CS-184: Computer Graphics

Lecture #17: Introduction to Animation

Prof. James O'Brien
University of California, Berkeley

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Introduction to Animation

- Generate perception of motion with sequence of image shown in rapid succession
  - Real-time generation (*e.g.* video game)
  - Off-line generation (*e.g.* movie or television)

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Introduction to Animation

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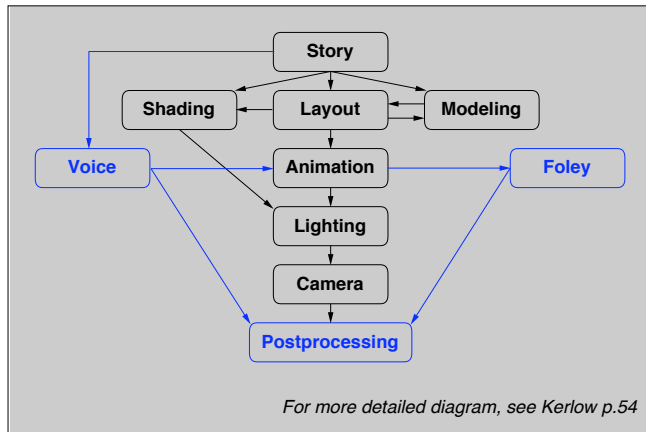 - Amorphous objects
  - Control

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Introduction to Animation

- 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

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Introduction to Animation

Computer Animation Pipeline (v 1.1)


```
                    ┌───────┐
                    │ Story │
                    └───────┘
      ┌─────────┐  ┌────────┐  ┌──────────┐
      │ Shading │  │ Layout │  │ Modeling │
      └─────────┘  └────────┘  └──────────┘
  ┌───────┐   ┌───────────┐   ┌───────┐
  │ Voice │   │ Animation │   │ Foley │
  └───────┘   └───────────┘   └───────┘
              ┌──────────┐
              │ Lighting │
              └──────────┘
              ┌────────┐
              │ Camera │
              └────────┘
          ┌────────────────┐
          │ Postprocessing │
          └────────────────┘
```

For more detailed diagram, see Kerlow p.54

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Introduction to Animation

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

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Key-framing (manual)

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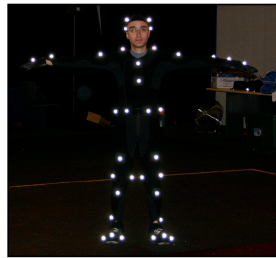- High quality / high expense
- Limited applicability

From **Learning Maya 2.0**
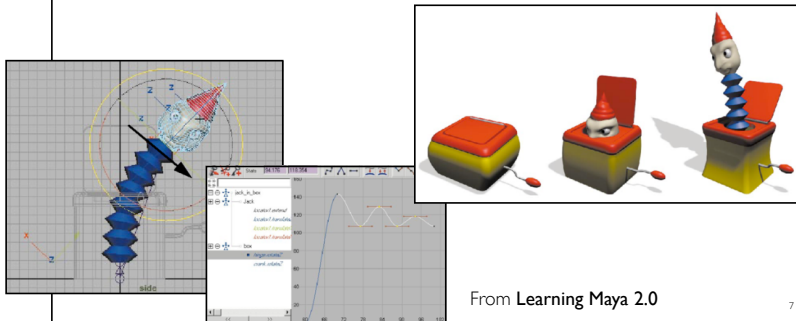
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Motion Capture (recorded)

- Markers/sensors placed on subject
- Time-consuming clean-up
- Reasonable quality / reasonable price
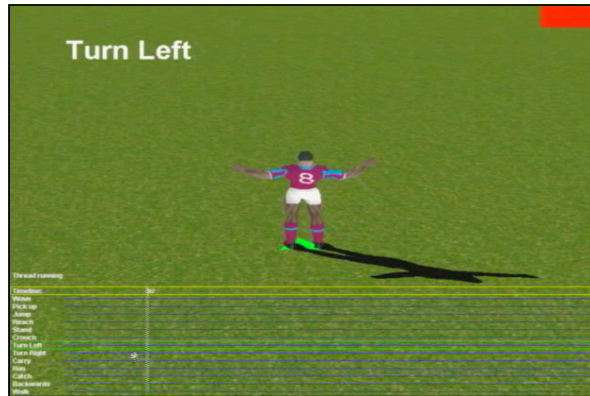- Manipulation algorithms an active research area
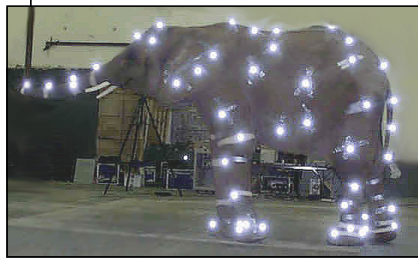
MotionAnalysis / Performance Capture Studio   Okan Arikan   8

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Motion Editing

Turn Left

Arikan, Forsyth, O'Brien, SIGGRAPH 2002
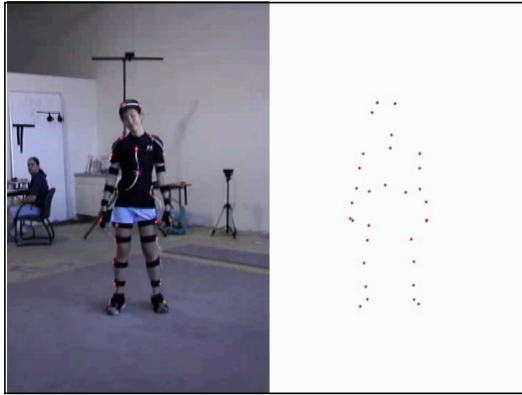
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Motion Editing

Arikan, Forsyth, O'Brien, SIGGRAPH 2002

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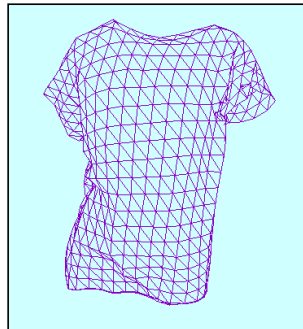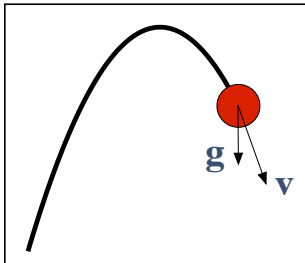Sunday, November 8, 2009

Model Construction

Kirk, O'Brien, Forsyth, CVPR 2005

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Simulation

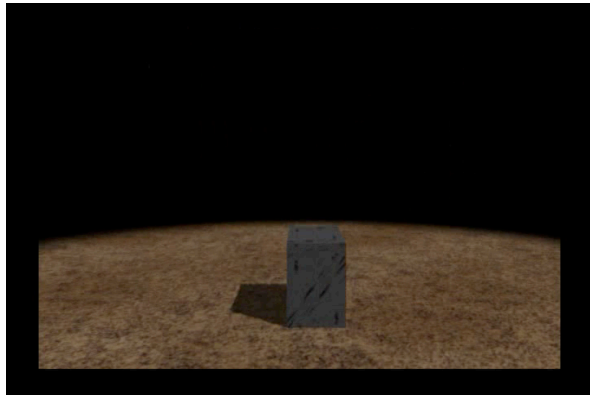- Generate motion of objects using numerical simulation methods

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Simulation

- Perceptual accuracy required
- Stability, easy of use, speed, robustness all important
- Predictive accuracy less so
- Control desirable

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Simulation

Feldman, Arikan, O'Brien, SIGGRAPH 2003

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What to do with animations?

• Video tape

• Digital video

• Print it on yellow sticky notes

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Video Tape

• Analog tape formats
  • VHS/SVHS
  • Beta SP
  • 3/4'' U-matic
• Digital tape formats
  • Digi Beta
  • DV Tape
  • DVD (yes, I know DVDs are not tapes)

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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

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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)

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Path to Tape

- Not much of an issue any longer
  - Cheap (< $100) devices can give good amateur quality output
  - Pro quality also cheap (< $5000)
  - Beware many cheap solutions over use compression
  - Good analog tape decks still expensive

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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
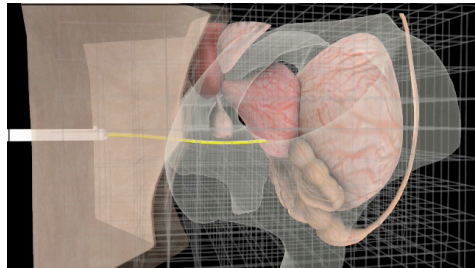
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Interactive Animation

- Video Games

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Interactive Animation

• "Serious" Games

Interactive Animation

• "Serious" Games

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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

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Motion Blur

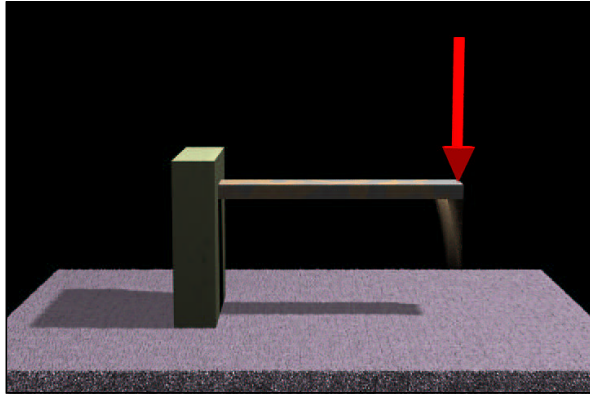- Easy to do in a sampling framework
- Interpolation is an issue

Motion Blur – Cont.

Interpolation is an issue

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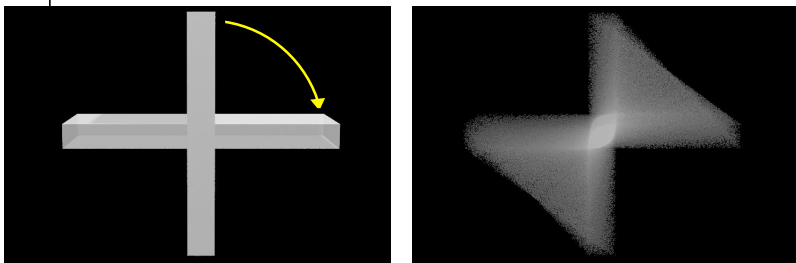
Motion Blur

- Velocity based blur often works poorly