Animation in the Interface
Readings (not required): This section based on 2 papers

• Principles of traditional animation
  (derived from Disney and translated for geeks):
  http://doi.acm.org/10.1145/37401.37407
Reading assignment:
This section based on 2 papers

• How does this relate to user interfaces

http://doi.acm.org/10.1145/168642.168647
Luxo Jr.
By John Lasseter et al.
Pixar

http://www.pixar.com/shorts/ljr/index.html
Concept Videos

• Apple Knowledge Navigator
• AT&T Connections
• SUN Starfire
Animation is of increasing interest

- Perceptual and other advantages
- Only recently (compared to development of rest of GUI) had enough spare horsepower
- Now seeing this in the mainstream
  - starting with Win ‘98
  - but some examples as early as 1984 Mac
Why animation?

- Gives a feeling of reality and liveness
  - “animation” = “bring to life”
  - make inanimate object animate

- With this can come appeal and desirability
Why animation?

• 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
• Never enough pixels...
  – Can possibly trade space for time
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

- also done wrong, tends to get in the way
Why Animation?

• Used sparingly and understandingly, animation can enhance the interface

• Quite a bit of untapped potential
Three principles from traditional animation (Following Chang & Ungar)

- not mutually exclusive
- Everything we know, we learned from Disney (more or less)

- **Solidity**
  - make objects appear to be solid

- **Exaggeration**
  - exaggerate certain physical actions to enhance perception

- **Reinforcement**
  - effects to drive home feeling of reality
Specific techniques employing these principles (Better descriptions in Lasseter)

• Solidity
  • want objects to appear solid and appear to have mass
    – Solid (filled) drawing
  • now common place
Specific techniques employing these principles

• Solidity
  – 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)
Specific techniques employing these principles

• Solidity
  – Motion blur
    • if objects move more than their own length (some say 1/2 length) in one frame, motion blur should be used to avoid “strobing”
    • matches real world perception
    • makes movement look smoother
    • doesn’t need to be realistic
Specific techniques employing these principles

• Solidity
  – Squash and stretch
    • Cartoon objects are typically designed to look “squishy”
    • When they stop, hit something, land, they tend to squash
      – like water balloon
      – compress in direction of travel

• Important to preserve volume
  – expand in the other direction
Specific techniques employing these principles

- Solidity
  - Squash and stretch
    - Also stretch when they accelerate
      - opposite direction
  - Basically an approximation of inertia + conservation of volume (area)
Specific techniques employing these principles

• Solidity
  – Squash and stretch
  • Although S&S makes things look “squishy” they contribute to solidity because they show mass
  • (This tends to be exaggerated)
Specific techniques employing these principles

- Solidity: 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)

Follow Through

• Notice feather lags behind character

• Also S&S here

Specific techniques employing these principles

• Exaggeration
  – 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
    • Best to exaggerate only important parts and leave “background” realistic in order to create contrast
Specific techniques employing these principles

• Exaggeration
  – Anticipation
    • e.g., small counter movement just prior to the main movement
    • this sets our attention on the object where the action is (or will be)
    • Faster motions need more anticipation to avoid being missed
  – Squash & stretch
  – Follow through
Specific techniques employing these principles

- Reinforcement
  - 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 and decelerate
      - interesting parts typically @ ends
        » tweaking perception
Specific techniques employing these principles

- Reinforcement
  - Movement in arcs
    - Objects move in gently curving paths, not straight lines
    - Movements by animate objects are in arcs (due to mechanics of joints)
    - Most movements in gravity also in arcs
• Another example:

• http://www.dailymotion.com/video/xighv_road-runner-wile-e-coyote-10
Programming Animations

• Play a movie
  – Mpg, quicktime, avi, etc.
  – Microsoft DirectX: DirectShow - video streams
  – Windows Media Player control

• Sequence of images
  – Animated gifs
  – Or controlled by a timer
Programming Animations

- Object-oriented animations: other options available
  - In Flash, etc., move objects through a path
    - Motion tween
    - Shape tween
  - Change parameters through time
  - Main focus of Flash
    - Also Director, and others
Parts of Motion

• In general 3 parts of a motion:
  – Anticipation, the motion, follow-through
  – Actions not normally disjoint
    • Next may start before previous over (overlapping action)
Recap

- 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
Reminder

• Animation can bring otherwise boring things to life, but...
• It’s not a uniformly good thing
  – demands a lot of attention
  – can take time
• Needs to be used wisely (and probably sparingly)
• Questions?