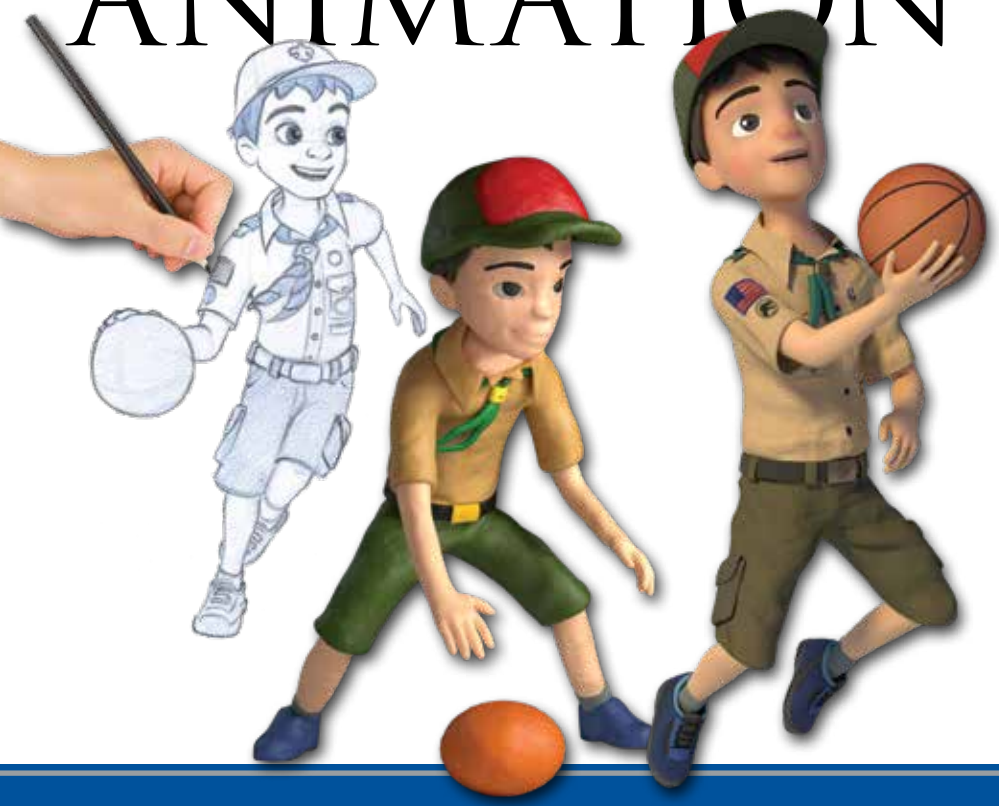
MERIT BADGE SERIES







ANIMATION



Scouting America

How to Use This Pamphlet

The secret to successfully earning a merit badge is for you to use both the pamphlet and the suggestions of your counselor.

Your counselor can be as important to you as a coach is to an athlete. Use all of the resources your counselor can make available to you. This may be the best chance you will have to learn about this particular subject. Make it count.

If you or your counselor feels that any information in this pamphlet is incorrect, please let us know. Please state your source of information.

Merit badge pamphlets are reprinted annually and requirements updated regularly. Your suggestions for improvement are welcome.

Who Pays for This Pamphlet?

This merit badge pamphlet is one in a series of more than 100 covering all kinds of hobby and career subjects. It is made available for you to buy as a service of the national and local councils of Scouting America. The costs of the development, writing, and editing of the merit badge pamphlets are paid for by Scouting America in order to bring you the best book at a reasonable price.

Send comments along with a brief statement about yourself to
Program Development Department
Scouting America • 1325 West Walnut Hill Lane • Irving, TX 75038 If you prefer, you may send your comments to merit.badge@scouting.org





SCOUTING AMERICA
MERIT BADGE SERIES

ANIMATION



"Enhancing our youths' competitive edge through merit badges"

Scouting America

Note to the Counselor

Thank you for offering your talents as a merit badge counselor. The entire merit badge program succeeds because of the dedication and generosity of people like you.

This merit badge is intended to introduce Scouts to the art of animation; how to create their own animations; the ways in which animation is used and experienced not only in cartoons and movies, but also in everyday life; and the fun and exciting career opportunities in animation.

To that end, the requirements are designed to expose Scouts to several types of animation but not to turn them into professional animators. The requirements are written to support all age levels and allow the counselor to guide Scouts in having fun with this merit badge while working within their age-appropriate abilities. Even a Scout with little or no artistic drawing ability can fulfill the badge requirements. (For ideas, see the examples in the Stop-Motion and Experimental Animation sections of this pamphlet.)

In scope, the requirements are limited to animation and do not include visual effects. It is also important to differentiate between animation and video. For the purposes of this merit badge, *animation* is bringing life to inanimate objects by taking multiple still images and building them into a video. *Video* is recording live action and breaking the recording down to single frames—the opposite of animation. Simply taking a video of something moving is not considered animation for this merit badge.

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At the online resource for this badge (scoutlife.org/Animation), the Scout will find extensive examples, video tutorials, and animation tools, with most of the material provided at a minimal cost or free. These resources are presented with the young Scout in mind and serve as an extension of this merit badge.

You and the Scouts you counsel are encouraged to take advantage of the special features offered in this book. You can also flip through the pages and see examples of animation running along the margins, and the centerfold section includes cutout pages with which to create an animation flip book. On the reverse side of the centerfold, you will find another example of 2-D animation.

In short, this book marks a new era in Scouting. Now, have fun with it—and let's get some Scouts excited about animation!



About the Patch

The design of the Animation patch includes several unique elements, the significance of which can be understood and appreciated only by those who are familiar with animation.



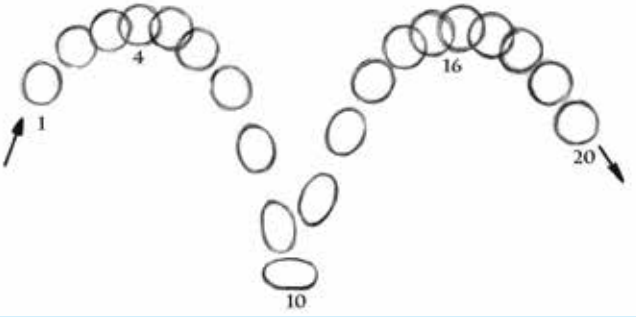
Original patch artwork



Final patch design



The black round object with horizontal bars is an animator's disk—a light table used to create hand-drawn two-dimensional animations. Multiple layers of transparent paper are laid on the disk and held in place by pegs (indicated by the white dots on the horizontal bars). The animator flips through the layers to see several previous frames of animation in order to judge where to draw the most recent frame on the top page. This layering explains why the ball has several light shades of blue with one dark blue ball. The previous frames of the ball motion are on lower layers, so they appear fainter.



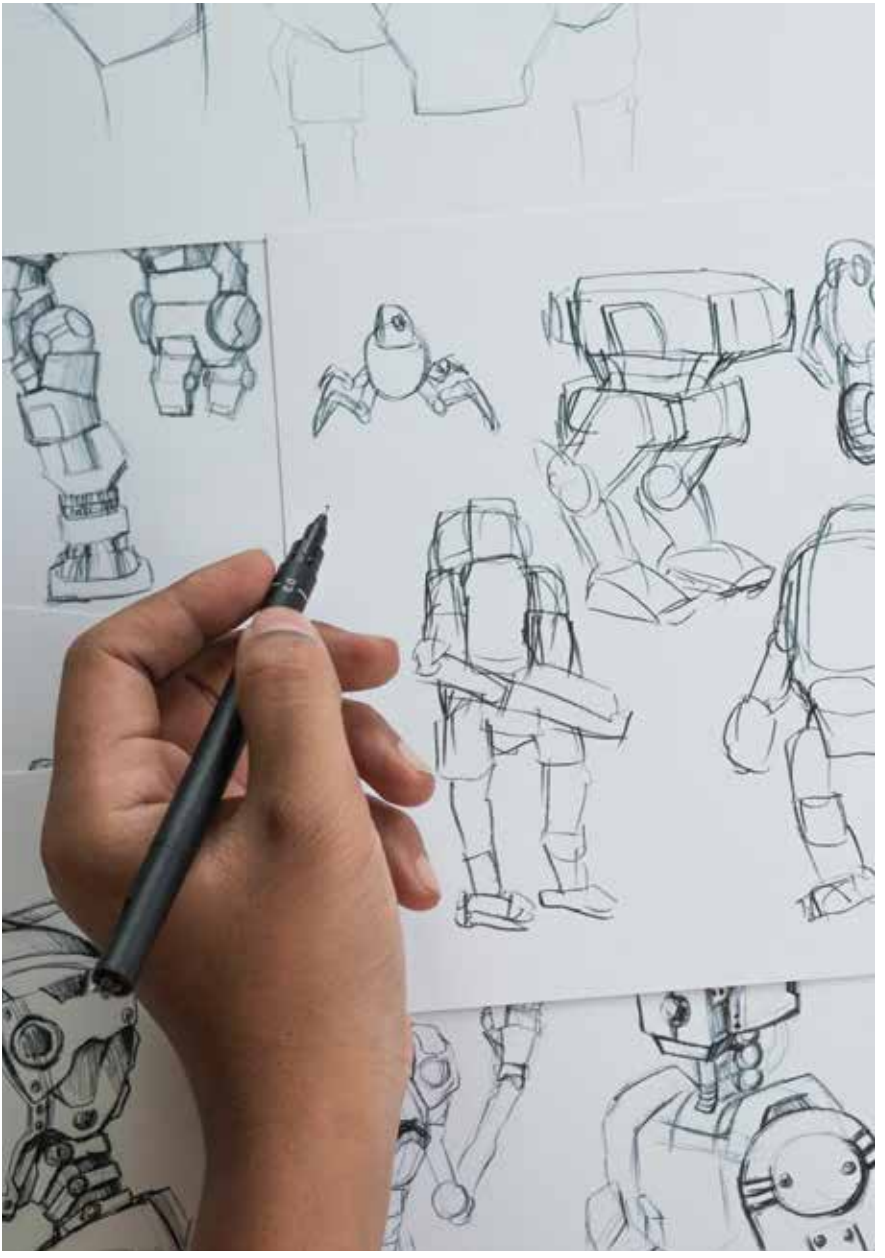
This rotating animation disk sits on a light table. Note the metal posts on the horizontal bars where the paper is mounted. Such disks traditionally are used to create hand-drawn animations.

The patch shows a ball animation, which typically is among the first projects an animation student must do in school. Note the squashing and stretching of the ball as it moves. This shaping makes the animation look more believable.

The balls are drawn in blue because animators often use blue pencil for initial sketches, then trace over the blue lines with dark pencil to create the "cleanup drawing." When photographed, the blue pencil does not show.

In this initial sketch of a bouncing ball, note how the ball squashes and stretches. When the individual frames are sequenced into a video, this technique makes the ball movement look more realistic.





Flip through pages 3–43 of this pamphlet from front to back and watch the simple 2-D animation of the stick figure in the right-hand margin! Now turn the pamphlet over and create your own stick figure flip-book animation in the margins. You could draw hikers, a motorboat, a rocket ship blasting off—anything you want. (The animation you create can be used toward fulfilling requirement 3.)





Requirements

Scouts should go to scouting.org/merit-badges/animation or check Scoutbook for the latest requirements.



Scan this QR code for the latest Animation requirements.







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What Is Animation?

Animation is the technique of displaying a series of images in rapid succession to create the illusion of movement. The images can be hand-drawn artwork, computer-generated imagery, or three-dimensional objects.

This pamphlet discusses principles and types of animation. While there are 12 ***principles*** (listed on page 33), the number of ***types*** is constantly changing as new animation technologies develop. For the purpose of this pamphlet, types are synonymous with styles, methods or techniques.

Types of animation include:

- Traditional or two-dimensional (2-D)
- Computer-generated or three-dimensional (3-D)
- Stop-motion
- Experimental or mixed media

You will learn about each of these types as you work on the merit badge requirements. Other types of animation include motion graphics, rotoscope, cut-out, live animated, pinscreen, screencast, typography, mechanical, whiteboard, augmented reality, retro, isometric, minimalist, 360, audio-animation and autonomatronics, chuckimation, puppetry, zoetrope, sand, paint-on-glass, drawn-on-film, erasure, hud, plexus, realistic cartoon and Tim Burton's style of animation.

Animators Are Keen Observers

What does it take to be an animator? A good animator is a spectator of the world, noticing everything. Try carrying a sketchbook with you wherever you go. Sketching is like taking notes—it teaches you to be a better observer.

However, you do *not* have to be an expert artist. Drawing well is something that can be learned. All you have to do is



to keep practicing. Draw whatever is around you: dogs, cats, plants, other Scouts, leaders, etc. Observe their body language and try to capture it in a quick sketch. This will train your eye to see the pose. Try to focus on capturing movement and emotion.

Watching animated films and live-action movies is another great way to study. Today's technology makes it easy to watch these frame by frame. Try drawing from these to learn how the

A good animator studies the work of great animators. Many "making of" and "how-to" guides are available via books, DVDs, and the internet. Take advantage of these resources to learn about making good animation. See the Resources section of this pamphlet for suggestions.





Character animation tells a story and is a kind of acting. The animator brings the character to life, giving the figure emotion and depth.

action is broken down in each frame. Try watching a movie without sound and pay attention to only the action and acting. A good animator is also a good actor. The characters you are animating are putting on a performance.

You also must understand anatomy and body mechanics. To animate something properly, the animator must understand how that subject is built and how it moves. An object moves



In animation, a frame is an individual picture in a series of images. A sequence of frames makes the animation.





differently in water, for example, than it does on land. For the best believability, objects must appear to abide by real-world physics. However, these physical laws may be broken for comedy, special effects, and various other reasons.



Animation Is Everywhere

Animation is everywhere you look these days. Cartoons, commercials, movies, and video games are obvious examples, but animation is also used in many other areas.



Animation may be used in factories to help operators visualize what is happening and to keep factories running at peak performance.

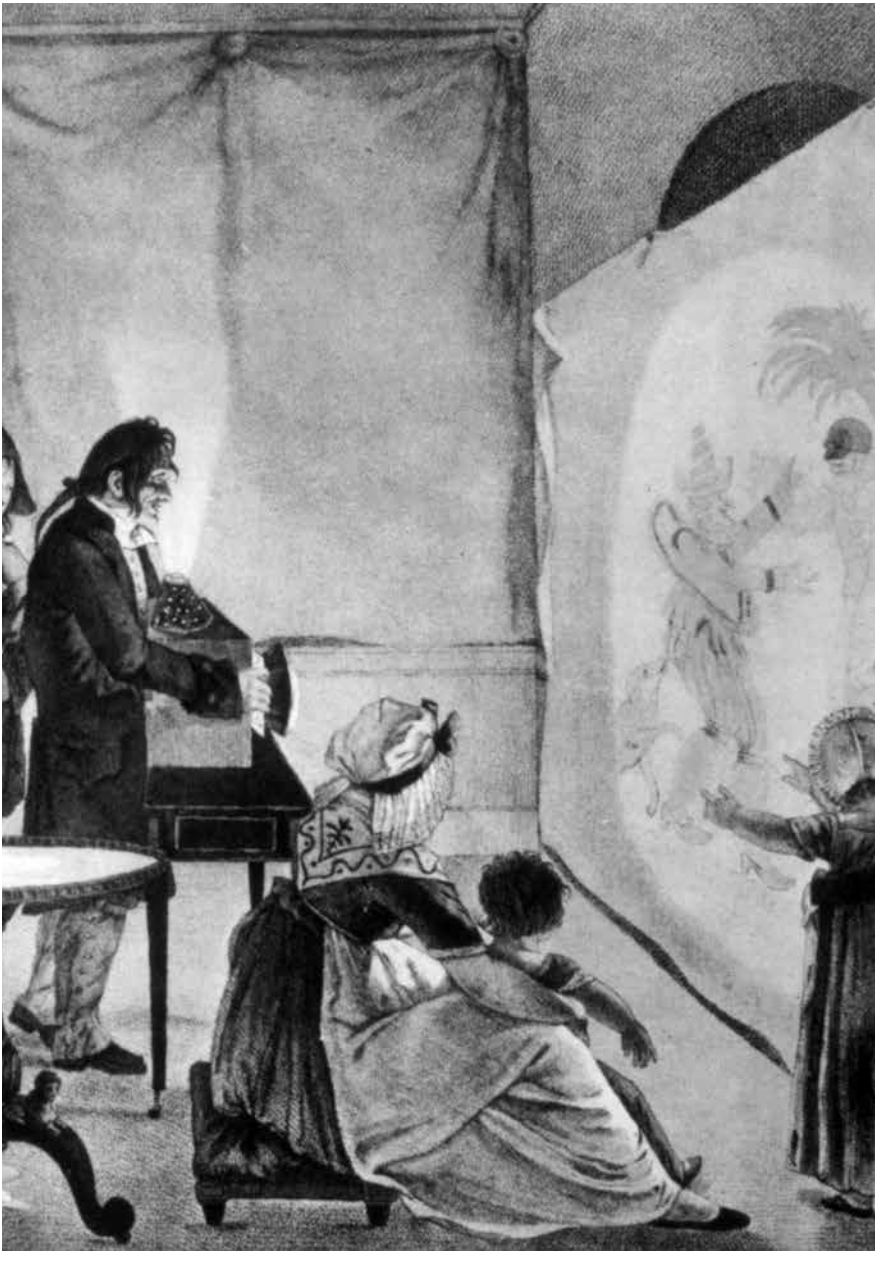


In fulfilling the requirements for the Animation merit badge, you will not only learn how animators work, you will also have opportunities to create your own fun animations. You will need only simple tools, most of which you probably have or can easily get. Ask your counselor for help in obtaining any special tools that you might not have readily available, such as a camera, a camera tripod, and video-editing software.

The military uses animation for simulations and training. Factories use animation to monitor the status of operations, such as how fast a tank is filling with fluid. Animation might be used in a courtroom to clarify details of an accident or a crime scene. NASA uses animation to track satellites, spacecraft launches, and mission progress. Physicians use animations to help visualize surgical procedures. Meteorologists use animations to show what the weather is doing. Through animation you can take virtual tours of buildings or even places you can't normally visit, like deep oceans or other planets.



Animation is used to teach human anatomy. It is also used in hospitals for diagnostic procedures.



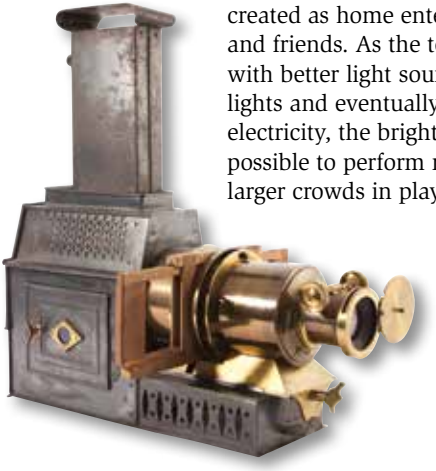
History of Animation

The history of animation is as old as the history of storytelling. The word animate means "alive." When early humans first painted animals and hunting scenes on cave walls, they lit fires to show off their work. The dancing flames cast irregular light in the caves, making the images of prehistoric animals appear to be alive and moving.

Also, from the earliest times, children worldwide have used a light source to project hand shadows onto a wall to create the shapes of animals or faces. This kind of entertainment can be enjoyed by a group of friends. The shared experience of creating lifelike imitation is a key part of the attraction of animation.

The idea of projecting shadows led to the first *magic lantern* shows, starting around the mid to late 1700s and lasting until the introduction of cinema. A primitive projection device like a wooden box with a candle inside was fitted with a lens. Hand-painted images on glass plates were placed between the light source and the lens, projecting the image onto a wall. The subject matter on these glass plates was as varied as a person's interest or imagination.

Some of the first magic lanterns were created as home entertainment for family and friends. As the technology advanced with better light sources, from candles to gas lights and eventually to arc lamps running on electricity, the brighter illumination made it possible to perform magic lantern shows for larger crowds in playhouses and theaters.



Magic lanterns were used in the 1700s to project hand-painted images that, when shown in sequence, told a story.

As the projectors became more powerful, several lenses could be used to show more than one image at a time, allowing for more intricate storytelling. Sometimes the images were shown in succession like the pages of a storybook, but with special effects added like shimmering water or elements of a drawing that would move. The more complex projectors could switch an image from one lens to another, creating a change in a character's facial expression or giving the illusion of morphing (transforming) a person into a hideous creature before the viewer's eyes. This kind of technology lent itself well to stories about monsters and mythology long before film was available.

The Persistence of Vision

By the 1830s, several inventions were making use of a trick of the eye called "the persistence of vision." Simply put, this means your eye will hold an image in your mind and associate it with another, similar image that changes slightly. Showing a series of such images in quick succession gave rise to a new form of entertainment—the phenakistoscope.



The phenakistoscope used the viewer's persistence of vision to create the illusion of movement.

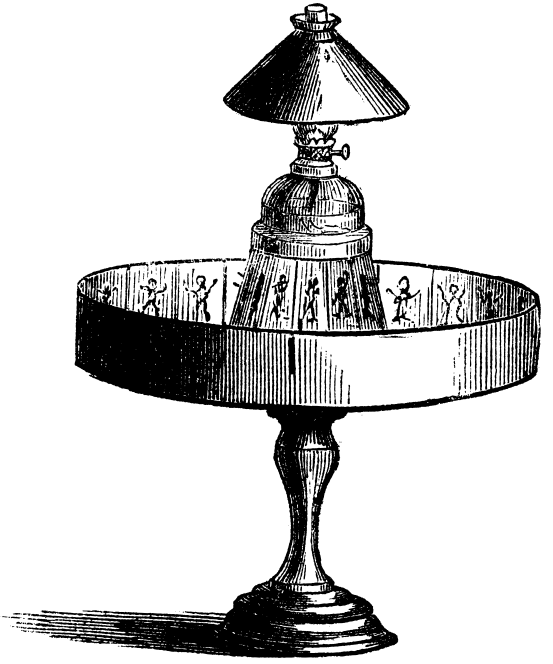
The *phenakistoscope* was a disk-shaped device that had a sequence of drawings around the outside of the circle. If you spun the phenakistoscope like a wheel, and looked into a mirror while holding the device and peering through the slits cut into the disk, you would see each drawn image separated for a fraction of time—long enough for your mind to see each image and associate it with the next slightly different image, creating the illusion of sequential movement.



The zoetrope also relied on persistence of vision. If you look at the images through the slits while the drum is rotating, you see what appears to be a galloping horse.

The *zoetrope* employed a similar principle and became a popular source of entertainment. Sequential drawings on strips of paper could be placed around the inner wall of a spinning drum. Slits along the upper rim of the wall allowed the viewer to look at the drawings inside, which seemingly moved in a continual motion. With the zoetrope sitting in the middle of a table, the experience could be shared by a large group looking in from all sides. This was an improvement over the phenakistoscope, which could be experienced by only a single viewer at a time.

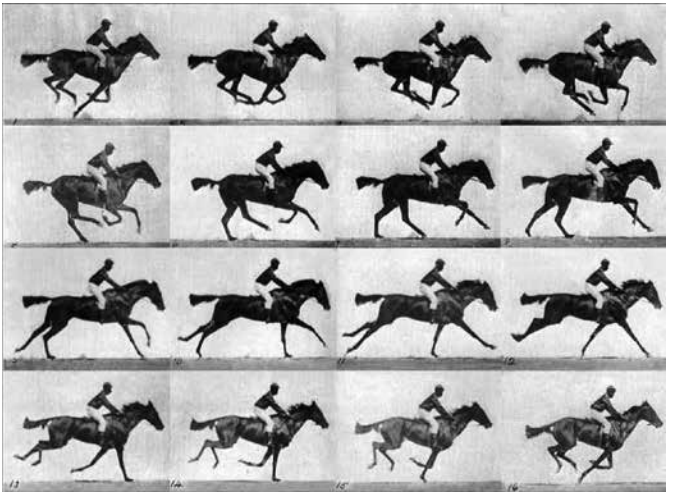
In 1877, the zoetrope was improved upon by replacing the slits with mirrors positioned in the middle of the drum. Called a praxinoscope, the device had many different designs, but all used sets of mirrors rather than slits.



The praxinoscope improved upon the zoetrope by adding mirrors. Now the viewer didn't have to look through slits.

Motion Pictures

In 1878, railway tycoon Leland Stanford wanted to have photos taken of his prize racehorse, named "Occident," at his Palo Alto farm (later the site of Stanford University). He hoped to win a bet over whether all four of his horse's hooves ever left the ground at the same time. The photographer, Eadweard Muybridge, set up a row of 24 cameras hooked to trip wires in front of a wall where the horse would run. As Occident trotted past the cameras, the hooves tripped the wires, causing each camera to take one exposure. When these images were presented in succession through an early movie projector called a zoopraxiscope, the concept of the motion picture was born.



When the horse tripped wires, each of Muybridge's 24 cameras took a photo. Viewed in a zoopraxiscope (an instrument Muybridge developed), these images showed an animated horse running.

Thomas Edison's invention of a motion picture camera led to the development of projectors that could bring this entertainment into theaters and playhouses. Around the year 1890, short film clips and movie reels were shown in combination with live theatrical acts. Eventually, moving film took over the theaters, and the modern cinema was born.

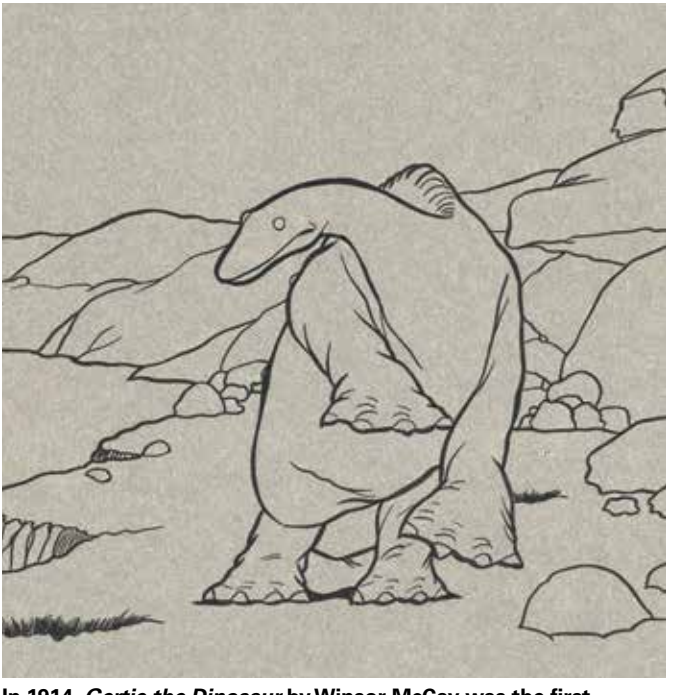
Animated Films

Almost from the first, live-action films were combined with cartoon animation. In 1900, J. Stuart Blackton made the first film that included animated sequences, *The Enchanted Drawing*, using stop-motion photography. Blackton filmed himself in front of a large character face on a drawing board, with which he appeared to interact. He achieved this illusion by stopping the camera to make changes to his drawing, as if the character were reacting to his actions. In 1906, Blackton made *Humorous Phases of Funny Faces*, the first animated film consisting mostly of drawings using stop-motion photography. Drawings were made on a chalkboard and filmed sequentially, with the images of a man and a woman appearing to react to one another.



The Enchanted Drawing **by J. Stuart Blackton was the first film made mostly with stop-action photography. Many consider Blackton to be the "father of animation."**

Other early attempts at making short animated films sometimes combined animated characters with live action. Artist Winsor McCay was an American cartoonist known for his comic strip *Little Nemo in Slumberland*, which he drew for 20 years starting in 1905. McCay made several short animation test films of his Little Nemo characters, but he is best known for his film *Gertie the Dinosaur*. In 1914, *Gertie* was the first *key frame* animated film. Key frames are drawings that plan out where the character is going to go and what the character is going to do.

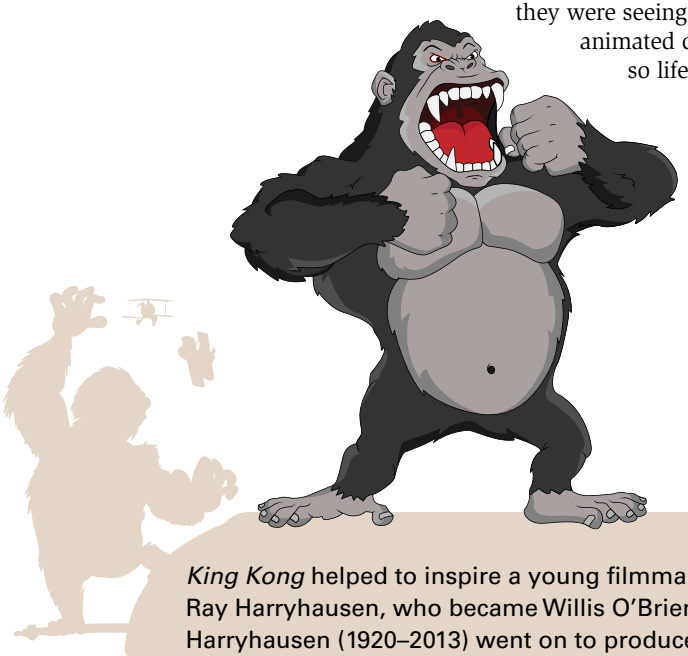


In 1914, *Gertie the Dinosaur* by Winsor McCay was the first animated film to use key frames.

Winsor McCay set a new standard of quality and craftsmanship in animation.

At this same time, Willis O'Brien was experimenting with the process called stop-motion animation. Using realistic puppets with a metal armature or poseable skeleton inside, O'Brien was able to reproduce convincing motions of dinosaurs and other creatures based on the paintings of artist Charles Knight. O'Brien made the short films *The Dinosaur and the Missing Link* (1915) and *The Lost World* (1925) before he made his most important feature films, *King Kong* (1933) and *Mighty Joe Young* (1949), which earned him an Academy Award® for best visual effects. All of these were black-and-white films that mixed stop-motion animation with live actors, making it look as if they shared the screen with one another.

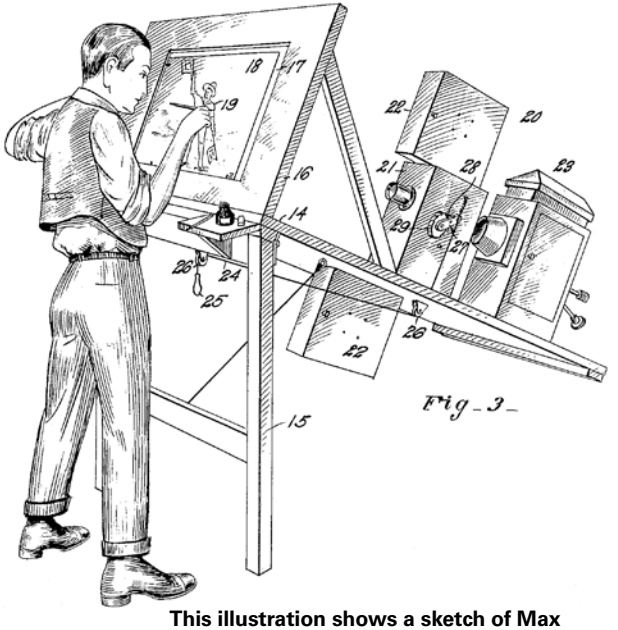
King Kong came out only a few years after the end of the silent film era. When people saw it, they were amazed by what they were seeing because the animated creatures seemed so lifelike.



King Kong helped to inspire a young filmmaker named Ray Harryhausen, who became Willis O'Brien's assistant. Harryhausen (1920–2013) went on to produce a series of monster films using stop-motion animation in color, between 1958 with *The 7th Voyage of Sinbad* and 1981 with *Clash of the Titans*. Harryhausen's films became the inspiration for many filmmakers today who love to work with special effects and creatures.

For many years, it was common for a short animated cartoon to be shown before the feature film. These are some of the influential animators of the silent and early sound eras in filmmaking and their cartoons:

- Otto Messmer's "Felix the Cat," first appearing in 1919, ranks among the greatest cartoon characters of all time and is one of the most recognized animated characters in film history.
- Max Fleischer's "Koko the Clown," also dating from 1919, was created by tracing over live-action film footage in a process called *rotoscoping*. Koko was forever escaping the ink bottle from which he was drawn and getting into trouble in the real world.
- Walt Disney's first cartoons were the "Laugh-O-Grams" created in the early 1920s in Kansas City. These featured various characters including barnyard animals that were animated in a style called "rubber hose." The characters had little definition in their arms and legs, and could bend and stretch beyond what was possible in real life. This made for funny-looking action that could only happen in the world of cartoons.



This illustration shows a sketch of Max Fleischer's rotoscope for the patent he filed.

Disney Studios

Walt Disney's first studio in Kansas City did not make money, so he moved to Hollywood. There he created the "Alice Comedies," which featured a live-action girl in a cartoon world. One of Disney's last successful short-film series of the silent picture era was *Oswald the Lucky Rabbit*. Despite the success of *Oswald*, Disney lost the rights to the character. Vowing that he would never again work for someone else, Disney started his own studio featuring a new character called Mickey Mouse.



Walt Disney was the voice of the original Mickey Mouse character.

The first cartoon with sound released to a large audience was *Steamboat Willie* (1928), starring a talking and even whistling Mickey Mouse. Disney Studios also made the first color animation with the short film *Flowers and Trees* (1932).

Among Walt Disney's other major contributions to animation was the full-length animated feature film, of which *Snow White and the Seven Dwarfs* was the first. (A "feature film" is a movie that is long enough to be thought of as the main film of a program.) Made in 1937, *Snow White* was a leap forward in the craft of animation, applying real-world principles of "squash and stretch" as well as action and reaction to what seemed like living, breathing characters made of art. The film won Disney a special Academy Award®. (Squash and stretch as well as other techniques are covered in detail in the next section, Principles of Animation.)

The success of *Snow White* allowed the Disney studio to grow and to improve the art of storytelling as it continued producing feature films. Other studios also began creating animated features.

Cartoons on Television

Television was the next big thing in animation. Several Hollywood studios created animated "shorts" that ran between seven and 10 minutes. These short films were viewed at the beginning of feature films and came after the trailers (previews) for upcoming films. TV was well-suited for airing these films. Warner Brothers Studios had great success with such cartoon characters as Bugs Bunny, Daffy Duck, Porky Pig, and the Road Runner. These shorts were grouped together in a show called *Looney Tunes*, typically seen on the Saturday morning cartoon lineup.

All of the major television networks hired animation studios to produce shows especially for children to watch on Saturday mornings. Hanna-Barbera Productions created *The Flintstones* and other cartoons aimed at children, including such series as *Yogi Bear, The Jetsons, The Huckleberry Hound Show,* and many more. United Artists also adapted some of the studio's animated cinema shorts to the TV screen and created *The Pink Panther Show.*

Cartoons that were viewed weekly had to be created quickly, and the need for speed forced a change in the style of animation. In a technique called *limited animation*, one piece of artwork represents the character's body or head, and another layer is placed on top with only the moving parts like the mouth and eyes of the head or the arms and legs of the body. This way, the artist saved time by not having to redraw the entire character in every frame. The method saved the studio money, but in some cases it made the animation look stiff.

Television also created new opportunities for animation in advertising. Products could be marketed to the ready audience of children who were watching Saturday morning cartoons. Ads for breakfast cereals are one example of how animation was used to market products to children, with animated cartoon characters appearing on cereal boxes on store shelves.

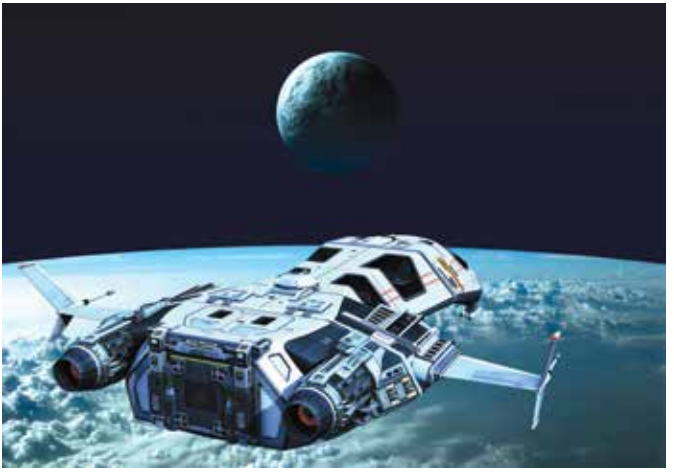


Computer-Generated Animation

Animation has enhanced live-action films both on television and on movie screens. *Star Wars* (1977) used animation to intensify the light sabers and for the stop-motion characters in the chess scene aboard the Millennium Falcon spacecraft. Director George Lucas created a special effects company called Industrial Light & Magic (ILM) with the artists who made the original *Star Wars* film. The ILM artists used various forms of animation in the movie's sequels. They were the first to use a computer-generated image (CGI) or computer-generated (CG) animation mixed with live action. The advances in animation technology at ILM led to the CG characters in many other productions, including the later *Star Wars* prequel films.

In 1985, the film *Young Sherlock Holmes* had the first photorealistic (lifelike) CGI character, a "stained-glass knight." Other highly realistic animated characters followed, such as the villain in the 1991 film *Terminator 2: Judgment Day*. Another notable advance in computer-generated animation was director Steven Spielberg's use of CG dinosaurs in the hit film *Jurassic Park* (1993).

Many animation artists who had worked in traditional special effects learned to use computers to remain relevant in this quickly changing industry.



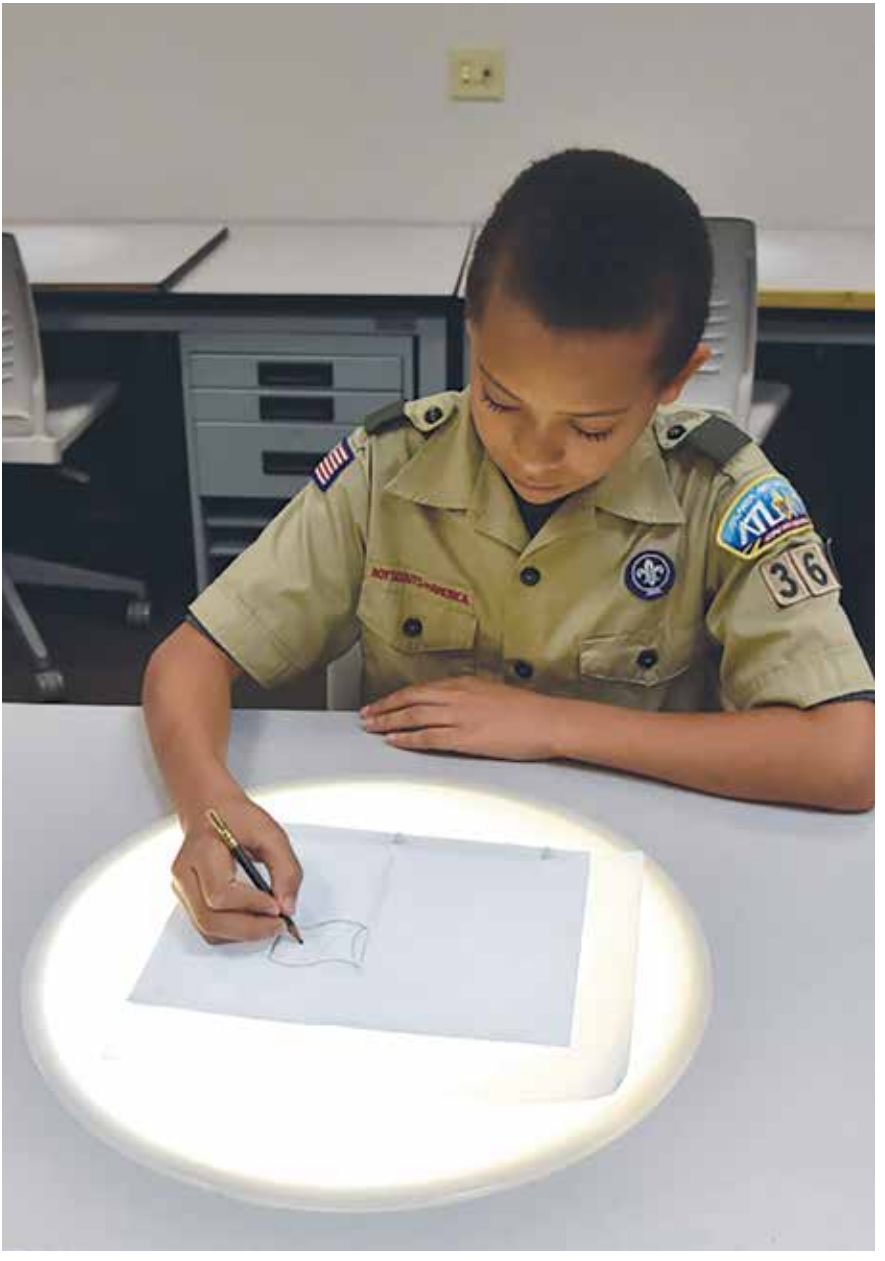
Pixar Animation Studios was created in 1986 from a group of artists working at Lucasfilm, the same group that created Industrial Light & Magic. Pixar made movie history with *Toy Story* (1995), the world's first feature-length computer-animated film.

In 2001, New Zealand animator/filmmaker Peter Jackson released the first in the *Lord of the Rings* trilogy of films. The special effects company Weta Digital created the first successful digital actor with the character Gollum (Smeagol), who was created using motion capture. In *motion capture*, an actor's primary movements and facial expressions are recorded by special cameras. This information is fed into a computer, which applies the motion to a digital model of the character or creature the actor is playing. Weta Digital also created software that could generate large numbers of digital characters, all driven in such a way that they responded to the other digital characters around them, just as in a video game.



Video games also use computer-generated animation and have advanced significantly from the pixelated characters of the 1980s, like Pac-Man, to the almost photorealistic games that are played today.

The entire history of animation—from the old-time magic lantern shows to today's computer-generated characters—is tied together by the element of storytelling. The following sections explain how the animation artist goes about creating the characters that give life to the story.

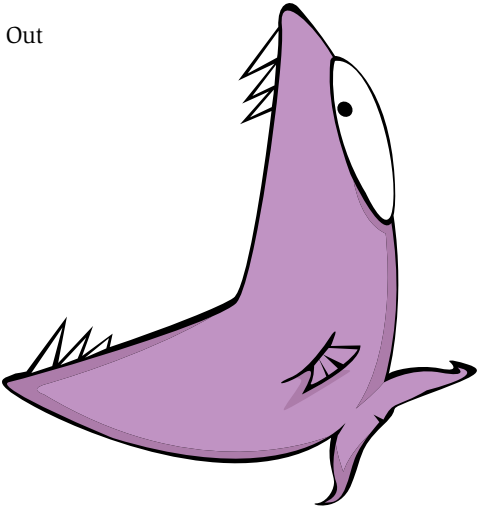


Principles of Animation

The principles of animation are a set of 12 basic ideas applied to animation to create appealing, believable results. They were introduced by two of the original Disney animators, Ollie Johnston and Frank Thomas, in their book, *Disney Animation: The Illusion of Life* (1981). Since that time, the principles have become standard in the animation industry.

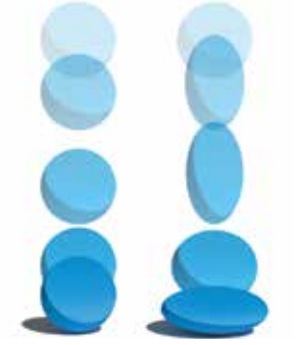
The principles are:

1. Squash and Stretch
2. Anticipation
3. Staging
4. Straight Ahead Action and Pose to Pose
5. Follow Through and Overlapping Action
6. Slow In and Slow Out
7. Arcs
8. Secondary Action
9. Timing
10. Exaggeration
11. Solid Drawing
12. Appeal



Squash and Stretch

Squash and stretch allows the animator to give the subject matter weight or flexibility. Squash and stretch is commonly added to a bouncing ball to give the ball a sense of speed while it's in the air and a sense of impact when it hits the ground. The animator can squash or stretch the object as much as desired, as long as the object retains its volume. For example, if the ball stretches vertically, it needs to squash in horizontally. An example appears in the Animation merit badge patch, where you can see the squash and stretch effect.



Shown is the same animation with and without squash and stretch. Notice how stretching as the ball falls gives it a sense of speed. In traditional animation, squash and stretch is frequently used instead of motion blur for rapidly moving objects.

Anticipation

Anticipation allows the animator to prepare the audience for the character's next action. For instance, a person can't just jump up off the ground. First, they must squat down to build up their energy, and *then* jump. A baseball pitcher can't just throw a ball; they must first wind back their arm to build up energy for the throw. Try standing up from your chair without first leaning forward to get your center of gravity over your feet. These kinds of actions must be taken into account in animation.

Staging

Staging is the presentation of an idea so that it is clear to the audience. The idea can be a broad action or something as simple as a change of expression on a face. Throughout the scene, one idea at a time should be introduced to the audience so that they will not miss any information.

Straight Ahead Action and Pose to Pose

Straight-ahead action and *pose to pose* are the two main methods for animating. Using straight-ahead action, the animator draws or animates frame by frame, doing the drawings in order: 1, 2, 3, 4, and so on. With pose-to-pose animation, in contrast, the animator draws or poses the main (key) frames of the animation before filling in the in-between frames. Using the pose-to-pose method, the animator might do drawing 1, then drawing 25, and then drawing 47, before going back to do the drawings in between.

Most animators use the pose-to-pose method because it offers benefits in timing and frame composition. The main exception is stop-motion animation, in which the animator has no choice but to use the straight-ahead method because it would be extremely difficult to go back and do in-between poses.

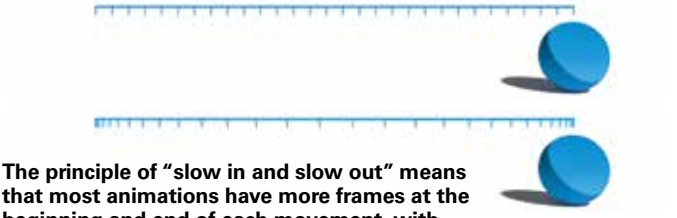
Follow Through and Overlapping Action

An object with momentum, such as a heavy ball on a chain, can't immediately stop after it has started moving. It must finish its movement first. Also, things don't stop all at the same time. First one part comes to a halt, and then another. For example, if you slide a gelatin sculpture across a table and suddenly stop it sliding, it will continue to wiggle. Or imagine a character running while wearing a long coat. When the character stops running, the coat will continue to move forward and then back again, slowly coming to a standstill well after the body stops moving. The animator needs to show these kinds of follow-through and overlapping motions.



Slow In and Slow Out

Slow in and *slow out* build on the principle that objects cannot start moving and stop moving immediately. To seem natural, they must build up momentum to start moving, and they must slowly decrease in speed to stop moving. Because of this principle, most animations have more frames at the beginning and ending of each movement and fewer frames in between.



The principle of "slow in and slow out" means that most animations have more frames at the beginning and end of each movement, with fewer frames in between.

Arcs

Arcs apply to most natural, lifelike movements. All natural movements tend to happen in arcs, or slightly circular motions. For instance, if a character's arm is swung, the hand will not go straight from point A to point B. It will move in an arc because it is attached to a pivot (the shoulder). If characters don't move in arcs, their movements will feel robotic and unnatural.



All natural movements tend to happen in arcs, or slightly circular motions.



Secondary Action

Secondary action is an action that results directly from another action, or is in addition to the main action of the scene. Secondary actions are important in adding realistic complexity to an animation. An example is a character that is clapping while running—the running is the main action, while the clapping is secondary.



Timing

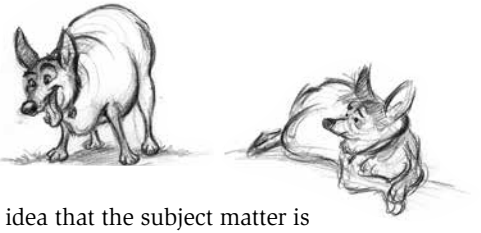
Timing refers to the number of animation frames needed for a given action. For example, knowing that it takes 24 frames to make up one second of film, it could take all 24 frames to animate a character jumping up and down once. Frames 1 through 11 could be the anticipation, frame 17 could be the highest point in the jump, and frame 24 could be the landing back on the ground. Using a stopwatch or studying video with a frame counter is a good way to analyze the timing of an action.



Exaggeration

Exaggeration means to overemphasize a movement. This technique was developed in the early days of film animation to give more life to animated characters. In general, the less a character has human proportions, the more exaggeration is put into the animation. For example, if a realistically drawn character is surprised, the character's eyes widen and the mouth opens. If the character is designed to be more cartoonish, the animation could exaggerate the widening of the eyes, with the head popping out and the jaw dropping to the floor.





Solid Drawing

Solid drawing is the idea that the subject matter is actually a three-dimensional object and should be drawn with weight and volume. Even two-dimensional drawings (without depth) can appear to have three-dimensional form (with depth) simply because of the way they are drawn and animated. *Character sheets*—pages with the character drawn from several different angles and poses—have traditionally been useful for animating characters with 3-D form. Modern-day computer animators, however, do not have to draw as much because the models they animate are rendered in three-dimensional space.



"Solid drawing" is the idea that the subject matter is a three-dimensional object and is to be drawn with weight and volume.

Appeal

Appeal is all about making characters that are believable and interesting. Appeal applies both to the way a character acts and to the way the character is designed and drawn.





ANIMATIC

-CAMERA SET UP
-STORYBOARDING
-LENS SELECTION
-BLOCKED CHARACTERS
-FINAL CAMERA ANIMATION



CAMERA AND STAGING



FINAL



Scene Planning

Be Prepared! The Scout motto is also the animation motto. Before you start a journey, you have to know where to start and where you are going. Animating a scene is quite time-consuming, and you need to have a plan before you begin.

Professional animation can be very expensive. In a professional animation studio, a movie or commercial is meticulously planned out before the animation work begins. The professional studio usually will *storyboard* each scene to make sure the successive scenes work together as a whole to communicate a vision. You can learn more about storyboarding in the *Moviemaking* merit badge pamphlet.

For the Animation merit badge, you will focus on making one scene and doing it to the best of your ability. Three important things to do before starting to animate are to:

1. Think about your scene.
2. Create thumbnails.
3. Map out your animation.

Think About Your Scene

Don't jump in headfirst and start animating. Take time to think through your scene. Make sure the action is clear in your mind before you start. If you are animating a character, know what the character is trying to do. Understand the character's personality and how he or she would act in a certain situation.

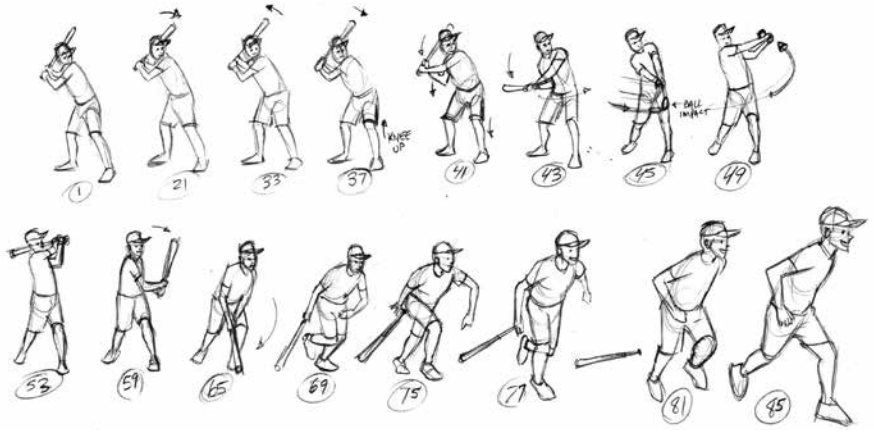
Whatever animation method you intend to use, create some type of guide so that you will know how far to move your character. For all of these examples, make sure you know how long the scene will last.



Think about the timing of your scene. How long does the action take? Will the scene have audio? These are the kinds of questions you need to answer at this stage of your planning. A stopwatch is a great tool to help you estimate the time needed for the scene. A film or video reference can be used to help guide your drawings. To identify the key character poses you will need, try shooting a reference with a video camera or a smartphone. Play back the video with a program that lets you step through the frames one at a time. If your program has a frame counter, take note of the frame number of each pose for timing purposes.

Create Thumbnails

Thumbnail is an old animation term for a small drawing not much larger than a person's thumb. Animators would create these tiny drawings to help them visualize the key poses they wanted in their animations. By drawing small, they could quickly create thumbnails and not get caught up in too many details. The important thing is to capture the main gesture that illustrates a key story point.



A thumbnail sketch is a tiny drawing about the size of a person's thumb.

Map Out Your Animation

Create a guide for your animation. In the animation industry, this is known as a *scene layout*.

If you are creating a two-dimensional (2-D) animation, simply use one sheet of paper and draw your first, middle, and last pose on it. Think of the piece of paper as a television monitor or a movie screen. Place your drawings on the paper where you would expect your audience to see them once they are on the screen. This piece of paper will serve as your guide when you proceed to do your animation drawings.



This is an example of a layout drawing for an animation of swinging a bat. The trees, grass, and bag represent the stage or background for the animation and would later be turned into a colored painting. The two character drawings represent the first and last pose of the animation. This layout helps to guide the animator in knowing where to animate on the page and how to keep the proper perspective in the drawings.

If your project will be a stop-motion animation, then create a way to measure the distance your animation will travel, and map it out with some type of guide. You could use simple markings on the ground where a character will place his or her feet while walking.

The same process is used in three-dimensional (3-D) animation. Using a character model, create the key poses that will be needed to guide you as you animate in the computer.

Now, on to the fun part: animating!

Make a Flip Book!

1. Carefully remove the center two sheets of paper from this merit badge pamphlet (or download the PDF from scoutlife.org/Animation).
2. Cut out all the images following the dotted lines. Stack the images in numerical order, and line up the right edges.
3. Staple the images along the left edge to make a miniature book.
4. Flip through the pages to see the animated character in action!

Now turn the book over and create your own flip. Or use a few blank sheets of paper and follow the same process. This is a great way to create your own animation for requirement 3.



Why Are Some Images Missing?

When you see missing frame numbers, this alerts the person recording the animation to repeat the previous image. This is called "shooting on twos." Animators do this to save time and money. Faster action, like when this character is swinging the bat, calls for *every* frame to be drawn so the fast motion can be captured. We call that "shooting on ones."

You will notice that in some of the frames, the bat and the ball are stretched out. This is a good example of the squash and stretch principle of animation.

See the finished animation on the companion website for the Animation merit badge at scoutlife.org/Animation.

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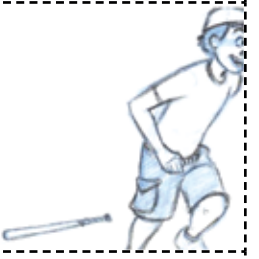
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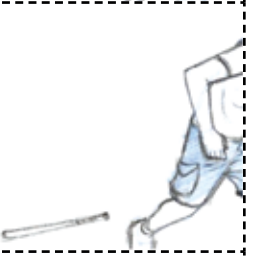
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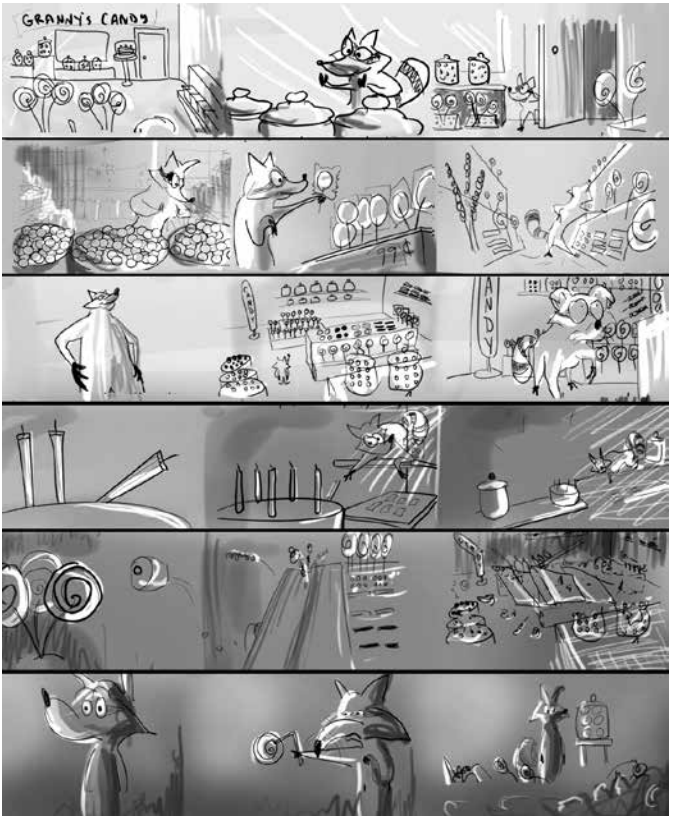
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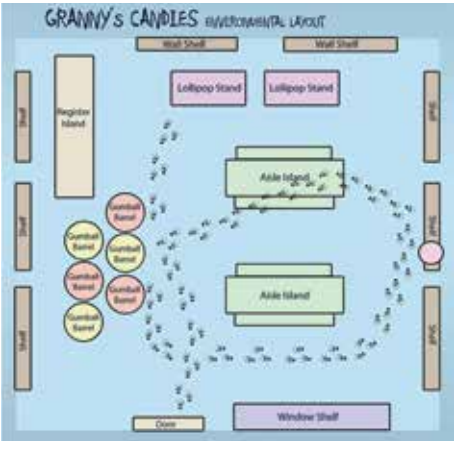
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This storyboard from a short film, *Baxter*, by Ty Coyle shows how the animated character moves through the scene and how it interacts with the environment.



This map shows character movement through the scene from the film *Baxter*.



2-D Animation

Two-dimensional (2-D) animation—also called classical, traditional, or hand-drawn animation—involves drawing every character, prop, and effect by hand and photographing each in the proper sequence on top of a background.

2-D animation typically starts with a blank sheet of paper. However, computer software programs such as Adobe® Flash® animation or Toon Boom®, which can achieve the look of 2-D animation, are used by professional animators to produce TV cartoon shows and by hobby artists to create content for online video-sharing websites.

The 2-D Animation Process

Once a scene has been properly planned out, the traditional 2-D animator starts drawing on specially designed paper that has registration holes like those punched in the paper for a three-ring binder. In the United States, these holes are called ACME registration, and they fit on a peg bar with distinctive pegs that hold the paper in place while drawings are created in layers to create the illusion of movement. These same peg bars are then used when shooting or filming the animation one frame at a time.



This animator's disk is mounted on a light table so it's easier to see through the layers of pages. There are special pegs for holding the paper while the animator draws.



Registration holes hold the paper in place while animators create drawings in layers.

Animating a Feature Film

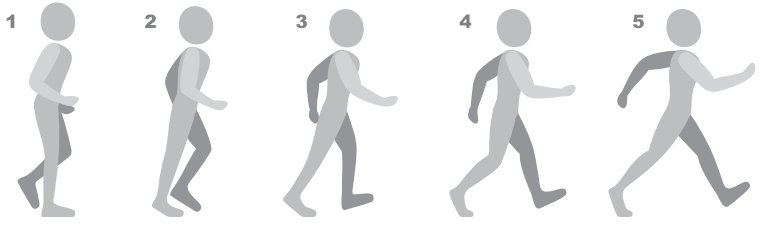
On a large production, professional hand-drawn animation passes through many hands before it is seen on the screen. Working under the film's director or directors are *supervising animators* who control the quality of production and may be assigned to one particular character. The supervisor establishes the character's look and movement and monitors the work of the key animators who work on that particular character.



Key animators create key drawings that represent the movement of a character within a scene. Each key animator works with an assistant or cleanup artist. The animators typically do rough drawings using colored pencil—usually blue, because blue can be taken out in the filming process. Graphite pencil is used when the motion is put in final form.

The assistant then cleans up the drawing, usually by creating a new drawing that traces over the animator's work. The assistant follows *timing keys*, small charts typically found in the margin of the page that show what the animator would like to see in the various drawings between the key poses.

As many as 300 artists might work on the production of a classical animated feature film. When many artists are drawing the same character, it is important that they all draw the character consistently so that it will look the same throughout the film. Model sheets are created as examples of the way a character may look with various expressions or body movements.

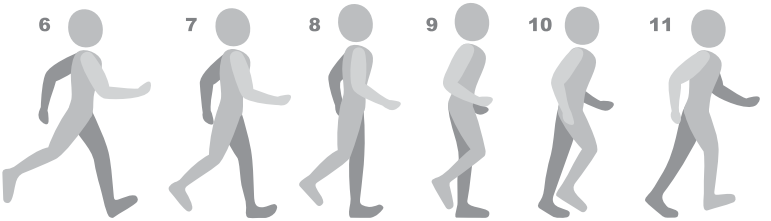


Animators must be able to work out the timing and the spacing of the action. Often they act out the motion on their own, sometimes filming themselves as a reference and using a stopwatch to figure out how long the action takes.

For a professional film project, traditional animation produces a huge amount of artwork. In film, each individual image moves at 24 frames a second. In video, the image moves at 30 frames per second. For typical or slower animated motion, a single drawing can be filmed on two frames, meaning that it takes 12 drawings on film to create one second of movement. Faster action requires a new drawing on each frame—meaning that 24 drawings are required to create a single second of movement.

A typical 90-minute animated feature film can easily require more than 100,000 drawings.

Most of the artwork created in the classical animated film industry is done by the *in-betweener*. This usually is an entry position for a new artist who is interested in animation. In-betweeners take the key drawings and create all the similar drawings that appear between them. For one second of animation, as few as four drawings might represent the work of the animator. The assistant might do several breakdown drawings to help an in-betweener understand the relationship between key poses, but typically all the other drawings on an animated production are created by the in-betweeners. It's no wonder that computers became such assets to the world of animation.



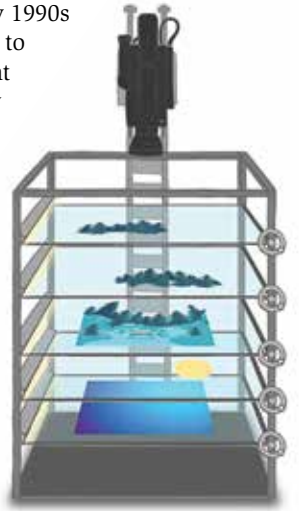
From "Ink and Paint" to Digital Painting

Before computers were employed in classical animation to paint each frame, a process called "ink and paint" was required for the final images to be filmed. Every hand-drawn picture needed to be traced by an artist in ink on the front of a clear celluloid sheet, and then painted on the back. (The term *animation cel*—pronounced like "cell"—comes from celluloid.) Later, a process was created so that the drawings could be printed onto the celluloid with a special printer, then painted on the back. The cels (celluloid sheets) had the same registration holes as the animation paper and fit on the same peg bars.

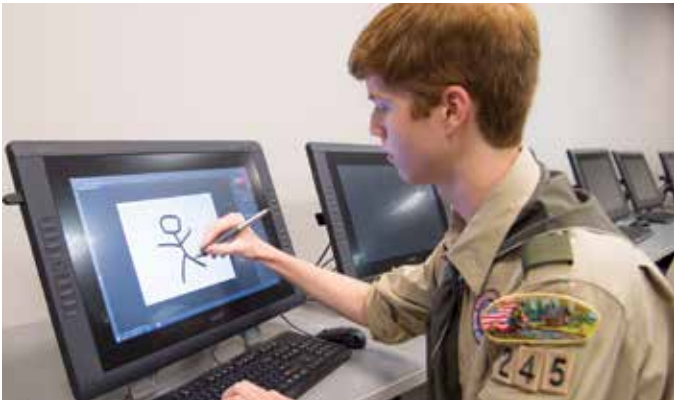
Many different cels along with the background painting were stacked atop one another on a special camera stand. One picture was taken to make up one frame of film. Then those cels were replaced with the next set of cels to be photographed against the background. This process was repeated again and again until the entire scene was filmed.

Today, a single artist using a computer and working alone can produce the same quality of production as *The Flintstones* cartoon show. Back in the 1960s when *The Flintstones* television show was produced, it required a whole team of artists.

A process developed in the early 1990s allowed original animation drawings to be scanned into digital images so that areas could be filled in automatically on a computer. This saved costs by replacing the long process of painting by hand.



This illustration shows how the multiplane camera captures multiple "levels" of an image.



The computer has been one of the animator's most time-saving tools.

Animation Software

Computer software can now be used to create the hand-drawn look of 2-D animation. The same steps are needed for planning out the scene, but the software can now insert the in-between drawings from just the key drawings or poses. Software can also automatically color and *composite* (layer) the character over the background as the frames are made. Specific motion like *lip sync*, or the mouth shapes of a character's dialogue, still requires the artist's attention, but computers have greatly reduced the labor-intensive aspects of 2-D animation.

Simple Animation Tools

You can easily produce 2-D animation using simple tools such as a sketchbook or a stack of sticky notes (like Post-it® notes). To create a 2-D animation sequence and achieve the illusion of motion, make one drawing after another and flip the pages of the notebook, or film a series of sticky notes. Adding elements of music and sound can create a dynamic storytelling experience for your viewing audience.



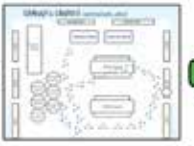
BRAIN STORM



2D ANIMATIC



LAYOUT

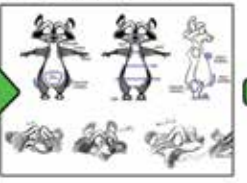


BUILD ASSETS



CHARACTER DESIGN + DEVELOPMENT





MODEL AND RIG CHARACTER



3D ANIMATIC



REFERENCE FOOTAGE AND ANIMATION



TEXTURING



LIGHTING



REVIEW



3-D Animation



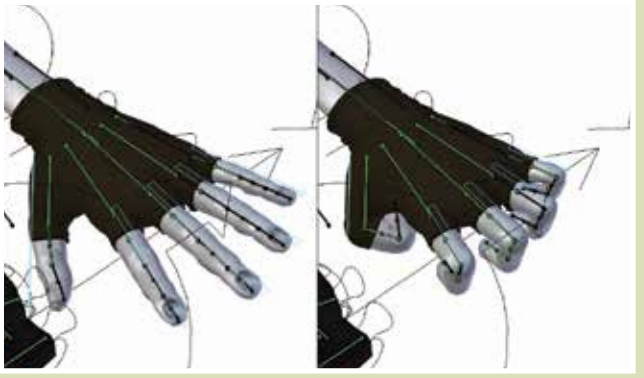
In 3-D animation, also known as computer animation or computer-generated imagery (CGI), the animator creates three-dimensional characters in a three-dimensional environment. Using special computer software, you create a character that has width, depth, and a skeleton that you can view from all angles and pose like an action figure. That's important: You don't redraw the character for each frame of the animation; you pose the *rigged* 3-D model. You then create a 3-D scene in which to place the character. Because it is all computer-generated, the scene or environment can be anything you want—outer space, a city, a mountain range, an ocean, etc. Given the scene and the character(s), you are ready to start animating.

Animating in 3-D is similar to animating in stop motion (see the next section of this pamphlet), but the computer software helps a great deal. In stop motion, you must painstakingly pose the character for every frame of the video.

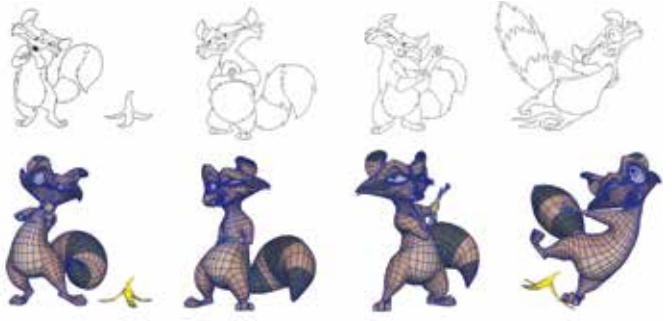
Computers have changed the world of animation. Starting with the first computer-animated feature film, Pixar Animation Studios' *Toy Story* (1995), CGI has removed some of the past restrictions of traditional 2-D animation. In computer-generated animation, the camera can move anywhere and in any way the director likes. Without the use of computers, such camera moves in 2-D or hand-drawn animation would require animators to create a huge amount of artwork that would cost more than a film could make in ticket sales.

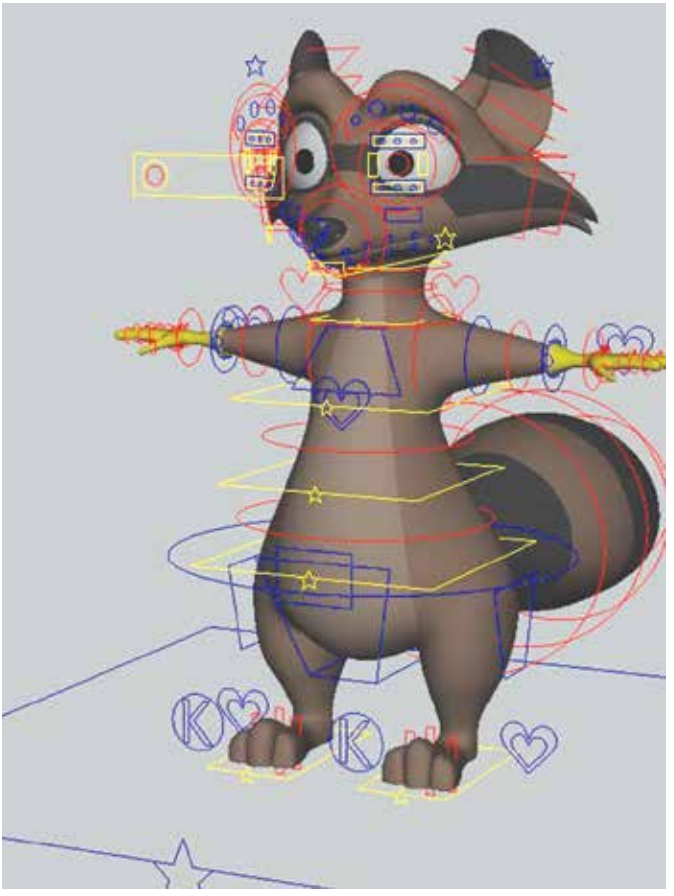
In 3-D animation, however, you pose the character only for key frames, and the software fills in the in-between frames. For example, if you need an arm to move from one position to another, you place the arm in the first position and then the last position, and the software can fill in the motion of the arm.

A *character rig* is the skeleton of the digital character. It defines how the parts of the character can be moved. Does an arm move like a board with hinges at the end, for example, or does it move like a rubber band? The answer depends on the effect the animator is trying to produce.



However, the software does not always know what you intend the character to do. Much of the time, you must go back and add in-betweens or tweak the animation to make the motion appear more natural.





In this example of 3-D animation, the colored lines show all the different things the animator has control over. This is called the "rig." The eye alone has almost two dozen controls, and the animator must adjust every one of those for every frame of the animation.

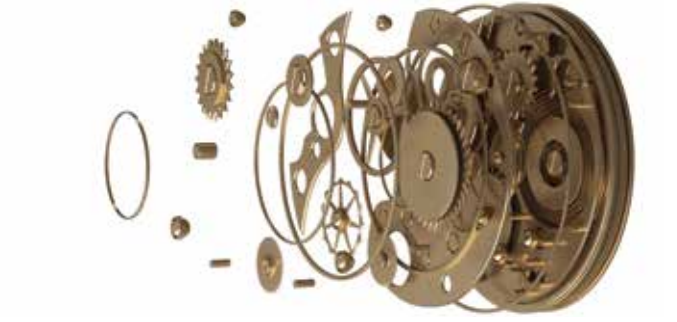




Scenes are created first with a rough sketch, then a simplified mock-up called an "animatic," and then the final image.

When the individual frames are played back as a video in real time, the series of poses that the animator has constructed creates a fluid performance.

3-D animation is used not only in live-action movies, animated movies, animated short films, and commercials, but also for industrial, medical, military, and educational purposes, and more.



The next time you watch an animated movie, watch the credits at the end. You might be amazed by how many artists are required to generate a full-length feature film. The different disciplines include animators, modelers, lighters, riggers, texture painters, effects artists, and more. It is important to appreciate that the work isn't all done by just one person.

3-D Animation Software

To create 3-D characters and scenes and do the animations, 3-D animators use software programs such as Autodesk® Maya,® Autodesk® 3ds Max,® Houdini™ by SideFX Software, MODO® by The Foundry, and Blender,® among others.

Blender® is an open-source computer application that you can use to create professional-quality 3-D animations. Some of the examples in this pamphlet were created using Blender. The software is free for personal and commercial use. To download it (with your parent or guardian's permission), go to blender.org. Do an internet search (with permission) for Blender 3-D animations and tutorials to learn everything you can do with the software.



Posing "Bonnie," a freely available character rig from professional animator Josh Sobel, in Autodesk® Maya.® (A character rig is the skeleton of the digital character.) This view shows several of the software controls that are used to manipulate the character.



This looks like an underwater photograph, but it is actually a completely computer-generated 3-D scene.



Everything in this scene was created on a computer. The black-and-white theme gives this 3-D image a classic old look, though none of it is "real."



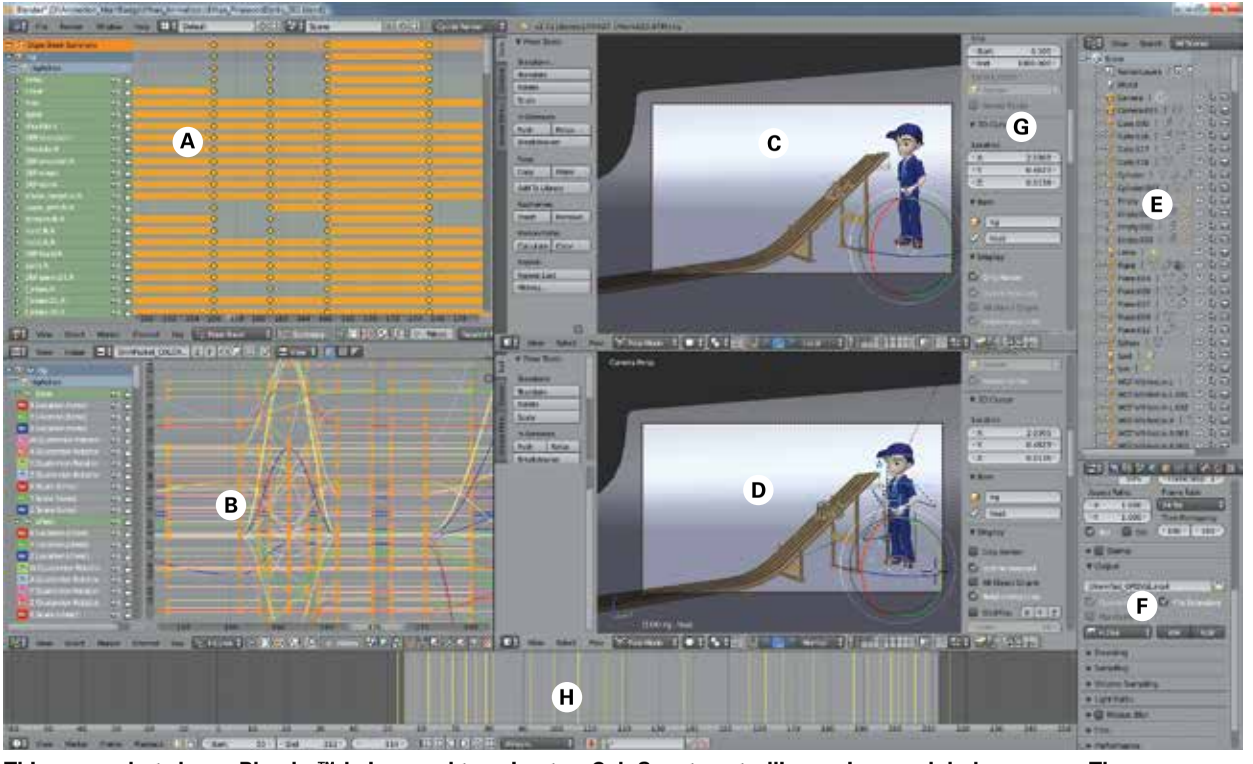
This image is from "Tears of Steel," an open-source project from the Blender Foundation. Combining a computer-generated 3-D environment and live-action content is called compositing. Compositing can be done in Blender™, the free, open-source 3-D software available at Blender.org.



This image is from "Big Buck Bunny," an open-source project from the Blender Foundation. You can tell exactly how each character feels simply by looking at their expressions and body language. The image was created using the Blender™ 3-D program.

Animators often use real-life videos as references when posing their characters to pick up on nuances or subtle details of movement.

This image from "Sintel" (an open-source project from the Blender Foundation) displays different shape keys, which are used to create different facial expressions on the main character, Sintel.



This screenshot shows Blender™ being used to animate a Cub Scout controlling a pinewood derby car race. The screen looks complicated, but by following video tutorials online, you can quickly learn how to use computer-animation tools like Blender. Ⓐ Dope sheet, Ⓑ Graph editor, Ⓒ 3-D view with controls turned off, Ⓓ 3-D view, Ⓔ Outliner, Ⓕ Render settings, Ⓖ Properties panel, Ⓗ Timeline







Stop-Motion Animation

Stop-motion animation is a technique that allows the animator to make physical, real-world objects appear to move on their own. This is achieved by taking a picture of the object, moving the object slightly, taking another picture, and then repeating this process until the animation is completed.

For stop-motion, the subject matter is almost unlimited. You could use clay, an action figure, sticky notes, toy construction bricks, or even yourself. The only requirement is that the subject matter physically exists and can be moved.



LEGO® bricks are a fun way to create animations.

Rather than using the key-frame animation methods that were discussed in the 2-D and 3-D animation sections, the animator works in a straight-ahead manner, starting at the beginning of the animation and working through until done. This is because it would be extremely difficult to take the key-frame pictures and then return the object to its exact location and pose for the in-between frames.

Stop-motion is not used as frequently as 3-D animation or 2-D hand-drawn animation because it is not as efficient or cost-effective. Stop-motion has been the technique of choice, however, for feature animations such as filmmaker Tim Burton's production *The Nightmare Before Christmas* (1993), *Wallace and Gromit: The Curse of the Were-Rabbit* (2005), *Fantastic Mr. Fox* (2009), *Coraline* (2009), and *ParaNorman* (2012). Before computer graphic visual effects took the stage, stop-motion was also used to bring to life everything from creatures to robots in a variety of popular films including *King Kong* (1933), *Jason and the Argonauts* (1963), *Star Wars* (1977), *Alien* (1979), *Clash of the Titans* (1981), and *The Terminator* (1984).



Clay animation, or *claymation*, is just one form of stop-motion animation. Animators form the characters—and sometimes the background—with clay, usually surrounding a wire armature for more stability. Claymation is a painstaking process.

Stop-motion animation requires the animator to plan ahead and have lots of patience.

Stop-motion characters use *armatures*—metal skeletons—inside either a clay or a latex body. The sturdy metal skeleton gives rigidity to the flexible latex or clay. It allows the animator to easily pose characters while providing enough support so that they don't accidentally move on their own.

With 3-D printing technology, stop-motion techniques have evolved tremendously. Instead of hand-crafting characters' faces for *ParaNorman*, Laika animation studio printed thousands of different 3-D faces so that all the characters could display every possible facial expression and mouth position. The stop-motion artists then swapped out the faces between frames as the characters' emotions changed in each scene.



A 3-D printer can "print" three-dimensional objects of almost any shape by setting down layers of a plastic material.

Creating a Stop-Motion Animation

To create your own stop-motion animation, you don't need professional equipment, a custom character with a complete armature, or a professionally constructed set. You just need a subject to animate, a camera, a tripod, and basic video-editing software. Simply mount your camera on the tripod and focus it on your subject. Take a picture of your subject, and then move the object slightly, take another picture, move it again, and repeat.

Try This!

A friend is a fun, easy subject to photograph for stop-motion animation. Have your friend stand in one location, take a picture, have him or her move a half step forward, take another picture, and then repeat the process. When you have edited the sequence of images into a video, it will appear as though your friend is sliding around on the ground.



Sticky notes were used to create this animation. Find out more at scoutlife.org/Animation.

You can make your subject do almost anything. Just move it and photograph it one frame at a time—and make sure your hand is out of the frame before you take each picture! After you have finished, plug your camera into a computer and load your sequence of images into any video-editing software.



A friend could be your stop-motion subject.



Posing a character for a stop-motion animation



Setting up a scene for a stop-motion animation



Posing LEGO® characters

A free stop-motion app downloaded to a smartphone will give you an instant stop-motion animation studio.





Mixed Media and Experimental Animation

Mixed media animation combines two or more different mediums to give the viewer a new or different experience. A medium can be just about anything that could be included in the animation. For example, you could use live-action footage (film or video) of someone walking through a parking lot, then draw the person wearing a superhero outfit over the original footage. The idea is to have different styles that contrast against each other but complement the animation as a whole.

Mixed media is open to all forms of animation and can bring stop-motion and 3-D together as one. The only requirement is that you include more than one method in the same animation. The art comes from knowing when and how to mix two mediums for a unique effect that neither medium could accomplish by itself.

Mixing also allows artists to emphasize the elements they want viewers to focus on. An emphasis on color could be achieved, for example, by mixing a black-and-white photo of a city and a 2-D animation of a big monster walking though the buildings in full vibrant color.

The most common mediums used in mixed media animation fall into two categories: live action and hand-drawn. Live action includes anything that could be taken from the world around you, including photographs, footage from a camera, or physical objects you can pick up. Hand-drawn elements can be anything created on a "canvas" of any type—whether that means static (motionless) drawings or 2-D and 3-D animations.

Many artists use mixed media animation to convey abstract or symbolic ideas. Because different mediums may not share the same level of detail, a highly detailed train (for example) might travel across the screen against a background of mountains that are indicated with only a few lines. Such a technique focuses most of the viewers' attention on the train because it is the most important element in the scene.

Experimenting With Mixed Media Animation

To begin exploring this type of animation, all you need are two or more different mediums and a way to record the animation in progress. Having the different pieces interact can be as simple as cutting a hand-drawn figure from a sheet of paper, then making an animation of the figure walking though fallen leaves. The leaves could symbolize that autumn has come, or many other concepts depending on the artist who creates the animation. Computer software may allow you to put several different mediums in your animation, then mix and match as you see fit.

When mixing animation styles, you can be as abstract as your imagination allows. Many experimental animations do not have a story line—they consist only of beautiful imagery.



You can make an animation using an old record player, some nuts and bolts, and a strobe light. When set in motion with the strobe light flashing at just the right rate, the wing nuts appear to move all by themselves.

The best way to learn is to watch a few videos of mixed media animation, then start experimenting on your own. If you are interested in trying something different and finding your own unique style, this may become your favorite type of animation. Don't be afraid to try something that has never been done before. After all, that is what viewers love to see.



Cut out a cardboard Scouting America logo and use it to "paint" the logo with sand. Take a photo, move the sand, take another photo, move the sand, etc. Assemble the images into an animation and see what it looks like.



Careers and Education

Animators are often actors, filmmakers, and storytellers all rolled into one. They are artists propelled by kid-like curiosity and seemingly possessed of magical abilities.

There are different types of animators:

- **Character animators** have an awareness of acting and study the movements of people and animals.
- **Visual effects animators** are more concerned with the movement of the environment, including fluids, particles, solid objects, complex systems that move, and crowds. These specialists are particularly aware of lighting, shadows, and textures.
- **Motion graphics designers** are animators who deal with moving typography (animated letters), design elements, and the raw movements of things. They might focus on interactive elements or artistic experimental animation like animations projected onto whole buildings.

These three areas of animation can overlap. Imagine a character animator, a visual effects animator, and a motion graphics animator going to dinner together. What would each person be likely to observe at the restaurant?



The *character animator* would notice the pace at which everyone walked, sat down, and chewed; how a friend with a toothache purses her lip; and how the server holds a tray in his right hand while leaning to the left.

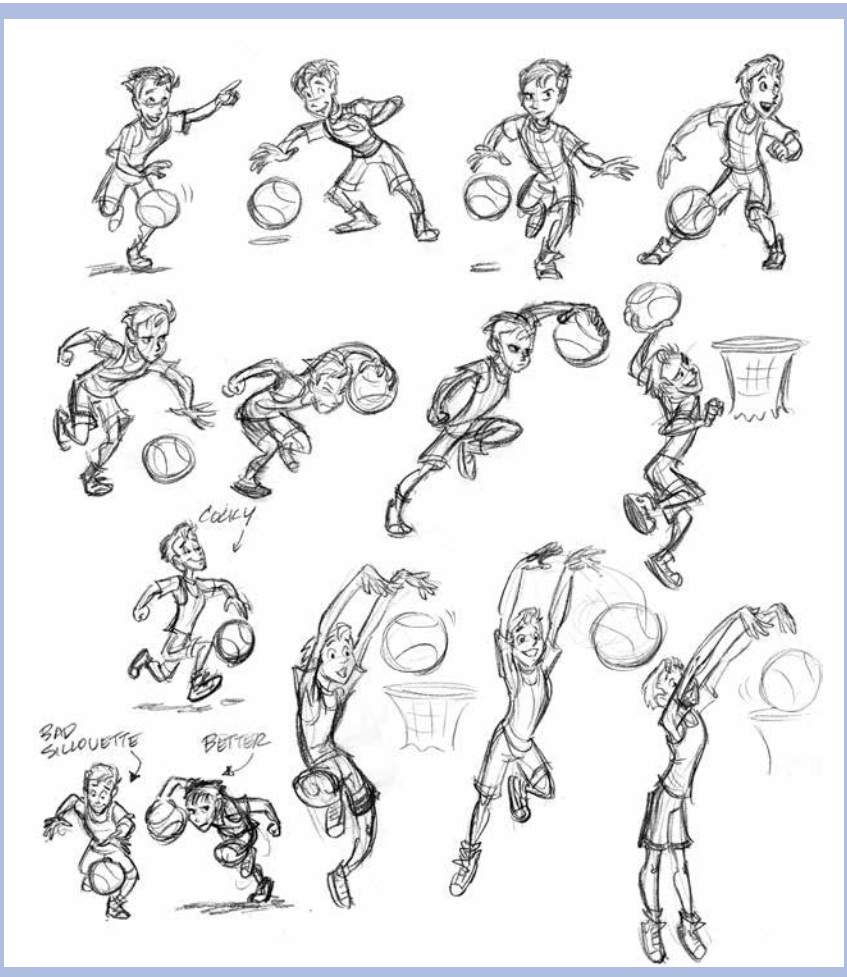
The *visual effects animator* would see the steam rising from hot plates; the way the light refracts in water glasses; how water condenses on a glass and drips onto the table; and how lights and shadows in the room are tinged with yellow and blue.

The *motion graphics animator* would notice the typography on the menu; how the layout of the restaurant's logo might be improved; and whether the online order app has a legible, interactive interface and colors that work with different tablet devices.



This striking example of visual effects is not a photograph. It's a 3-D computer-generated image—including the shadows and the translucent curtains.

Besides specializing in the three broad areas of animation—character, effects, and movable graphics or design elements—animators may have a wider set of skills, learning many animation styles, mediums, and subjects.



A knowledge of natural movement is needed for character animation.

Animators who study the latest developments in character, effects, and design will always be prepared for new and exciting animation projects.

The Outlook for Animation Careers

In every generation, children look for animated characters to delight them, and the entertainment industry steadily meets that desire. Also, kids aren't the only fans: People who grew up with interactive games often continue to play as adults, but by then they want more sophisticated visuals.

The need for animated media is also ever increasing in areas outside the entertainment industry, as proven by the continued popularity of mobile devices, visually compelling operating systems, and innovative software interfaces. People using the technology want animated icons to click and animated diagrams to show them how it all works.



In this motion media example, a student is pitching an idea to a sports network for the 2013 Super Bowl opening title sequence.

Once you begin to look, you'll see animation everywhere in your daily life.

Preparing for an Animation Career

Where do you begin? Start small. Learn to do a simple animation as you earn this merit badge. Then keep going.

No magic pill, piece of software, or any one thing will make you an animator. It takes constant observation of movement and close study of how and why things move the way they do. Then, just start drawing.

- Character animators are always creating little gesture studies from life. They fill sketchbooks with stick figures that capture the weight of someone leaning on an elbow or impatiently waiting for a bus—quickly drawn with a few simple lines.
- Visual effects animators may study and sketch how light fills a room, or use photography to capture the environments that grab their curiosity.
- Motion graphics animators may analyze and remake the shifting typography and images in the opening credits of a movie; the opening sequences of a television show; or a TV channel's spinning, three-dimensional, station identification logo.

A good animator soon realizes that moving the character, the object, or the graphics isn't the only important thing. More significant is the how the image moves, why it moves, and what story it is trying to tell. Do audiences feel the way they should after watching it?



Gesture sketches

For more about basic art principles, see the *Art* merit badge pamphlet.

Choosing an Art School

What should you look for in an art school that teaches animation? First and foremost, look for a university that teaches foundational drawing skills. You need to be an artist for one drawing before you can be an artist for 24 frames in a row. All artists need to understand the fundamentals of art, such as form, color, balance, and proportion.

In addition to the fundamentals:

- Character animators should study figure drawing and anatomy, and take acting and psychology classes.
- Visual effects animators need extra study of lighting, perspective, and photography, and perhaps higher math for those who want to go into technical direction of visual effects.
- Motion graphics animators need typography classes, photography, and perhaps printmaking.

Look for an animation program that allows you to take courses in multiple animation disciplines. Don't take only character-animation classes, for example, and neglect all other types of animation. Choose programs that offer different mediums (2-D, 3-D, stop-motion, mixed media).

Lastly, seek out a program that includes different styles of animation. For example, a Disney character moves differently from a character on the animated television shows *Adventure Time* or *Foster's Home for Imaginary Friends.* Experiencing or even being around these different types of media, styles, and disciplines will give you a broader artistic skill set. This wide range of knowledge is helpful when it comes time to take the first step into your career, and then the next. The market changes, and knowing only one medium, one discipline, or one style will open doors in only one type of market.

However, be sure to take enough classes to specialize in at least one area. You will have time to specialize in other areas as you move through your career. With a strong foundation of knowledge, you will easily be able to move into new areas and continue to grow as an artist and an animator.

Matching Your Training to Your Interests

Your unique learning experience should match your passions as an artist. Do you love space exploration? NASA employs animators to visualize data, to preview how missions will look, and to explain to the public what researchers have found. Are you interested in augmented reality and video games? Join a group project where a team of students are developing a game that needs animation. Or, take a course in making an interactive storytelling app.

Perhaps you will want to do your undergraduate studies in visual effects animation and then complete a graduate program in computer science to develop the next motion-capture method for the next blockbuster movie. Or maybe you want to major in character animation and minor in motion graphics so that you will gain experience in both character and non-character narrative animation. The combinations are nearly infinite when you consider all the animated media being used in so many specialized areas.

In an animation studio, many other people besides the animators contribute to the process. Writers and story artists help to construct the story. Background artists create the backgrounds. Audio engineers put together the audio tracks. Layout artists and scene planners help to plan out the animation so that the animators will know exactly what to do when they start their scenes. The animation industry offers many different types of jobs, and they all are rewarding.

If a career in animation interests you, now is the time to take the first step. After you have earned the Animation merit badge, don't stop. Keep animating and observing the world. Include animation in your daily activities and your homework. For a report in social studies class about supply and demand, for example, you might create an animation that shows the nationwide demand for strawberries. Be creative!

Many schools are using animation to improve the quality of education. Read more at toonboom.com/education/k-12.

SCAD: The Savannah College of Art and Design

Animation is an essential part of the film and entertainment industry, as evidenced by the 2-D animation of programs on the Cartoon Network, the 3-D animation of Oscar-winning features like Disney's *Frozen* (2013), and the motion-capture animation of films like *The Adventures of Tintin* (2011).



The Animation building at the Savannah, Georgia, campus of the Savannah College of Art and Design showcases student animations over the building's front entrance. SCAD also has locations in Atlanta, Georgia; Hong Kong; at Lacoste, France; and online through eLearning.

Animation students at the Savannah College of Art and Design (SCAD) learn to employ their craft in film, television, interactive media, and video games. They explore new ways to create believable worlds and to tell tales that reach across generations, cultures, and continents. SCAD has a diverse student body representing more than 100 countries. Alumni are employed throughout the animation industry, working for such companies as Disney, DreamWorks, Pixar, Blue Sky, 20th Century Fox, Cartoon Network, and Nickelodeon. Visit scad.edu for more information.



Visiting a local art school like the Savannah College of Art and Design is a great way to learn more about a fun and exciting career in animation.




Wacom



Glossary

animatic. A preliminary version or simplified mock-up.

animation. A simulation of movement created by displaying a series of pictures, or frames, in rapid succession.

armature. A metal skeleton inside a stop-motion puppet.

background. The part of the scene that is farthest to the rear; the artwork upon which the animation takes place.

breakdown. Intermediate drawing between the key drawings.

cel, cell (celluloid). A transparent sheet upon which traditional animation was inked and painted before being photographed. The picture's outline was drawn on the front of the animation cel, then colored on the back.

CGI (computer-generated imagery). Images created or manipulated with the aid of a computer.

cleanup. Tracing a clean line over a rough drawing to create a final drawing that can be inked, painted, and photographed.

compositing. Combining multiple levels or layers of artwork into a single image.

frame. A single photographic image in an animated movie. One second of film contains 24 frames.

in-betweens. The drawings that are between the key poses. In-betweens are drawn to create smooth transitions between key poses.

key poses. The main drawings in an animation sequence. Key poses establish important positions in the action, defining the starting and ending points of motions.

lip-sync. The process of matching a character's mouth to the dialogue. The mouth is adjusted frame by frame to match the sound of the dialogue and to create the illusion that the character is speaking.

mesh. A 3-D outline of an object.

model sheet. A collection of drawings that show animators how a character is supposed to be drawn.

motion capture. The process of recording the movements of a live actor and converting them into digital data that can then drive a computer-generated character. Also known as performance capture.

overlay. A part of the scene environment, such as a chair or a bush, placed in front of the main animation.

pose to pose. The technique of first doing the key drawings at significant points in the action, and then doing the in-between drawings.

rigging. Giving an underlying skeleton to the computer model of an animated character so that the character's body parts are attached to one another, allowing the animator to manipulate them. After the character model is rigged, the model's body parts will move in correct relation to one another.

rotoscoping. Tracing over live-action film movement, frame by frame, to create an animated sequence.

scene planning. Working out how the characters, backgrounds, and effects will be combined and how the animations will move.

slow in. The gradual acceleration of the action in an animation.

slow out. The gradual deceleration of the action in an animation.

storyboard. A visual plan of the scenes in an animation, indicating what will happen and when it will happen.

straight-ahead action. The technique of drawing or animating an entire sequence, in order, from the first position to the last.

thumbnail. A small image used as a reference or an indicator.

timeline. A horizontal representation of a scene's elements, timing, and key poses.

timing. The speed of an action; how slow or how fast an object or a character moves.



Animation Resources

With your parent or guardian's permission, visit Scouting America's official retail site, **scoutshop.org**, for a complete list of merit badge pamphlets and other helpful Scouting materials and supplies.

Scouting Literature

Art, Communication, Digital Technology, Drafting, Graphic Arts, Model Design and Building, Moviemaking, Photography, Programming, Robotics, and *Theater* merit badge pamphlets

Books

Bancroft, Tom. *Animator: The Coolest Jobs on the Planet.* Raintree, 2014.

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Online Resources

Animation merit badge
scoutlife.org/Animation

Adobe Animate Software
adobe.com

Animaker
animaker.com

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MERIT BADGE LIBRARY

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Always check scouting.org for the latest merit badge requirements. If a Scout has already started working on a merit badge when new requirements for that merit badge are introduced, *they may continue to use the same pamphlet to earn the badge and fulfill the requirements therein.* In other words, the Scout need not start over again with the revised requirements.

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