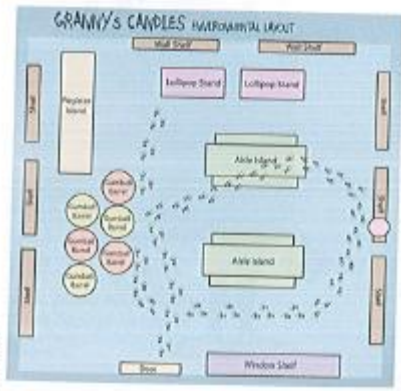
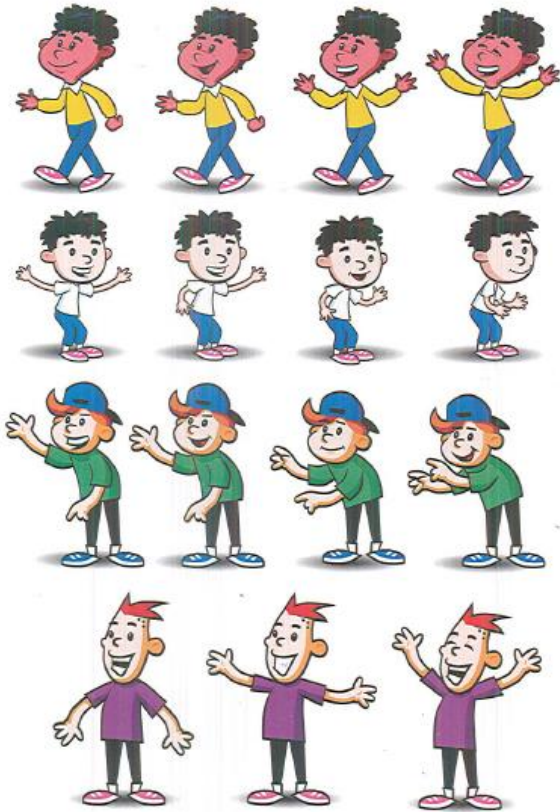


This storyboard from a short film, *Baxter*, by Ty Coyle shows how the animated character moves through the scene and how it interacts with the environment.



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.

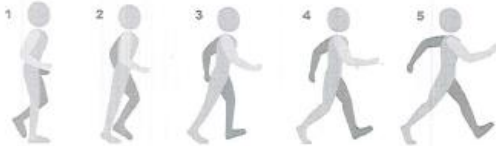
Key animators create key drawings that represent the movement of a character within a scene. Each key animator works with an assistant or cleanup artist.

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 it looks the same throughout the film. Model sheets are created as examples of the way a character may look with various expressions or body movements.

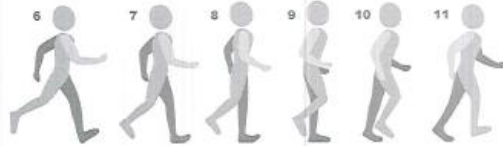


Animators must be able to work out the timing and the spacing of the action. Often they act out the motion on their own, sometimes filming themselves as a reference and using a stopwatch to figure out how long the action takes.

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 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.

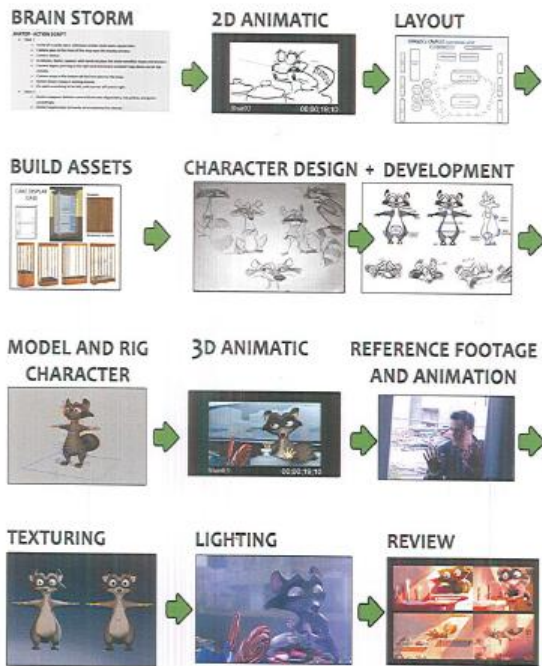
Animation Software

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.





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.

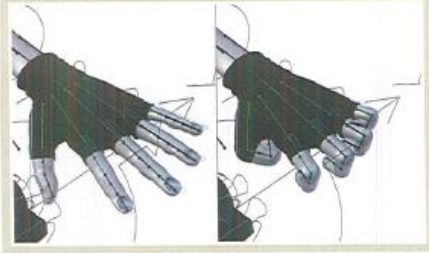
Animating in 3-D is similar to animating in stop motion (see the next section of this pamphlet), but the computer software helps a great deal. In stop motion, you must painstakingly pose the character for every frame of the video.



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 Side Effects Software, MODO[®] by The Foundry, and Blender,[™] among others.

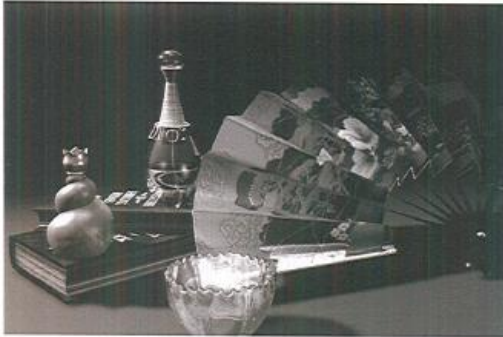
Blender[™] is an open-source computer application that you can use to create professional-quality 3-D animations. Some of the examples in this pamphlet were created using Blender. The software is free for personal and commercial use. To download it (with your parent's permission), go to <http://www.blender.org>. 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."

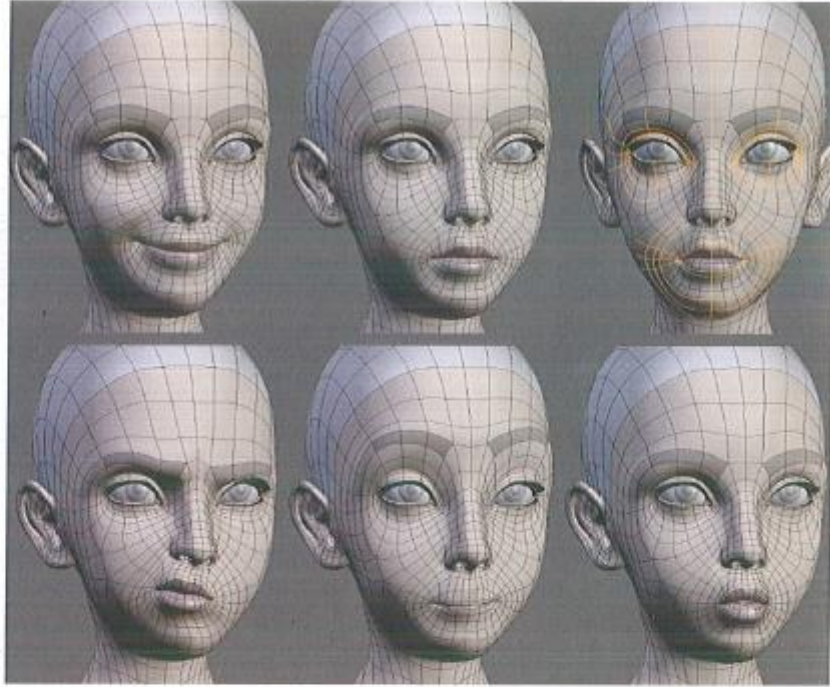


This image is from "Tears of Steel," an open-source project from the Blender Foundation. Combining a computer-generated 3-D environment and live-action content is called compositing. Compositing can be done in Blender™, the free, open-source 3-D software available at Blender.org.

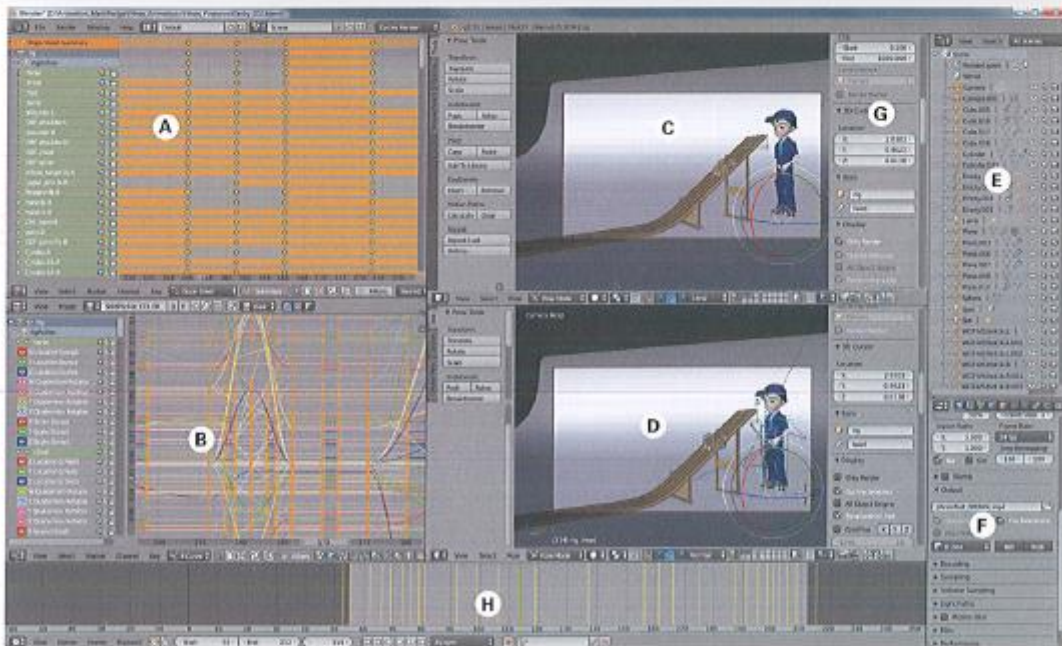


This image is from "Big Buck Bunny," an open-source project from the Blender Foundation. You can tell exactly how each character feels simply by looking at their expressions and body language. The image was created using the Blender™ 3-D program.

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 Cub Scout mascot "Ethan" 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. (A) Dope sheet, (B) Graph editor, (C) 3-D view with controls turned off, (D) 3-D view, (E) Outliner, (F) Render settings, (G) Properties panel, (H) 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).

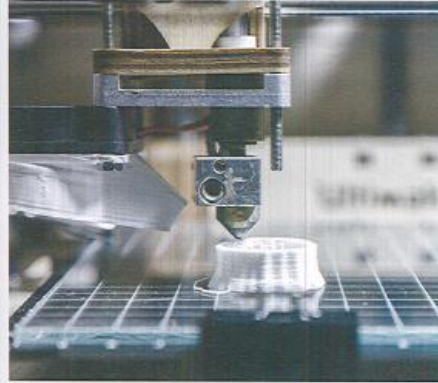


Clay animation, or *claymation*, is just one form of stop-motion animation. Animators form the characters—and sometimes the background—with clay, usually surrounding a wire armature for more stability. Claymation is a painstaking process.

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.



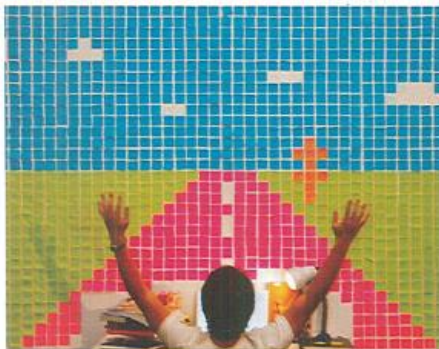
A 3-D printer can "print" three-dimensional objects of almost any shape by setting down layers of a plastic material.

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 www.boyslife.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 through 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 through 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 BSA 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 his 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 *Roster's Home for Imaginary Friends*. Experiencing or even being around these different types of media, styles, and disciplines gives 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 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 the animators 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 <http://www.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).

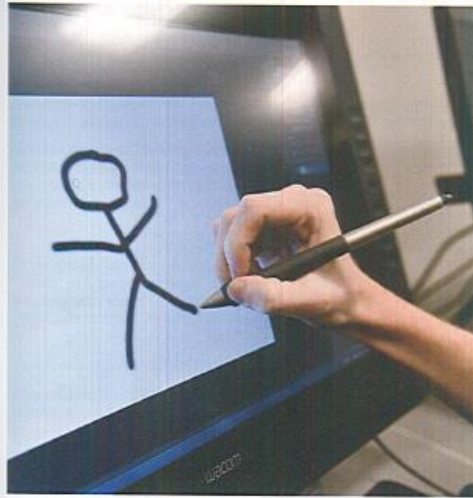


The Animation building at the Savannah, Georgia, campus of the Savannah College of Art and Design showcases student animations over the building's front entrance. SCAD also has locations in Atlanta, Georgia; Hong Kong; at Lacoste, France; and online through eLearning.

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 <http://www.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.





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.

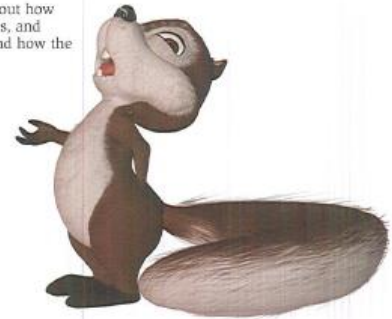
storyboard. A visual plan of the scenes in an animation, indicating what will happen and when it will happen.

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

Visit the Boy Scouts of America's official retail website (with your parent's permission) at <http://www.scoutstuff.org> for a complete listing of all 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*. Rainree, 2014.

———. *Creating Characters With Personality: For Film, TV, Animation, Video Games, and Graphic Novels*. Watson-Guptill, 2006.

Blair, Preston. *Animation 1: Learn to Animate Cartoons Step by Step*. Walter Foster Publishing, 2003.

———. *Cartoon Animation*. Walter Foster Publishing, 1994.

Goldberg, Eric. *Character Animation Crash Course!* Silman-James Press, 2008.

Johnston, Ollie, and Frank Thomas. *The Illusion of Life: Disney Animation*, 3rd edition. Disney Editions, 1995.

Stanchfield, Walt. *Drawn to Life: 20 Golden Years of Disney Master Classes*, volumes 1 and 2. Focal Press, 2009.

Williams, Richard. *The Animator's Survival Kit: A Manual of Methods, Principles and Formulas for Classical, Computer, Games, Stop Motion and Internet Animators*, 4th ed. Faber & Faber, 2012.

Online Resources

Animation merit badge

Website: <http://www.boyslife.org/Animation>

Blender Foundation

Website: <http://www.blender.org>

DAQRI 4D Studio

Website: <http://daqri.com>

Ryan Woodward Art & Animation

"Advice for Parents With Artistic Children" Website: <http://ryanwoodwardart.com/info/advice-for-parents-with-artistic-children/>

Be on the lookout for the enhanced digital version of this *Animation* merit badge pamphlet to be unveiled sometime in 2015.

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