Lecture 16: Principles of Animation

The term animation has a Greek (animos) as well as Roman (anima) root, meaning “to bring to life.”

Examples:
- Flip Books
- Stop Motion (Claymation)
- Traditional Hand Drawn Animation (Cel Animation)
- Computer-assisted Keyframing
- Motion Capture
- Simulation

Character Animation
- Traditional
  - Cell Animation, hand drawn, 2D
  - Lead Animator for keyframes

Character Animation
- Traditional, hand drawn animation
  - Lead Animator for keyframes and many secondary animators for the in-betweens
Character Animation

- Traditional, hand drawn animation
  - Keyframing @24fps – how many drawings for a 2 hour movie?

Principles of Animation


Principles of Animation

- Characters composed of living flesh do not move rigidly (muscle flex, skin sags, etc.)
- Preservation of volume is key
- Disney animators demonstrate it here with a half-filled bag of flour.

Principles of Animation

- Squash and Stretch
  - Weight is given to the ball using timing.
  - Add squash and stretch to further define the motion and show the speed of the ball:
  - A 2D representation of motion blur
  - Approximately maintain volume...but drastically change physical characteristics over time.

Principles of Animation

- Anticipation
  - Tell the audience what you are going to do before you do it.
  - Can be as simple as facial expressions or as broad as a body wind-up.
  - What is Donald about to do?
Principles of Animation

- Staging
  - A principle borrowed from the theatre stage.
  - Try to make actions to be clear in silhouettes.
  - Character posing and placing the camera is the key.

- Straight Ahead and Pose to Pose
  - Two ways to animate a scene.
  - Start with an idea in mind and draw all frames until done. Good for frantic motion such as a character jumping around in excitement.
  - Draw the key frames first. Fill in the in-betweens.

- Follow Through and Overlapping Action
  - Everything does not have to stop once a pose is reached.
  - The way the action is completed tells us a great deal about a character. In some sense this is the opposite of anticipation... tell the audience what happened!

- Slow In and Slow Out
  - Animator specifies the primary or key frames which are most important.
  - In order to stress these frames, move slowly away from one key frame, quickly in the in-between frames, and slowly into the next frame.
  - Most time is spent on/near the key frames.

- Arches
  - Motion in straight lines is often not organic.
  - Most human motion happens on curved trajectories or arcs.
Principles of Animation

- **Arcs**
  - Motion in straight lines is often not organic.
  - Most human motion happens on curved trajectories or arcs.

- **Timing**
  - The number of drawings determines the amount of time it takes on the screen.
  - No in-between: character hit with a huge force and his head is nearly snapped off
  - Two: nervous tic, muscle spasm
  - Five: Come on...hurry
  - Seven: tries to get a better look at something
  - Ten: stretches a sore neck

- **Exaggeration**
  - Exaggerate to make the action more believable.
  - Realism and believability are difficult to achieve.
  - Convey emotions.

- **Secondary Action**
  - Action aside from that of the primary character.
  - Must not distract the audience.

- **Solid Drawing and Appeal**
  - Characters are solid – have weight in the real world.
  - Appeal is what makes people want to look at a character.

How does all this lead to animation?
How about 3D Characters?

The same principles apply.

Character Animation

- A character in 3D is just like us.
- Inside they have a skeleton made up of rigid bones.
- Outside is a skin.

Character Animation

- A character in 3D is just like us.
- Inside they have a skeleton made up of rigid bones.
- Outside is a skin mesh.
Character Animation

- A character in 3D is just like us.
- Inside they have a skeleton made up of rigid bones.
- Outside is a skin mesh.
- The skin mesh can be very detailed — has additional elements to capture look of the character.

Character Animation

- A character in 3D is just like us.
- Inside they have a skeleton made up of rigid bones.
- Outside is a skin mesh.
- Parts of the skin are associated to the bones.

Character Animation

- A character in 3D is just like us.
- Inside they have a skeleton made up of rigid bones.
- Outside is a skin mesh.
- Parts of the skin are associated to the bones.
- We move the bones to move the skin.

Character Animation

- But how do we move the bones?
  - Manually
  - Mimic a performer