## CS-184: Computer Graphics

Lecture #17: Introduction to Animation

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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)

#### Introduction to Animation

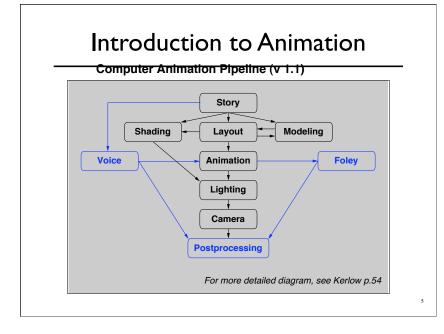
- Key technical problem is how to generate and manipulate motion
  - Human motion
  - Inanimate objects
  - Amorphous objects
  - $\circ$  Control

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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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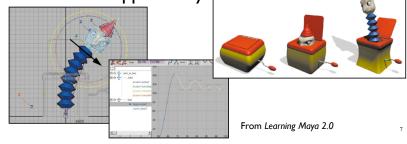
### Introduction to Animation

- $\circ$  Key-frame animation
  - $\circ\,$  Specification by hand
- Motion capture
  - $\circ\,\, \text{Recording}$  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



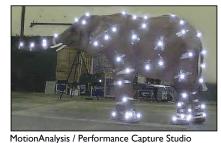


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# Motion Capture (recorded)

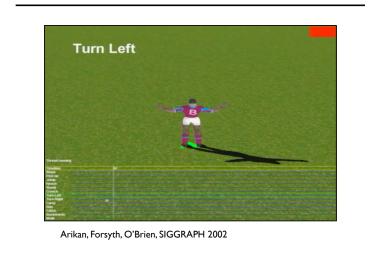
- Markers/sensors placed on subject
- Time-consuming clean-up
- Reasonable quality / reasonable price
- Manipulation algorithms an active research area



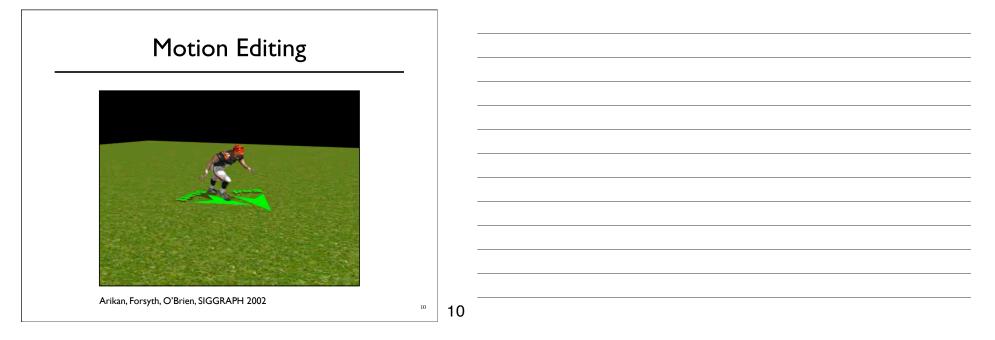




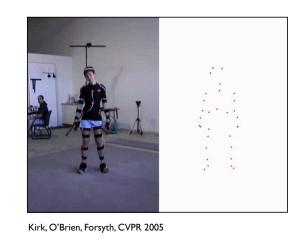
# Motion Editing



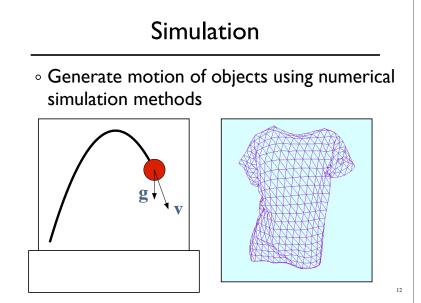
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# Model Construction





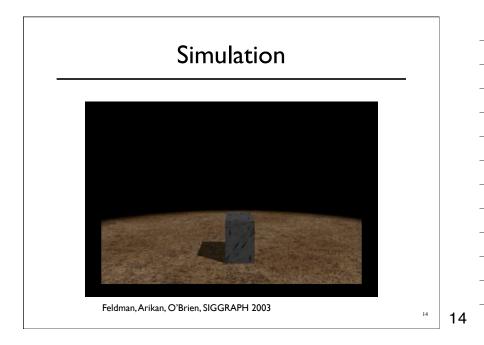


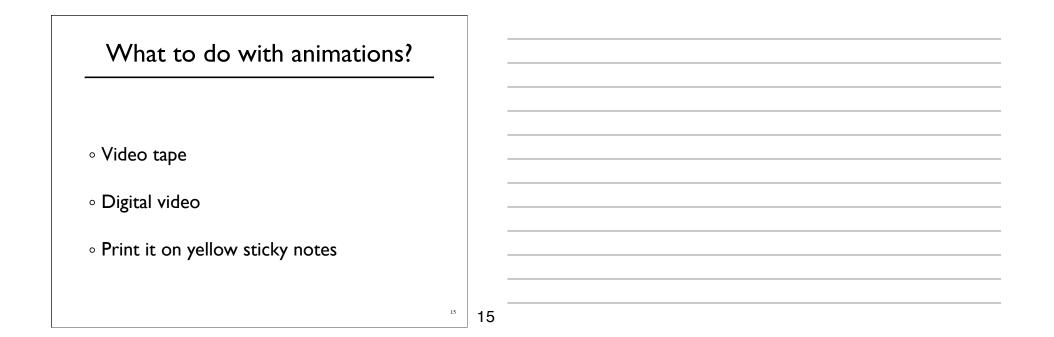


# Simulation

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

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### NTSC Standard

- $\circ$  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)
- $\circ$  Interlaced video
- Overscan regions

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## **Digital Video**

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

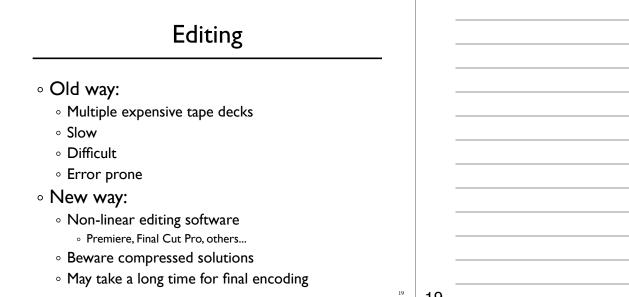
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# **Digital Video**

- Nearly all CODECs are lossy
  - $\circ~\mbox{Parameter}$  setting important
  - $\circ\,$  Different type of video work with different CODECs
  - $\circ$  Compressors not all equally smart
  - $\circ\,$  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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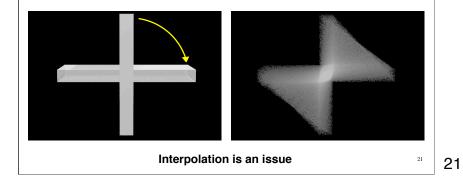
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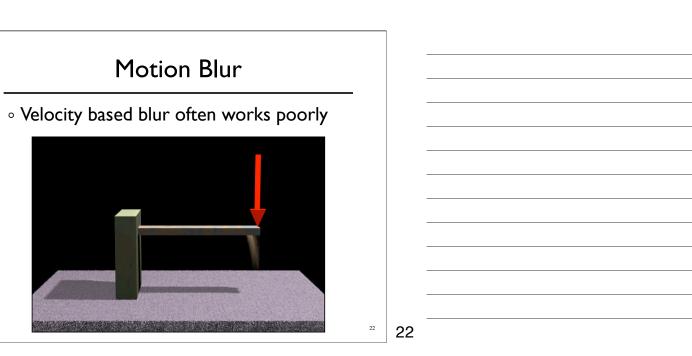


- Fast moving things look blurry
  - Human eye
  - Finite exposure time in cameras
- Without blur: strobing and aliasing
- Blur over part of frame interval
  - Measured in degrees (0..360)
  - 30 tends to often look good

# Motion Blur

• Easy to do in a sampling framework





Wednesday, November 12, 2008