Animation in the Interface

Readings (not required): This section based on 2 papers

- **Principles of traditional animation**

  (derived from Disney and translated for geeks):

  John Lasseter, "Principles of Traditional Animation Applied to 3D Computer Animation", Proceedings of SIGGRAPH '87, pp.35-44, July 1987.

  http://doi.acm.org/10.1145/37401.37407

Reading assignment: This section based on 2 papers

- How does this relate to user interfaces

  Bay-Wei Chang, David Ungar, "Animation: From Cartoons to the User Interface", Proceedings of UIST' 93, pp.45-55, Nov. 1993.

  http://doi.acm.org/10.1145/168642.168647

Preview Video

Luxo Jr.

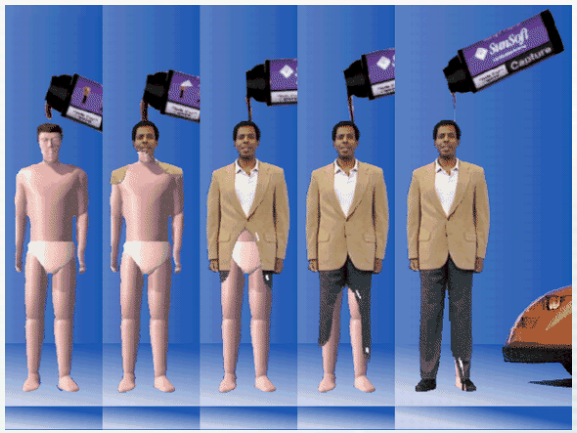
By John Lasseter et al.

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?

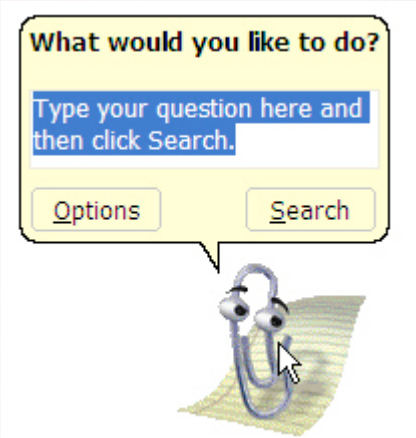
- Gives a feeling of reality and liveness
  - "animation" = "bring to life"
  - make inanimate object animate
- With this can come appeal and desirability

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

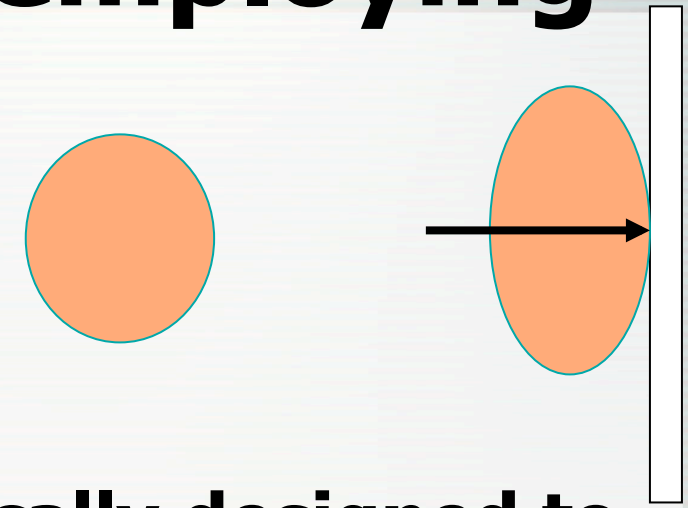
Specific techniques employing these principles

- **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

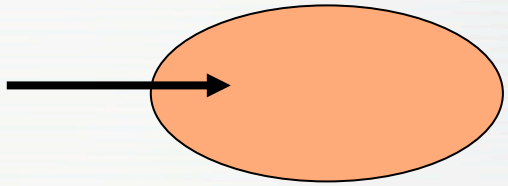
- Solidity
  - Motion blur
    - if objects move more than their own length (some say 1/2 length) in one frame, motion blur should be used to avoid "strobing"
    - matches real world perception
    - makes movement look smoother
    - doesn't need to be realistic

Specific techniques employing these principles

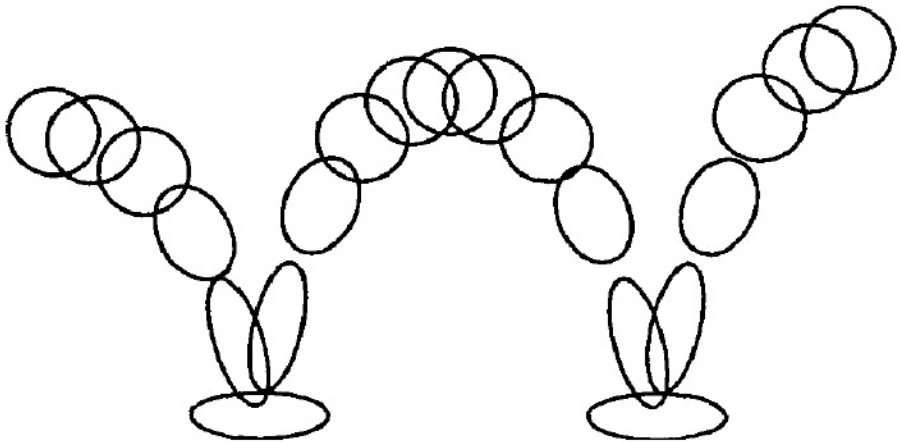


- Solidity
  - Squash and stretch
    - Cartoon objects are typically designed to look "squishy"
    - When they stop, hit something, land, they tend to squash
      - like water balloon
      - compress in direction of travel
    - Important to preserve volume
      - expand in the other direction

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)

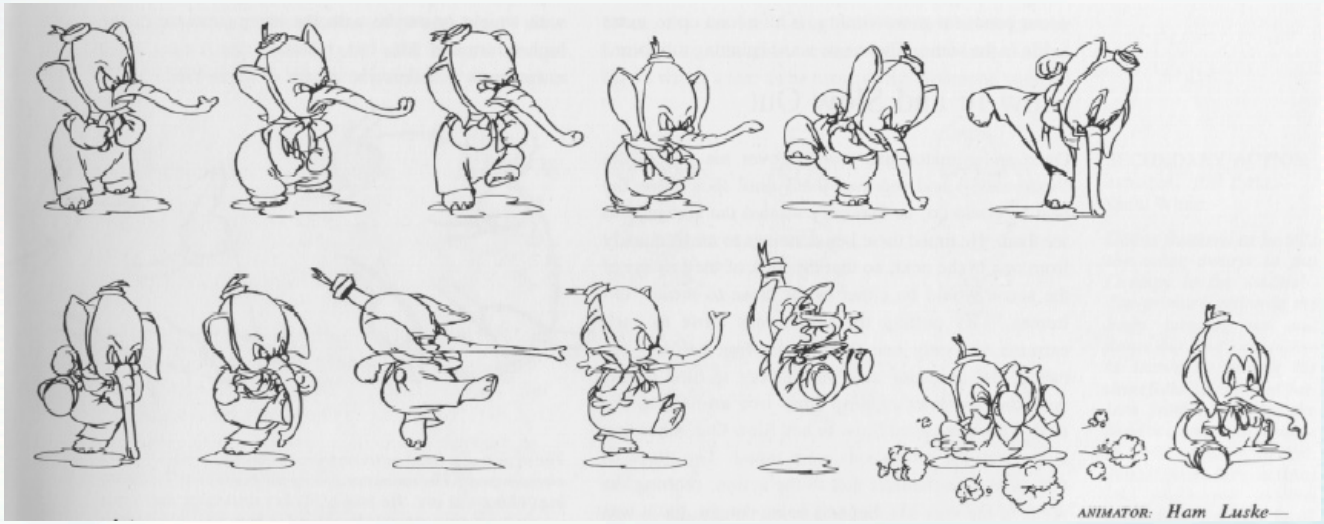


Specific techniques employing these principles

- 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)**



From: Thomas & Johnston "The Illusion of Life: Disney Animation", Hyperion, 1981

Follow Through

- **Notice feather lags behind character**
- **Also S&S here**

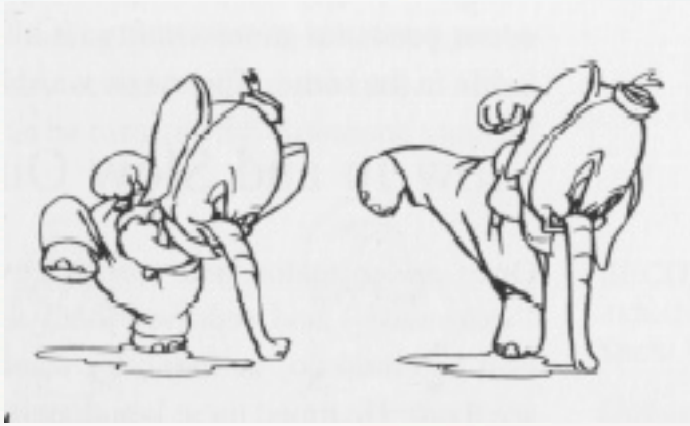
From: Thomas & Johnston "The Illusion of Life: Disney Animation", Hyperion, 1981

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?**