Lecture 11: Principles of Animation

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Acknowledgement: “PRINCIPLES OF TRADITIONAL ANIMATION APPLIED TO 3D COMPUTER ANIMATION” by John Lasseter et al.
History

• It all started after the 30s when Walt Disney noticed that the level of animation was inadequate (little or no reference to nature).
• Classes for his animators were set up.
• A new way of drawing moving human figures and animals was then created (analysis of real action: models in motion and live action film).
• Named and known as the fundamental principles of animation
History

- **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.
What Character Animation Isn’t

• Character animation is about an artist bringing a character to life. It isn't blindly copying motion.

• Animation requires the artist to interpret and create something that is more than the original.

• The following principles are the foundation upon which good character animation lies.

• With practice, patience and perseverance one’s animation skills will improve.
Principles of Animation

• The principles are:
  – Timing
  – Ease In and Out (or Slow In and Out)
  – Arcs
  – Anticipation
  – Exaggeration
  – Squash and Stretch
  – Secondary Action
  – Follow Through and Overlapping Action
  – Straight Ahead Action and Pose-To-Pose Action
  – Staging
  – Appeal
  – Personality
Principle 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.
- Example: an eye blink can be fast or slow.
Principle 1: Timing

• J. Lesseter’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).
 Principle 2: Ease In and Out (or Slow In and Out)

- Has to do with gradually causing an object to accelerate, or come to rest, from a pose.
- A limb may slow down as it approaches a pose (Ease In) or gradually start to move from rest (Ease Out).
Principle 2: Ease In and Out (or Slow In and Out)

- Another 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.

FIGURE 9. Timing chart for ball bounce.
Principle 3: Arcs

- In the real world almost all action moves in an arc.
- Even gross body movements when you walk somewhere tend not to be perfectly straight.
- Gross body movements while walking and hand/arm reaching out.
- An example – Kicking a ball.

![Diagram of kicking a ball showing the trajectory of the ball]
• When creating animation one should try
• to have motion follow curved paths rather than linear ones.
Principle 4: Anticipation

• Action in animation usually occurs in three sections.

  ![Diagram](image)

  - Anticipation
  - Action
  - Follow Through

• 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.
Principle 4: Anticipation

• 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.

• Example,
  http://www.phong.com/tutorials/flash/animation/
Principle 5: Exaggeration

- Exaggeration is used to accent an action and make it more realistic and entertaining.
- One can exaggerate motions, for example an arm may move just a bit too far briefly in an extreme swing.
- 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.

FIGURE 11. Varying the scale of different parts of Dad created the child-like proportions of Luxo Jr.
Principle 6: Squash & Stretch

• Squash and stretch is a way of deforming an object such that it shows how rigid the object is.

• 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.

• Another example: if a rubber ball bounces and hits the ground it will tend to flatten when it hits (squash principle). As it starts to bounce up it will stretch in the direction it is going.
Principle 7: Secondary 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.

• Secondary action creates interest and realism in animation.

• Noticed but still not overpower the main action (Facial expression).
Principle 8: Follow Through and Overlapping Action

- Follow Through is termination 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. 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.
  - Another Example: http://www.phong.com/tutorials/flash/animation/
Principle 8: Follow Through and Overlapping Action

- Antenna, stinger, and feet in zip off animation
Principle 8: Follow Through and Overlapping Action

• Overlapping action: an action should never be brought to a complete stop before starting another action, and the second action should overlap the first.

• Overlapping maintains a continual flow and continuity between whole phrases of actions.
Principle 9: Straight Ahead Action and Pose-To-Pose Action

- **Straight ahead animation**
  - is one where the animator draws or sets up objects one frame at a time in order.
  - this approach tends to yield a more creative and fresh look but can be difficult to time correctly and tweak.
  - you’re not quite sure how things will turn out until you are done

- **Pose-To-Pose animation**
  - is created by setting up key poses and then drawing or creating in-between images.
  - it is excellent for tweaking timing and planning out the animation ahead of time.
  - this is very useful when specific timing or action must occur at specific points.
  - you always know exactly what will happen ahead of time,

- With computers, some people tend to create a hybrid of the two, planning out the overall poses, and then straight ahead animating the stuff in-between.
• For example, the animator
draws the first frame of the animation, then
draws the second, and so on until the sequence
• is complete.
Principle 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.

• 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.
Principle 10: Staging

• 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.
Principle 11: Appeal

- Appeal means anything that a person likes to see (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.
- 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.
Principle 12: Personality

• 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.
• 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.
• Distinct but familiar.
• One character would not perform an action the same way in two different emotional states. No two characters would act the same.
How many principles you could recognize in this animation?
• squash and stretch,
• anticipation,
• follow through,
• secondary action.