



# PIXEL LOGIC

Pixel art tutorials

Written by  
**Michael Azzi**

**Preview  
edition**

## **This is the free preview of Pixel-Logic!**

Within this you'll be able to read the **Introduction** and **Chapter 1: Line art**. If you like what you read and want to know more, you can purchase the guide here!

**[gumroad.com/michafrar](https://gumroad.com/michafrar)**

The guide is constantly being updated with new chapters, so once you purchase you'll always get the latest chapters and updates free.

**Thankyou for the support and for reading!**



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**Written by Michael Azzi.**

[www.michafrar.com](http://www.michafrar.com)

**Design by Jenna Brown.**

[www.cyanatar.com](http://www.cyanatar.com)

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# PIXEL LOGIC





# Introduction

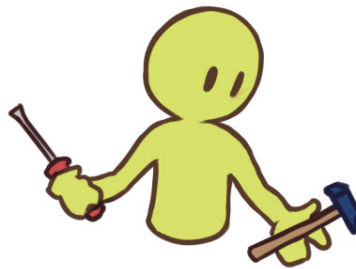
## Getting started

# Prologue



## What programs do I use?

You can keep using software you already know or switch to a new one. Some programs do more than pixel art, others don't. **In the end, it doesn't matter how advanced or fancy your technology is.** Even MS Paint does the trick! Check **page 14** for some software examples.



## Why is pixel art different from other pixelated art?

**In pixel art, you have total control and can manipulate every single pixel yourself.** Advanced tools will *not* do the job. Of course, that makes your artwork sharper because you don't have the soft blur from paintbrushes. However pixel art is not just about the tools. Learning techniques is equally as important to get good results and work faster.

### **You control the pixels. The tools don't control you.**

It doesn't mean you have to place every single pixel like a brick.

There are shortcuts. Don't worry!

### **Non-pixel art:**

**Doesn't require you to zoom much.  
Doesn't require pixel-precision.  
Uses brush strokes and pen pressure.**



**Pixel art was born from limitations.**  
That's why many manual techniques are still used today.

Technological progress gave new possibilities in 2D games: digitized pictures and photographs, pre-rendered 3D models, full motion video and much more. Once sprites stopped being edited on pixel level, they were not considered pixel art anymore. **They are still sprite objects on screen, but not the *traditional* hand-made pixel-sprites we know of.**



**Non-pixel art**



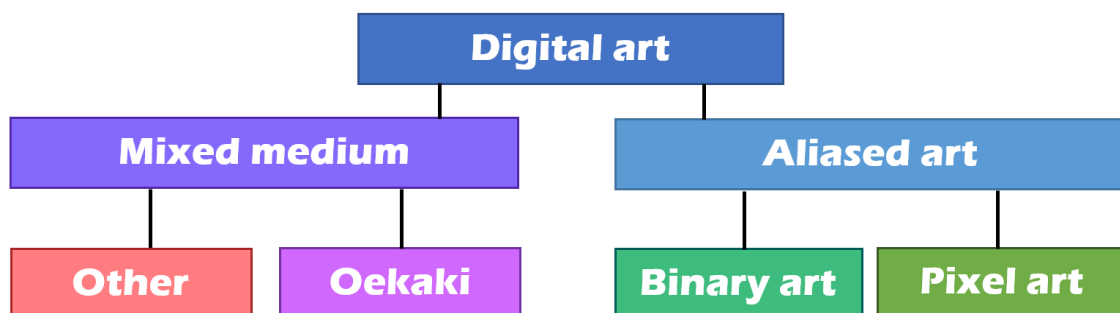
**Oekaki or binary art**



**Pixel art**



Pixel art is often confused with other art mediums such as Oekaki or Binary art. That's because they often use aliased graphics: art made with non smoothing tools. Regular paintbrushes smooth your lines. Aliased art keeps everything pixelly & sharp.

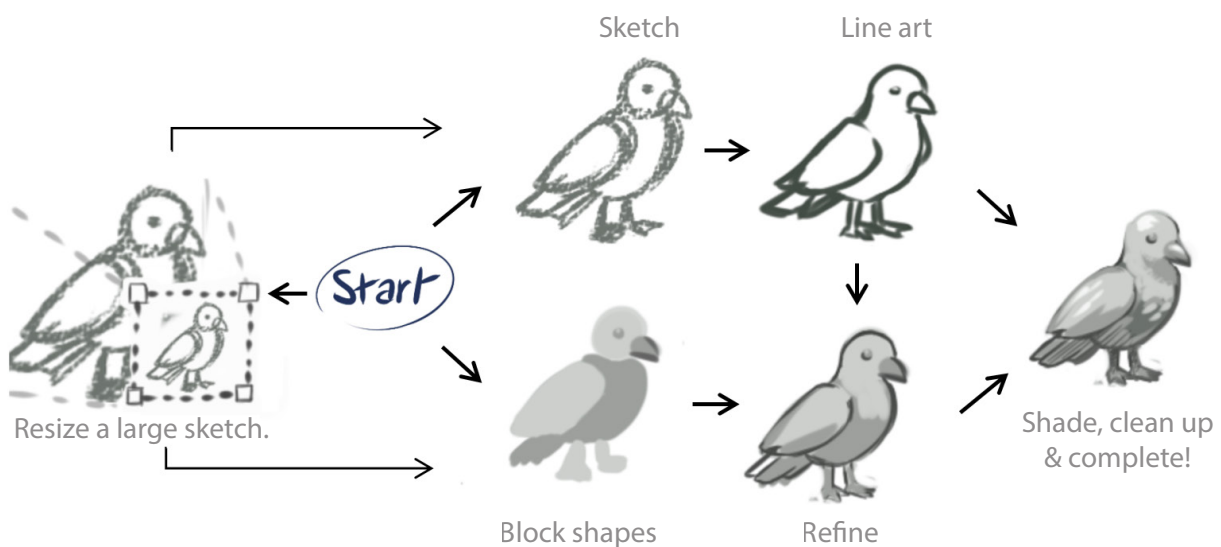


This diagram is a summary. For more info, check the tools on page...



## So where do I start?

There are **multiple ways** to start. Let's compare it to something more familiar: drawing & painting! The methods aren't all that different from pixel art! You'll see.



You can start multiple ways and take different paths. You can even mix paths. **If you already make illustrations, stick to your method of preference!** If you feel adventurous, try something new. However, pixel art is usually 1 single layer.

If you're not comfortable working on 1 single layer, don't worry; you can still use layers, but make sure to combine them so you don't get too dependent. Especially with animation, having layers will hinder you more than anything. If you make entire scenes or mock game screenshots, layers are necessary though! As a result, this brings pixel art closer to more traditional artwork.

**Pixel art is like 2D sculpting.**  
You start with a base, then chisel and add pixels!

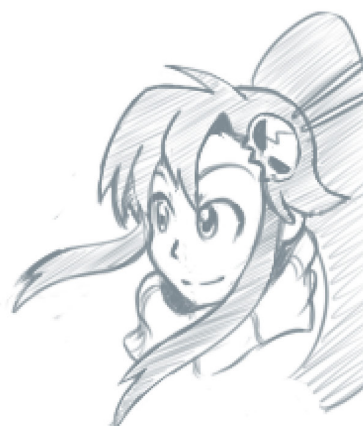




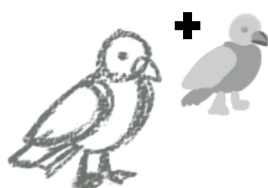
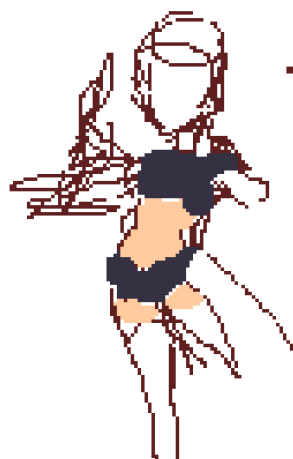
Here are a few examples of the multiple ways to make your sprites/pixelart.



Guest artist: Neoriceisgood



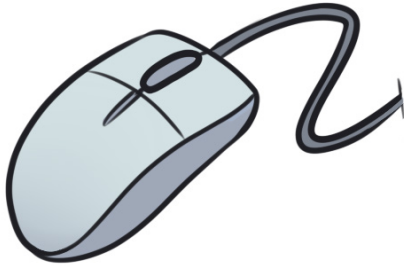
By Michafar



Guest artist: Anubis Jr

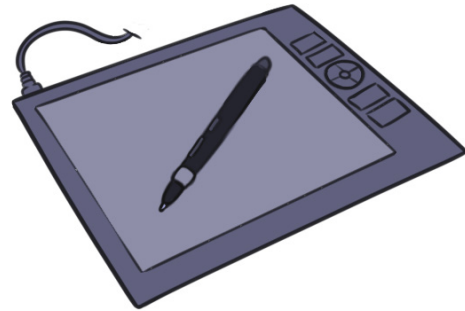
# Hardware tools

**Both mouse and tablet are perfectly fine!**



**OK!**

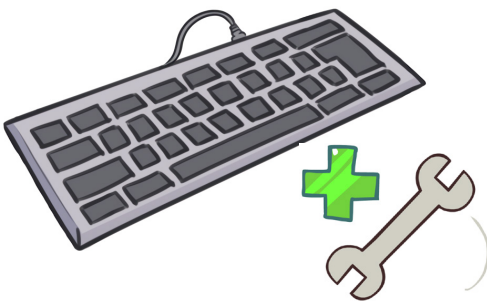
A Mouse is good with clicks  
Harder to draw with,  
but offers click precision.  
Good for clean up and final touches.



**OK!**

A Tablet is good with strokes.  
Harder to click or tap constantly,  
but easier for intuitive control.  
Good for the sketch/beginnings.

It doesn't matter what you use. Remember the saying:  
**"It's not about the tools. It's how you use them"**



Remember: your keyboard is a powerful tool for art too!

You can use keyboard shortcuts to make the process faster and flip through animation frames. You can also use extra buttons on your mouse or tablet, if they have them. Sometimes, you can even make your own new shortcuts.

**Stick to the tools that let you work more efficiently and faster.**

# “Old school” hardware

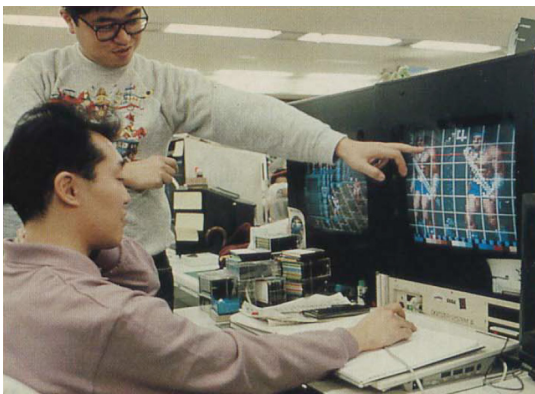
Here’s a few examples of how sprites were made back in the 80’s and 90’s.  
**They’re not all that different from today’s hardware, just more archaic!**

Early video game developers used special tech such as tablets with a mouse that had a crosshair. The tablet was calibrated to the screen, unlike a regular mouse. These devices were called **digitizers** and the mouse was called a **digitizer puck**.

**Sprites were roughed out on paper, placed over the digitizer and then traced with the puck.**



Capcom artists drew frames on grid paper and pixelated them with digitizers.  
Felicia art by Akira “Akiman” Yasuda featured in Darkstalkers (1994).



Images from the development of Golden Axe in Mega Drive (1989)  
from the French Magazine “MegaForce #4” January-February 1992.

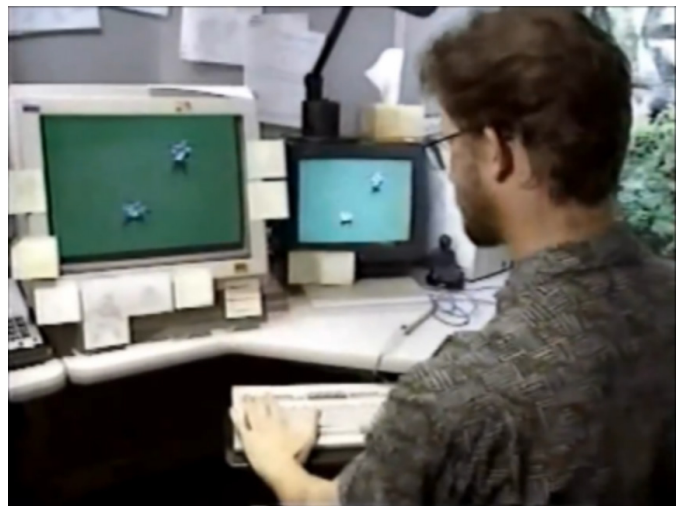


Another peripheral was a digitizer connected to a **light pen**: a screen stylus used to touch the surface of screens to recognize the X and Y axis of the monitor.

**They can be considered the precursor of embedded LCD tablets of today**, such as the Wacom Cintiq, letting you draw directly on screen.



**Other developers drew directly on computers with a regular mouse and keyboard.** Some pixel artists today still use this setup. These pictures are from a documentary that features *Comix Zone* (1993-1995) with animator Dean Ruggles.



Full video: [youtu.be/-M8Rlc6Ek0Q](https://youtu.be/-M8Rlc6Ek0Q)

A dual monitor setup isn't required since modern computers have high resolutions. Having a second monitor is extremely useful, though!

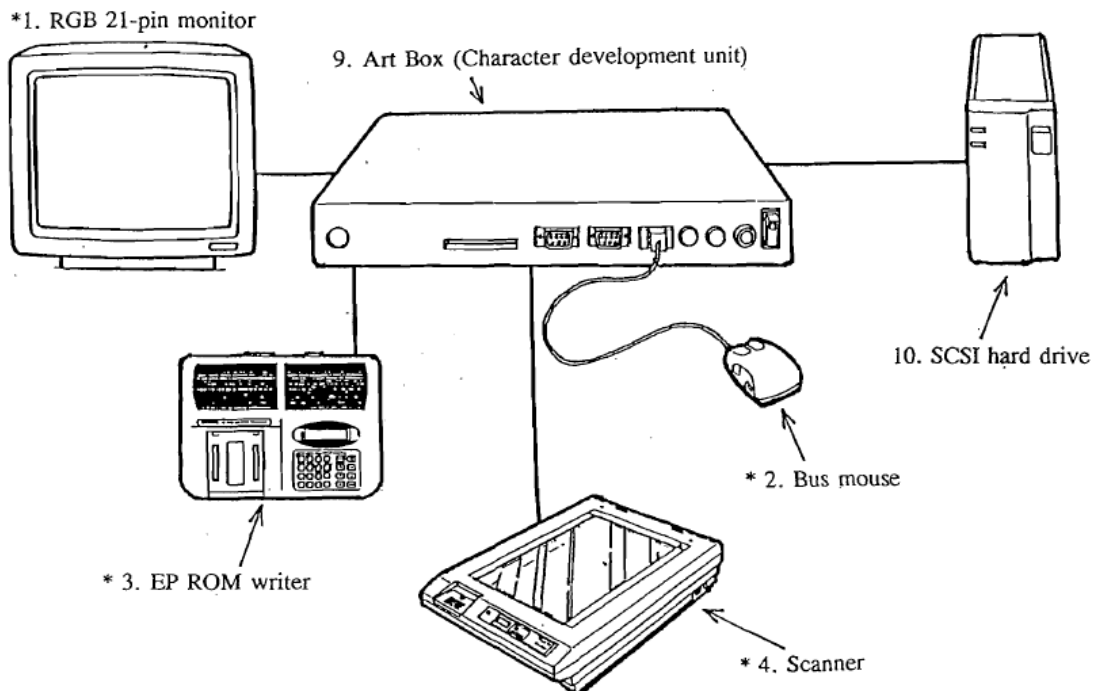




Screenshots from a 1995 Promotional commercial for *Fatal Fury 3* Neo Geo CD (Japan).

**An artist's workspace at SNK for Neo Geo hardware circa 1995  
Notice the inclusion of a scanner and a mouse.**

• Structural Diagram of Character Development Tool



From the "Neo-Geo Hardware Specification" booklet, page 93, issued by SNK Playmore Corporation

# Software & Programs

As mentioned previously, ***your tools will not define you as an artist***. These programs are there to help make the pixel art process easier so you can improve your skills. Each program listed below offers their own unique benefits and you may find one program suits your process more than others.

**It's important to try them out for yourself and see what you enjoy!**

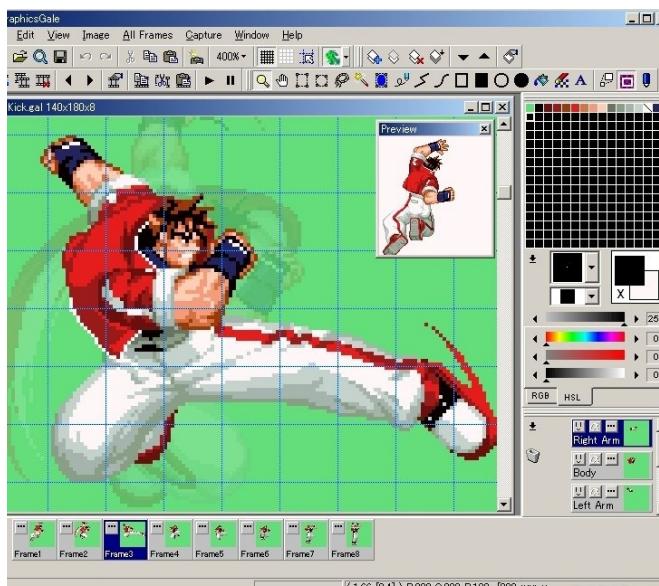
## Speciality pixel-art programs

### Graphicsgale

**Price:** 1,995 JPY / \$20

*Free version available but no gifs.*

This powerful pixel tool is suitable for animation and pixelart. With gamedev friendly tools such as tile sets, export options and palette editors; this program is quite popular with pixel artists. The Customizable layout and hotkeys make it very versatile software. Unfortunately, the timeline is a bit too simple to do full scenes. It's also great for binary artists with an extensive array of customizable brushes. This Japanese program is translated and it's quite cheap too! Make sure to try the free version.



humanbalance.net

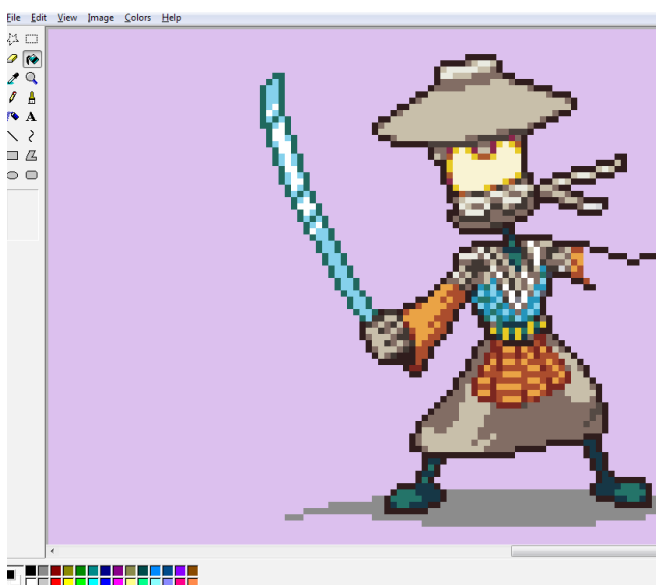
### MS Paint XP/Vista

**Price:** Free

*This version is not pre-installed on win.7/8/10*

The tool that many beginners and masters have used over the past decades. Make sure you use the Windows XP or Windows Vista version of Paint. Every version after Windows 7 feature non-pixelart tools that don't allow you to make clean pixelart.

This software just has the bare minimum, but sometimes, that's all you need. Paint is great to start your pixel adventure!



by Michafarar

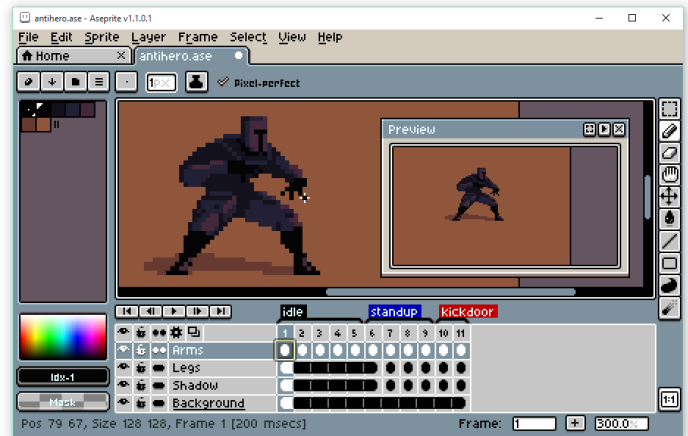
## Aseprite

**Price:** \$15

*Free version available but limited features.*

This indie developed pixelart software is always full of surprises! With frequent updates about every month or so, expect this program to become quite powerful. It's cheap, has an intuitive animation timeline close to programs like Adobe Flash.

You can easily edit and load colours and even access palettes from retro consoles. Unfortunately the user interface and layout are low resolution and pixelated, but future updates may add a different skin.



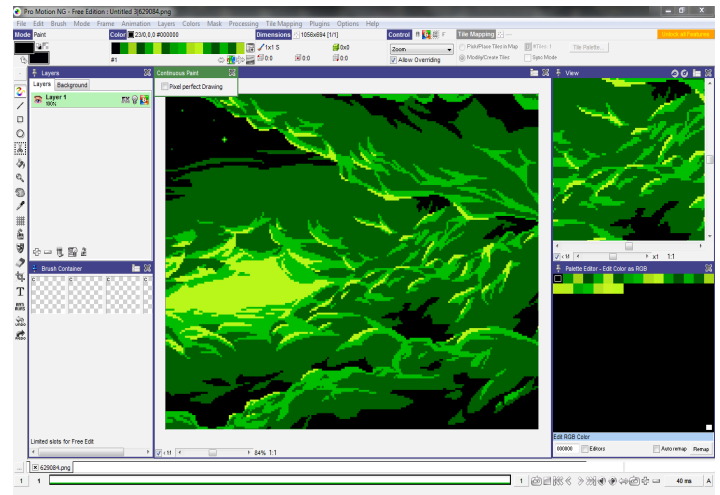
aseprite.net

## Promotion

**Price:** \$59

*Free version available but limited features.*

This tool has grown in popularity after the success of the indie game "Shovel Knight" by Yacht Club Games. This software is a great way to animate sprites. It features an advanced onion skin tool and allows you to zoom in up to 5000%. It's quite plug in friendly and allows you to customize the layout! The price is slightly higher than the other cheap software, but look out for sales every now and then.



Shovel Knight (PC)

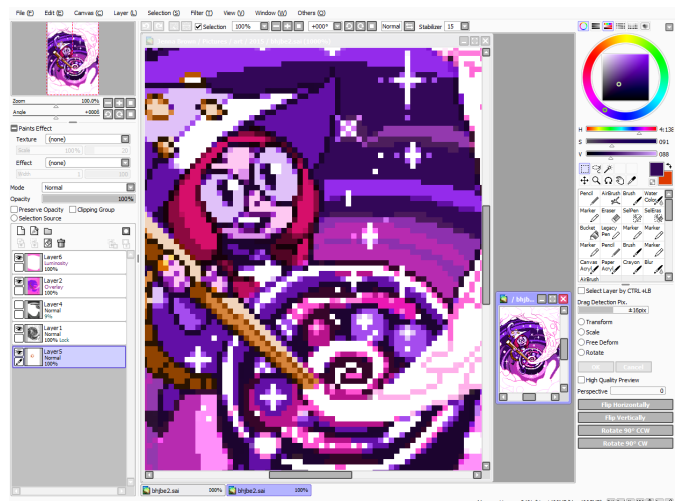
## General art programs

### Paint tool SAI

**Price:** 5,400 JPY / \$50

*30 day free trial available*

This software combines the ability to create both pixelated and non-pixelated images. Its key features include a hue shift option which allows more colour control than pixel orientated programs. It also features the ability to make smooth 1px lines with the legacy pen and stability options, along with an accurate wand tool. The program is also tablet user friendly.



Guest artist: cyanatar

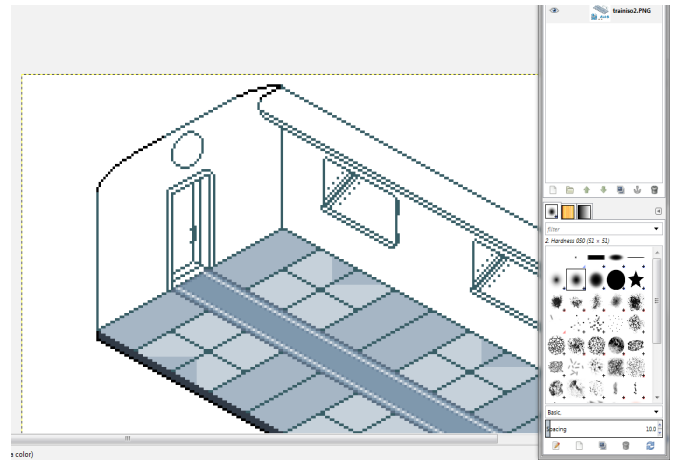
## GIMP

**Price:** Free

*An open source software app*

GIMP is a free drawing software which has the ability to also do pixel-art. This immediately makes it more accessible than the programs listed before, however while free it doesn't have an intuitive interface for pixel-art.

The program includes a lot of useful tools, including customizable grids and transparency options. It also has a text tool. Having the option to have extensive configurations to suit your needs will either be convenient or overwhelming, depending on your preferences.



by Michafarar

## Adobe Photoshop

**Price:** \$699+

*Extremely expensive program!*

Photoshop is well known as the software standard for digital art, as well as being the most expensive! There are more wallet-friendly options thanks to adobe cloud subscriptions but if you're tight on a budget it's still quite expensive.

If you can afford it, the program really does everything you could need including pixel work. It may lack the precision of dedicated software, so if you want to set up pixel art tools in the program you may need to read up on specific tutorials to get the most out of it.

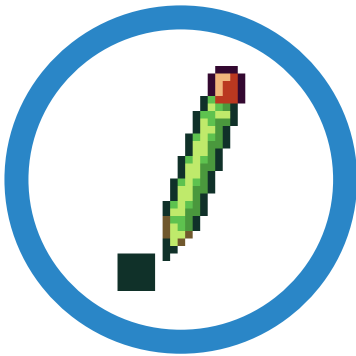


Guest artist: cyanatar



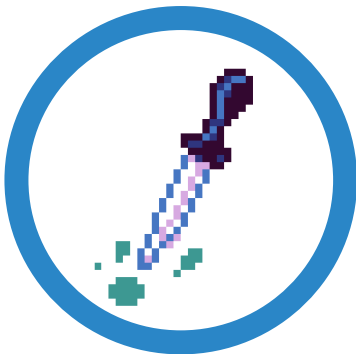
# Software tools

Regardless of the software, you will need **at least these 4 tools**.  
These are the minimum required to make pixelart.



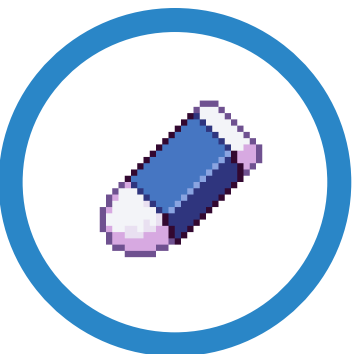
## Pencil tool

Most basic tool. Some software have a brush.  
It gives you a **1 px tool** of crisp and clean pixels.



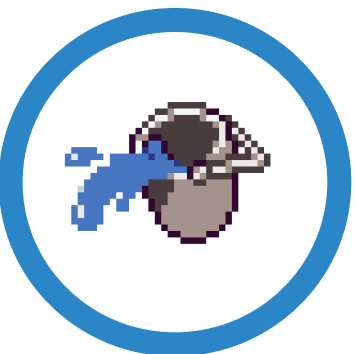
## Eyedropper

Absorbs a colour. Sometimes assigned to the right click.  
It allows you to **pick up colours** and make palettes.



## Eraser

Erases your mistakes. Some software don't include it  
because you can just **erase with white** or transparency.



## Bucket

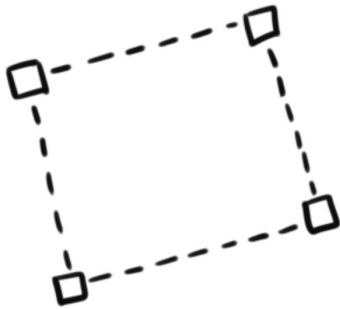
Makes your life easier. It **fills an empty area** with 1 solid colour.  
Watch out for gaps! Or it will fill the whole screen.



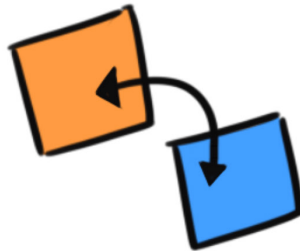
Some programs don't include an eraser and group the eyedropper with the brush. That gives you 2 tools combining the power of 4!



### Other must-have tools:



Selection tool



Recolour tool

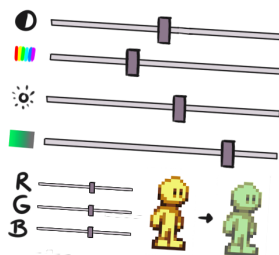


Line tool

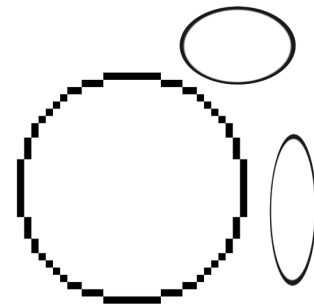
### Use & edit manually:



Rotation tool

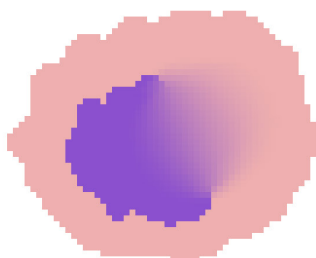


Colour settings



Circle tool

### Avoid:



Blur



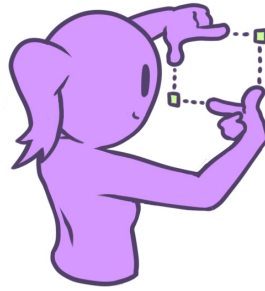
Brushes



Blurred gradients

Why avoid automatic tools? Because the artist can't predict how the result will turn out.

**Remember: Pixel art is about having 100% control over what you do.**



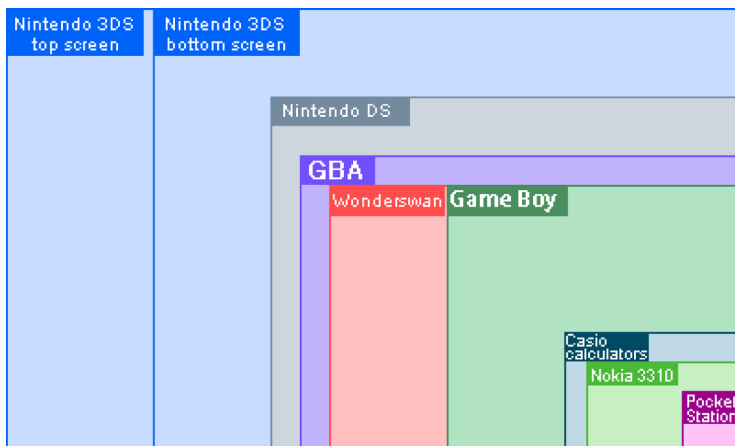
## What canvas size?

“What size do I make my sprites and backgrounds” is a common question. **Old computer graphics had low resolution, thus pixel art is often small.** When making pixel art, you will have to decide a canvas size from the very start.

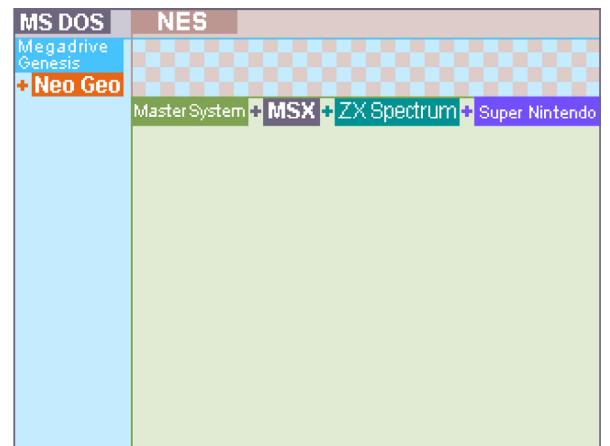
For more information on sprite sizes, read **Chapter 4: Readability**

### “I want to make artwork and display it online.”

Draw however big or small you want your artwork or animation to be. A good canvas tends to stick under resolutions of pixelated videogames.



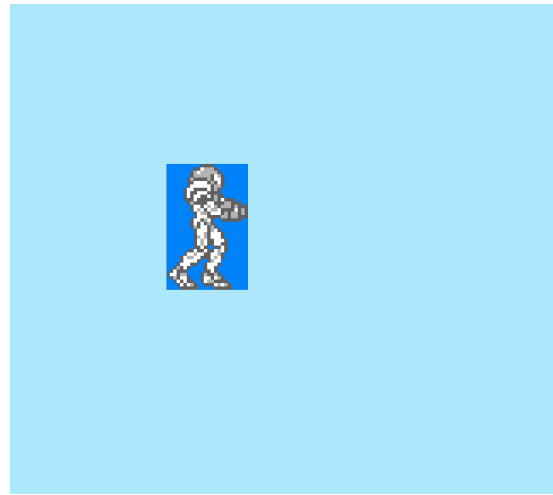
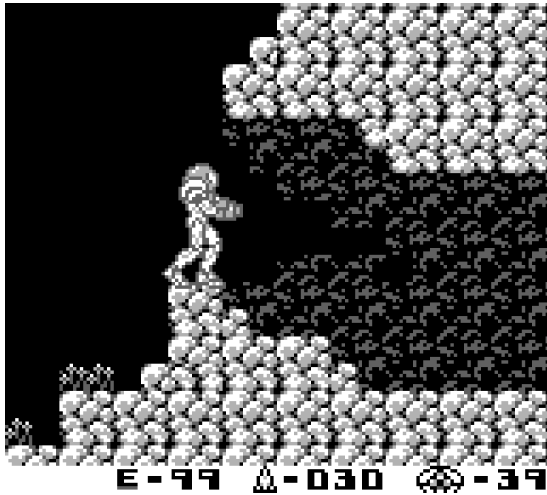
Nintendo 3DS top screen	Nintendo 3DS bottom screen	Nintendo DS	GBA	Wonderswan	Game Boy	Casio calculators	Nokia 3310	Pocket Station
400x240	256x192	240x160	244x144	160x144	94x64	84x48	32x32	
320x240								



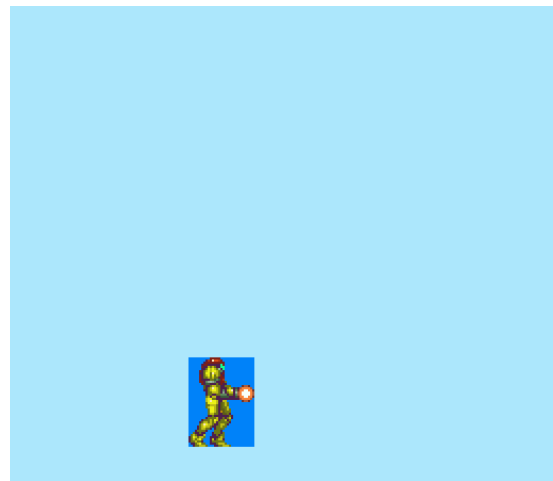
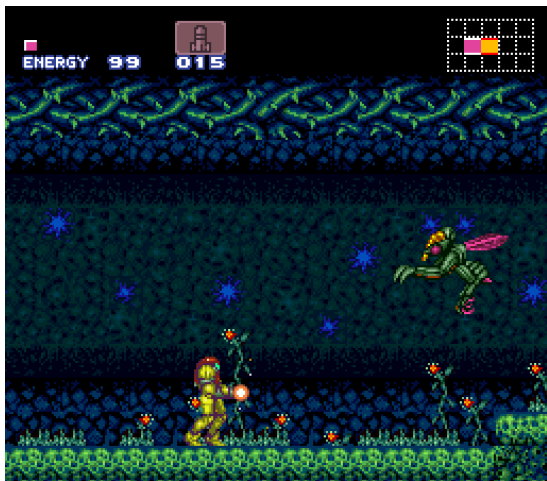
MS DOS	NES	Megadrive Genesis	Neo Geo	Master System	MSX	ZX Spectrum	Super Nintendo
320x240	256x240	320x224	256x192				

### “I want to make sprites for a video game.”

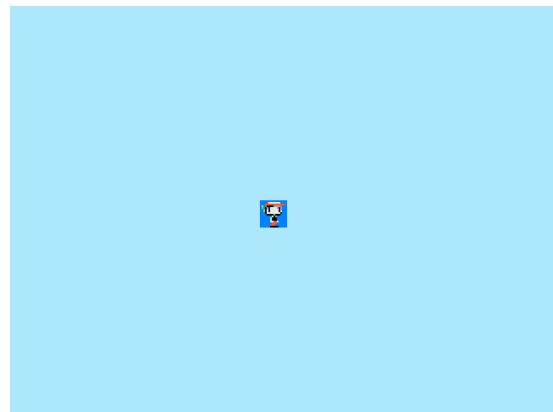
Make sure to check what ratio is between your sprite and the canvas.



*Metroid II: Return of Samus* (Gameboy) has a **LARGE** **sprite to canvas ratio** for a playable character. The sprite is 1:24, about 4% of the screen. It's not very suitable for manoeuvring in level.

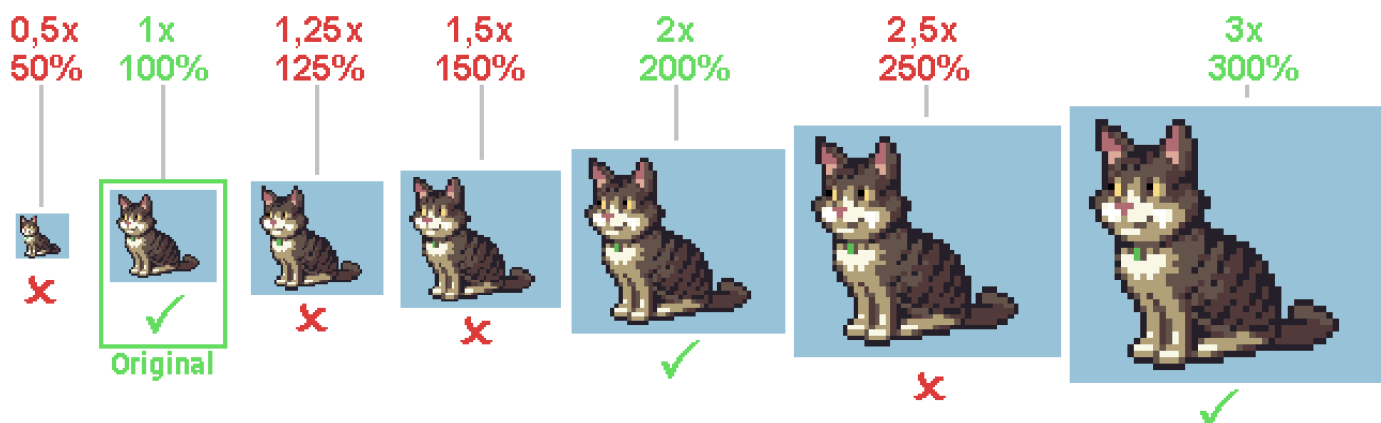


*Super Metroid* (Super Nintendo) has a **LOW** **sprite to canvas ratio** for a playable character. The sprite is 1:38, about 2,5% of the screen. It allows for the player to see more of their environment.



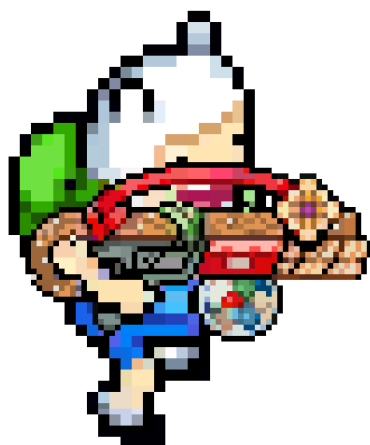
*Cave Story/Doukutsu Monogatari* (PC) has a **TINY** **sprite to canvas ratio** for a playable character. The sprite is 1:300, about 0.33% of the screen. Characters are still visible but minimalist due its tiny size.

This may sound obvious to many artists, **but when you resize ALWAYS stick to WHOLE NUMBERS.**



You can resize sprites to any percentage BUT you will have to manually fix them to keep it 1x size (100%).

Even more importantly, **NEVER EVER** mix different pixel ratios.



Adventure Time:  
EtDBIDK! (Various platforms)



Half-Minute Hero (PSP)

## Moving forward...



This short prologue was just scratching the surface on how *you* can make sprites.

**In the end, there's a method for every type of artist!**



**Chapter**  
Line art

**1**

# Introduction



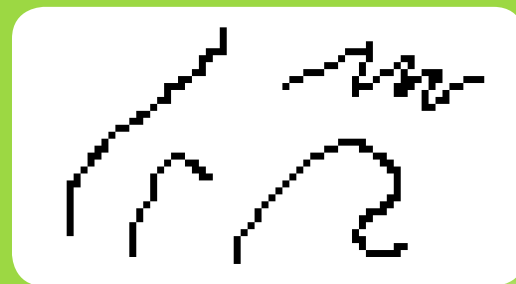
Earthbound/Mother 3 (SNES)



Tekken Card Challenge (WonderSwan)

Line art is the **base of your sprite** regardless of whether you start with shapes, loose sketches or no line art at all! It will often be applied at some point in the process.

**Consistency is essential.**



**Natural brushstrokes don't look great in pixels!**



## Keep the same line thickness throughout the **whole** sprite!

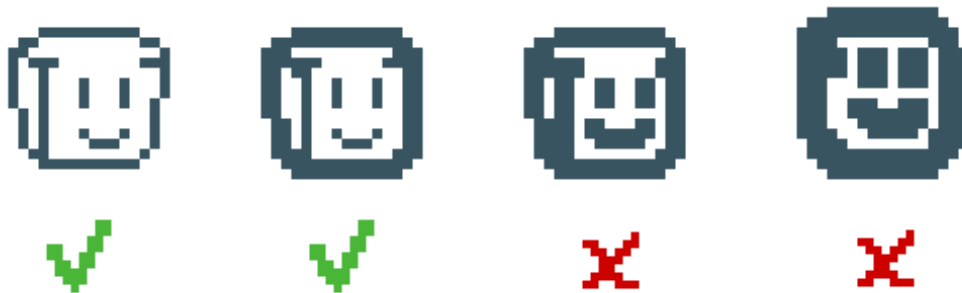
It makes sprites more readable and appealing.

Prefer thicker lines? Make sure to keep the line art clean and easy to follow. Some lines however *can* be thinner than the rest of the drawing if the style requires it

**Thin lines are better for small areas.**

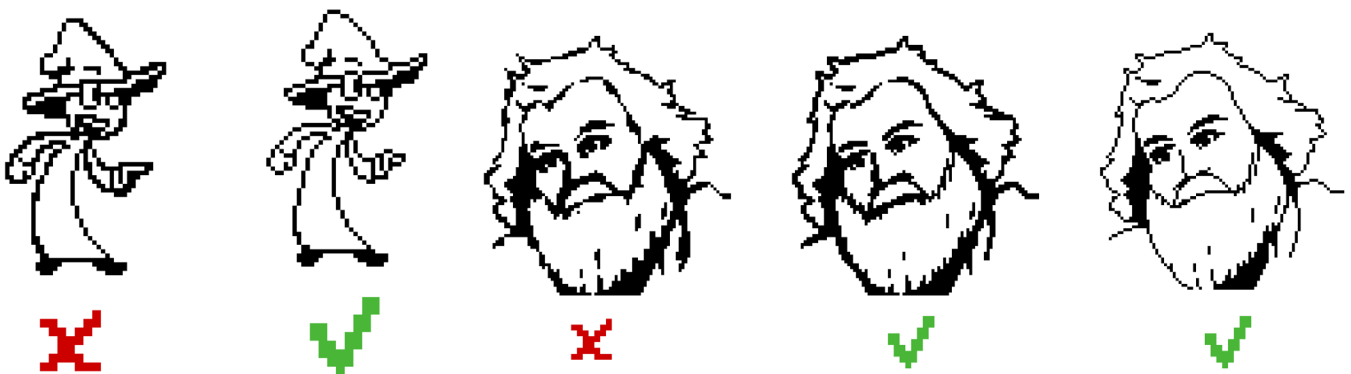


Bottom L-R: SNK v C Card Fighter's Clash (Neo Geo)  
Pokémon Pinball RS (GBA)



Sprites are often small graphics! As a result, you will notice that in games ...

**Most pixel art has 1px line art.**

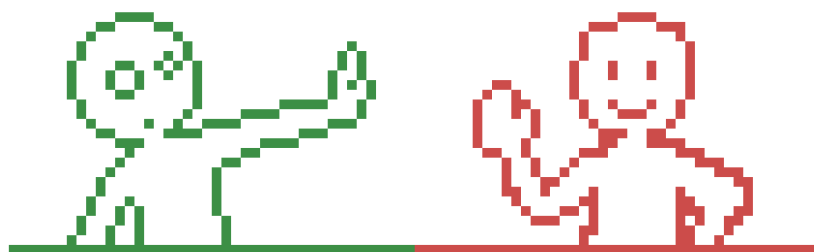


By Michafarar

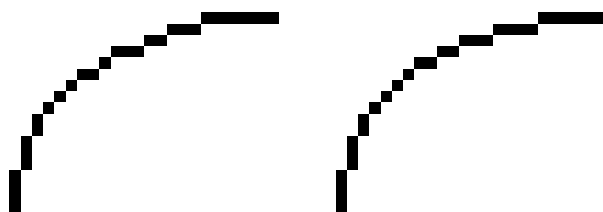
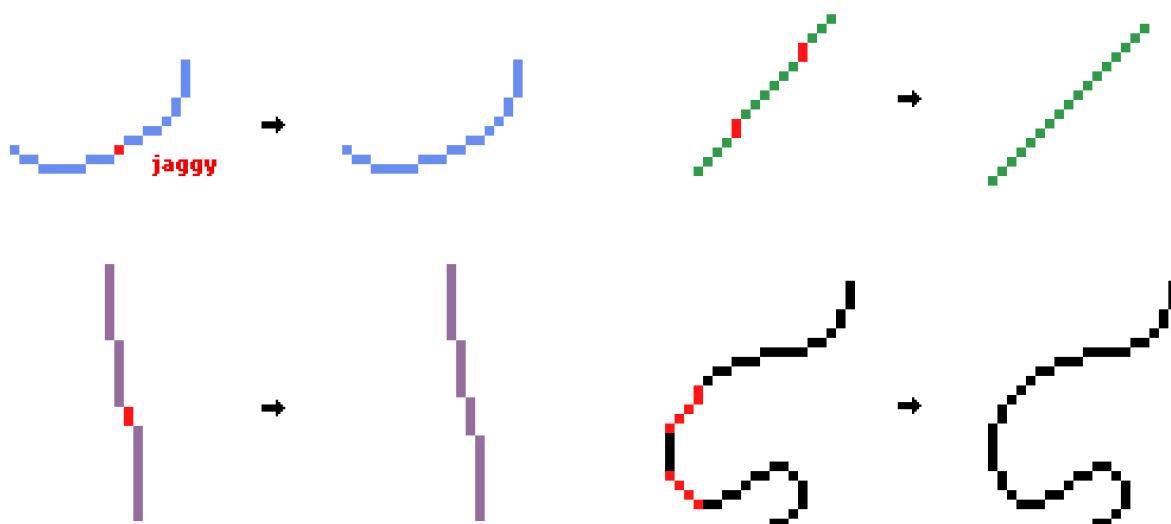


# Lines and curves

Ever noticed when drawing a pixel line or curve in 1 stroke, it doesn't look as smooth as you want?



That is because of **jaggies**. These are jagged parts of a line or curve.



Oh no!



Much better!

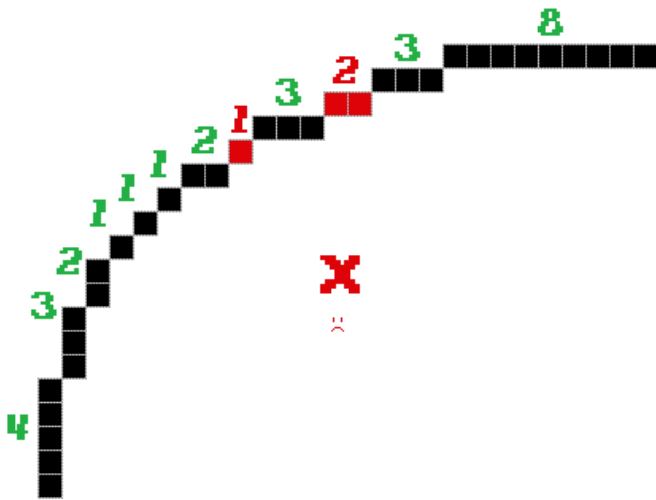
So how do you fix your lines with jaggies?

Easy!

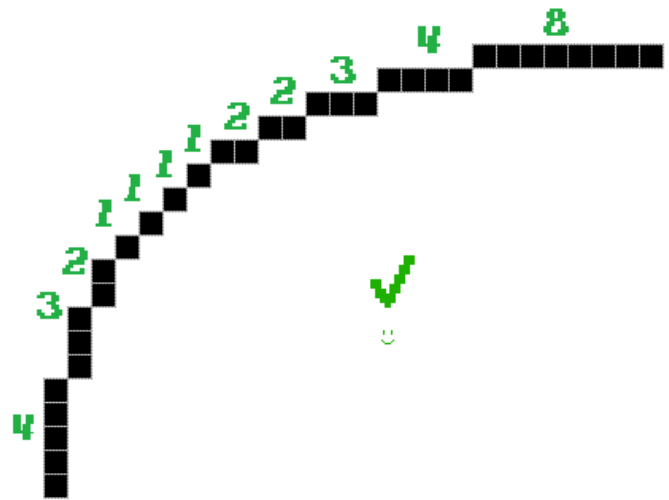
There is a **process** that works for every type of line!



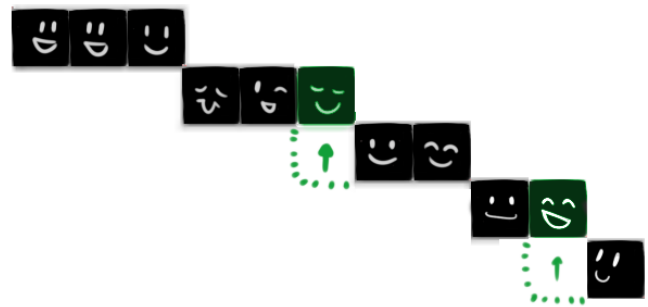
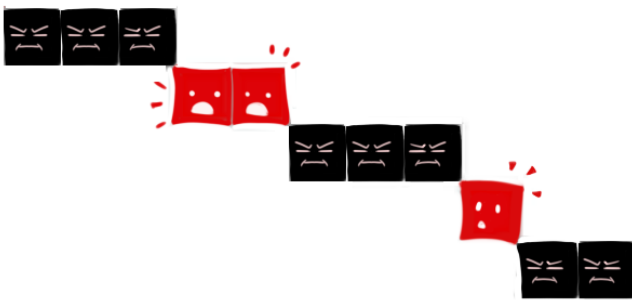
The key thing to remember with jaggies?  
**Don't surround a row of pixels with bigger ones.**



4-3-2-1-1-1-2-1-3-2-3-8



4-3-2-1-1-1-1-1-2-3-4-8



This will happen **ALL** the time!

## Important note!

You do **NOT** need to draw curves pixel by pixel. That's too much work!

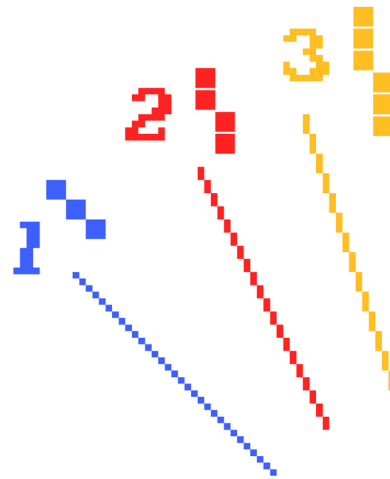
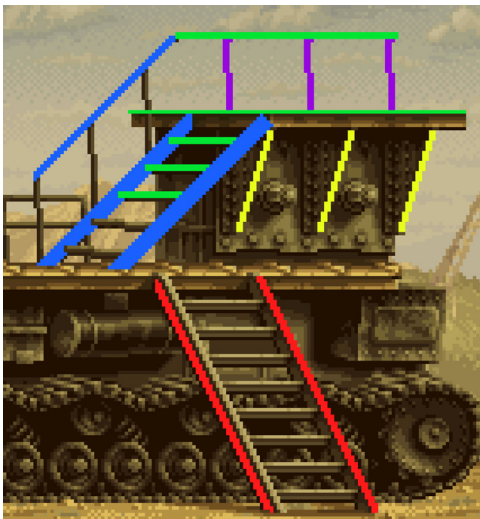
Draw rough lines and chisel away parts you don't need. While some programs offer better pixel brushes that can avoid thicker parts, jaggies are **UNAVOIDABLE**. So fix them!



Pixel art **loves** lines that have the same “stairs”, staircases with the same number of pixels on each step. . . It just looks smoother!



Metal Slug 3 (Neo Geo)



**The steeper the line, the bigger the ‘step’!**

**DON'T MIX STAIRCASES.** If you have stairs of TWO, don't include a ONE. Keep your staircase equal and avoid jaggies.



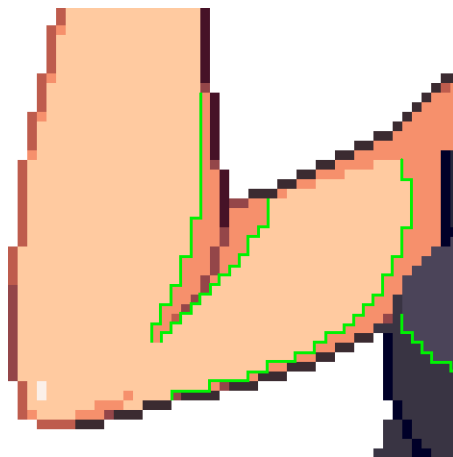
**There's no need to redraw the lines or CTRL+Z every time.**

**Remember that you can always use the selection tool. You can also chisel away pixels. Chip away or add pixels so that you obtain nice lines!**



# Lines are everywhere

Even when you don't have lines, any shape within your pixel art has an edge.



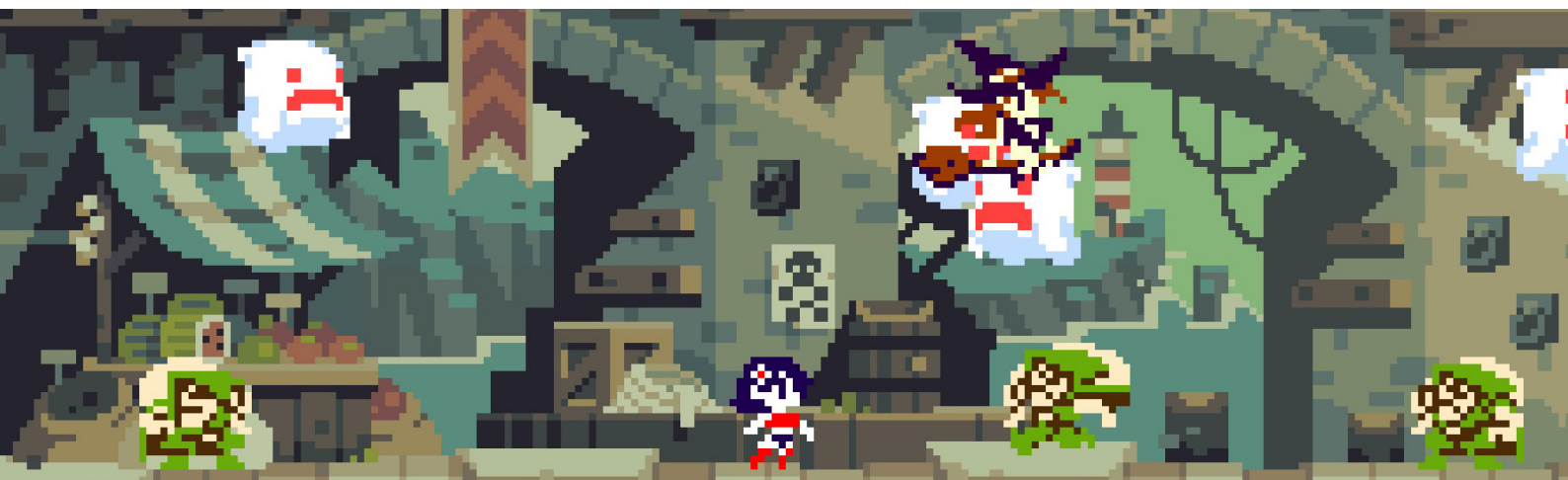
Guest artist: Anubis-works

**When 2 shapes of colours touch each other, they create a line. So, even cell shading creates "lines".** On smooth surfaces, your shading shouldn't have jaggies either!

Tuna head from The Guided Fate Paradox (PS3)



Graphics without any line art, such as *Curses 'N Chaos* (PC/PS4), still have clean-looking pixelart. It's quite effective for backgrounds. For more examples, check **page 30**.





# Pixel-Logic Bonus #1

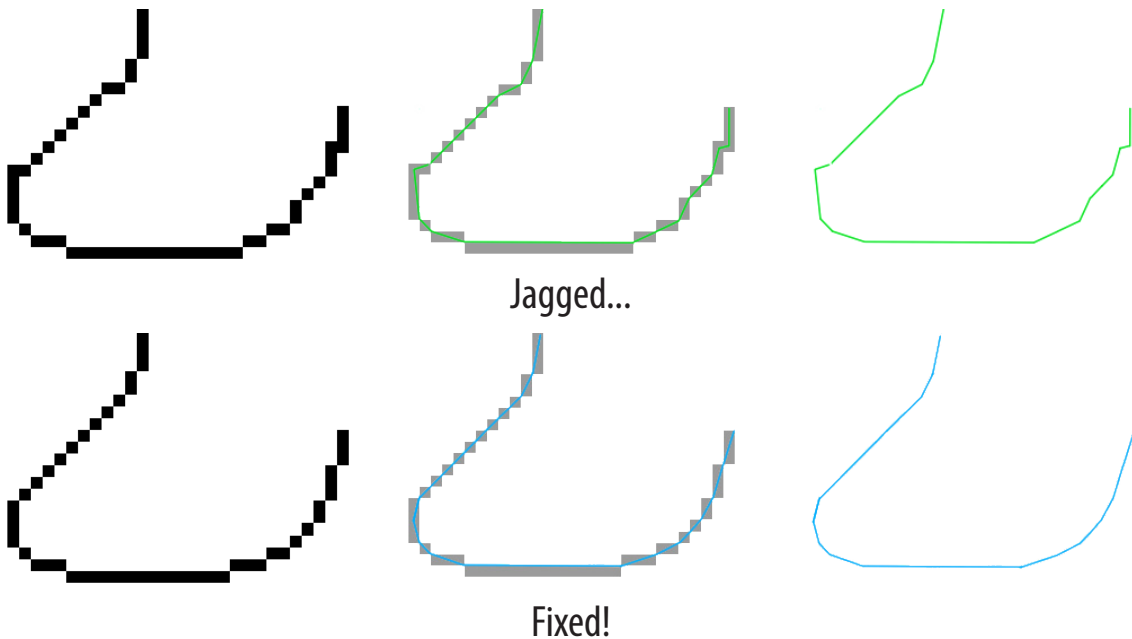
Still unsure of how to clean up jaggies? **No problem!**  
Throughout the guide I'll provide extra tips, starting here!

As I've described, chiselling away at your lines is much more natural than being a perfectionist. This works for every issue, and you can see below some examples I did to emphasise that!

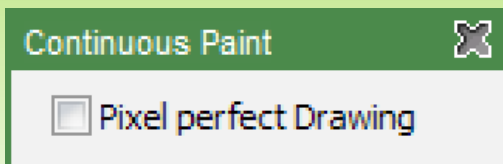


Another way to see jaggies is to imagine your pixelart like **vector lines!**

So if you're not sure, draw over it and you'll see the mistakes.



Some programs help you make smoother lines with "pixel perfect" options. However the outcome isn't perfect. Don't rely on these options, pixel by pixel is still the way to go.



Pro Motion



Aseprite

# Outlines

**The outline is a major attribute that defines a sprite's style.**

You may have noticed that pixelart comes in many shapes and forms. Like any art!  
Here are the types of outlines I identify:

## No outline



Super Mario Brothers (NES), Metroid (NES), Sonic 3 and Knuckles (Genesis),  
Castlevania SotN (PS1), Cave Story + (PC), Mario & Luigi: Dream Team (3DS), Streets of Rage (Genesis)

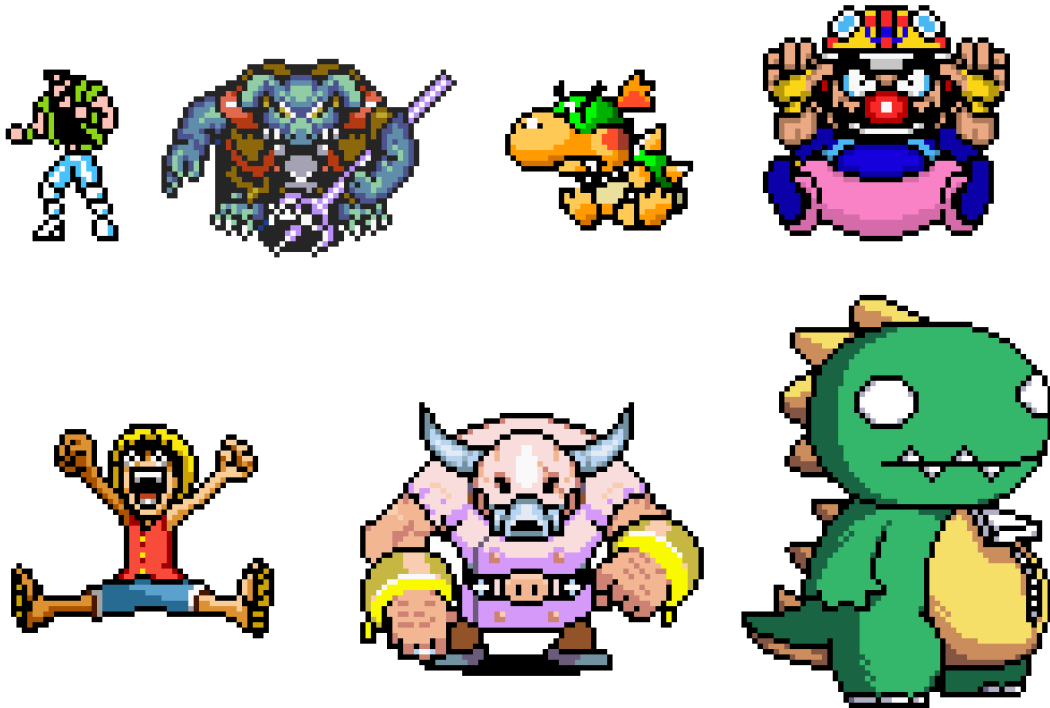


No outline sprites are pixels with **vector shaped graphics**.

They are usually **solid colours** and occasionally have shading and broken outlines.

Don't be fooled; even without lines, **you still need to clean jaggies!** (sorry...)

## Black inline



Shatterhand (NES), LoZ: Link to the Past (SNES) , Yoshi's Island (SNES), WarioWare Twisted (GBA), Shonen Jump: Jump Ultimate Stars (DS) , Mother 3 (GBA), Scott Pilgrim (Xbox 360)



Black inline pixels are sprites with **black line art** that goes **inside the sprites too**.

This was very effective in the **NES era** as a way to circumvent the limitations. Today, It makes sprites rather muddy.

Well, not ALL sprites...!



Shovel knight (various)

## Black contour

WarioLand 4 (GBA), Kirby Superstar Ultra (DS), Mario & Luigi: Bowser's Inside Story (DS),  
Magical Taruruuto-Kun (Genesis), Chrono Trigger (SNES), Kirby Squeek Squad (DS), Boktai 3 (GBA),  
Riviera: The Promised Land (GBA)



Mario & Luigi: Bowser's Inside Story (DS)

With black contouring, **only the contour has a black outline**, but the **inside is completely coloured** with little to no black. It helps your sprite stand out from backgrounds and look clean!

It's the style that is used commonly today with sprites, and is very popular with modern **handheld games**.

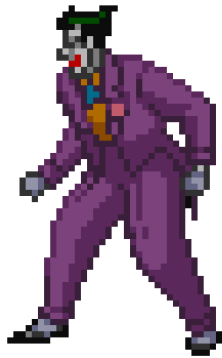
**Note: Your outline can be thick or thin, it is a stylistic choice! The thicker the outline, the more **Anti-Aliasing** it will require.**





## Coloured

Adventures of Batman and Robin (SNES), Enchanted (GBA), Congo's Caper (SNES),  
Mario All Stars (SNES), Hamelin No Violin Damaki (SNES) Metroid Fusion (GBA), DK King of Swing (GBA),  
Castlevania: AoS (GBA), Monster World IV (Genesis)



The outline is coloured according to the colour it surrounds. Every part of an object has its own coloured outline.

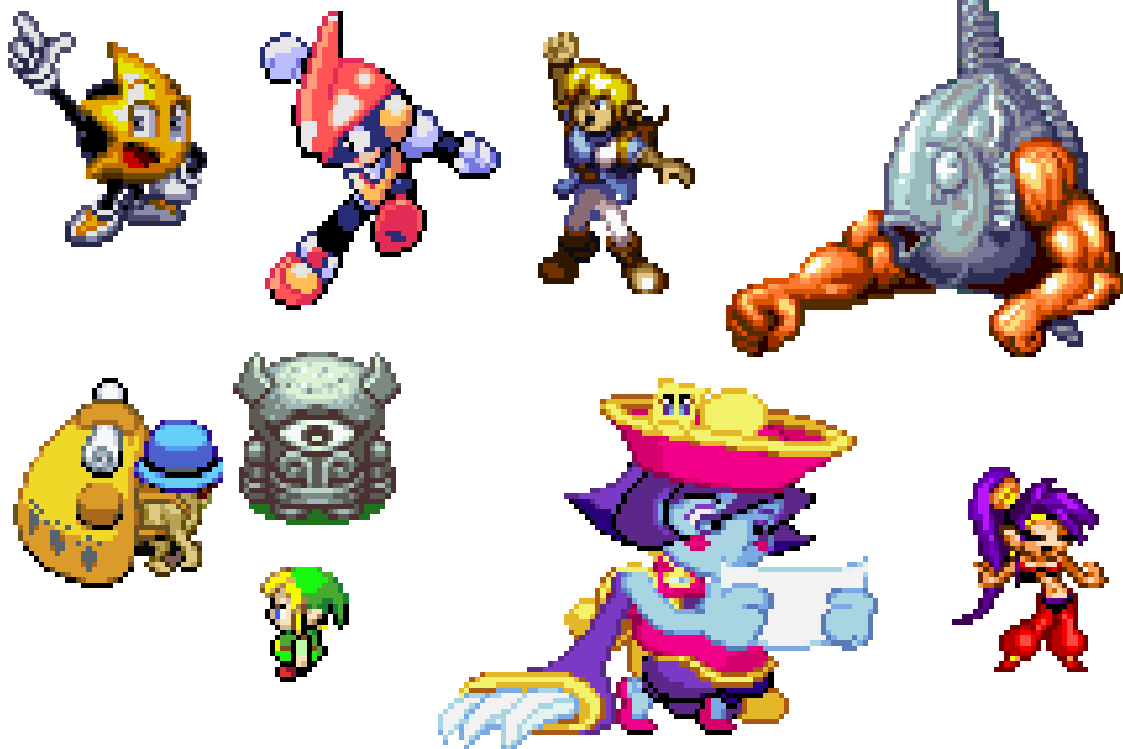
**The outline of a block will be the darkest shade of the inner block.**



Above: Slime Mori Mori DQ (GBA)  
Right: Sam and Max Hit the Road (PC)

# Selective outline

Selective outline is line art that is shaded with a light source! It's the most common type of outline in pixel art, and works great with backgrounds.



Ristar (Genesis), Pulseman (Genesis), Alundra (PS1), Parodius Da (SNES), LoZ: Minish Cap (GBA), Super Pocket Fighter (Saturn), Shantae: Risky's Revenge (DSi)



Metroid: Zero Mission (GBA)

It blends perfectly with the environment.  
Light or dark background, it doesn't matter!

## Case example: Pokémon sprites



Generation IV sprites (DS)

Pokémon sprites from the Gameboy Advance up to the Nintendo DS feature selective outline. They're timeless. The colourful outline makes them so great.

**Pokémon sprites are a prime example of selective outline.**

**Go study them.**

It may be hard to see the outline fully without zooming in or with inner colour. **Let's remove everything but the outline.**

**It's super effective!**

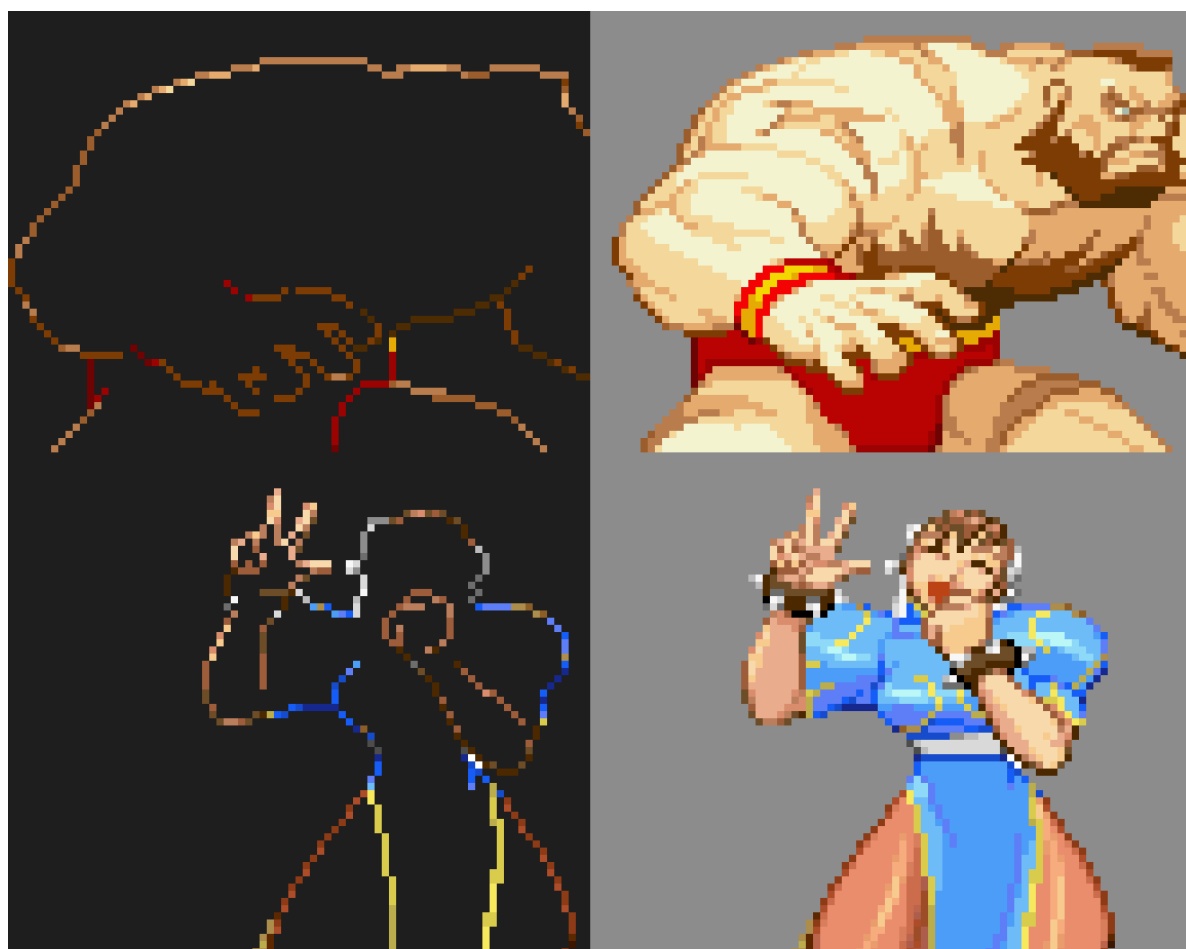
It's now obvious that:

- 1) The line art is clearly shaded.
- 2) The light source is visible.





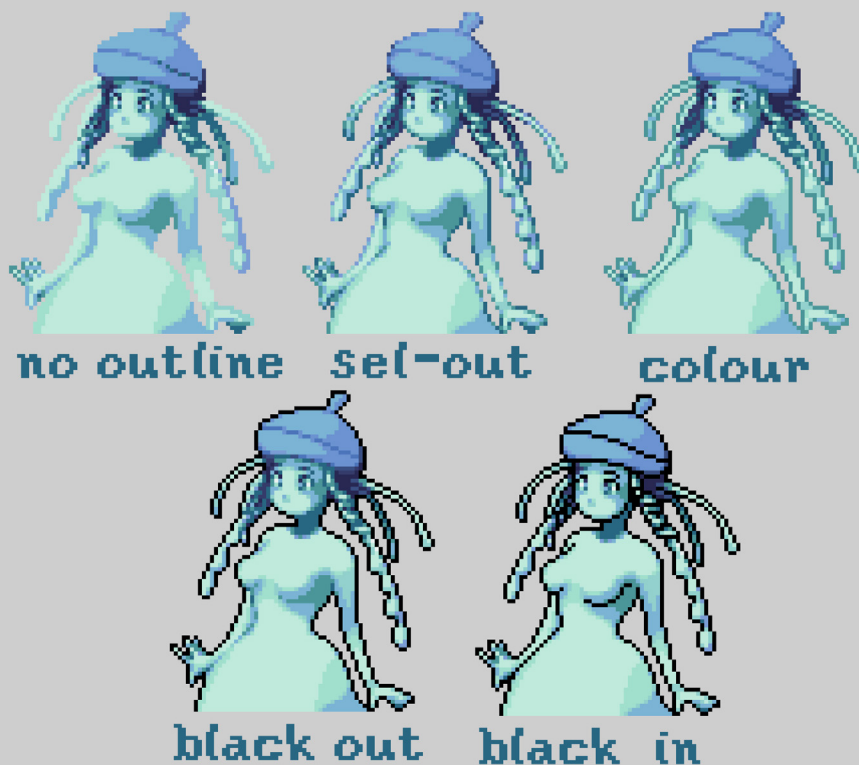
Namco x Capcom (PS2)



Streetfighter III: 3rd Strike (Arcade), Marvel vs Capcom II (Arcade)

# Conclusion

Here's a summary of the different types of outlines, **different outlines can completely change the style of a sprite!** Regardless of what technique you use, line art will be applied at any stage of the process.



## Food for thought

Introduction  
Lines & Curves  
Lines Are Everywhere



## Types of Outlines

No Outline  
Black Inline  
Black Contour  
Coloured Outlines  
Selective Outlines