

Tutorial #11

Prepared by Gustavo Carneiro

This tutorial was based on the Notes by P. Coleman, on the web-page <http://www.comet-cartoons.com/toons/3ddocs/charanim/>, and on the paper “**Principles of Traditional Animation Applied to 3D Computer Animation**”. By J. Lasseter, Pixar, San Rafael, California. In ACM Computer Graphics (21), 4, July 1987.

The Fundamental Principles of Animation

It all started after the 30s when Walt Disney noticed that the level of animation was inadequate for some new story lines. Classes for his animators were set up under the instruction of Don Graham. Before those classes, the animations were made with little or no reference to nature. Out of these classes grew a new way of drawing moving human figures and animals, where the analysis of real action became important to the development of animation. After a while, each technique was named and they became known as the fundamental principles of animation.

Ultimately, the animator must have a sense of what makes an inanimate character alive.

The principles are:

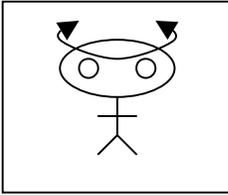
1. Timing
2. Ease In and Out (or Slow In and Out)
3. Arcs
4. Anticipation
5. Exaggeration
6. Squash and Stretch
7. Secondary Action
8. Follow Through and Overlapping Action
9. Straight Ahead Action and Pose-To-Pose Action
10. Staging
11. Appeal
12. Personality

Simply memorizing these principles isn't the point. No one will care whether or not you know this list. It's whether or not you truly understand and can utilize these ideas that matter. If you do, it will show automatically in your work.

1. Timing

Timing is the essence of animation. The speed at which something moves gives a sense of what the object is, the weight of an object, and why it is moving. Something like an eye blink can be fast or slow. If it's fast, a character will seem alert and awake. If it's slow the character may seem tired and lethargic.

J. Lasseter's example. Head that turns left and right.



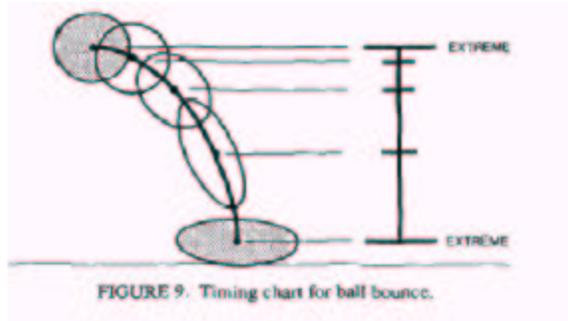
- Head turns back and forth really slow: it may seem as if the character is stretching his neck (lots of in between frames).
- A bit faster it can be seen as saying "no" (a few in between frames)
- Really fast, and the character is reacting to getting hit by a baseball bat (almost none in between frames).

2. Ease In and Out (or Slow In and Out)

Ease in and out has to do with gradually causing an object to accelerate, or come to rest, from a pose. An object or limb may slow down as it approaches a pose (Ease In) or gradually start to move from rest (Ease Out).

For example, a bouncing ball tends to have a lot of ease in and out when at the top of its bounce. As it goes up, gravity affects it and slows down (Ease In), then it starts its downward motion more and more rapidly (Ease Out), until it hits the ground.

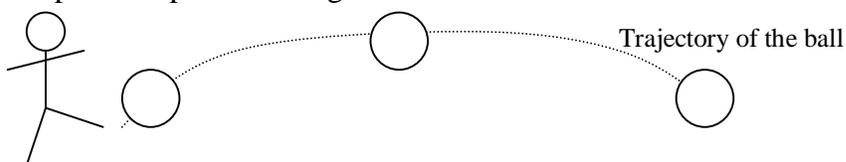
Note that this doesn't mean slow movement. This really means keep the in between frames close to each extreme.



3. Arcs

In the real world almost all action moves in an arc. When creating animation one should try to have motion follow curved paths rather than linear ones. It is very seldom that a character or part of a character moves in a straight line. Even gross body movements when you walk somewhere tend not be perfectly straight. When a hand/arm reaches out to reach something, it tends to move in an arc.

Simple example – Kicking a ball



4. Anticipation

Action in animation usually occurs in three sections. The setup for the motion, the actual action and then follow-through of the action. The first part is known as anticipation. In some cases anticipation is needed physically. For example, before you can throw a ball you must first swing your arm backwards. The backwards motion is the anticipation, the throw itself is the motion.

Anticipation is used to lead the viewers eye to prepare them for the action that follows. Longer period of anticipation is needed for faster actions. Example, a character zips off screen leaving a puff of smoke. Usually just before the zip, there is a pose where the characters raises a leg and bends both arms as if he's about to run. That's the anticipation pose for the off screen run.

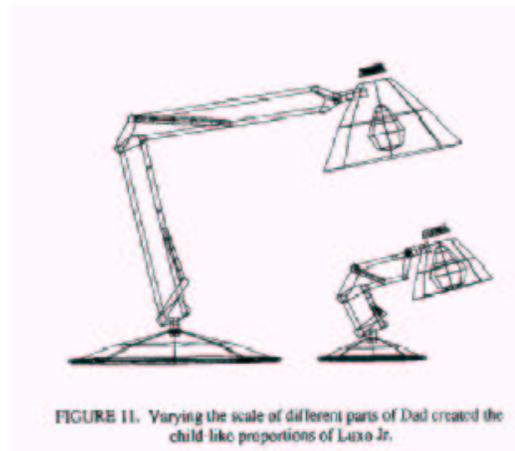
Generally, for good clear animation, the viewer should know what is about happen (anticipation), what is happening (the actual action itself) and what happened (related to follow through).

5. Exaggeration

Exaggeration is used to accent an action. It should be used in a careful and balanced manner, not arbitrarily. Figure out what the desired goal of an action or sequence is and what sections need to be exaggerated. The result will be that the animation will seem more realistic and entertaining.

One can exaggerate motions, for example an arm may move just a bit too far briefly in an extreme swing. Generally when animating to dialogue, one listens to the track and picks out areas that sound like they have more stress or importance, and then tends to exaggerate poses and motions that fall at those times.

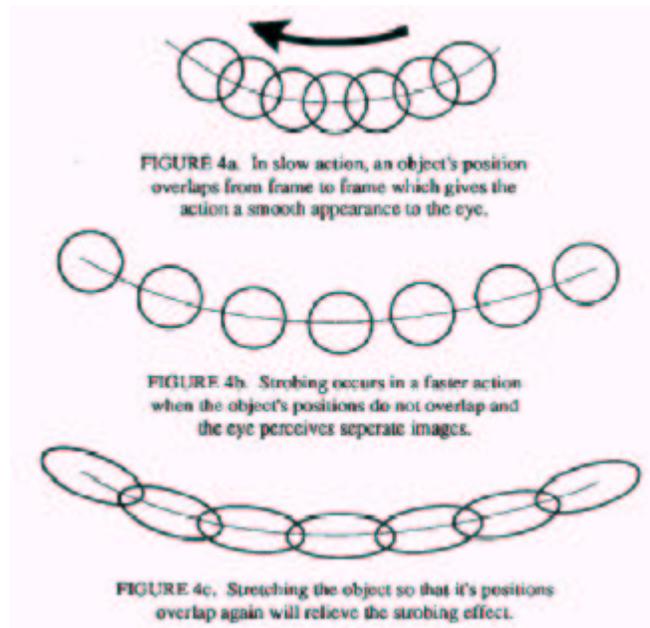
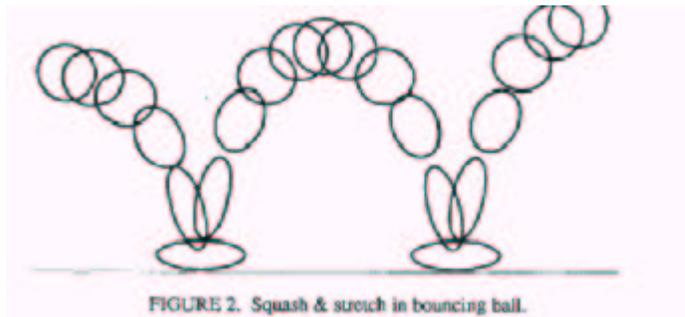
The key is to take something and make it more extreme in order to give it more life, but not so much that it destroys believability. Example: exaggerating the lamp proportions to give a sense of dad and son.



6. Squash and Stretch

Squash and stretch is a way of deforming an object such that it shows how rigid the object is. For example if a rubber ball bounces and hits the ground it will tend to flatten when it hits. This is the squash principle. As it starts to bounce up it will stretch in the direction it is going. Squash and Stretch was also initially done to prevent strobing due to lack of motion blur.

An important note about squash and stretch, is that no matter how an object deforms, it should still appear to retain its volume. The most obvious usage in character animation is muscles. When a muscle is contracted it will squash and when extended, it stretches. Rigid objects can still squash and stretch in a way. Think of the lamps above. The lamp itself is a rigid metal object. But before it jumps it anticipates the action by crouching down and bending. That bending is basically squash and stretch.



7. Secondary Action

Secondary action creates interest and realism in animation. It should be staged such that it can be noticed but still not overpower the main action. A good example of this is a character at a table acting and delivering their main acting. A side piece of acting business might be the character thumbing their fingers on the table. This isn't the main action say, perhaps it occurs as the other hand is more largely gesturing and your focus is on the face.

But it is something that the character is doing/acting that adds a more realistic and natural feel to the animation. As mentioned, it must be staged so that the main action isn't overpowered. It's the kind of thing that is usually more subtle or can be felt more than noticed immediately.

8. Follow Through and Overlapping Action

Follow Through is the same as anticipation, only at the end of an action. It is usually animated as something goes past its resting point and then coming back to where it would normally be. For example, in throwing a ball, you put your hand back, that's anticipation, it's the preparation for the throwing action itself. Then you throw the arm comes forward for the main action. Follow Through is then the arm continuing past the normal stopping point, overshooting it and then coming back. The arm has continued or "followed through" on the action it was doing before returning back to rest.

Overlapping Action is an action that occurs because of another action. For example if a dog is running and suddenly comes to a stop, its ears will probably still keep moving for a bit. Another example, if an alien is walking and it has an antenna on it, the antenna will probably sway as a result of the main body motion. This is overlapping action. It is caused because of the main motion and overlaps on top of the main motion.

9. Straight Ahead Action and Pose-To-Pose Action

There are 2 basic methods to creating animation. Straight ahead animation is one where the animator draws or sets up objects one frame at a time in order. For example, the animator draws the first frame of the animation, then draws the second, and so on until the sequence is complete. In this way, there is one drawing or image per frame that the animator has setup. This approach tends to yield a more creative and fresh look but can be difficult to time correctly and tweak.

The other approach is Pose-To-Pose animation. Pose to Pose is created by drawing or setting up key poses and then drawing or creating inbetween images. This is the basic computer "keyframe" approach to animation. It is excellent for tweaking timing and planning out the animation ahead of time. You figure out the key poses, and then the motion inbetween is generated from that. This is very useful when specific timing or action must occur at specific points. You always know exactly what will happen.

The basic difference is with Pose-To-Pose you plan out, and know exactly what will happen ahead of time, whereas with Straight Ahead, you're not quite sure how things will turn out until you are done. With computers, some people tend to create a hybrid of the two, planning out the overall poses, and then straight ahead animating the stuff inbetween.

10. Staging

Staging is presenting an action or item so that it is easily understood. An action is staged so that it is understood; a personality is staged so that it is recognizable; an expression so that it can be seen; a mood so that it will affect the audience.

In general, it is important that action is presented one item at a time. If too much is going on the audience will be unsure what to look at and the action will be "upstaged".

With characters, it is important to really think about whether or not each pose for an action adequately and correctly reads to the audience. You should also make sure no two parts of a character contradict each other (unless it's intended). For example if you're staging a sad pose you may have the character hunched over with his arms hanging at his sides and a high camera angle...but if you give him this big grin on his face it won't fit with the rest of the pose.

Staging multiple characters is also an important issue. Generally you want to always make sure you know where the audience is looking within the shot. Background characters must be animated such that they are still "alive", but not so much that they steal the viewer's attention from the main action. Staging like this is also related to a lot of directing and editing principles.

11. Appeal

Appeal means anything that a person likes to see. This can be quality of charm, design, simplicity, communication or magnetism. Appeal can be gained by correctly utilizing other principles such as exaggeration in design, avoiding symmetry, using overlapping action, and others. One should strive to avoid weak or awkward design, shapes and motion. It's important to note that appeal doesn't necessarily mean good vs. evil. For example, in Disney's animated classic "Peter Pan", Captain Hook is an evil character, but most people would agree that his character and design has appeal. The same goes for Hopper in "A Bug's Life". Even though he's mean and nasty, his design and characterization/personality still has a lot of appeal.

12. Personality

This word isn't actually a true principle of animation, but refers to the correct application of the other principles. Personality determines the success of an animation. The idea is that the animated creature really becomes alive and enters the true character of the role. One character would not perform an action the same way in two different emotional states. No two characters would act the same. It is also important to make the personality of a character distinct, but at the same time be familiar to the audience.

Personality has a lot to do with what is going on in the mind of the character, as well as the traits and mannerisms of the character. It is helpful to have some background in acting, and certainly taking an acting or improve class as an animator is a good idea.

What Character Animation Isn't

Character animation is about an artist bringing a character to life. It isn't rotoscoping or blindly copying motion. It isn't using raw motion capture or other automated techniques to make something simply move. In much the same way tracing isn't really drawing, animation requires the artist to interpret and create something that is more than the original. The above principles are the foundation upon which good character animation lies. With practice, patience and perseverance ones animation skills will improve.