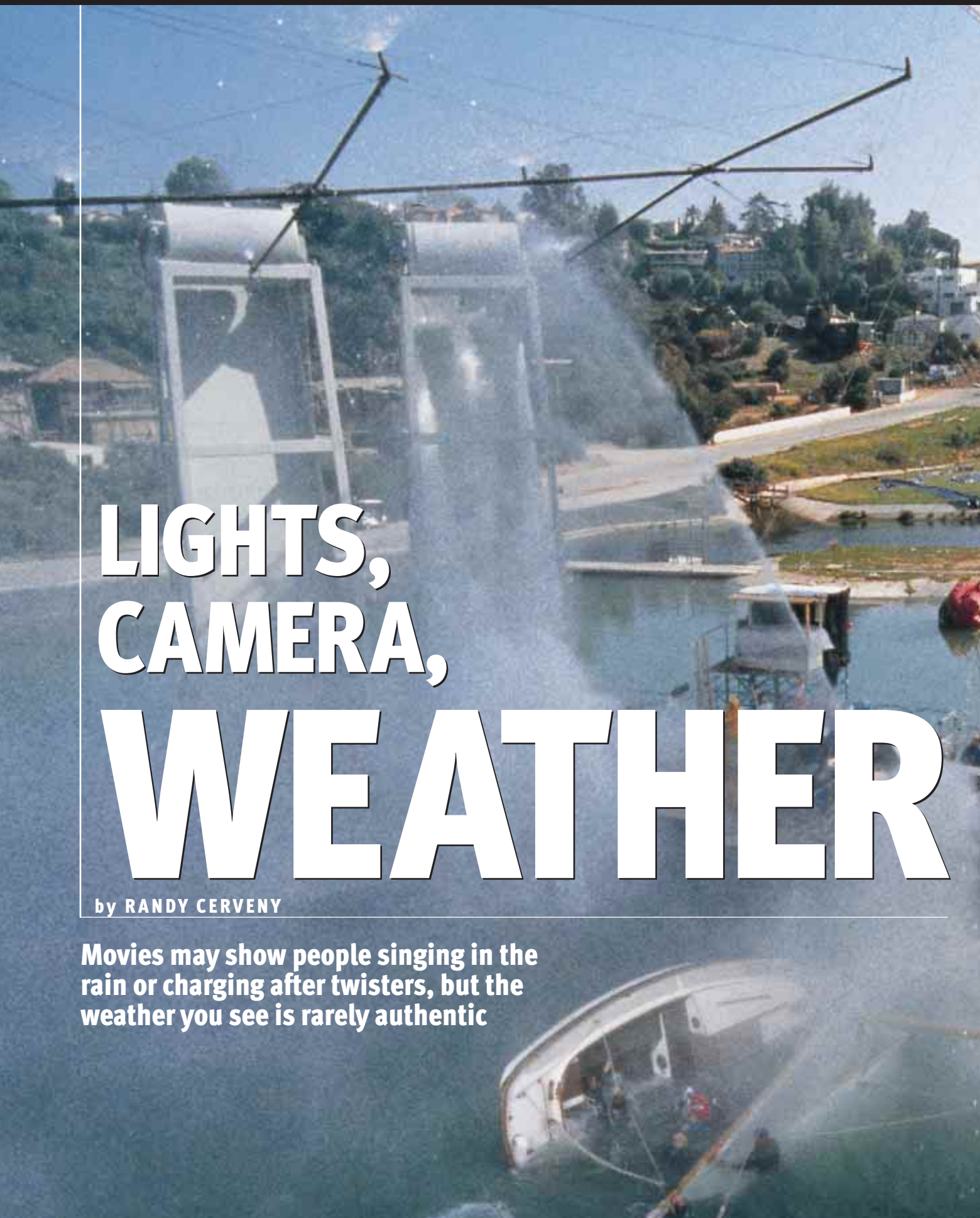


LIGHTS, CAMERA, WEATHER

by RANDY CERVENY

Movies may show people singing in the rain or charging after twisters, but the weather you see is rarely authentic

In much the same way that Jim Carrey's character in the 1998 film *The Truman Show* suffered through simulated lightning, thunder and rain, believing they were real, moviegoers often fail to realize that the weather in motion pictures is almost always fake. Movie weather—as with all aspects of a film—must be at the beck and call of directors and producers. Unfortunately, the desired storms rarely occur on schedule and usually don't film particularly well. Consequently, directors typically rely on special-effects wizards to re-create the variety of weather they need.

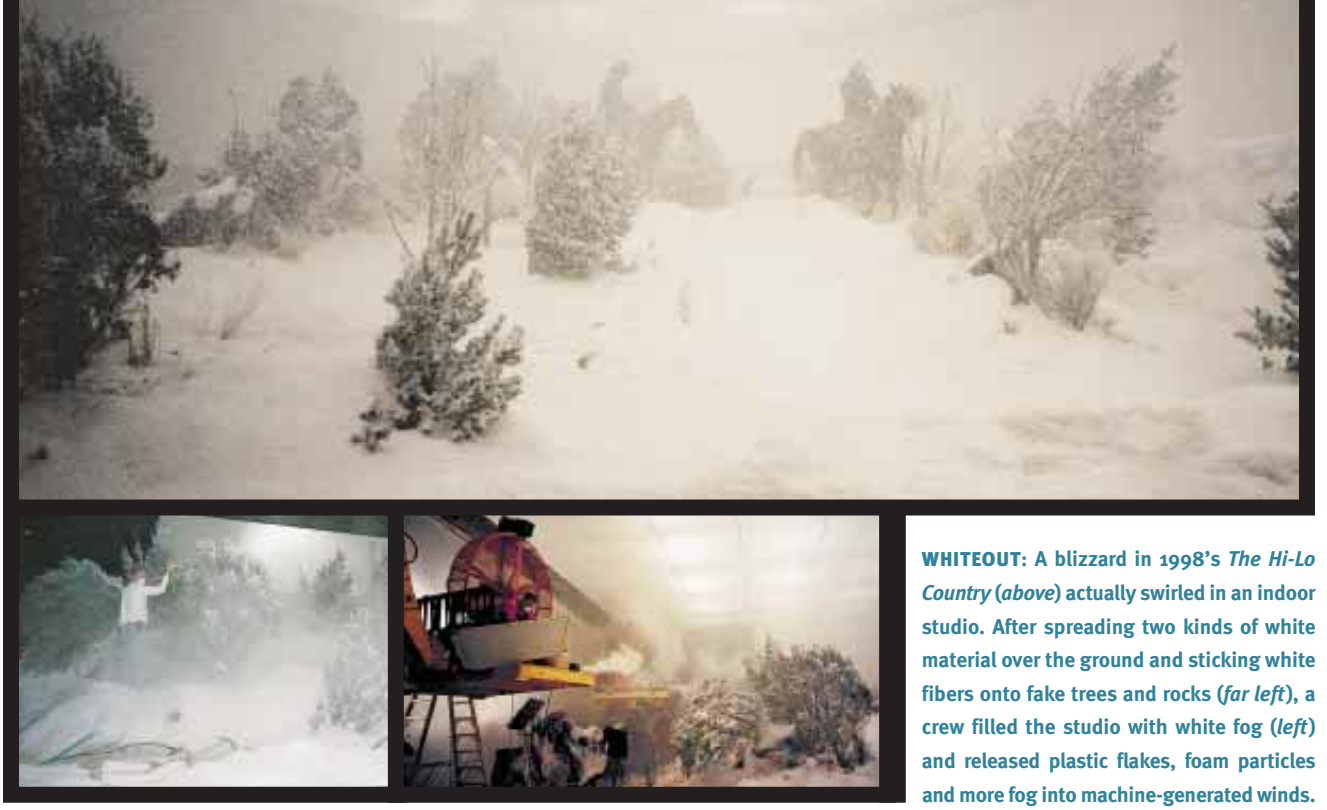
Celluloid weather has entertained moviegoers for more than 60 years. Indeed, the very first Academy Award for special effects honored the spectacular monsoon scenes of the 1939 movie *The Rains Came*. During that feature's soggy climax, an astounding 10,000 gallons of water drenched the actors every minute. If that had been real rain, the deluge would have corresponded to an incredible rate of 40 inches a day. Such massive simulated downpours are produced by pumping water from large tanks into sprinklers set high above the action; the water is then captured for reuse in additional takes.

The watery effects were actually even more astonishing in John Ford's Oscar-winning 1937 movie *The Hurricane*. Particularly exciting was a gargantuan storm-generated "tidal" wave, made by dumping 2,000 gallons of water down chutes and then blowing it onto the actors with two huge airplane propellers. For safety, the actors were tethered to trees.

These unnatural disasters were especially impressive because even heavy rain is rather translucent and thus extremely difficult to capture on film. That's why news footage on hurricanes often depicts the storms' results (flooded roads, rapidly working windshield wipers) rather than focusing on the rain itself.

DUNKING TRUMAN: A rainstorm in *The Truman Show* came not from the sky but from a complex system of faucets, pipes and fans.

PARAMOUNT PICTURES CORP./PHOTOGRAPH BY MELINDA S. GORDON



STURM'S SPECIAL EFFECTS (www.snowmaker.com)

WHITEOUT: A blizzard in 1998's *The Hi-Lo Country* (*above*) actually swirled in an indoor studio. After spreading two kinds of white material over the ground and sticking white fibers onto fake trees and rocks (*far left*), a crew filled the studio with white fog (*left*) and released plastic flakes, foam particles and more fog into machine-generated winds.

In older films, "rain" was often made more visual by mixing water with milk. Today many moviemakers employ a series of carefully positioned overhead sprinklers above the actors. Frequently, water from these sprinklers is sprayed upward, instead of directly downward, to yield a more realistic falling effect on screen. When a riveting movie car chase during a fierce thunderstorm ends with the car skidding wildly out of control into a wall, the untold story is usually that, just off-camera, a water tanker is driving alongside with pumps spraying water skyward over both road and car.

Sometimes the application of watery special effects has extra benefits. When designers created the main set for the 1995 movie *Congo,* about the discovery of great gorillas in the wild, they fashioned a rain forest from more than 2,500 live tropical plants. They then had to construct a sophisticated overhead misting system to maintain the lush greenhouse foliage properly. Director Frank Marshall noted that Allen Daviau, director of photography, found the misters a wonderful alternative to the smoke generators conventionally used in Hollywood to create a hazy atmosphere.

Fog is another atmospheric phenomenon that can be problematic to photograph in its natural state but can be simulated in various ways. In old movies, "ground fog" and the visible breath of people in the cold were manufactured by simply vaporizing frozen carbon dioxide, or dry ice. Unfortunately, carbon dioxide can be lethal if inhaled for prolonged periods, and dry ice (which is colder than –100 degrees Fahrenheit) can be extremely dangerous to hold. In scenes in which breath needed to be visible, actors used to pop a safely boxed cube of dry ice into their mouths and let their breath gently warm the carbon dioxide, which would then evaporate, producing a visible mist. An actor unaware of the dangers once decided to skip the box because of its effect on his speech. He simply slipped the chunk of dry ice into his mouth—and ended up with severe cold burns.

Special-effects artists are often asked to produce convincing footage of other cold-weather phenomena as well. In early movies, falling snow was often, in fact, minced chicken feathers. The feathers did float realistically, but they also collected in the poor actors' nasal passages. Since those days, "snow" has been made from a wide range of materials, including shredded polyethylene, painted balsa wood, powdered detergent or even bleached cornflakes. Snow cover for backgrounds may consist of permanent materials, such as plastic bits, rock salt crystals or even plain old white paint. Close-up foreground shots, though, might feature temporary but more realistic-looking foams (such as the stuff in fire extinguishers) or ice shavings.

Directors have complained about pseudo snows, however, because of their regrettable failure to melt. Watch carefully, for instance, the snow on Jimmy Stewart in the last scene of the 1946 Christmas classic *It's a Wonderful Life*. The white stuff often sticks unrealistically to the actors' clothes long after actual precipitation would have melted. So today special-effects companies commonly employ actual snowmaking equipment capable of turning any landscape into a winter wonderland—that is, when they don't simulate snow entirely by computer.

A Tankful of Clouds

Clouds pose yet another challenge to moviemakers. The typical solution is the cloud tank, a large aquariumlike glass structure that is filled with a mixture of saltwater and freshwater. The saltwater, being denser, stays at the bottom of the tank, thereby creating two distinct but visually similar layers. Next, an injection device, carefully placed into the boundary between the layers, feeds an opaque tempera or a thinned latex paint mixture into the tank. Cloudlike shapes

form as the paint billows out and swirls in the fluid. Cameras positioned outside the tank take the shot, which is later combined with the live action.

The cloudy skies can also be enhanced in several ways. Notably, spotlights arranged beside the tank can illuminate or shadow specific parts of the paint clouds. Gels of various kinds can confer color and texture to thunderclouds. And strobe lights above or behind the tank can simulate lightning in the clouds. Although the cloud tank is mechanically simple to operate, the texture of the final "sky" is satisfyingly complex. This method for manufacturing clouds, thunderstorms and lightning has been exploited in a number of popular movies, including *Close Encounters of the Third Kind, Raiders of the Lost Ark* and *Star Trek II*.

Surprisingly, movie lightning—in contrast to other atmospheric phenomena created for film—frequently fails to abide by basic physical laws. In the real world, the difference between the speed of light and the speed of sound means that a viewer rarely experiences lightning and thunder at the same time. An interval of five seconds between a flash and the corresponding thunderclap means the lightning is a mile away, 10 seconds of separation corresponds to two miles, and so on. Directors, however, often have their lightning and thunder occurring simultaneously—something that would happen in real life only if the lightning were directly overhead. Portrayal of an accurate separation, they say, would disrupt the mood they want to set.

Sometimes effects normally employed to produce ersatz weather are enlisted to achieve other tricks. For example, the alien spaceships in the 1977 movie *Close Encounters of the Third Kind* are first seen as amorphous balls of light. If filmed under normal conditions, the neon-lighted alien ships would have appeared very flat and mechanical. To make them seem softer and more organic, Douglas Trumbull and his special-effects company, Future General Corporation, filled a model studio with an amount of smoke that, in other movies, might have been used to simulate fog or haze. In this case, the smoke diffused the brilliant lights of the alien UFOs.

MUSEUM OF MODERN ART FILM STILLS ARCHIVE

AS WET AS RAIN: *The Rains Came*—a 1939 feature starring Myrna Loy and Tyrone Power—won the first Oscar for special effects. Its manufactured monsoons consisted of thousands of gallons of water pumped through sprinklers.

EVERETT COLLECTION

DUST MUMMY: A dust storm that later morphed into an evil face in 1999's *The Mummy* was created by computer.

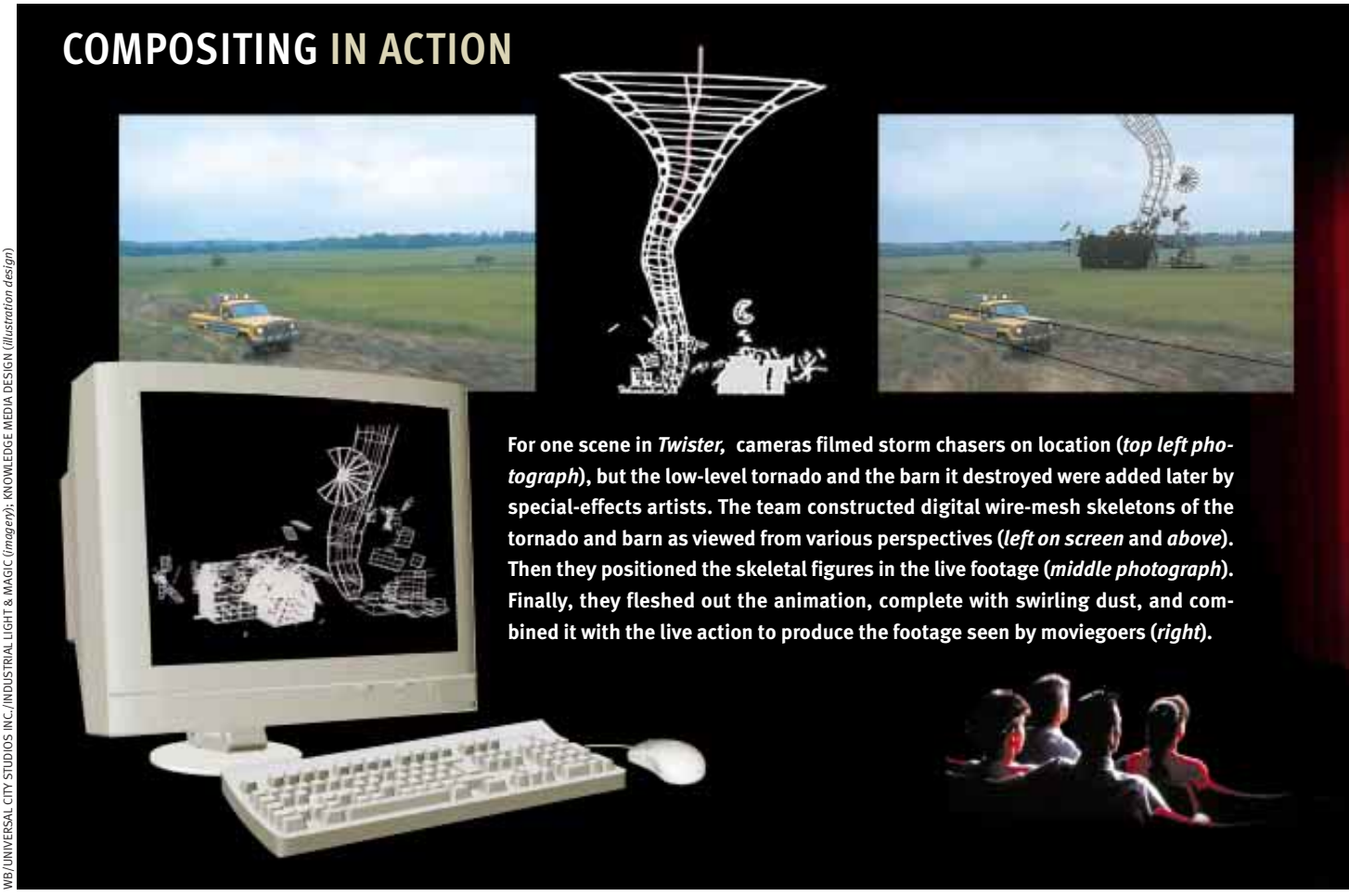
Computers Reign

Today movie depictions of meteorological phenomena are often achieved through a clever combination of imagination, miniatures and computer graphics—a trend that has gained increasing momentum over the past 20 years. For example, James Cameron's special-effects team, Digital Domain, created a number of cold-weather effects in 1997's *Titanic*. The film's infamous iceberg that sank the ill-fated ship was a classic small-scale model; the chunks of ice that cascaded from it onto the *Titanic*'s deck were created with computer graphics. Even more amazing, in contrast to the dry-ice antics of past films, the cold-breath exhalations of the *Titanic*'s passengers and crew were added seamlessly by computer into the real-action footage, which had been filmed earlier in warm Mexico.

In the past, disparate elements had to be combined, or composited, optically by masking some parts of frames on a film, superimposing other images on the masked areas and then creating a new piece of film with all the images combined. If the various elements were not merged with exacting precision, the material added to a live scene looked disconnected from the rest of the image and therefore unconvincing.

Optical compositors did have some help from a technique called rotoscoping, which tracks individual elements in a given movie sequence. The rotoscope, developed in 1917 by animation genius Max Fleischer, is simply an elevated device that projects film sequences, frame by frame, down onto a flat surface. For each frame, animators using a classic rotoscope must manually trace every element to be added or altered. The finished product is a series of drawings that indicate where the special effects need to go on each frame. In *Star Wars,* for example, a rotoscope was used to trace the blade of each light saber, thereby showing the animators precisely where the various color

COMPOSITING IN ACTION



For one scene in *Twister,* cameras filmed storm chasers on location (*top left photograph*), but the low-level tornado and the barn it destroyed were added later by special-effects artists. The team constructed digital wire-mesh skeletons of the tornado and barn as viewed from various perspectives (*left on screen* and *above*). Then they positioned the skeletal figures in the live footage (*middle photograph*). Finally, they fleshed out the animation, complete with swirling dust, and combined it with the live action to produce the footage seen by moviegoers (*right*).

WB/UNIVERSAL CITY STUDIOS INC./INDUSTRIAL LIGHT & MAGIC (*imagery*); KNOWLEDGE MEDIA DESIGN (*illustration design*)

glows of the swords were to be positioned. After the saber lights were created as separate elements, they were optically composited into the live-action sequences.

To facilitate the creation of seamless compositing, moviemakers commonly record the live scenes in front of a "blue screen," an evenly lit, blue-colored background. Later, all blue in the picture is eliminated and replaced with other images. The blue-screen process is familiar to all those who watch the evening weather report on television. Meteorologists who seem to be pointing to a colorful weather map are actually gesturing to a blank screen. The busy weather maps behind them are composited in the TV studio to produce the final image of map and person. Blue has been the standard screen color because its elimination from film does not distort human skin color. Other colors, however, especially green and red, are now in use as well. Each hue has its own advantages in the film industry. Green, for instance, is highly reflective and therefore easy to find and drop out of a scene.

Today's special-effects artists usually use digital compositing methods, which are far superior to optical techniques, both in the labor involved and in image quality. Movie directors have their film negatives scanned into digital form. Next, the composite image is created on a computer (which can add in any additional visual elements the director requires). Then the completed images are scanned back onto film. One of the greatest advantages of digital compositing is that it allows near-perfect registration of the scene components, so that the viewer cannot distinguish between what is real and what is computer-generated. More important, the technology allows the director more direct control to add, alter or move objects.

The rotoscoping step in the digital age is also a much faster, computerized process. Animators can now indicate the position of a specific element in one frame and its subsequent position a few frames ahead. The computer then interpolates the element's positions for intermediate frames. After the positions of all elements are charted, the special effects, many of which are now created digitally, are inserted into the film sequence.

Digital techniques for creating special effects and fusing them with live-action scenes allowed the natural-disaster movie *Twister,* which was nominated for the 1996 Academy Award for Best Visual Effects, to be so convincing. Powerful Silicon Graphics computer workstations enabled each tornado in the movie to be crafted as a multitude of individual moving objects, rather than as a single figure. First, the computer experts at Industrial Light & Magic (ILM) constructed a virtual wire-mesh skeleton of the tornado's funnel. Then they applied complex fractal programs to create the rough texture of the vortex's ever changing surface. Finally, they "motion-blurred" the entire debris cloud of each tornado to simulate the natural blurring we perceive when viewing fast-moving objects. This new

type of effects artistry far exceeds the feats that could be accomplished when A. Arnold (Buddy) Gillespie resorted to a fan-blown, 35-foot muslin wind sock to create the famous, and surprisingly believable, Kansas tornado of 1939's *The Wizard of Oz*.

(Modern computer-generated compositing of images also frees the creators to have a bit of personal fun and digitally add features never present in the actual live filming of the scene. As *Twister*'s visual-effects producer Kim Bromley related, "One of the modelers' nicknames is Edsel, so he modeled a grille from an Edsel and made it into a piece of debris." This fictitious remnant of the tornado was then digitally inserted into the movie.)

Similar computer-generated effects breathed life into the monstrous and memorable dust storm incarnation of the title character in the 1999 blockbuster *The Mummy*. To make a huge outdoor dust storm morph into a large malevolent face, the effects people at ILM, under the supervision of John A. Berton, improved on the methods they developed in *Twister*. Instead of portraying the dust storm's components as disjointed clusters of particles, Berton's team created a specially designed particle renderer that gave the storm a continuous flowing character. The dust storm images were composed on computer workstations and then digitally merged into live-action sequences, which had been filmed in Morocco.

A second weather-related phenomenon in *The Mummy* was also computer-generated. The sinister "sand-devil" aspect of the Egyptian mummy Imhotep—the sudden indoor formation of the villain from the very sands of the desert—was created by making digital sand particles from various parts of the scene target specific areas of a wire-frame model of a human figure. The visual effect was further enhanced by generating streams or ribbons from these digital particles that then wove themselves around the human framework.

Sounds Scary

Sound is as important as visuals in generating realistic weather on the screen. So far, though, the art of producing sound effects remains rather more low-tech and empirical than the art of making images. For *Twister,* foley artists—the professionals who assemble the distinctive sounds for movies—used an imaginative variety of materials to simulate the monstrous noises of severe weather. They simply but effectively produced the clattering sound of icy hailstones by dropping pea-size gravel and clinking swords onto metal and wooden surfaces.

To craft the tornado's characteristic moaning and whistling sounds, *Twister*'s audio engineers built an ingenious contraption consisting of different-size pipes and lengths of fishing line. The device was then placed onto a truck and driven at highway speeds so that digital recordings could be made of the wind whipping through and over the pipes and wires. Yet even those masterful sounds didn't completely satisfy the movie's director and sound-effects artists. *Twister*'s tornado screams eventually included other digitally mixed sounds, including the squeals of pigs and camels as well as a classic audio effect used in *The Wizard of Oz:* the noise of loose paper flapping around on the outside of a large rotating barrel.

Of course, the field of special-effects weather is hardly static. As directors demand more and better effects, the bar keeps getting raised. For example, moviemakers have recently started placing more emphasis on indirectly enhancing the main action by introducing seemingly invisible secondary effects behind it. Images of planet surfaces seen in the latest *Star Wars* epic, *The Phantom Menace,* included moving waterfalls and other background motion to impart a more realistic feeling. And the use of computer graphics is still in its infancy. Indeed, the eventual future of feature movies may well be the computerized creation of the entire production—including the total physical environment and perhaps even the actors themselves in a way that makes everything and everyone seem compellingly authentic.

What will be the end result of such work? Many special-effects artists maintain that the greatest compliment they can receive is when, after seeing or hearing a movie effect, the audience simply believes it was real. To paraphrase the classic line, the masters of movie special effects want to be sure that neither rain, nor sleet, nor dark of night will prevent them from achieving the goals of their directors.

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