began work on a new handheld device that would ultimately be released in 1999 as Bandai's Wonderswan. Tragically, however, Yokoi himself would not live to see the Wonderswan's completion as, on October 4, 1997, he, along with business associate Etsuo Kisoo, was struck and killed by a car on **Japan**'s Horukiko Expressway after being involved in a minor collision.

Ben Gill

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Z

z-axis depth

Video games use techniques found in other graphical media for suggesting depth into the picture plane (that is, along the z-axis): overlap, apparent size, linear perspective, foreshortening, texture gradients, aerial perspective, shadowing, parallax, and the rotation of objects. The use of these techniques depend on the state of available technology and **game design**, which determine what can be put into practice.

Early games, with their simple **graphics**, were unable to achieve much illusion of depth. Overlap and apparent size were used, but the simple shapes and few colors available made it difficult to counter the screen's flatness. Attempts at linear perspective came in 1976, when **racing games** such as *Datsun 280 Zzzap* and *Night Driver* both featured small, white rectangles arranged to suggest roadside pylons that defined a roadway extending toward a vanishing point. Scalable sprites, introduced in the 1970s, also helped smooth changes in apparent size. Advances during the 1980s, including higher-**resolution** imagery, texture gradients, and more available colors, increased the amount of graphical detail and made subtler depth cues possible, creating a better illusion of depth in game imagery.

True three-dimensional computation, which rendered views of scenes produced with three-dimensional coordinate systems, first appeared commercially in **vector games** like *Speed Freak* (1978), *Barrier* (1978), and ***BattleZone*** (1980). The first three-dimensional game with filled-polygon graphics was ***I, Robot*** (1983), but its graphics were simple and **abstract**; it would not be until the late 1980s that games with three-dimensional filled-polygon graphics would appear regularly.

While games awaited the computing power necessary for true three-dimensional graphics, other design strategies were used to simulate depth. Shifting, overlapping planes could produce a parallax effect, as in *Moon Patrol* (1982). Sprites were detailed enough to allow characters to appear in different positions, making them look more dimensional. Large numbers of sprites could be scaled to produce a three-dimensional feel, as in *Pole Position* (1982) and *Space Harrier* (1985). A few games were 3-D through the use of stereo images, like *Subroc-3D* (1982). Axonometric projections gave graphics a three-dimensional feel without any three-dimensional calculations, as in ***Q*bert*** (1982) and *Crystal Castles* (1983). Images with first-person perspectives were used in *Maze War* (1974) and *Spasim* (1974), and pre-rendered three-dimensional imagery was used in **laserdisc games** and early **CD-ROM-based games**. Each of these methods, however, had its limitations, and none of them allowed dynamic, interactive camera movement in real time.

With the advent of true three-dimensional computation done in real time, interactive three-dimensional environments became possible, and the z-axis depth they generated was based on a three-dimensional coordinate system that made their spaces look more realistic. Computer graphics advances such as the Z-buffer helped to reduce the amount of processor speed and memory needed to produce imagery with depth, but both still limited what was possible. Sightlines extending too far into the distance made render time too slow for real-time interaction. Thus games had to limit the amount of depth in the player's view; for example, the first two ***Grand Theft Auto*** games had an overhead view of the street to limit what needed to be rendered. Other games designed their landscapes or building interiors with limited visibility, so only a small portion of the world can be seen at any given time. Devices such as fog, shadow, and exaggerated aerial perspective obscured visibility beyond a certain distance, as in games of the *Tomb Raider* series and *Silent Hill* series. As computing power increased, depth-obscuring devices became less necessary. Methods that reduce render time are still used, however, such as NURBS, non-uniform rational basis (or Bézier) splines, which dynamically reduce an object's polygonal resolution as it moves into the distance, reducing the number of polygons needed to be rendered.

Z-axis depth is necessary for a strengthened illusion of a real three-dimensional space, and although it places demands on hardware, software, and game design, it fills the player's viewpoint with a larger and more detailed **world** of interconnected locations, adding to a game's verisimilitude and encouraging player involvement.

Mark J. P. Wolf

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Zeebo

The Zeebo is a 3G-enabled game **console** that was introduced in Brazil and Mexico in 2009. The development of the Zeebo console began as a partnership between California-based Qualcomm and Brazil-based Tectoy. Executives including Reinaldo Normand, Mike Yuen, and John Rizzo oversaw the initial launch of the console at the **Game Developers Conference (GDC)** in San Francisco in March 2009. Initial tech press and blog accounts called the Zeebo the console for the "next billion" gamers.

The original impetus behind the Zeebo console was Reinaldo Normand's desire to create a console that would be affordable for middle-class families in emerging markets (Hall, 2009). Zeebo pursued partnerships with local wireless carriers such as Claro, using a 3G connection bundled with the console as a way to distribute games digitally, avoiding distribution problems posed by the geographic limits of broadband infrastructures. Zeebo's corporate leaders also considered digital distribution via 3G networks as a way to curtail rampant **piracy**. Games were released in BREW (binary runtime environment for wireless), which led some critics and players to argue that the Zeebo was not a game console in the traditional sense but a glorified cell phone.

Reinaldo Normand, founder of Zeebo, holds up his latest game console for use in developing countries on March 23, 2009. The Zeebo is targeted at consumers in emerging markets like India, China, Brazil, and Eastern Europe who may not be able to afford the latest high-end consoles, or the games published for them. (AP Photo/Eric Risberg)

Because of lackluster sales and problems in establishing game markets in **Latin American** markets, the Zeebo has recently been repositioned as an **educational platform**. Part of the failure of the Zeebo may be due to the fact that major game publishers and developers used the system to port titles and as a way to monetize back catalog titles. Although the system was more affordable than legal versions of current consoles, it was only slightly cheaper than pirated versions of the **Microsoft Xbox 360** and the **Sony PlayStation 3** that allowed game players to access current titles (also available on the black market). Despite problems with the console, independent developers and Latin American developers expressed enthusiasm over the emergence of a new platform that might allow them new forms of access to consumers—unlike the licensing arrangements and complicated approval processes associated with the big three consoles and the Apple iPhone. Despite the corporate restructuring that has shifted the Zeebo from being a game console designed for entertainment to a platform designed to improve educational access and literacy, the Zeebo's introduction as a new console illustrates the need to develop more nuanced accounts of cultural differences in game play and how transnational and global accounts of gaming industries and cultures must move beyond a focus on the big three markets of the **United States**, **Japan**, and **Europe**.

Ben Aslinger

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Zelda series

See Legend of Zelda series

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