Computer Animation

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CS395: Introduction to Computer Animation

Animation

- Animate = “to give life to”
- Specify, directly or indirectly, how ‘thing’ moves in time and space
- Tools

Two main categories

- Computer-assisted animation
  - 2D & 2 1/2 D
  - Inbetweening
  - Inking, virtual camera, managing data, etc
- Computer generated animation
  - Low level techniques
    - Precisely specifying motion
    - High level techniques
      - Describe general motion behavior

Low level techniques

- Shape interpolation (in-betweening)
- Have to know what you want

High level techniques

- Generate motion with set of rules or constraints
  - Physically based motion

Abstraction

Animator colors each pixel
to
Tell computer to “make movie about a dog”

http://www.cs.berkeley.edu/~job/Projects/SoundCat/videos.html
Perception of Animations

- Playback rate
- Sampling or update rate

- TV: 30 images/second
- Sat Morning Cartoons:
  - 6 different images per second
  - Each image repeated five times

Heritage of Animation

- Persistence of vision: discovered about 1800s
  - Zoetrope or “wheel of life”
  - Flip-book

- Camera to make lifeless things move
  - Meleis 1890 using simple tricks
  - Emil Cohl (1857-1938, French)

- First celebrated Animator
  - Winsor McCay (American)
    - Little nemo
    - Gertie the Dinosaur (1914)

Heritage of Animation

- J. Stuart Blackton (American)
  - Meet Thomas Edison in 1895
    - Combine drawing and file: “The Enchanted Drawing”
    - Six years later: “Humorous Phases of Funny Faces”
  - Animated smoke in 1900: First animated cartoon in 1906

- First major technical development
  - John Bray /Earl Hurd (1910)
    - Translucent cells (short for celluloid) in compositing multiple layers
    - Use of grey scale (as opposed to B&W)
    - Color short in 1920
Heritage of Animation

Out of Bray’s studio
- Max Fleischer (Betty Boop, Popeye)
  - Patented rotoscoping in 1915
  - Drawing images on cells by tracing over previously recorded live action
- Paul Terry (Terrytoons: Mighty Mouse)
- George Stallings (?)
- Walter Lantz (Woody Woodpecker)

Disney: Animation as an art form

- Innovations
  - Storyboard to review story
  - Pencil sketch to review motion
  - Multi-plane camera stand
  - Color (not first to use color)
  - Sound!
    - Steamboat Willie (1928)

Multiplane Camera

- Move scene layers independently of camera

MGM and Warner Brothers, etc.

Heritage of Animation

- Animation as an art form
  - First animated character with personality
    - Felix the cat by Otto Messmer (1920s)
- Force to reckon with
  - Sound and Walt Disney

Other Media Animation

- Computer animation is often compared to stop motion animation
  - Puppet animation
    - Willis O’Brian (King Kong)
    - Ray Harryhausen (Mighty Joe Yong, Jason and the Argonauts)
Other Media Animation

– Claymation
– Pinhead animation
– Sand animation
• Physical object is manipulated, image captured, repeat

Hierachy of film/animation

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<td>Act</td>
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<td>Scene</td>
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<td>Shot</td>
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<td>Frame</td>
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Production of Animation

• Preliminary story
• Story board
• Detailed story
• Key Frames
• Test shot
• Pencil test
• Inbetweening
• Inking
• Coloring

Computer Animation as Animation

• Lasseter translated principles of animation as articulated by two of Nine Old Men of Disney to computer animation
  – Lasseter is conventionally trained animator
    • Worked at Disney before going to Pixar
    • Many celebrated animations
    • Knick-knack (oscar-winning)

Short History of Computer Animation

In Research labs
• NYIT

In Research Labs

• University of Utah
  – Films on walking and talking figure
  – Animated hand and animated face (1972)

• University of Pennsylvania
  – Human figure animation (Norm Badler)
• Cornell University
  – architectural walk-throughs (Don Greenberg)
History of Computer Animation

- 1974: Hunger by Rene Jodoin and Peter Foldes
  - 2.5D system, object interpolation

Current activity Centers

- University of Toronto's Computer Science Department
- Simon-Fraser University's Graphics and Multimedia Research Lab
- Georgia Tech's Graphics Visualization and Usability Center
- Brown University Computer Graphics Group
- Ohio State University's ACCAD
- Ohio State University's Department of Computer and Information Science
- George Washington University Graphics Group
- UC San Diego's Department of Computer Science and Engineering
- University of North Carolina's Computer Science Department
- MIT's Media Lab
- MIT's Laboratory for Computer Science
- University of Wisconsin at Madison

History of Film & Video

- Companies
  - Mathematical Applications Group, Inc. (MAGI)
  - Information International Inc. (III, or Triple-I)
  - Digital Production
  - Digital Effects
  - Image West
  - Robert Abel and Associates
  - Cranston-Csuri.

Current Companies

- Pixar
- Industrial Light and Magic (ILM)
- Pacific Data Images (PDI)
- Disney
- Toon
- Rhythm & Hues
- Digital Domain
- Lamb & Company
- Metrolight Studios
- Boss Film Studios
- deGraf/Wahrman
- R/Greenberg Associates
- Blue Sky Productions
- Sony Pictures
- Cinesite
- Imageworks
- Apple...

Animations that paved the way

Pixar
- Luxo Jr. (1986)
  - first computer animation to be nominated for an Academy Award
- Red's Dream (1987)
- Tin Toy (1988)
  - first computer animation to win an Academy Award
- Knick Knack (1989)
Early CG in film

- Future World (1976)
- Star Wars (1977)
  - Lawnmower man (1992, Xaos, Angel Studios)
    - Hollywood’s view of VR
- Tron (1982, MAGI)
  - Supposed to look like a computer
- The Last Starfighter (1984)
  - Use CG in place of models
- Willow (1988, ILM)
  - Morphing video
    - First digital blue screen matte extraction
- Howard the Duck (1986, ILM)
  - First wire removal
- The Abyss (1989, ILM)

More early CG in film

- Jurassic Park (1993, ILM)
  - Forest Gump (1994, Digital Domain)
    - Insert CG ping pong ball
- Babe (1995, Rhythm & Hues)
  - Move mouths of animals & fill in background
- Toy Story (1995, Pixar & Disney)
  - First full length fully CG 3D animation

Early CG on TV

- Reboot (1995, Limelight Ltd. BLT Productions)
  - Similar intention of “inside computer”
    - First fully 3D Sat. morning cartoon
- Babylon 5 (1995)
  - Routinely used CG models as regular features
- Simpsons (1995 PDI)

Resources

- Milestones of the animation industry in the 20th Century
  - http://www.fact-index.com/a/an/animation.html#History%20of%20Animation

Resources (con’t.)

- Timeline from Brown Animation class
  - http://www.cs.brown.edu/courses/cs229/animTimeline.html
- In-betweening
Credits/Resources

- Rick Parent
- America’s Story
  - http://www.americaslibrary.gov/cgi-bin/page.cgi/sh/animation/blcktn_2

Character Animation

- Control motion of articulated limbs
- Skeletal-muscle-skin models
- Facial animation
- Representation and Animation of surface detail
  - Hair
  - Clothes

Utah CG History