

In 1895 Georges Méliès—a well-known magician in Paris at the time—began making movies employing many of the stage techniques he had learned during his career, as well as many he invented especially for his films. Although today most of his films seem quaint or even crude, they amazed his audiences, who had never before seen anything like them.

Many of the techniques Méliès invented are still in use today. Among them are the substitution shot, stop-motion animation, and double exposure. The substitution shot, which was probably the first cinematic special effect ever created, was invented by accident when Méliès stopped his camera while filming people walking along a sidewalk. After a few minutes he started it again. When he projected the finished film, he was astonished to see people suddenly disappear, replaced by entirely new pedestrians. "I suddenly saw an omnibus changed into a hearse," he wrote in astonishment. Both he and other filmmakers quickly realized that by stopping the camera, rearranging part of a scene, and restarting the camera again, all sorts of amazing effects could be created. It was first used in the movie *The Execution of Mary Queen of Scots* (1895). In this film, the camera was stopped and the actors held their positions just as the ax was poised to fall on the queen. A dummy was then substituted for the actress, and the camera was restarted to create the illusion of the beheading. The substitution shot is still used today to make objects suddenly appear and disappear.

Stop-motion animation makes inanimate objects appear to move on their own. The technique is similar to making an animated cartoon, except that three-dimensional objects are used instead of drawings. For instance, to make a puppet appear to be alive, it is moved incrementally through a range of motions and photographed one frame at a time with each change of position. When the film scene is run at the conventional film speed of twenty-four frames per second, the illusion is created that the creature is moving. Edwin Porter made one of the first all stop-motion films in 1906 called *The Teddy Bears*. The short sequence of frolicking teddy bears, which lasts just over one minute, took approximately fifty-six hours to animate.

Double exposures are probably the simplest of all effects to accomplish. All the filmmaker needs to do is shoot a scene, rewind the film in the camera, and shoot something different. Transparent ghost effects are easily accomplished this way. If a strip of film

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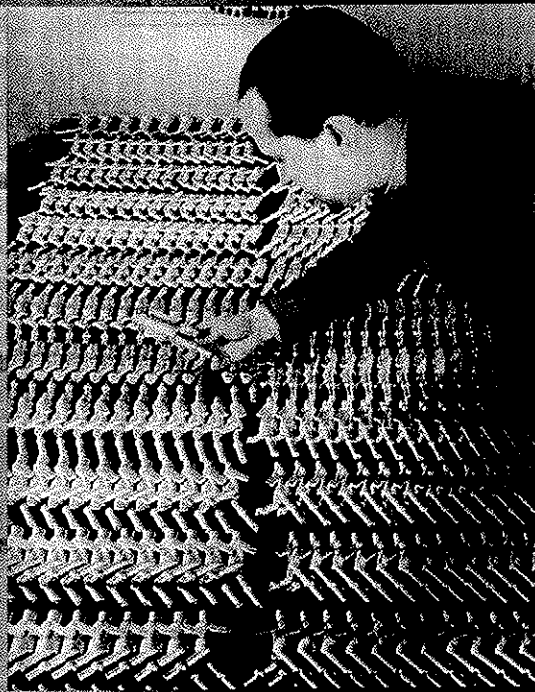
STOP-MOTION ANIMATION

Very early in the history of motion pictures it was realized that three-dimensional objects could be animated just as drawn and painted characters were. If a puppet, for instance, were to be moved a fraction of an inch at a time, and a motion picture camera were to

expose a single frame of film for each movement, the puppet would appear to move when the film was projected. This is called "stop-motion animation," "3-D animation," "dimensional animation," or "displacement animation."

There are several ways in which this can be done. One is a technique called "replacement animation." This was employed by

Pioneer stop-motion effects animator George Pal is seen here with the hundreds of individual figures needed to animate a single character in one of his short "Puppetoon" films. Instead of using a single flexible figure—such as that used in King Kong—Pal created a separate, individual sculpture for each movement. Although this was extremely time-consuming, it allowed for very precise movements and realistic facial expressions. This technique is called replacement animation because the figure in each frame is replaced by a new figure for the next frame.

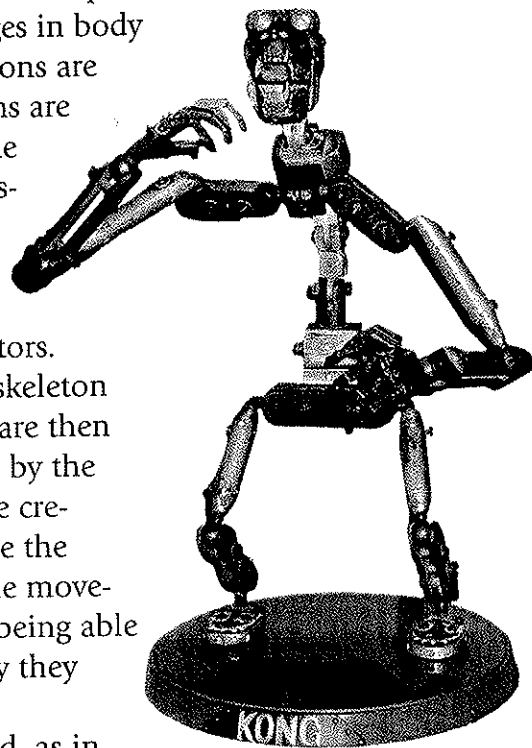


George Pal in the creation of his Puppertoons and by Henry Selick in the making of *The Nightmare Before Christmas* (1993). Replacement animation requires a separate puppet for every change in pose—or, as is usually the case, separate body parts or facial expressions for each change. It is an extremely time-consuming and exacting task, since each separate puppet or body part must precisely match the ones that precede and follow it—except for the necessary change in shape—for the illusion to work. For a complex action, dozens of different models have to be made. It also means that every movement has to be planned far in advance, allowing little to no creative input or spontaneity on the part of the animator. The technique does have its advantages, though, where radical changes in body shape are required or when subtle facial expressions are important. It is also used when repetitive motions are involved—such as running or walking—since one cycle of motion can be repeated as often as necessary.

More common than replacement animation is the technique used by Willis O'Brien, Ray Harryhausen, and most modern 3-D animators. In this case, the puppets are constructed over a skeleton of hinged and pivoted metal parts. The models are then physically moved a fraction of an inch at a time by the animators. This type of animation allows for the creation of very subtle, realistic movements because the animators are so directly involved in creating the movement. Harryhausen, for instance, is famous for being able to give his creatures real personalities in the way they moved.

Occasionally the two methods are combined, as in *The Nightmare Before Christmas*, where the puppets had poseable bodies and replacement animation faces. This allowed the animators to achieve a great deal of realism when the characters spoke and sang.

A flaw in traditional 3-D animation is that the puppet is not moving when a frame is taken. When a motion picture is taken of a live actor walking, the actor is actually moving when each frame of the film is taken. This means that there is going to be a slight blurring of her legs and arms, for instance. This is just as though you were taking an ordinary still photo of someone.

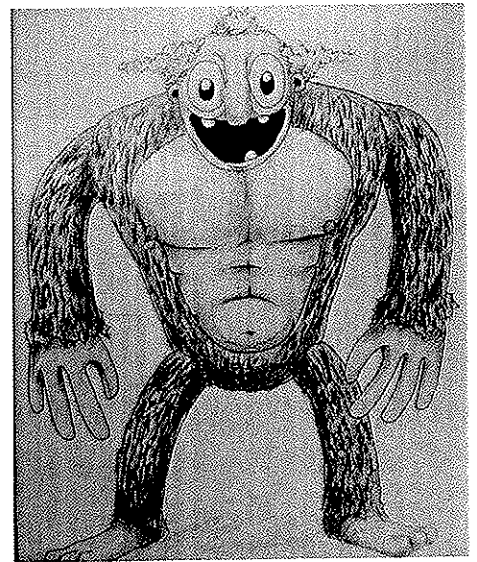
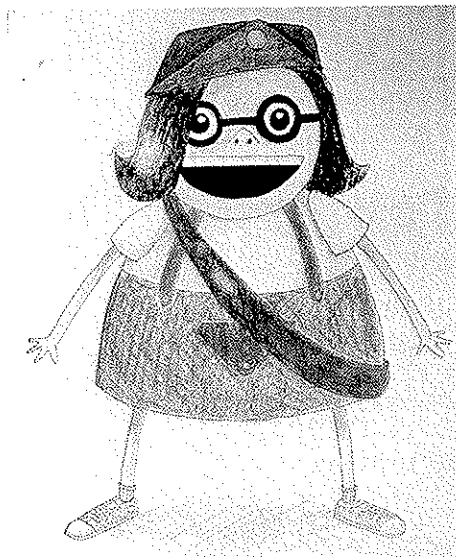


Inside the original King Kong was a steel skeleton. Ball-and-socket joints allowed the animator to pose Kong in any position desired. (Photo courtesy of Bob Burns)

If they are moving, the picture will be blurred, but if they hold as still as possible, the picture will be sharp. This is the critical difference between 3-D animation and live-action cinematography. Projecting a series of sharply focused frames results in movement that looks hard-edged and "jerky." For most fantasy films, this isn't too much of a problem since it merely adds to the sense of unreality. But if a lifelike effect is desired, the jerky quality of traditional stop-motion animation can be very distracting.

Many animators tried different methods to add motion blur to their films. Their methods ranged from those as simple as poking the model with a finger just as the frame was taken so that it wiggled slightly during the exposure, to shooting through a sheet of glass smeared with Vaseline. Today, motion blur is most often achieved using elaborate setups where the model is moved in a very precise and continuous way by means of computerized motors. This was the method pioneered by Phil Tippett and Dennis Muren to create the smooth motion of the tauntaun in *The Empire Strikes Back* (1980).

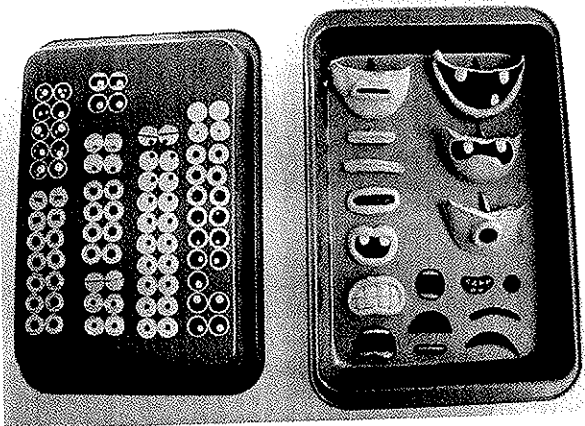
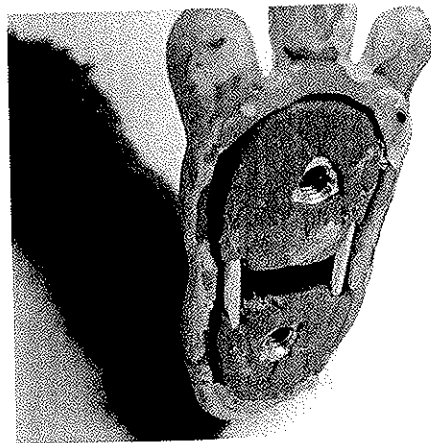
Puppets for 3-D animation are sometimes made of colored clays, similar to those used in schools. This makes the entire character not only infinitely poseable but capable of any sort of transformation the animator desires. Will Vinton, who coined the term "Claymation" for this kind of work, used clay animation for some remarkable scenes



The creation of a stop-motion puppet begins with preliminary sketches.
(Photo courtesy of Max Winston)

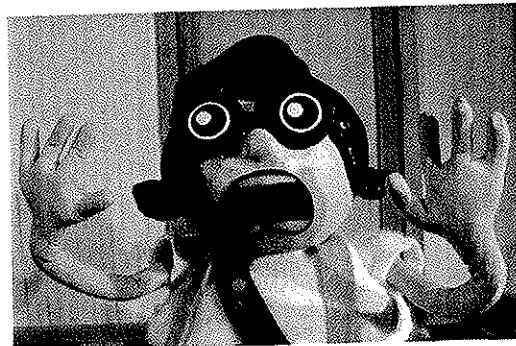


The puppet is first sculpted in clay and then molds are taken from the different body parts. These are then cast in foam rubber, with a bendable metal armature inside. This allows the puppet to be positioned by the filmmaker. Sockets on the bottoms of the puppets' feet (below) allow them to be securely fastened to the floor of the miniature set.

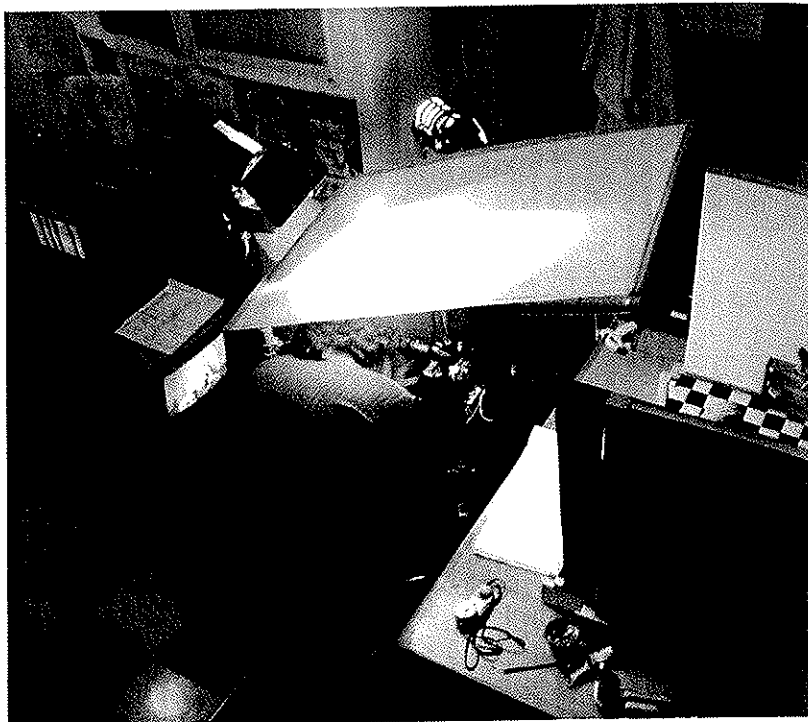


Replacement eyes, mouths, and other features are used on stop-motion puppets.

The stills below (from an amateur stop-motion animated film) show the use of replacement parts to change a character's expression. The basic figure puppet remains unchanged, but features such as the hands, eyes, and mouth can be replaced to make the character appear to move its eyes or open and close its mouth. The puppet of the little girl had ninety replacement eyes to allow her a full range of expression. (Photos courtesy of Max Winston)



Filming a stop-motion movie is a laborious process. The puppets have to be carefully repositioned for every frame of film. Creating just a few seconds of film could take days. (Photo courtesy of Max Winston)



in *Return to Oz* (1985) and his Claymation feature, *The Adventures of Mark Twain* (1985). Nick Park has raised the art to a very high standard in his popular Wallace & Grommet films and the feature-length *Chicken Run* (2000).

Stop-motion animation can be used as an end to itself—as in films like *Chicken Run* or *The Nightmare Before Christmas*—but more often it has to be combined with footage of live actors, so that it will appear as though the actors and animated characters are interacting with one another. There are a number of ways in which this can be done. The puppet can be animated in front of a blue screen and inserted into the live action as a traveling matte. For his fantasy and science-fiction films, Ray Harryhausen developed Dynamation to allow him to shoot his animated characters and prefilmed live action at the same time.

In its most basic form, Dynamation is a variation on the split-screen technique. It consists of a rear projection screen in front of which a stage displays puppet animation. Between this and the camera is a sheet of glass on which is painted a black foreground matte. Prefilmed footage of actors is projected one frame at a time onto the rear screen. The puppet can then be animated to react to the actors.