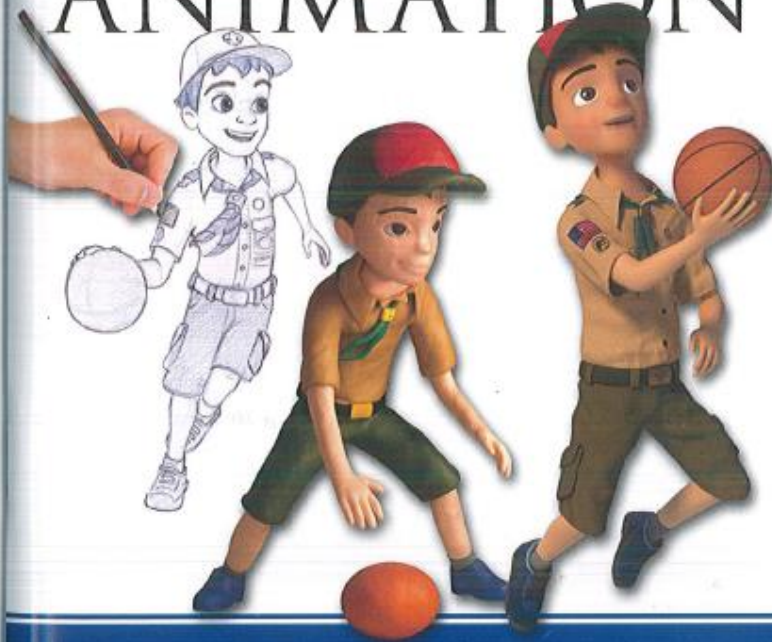


MERIT BADGE SERIES



ANIMATION



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.

At the online resource for this badge (<http://www.boyslife.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, including augmented reality (see sidebar). 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.

This *Animation* merit badge pamphlet is also among the first to be offered as a digital publication, incorporating interactive media.

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.



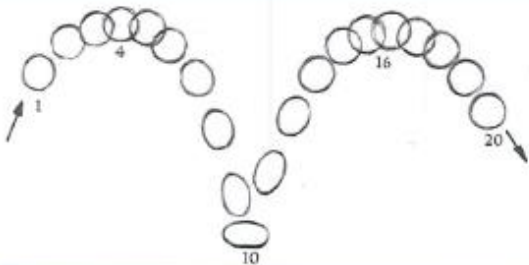
Original patch artwork



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.



Augmented Reality

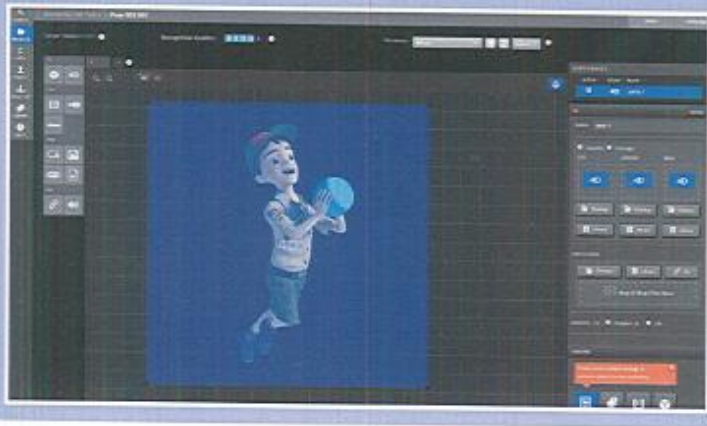
A special app has been created to enhance the content of the *Animation* merit badge pamphlet with videos, animations, and interactive images. This augmented reality or “AR” app goes live early in 2015. You can download it for your smartphone or tablet and watch as the pages of this book jump to life.

Make print come alive!

Scouting 4D

Try AR—Augmented Reality:

1. With your parent’s permission, go to the App Store, download the free Scouting 4D app, and install it on your phone or tablet.
2. Place your device over the active pages in the *Animation* merit badge pamphlet. To discover which pages are active with extras, see www.boyslife.org/Animation for the most up-to-date listing.



DAORI created an amazing app utilizing augmented reality for the *Robotics* merit badge pamphlet. As the user scrolls over the cover and other select pages, special effects make the book come to life.

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 3b.)



Requirements

1. General knowledge. Do the following:
 - a. In your own words, describe to your counselor what animation is.
 - b. Discuss with your counselor a brief history of animation.
2. Principles of animation. Choose five of the following 12 principles of animation, and discuss how each one makes an animation appear more believable: squash and stretch, anticipation, staging, straight-ahead action and pose to pose, follow through and overlapping action, slow in and slow out, arcs, secondary action, timing, exaggeration, solid drawing, appeal.
3. Projects. With your counselor's approval, choose two animation techniques and do the following for each:
 - a. Plan your animation using thumbnail sketches and/or layout drawings.
 - b. Create the animation.
 - c. Share your animations with your counselor. Explain how you created each one, and discuss any improvements that could be made.
4. Animation in our world. Do the following:
 - a. Tour an animation studio or a business where animation is used, either in person, via video, or via the Internet. Share what you have learned with your counselor.
 - b. Discuss with your counselor how animation might be used in the future to make your life more enjoyable and productive.
5. Careers. Learn about three career opportunities in animation. Pick one and find out about the education, training, and experience required for this profession. Discuss your findings with your counselor. Explain why this profession might interest you.

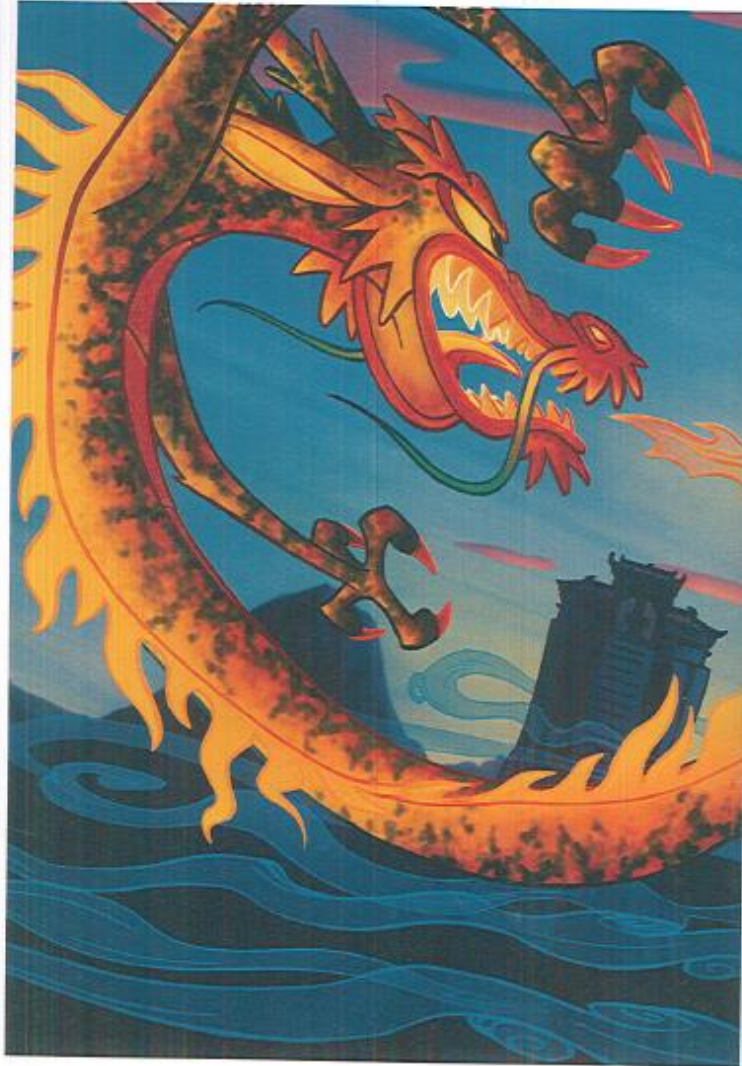




Contents

What Is Animation?	13
History of Animation	19
Principles of Animation	33
Scene Planning	41
2-D Animation	55
3-D Animation	61
Stop-Motion Animation	71
Mixed Media and Experimental Animation	79
Careers and Education	83
Glossary	92
Animation Resources	94





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.

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 methods as you work on the Animation merit badge requirements.

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, especially for Scouting events. 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 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.

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.

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 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.



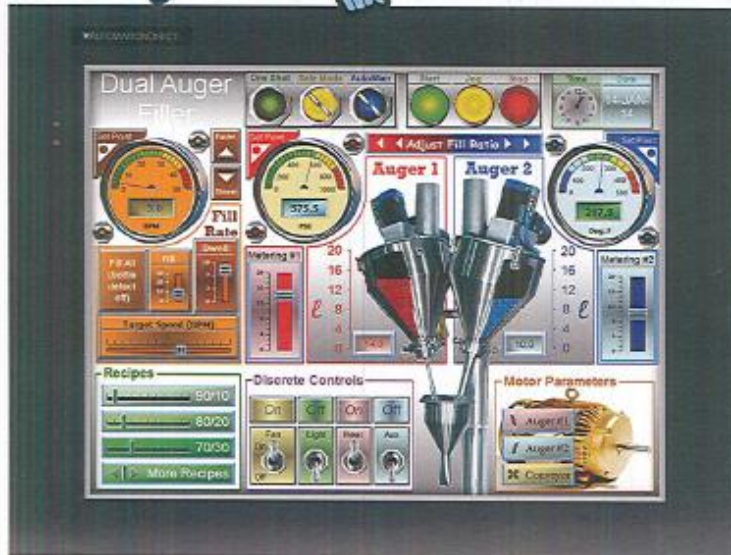
In animation, a frame is an individual picture in a series of images. A sequence of frames makes the animation.





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 merit badge 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.



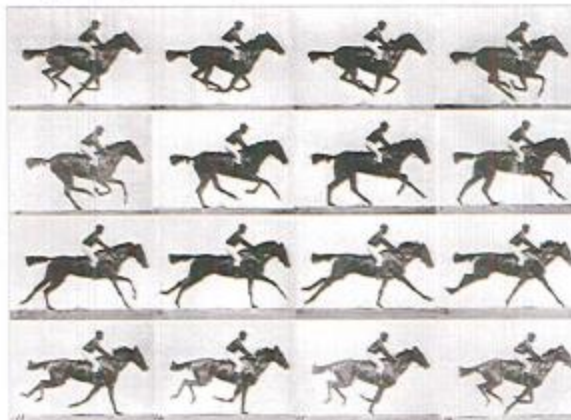
In 1877, the zoetrope was improved upon by replacing the slits with mirrors positioned in the middle of the drum. Called a praxinoscope, the device had many different designs, but all used sets of mirrors rather than slits.



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.



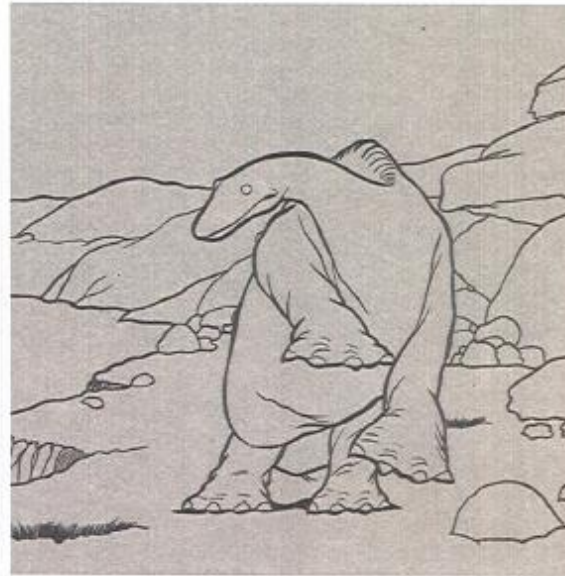
Animated Films

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.

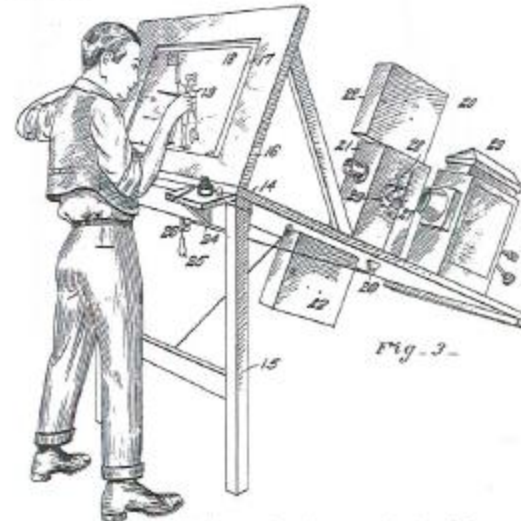
King Kong came out only a few years after the end of the silent film era. When people saw it, they were amazed by what they were seeing because the animated creatures seemed so lifelike.



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



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

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.

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 7 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.

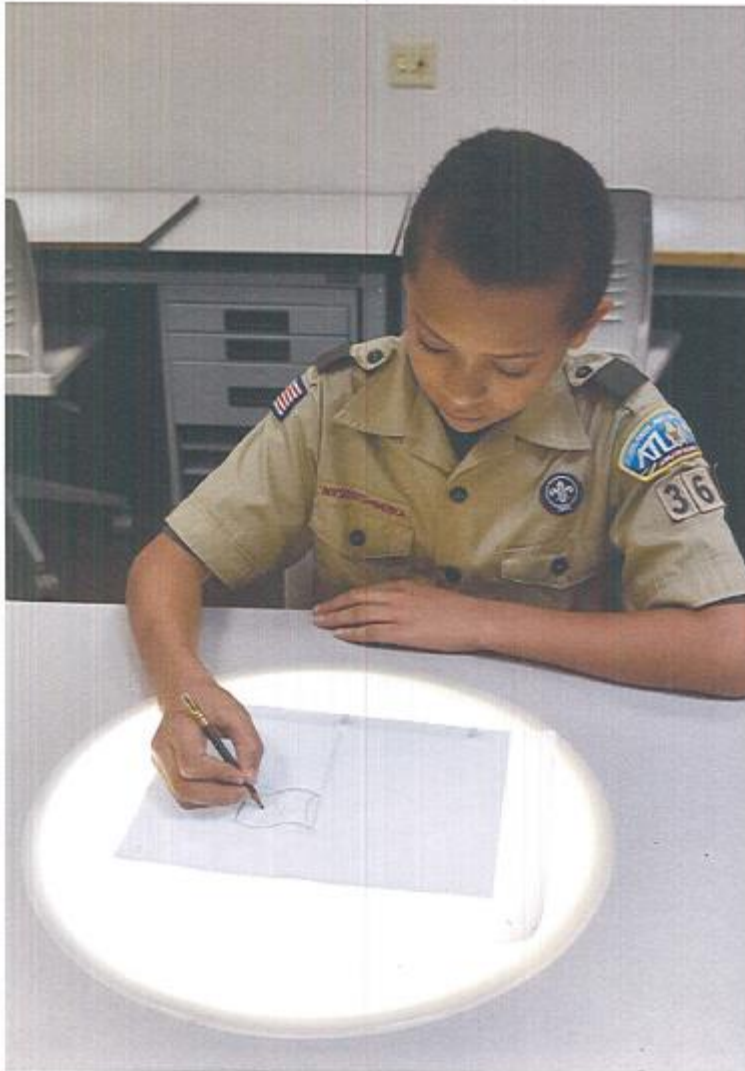
In 2001, New Zealand animator/filmmaker Peter Jackson released the first in the *Lord of the Rings* trilogy of films. The special effects company Weta Digital created the first successful digital actor with the character Gollum (Smeagol), who was created using motion capture. In *motion capture*, an 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.



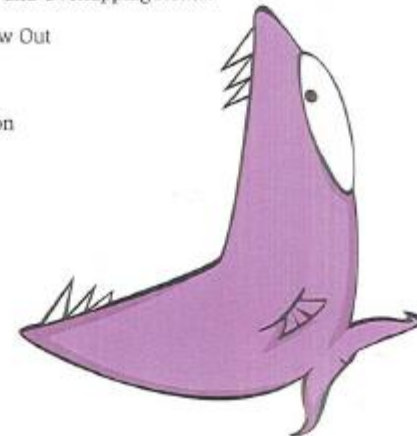


Principles of Animation

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



1



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; he must first wind back his 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 they do 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.

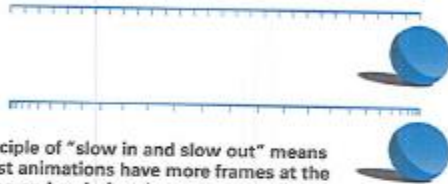
Follow Through and Overlapping Action

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 swings his arm, his 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 person clapping his hands while running—the running is the main action, while the clapping is secondary.



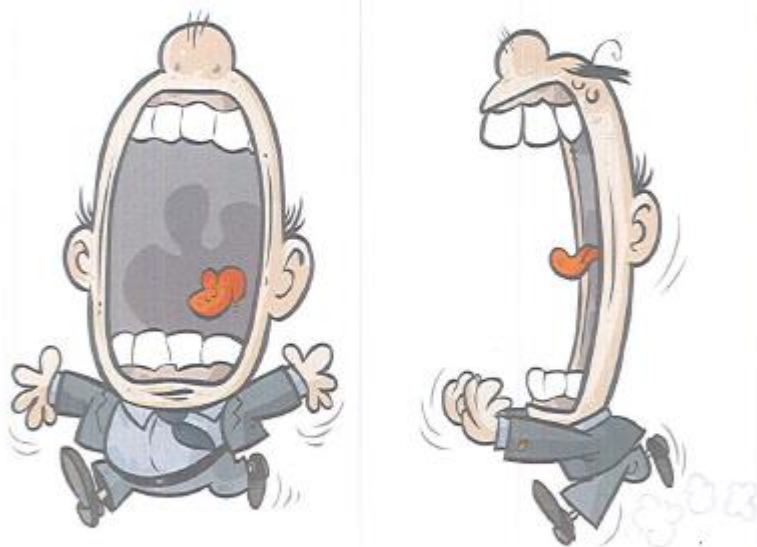
Timing

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

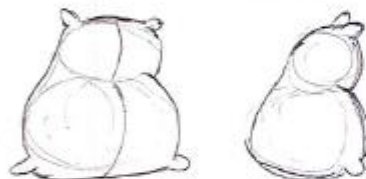
Exaggeration means to overemphasize a movement. This technique was developed in the early days of film animation to give more life to animated characters. In general, the less a character has human proportions, the more exaggeration is put into the animation. For example, if a realistically drawn character 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.

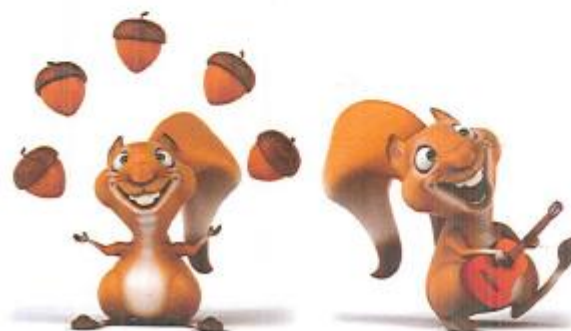
Character sheets—pages with the character drawn from several different angles and poses—have traditionally been useful for animating characters with 3-D form. Modern-day computer animators, however, do not have to draw as much because the models they animate are rendered in three-dimensional space.

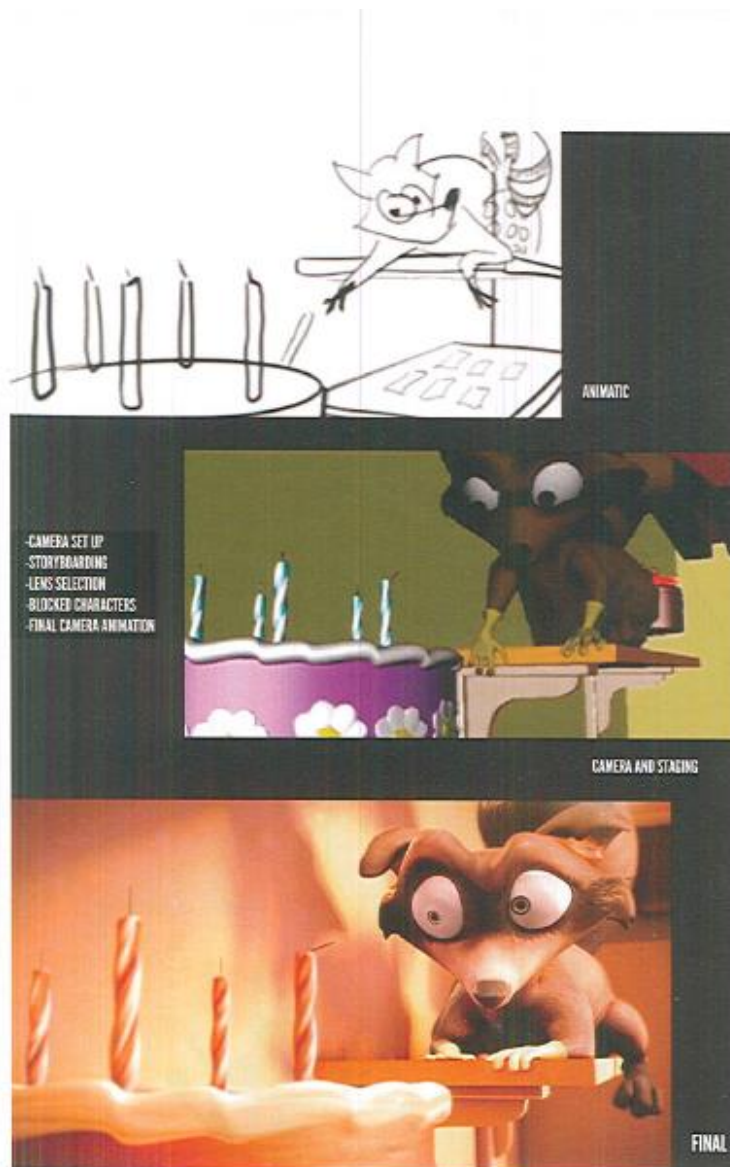


"Solid drawing" is the idea that the subject matter is a three-dimensional object and is to be drawn with weight and volume.

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.





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 he is trying to do. You should know what the character's personality is and how he would properly act in a certain situation.

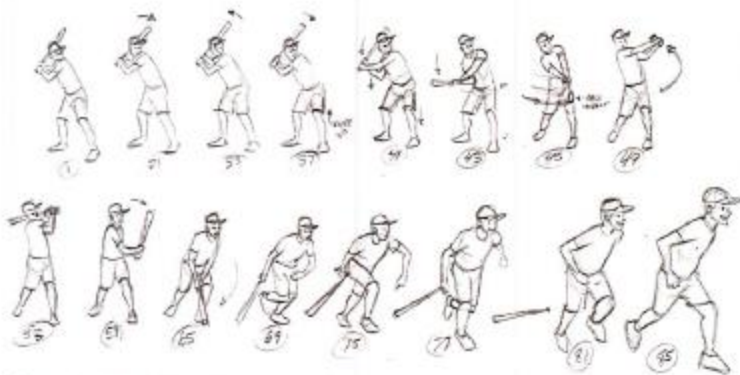
Whatever animation method you intend to use, create some type of guide so you know how far to move your character. For all of these examples, make sure you know how long the scene will last.



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.

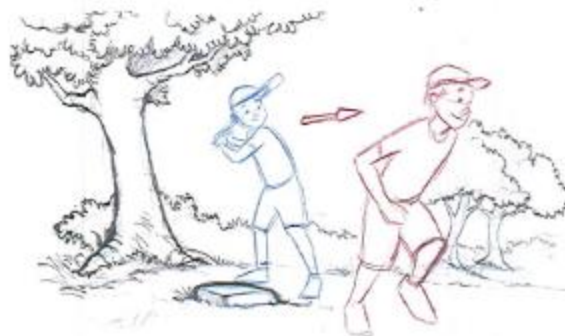


A thumbnail sketch is a tiny drawing about the size of a person's thumb.

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 drawings of Ethan 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 feet as he is walking.

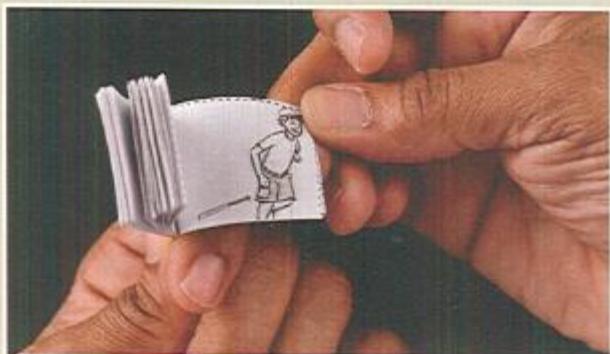
The same process is used in three-dimensional (3-D) animation. Using a character model, create the key poses that will be needed to guide you as you animate in the computer.

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 www.boyslife.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 4.



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 www.boyslife.org/Animation.

