CS-184: Computer Graphics

Lecture #17: Introduction to Animation

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Introduction to Animation

- Generate perception of motion with sequence of images shown in rapid succession
  - Real-time generation (e.g., video game)
  - Off-line generation (e.g., movie or television)
### Introduction to Animation

- Key technical problem is how to generate and manipulate motion
  - Human motion
  - Inanimate objects
  - Amorphous objects
  - Control

### Technical issues

- Technical issues often dominated by aesthetic ones
- Violation of realism desirable in some contexts
- Animation is a communication tool
  - Should support desired communication
  - There should be something to communicate
Introduction to Animation

1. Key-frame animation
   - Specification by hand
   - Motion capture
     - Recording motion
   - Procedural / simulation
     - Automatically generated
   - Combinations
     - e.g. mocap + simulation

For more detailed diagram, see Karlow p.54
Key-framing (manual)

- Requires a highly skilled user
- Poorly suited for interactive applications
- High quality / high expense
- Limited applicability

Motion Capture (recorded)

- Markers/sensors placed on subject
- Time-consuming clean-up
- Reasonable quality / reasonable price
- Manipulation algorithms an active research area
Model Construction

Simulation

- Generate motion of objects using numerical simulation methods

\[ x(t + \Delta t) = x(t) + \Delta t v + \frac{1}{2} \Delta t^2 a \]

\[ g \rightarrow v \]
Simulation

- Perceptual accuracy required
- Stability, easy of use, speed, robustness all important
- Predictive accuracy less so
- Control desirable
### What to do with animations?

- Video tape
- Digital video
- Print it on yellow sticky notes

### NTSC Standard

- Used by DVD, DV, and VHS
- 720x486 resolution (sort of)
- 1.33 aspect ratio
- Limited color range
- 30 frames per second (sort of 29.97)
- Interlaced video
- Overscan regions
### Digital Video

- Wide range of file formats
  - QuickTime
  - MS Audio/Visual Interleaved (AVI)
  - DV Stream
  - Bunch o’ images
- Some formats accommodate different CODECs
  - Quicktime: Cinepak, DV, Sorenson, DivX, etc.
  - AVI: Cinepak, Indeo, DV, MPEG4, etc.
- Some formats imply a given CODEC
  - MPEG
  - DV Streams

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### Digital Video

- Nearly all CODECs are lossy
  - Parameter setting important
  - Different type of video work with different CODECs
  - Compressors not all equally smart
  - Compression artifacts are cumulative in a very bad way
- Playback issues
  - Bandwidth and CPU limitations
  - Hardware acceleration
  - Missing CODECs (avoid MS CODECs and formats)
Editing

- Old way:
  - Multiple expensive tape decks
  - Slow
  - Difficult
  - Error prone
- New way:
  - Non-linear editing software
  - Premiere, Final Cut Pro, others...
  - Beware compressed solutions
  - May take a long time for final encoding

Interactive Animation

- Video Games
Interactive Animation

• “Serious” Games

Motion Blur

• Fast moving things look blurry
  • Human eye
  • Finite exposure time in cameras
• Without blur: strobing and aliasing
• Blur over part of frame interval
  • Measured in degrees (0..360)
  • 30 tends to often look good
Motion Blur

- Easy to do in a sampling framework
- Interpolation is an issue

Motion Blur

- Velocity based blur often works poorly