Motion Capture

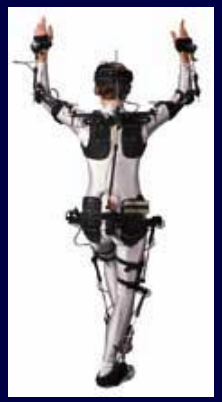
Magnetic Capture Systems

- Tethered
- Sensitive to metal
- Low frequency (60Hz)

2

Mechanical Capture Systems

- Any environment
- Measures joint angles
- Restricts the motion



3

Optical motion capture

- Place markers on the actor

- Cameras can determine marker positions

4

Optical Capture Systems

- 8 or more cameras
- Restricted volume
- High Frequency (240Hz)
- Occlusions

5

How Does It Work?

8 cameras + 120 Hz + Special tape = Raw Point Data

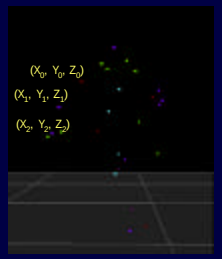
6

Optical motion capture process

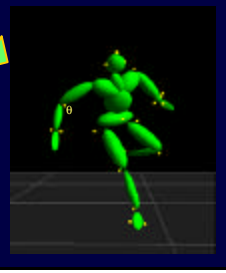
1. Perform a motion trial
2. Triangulate camera views to compute marker positions
3. Identify and uniquely label markers
4. Fill in the occluded marker paths
5. Use IK to calculate joint angles from maker paths

7

Marker Identification



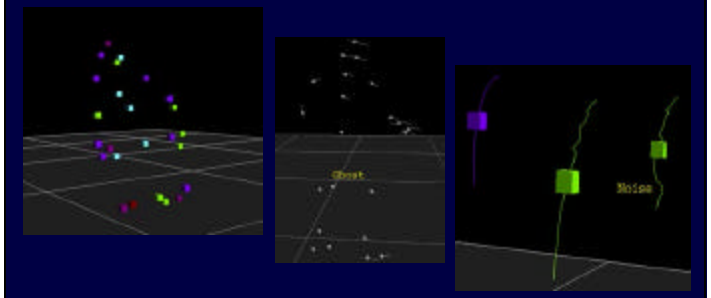
At each frame, motion capture gives us a set of points



We would like something more intuitive

8

Marker Identification Problems



Making sense of raw data...

9

IK Problem Definition

- 1) Create a handle on body
  - position or orientation
- 2) Pull on the handle
- 3) IK figures out how joint angles should change

10

More Formally

Let:

q actor *state vector* (joint bundle)

C(q) constraint functions that pull handles

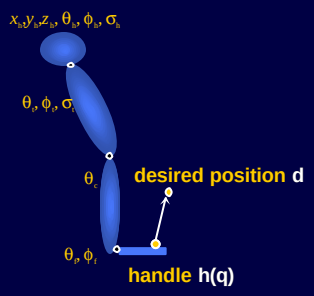
Then:

solve for **q** such that **C(q) = 0**

11

What's a Constraint?

$q=[\ x_s, y_s, z_s, \theta_s, \phi_s, \sigma_s, \theta_r, \phi_r, \sigma_r, \theta_e, \theta_f, \phi_f\ ]$

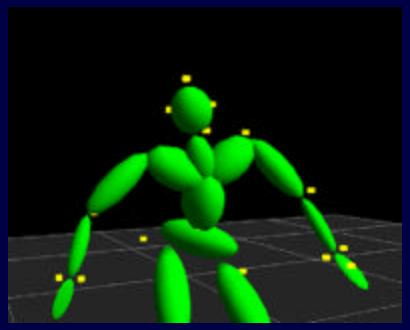


- Can be rich, complicated
- But most common is very simple:
- Position constraint just sets difference of two vectors to zero:

C(q) = h(q) - d = 0

12

Data Reconstruction



13

Processing techniques

- Matching metrics
- Statistical methods
- Inverse kinematics

14

Motion capture as UI

- Map a “whiteboard space” anywhere
- Full body user interface
  - Gesture recognition
- Full-body teleconferencing

15