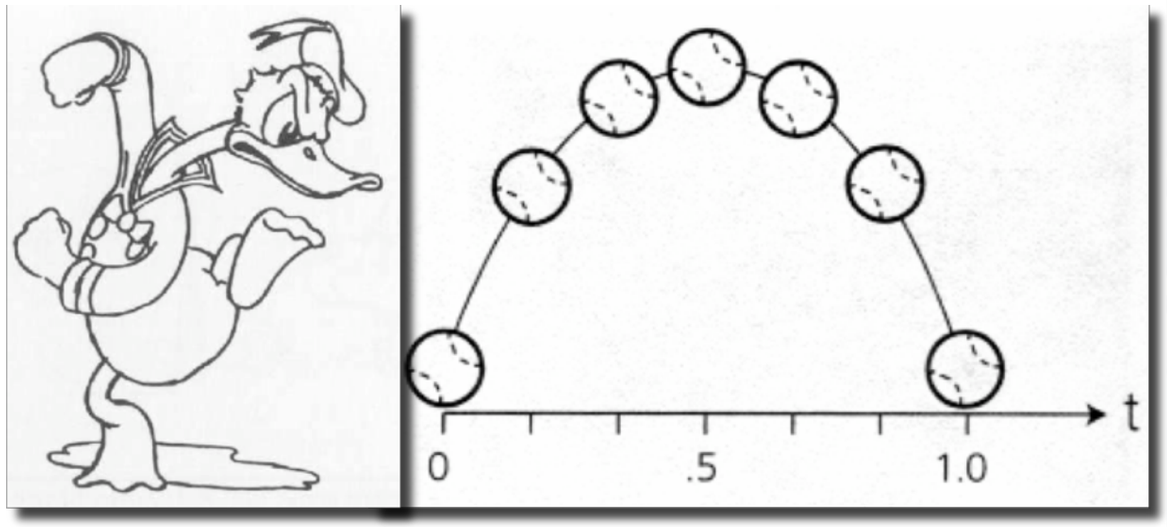
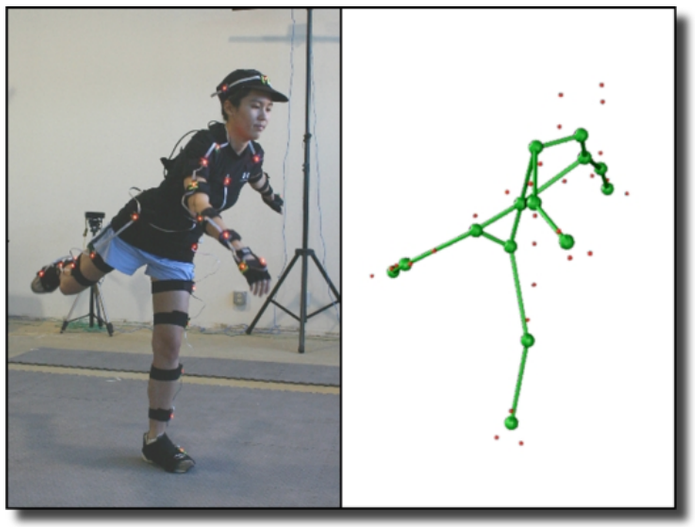
Techniques for Creating Animation

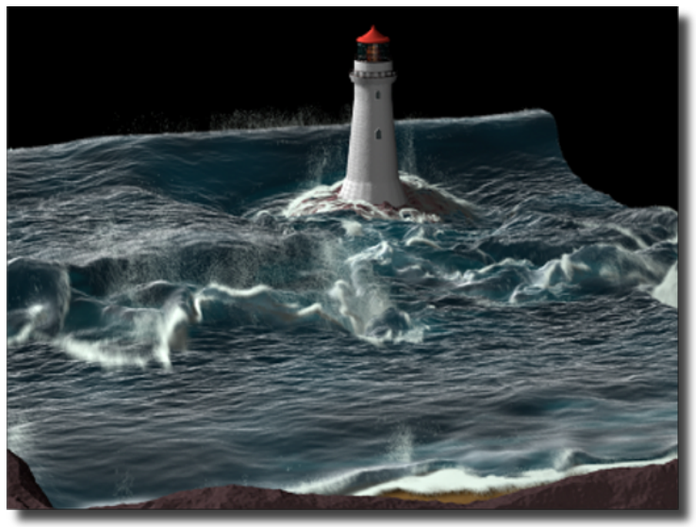


Keyframing

Procedural Animation

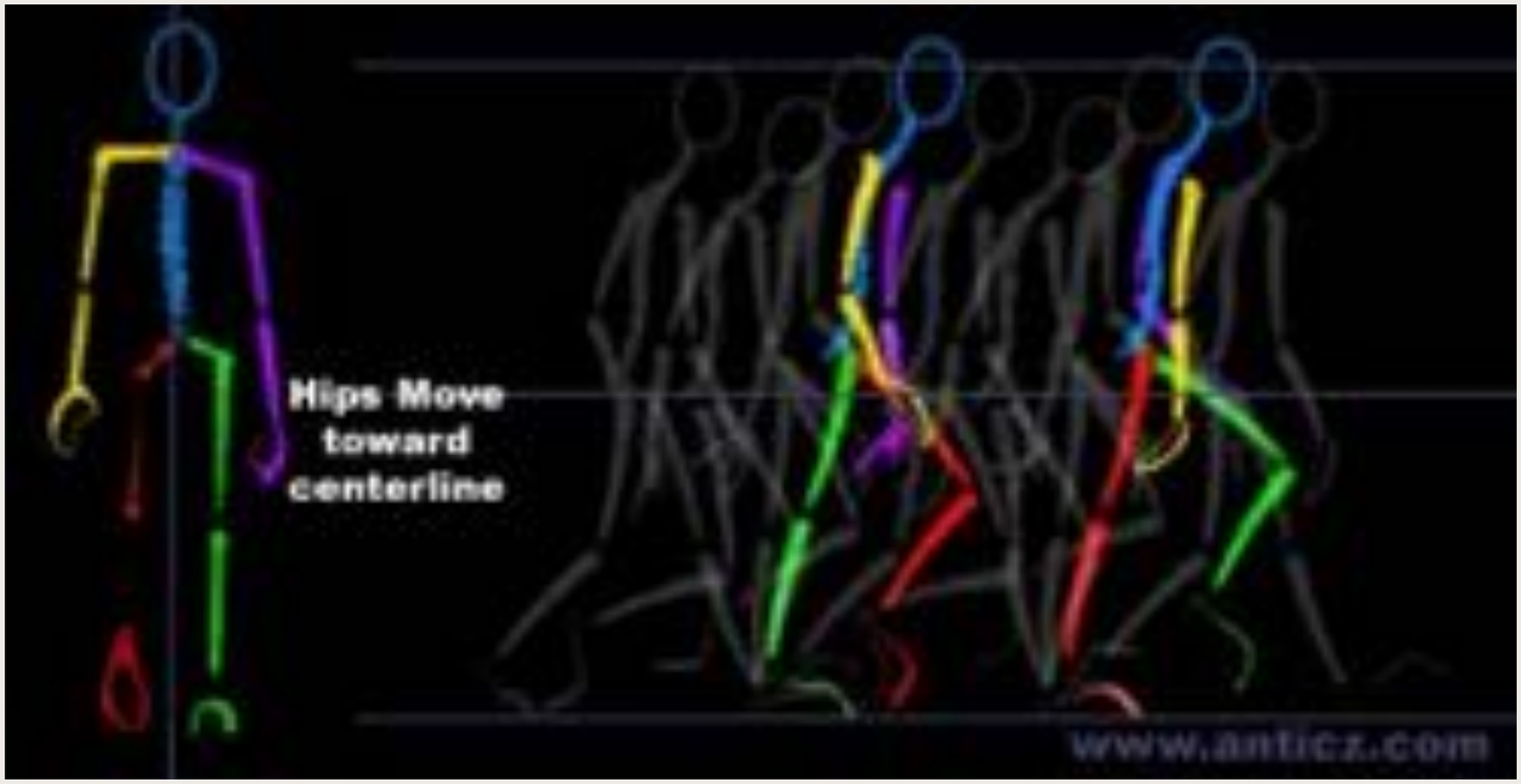


Data-driven Animation



Physical Simulation

Keyframing: animation

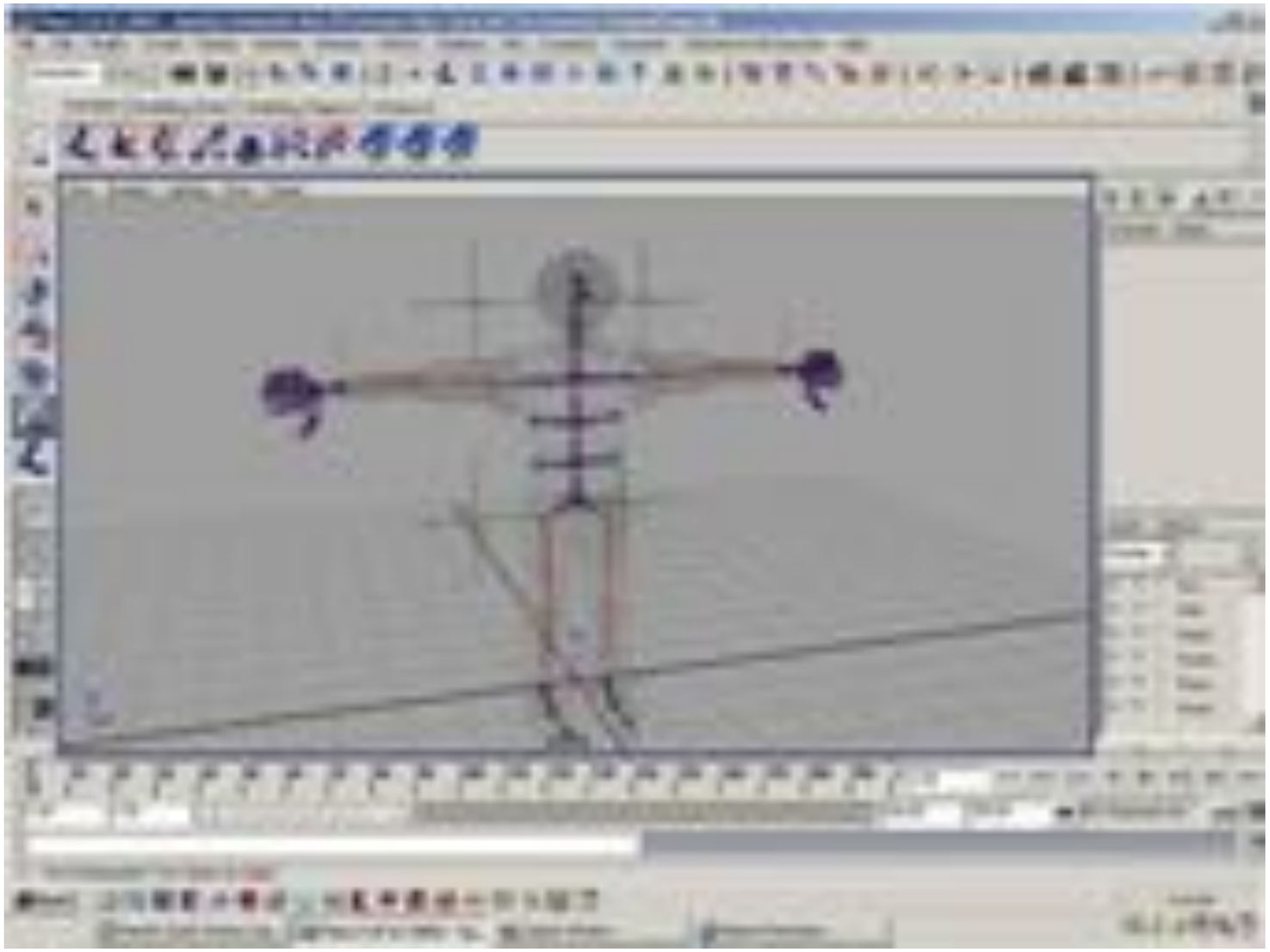


A basic walk cycle tutorial:

http://www.anticz.com/Walks.htm

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=rWKLPDfamm0

Keyframing = Traditional Animation?

Stop Motion

Boxtrolls

Kubo and the two strings

https://www.youtube.com/watch?v=Vhpq7-c911A

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

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

Keyframing = Traditional Animation?

http://www.pastemagazine.com/articles/2014/12/the-best-animated-character-designs-of-2014.html

Principles of Traditional Animation
[Lasseter, SIGGRAPH 1987]

- Stylistic conventions followed by Disney's animators and others

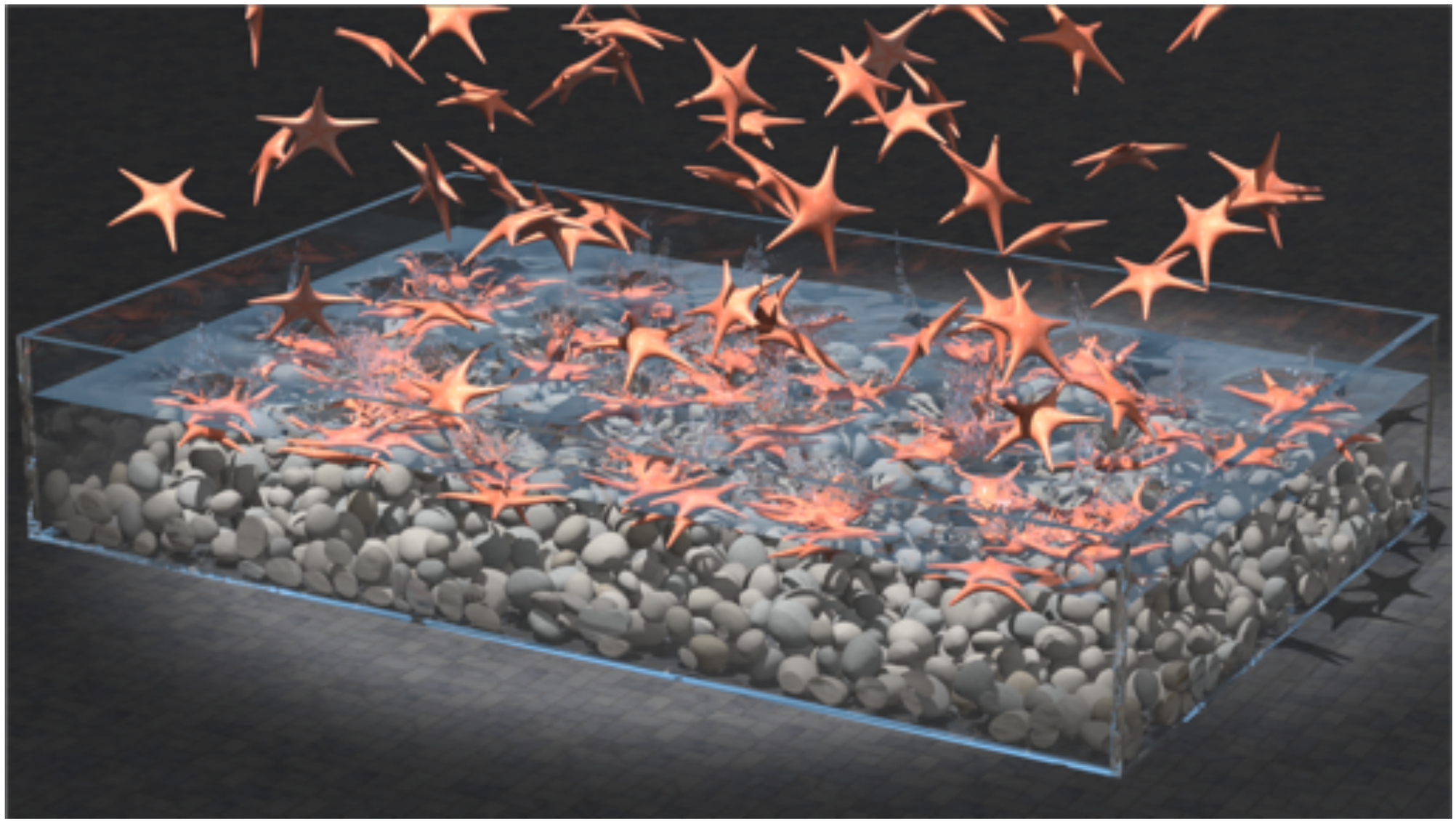
- From experience built up over many years
  - Squash and stretch -- use distortions to convey flexibility
  - Timing -- speed conveys mass, personality
  - Anticipation -- prepare the audience for an action
  - Followthrough and overlapping action -- continuity with next action
  - Slow in and out -- 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

http://graphics.cs.cmu.edu/

Motion Capture Lab

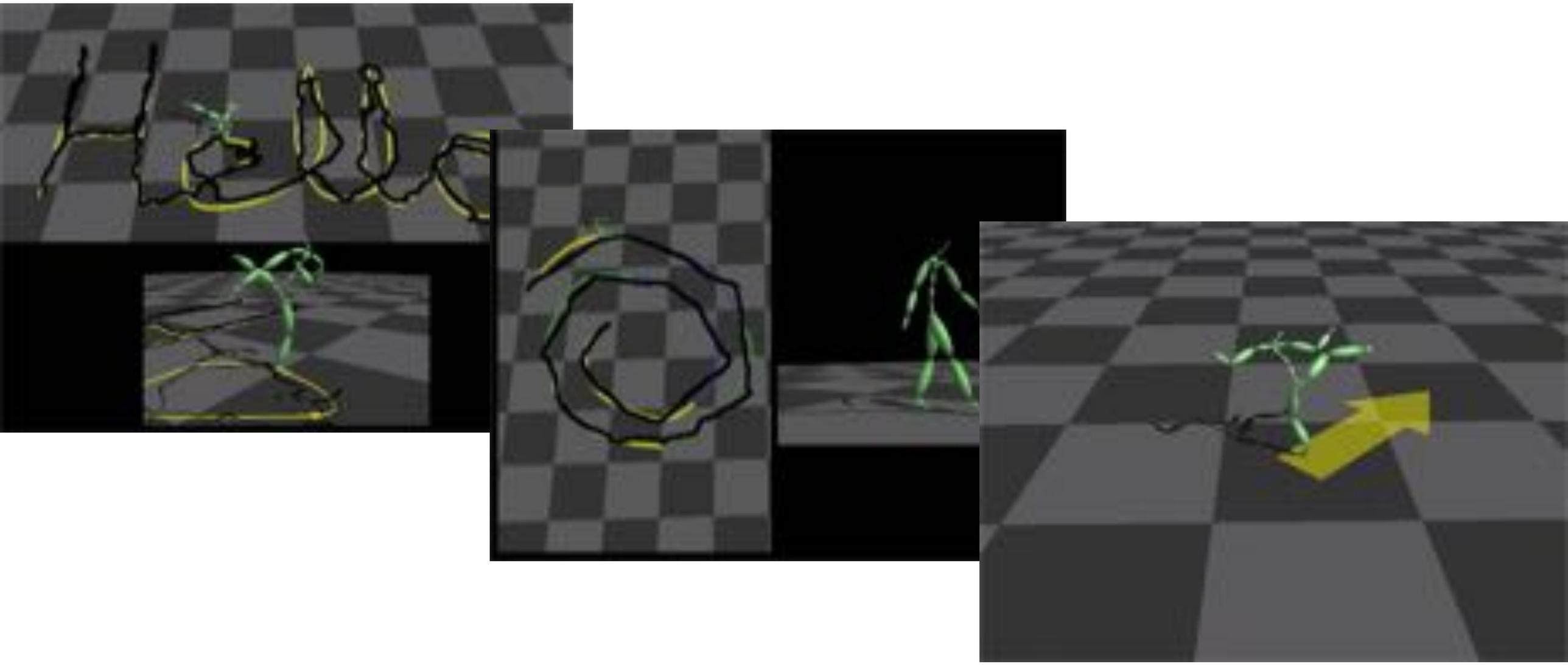
Wean 1334

http://graphics.cs.cmu.edu/

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 Lee[1] Seyoung Lee[1] Jehee Lee[1]

[1] Seoul National University

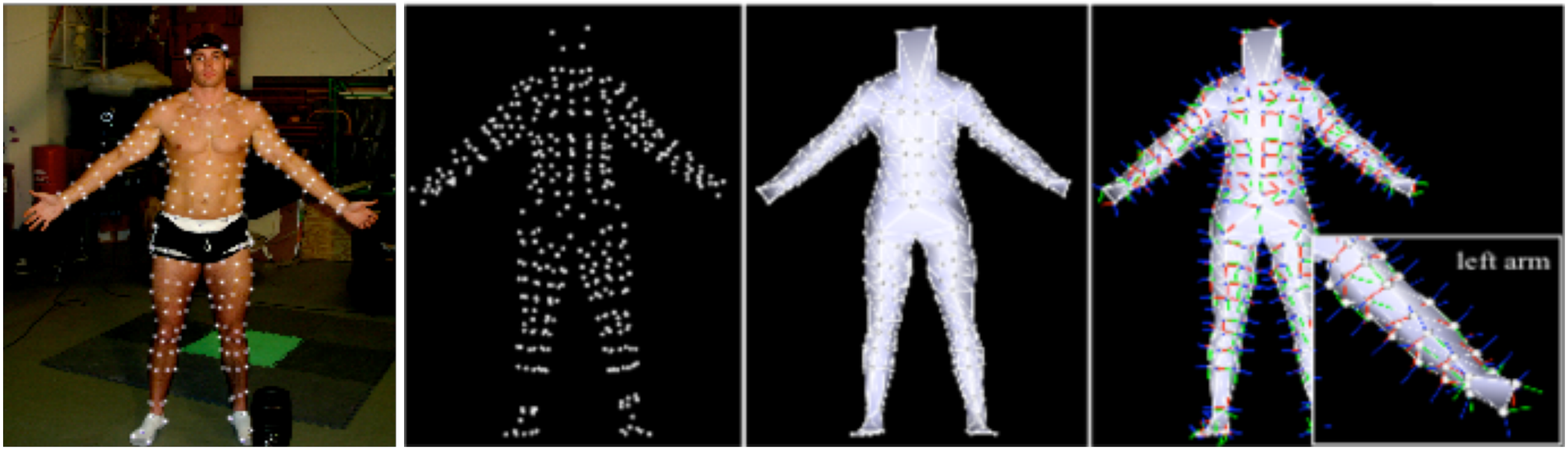
Recurrent neural network learned basketball rules and skills for interactive character animation.

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

Dense Body Capture

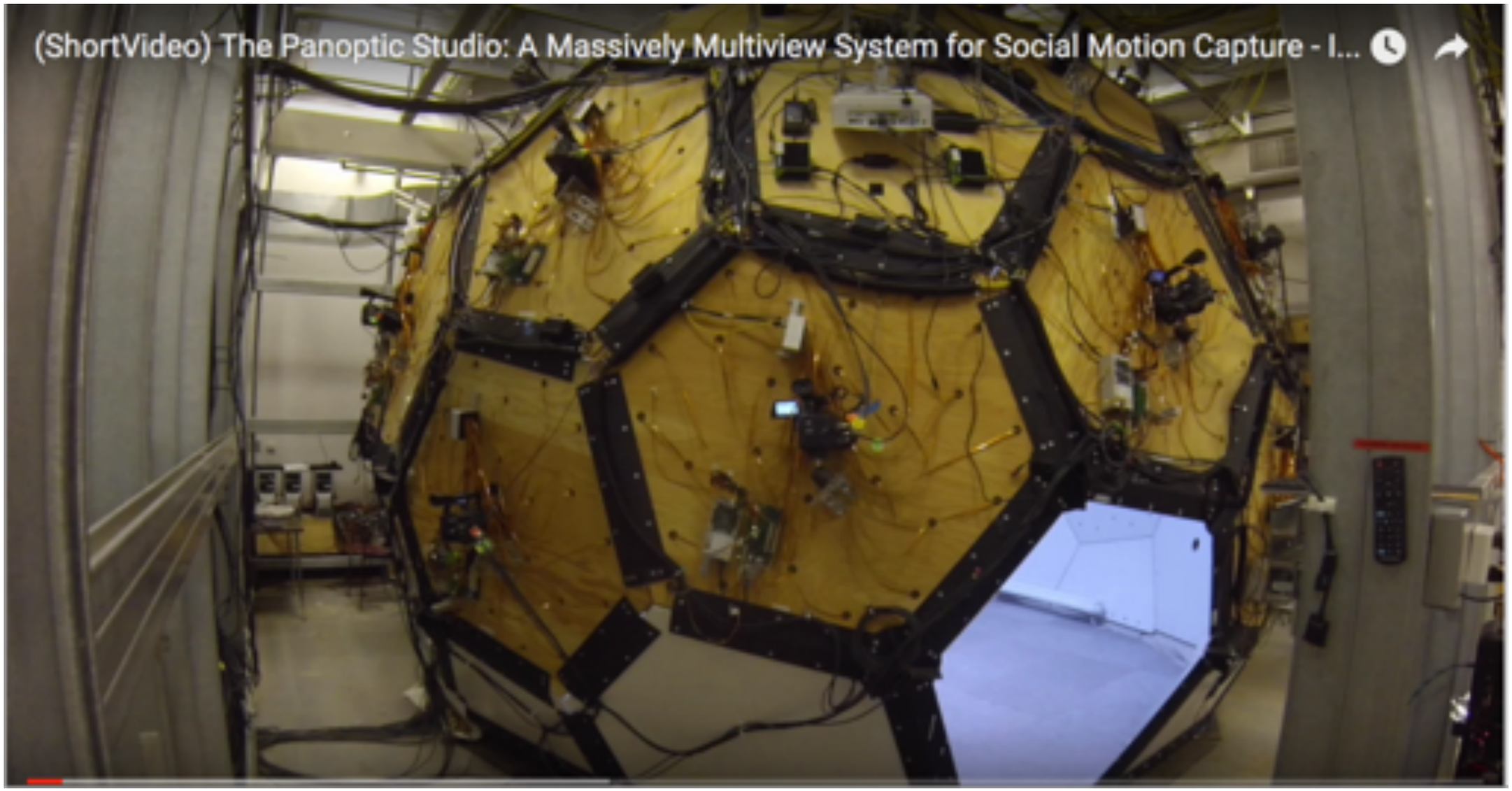
Laser Range Scanning

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

de Aguiar et al

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

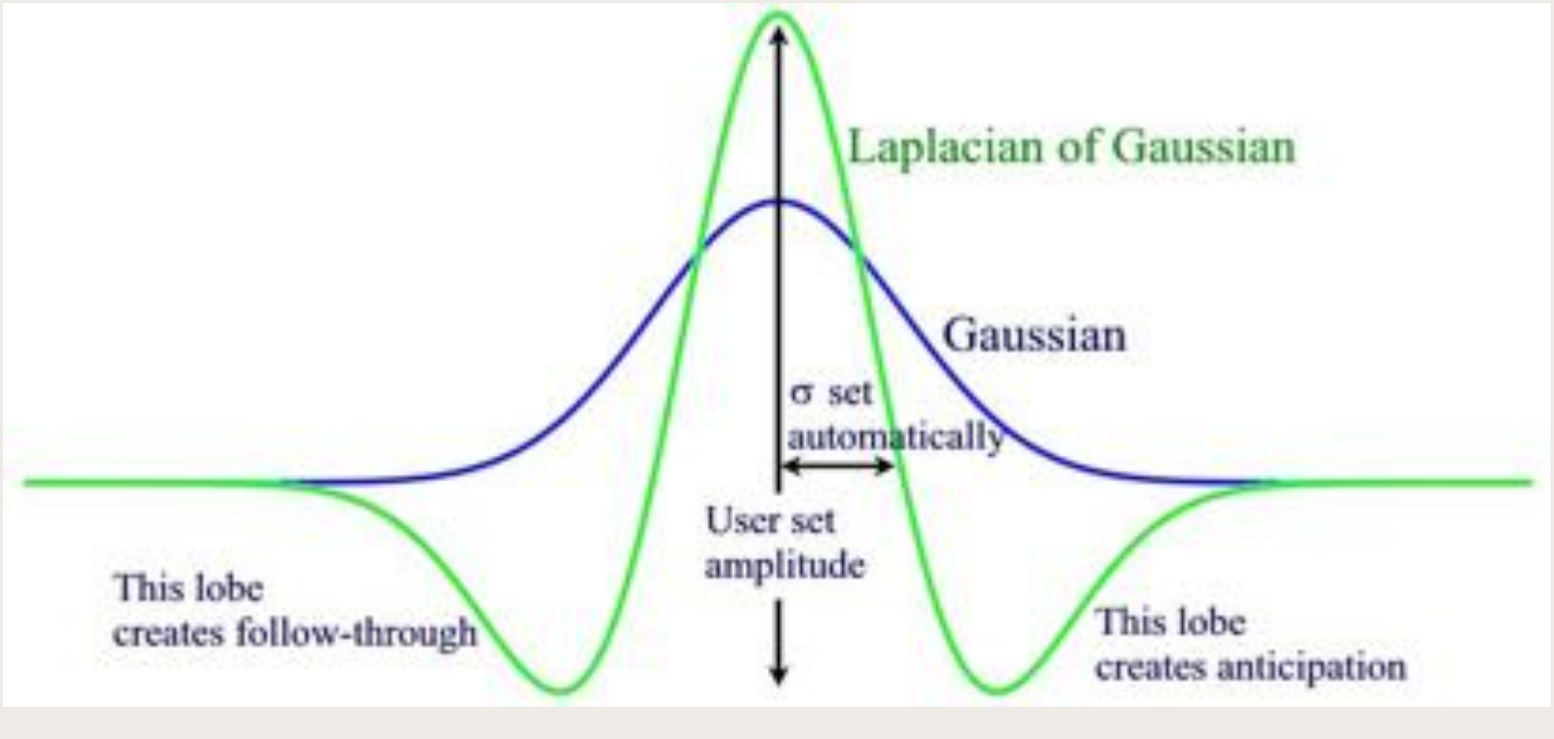
Displacement Curves

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