CS4620/5620: Lecture 29

Animation

What is animation?

- Modeling = specifying shape
- Animation = specifying shape as a function of time
  - Just modeling done once per frame?
  - Need smooth, concerted movement
- Controlling shape = the technical problem
- Using shape controls = the artistic problem

Approaches to animation

- Straight ahead
  - Draw/animate one frame at a time
  - Can lead to spontaneity, but is hard to get exactly what you want
- Pose-to-pose
  - Top-down process:
    - Plan shots using storyboards
    - Plan key poses first
    - Finally fill in the in-between frames

Pose-to-pose animation planning

- First work out poses that are key to the story
- Next fill in animation in between
Keyframe animation

- Keyframing is the technique used for pose-to-pose animation
  - Head animator draws key poses—just enough to indicate what the motion is supposed to be
  - Assistants do “in-betweening” and draw the rest of the frames
  - In computer animation substitute “user” and “animation software”
  - Interpolation is the main operation
- Pro: lots of artistic control
- Con: Manually intensive

Principles of Animation

- Classic paper by Lasseter

Principles of Animation

- 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

Animation principles: timing

- Speed of an action is crucial to the impression it makes
  - gives physical and emotional meaning
  - examples with same keyframes, different times:

  60 fr: looking around 30 fr: “no” 5 fr: just been hit

Timing

- Indicates emotional state
- Eg. Look over left shoulder, then right

  On a scale of 1 to 10
  - No in-between: snap
  - 1 in-between: hit with force
  - 2 in-betweens: nervous twitch
  - 3 in-betweens: dodging something
  - 4 in-betweens: giving an order
  - 6 in-betweens: sees something inviting
  - 9 in-betweens: thinking
  - 10 in-betweens: stretching

Animation principles: ease in/out

- Real objects do not start and stop suddenly
  - animation parameters shouldn’t either

  straight linear interp. ease in/out

  - a little goes a long way (just a few frames acceleration or deceleration for “snappy” motions)
**Animation principles: moving in arcs**

- Real objects also don’t move in straight lines
  - generally curves are more graceful and realistic

**Animation principles: anticipation**

- Most actions are preceded by some kind of “wind-up”

**Animation principles: exaggeration**

- Animation is not about exactly modeling reality
- Exaggeration is very often used for emphasis

**Animation principles: squash & stretch**

- Objects do not remain perfectly rigid as they move
- Adding stretch with motion and squash with impact:
  - models deformation of soft objects

**Animation principles: follow through**

- We’ve seen that objects don’t start suddenly
- They also don’t stop on a dime
  - Let arm complete motion
  - Let leg kick complete motion
**Anim. principles: overlapping action**

- Usually many actions are happening at once
- Have a plan

**Animation principles: staging**

- Want to produce clear, good-looking 2D images
- Attract attention to key character/actor
  - need good camera angles, set design, and character positions
  - rim lighting

**Principles at work: weight**

**Extended example: Luxo, Jr.**

**Computer-generated motion**

- Interesting aside: many principles of character animation follow indirectly from physics
- Anticipation, follow-through, and many other effects can be produced by simply minimizing physical energy
- Seminal paper: “Spacetime Constraints” by Witkin and Kass in SIGGRAPH 1988