Computer Animation and Games I

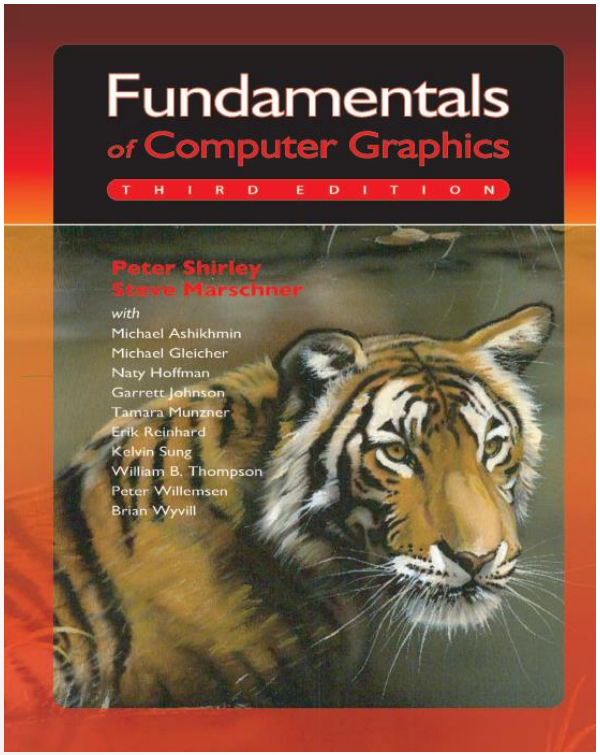
CM50244

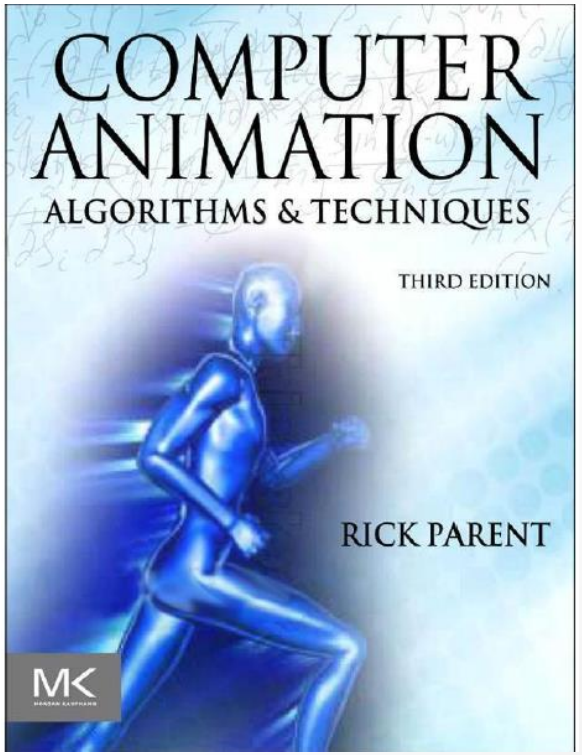
Basic Info

- Lecturer: Yongliang (Mac) Yang
- Lectures
  - Monday (13:15-16:05, Week 1-3, 8W 2.12)
  - Friday (10:15-12:05, Week 1-3, CB 4.5)
- Lab times
  - Friday (10:15-12:05, 1W 2.53, Week 4-11, and 15)

Other Resources

- Moodle page
  - collections of materials from Prof. Phil Willis
- Reference text book





Today's Lectures

- Introduction to Computer Animation
- Introduction to Computer Games
- 2D/3D Shape Representations

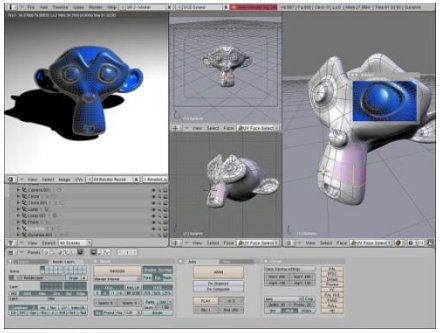
What an Animation Is?

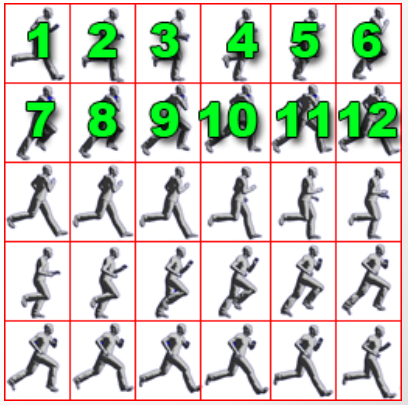
Overview

- Animation & Production
- Rigging
  - Procedural
  - Skeleton-based
- Animation
  - Keyframe Animation
  - Motion Capture
  - Physics-based Animation

Computer Graphics Sub-areas

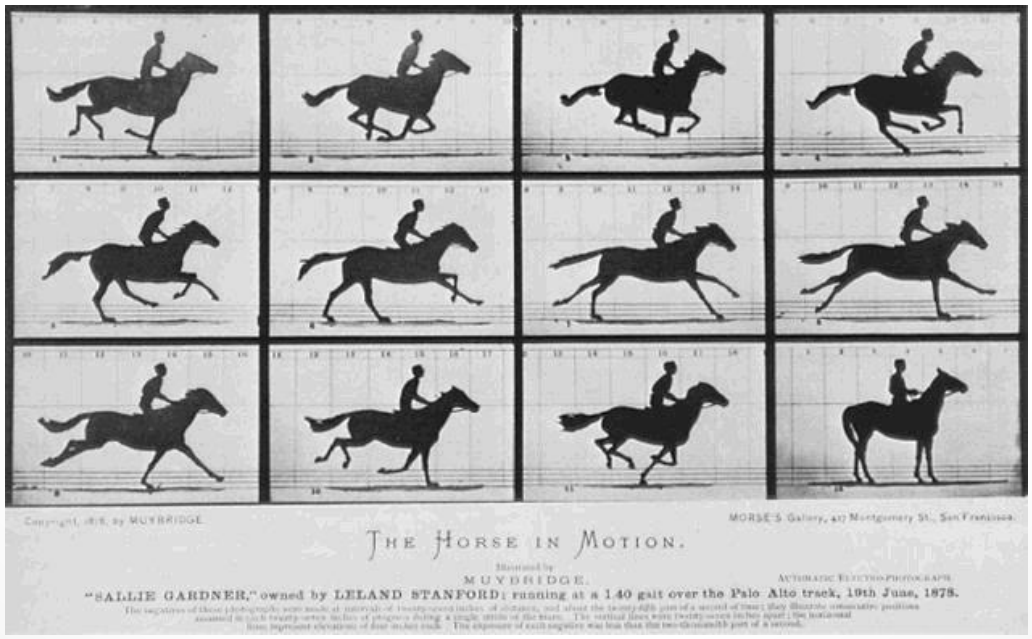
- Imaging
  - how to manipulate images
- Modeling
  - how to manipulate shapes
- Rendering
  - how to create synthesized images from shapes
- Animation
  - how to generate movement over time





Animation

- Sequence of images that give perception of movement when played in rapid succession
  - Film: 24 fps
  - Video: 30 fps
- ~130k images to make a 90 minute movie



Animation Production

1. Story Board
2. Conceptual Art
3. Recording
4. Modeling
5. Rigging
6. Layout
7. Animation
8. Special Effects
9. Shading
10. Lighting
11. Rendering

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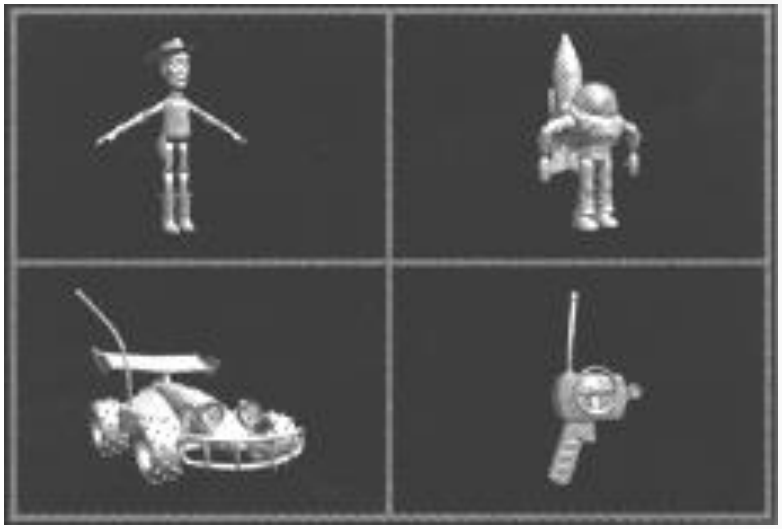

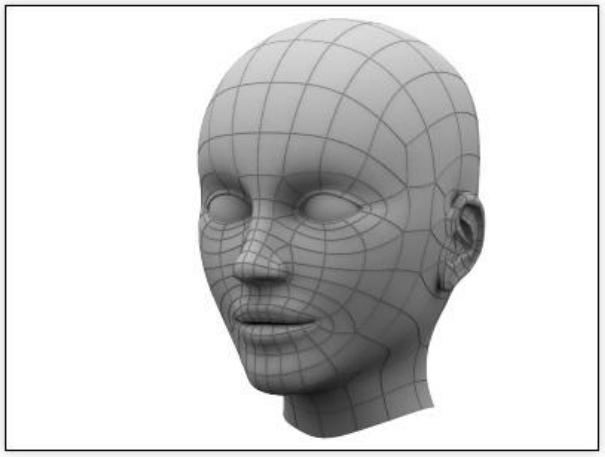

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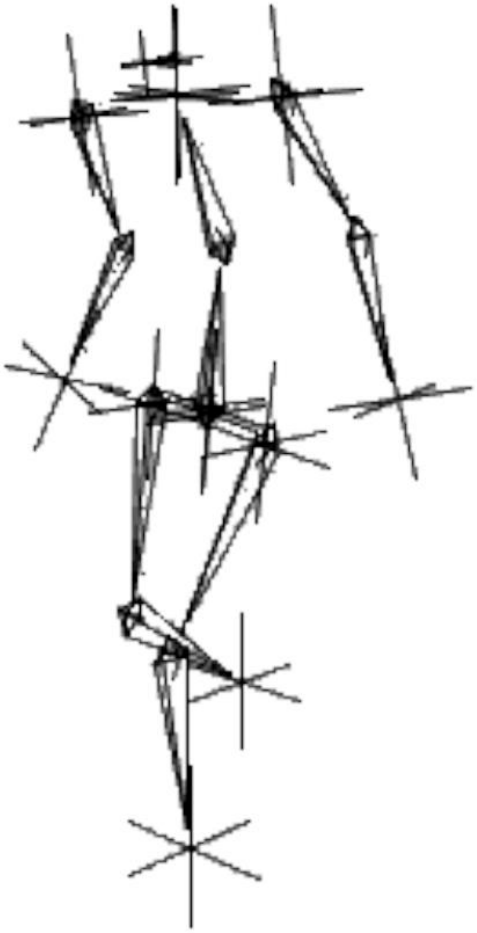

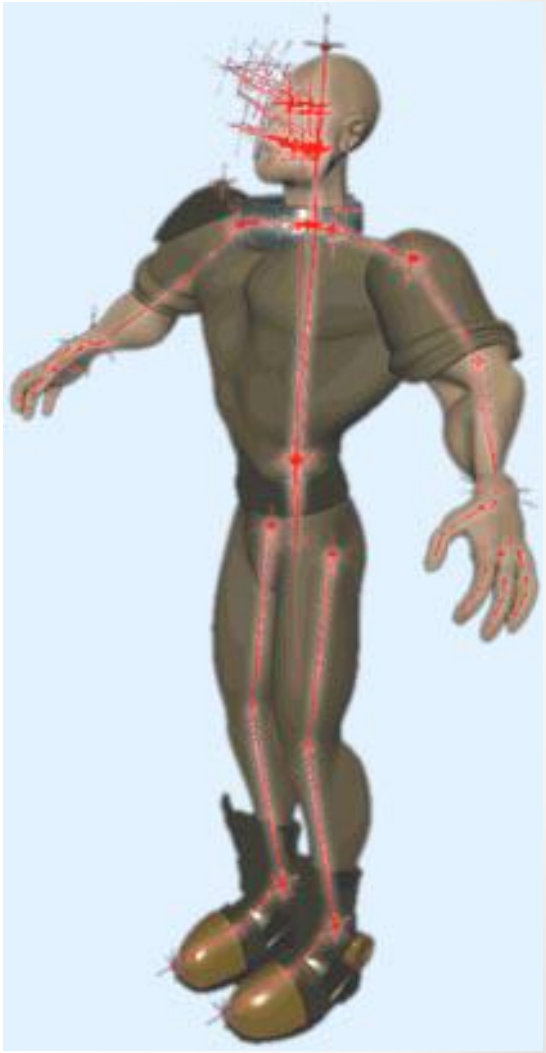

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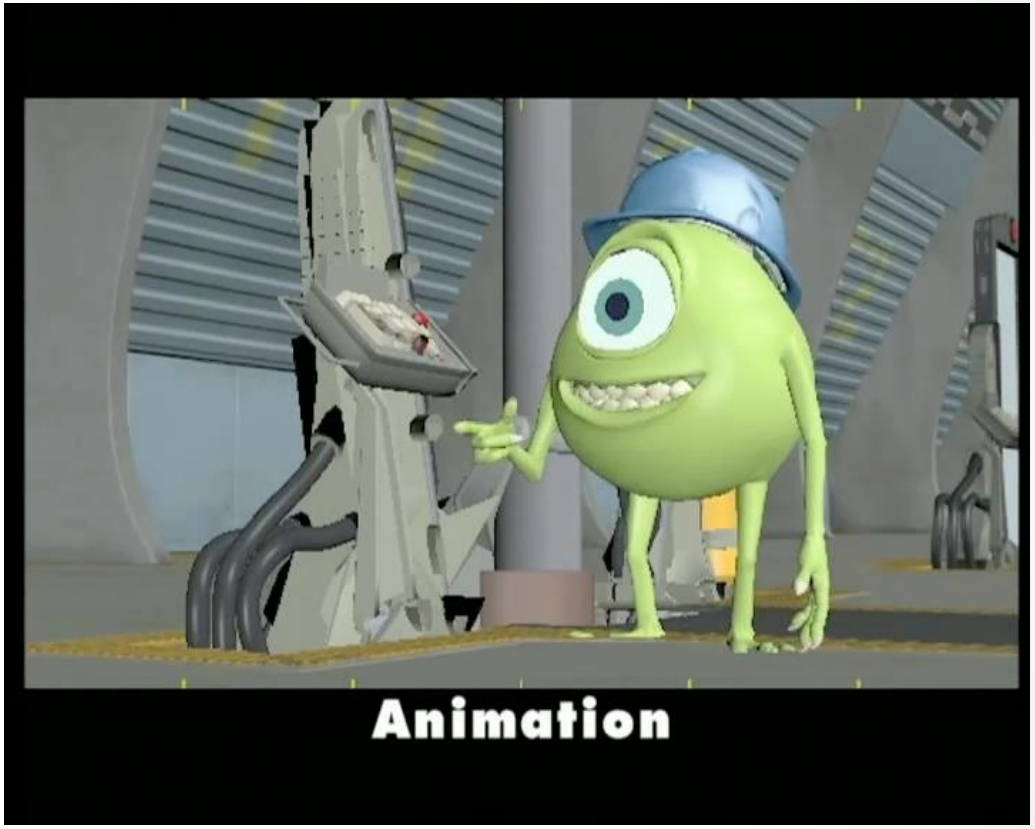

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Octapodi

(Oscar Nominated Short Animated Film 2007)

Overview

- Animation & Production
- **Rigging**
  - **Procedural**
  - **Skeleton-based**
- Animation
  - Keyframe Animation
  - Motion Capture
  - Physics-based Animation

Rigging

- Deform character with controls to easily change its pose, create facial expressions, etc.

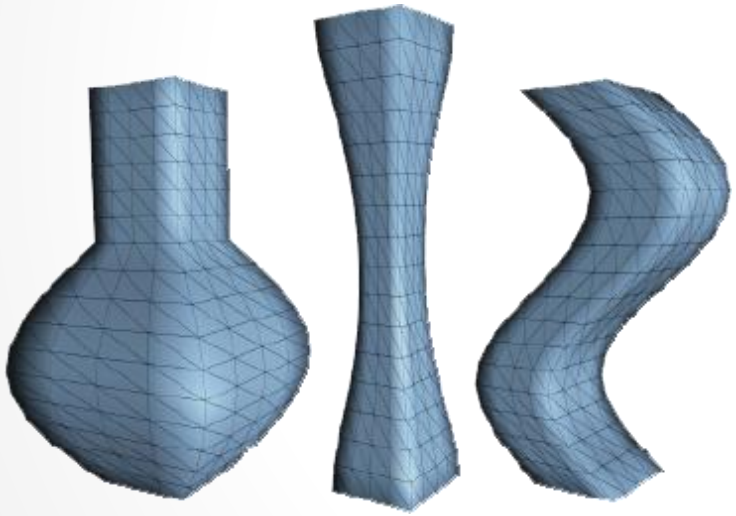
- Rigging is like the strings on a marionette.

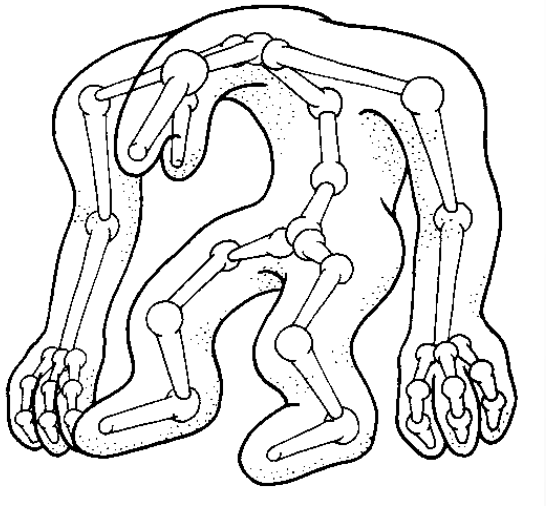
Rigging

- Extremely important:
  - Determines final shape of the character
  - Quality of rigging deformations has large influence on quality of animation itself
- Expensive:
  - Manual effort
  - Both artistic and technical training

Types of rigging

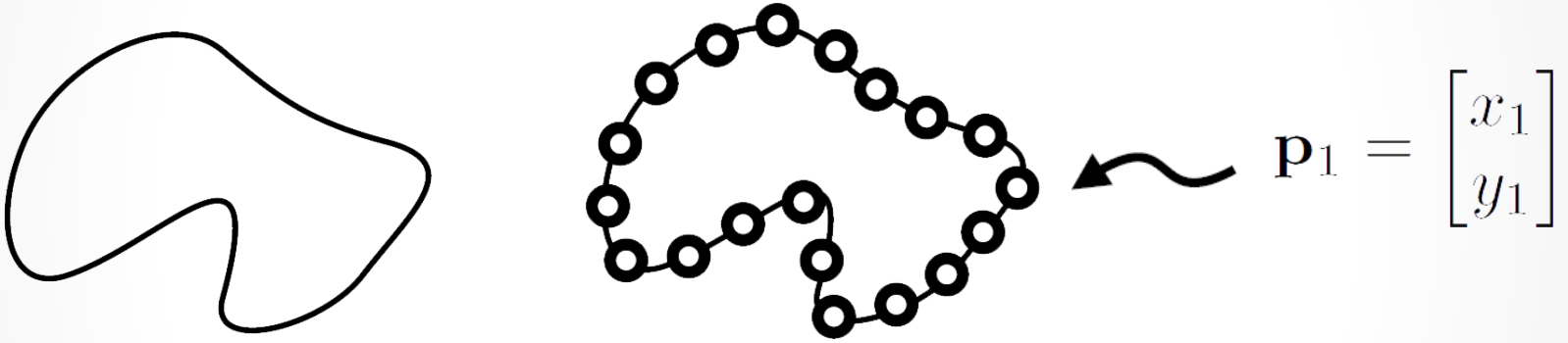
- **Procedural Rigging**
- Skeleton-based Rigging





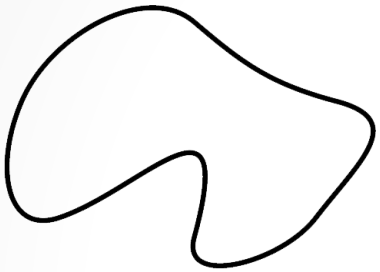
Procedural Rigging

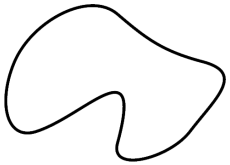
- Apply function to points specifying the shape



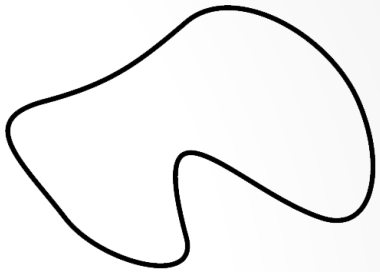
$$\mathbf{p}' = f(\mathbf{p})$$

Linear Deformation

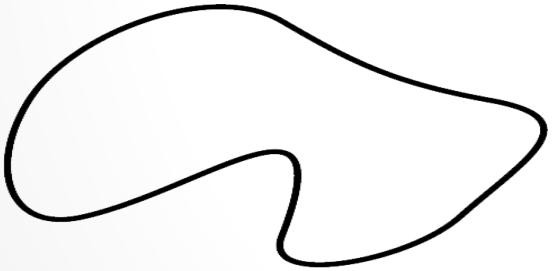




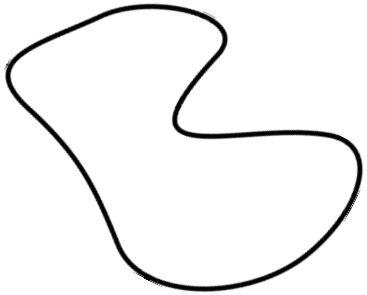
scale



flip



stretch

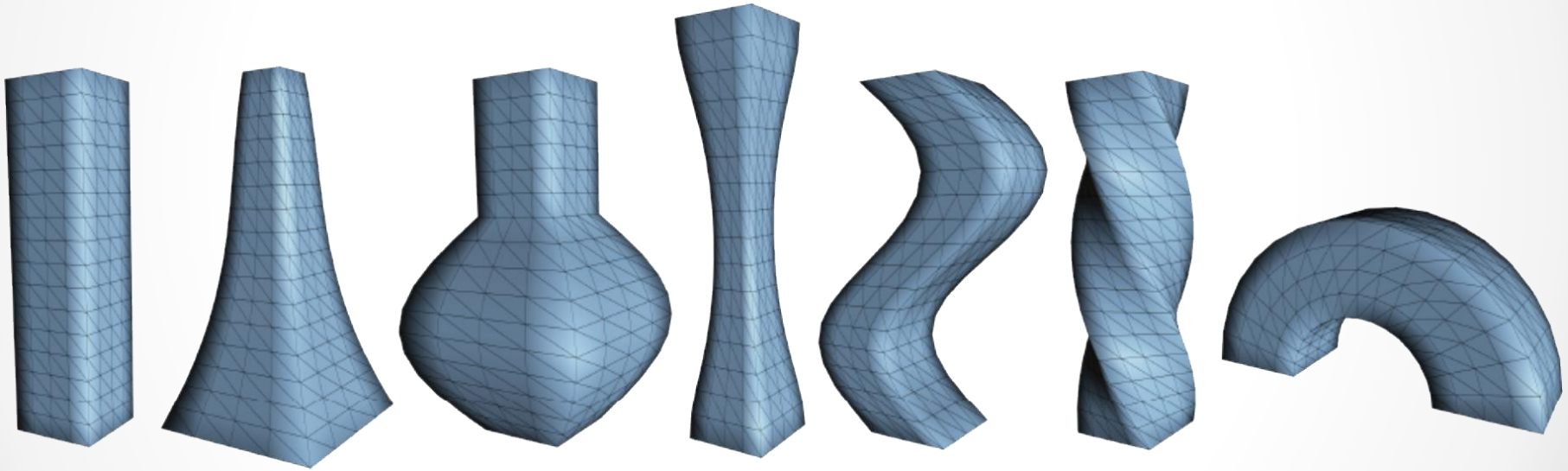


rotate

shear

Non-linear Deformation

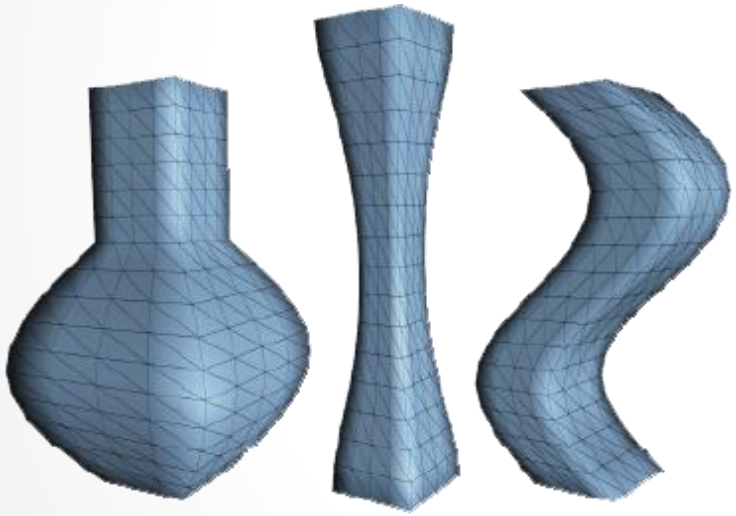
- Non-linear deformations for bends, twists, tapering, bulges, etc.

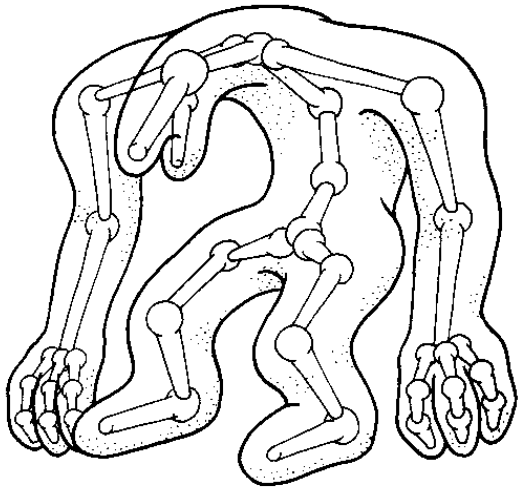


Al Barr. Global and Local Deformations of Solid Primitives. SIGGRAPH 1984.

Types of rigging

- Procedural Rigging
- **Skeleton-based Rigging**

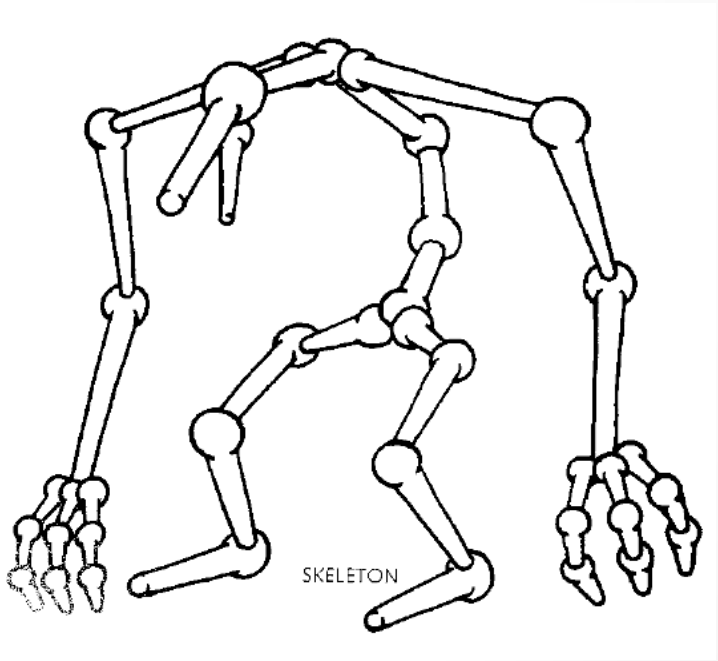




Skeleton-based Rigging

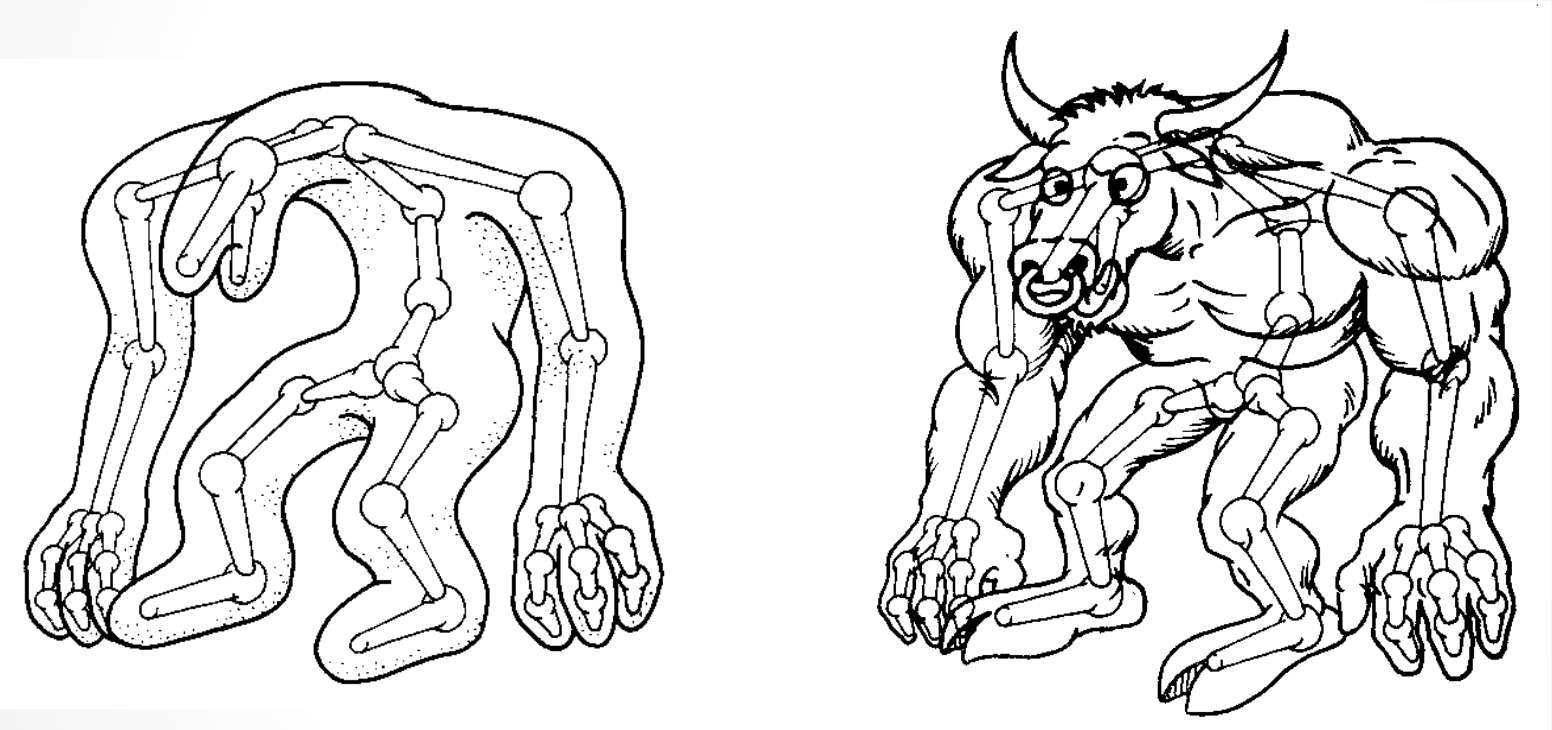
- Parameterize character deformation with a skeleton.

- Approximate actual skeleton of the character.



Skeleton-based Rigging

- Skin on top of the skeleton



Overview

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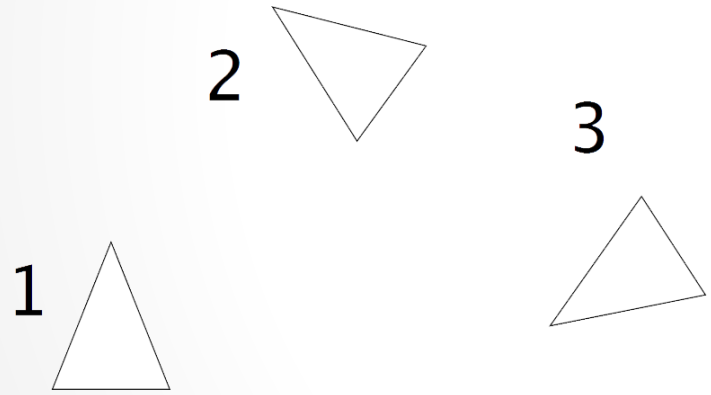
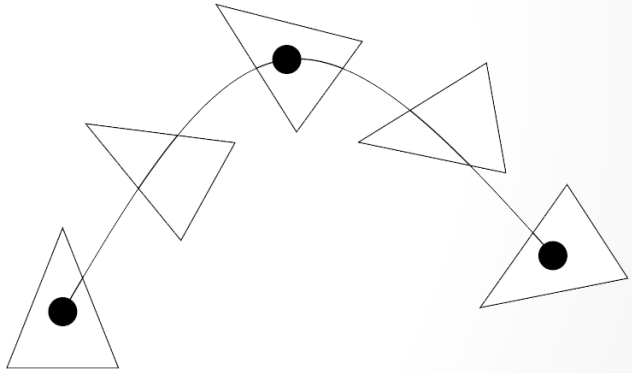
- **Animation**
  - **Keyframe Animation**
  - **Motion Capture**
  - **Physics-based Animation**

Keyframe animation

- Animator draws character at "extreme" poses
- Fill in in-betweens



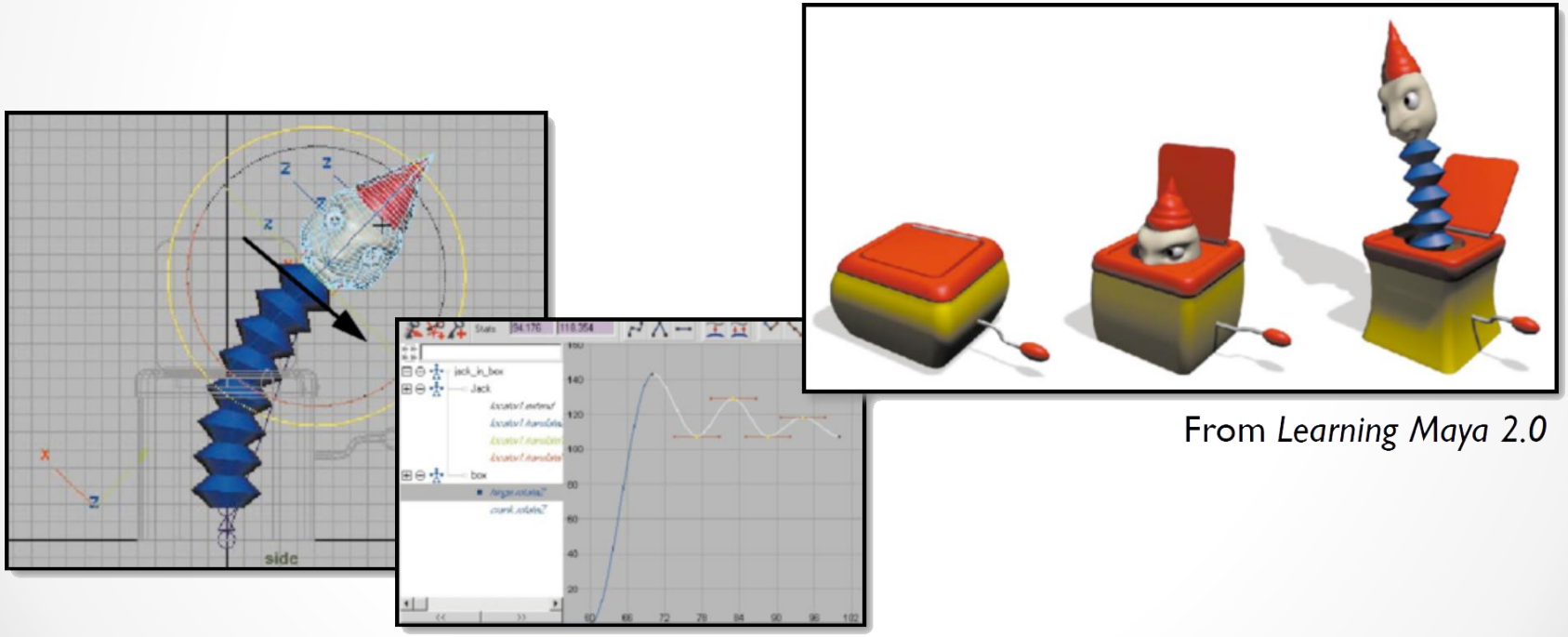
Keyframes



Animation

Keyframe animation

- Expressive! Gives artist total control
- But labor intensive even for talented artist



From *Learning Maya 2.0*

Motion Capture

- Record live action
- Transform to virtual character

Optical

Motion Capture

Avatar

(20th Century Fox)

We can capture these…

Motion Capture??

Physics-based Animation

- Use computational model (usually physics-based) to control the animation

Fluid Simulation

(SIGGRAPH 2010)