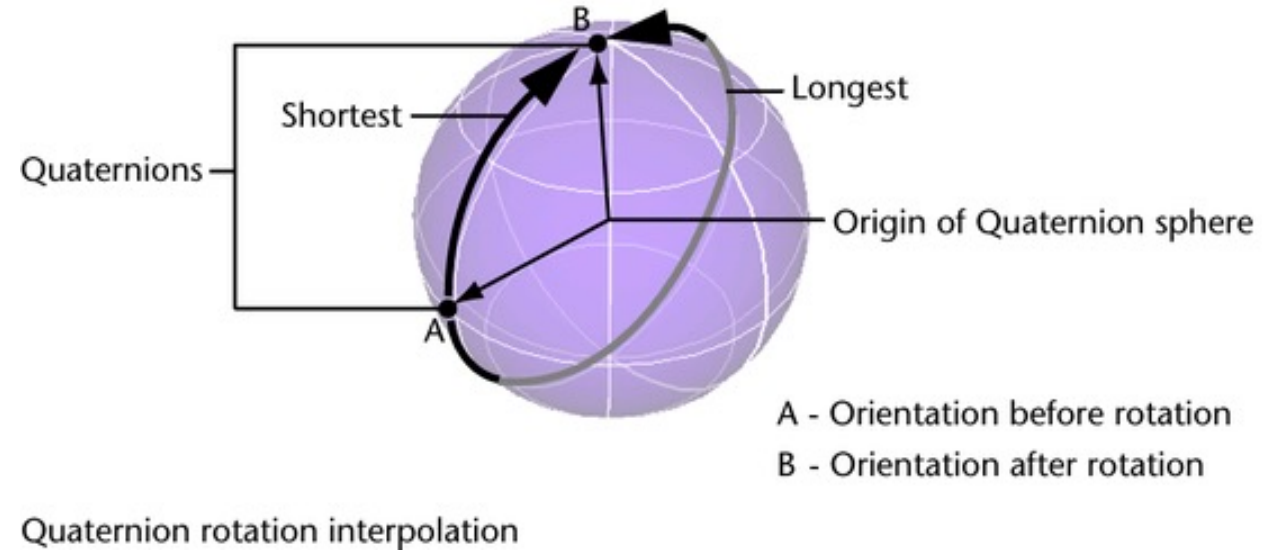


11 – animation

Interpolating “values”

- Want to interpolate position, orientation, scale ... also, color, etc
 - Anything that can be expressed parametrically

Interpolate Angles using Quaternions



Animate time from 0..1 and interpolate value

Specifying time: absolute or speed

Non-linear motion: easing functions

Applying Traditional Animation to 3D

- Based on paper (read if you are interested)
 - John Lasseter, “Principles of traditional animation applied to 3D computer animation”, Proceedings of SIGGRAPH ‘87, pp. 35 - 44
- Additional papers, applying it to 2D Uis (if you are interested)
 - Bay-Wei Chang, David Ungar, “Animation: From Cartoons to the User Interface”, Proceedings of UIST’ 93, pp.45-55.
 - Scott E. Hudson, John T. Stasko, “Animation Support in a User Interface Toolkit: Flexible, Robust and Reusable Abstractions”, Proceedings of UIST ‘93, pp.57-67.

Why Animation?

- Gives a feeling of reality and liveness
 - “animation” = “bring to life”
 - make inanimate object animate
- Provides visual continuity (and other effects) enhancing perception
 - particularly perception of change
 - hard to follow things that just flash into & out of existence
 - real world doesn't act this way

Why Animation?

- Can also be used to direct attention
 - movement draws attention
 - strong evolutionary reasons
 - Therein lies a danger
 - Overuse tends to demand too much attention
 - e.g., the dreaded paper clip!
- Used sparingly and intelligently, animation can enhance interfaces

Three principles from traditional animation

(Not mutually exclusive)

1. Solidity

- Want objects to appear solid and have mass

2. Exaggeration

- Exaggerate certain physical actions to enhance perception

3. Reinforcement

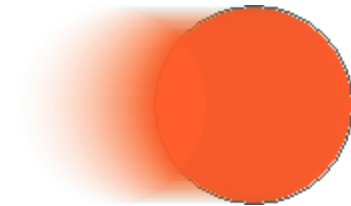
- Effects used to drive home feeling of reality

Solidity in Practice

- No teleportation
 - Objects must come from somewhere
 - Not just “pop into existence”
 - Nothing in the real world does this (things with mass can't do this)

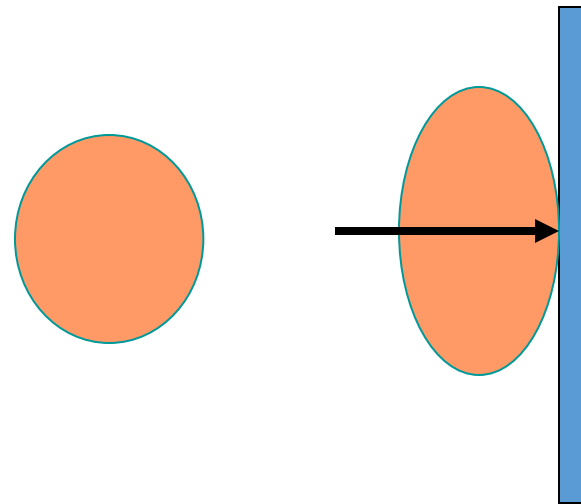
Solidity in Practice

- Motion blur
 - If objects move more than their own length (some say $1/2$ length) in one frame, motion blur should be used
 - Matches real world perception
 - Makes movement look smoother
 - Doesn't need to be realistic



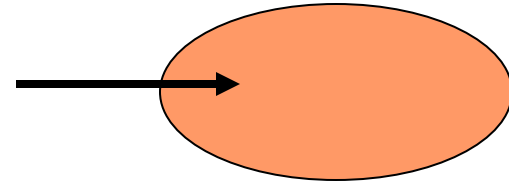
Solidity in Practice

- Squash and stretch
 - Cartoon objects typically designed to look “squishy”
 - When they stop, hit something, land, etc., they tend to squash
 - Compress in direction of travel



Solidity in Practice

- Squash and stretch
 - Also stretch when they accelerate
 - Opposite direction
 - Basically an approximation of inertia + conservation of volume (area)
- Comment
 - Although S&S makes things look “squishy” they contribute to solidity because they show mass
 - This tends to be exaggerated



Solidity in Practice

- Follow through (& secondary action)
 - Objects don't just stop, they continue parts of the motion
 - e.g., clothes keep moving, body parts keep moving
 - Reinforces that object has mass via inertia
 - (also tends to be exaggerated)

Solidity: Example

- S&S of various parts
- Follow Through
 - Notice feather lags behind character
- From: Thomas & Johnston
“The Illusion of Life: Disney Animation”, Hyperion, 1981



Exaggeration in Practice

- Cartoon animation tends to do this in a number of ways
 - paradoxically increases realism (liveness) by being less literal
- What is really going on is tweaking the perceptual system at just the right points

Exaggeration in Practice

- Anticipation
 - Small counter movement just prior to the main movement
 - This sets our attention on the object where the action is (or will be)
- Squash & stretch
- Follow through

Reinforcement in Practice

- Slow-in / Slow-out
 - Movement between two points starts slow, is fast in the middle, and ends slow
 - Two effects here
 - Objects with mass must accelerate
 - Interesting parts typically at ends of motion

Reinforcement in Practice

- Movement in arcs
 - Objects move in gently curving paths, not straight lines
 - Movements by “*real*” animate objects are in arcs (due to mechanics of joints)
 - Most movements in gravity also in arcs

Recap: Animation Principles in Practice

- Appearance of mass
 - Solidity & conservation of volume
 - Several ways to show inertia
- Tweak perception
 - Direct attention to things that count
 - Time on conceptually important parts
- Caricature of reality

Revisit easing functions