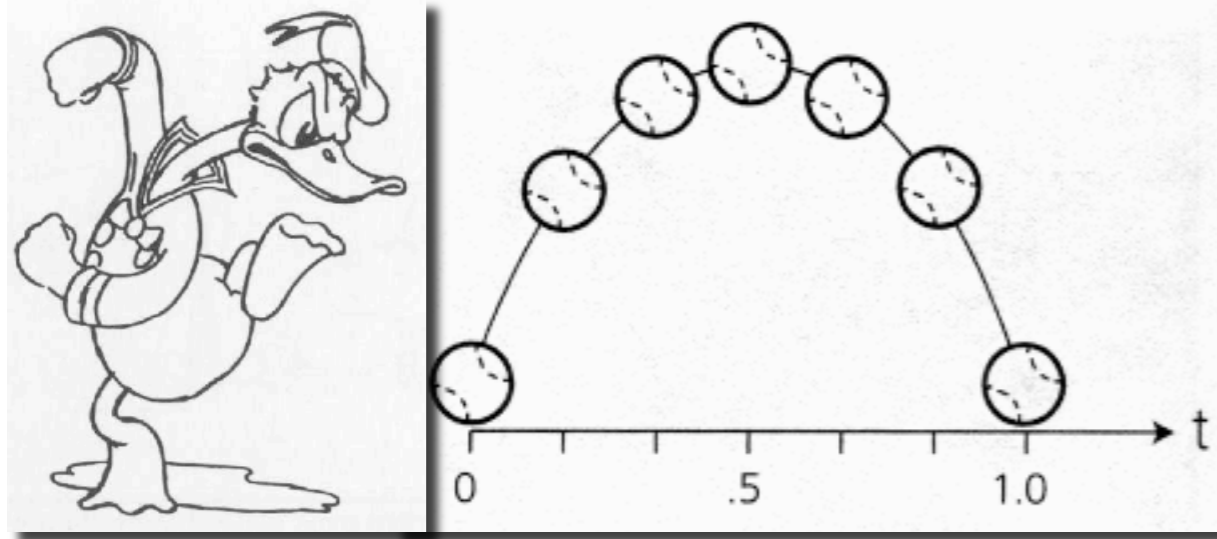


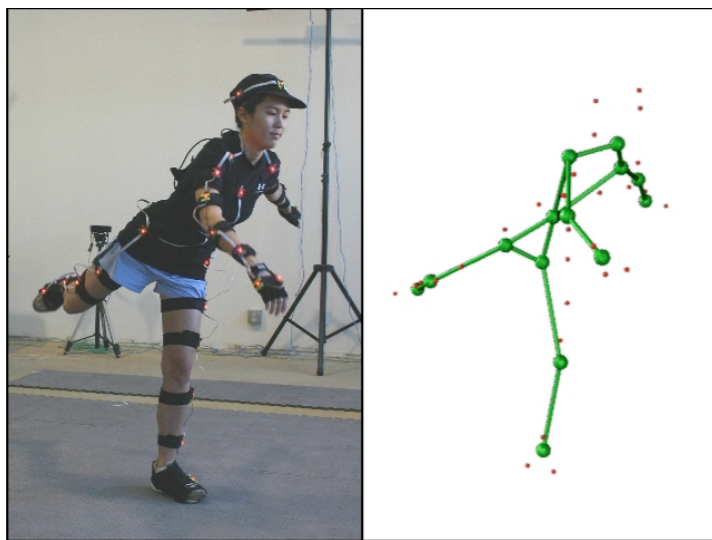
Techniques for Creating Animation



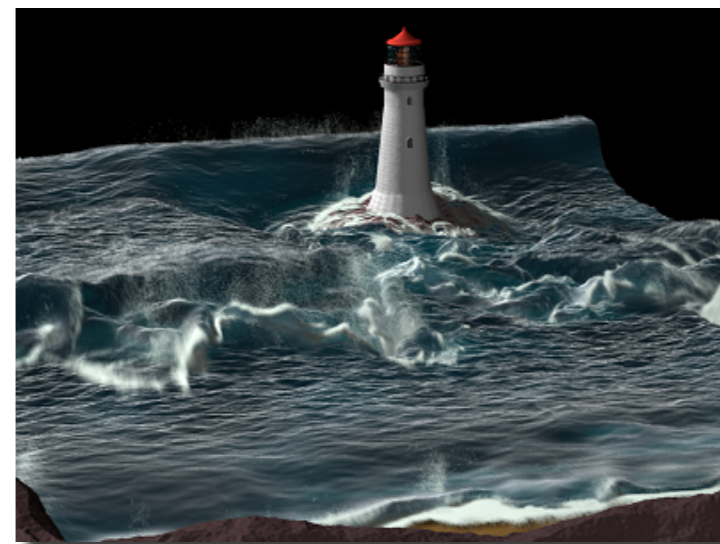
Keyframing



Procedural Animation

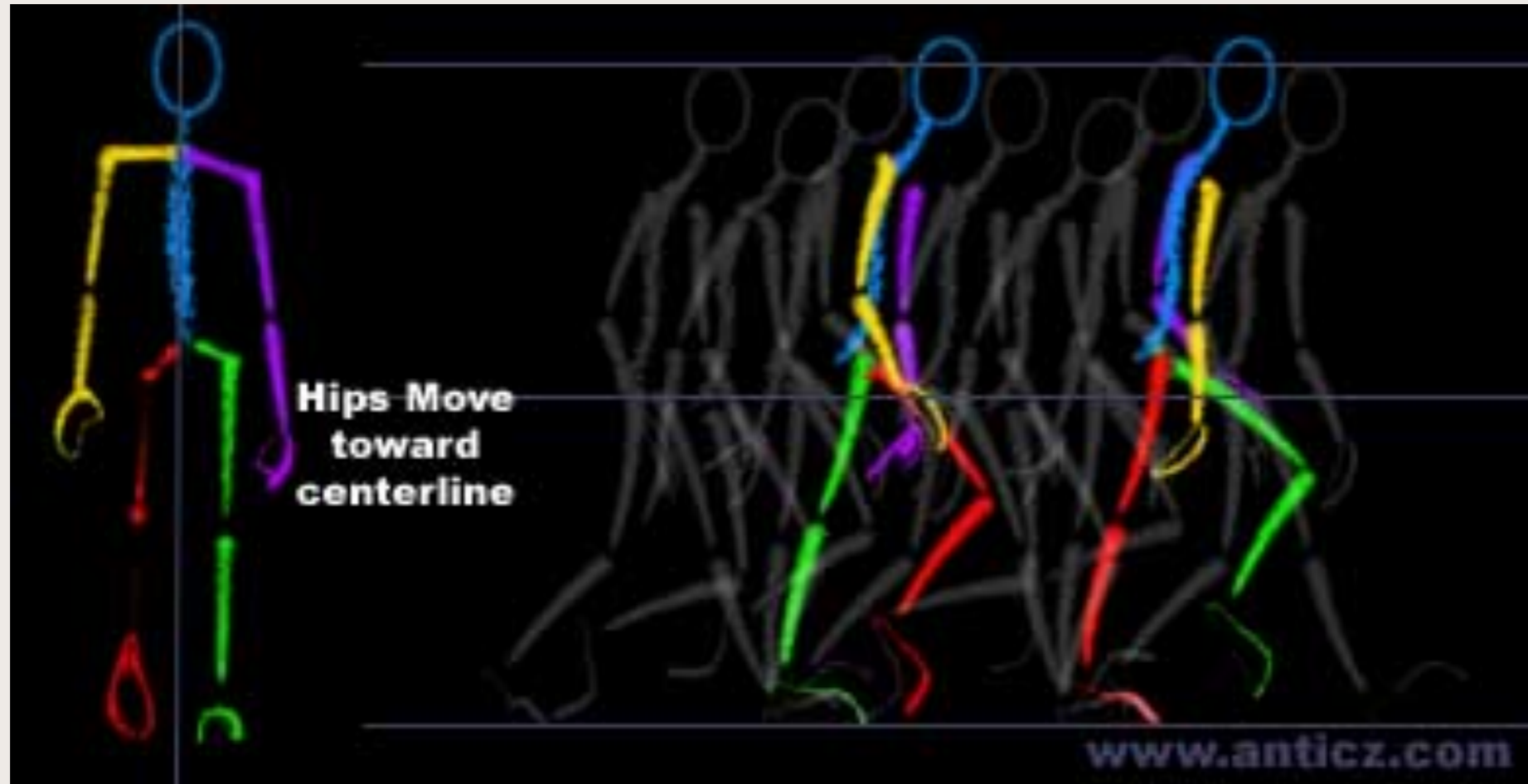


Data-driven Animation



Physical Simulation

Keyframing: animation

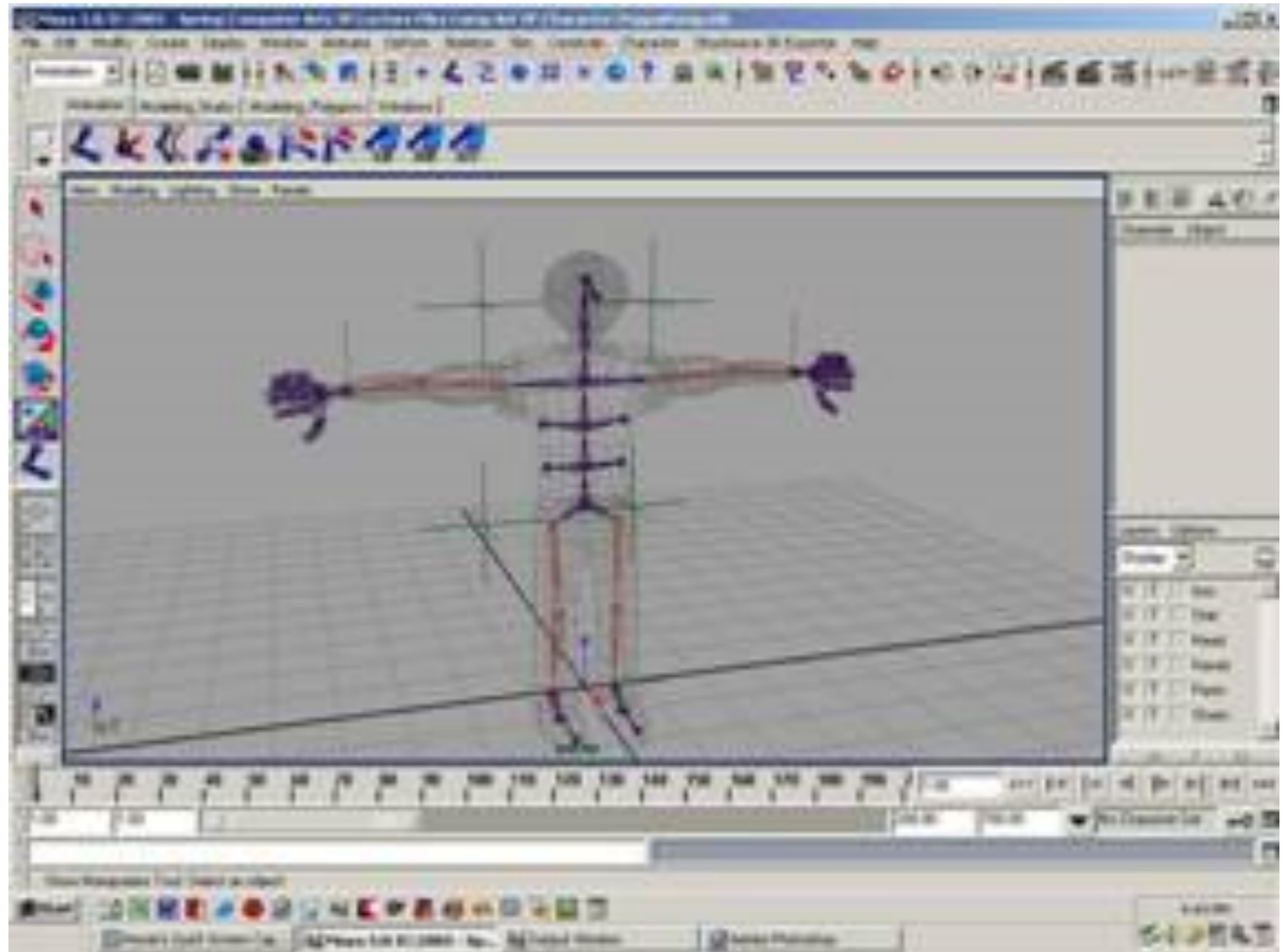


A basic walk cycle tutorial:

<https://design.tutsplus.com/tutorials/animation-for-beginners-how-to-animate-a-character-walking--cms-25536>

3D Keyframing: setup

**Model, rig, and
animate your
character in Maya**



<http://cgi.tutsplus.com/tutorials/creating-and-rigging-a-non-deformable-wooden-character-in-maya-part-1--cg-25436>

<http://www.youtube.com/watch?v=rWKLDPfam0>

Keyframing = Traditional Animation?

Stop Motion

Boxtrolls

Kubo and the two strings

<https://www.youtube.com/watch?v=Vhpq7-c91IA>



**Big Hero 6 – 3D modeling,
animation, and rendering
pipeline**



<https://www.youtube.com/watch?v=y6yrHkZVGF8>

Keyframing = Traditional Animation?



<https://www.esquire.com/entertainment/movies/g2202385/best-animated-movies-2018/>

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

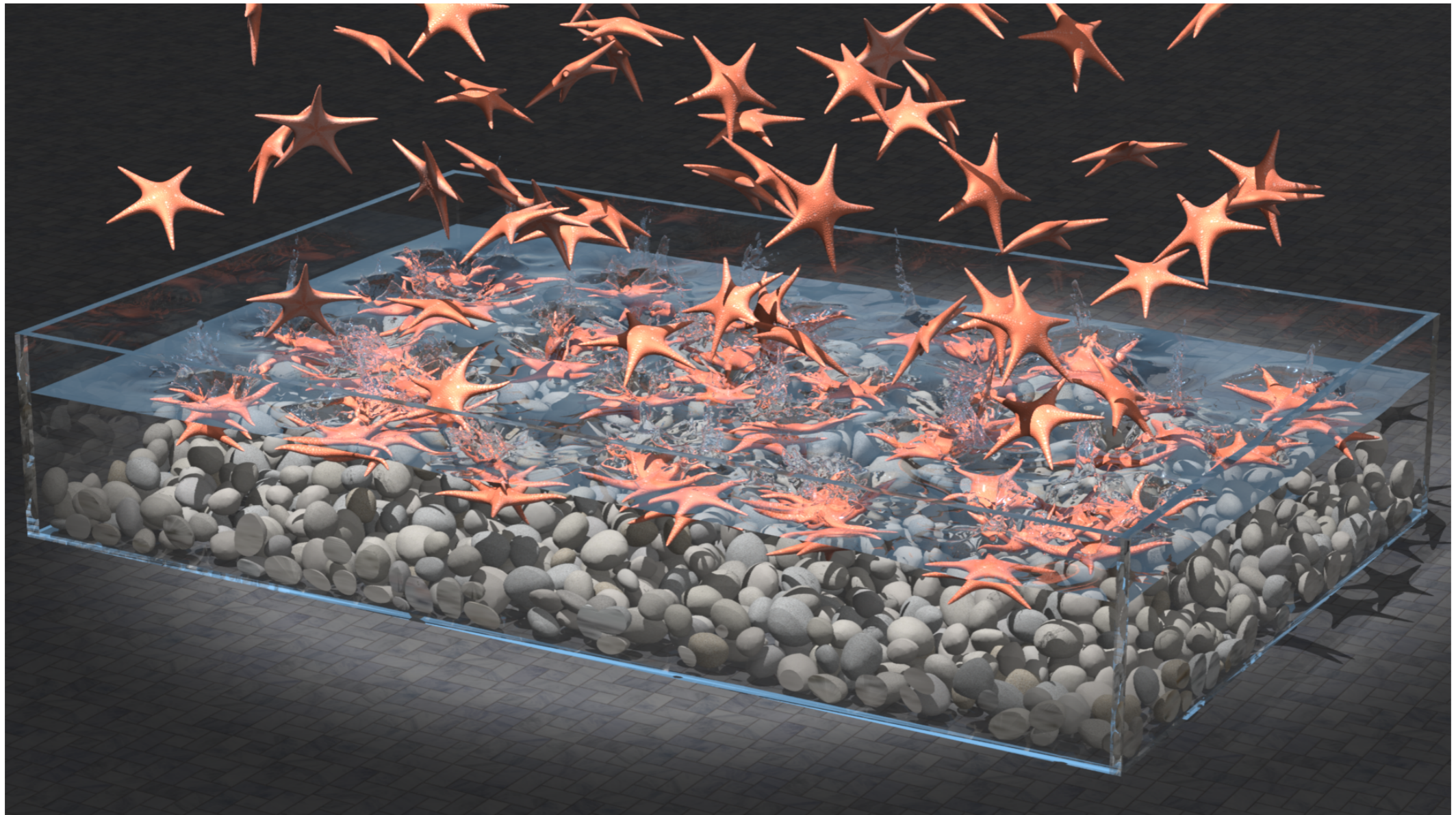
Procedural Animation



<http://www.massivesoftware.com/>

<http://video.wired.com/watch/design-fx-world-war-z-building-a-better-zombie-effects-exclusive>

Physics-based Animation



<http://physbam.stanford.edu/~fedkiw/>

Data-driven Animation

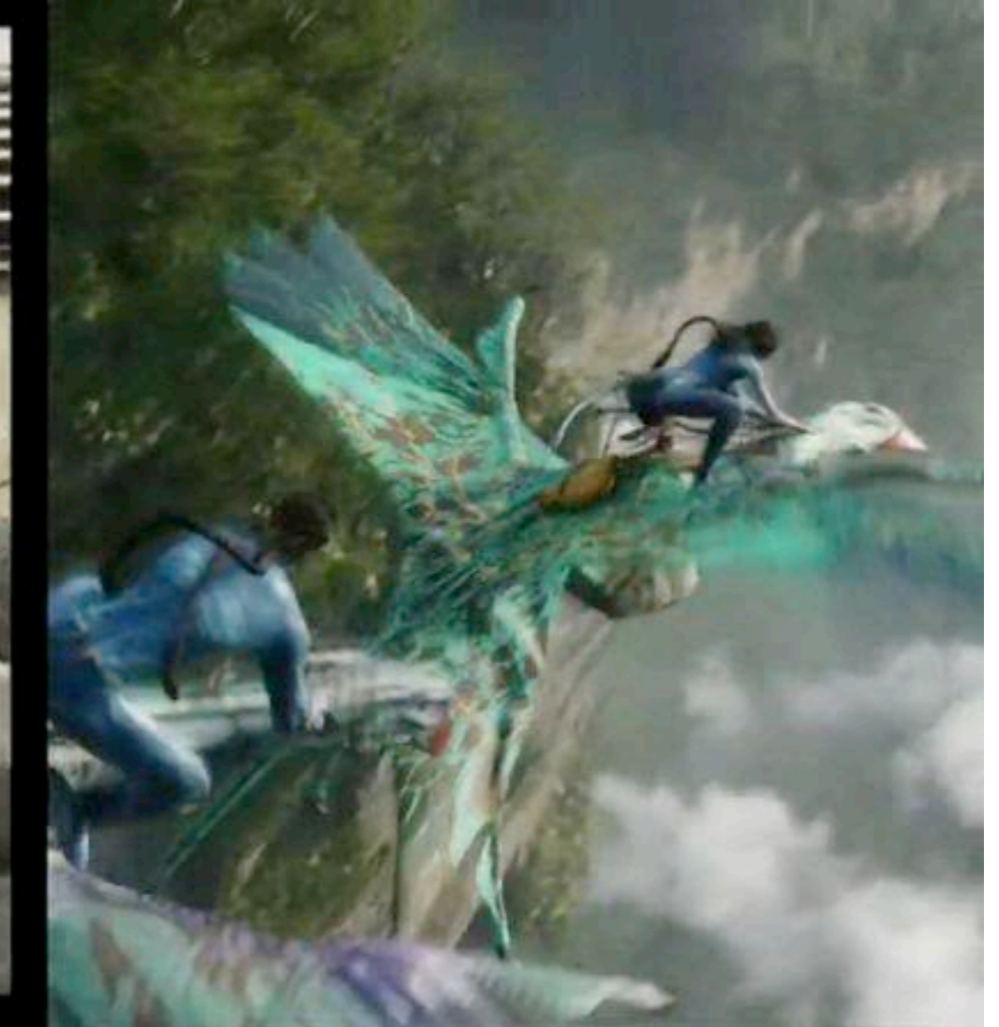


Motion Capture Lab

Wean 1334

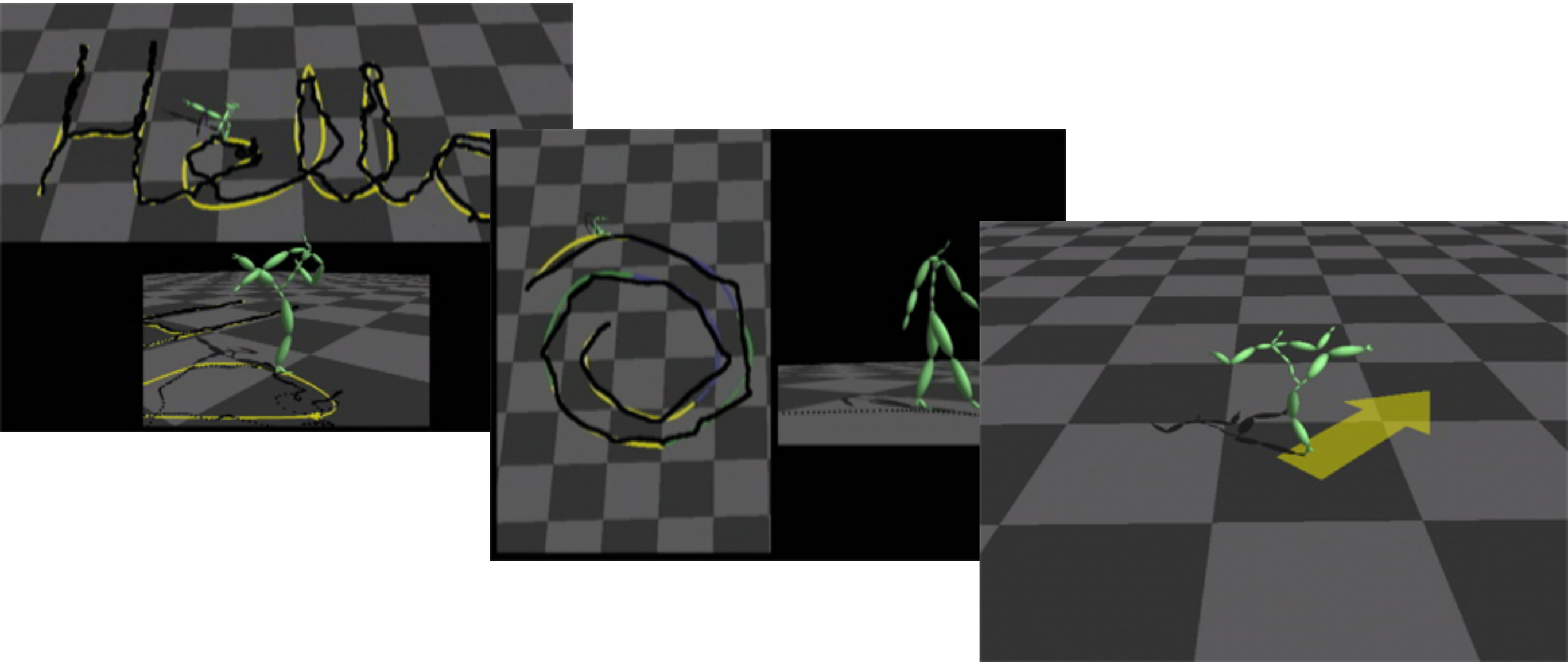


We can capture an individual performance



https://www.youtube.com/watch?v=P2_vB7zx_SQ

What about creating autonomous or responsive characters? Motion Graphs (2002)



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

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

What about creating autonomous or responsive characters? Learning (2018)

Interactive Character Animation by Learning Multi-Objective Control

Kyungho Lee¹

Seyoung Lee¹

Jehee Lee¹

¹ Seoul National University



Recurrent neural network learned basketball rules and skills for interactive character animation.

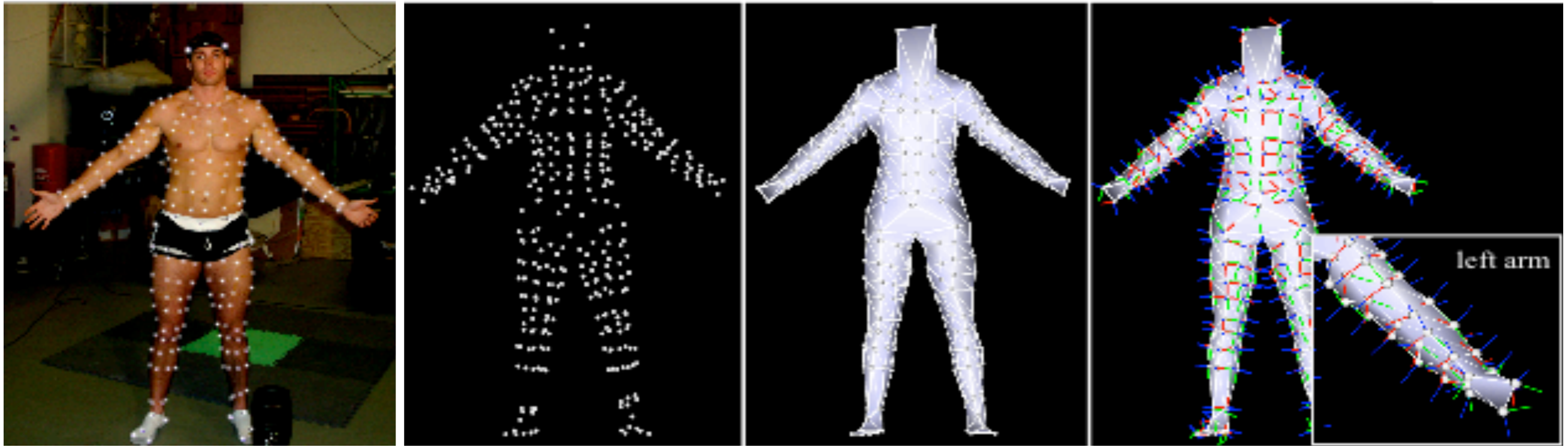
<http://mrl.snu.ac.kr/research/ProjectMultiObjectiveControl/index.htm>

Dense Body Capture



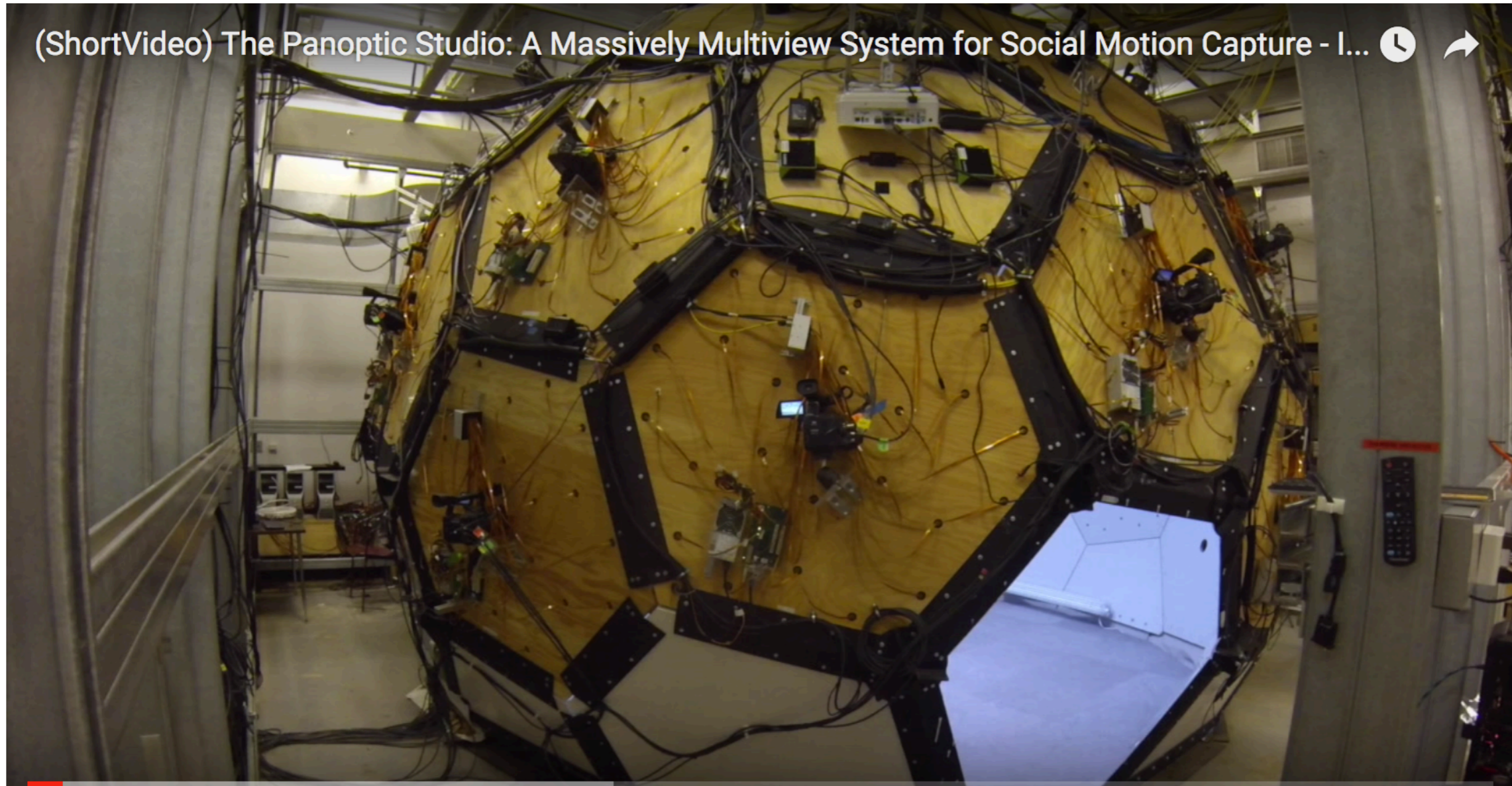
Laser Range Scanning

Dense Marker Capture



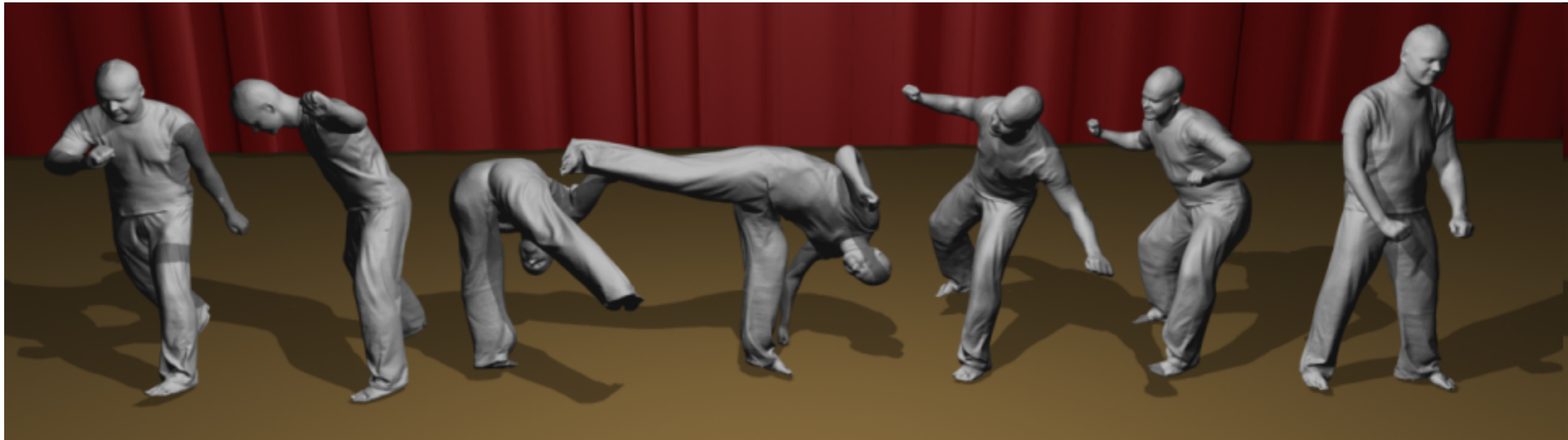
Sang Il Park (CMU / Sejong University)
with Jessica Hodgins

Panoptic Studio (CMU)



https://www.youtube.com/watch?v=wb32z_xwk0c

Performance Capture from Sparse Multi-view Video



Keyframing vs. Motion Capture

Keyframing: setup

What is accomplished?

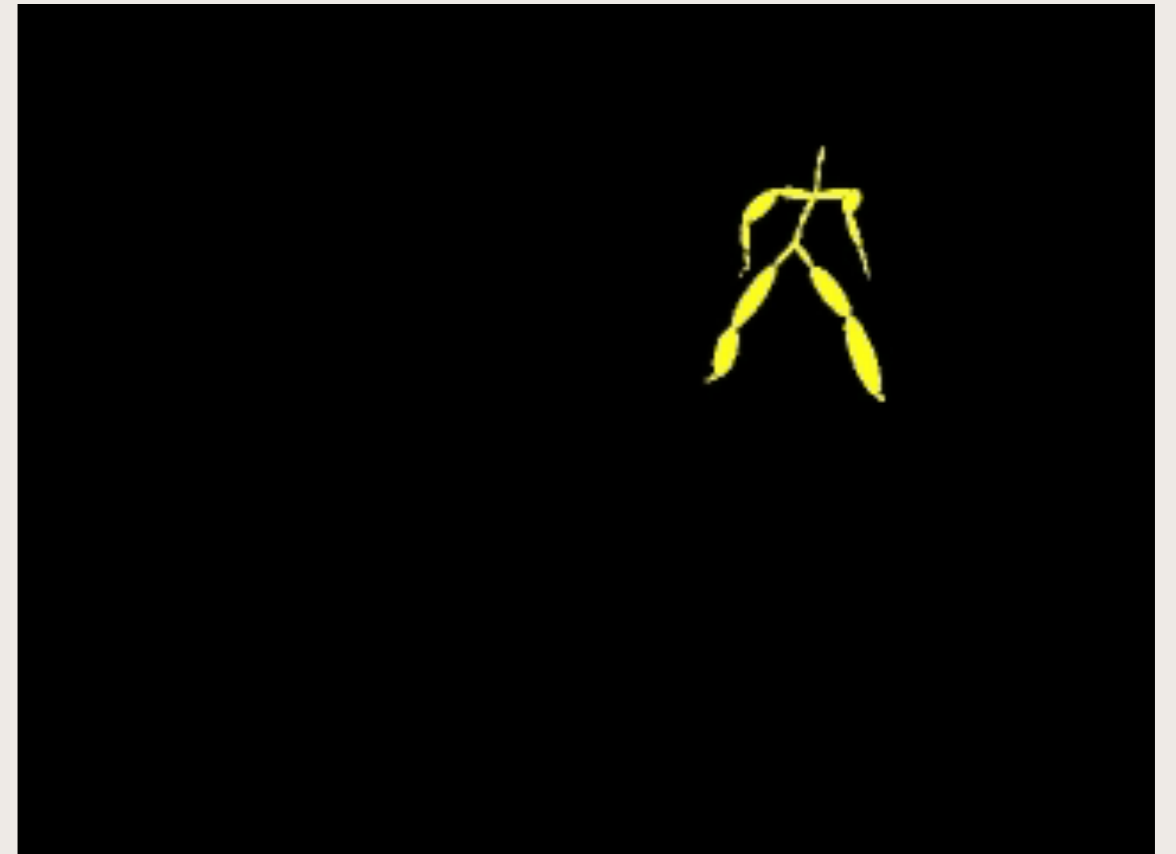
- Define joint locations and bone heirarchy using a point and click interface
- Define joint limits
- Set up Inverse Kinematics handles
- Bind skeleton to its “skin”

Walk Cycle Variations



<http://www.amazon.com/Animators-Survival-Kit-Richard-Williams/dp/0571202284>

Working with Motion Capture is Quite Different...



<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?

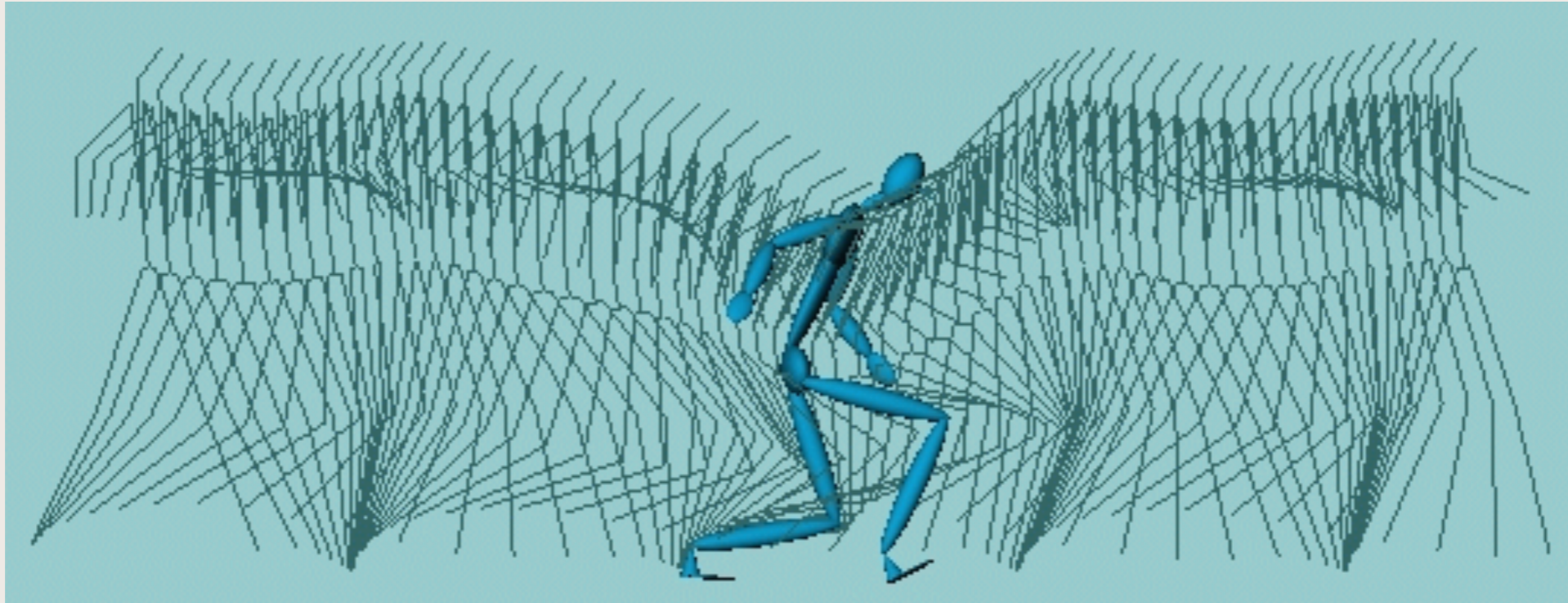
Retiming

Displacement curves

Motion “filtering”

Keyframe extraction / edit keyframes

Displacement Curves

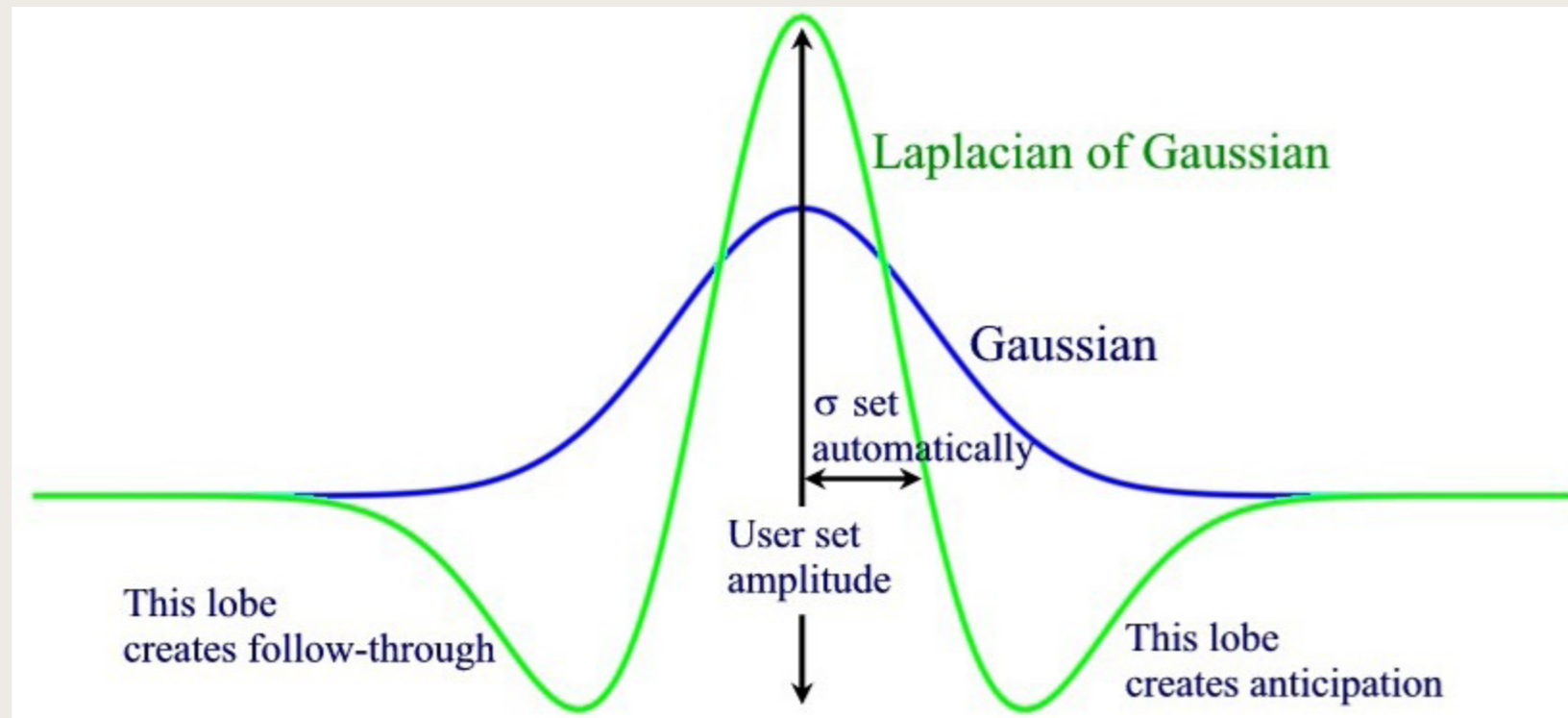


Main ideas:

- **User edits → displacements to the original motion**
- **Displacements can be made at different resolutions in a hierarchical scheme**

Jehee Lee and Sung Yong Shin, A Hierarchical Approach to Interactive Motion Editing for Human-like Characters, SIGGRAPH 99, 39-48, August 1999.

Motion Filtering



Main idea:

- **A simple filter applied to a motion sequence can create squash and stretch effects and cartoon like exaggeration**

The Cartoon Animation Filter

Jue Wang, Steve Drucker, Maneesh Agrawala, Michael Cohen
SIGGRAPH 2006, July 2006. pp. 1169-1173.

Keyframe Extraction



Main idea:

- **Keyframes are local extrema of an embedding of the motion into a low-dimensional space**

Jackie Assa, Yaron Caspi, and Daniel Cohen-Or
Action Synopsis: Pose Selection and Illustration
SIGGRAPH 2005