

CS4620/5620: Lecture 29

Animation

Animation

- Industry production process leading up to animation
- How animation works (very generally)
- Artistic process of animation
- Further topics in how it works

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

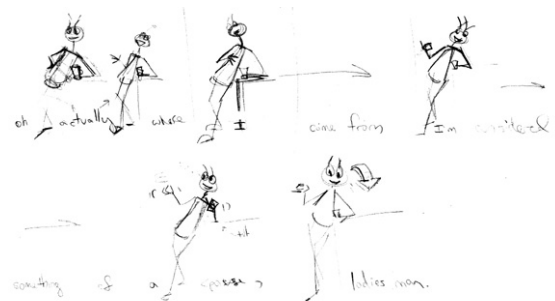
- Straight ahead
 - Draw/animate one frame at a time
 - Can lead to spontaneity, but is hard to get exactly what you want



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



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- 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 draws 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

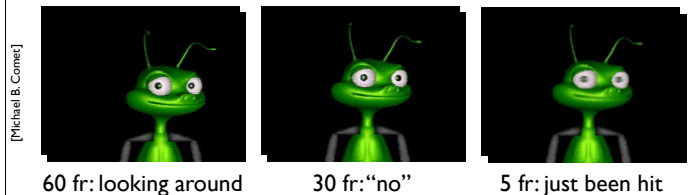
- Classic paper by Lasseter
 - “Principles of Traditional Animation Applied To 3D Computer Animation”, John Lasseter, ACM Computer Graphics, Volume 21 Number 4, July 1987

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:

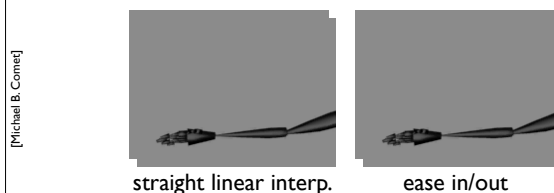


Timing

- 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

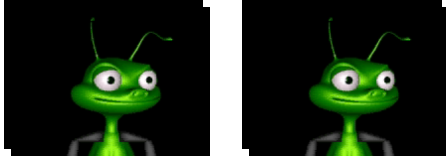
- Real objects do not start and stop suddenly
 - animation parameters shouldn’t either



– 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



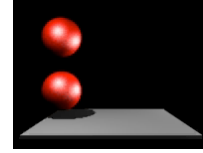
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Animation principles: anticipation

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



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Animation principles: exaggeration

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



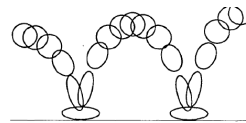
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Animation principles: squash & stretch

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



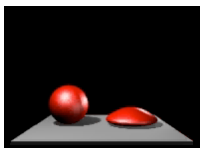
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Animation principles: squash & stretch

- Objects do not remain perfectly rigid as they move
- Adding stretch with motion and squash with impact:
– scale object along direction of motion (elongate or squash)
• maintain constant volume
– indicates motion by simulating exaggerated “motion blur”



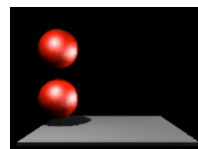
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Animation principles: follow through

- 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



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Anim. principles: overlapping action

- Usually many actions are happening at once



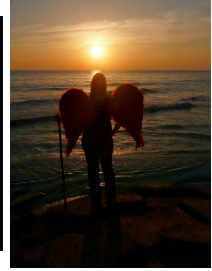
- Have a plan

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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

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Principles at work: weight



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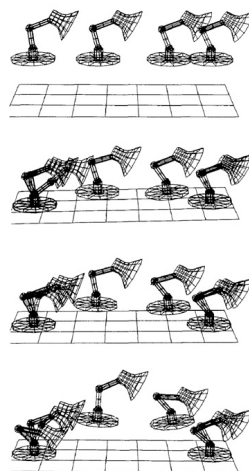
Extended example: Luxo, Jr.

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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



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