Today is just to get you thinking

Project

• Build something interesting to you
• Teams of three - choose your team
• 20% for 184, 40% for 284A

Timeline: 4 weeks

• April 2  Proposals due
• April 9  Feedback on proposals
• April 23 Graded checkpoint
• May 2  Presentations
• May 4  Final reports due
Lecture 25:

Intro to Animation

Computer Graphics and Imaging
UC Berkeley CS184/284A
Topics

History, goals and principles

Artist-driven animation: rigging, posing, keyframing

Procedural animation: physical simulation

Cloth simulation

Computer aids: forward & inverse kinematics

Data-driven animation: motion capture
Animation

“Bring things to life”

• Communication tool

• Aesthetic issues often dominate technical issues

An extension of modeling

• Represent scene models as a function of space

Output: sequence of images that when viewed sequentially provide a sense of motion

• Film: 24 frames per second

• Video: 30 fps

• Virtual reality: 90 fps
Historical Points in Animation
(slides courtesy Keenan Crane)
First Animation

(Shahr-e Sukhteh, Iran 3200 BCE)
History of Animation

(tomb of Khnumhotep, Egypt 2400 BCE)
History of Animation

(Phenakistoscope, 1831)
First Film

Originally used as scientific tool rather than for entertainment

Critical technology that accelerated development of animation

Edward Muybridge, “Sallie Gardner” (1878)
First Hand-Drawn Feature-Length Animation

Disney, “Snow White and the Seven Dwarfs” (1937)
First Digital-Computer-Generated Animation

Ivan Sutherland, “Sketchpad” (1963) – Light pen, vector display
Early Computer Animation

Ed Catmull & Frederick Parke, “Computer Animated Faces” (1972)
Digital Dinosaurs!

Jurassic Park (1993)
First CG Feature Film

Pixar, "Toy Story" (1995)
Computer Animation - Present Day

Sony Pictures Animation, “Cloudy With a Chance of Meatballs” (2009)
Animation Principles
(slides courtesy Mark Pauly)
Animation Principles

From


In turn from

• “The Illusion of Life”  
  Frank Thomas and Ollie Johnson

Same for 2D and 3D

http://www.siggraph.org/education/materials/HyperGraph/animation/character_animation/principles/prin_trad_anim.htm
Squash and Stretch

Refers to defining the rigidity and mass of an object by distorting its shape during an action.

Shape of object changes during movement, but not its volume.
Anticipation

Prepare for each movement
For physical realism
To direct audience’s attention

Timing for Animation, Whitaker & Halas
Staging

Picture is 2D
Make situation clear
Audience looking in right place
Action clear in silhouette

Disney Animation: The Illusion of Life
Follow Through

Overlapping motion
Motion doesn’t stop suddenly
Pieces continue at different rates
One motion starts while previous is finishing, keeps animation smooth
Ease-In and Ease-Out

Movement doesn’t start & stop abruptly.
Also contributes to weight and emotion
Arcs

Move in curves, not in straight lines
This is how living creatures move

Disney Animation: The Illusion of Life
Secondary Action

Motion that results from some other action
Needed for interest and realism
Shouldn’t distract from primary motion

Cartoon Animation, Preston Blair
Timing

Rate of acceleration conveys weight

Speed and acceleration of character’s movements convey emotion

Timing for Animation, Whitaker & Halas
Exaggeration

Helps make actions clear
Helps emphasize story points and emotion
Must balance with non-exaggerated parts

Timing for Animation, Whitaker & Halas
Appeal

Attractive to the eye, strong design

Avoid symmetries

Disney Animation: The Illusion of Life
Personality

Action of character is result of its thoughts
Know purpose & mood before animating each action
No two characters move the same way
Further Reading

- The Illusion of Life: Disney Animation by Frank Thomas and Ollie Johnston
- Timing for Animation by Harold Whitaker and John Halas
- Cartoon Animation by Preston Blair
12 Animation Principles

1. Squash and stretch
2. Anticipation
3. Staging
4. Straight ahead and pose-to-pose
5. Follow through
6. Ease-in and ease-out
7. Arcs
8. Secondary action
9. Timing
10. Exaggeration
11. Solid drawings
12. Appeal
12 Animation Principles

THE ILLUSION OF LIFE

Cento Lodgiani, https://vimeo.com/93206523
12 Animation Principles

Applications:

- Movies
- Games
- User interfaces
- …
Computer Animation
Keyframe Animation

Animator (e.g. lead animator) creates keyframes
Assistant (person or computer) creates in-between frames ("tweening")
Keyframe Interpolation

Think of each frame as a vector of parameter values

Hearn, Baker and Carithers, Figure 16.11
Keyframe Interpolation of Each Parameter

Linear interpolation usually not good enough

Recall splines for smooth / controllable interpolation
Next Time: Physical Simulation
Acknowledgments

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