

CS 130 : Computer Graphics

Animation

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Types of animation

- keyframing
- rotoscoping
- stop motion
- procedural
- simulation
- motion capture

history

Gertie the Dinosaur

1914

12 minutes

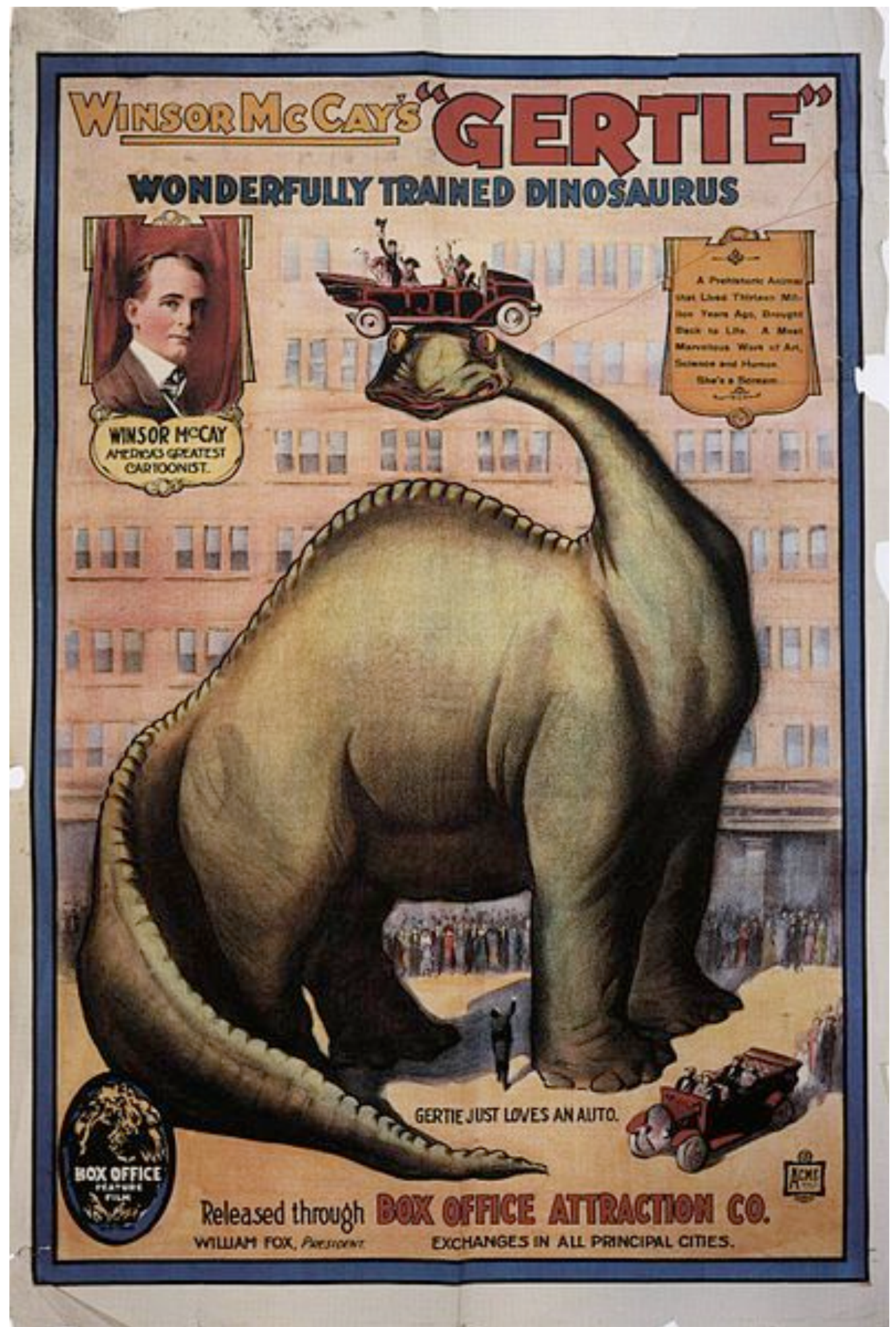
hand drawn

keyframe animation

registration

cycling

link



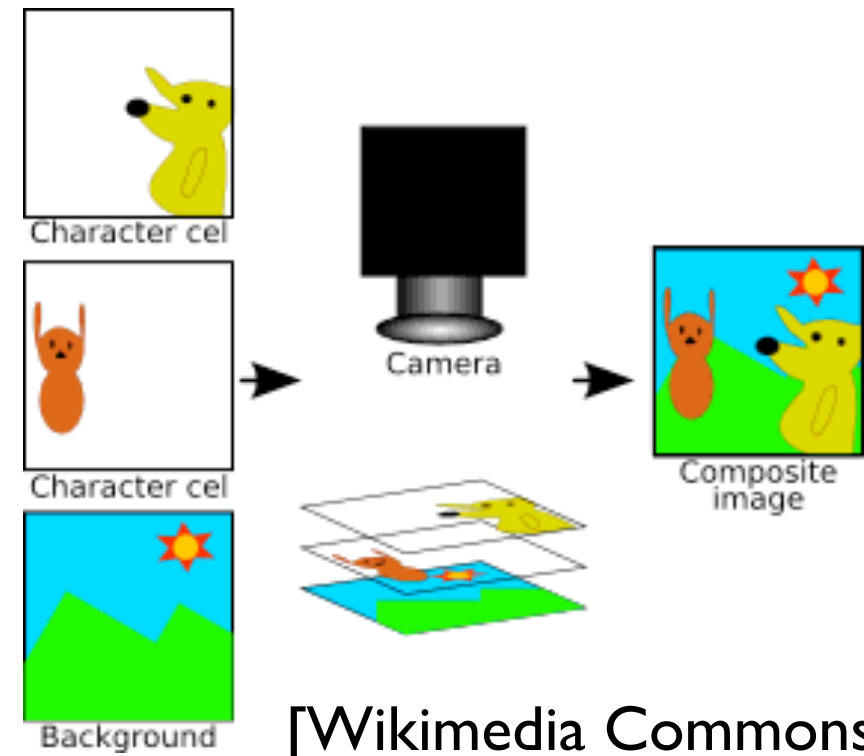
Traditional animation

Cels

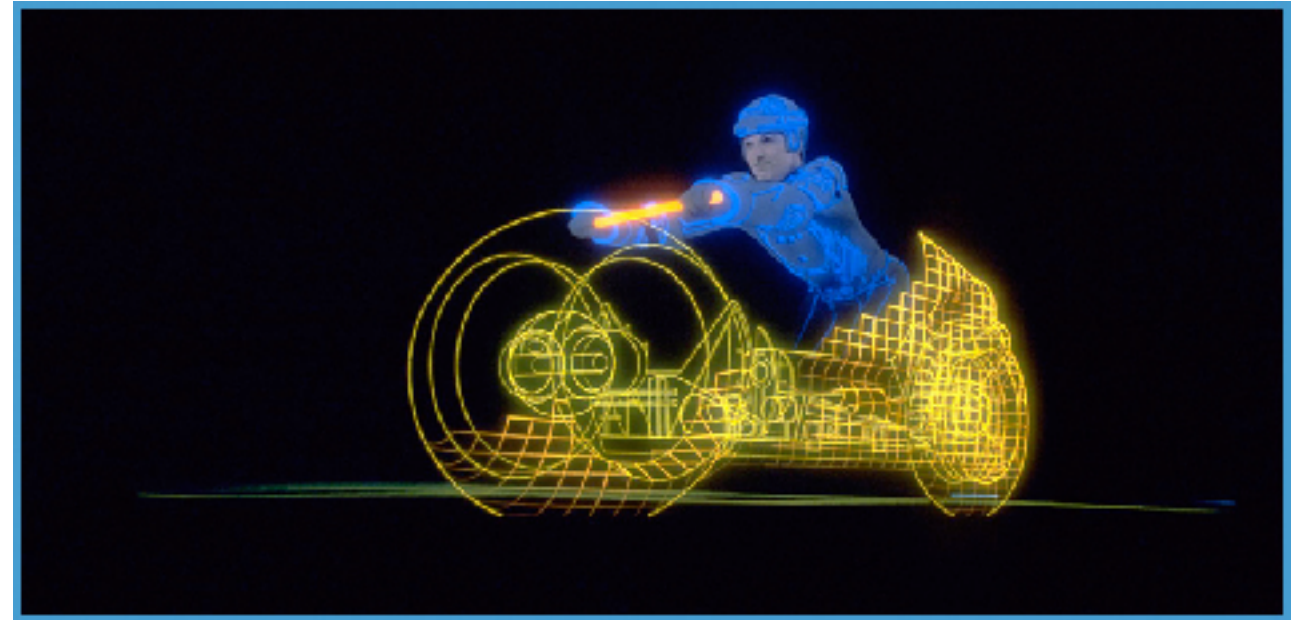
Multiplane camera



Sleeping Beauty, Disney, 1959



Realistic 3D animation



- Disney's Tron, 1981
- Pixar's Toy Story, 1995, first 3D feature



Performance capture



Lord of the Rings, 2001



Rise of the Planet of the Apes, 2011



Avatar, 2009



Disney's Paperman

Paperman and the Future of 2D Animation



animation principles

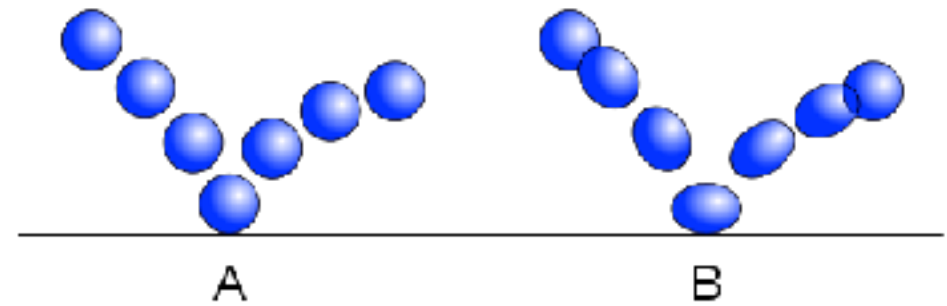


The famous half-filled flour sack, guide to maintaining volume in any animatable shape, and proof that attitudes can be achieved with the simplest of shapes.



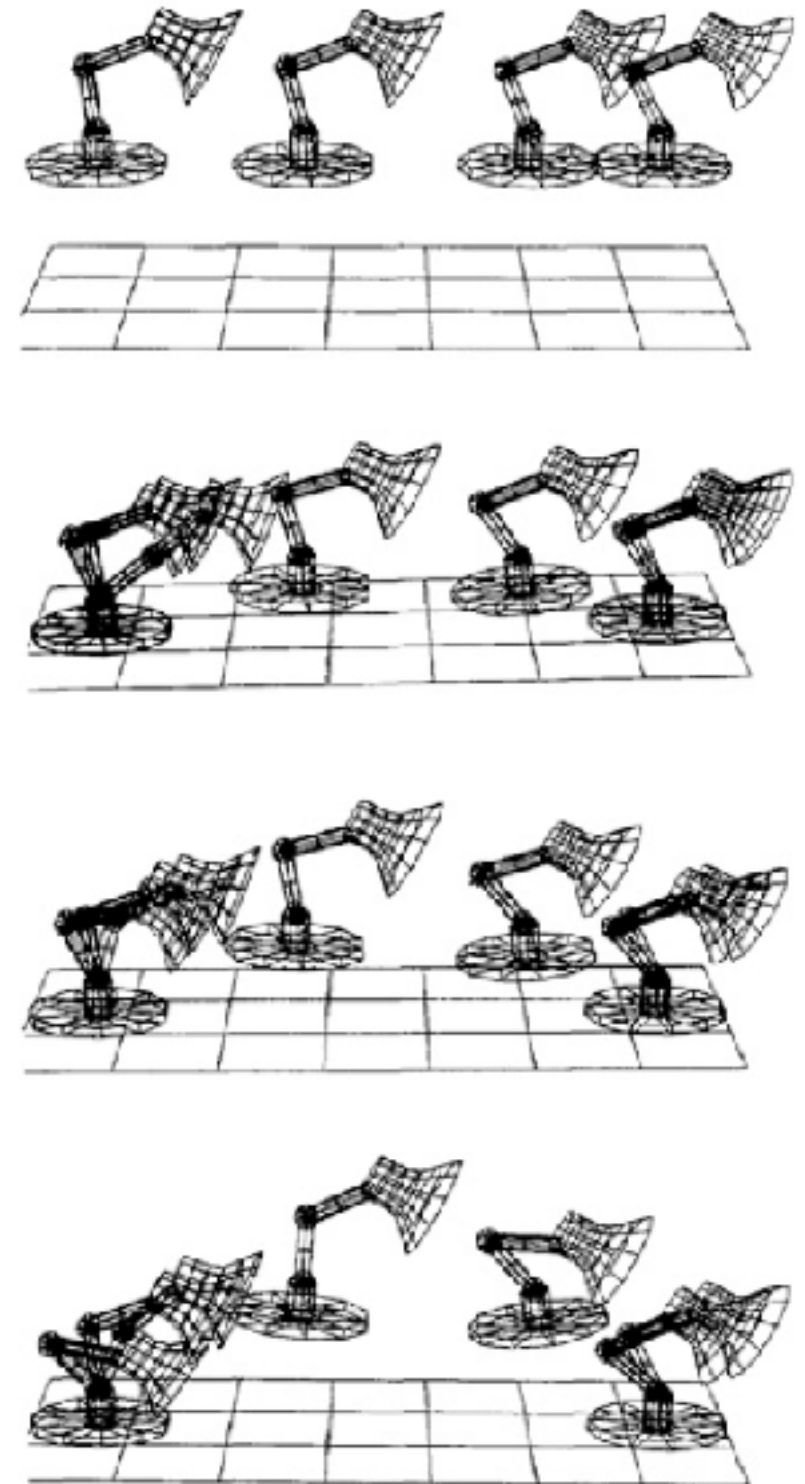
12 principles of animation

1. Squash and stretch
2. Anticipation
3. Staging
4. Straight ahead action and pose to pose
5. Follow through and overlapping action
6. Slow in and slow out
7. Arcs
8. Secondary action
9. Timing
10. Exaggeration
11. Solid drawing
12. Appeal



Physics-based animation

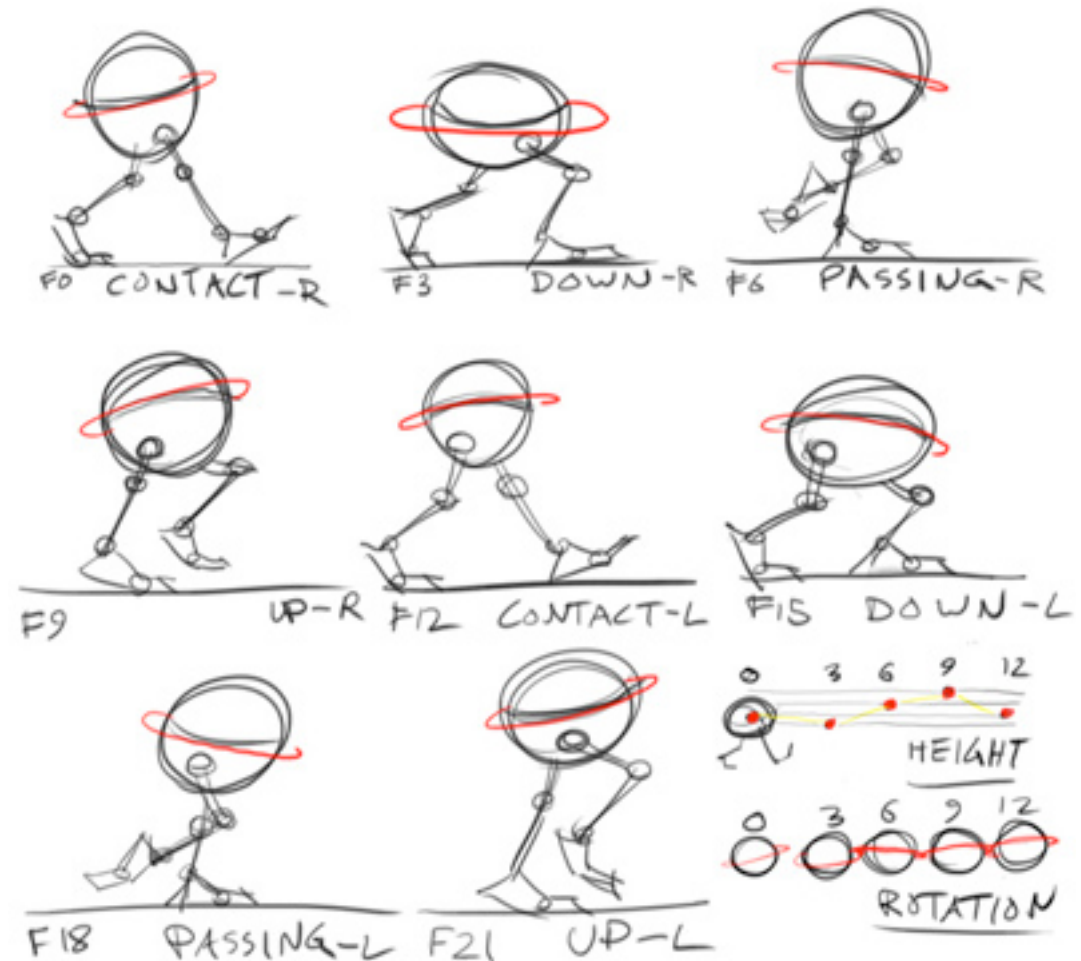
- Many animation principles follow from underlying physics
- anticipation, follow through, secondary action, squash and stretch, ...
- *Spacetime Constraints*, Witkin and Kass 1988



keyframe animation

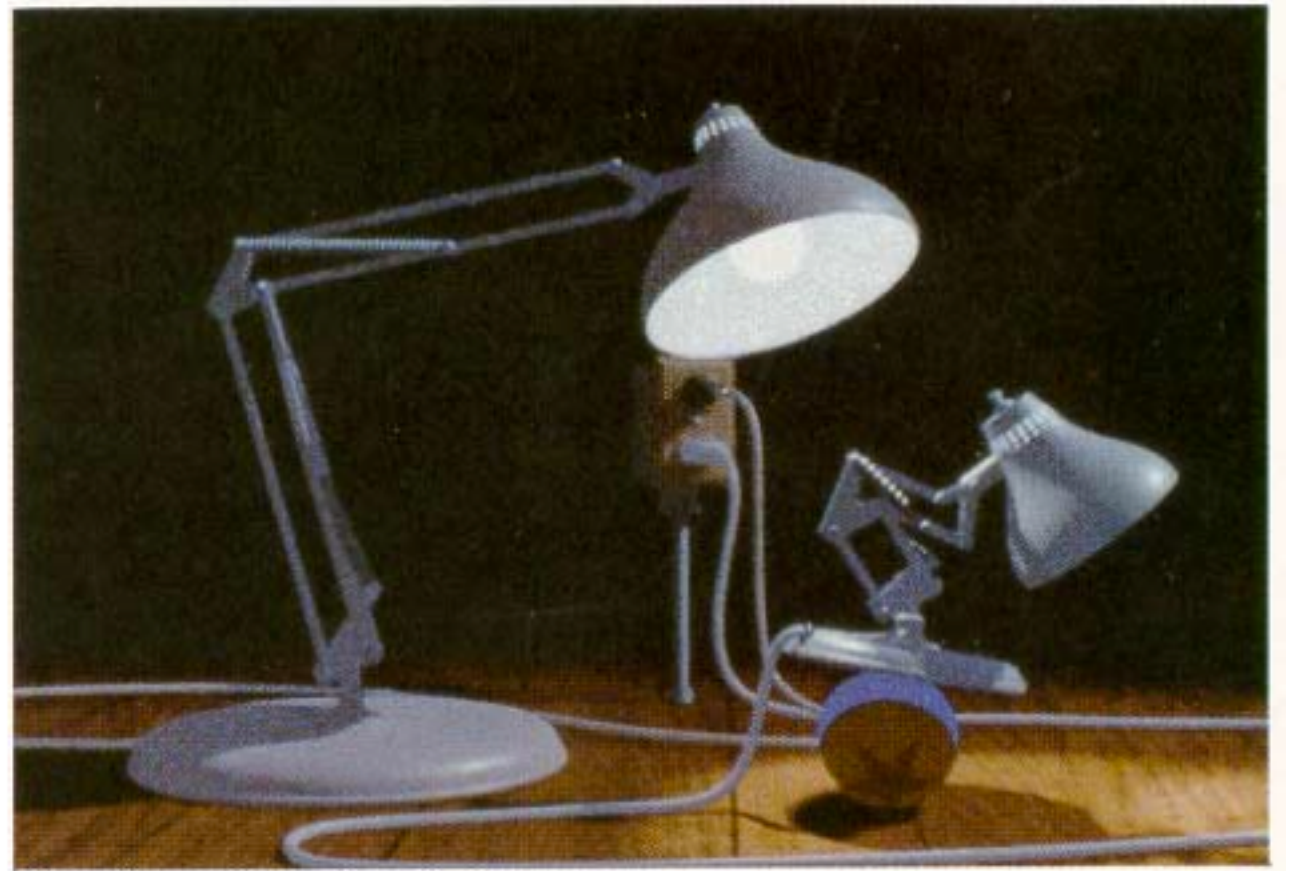
Keyframe animation

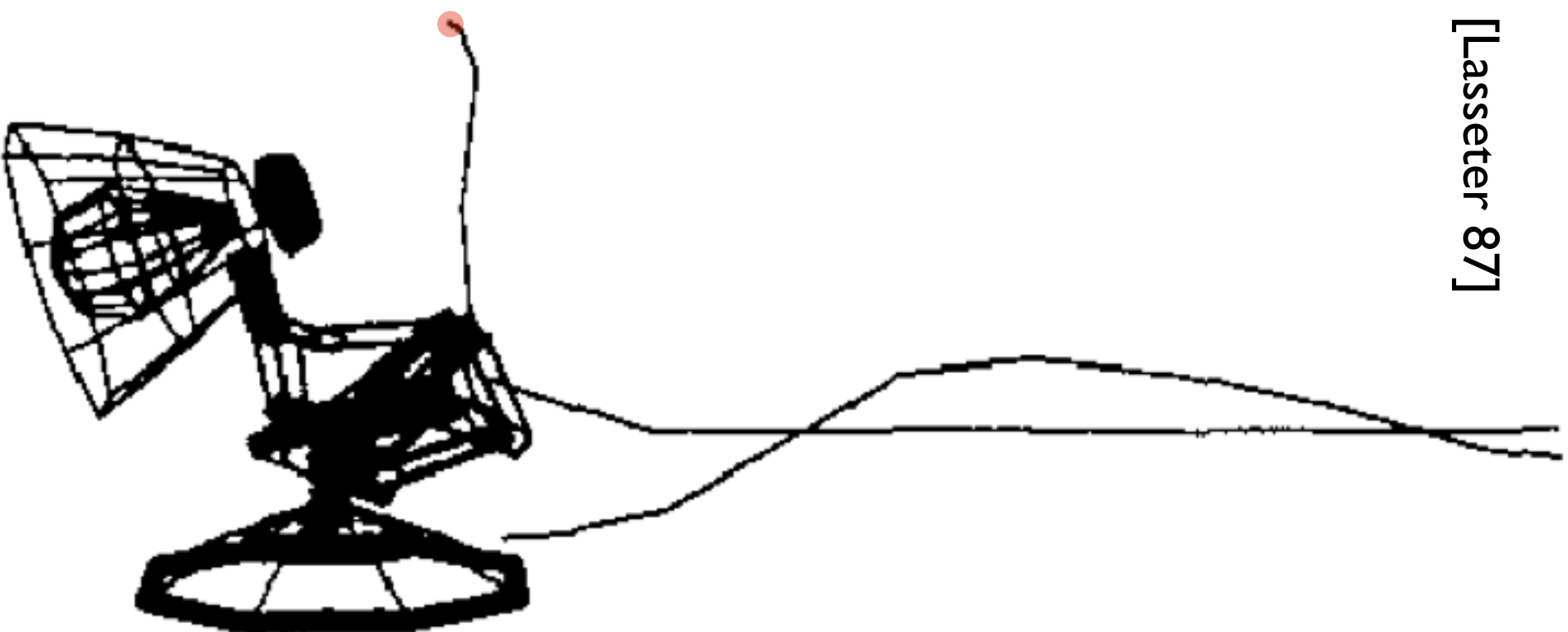
- draw a series of poses
- fill in the frames in between (“inbetweening”)
- computer animation uses interpolation



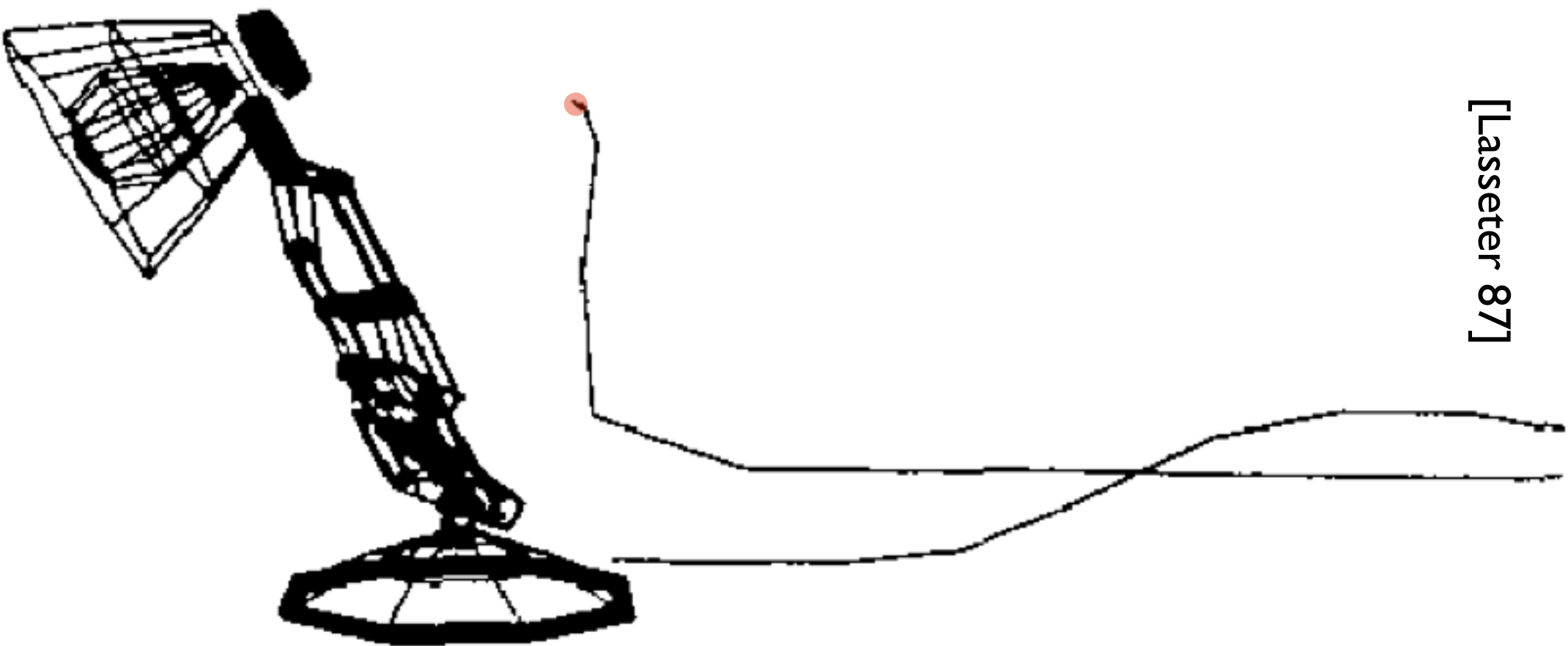
<http://anim.tmog.net>

Luxo Jr.

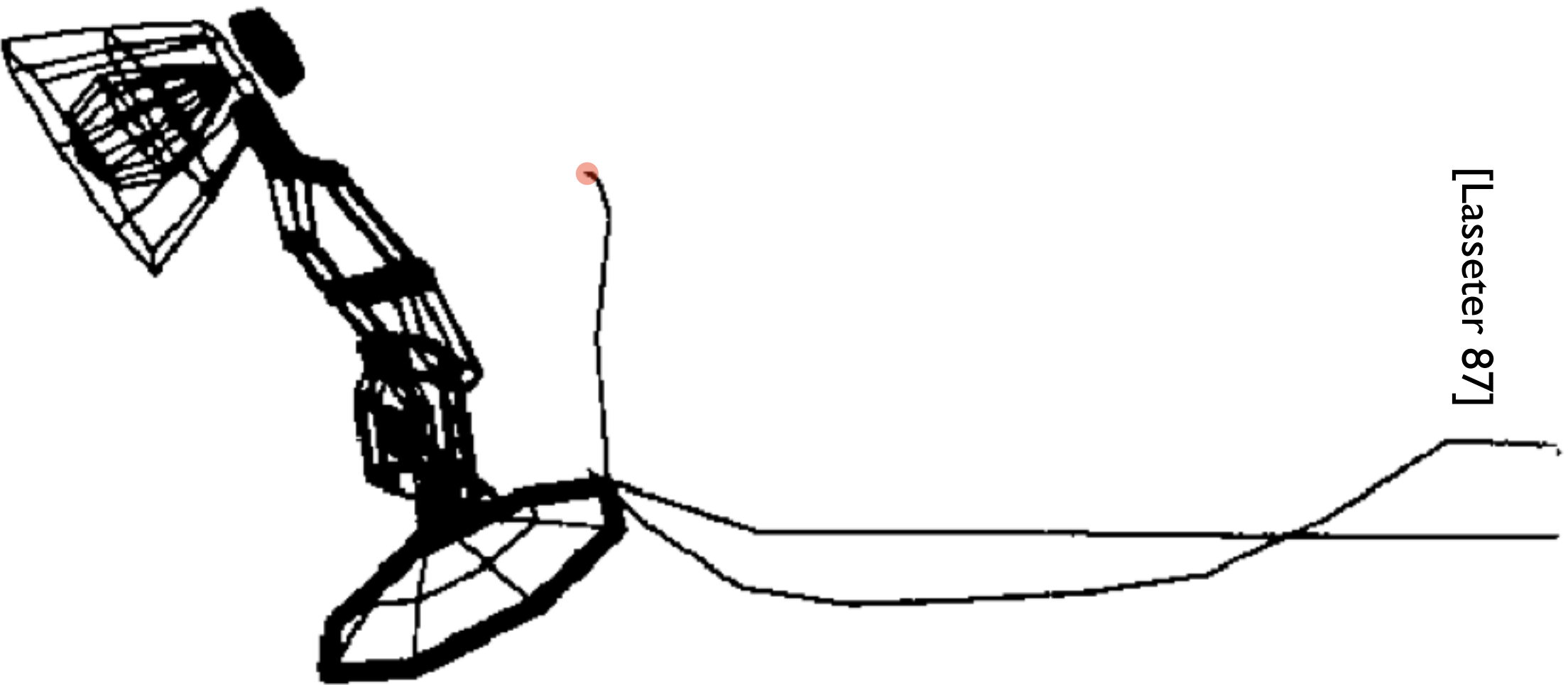




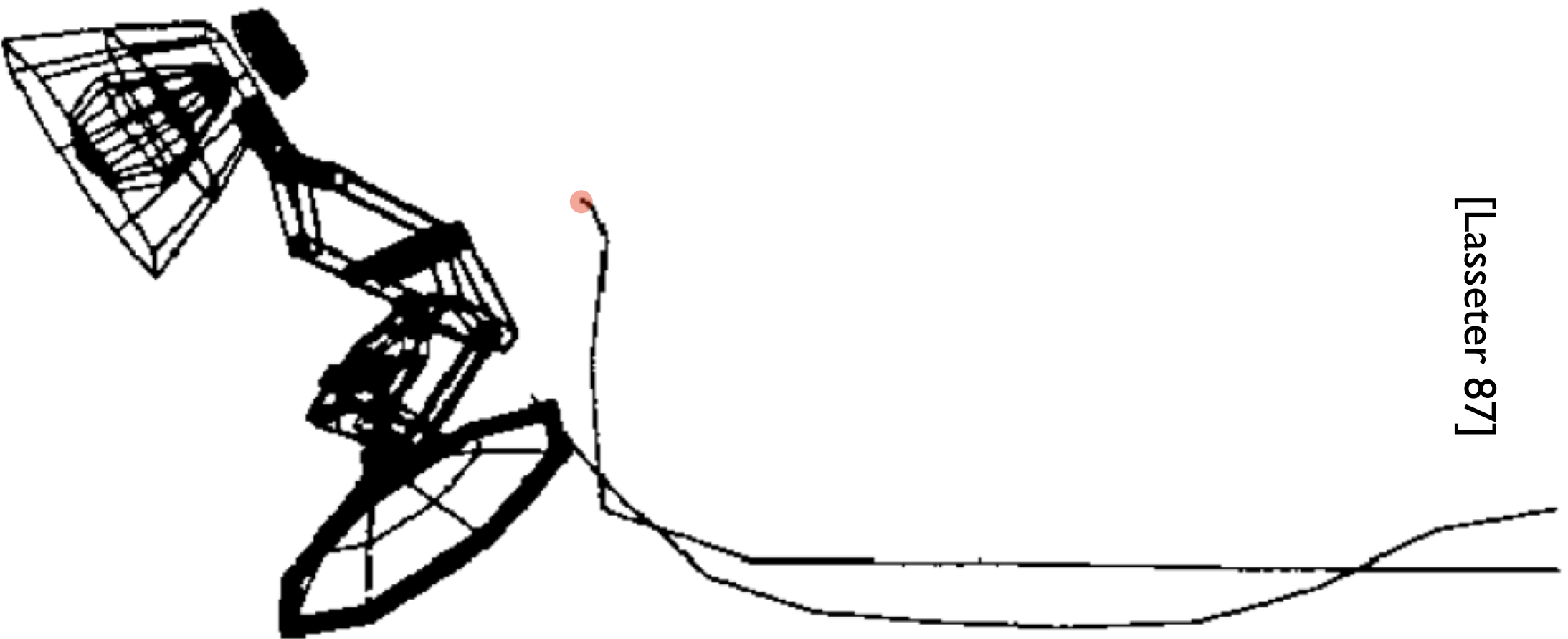
[Lasseter 87]



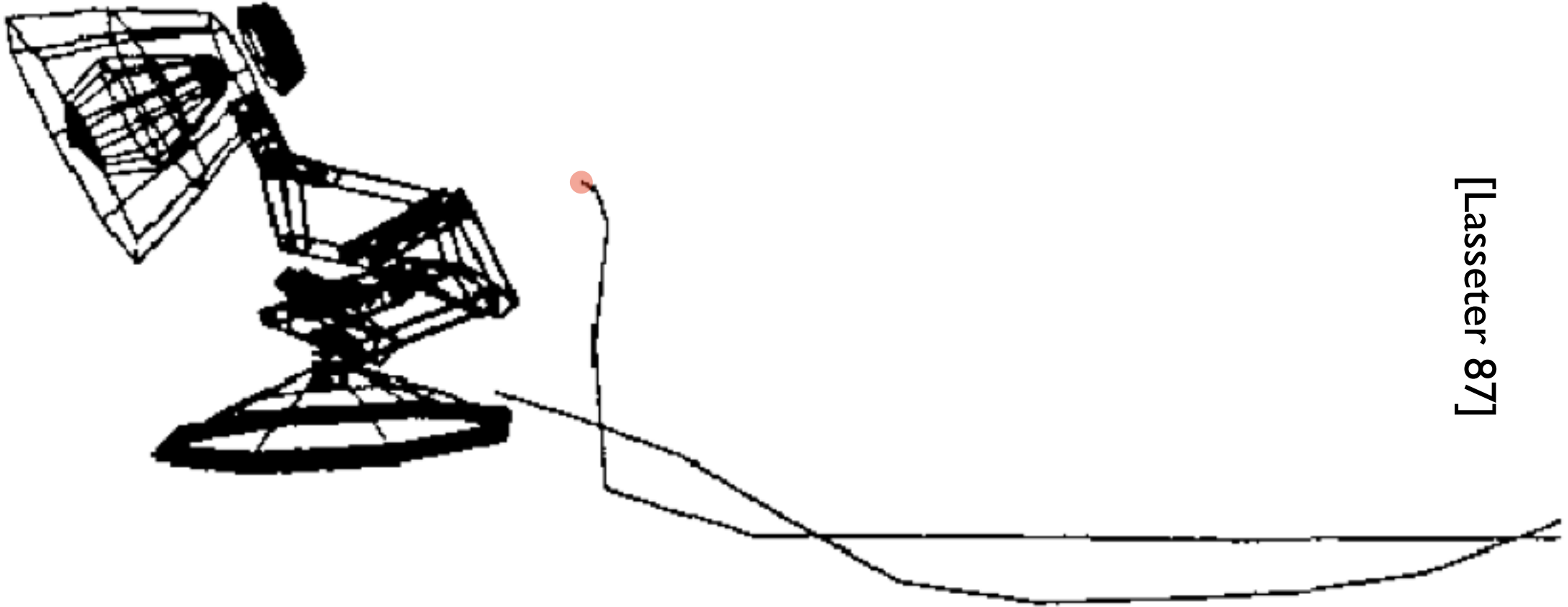
[Lasseter 87]



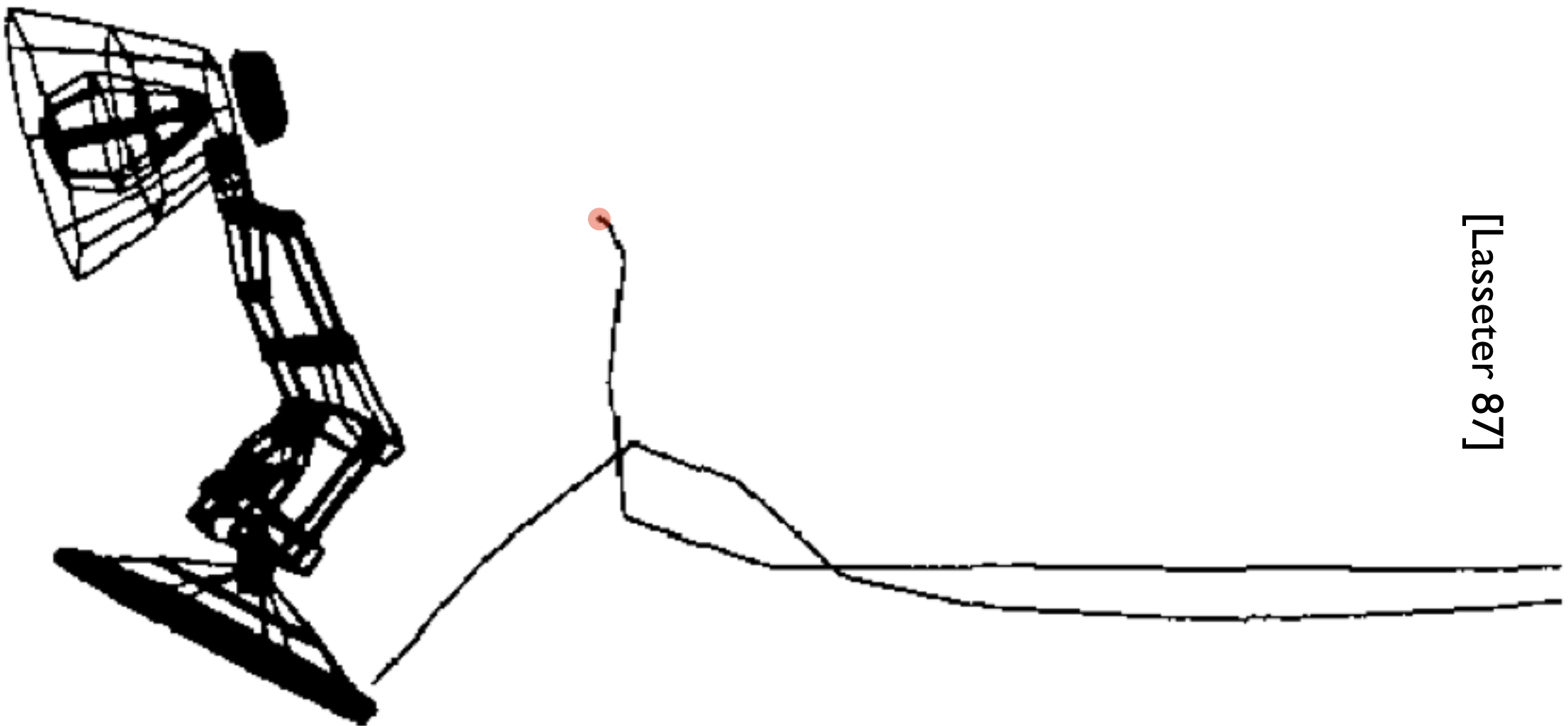
[Lasseter 87]



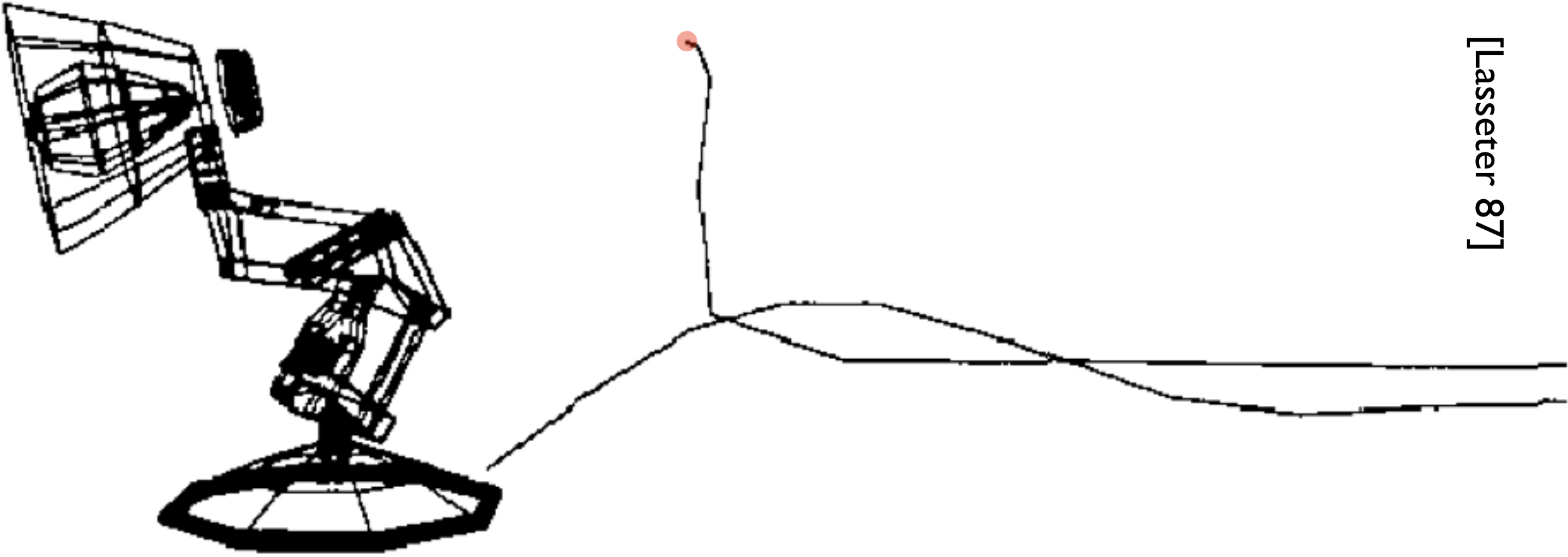
[Lasseter 87]



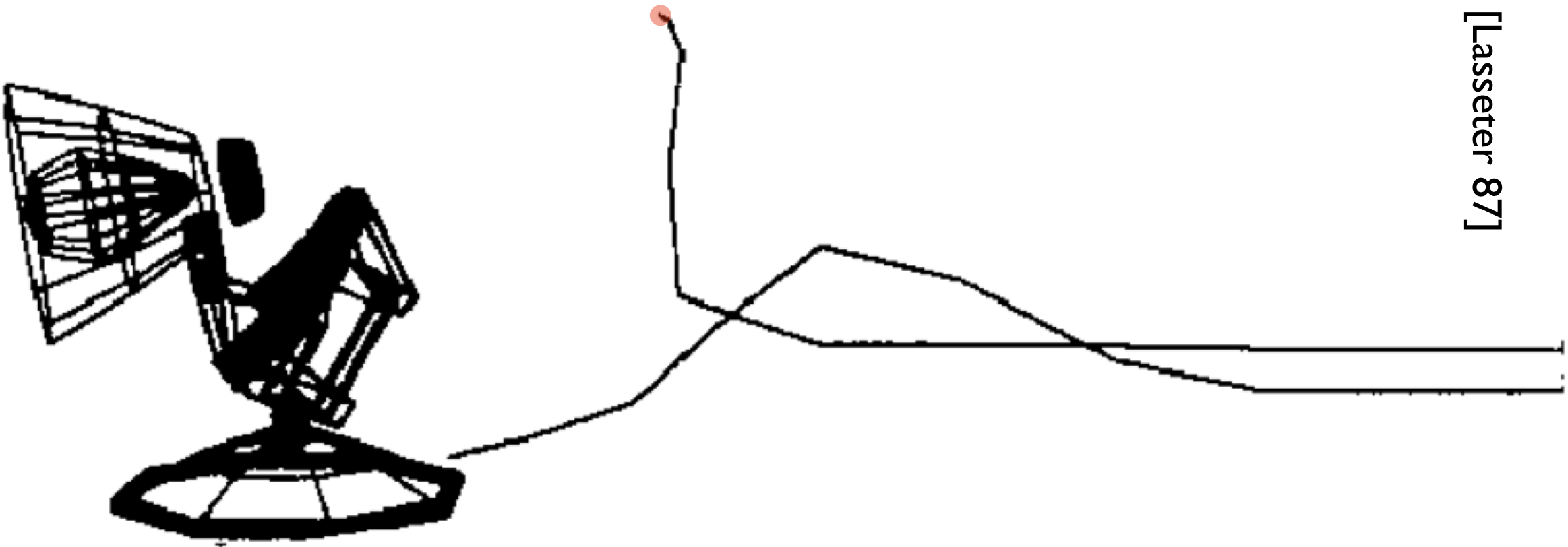
[Lasseter 87]



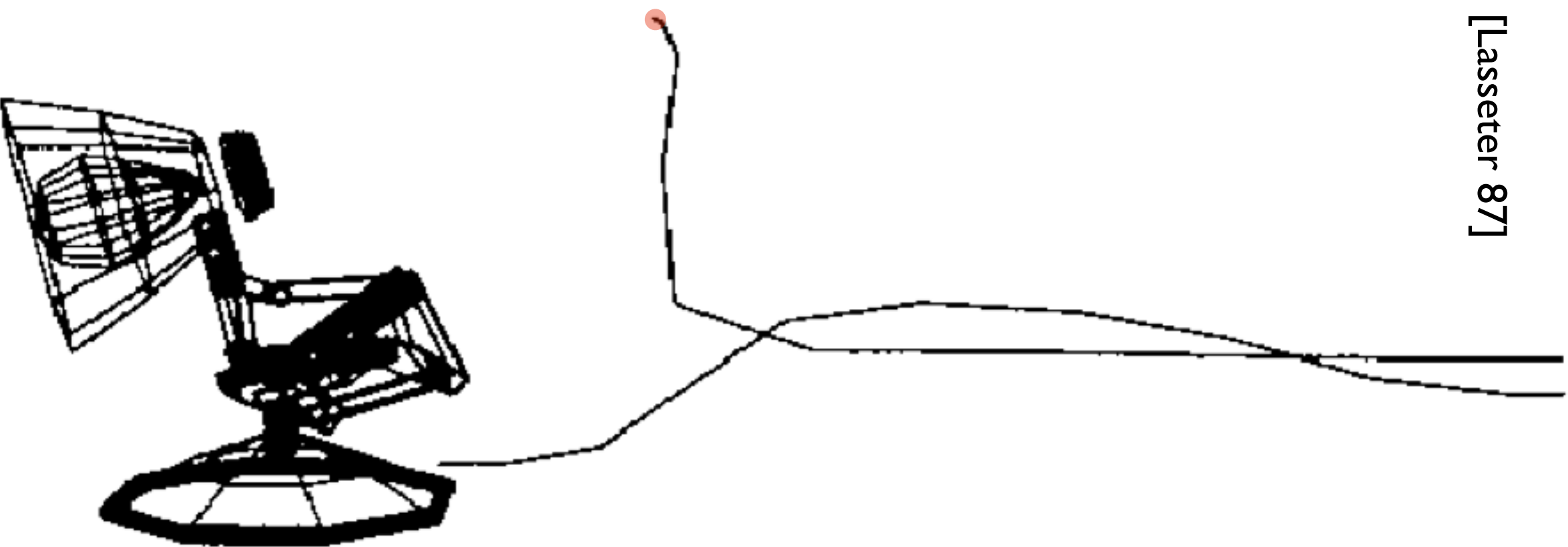
[Lasseter 87]



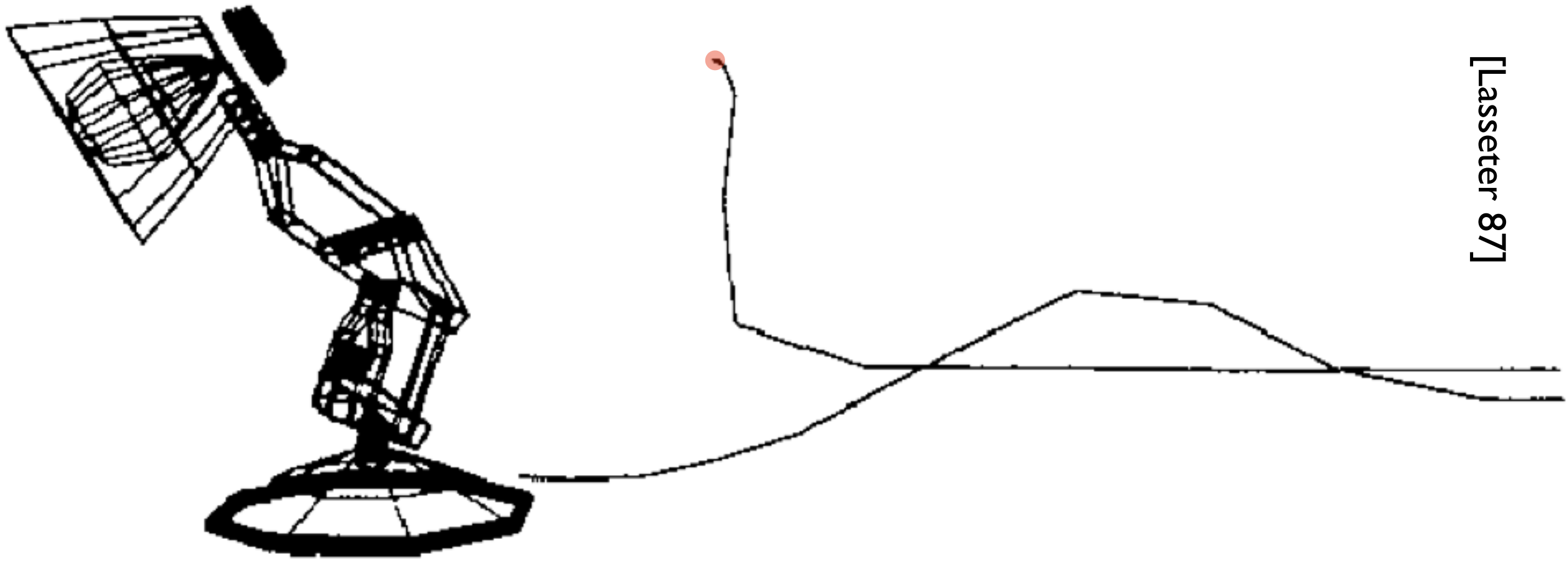
[Lasseter 87]



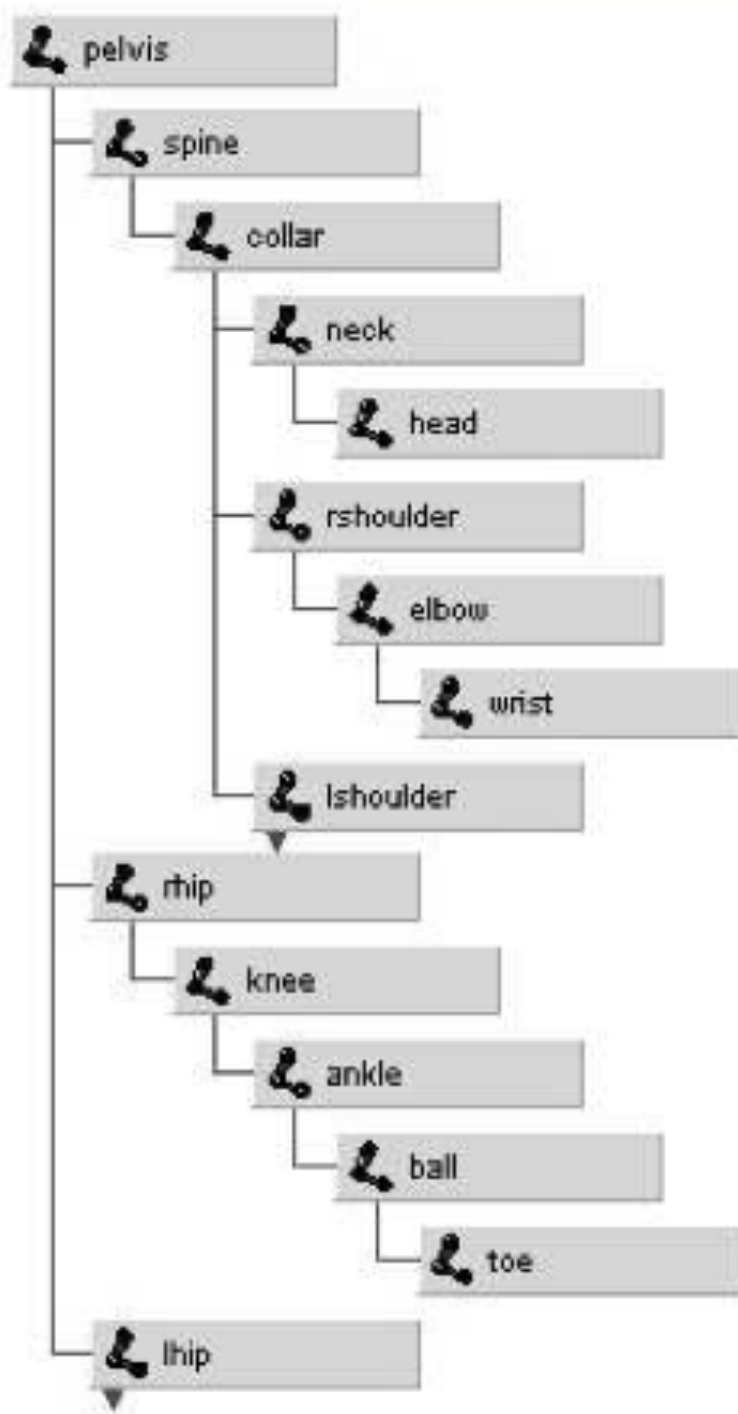
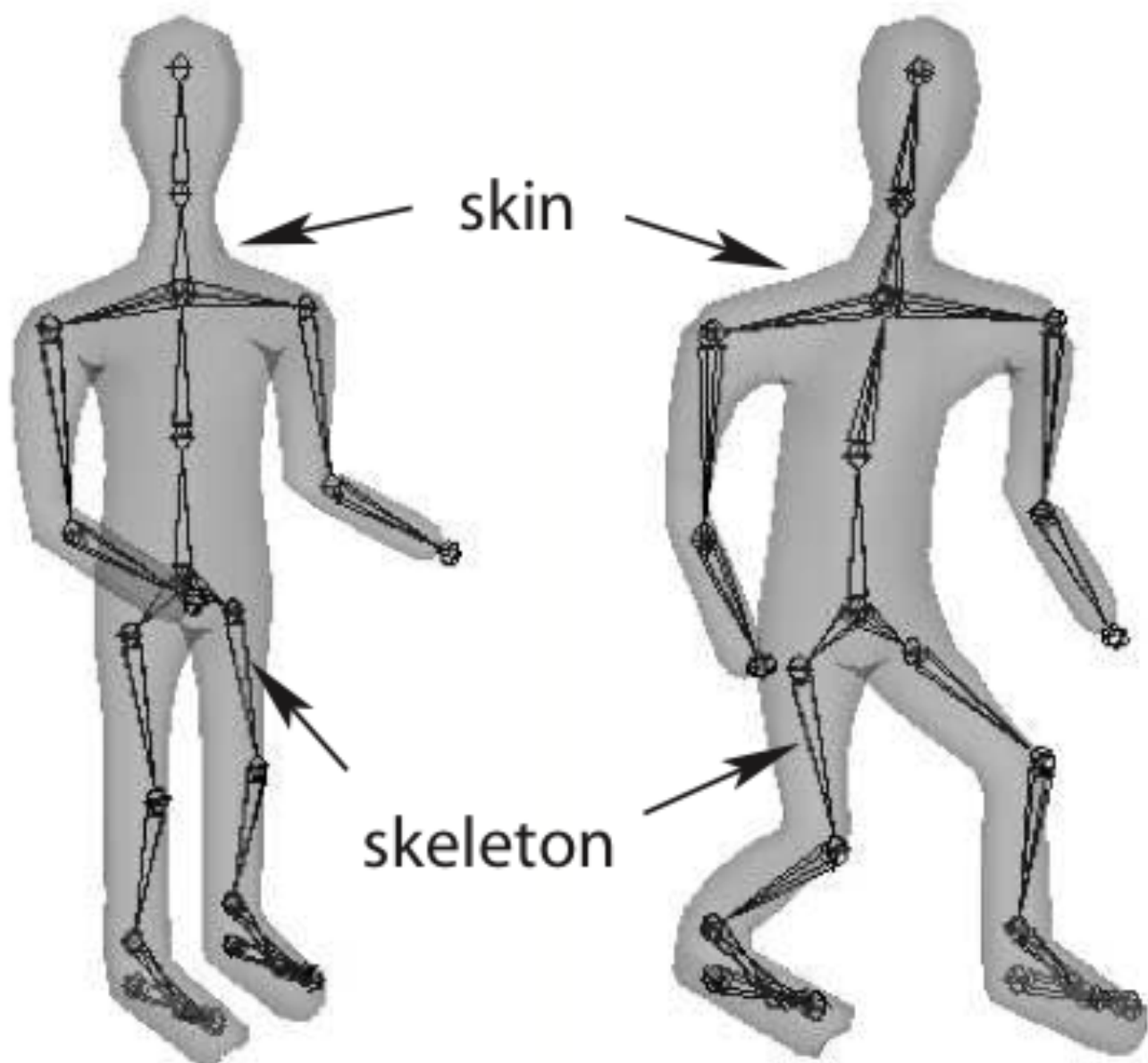
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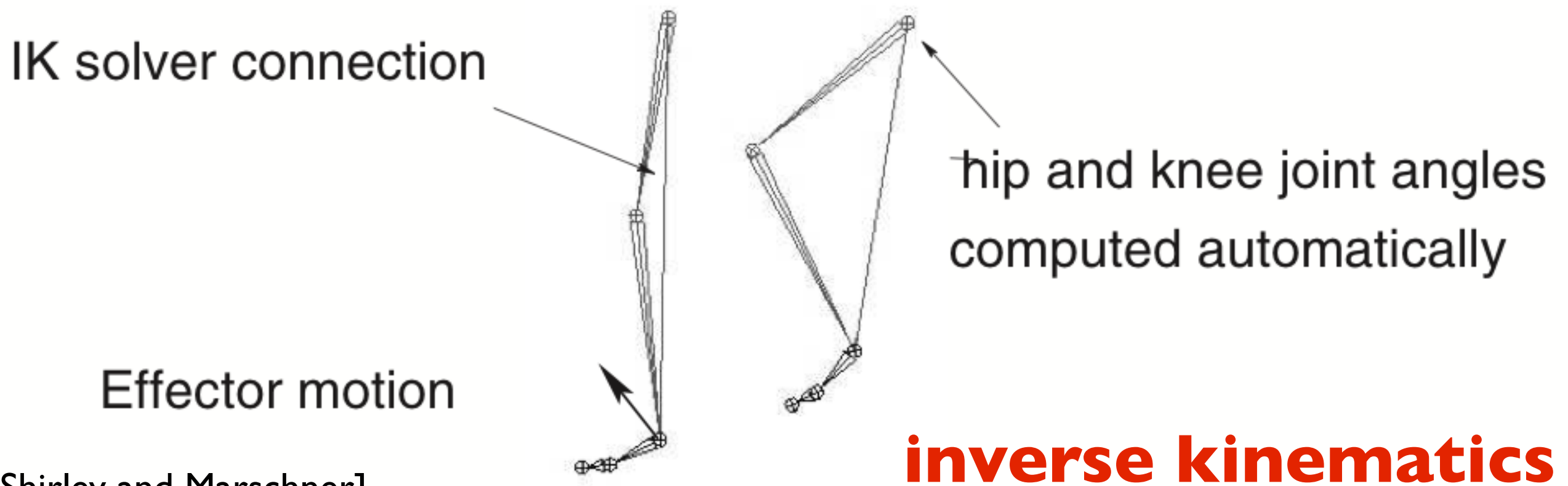
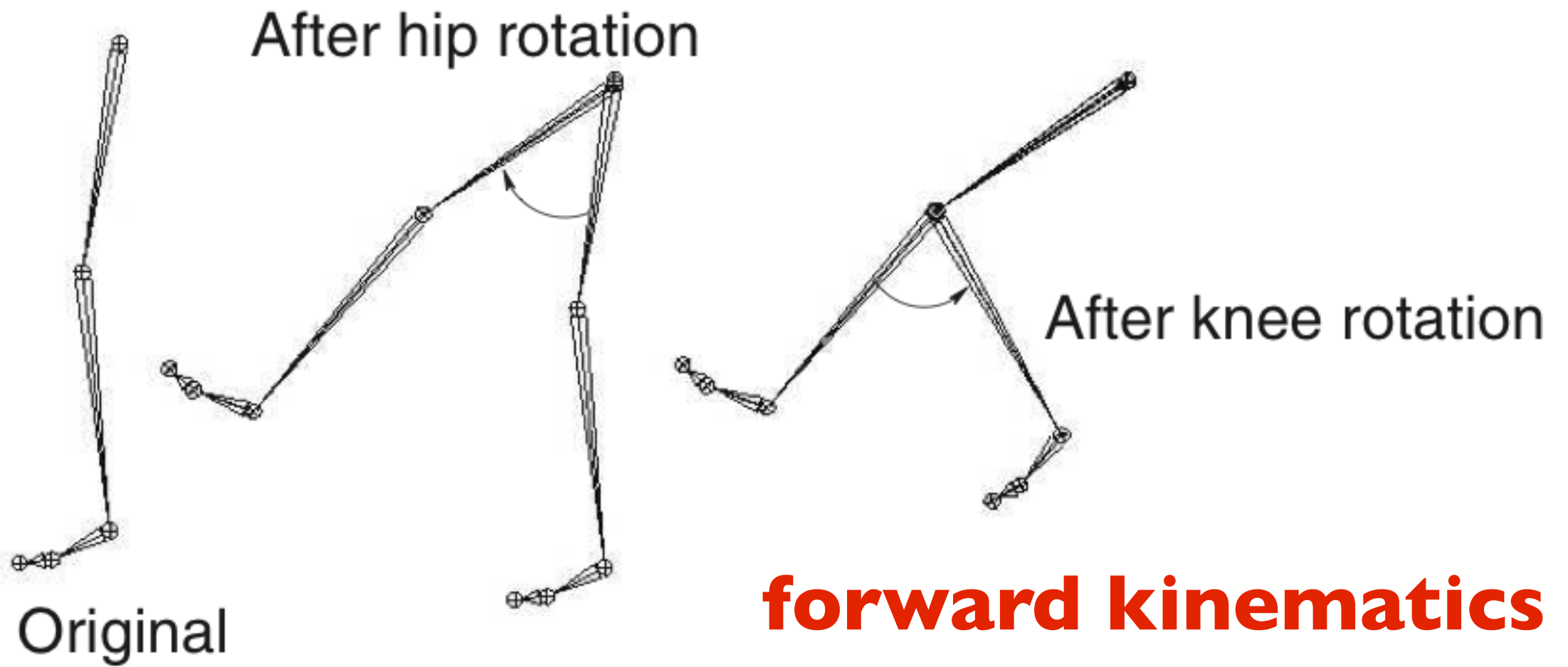
[Lasseter 87]

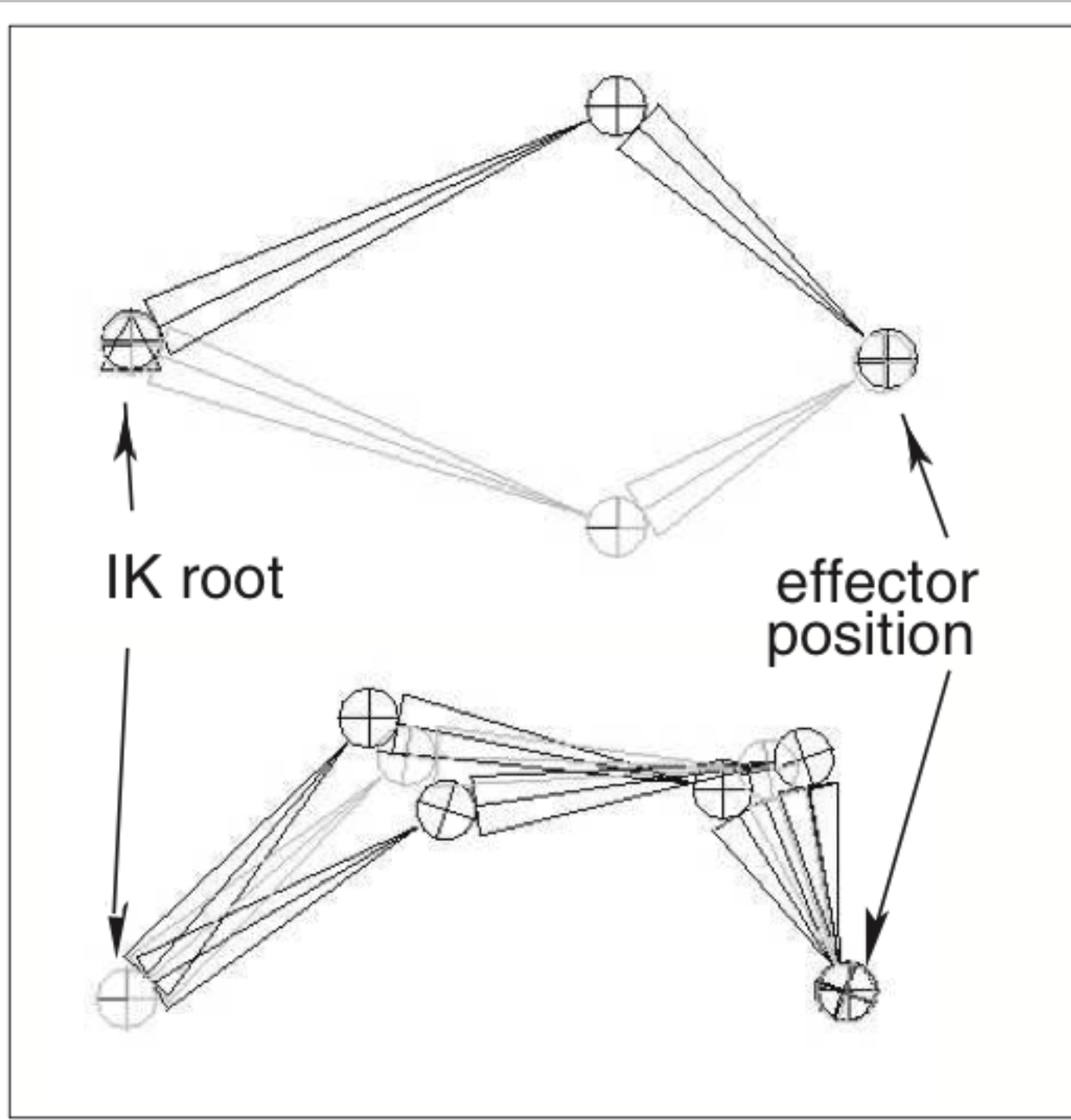


[Lasseter 87]



[Shirley and Marschner]





multiple possible
states of joints

inverse kinematics

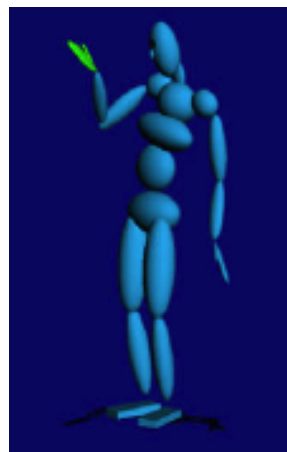
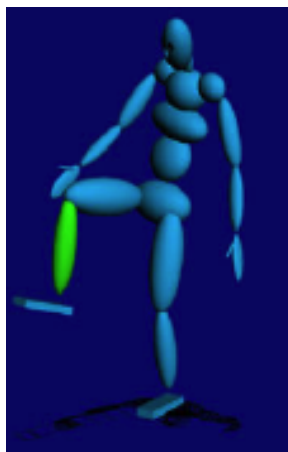
Keyframe character DOFs



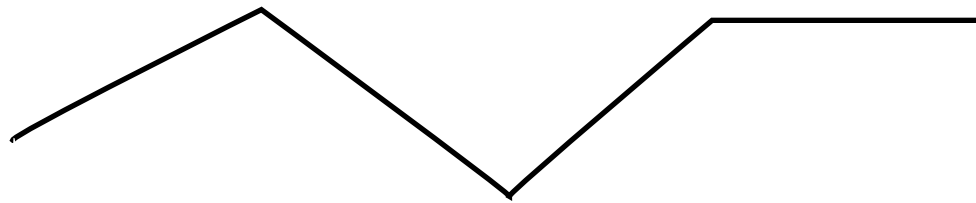
3 translational DOFs

48 rotational DOFs

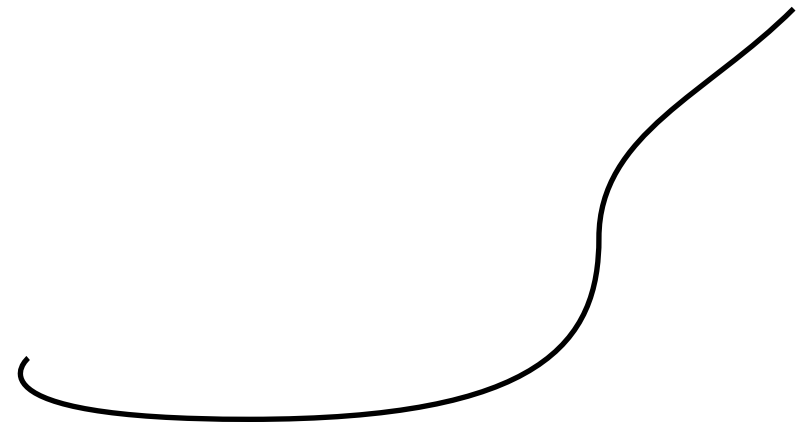
Each joint can have up to 3 DOFs



Interpolation of keyframes

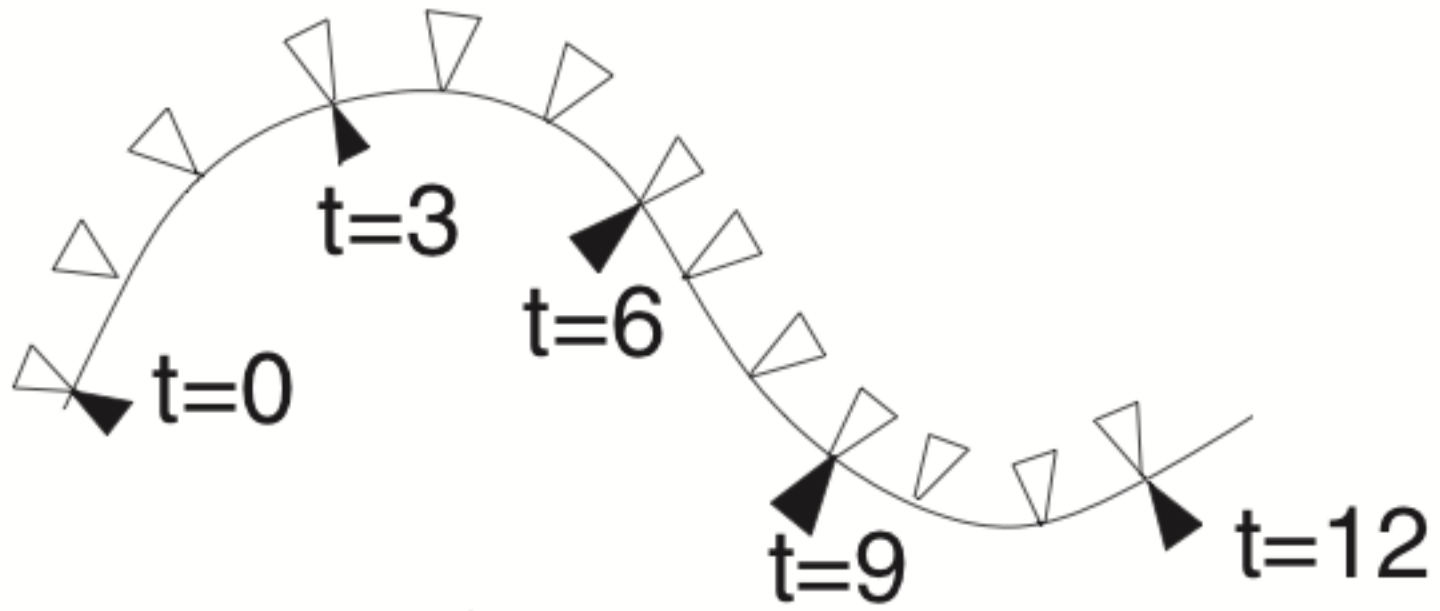


linear interpolation

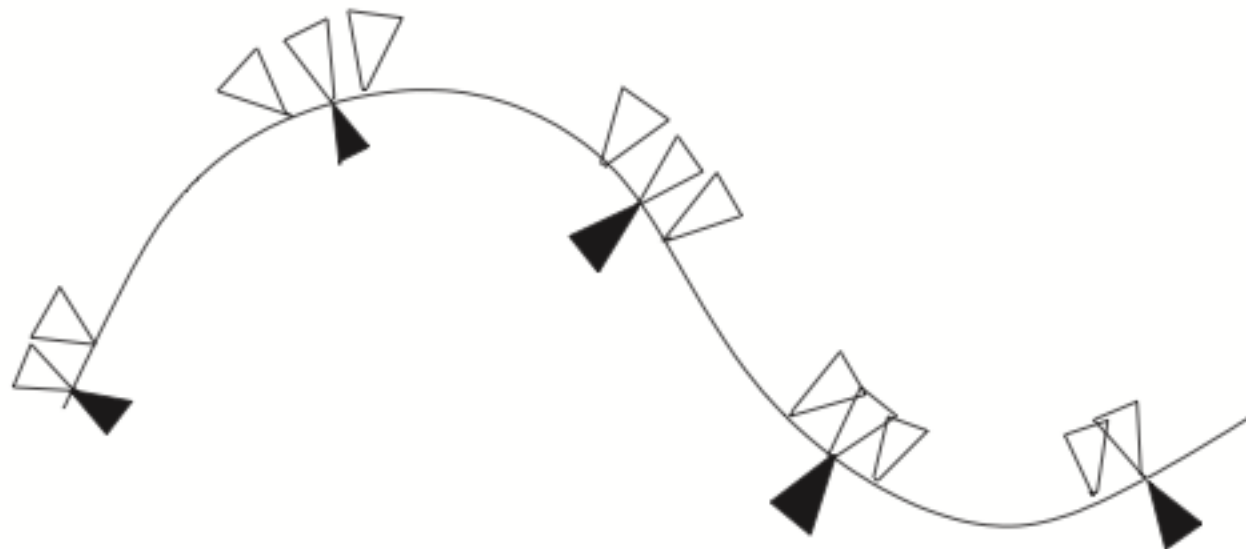
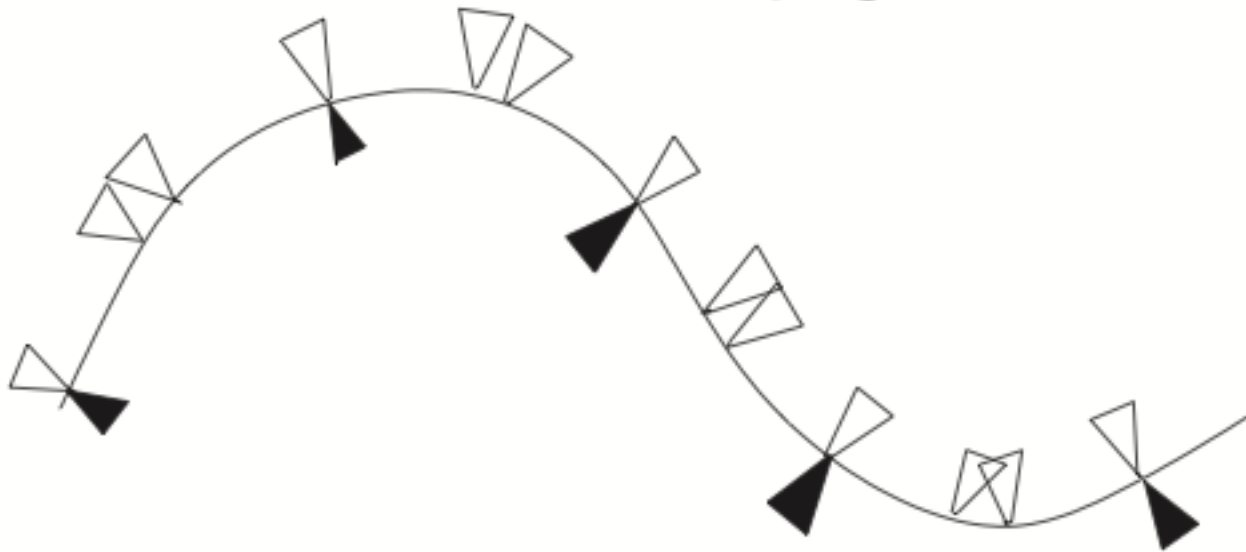


spline interpolation

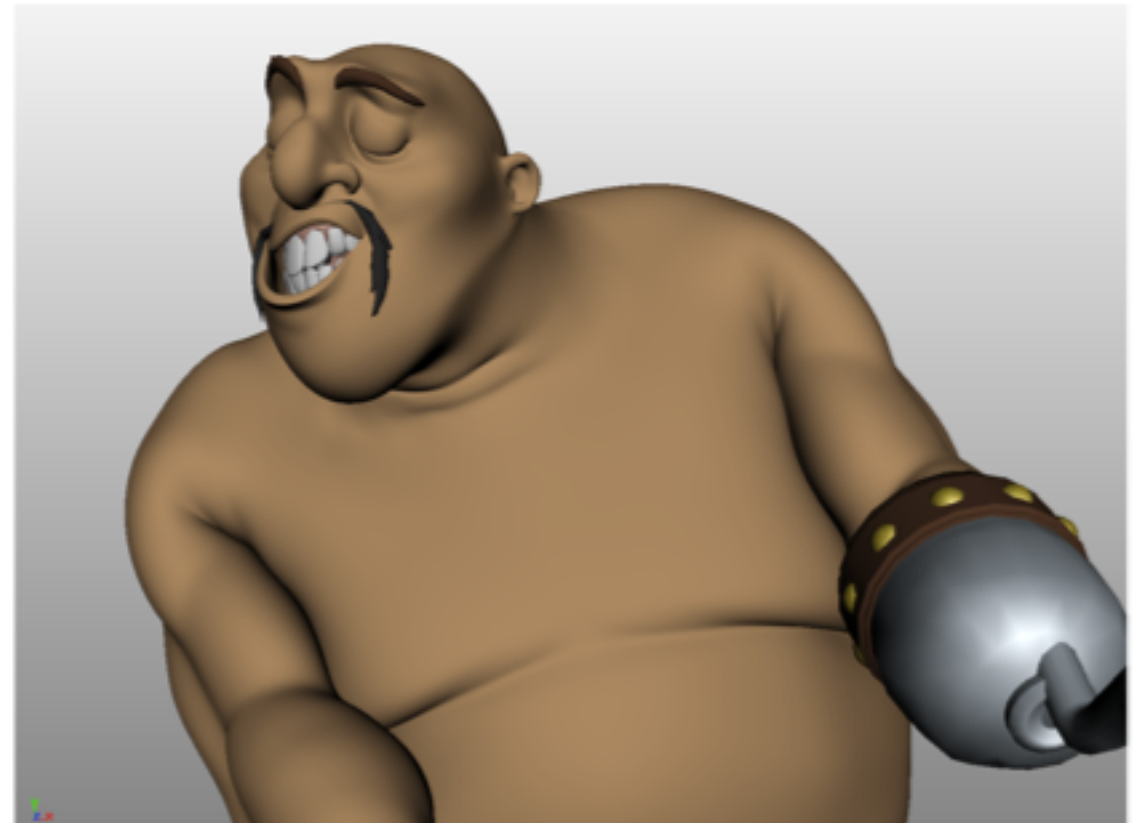
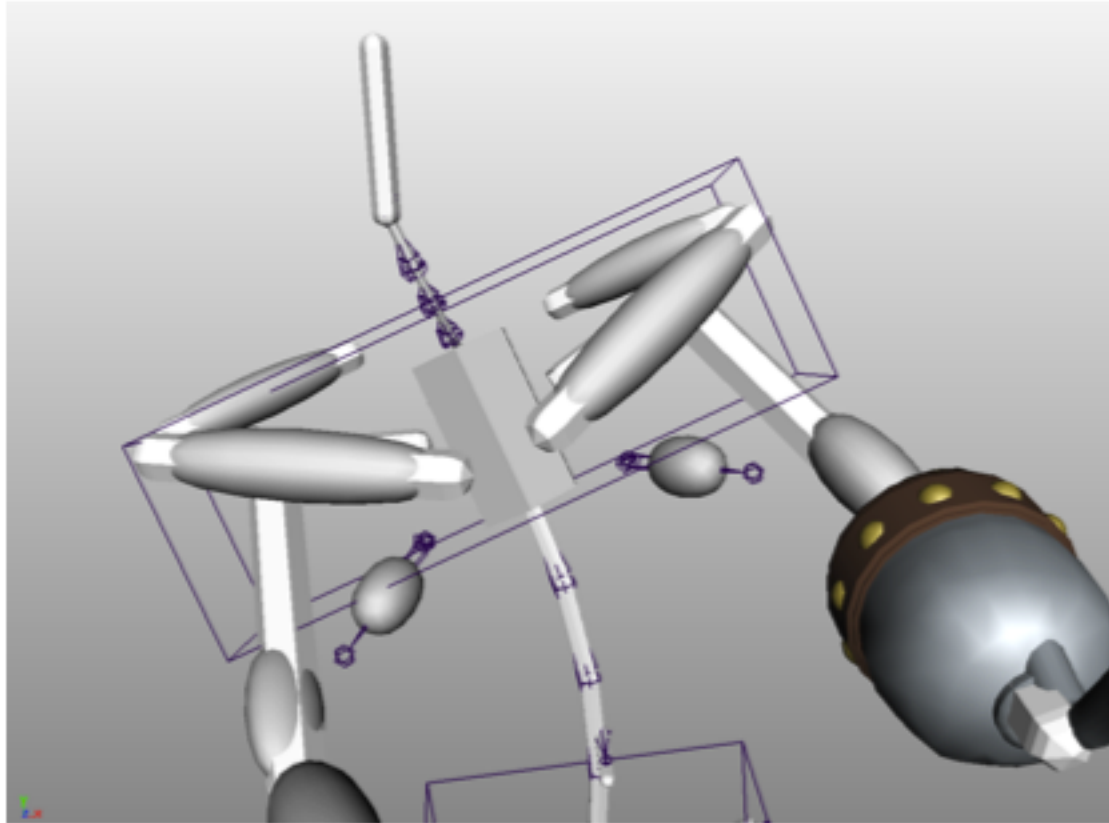
Straightforward to interpolate position but what about orientation?



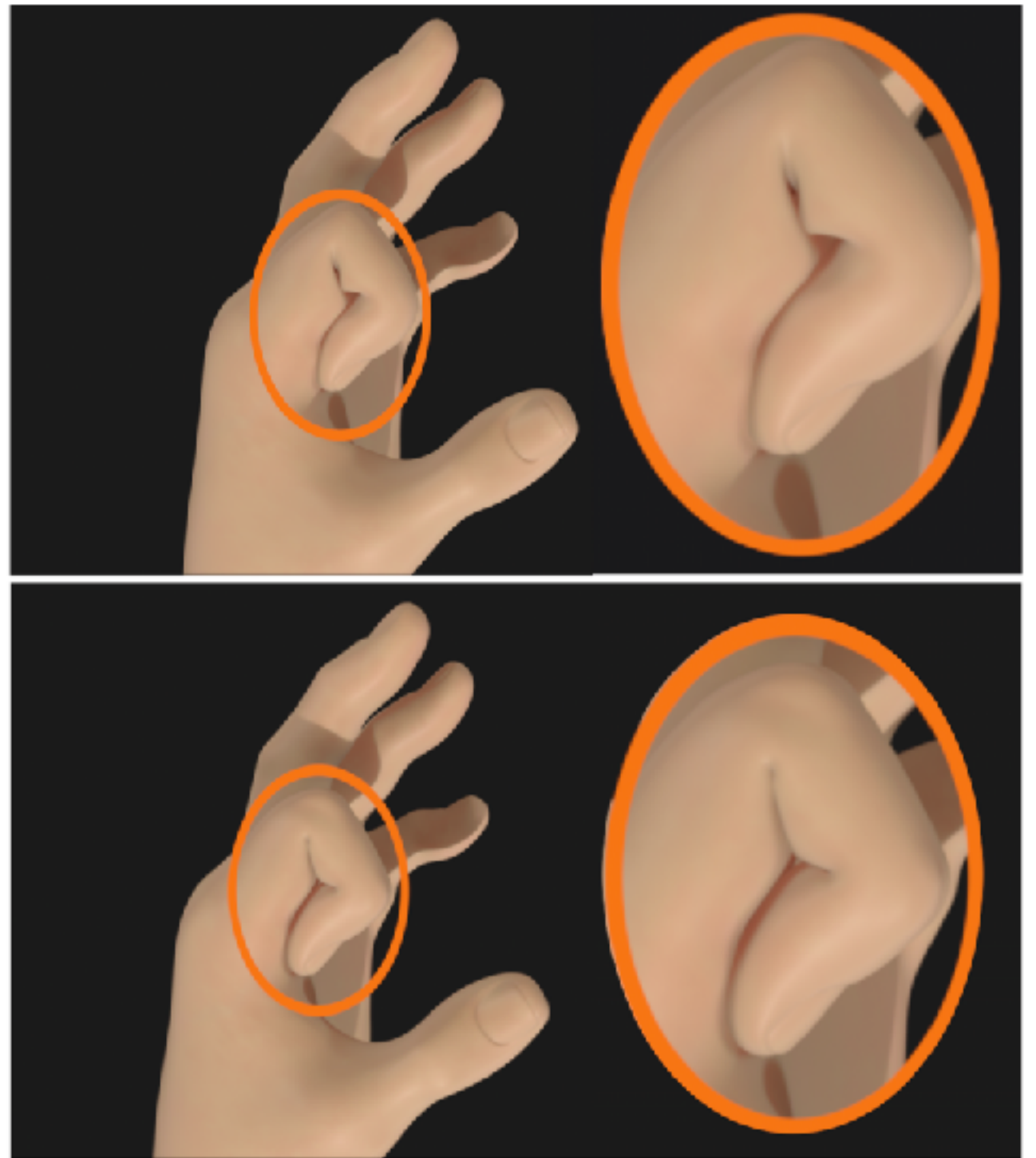
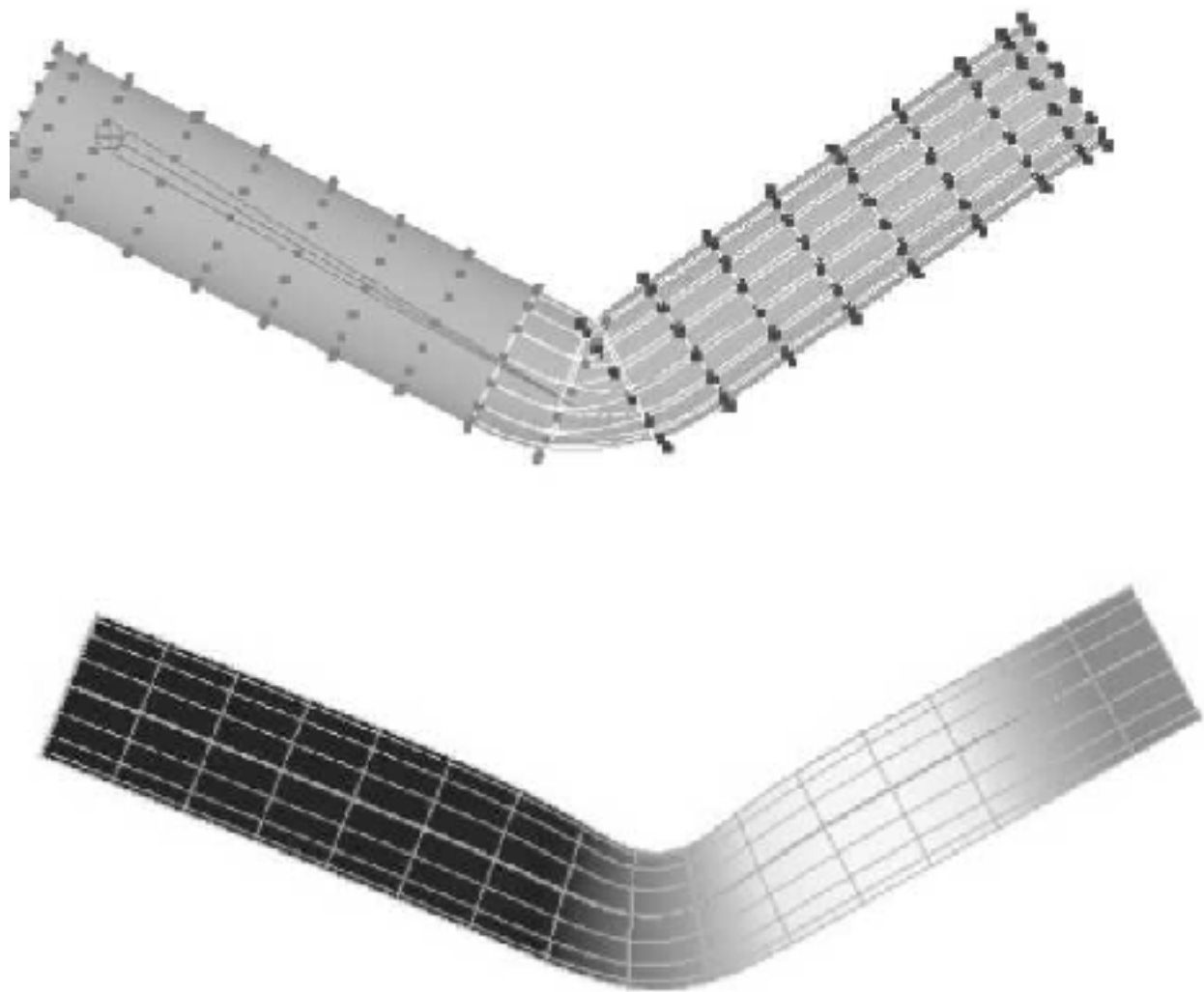
need to consider
both
shape of motion
and
speed of motion



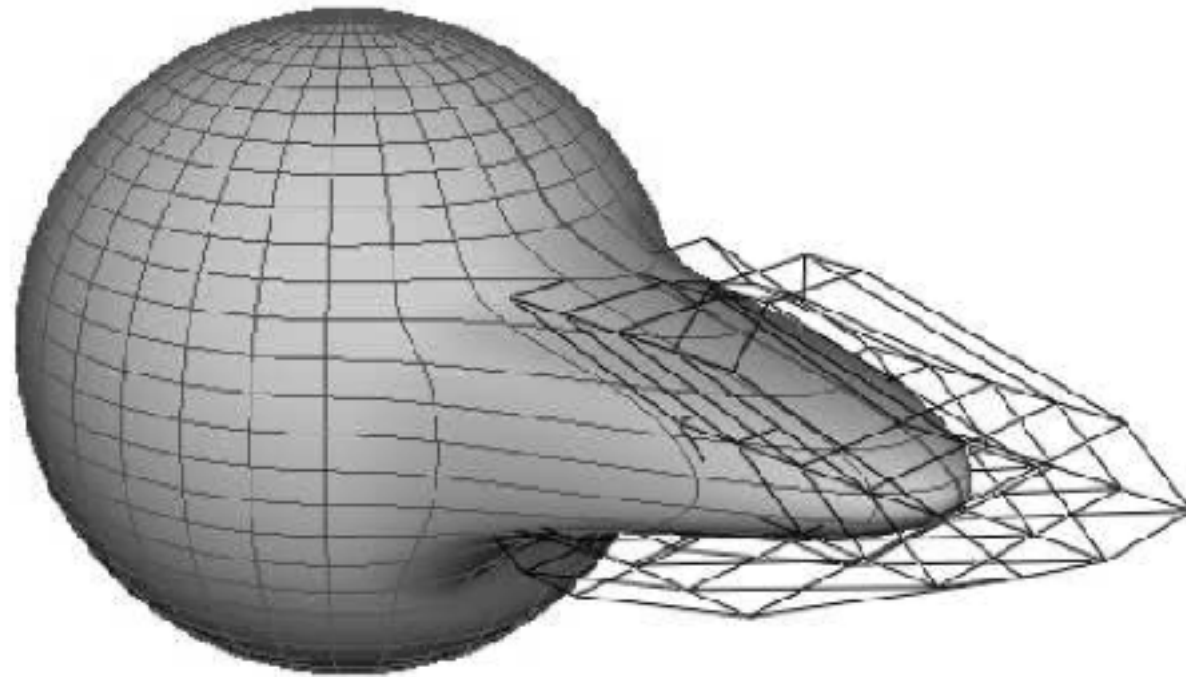
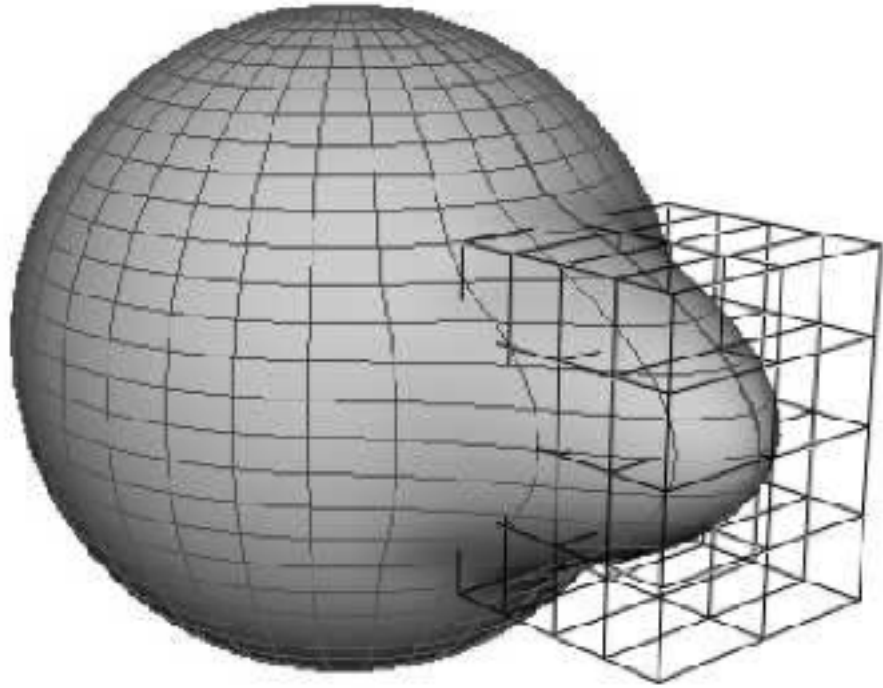
Character Skinning



Character Skinning



[McAdams et al. 2011]



free form deformation

[Sederberg 1986]

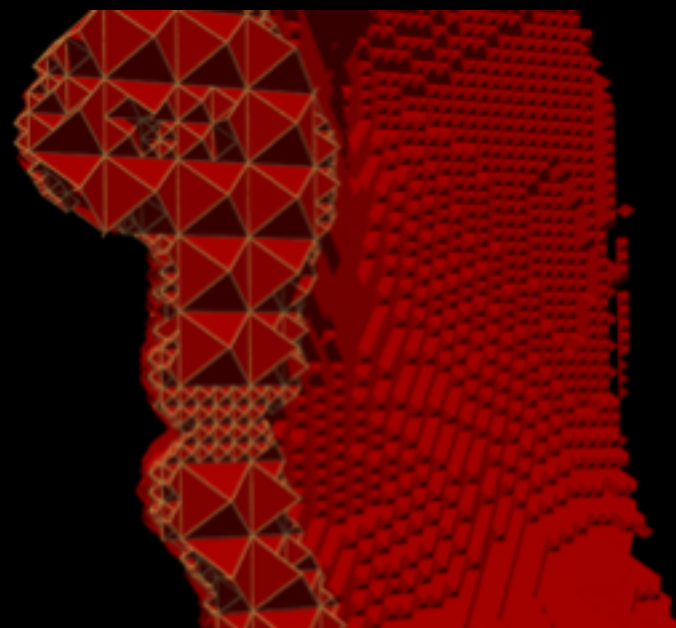
facial animation



©2004 Disney/Pixar



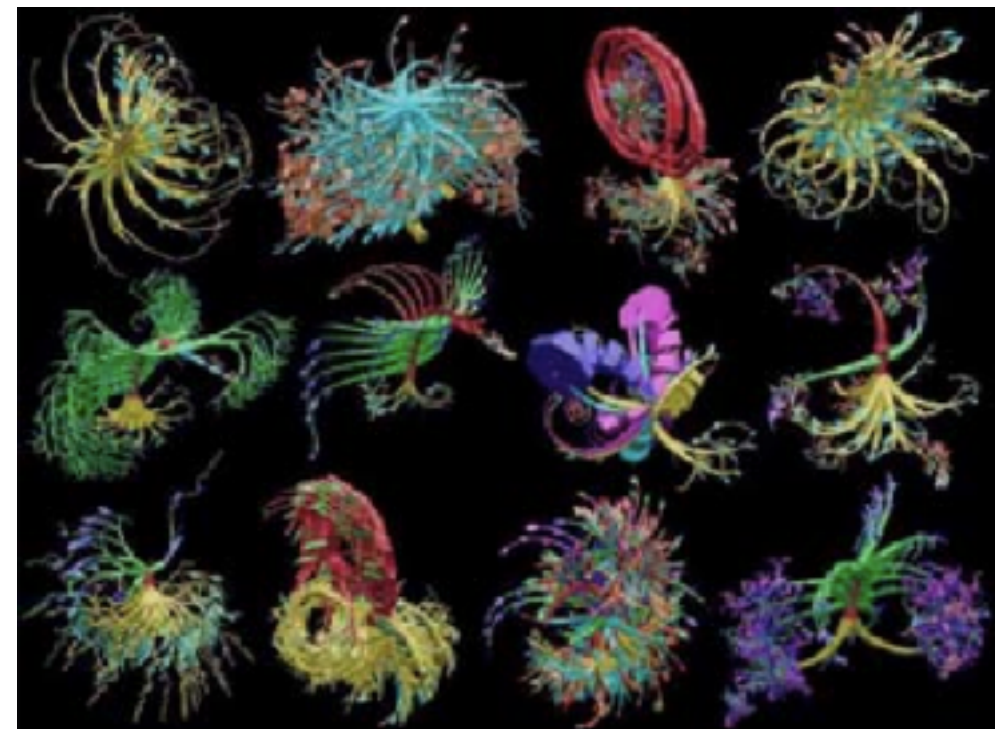
Facial animation



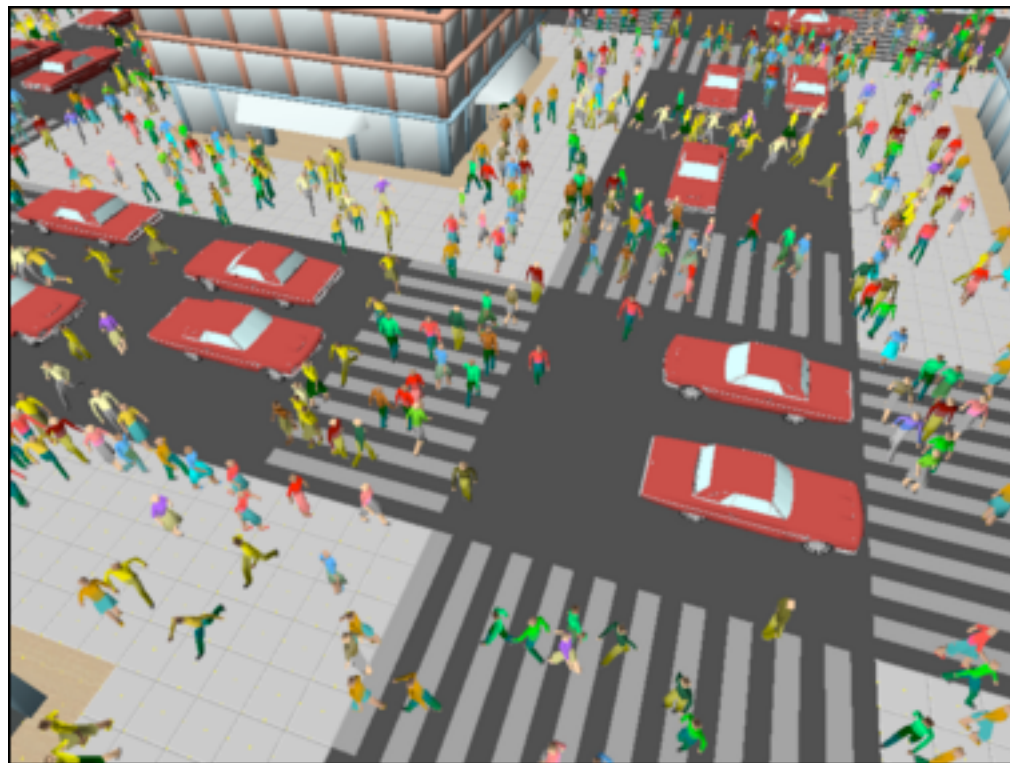
procedural animation

Artificial life

- plants - movement and growth
- evolving artificial life



Crowd simulation



[Treuille et al. 2006]