2D & 3D Animation

NBA 6120

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Lecture 8
What is cartoon animation?

- A sequence of drawings which, when viewed in rapid succession, create an illusion of continuous life-like movement.

Cel animation

- Process in which background and action are drawn separately
- Background and action are placed together when ready to film
Steps for creating cel-animated films

- Background is drawn and colored
- Key animator draws the most important, or key, frames of character
- In-betweener fills in the key frames with all the action required of the character
- Cels are inked and painted
- Checker places each cel on the background and checks the quality of art and movement
- Each cel is filmed
Cel-animation
SONG
"MY FAVORITE TIME OF THE YEAR"
Prod. #110-1

ROGER SC. #110
P. - 35

REVISED 10/13/77

L.O. CHECK 26'S MOUTH SC. #56 FOR CONSISTENCY

(FX: DOOR SLAM!)

OCT 21 1977

FINAL PRODUCTION BOARD

Fred: MERRY CHRISTMAS, MISTER SLATE!

(FRED SAGS)

Fred: (RELIEVED) WHEW!

OH BOY! OH BOY! OH BOY! OH BOY!

(INTO HAPPY REALIZATION)

Fred: YABBA DABBA DOO!
Figure 2a: Walt Disney's multiplane camera stand
Almost the entire process of creating an animated film can be automated with a computer:

- Backgrounds can be drawn and colored on a computer.
- Key frames should still be drawn by key animator.
- In-between frames can be interpolated with a computer.
- Cels can be inked and painted on a computer.
- Cel and background can be put together and checked with a computer and then filmed.
Approximate Employee Distribution

- Storyboard/Screen Writers: 5
- Background: 10
- Animators (140):
  - Key: 25
  - Ass’t: 40
  - In-betweeners: 75
- Checkers: 10
- Inking/Painting: 220
- Sound/Music: 5
- Editing: 10

Total: 400
Automating the production process with computers for keyframe animation

- Backgrounds can be drawn and colored on a computer
- **Key frames are still drawn by key animator**
- **All in-between frames are still drawn by animators**
- Cels can be inked and painted on a computer
- Cel and background can be put together and checked with a computer and then filmed
Advantages of Partial Animation

– All artistic control stays with the animators
– The cost of the most expensive part of the production process (inking and painting) is vastly reduced \((1/10^{th})\)
– Can still take advantage of special features
  > Zooming
  > Color changes
  > Multi-Plane camera simulation
  > Reduction in scale
Three-Dimensional Computer Animation
Why do we need an animation production pipeline?

• Animated full-length features are huge endeavors
  – Up to 5 years from conception to final (2 years in production)
  – > 500 people involved

• Currently requires big budgets and big organizations
  – $100 M - $150M per movie

• Needs a very organized structure to bring the creative process from conception to final product
What is the animation production pipeline?

• Logical organization of the steps required to produce an animated feature film

• Every company has its own pipeline

• Every movie changes the pipeline
  – Requirements are changing
  – Save money
  – Increase the quality of the movie
1 / SKETCHES There are 49,516 of these sketches in the movie’s story reel.

Building a single frame

5 / FINALE Surfaces—walls, clothing, faces—are fed through rendering software that simulates light and shadow. An average frame takes more than seven hours of computing time to render. This one required eleven hours.

The simplified pipeline

- Many departments

- Story
- Art
- Casting
- Editorial
- Modeling
- Shading
- Texturing
- Rigging
- Backgrounds
- Layout
- Animation
- Simulation
- Effects
- Lighting
- Rendering
Jan Pinkava – Storyboard,

GERI’S GAME
(Pencil)
The control mesh for Geri’s head, created by digitizing a full-scale model sculpted out of clay.
Subdivision surfaces
Story Development
Art Development - Characters

© Pixar/Disney
Art Development - Environments
Dialogue Recording

- Useful for animation reference
Editorial

• The keeper of the flow
  – Study the timing of actions in the movie
• Manage the editing of the movie
  – Prepare the various releases
• Similar to a traditional studio
The Simplified Pipeline

- Characters and Sets

- Story
- Art
- Casting
- Editorial

- Modeling
- Shading
- Texturing
- Rigging
- Backgrounds

- Layout
- Animation
- Simulation
- Effects

- Lighting
- Rendering
Modeling

• Defines the shape

• Process
  – Starts with art data
    > Drawings
    > Sculptures (sometimes scanned)
  – Recreate geometry in the modeling environment

• Models have to
  – Look good – to please the eye
  – Be functional – to fit in the pipeline
  – Work when deformed – for animation
Character Modeling
Shading
Backgrounds

- Creates sets out of props
- Prepares a stage for acting
Backgrounds

© Pixar/Disney
The Simplified Pipeline

- Movement

- Story
- Art
- Casting
- Editorial
- Modeling
- Shading
- Texturing
- Rigging
- Backgrounds
- Layout
- Animation
- Simulation
- Effects
- Lighting
- Rendering
Layout

• Defines the camera
  – Starting position
  – Framing – which objects are seen
  – Movement

• Defines basic object positions
  – Starting point for animation

• Story boards are used as reference
Animation

• Keyframed animation
  – Movement is specified by changing individual controls on characters at various frames
  – Similar to 2d animation
  – Used by Pixar and DreamWorks

• Motion capture
  – Movement is recorded using live actors
  – Editing to fix problems
  – Used by Sony Imageworks, Weta
Animation

• Very time consuming!
  – Requires big budgets and long development times
• Today it is the biggest distinction between large studios and smaller ones
• Hard to develop “economy of scale”
Simulation

• Not possible to animate everything

• Physically-based animation
  – Movement is computed to simulate physics

• Applications
  – Humans: hair, cloth, skin
  – Natural media: water, fire, smoke
  – Special effects: explosions
Effects

• Natural media: Water, Fire, Smoke
• Weather: Snow, Rain, Wind
• Special effects: Explosions, Morphing
• Very specific
• Encompasses modeling, animation and shading
The Simplified Pipeline

- Final images

- Story
- Art
- Casting
- Editorial
- Modeling
- Shading
- Texturing
- Rigging
- Backgrounds
- Layout
- Animation
- Simulation
- Effects
- Lighting
- Rendering
Lighting

• Defines scene illumination

• Process
  – Study real world footage
  – Study material/light interaction
    > Simple materials: plastic, woods, etc.
    > Complex materials: metals
    > Characters: skin, hair
  – Start with art images
  – Add and change lights to obtain the final picture
Lighting

Lighting

Lighting

Particulate Matter
Surge and Well
Caustics
Murk
Reflection Refraction
Rendering

• Compute the final images
End