

Animation

COSC450

Principles of Computer Animation

Disney Animation Principles

1. Squash and Stretch
2. Anticipation
3. Staging
4. Straight-Ahead and Pose-to-Pose
5. Follow-Through and Overlapping Action
6. Slow in and Slow Out
7. Arcs
8. Secondary Action
9. Timing
10. Exaggeration
11. Solid Drawing (Weight)
12. Appeal

Do these principles still apply to computer animation? First, a little history...

The Beginnings of Computer Animation

The Adventures of André and Wally B.

- ▶ Animated short, 1984
- ▶ Made at The Graphics Group in Lucasfilm
- ▶ Released at SIGGRAPH'84
- ▶ Directed by Alvy Ray Smith
- ▶ Animation by John Lasseter (between projects at Disney)

Technical stuff

- ▶ Trees are particle systems by Bill Reeves
- ▶ Rendering equipment:
 - ▶ Cray XMP-2 and XMP-4 (“The most powerful machine in the world”)
 - ▶ 800 MFLOPS, \$US15 million (+disks)
 - ▶ 15 VAX ‘superminicomputers’
 - ▶ 5 at LucasFilm, 10 at Project Athena
 - ▶ VAX-11/750: 3.125 MHz processor

Pixar Animation Studios

- ▶ 1979: Graphics Group at Lucasfilm
- ▶ Ed Catmull, Alvy Ray Smith
- ▶ Funded by Steve Jobs
- ▶ Spun out as Pixar in 1986
- ▶ John Lasseter made animations to show off their graphics hardware
- ▶ *Luxo Jr.*, 1986
- ▶ Supplied hardware to Disney and others
- ▶ Shifted focus to animation (Renderman)
- ▶ *Toy Story* released in 1995
- ▶ Bought by Disney in 2006
- ▶ Toy Story (and Toy Story 2, 3, and 4)
- ▶ Monsters Inc. and Monsters University
- ▶ Finding Nemo
- ▶ The Incredibles
- ▶ Cars and Cars 2
- ▶ Ratatouille
- ▶ WALL-E
- ▶ Up
- ▶ Brave
- ▶ Inside Out

Principles of Computer Animation

Principles of Traditional Animation Applied to 3D Computer Animation John Lasster, SIGGRAPH 1987

- ▶ Lists *eleven* animation principles
- ▶ Solid drawing is not listed
- ▶ Examples from *The Adventures of André and Wally B.* and *Luxo Jr.*
- ▶ Most of the techniques transfer across

Particular techniques:

- ▶ Splines provide arcs and slow in/out
- ▶ Kinematic posing provides arcs also
- ▶ Keyframes are pose-to-pose animation
- ▶ Spacing of keyframes gives timing
- ▶ Many others are the animator's job

Solid Drawing

Solid drawing in traditional animation

- ▶ Partly the solid fill in the 'Disney style'
 - ▶ Is this necessary in computer animation?
 - ▶ Is it desirable?
- ▶ Also the illusion of 3D form
 - ▶ Again, is this a problem for computer animation?
 - ▶ If not, are there other concerns?

Advice from Johnson and Thomas:

- ▶ Does your drawing have weight, depth, and balance
- ▶ Watch out for 'twins' in [your] drawings'
- ▶ Our main search was for an "animatable" shape, one that had volume but was still flexible, possessed strength without rigidity

Realism vs. Artistic Style

Different films have different styles

- ▶ Generally not realistic
- ▶ Aiming for a particular style
- ▶ This may be limited by technology
- ▶ Human characters?
- ▶ The 'uncanny valley'



Animation and Simulation

Many films have a specific challenge

- ▶ Some element that has not been modelled well before
- ▶ *Monsters Inc.* – Sully's fur
- ▶ *The Incredibles* – People (motion, hair, clothes), Fire, water, smoke, explosions
- ▶ *Frozen* – Snow in various forms

Simulating these things is difficult

- ▶ Physical simulation of dynamics
- ▶ What simplifications are OK?
- ▶ What looks best?
- ▶ Realism vs. stylised
- ▶ What will audiences respond to?

How does this relate to Solid Drawing?

Mixing Animation and Live Action

Many films mix animation and live action

- ▶ This is not new or exclusive to CGI
 - ▶ Disney's *Alice Comedies*, 1920s
 - ▶ *Mary Poppins*, 1964
 - ▶ *Who Framed Roger Rabbit*, 1988
- ▶ Often want more realistic animation
- ▶ Matching lighting etc.
- ▶ Interactions between animated characters and live actors

“In my mind it isn't animation, unless it *looks* like animation” – Roger Ebert

