A Sketching Interface for Articulated Figure Animation

CS-184: Computer Graphics

Lecture 19: Introduction to Animation

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Slides based on those of James O'Brien

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

Introduction to Animation

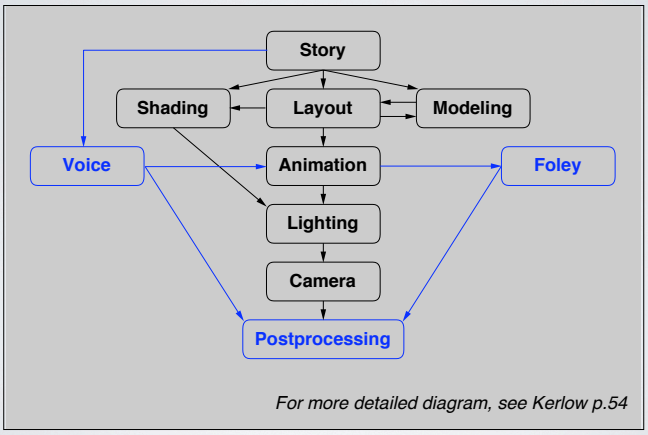
Technical issues often dominated by aesthetic ones

Violation of realism desirable in some contexts

Animation is a communication tool

- Should support desired communication
- There should be something to communicate

Introduction to Animation



For more detailed diagram, see Kerlow p.54

Introduction to Animation

Key-frame animation
- Specification by hand

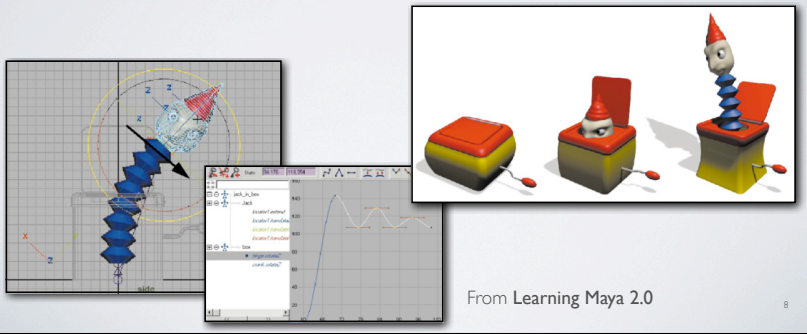
Motion capture
- Recording motion

Procedural / simulation
- Automatically generated

Combinations
- **e.g. mocap + simulation**

Key-framing (manual)

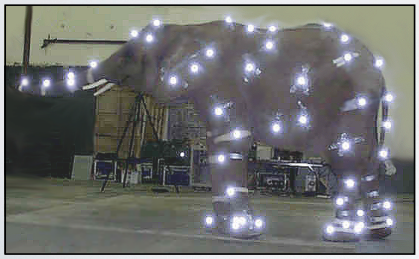
Requires a highly skilled user
Poorly suited for interactive applications
High quality / high expense
Limited applicability



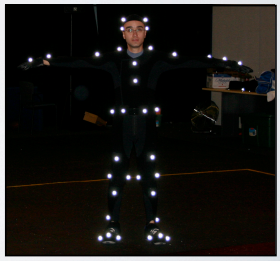
From **Learning Maya 2.0**

Motion Capture (recorded)

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

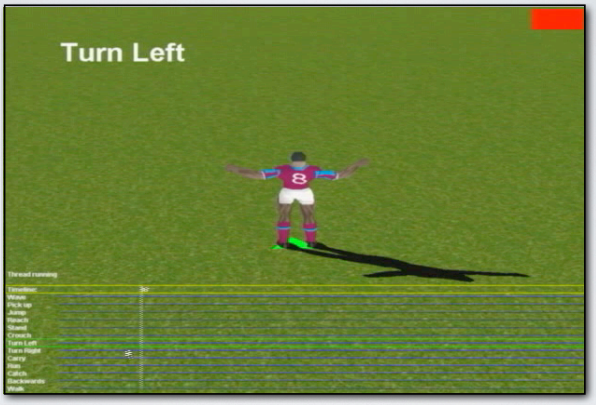


MotionAnalysis / Performance Capture Studio



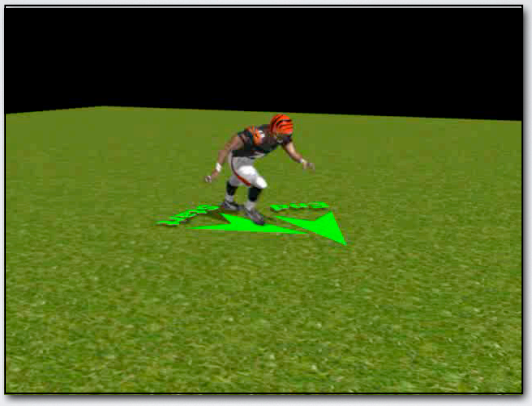
Okan Arikan

Motion Editing



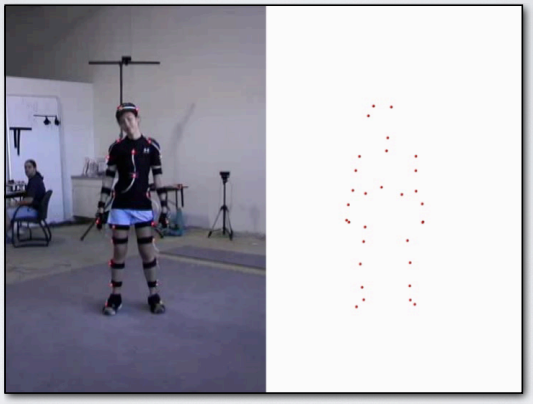
Arikan, Forsyth, O'Brien, SIGGRAPH 2002

Motion Editing



Arikan, Forsyth, O'Brien, SIGGRAPH 2002

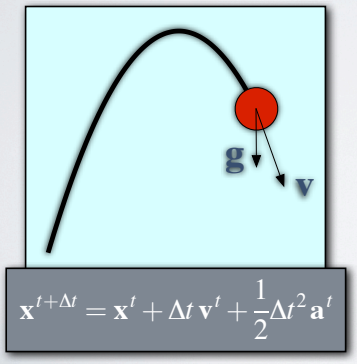
Model Construction



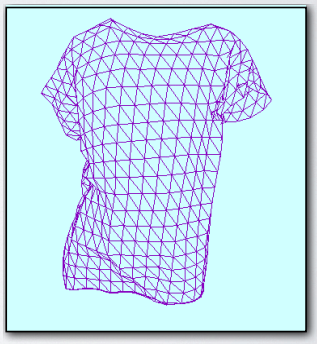
Kirk, O'Brien, Forsyth, CVPR 2005

Simulation

Generate motion of objects using numerical simulation methods



$$\mathbf{x}^{t+\Delta t} = \mathbf{x}^t + \Delta t\,\mathbf{v}^t + \frac{1}{2}\Delta t^2\,\mathbf{a}^t$$



Simulation

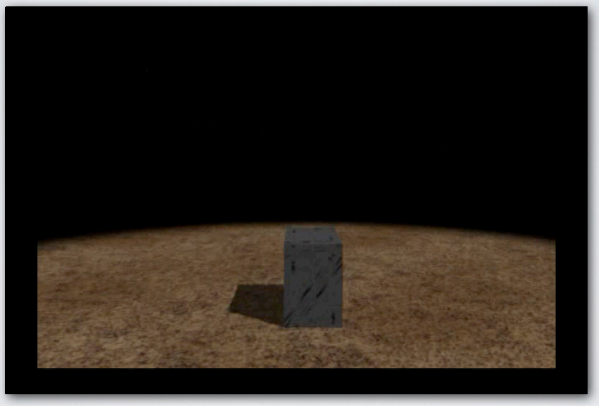
Perceptual accuracy required

Stability, easy of use, speed, robustness all important

Predictive accuracy less so

Control desirable

Simulation



Feldman, Arikan, O'Brien, SIGGRAPH 2003

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

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

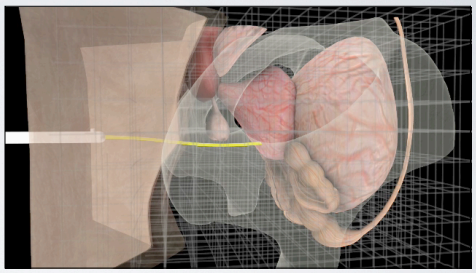
Video Games

Interactive Animation

"Serious" Games

Interactive Animation

"Serious" Games



Motion Blur

Fast moving things look blurry

- Human eye
- Finite exposure time in cameras

Without blur: strobing and aliasing

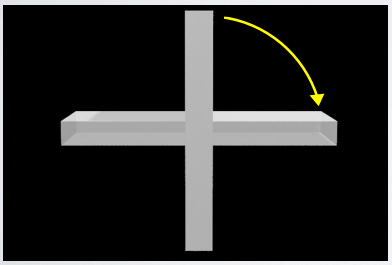
Blur over part of frame interval

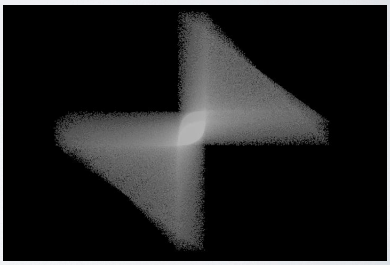
- Measured in degrees (0..360)
- 30 tends to often look good

Motion Blur

Easy to do in a sampling framework

Interpolation is an issue





Motion Blur

Velocity based blur often works poorly