Animation Principles

Goal:

Make characters that move in a convincing way to communicate personality and mood.

Walt Disney developed a number of principles.

Computer graphics animators have adapted them to 3D animation.

Animation Principles

The following are a set of principles to keep in mind:

1. Squash and stretch
2. Staging
3. Timing
4. Anticipation
5. Follow through
6. Overlapping action
7. Secondary action
8. Straight−ahead vs. pose−to−pose vs. blocking
9. Slow in, slow out
10. Exaggeration
11. Appeal

We will consider each...

Squash and stretch

Squash: flatten an object or character by pressure or by its own power.

Stretch: used to increase the sense of speed and emphasize the squash by contrast.

Note: keep volume constant!

Staging

Present the idea so it is unmistakably clear.

Audience can only see one thing at a time.

Useful guide: stage actions in silhouette.

In dialogue, characters face 3/4 towards the camera, not right at each other.

Timing

An action generally consists of anticipation, the action, and the reaction. Don't dwell too long on any of these.

Timing also reflects the weight of an object:

– light objects move quickly
– heavier objects move more slowly

Timing can completely change the meaning of an action.

Anticipation

An action has three parts: anticipation, action, reaction.

Anatomical motivation: a muscle must extend before it can contract.

Prepares audience for action so they know what to expect.

Directs audience's attention.

Amount of anticipation can affect perception of speed or weight.

Follow through

Actions seldom come to an abrupt stop.

Overlapping action

One part intiates ("leads") the move. Others follow in turn.

Hip leads legs, but eyes often lead the head.

Loose parts move slower and drag behind.

Overlaps apply to intentions. Example: settling into the house at night.

- Close the door
- Lock the door
- Take off the coat
- etc...

Each action doesn’t come to a complete finish before the next starts.

Secondary action

An action that emphasizes the main point but is secondary to it.

Straight−ahead vs. pose−to−pose vs. blocking

Straight ahead: proceed from frame to frame without planning where you want to be in ten frames. Can be wild, spontaneous.

Pose−to−pose: Define keyframes and "inbetweens".

Blocking: Computer graphics animators adaptation

Start key−framing at the top of the hierarchy.
Refine level by level.
Keyframes for different parts need not happen at the same time.

Slow in and slow out

An extreme pose can be emphasized by slowing down as you get to it (and as you leave it).

Exaggeration

Get to the heart of the idea and emphasize it so the audience can see it.

Appeal

The character must interest the viewer.

It doesn't have to be cute and cuddly.

Design, simplicity, behavior all affect appeal.

Note: avoid perfect symmetries.

Example: Luxo, Jr. is made to appear childlike.

Frontiers in animation

Motion capture

- Making a realistic human body motion is hard
- Solutions
  - Computer vision using raw video footage
    - not accurate enough
  - Special sensors that give joint angles and/or positions
    - wires get in the way
  - Cover person with white or retroreflective targets like ping pong balls
    - Have to handle occlusions

Motion processing

- Motion data is often noisy –> filter it with smoothing filter
- Can apply a variety of filters
- "Re–targeting" motion is challenging

Frontiers in animation, cont'd

Facial animation

- Making realistic human facial animations is *really* hard
  - There were no good human facial animations in Toy Story
  - Geri's Game, on the other hand...

- Modeling the shape of a face
  - free form CAD design
  - laser scanner (0.5mm resolution)
  - photographs

- Designing the right set of controls
  - Muscle groups? Not necessarily...

- Can choose among a palette of expressions to make new ones

- Future input device: performance driven facial animation
  - animator makes faces
  - video camera watches
  - computer processes in real time
  - character's face comes to life
  - animators are actors!!

Frontiers in animation, cont'd

Controllable simulation

- Some effects are too difficult to model by hand. Examples:

- Can do simulation (both physical and non−physical)
  - Particle systems
  - Wind turbulence modeling
  - Mass−spring models
  - Rule−based behaviors

- The main problem: animator and director want to have some interactive control.
  - Example: insert cloth wrinkle here.
  - How do you merge this with the physical simulation without starting over?