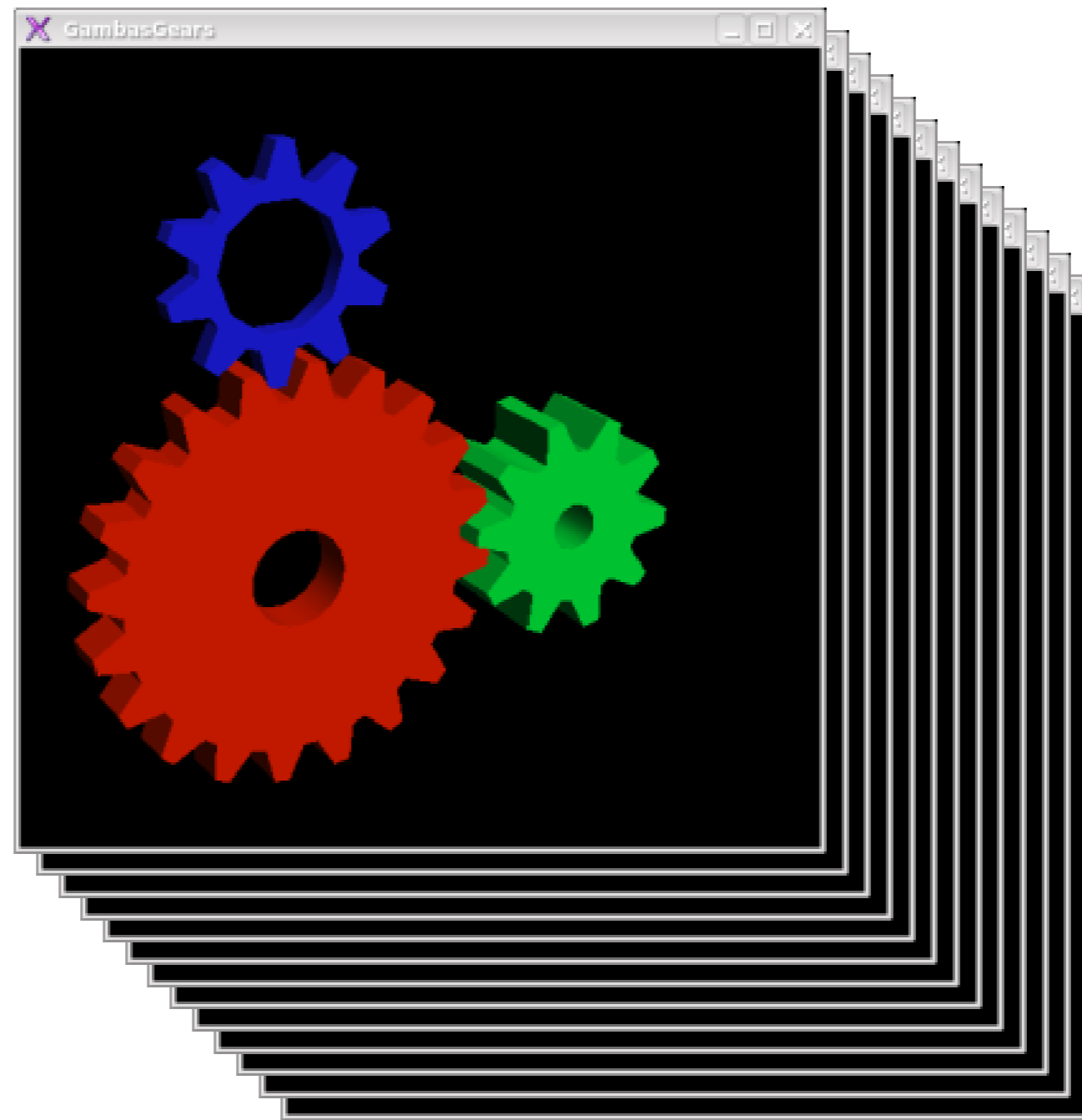


Animation, Motion Capture, Keyframing



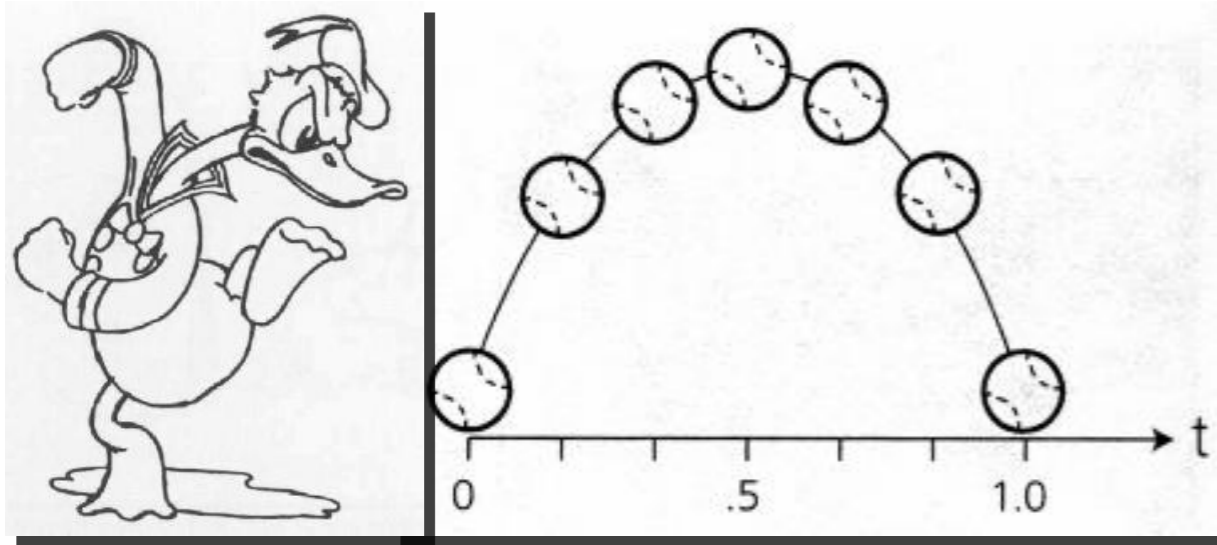
source: http://scaq.blogspot.com/2006_11_01_archive.html

What is Animation?



Animation = Graphics × Time

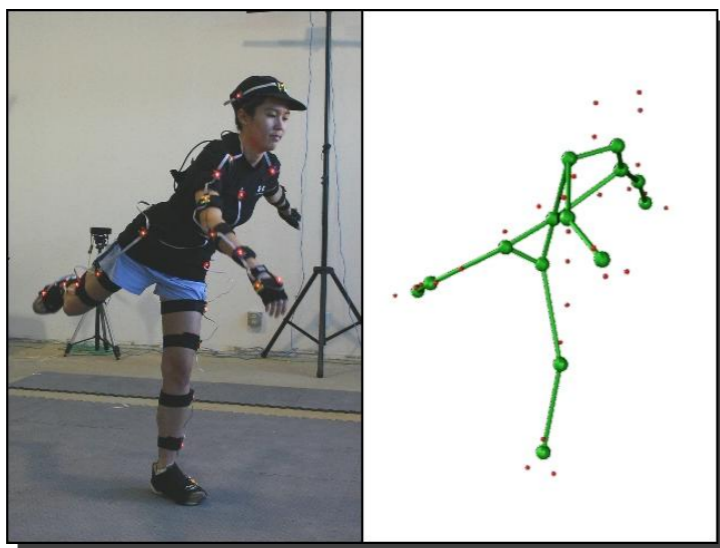
Techniques for Creating Animation



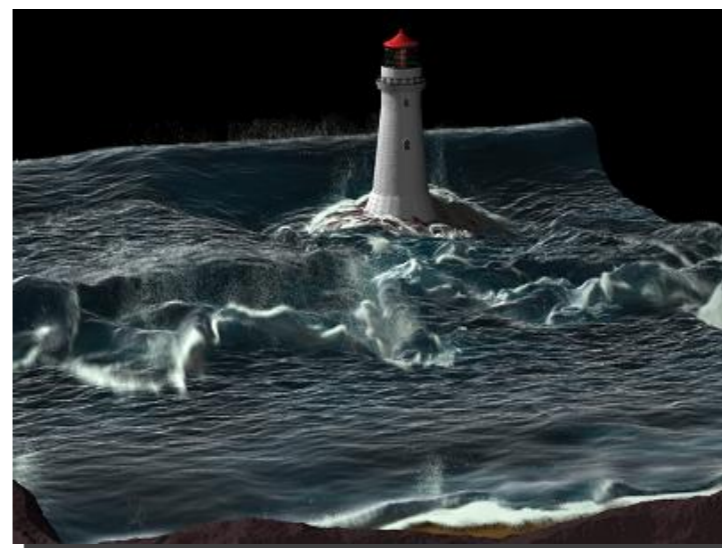
Keyframing



Procedural Animation

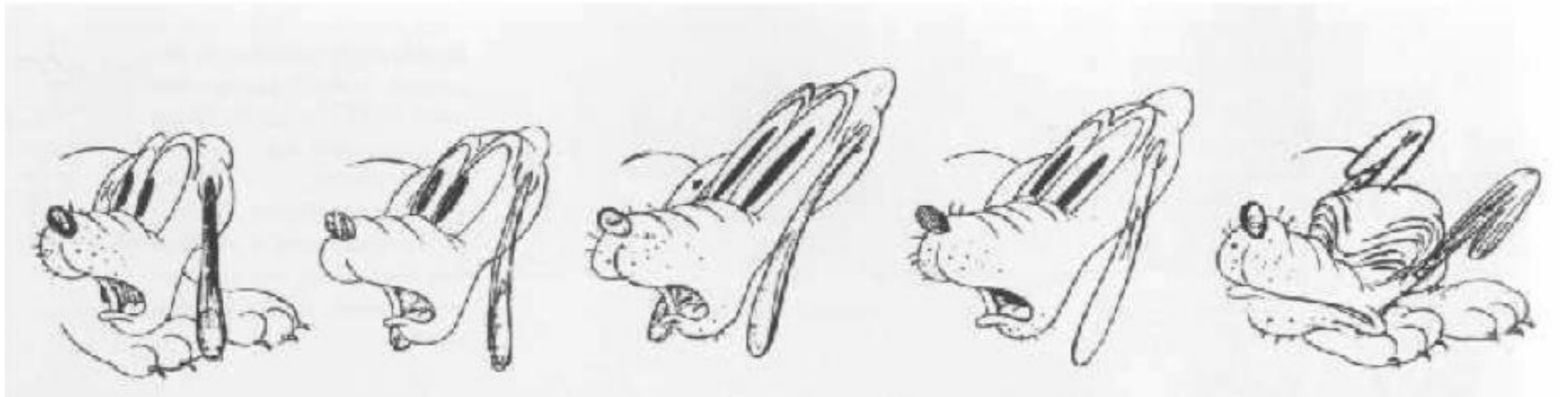
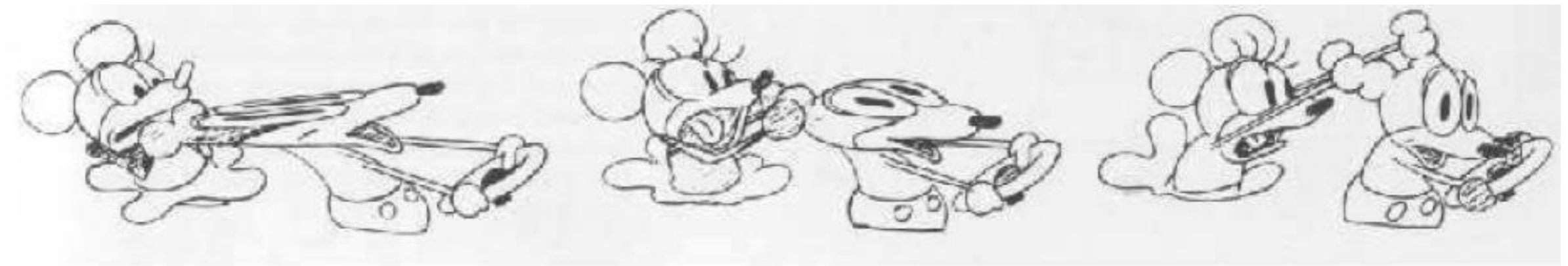


Data-driven Animation

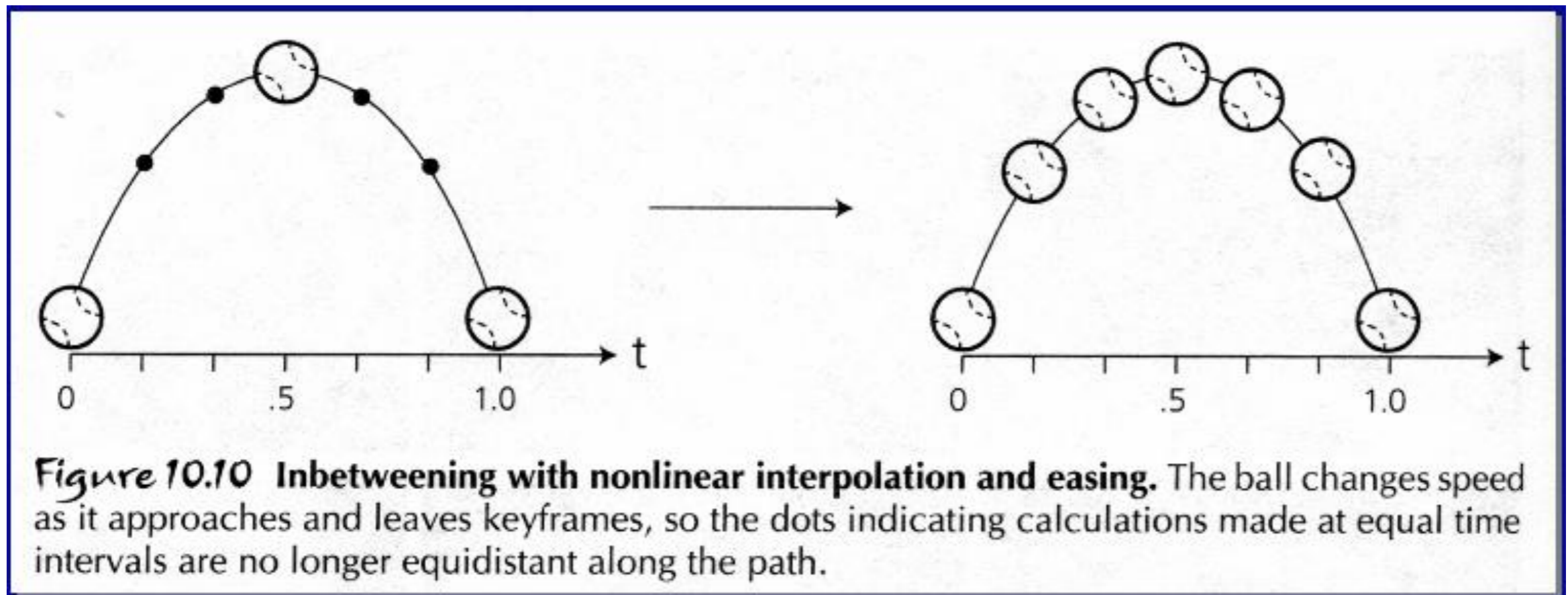


Physical Simulation

Keyframing



Keyframing



Principles of Traditional Animation

[Lasseter, SIGGRAPH 1987]

- Stylistic conventions followed by Disney's animators and others
- From experience built up over many years
 - Squash and stretch -- use distortions to convey flexibility
 - Timing -- speed conveys mass, personality
 - Anticipation -- prepare the audience for an action
 - Followthrough and overlapping action -- continuity with next action
 - Slow in and out -- speed of transitions conveys subtleties
 - Arcs -- motion is usually curved
 - Exaggeration -- emphasize emotional content
 - Secondary Action -- motion occurring as a consequence
 - Appeal -- audience must enjoy watching it

“Traditional” Animation?



http://blogs.suntimes.com/ebert/2011/01/the_best_animated_films_of_201.html

Procedural Animation



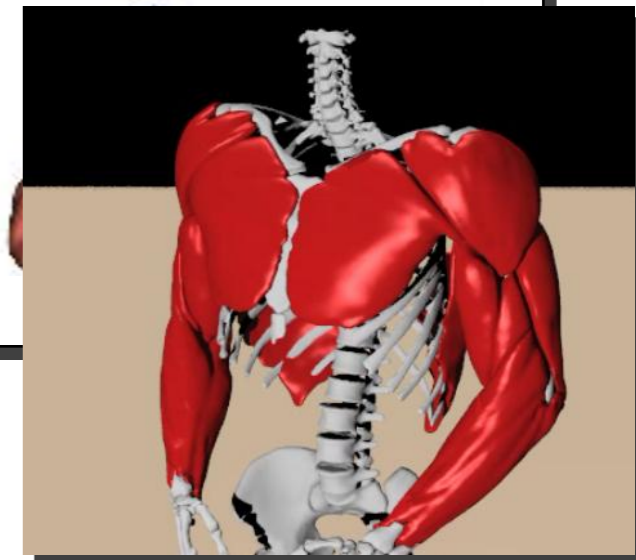
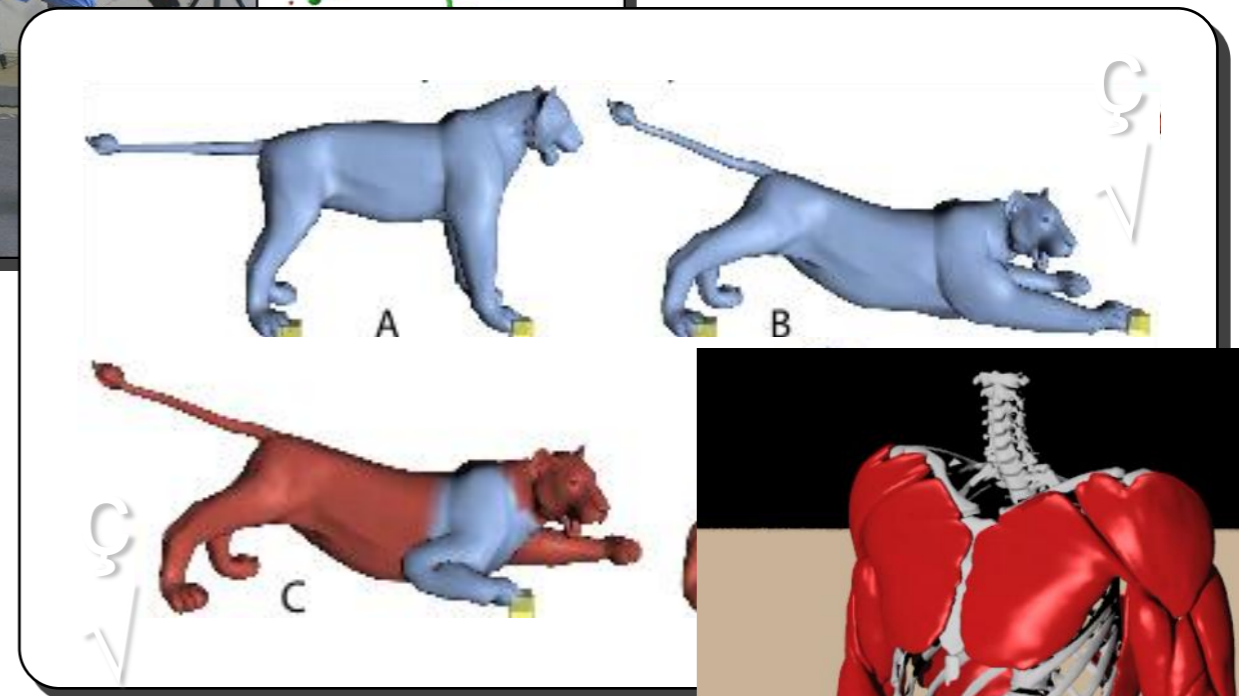
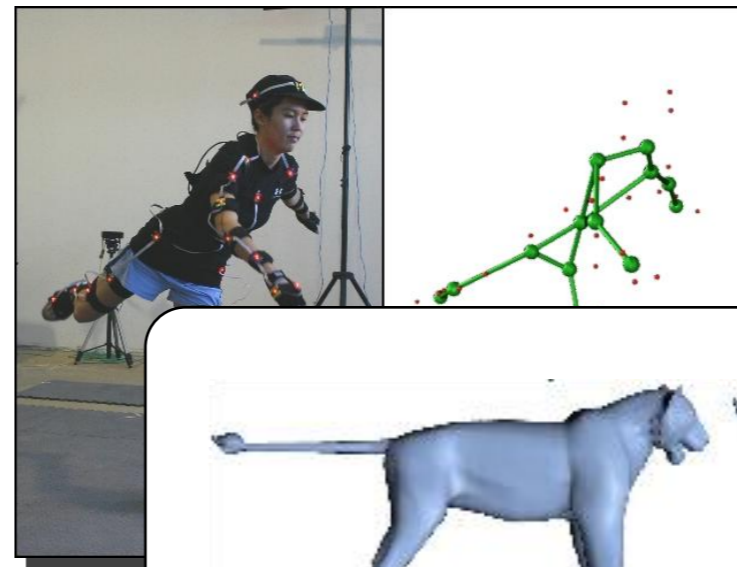
<http://www.massivesoftware.com/film-television-games//>

Data-driven Animation



Body Representation

- Kinematic Skeleton
- Anatomical
- Pure Mesh



Motion Capture

- Animation
- Interactive characters
- Robot control



Motion Capture

Record movements of actors

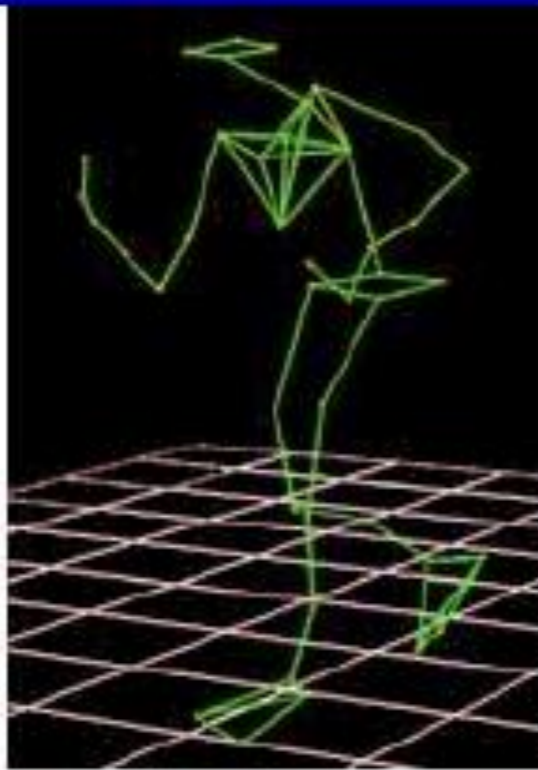
Motion capture lab at CMU (1ST Floor of Wean):

Vicon M camera system, 12 cameras

9mm markers



Motion Capture



Motion Capture

Motion capture

- track motion of reference points
 - » body or face
 - » magnetic
 - » optical
 - » exoskeletons
- convert to joint angles (not so straightforward)
- use these angles to drive an articulated 3-D model
- modify the motion for the situation
- give the user control

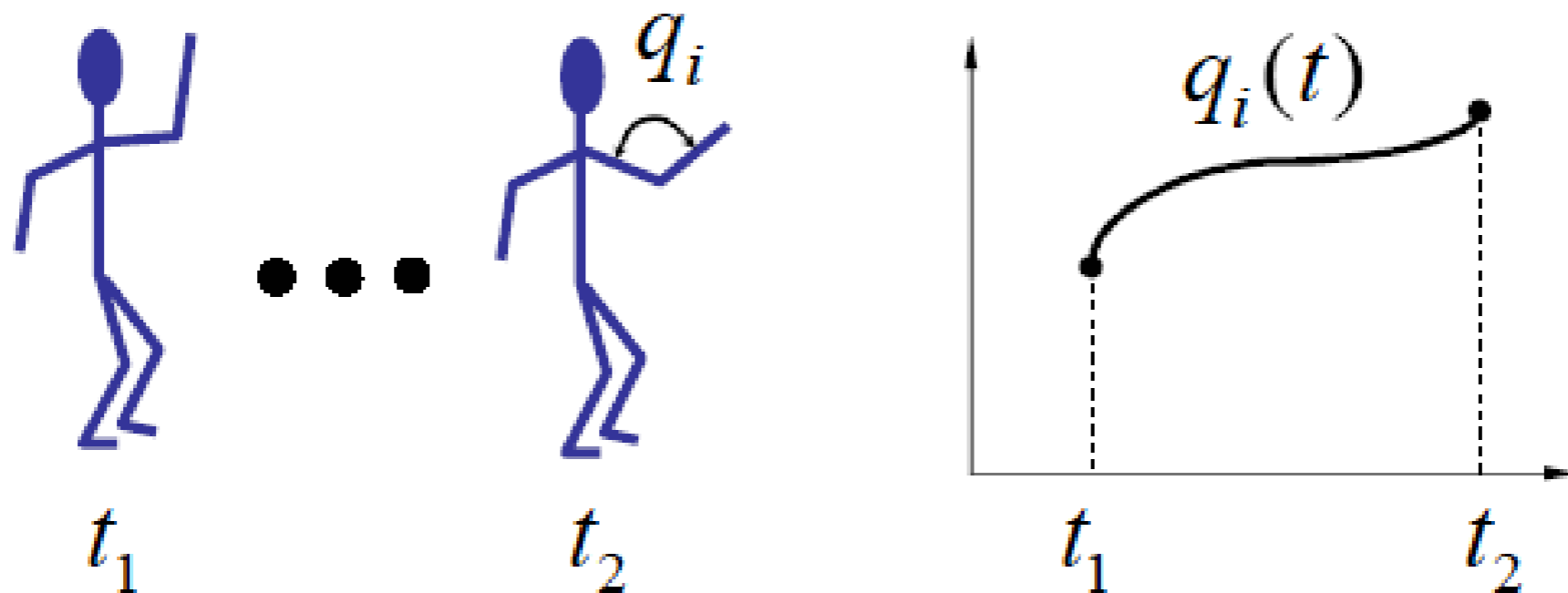


Articulated Models

Articulated models:

- rigid parts
- connected by joints

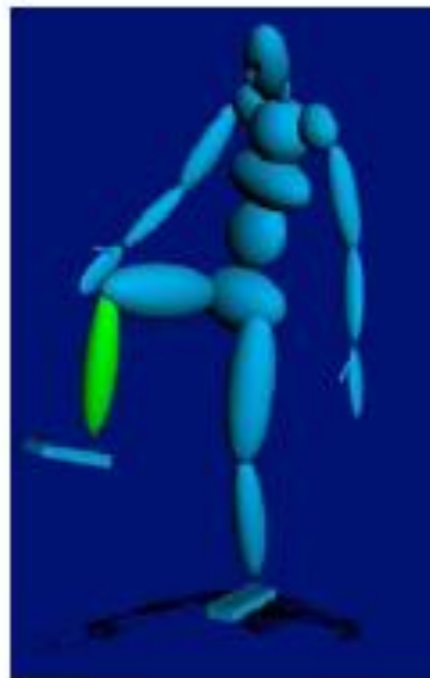
They can be animated by specifying the joint angles (or other display parameters) as functions of time.



Forward Kinematics

Describes the positions of the body parts as a function of the joint angles.

1 DOF: knee



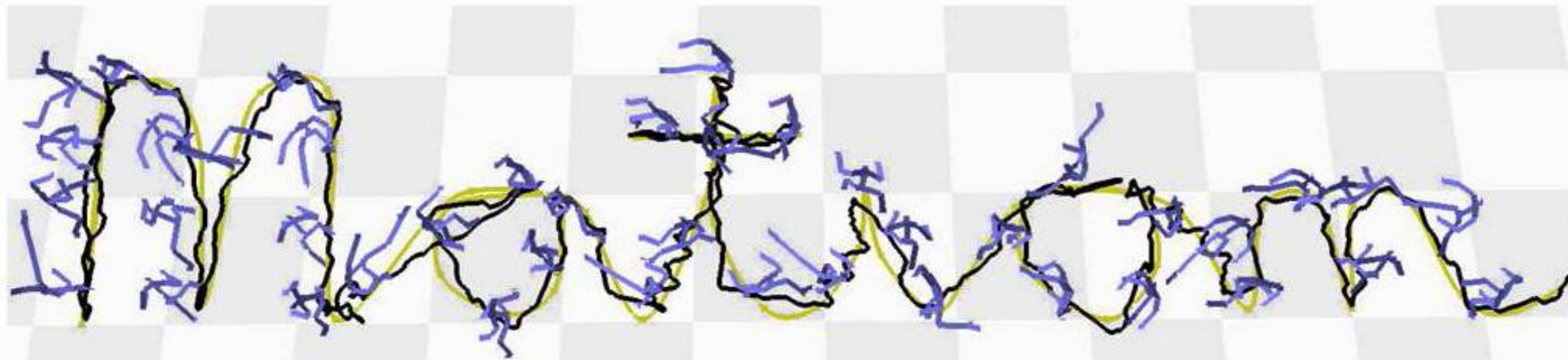
2 DOF: wrist



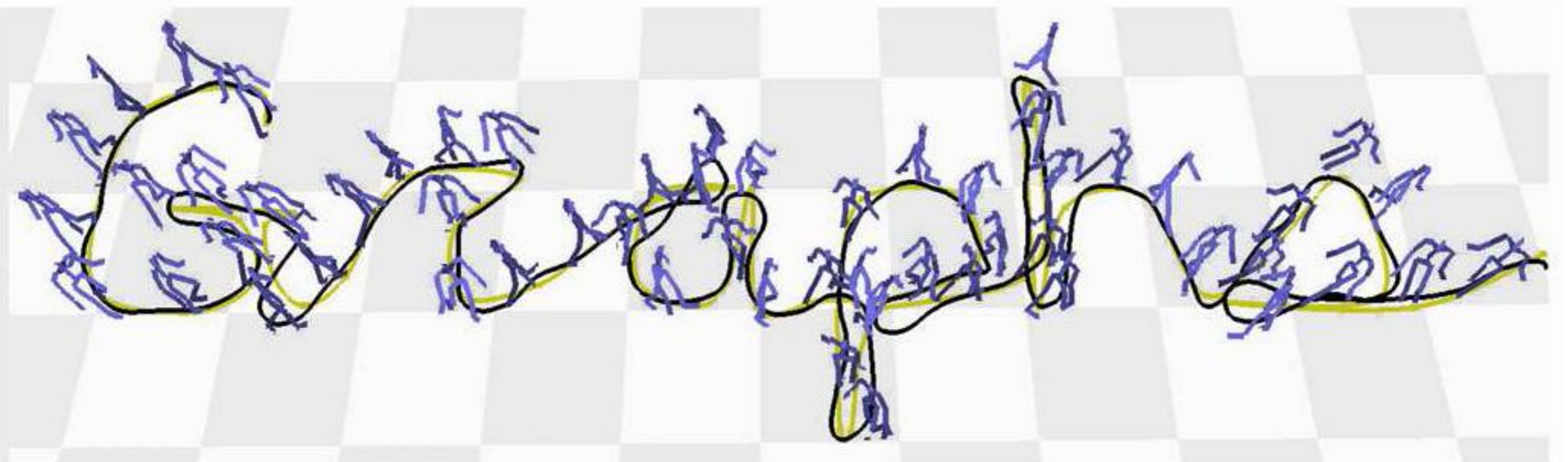
3 DOF: arm



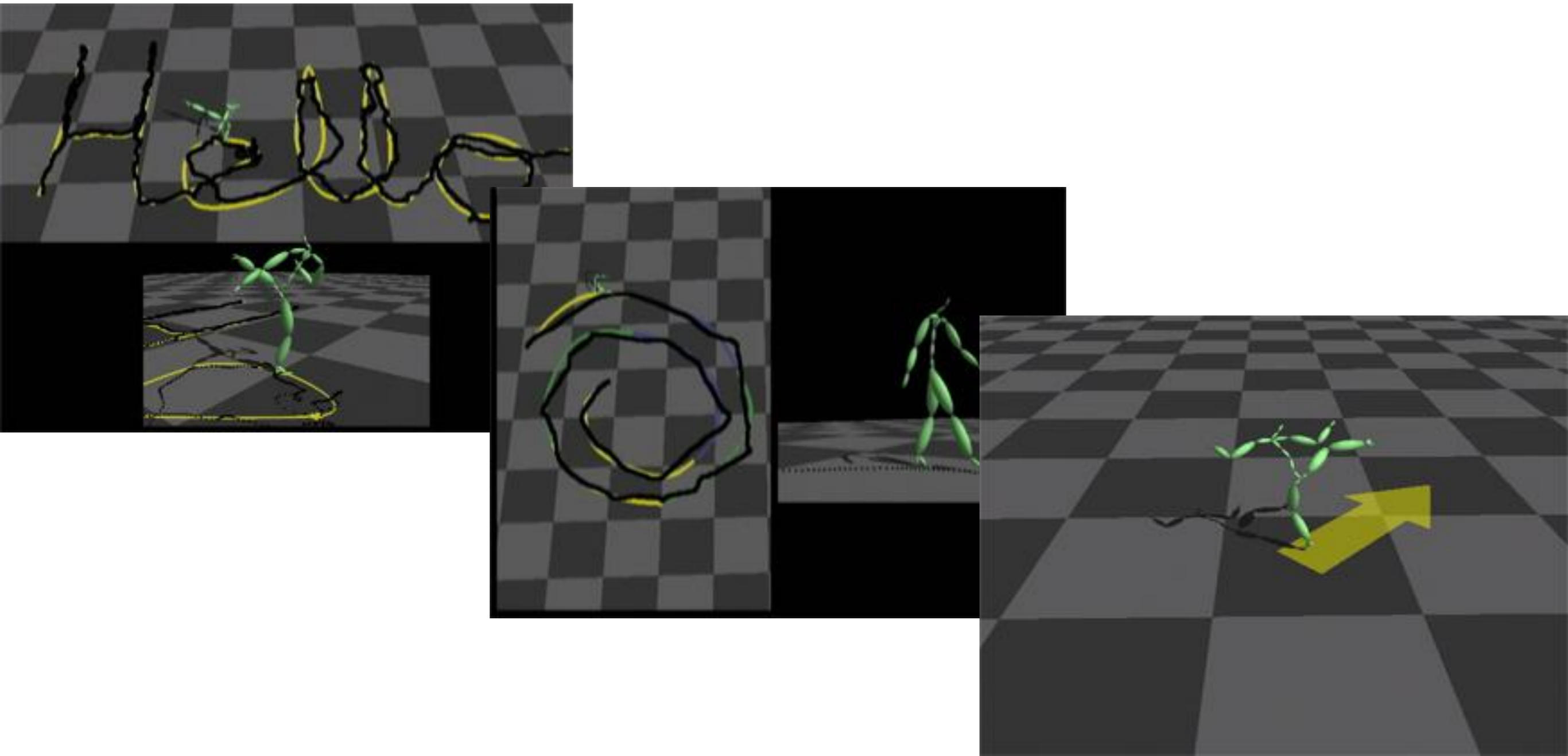
Motion Graphs



<http://www.cs.wisc.edu/graphics>



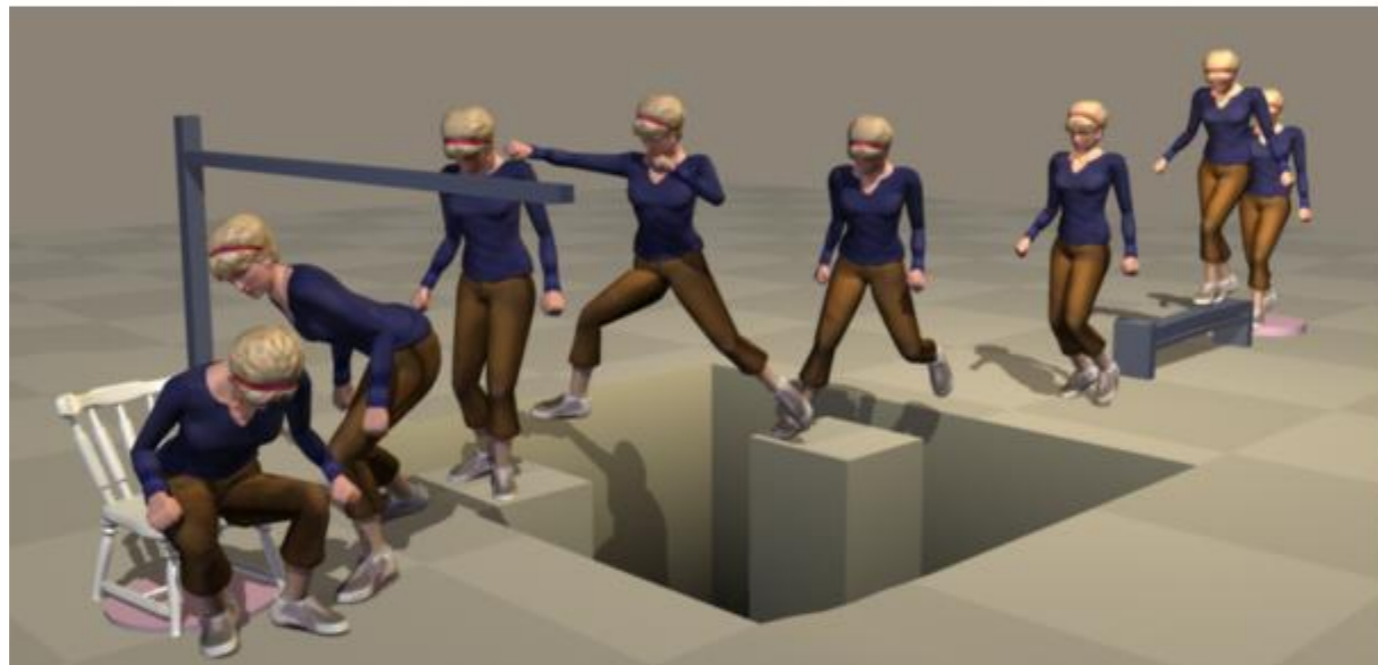
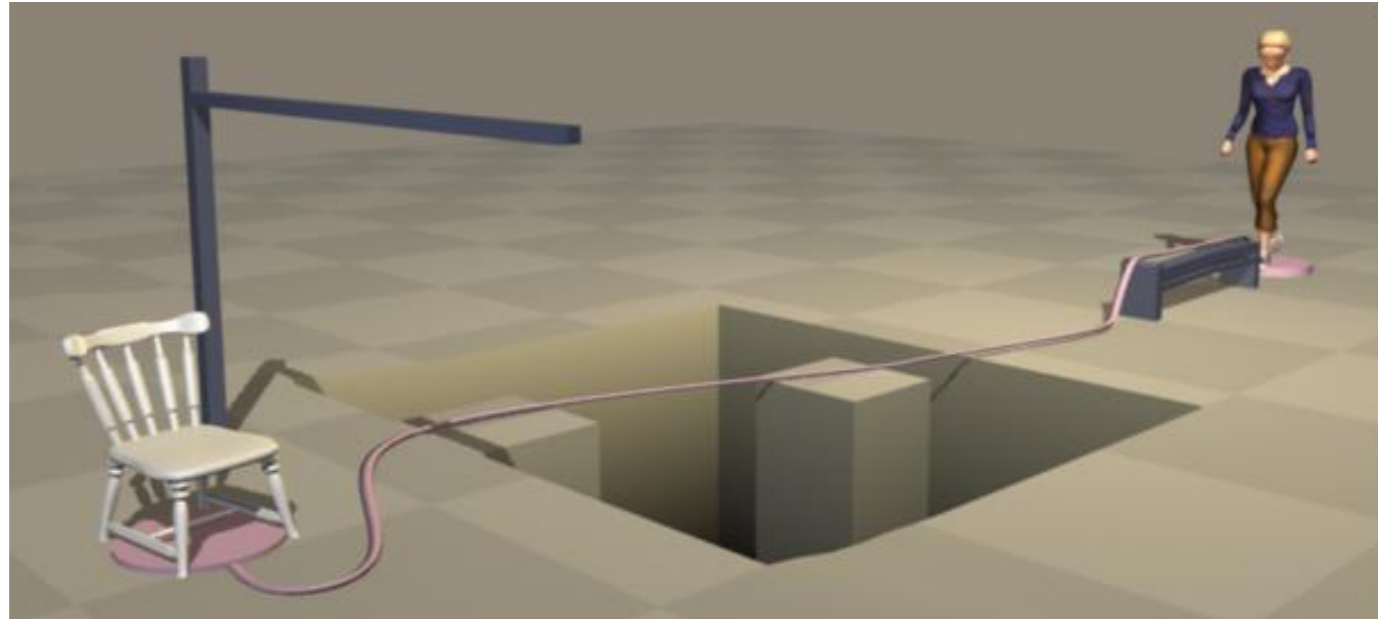
Motion Graphs Videos



<http://www.cs.wisc.edu/graphics/Gallery/kovar.vol/MoGraphs/>

Lucas Kovar (U. Wisconsin / ILM)
with Michael Gleicher

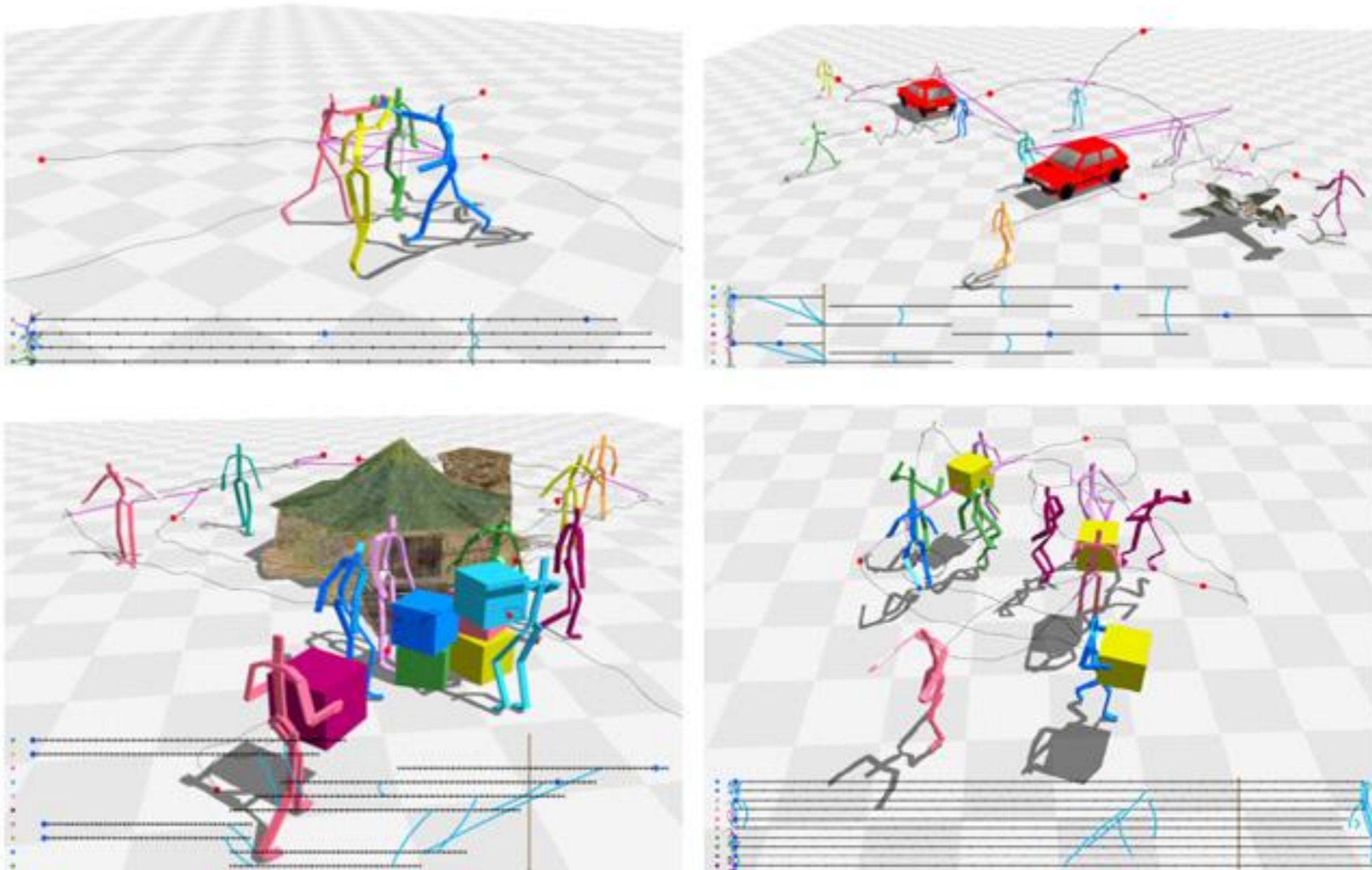
Interpolated Motion Graphs



<http://www.seas.upenn.edu/~alla/>

Alla Safonova (CMU / U. Pennsylvania)
with Jessica Hodgins

Interactive Editing



<http://mrl.snu.ac.kr/~jehee/>

Jehee Lee (Seoul National University)

Dense Body Capture

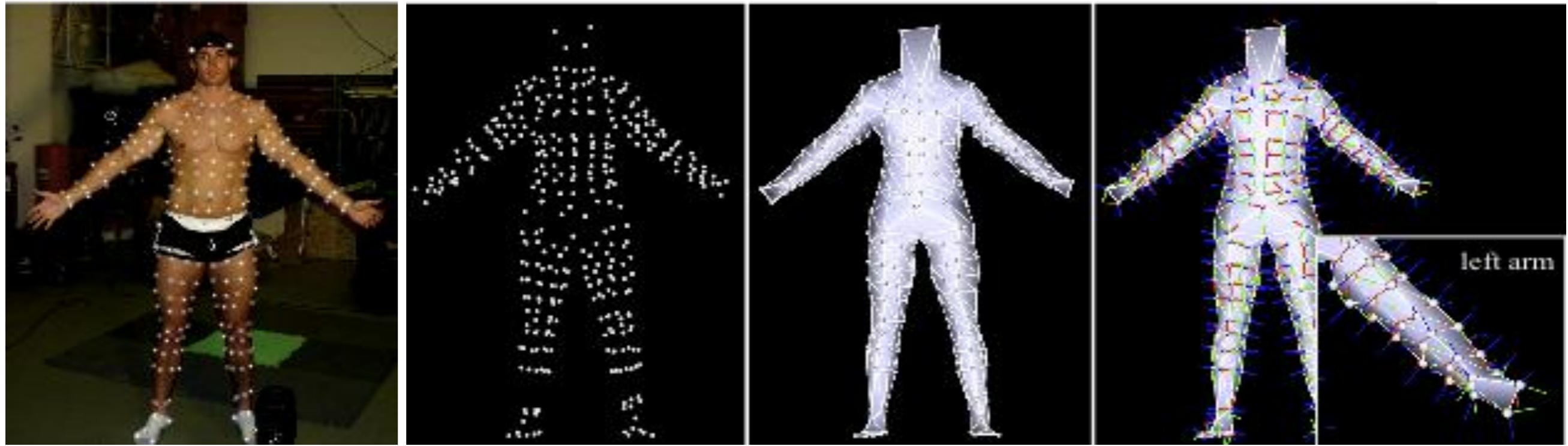


Laser Range Scanning

Performance Capture from Sparse Multi-view Video

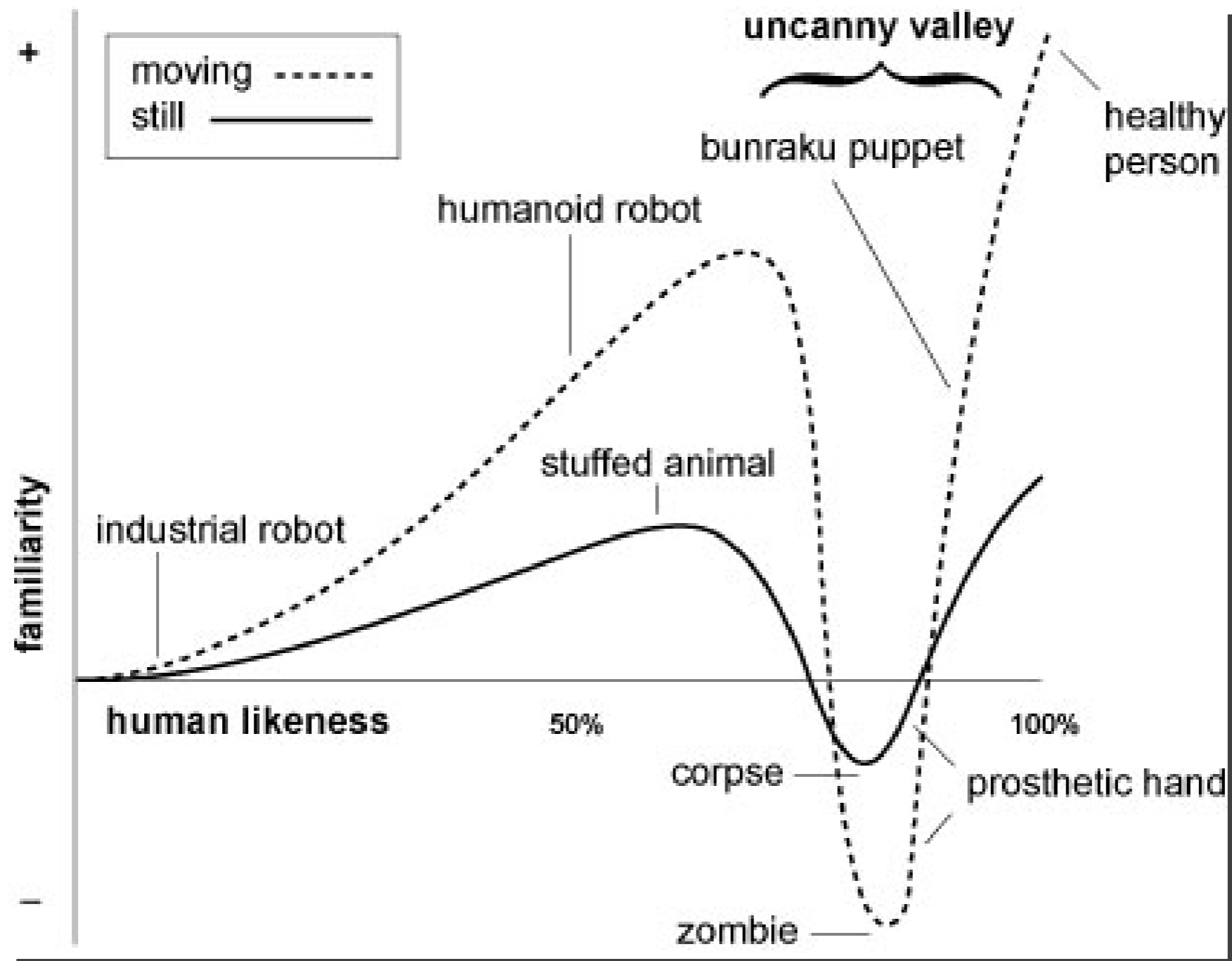


Dense Marker Capture



Sang Il Park (CMU / Sejong University)
with Jessica Hodgins

Uncanny Valley



Uncanny Valley or Not?

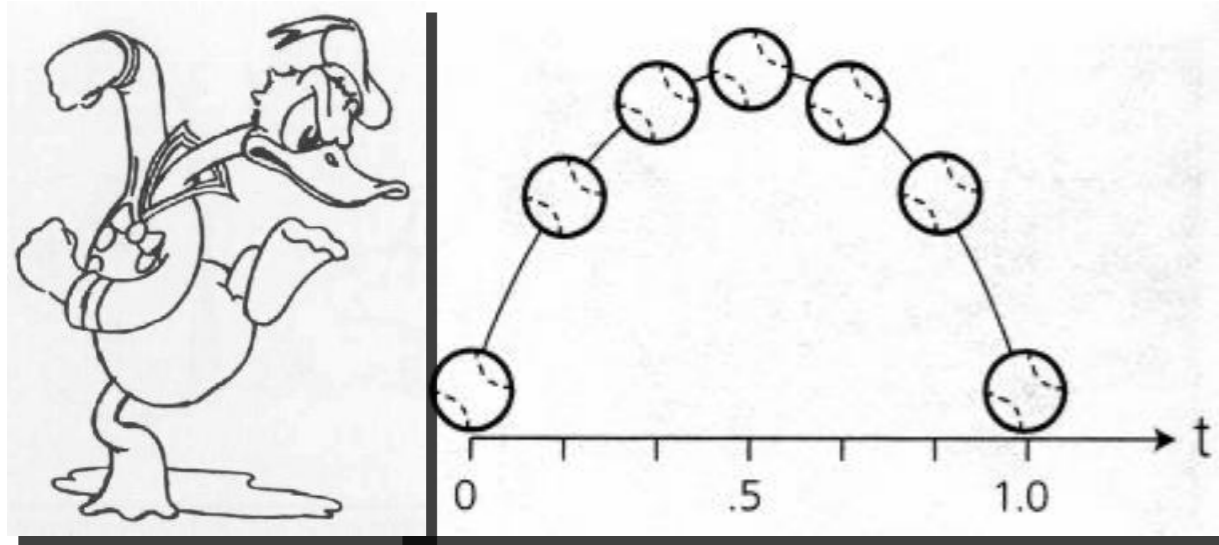
Let's watch some movies →

<http://www.youtube.com/watch?v=jVfB6GhlwIM>

<http://www.youtube.com/watch?v=svc4verU0dc&feature=related>

<http://www.youtube.com/watch?v=pkqzFUhGPJg>

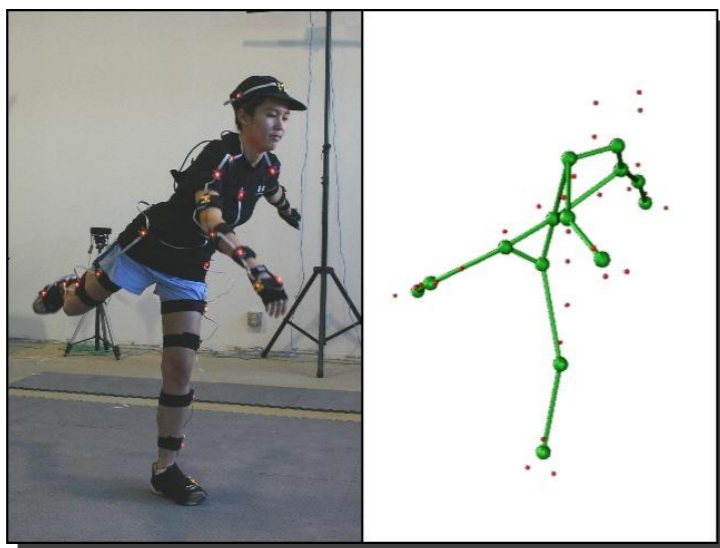
Techniques for Creating Animation



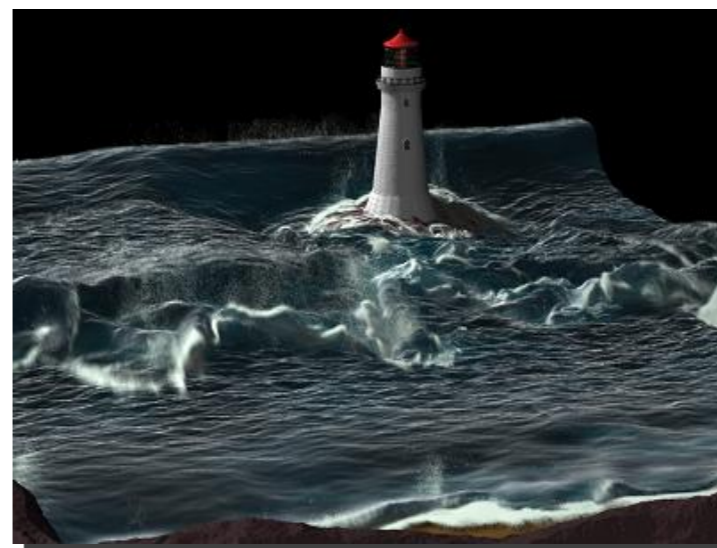
Keyframing



Procedural Animation

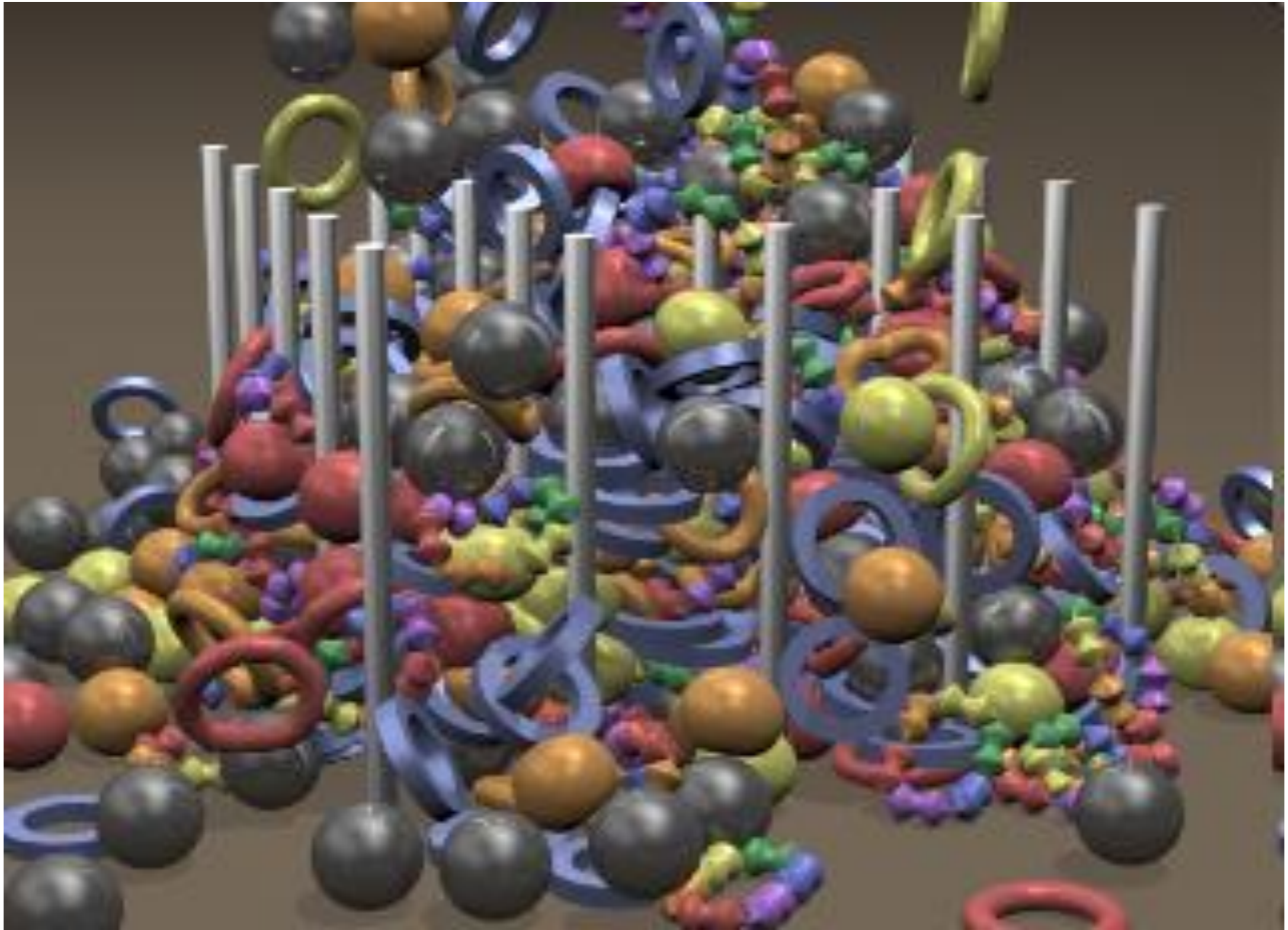


Data-driven Animation



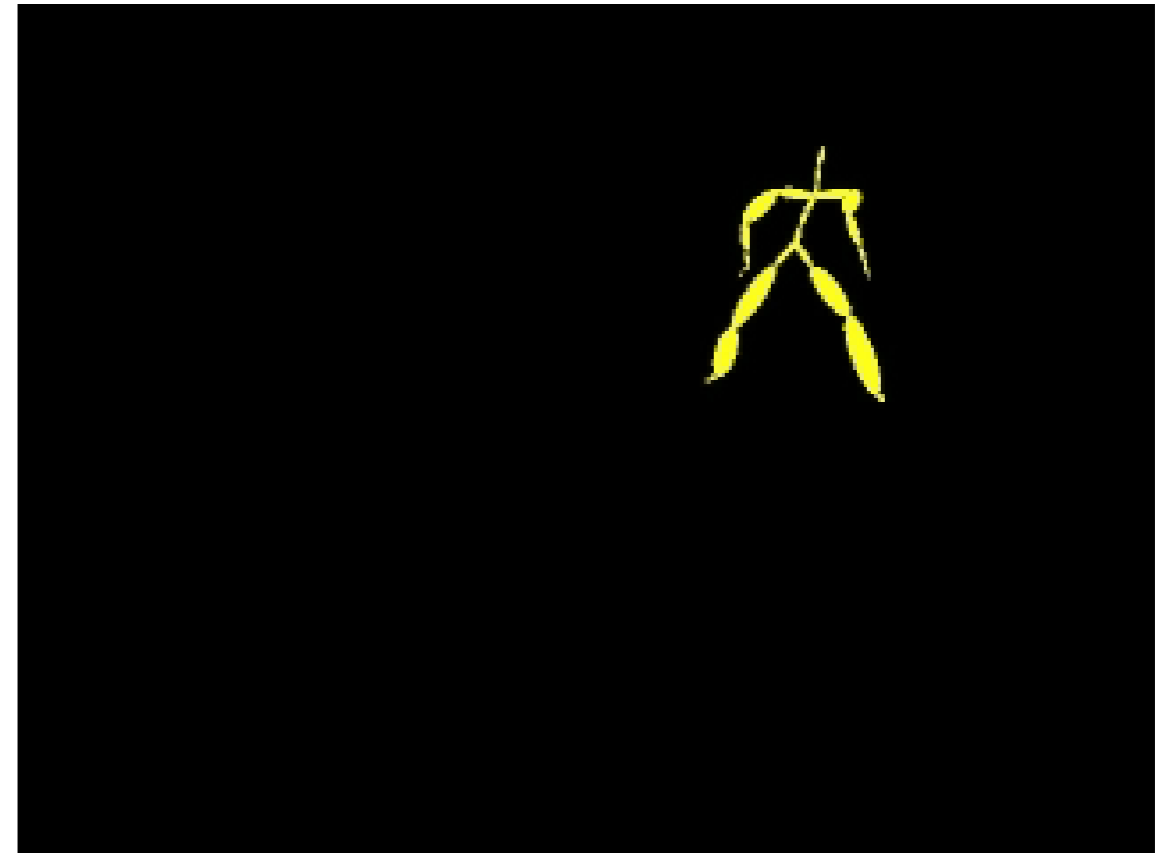
Physical Simulation

Physics-based Animation



Now for some details...

CMU Mocap Database



<http://mocap.cs.cmu.edu/>

CMU Mocap Database

To define a motion, we need:

The skeleton file: ASF format

The motion file: AMC format

Let's look at these...

Editing Motion Capture Data

How might you edit motions in such a format?

Retiming

Displacement curves

Keyframe extraction / edit keyframes