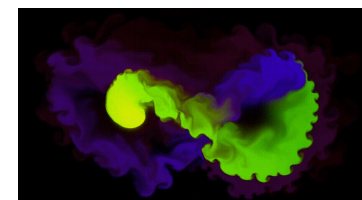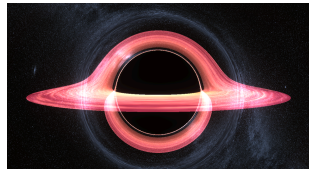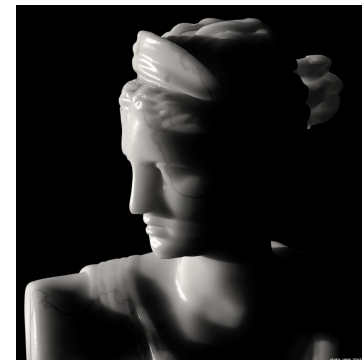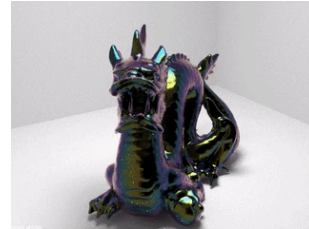# Primer on Final Project - Spring 2021

Today is just to get you thinking

Project

- Build something interesting to you
- Teams of four - choose your team
- 20% for 184, 40% for 284A

Timeline: 4 weeks

- April 8   Proposals due
- April 27 Milestone Due
- May 6   Presentations
- May 11   Final reports due

Ng & Kanazawa

Inspirations

Past show case winners:

https://cs184.eecs.berkeley.edu/sp18/article/38

https://cs184.eecs.berkeley.edu/sp20/article/39/final-project-showcase

Ideas:

https://cs184.eecs.berkeley.edu/sp20/article/35/final-project-ideas

This year's spec will be up soon.

Be creative!

Go browse https://www.shadertoy.com/

Incorporate your hobby / passion

Lecture 25:

Intro to Animation

Computer Graphics and Imaging
UC Berkeley CS184/284A

Topic Plan

History, goals and principles of Animation

....

Procedural animation: physical simulation

Cloth simulation

....

Artist-driven animation: Rigging, Skinning, Posing

Data-driven animation: Motion Capture

Principles of Animation

Ng & Kanazawa

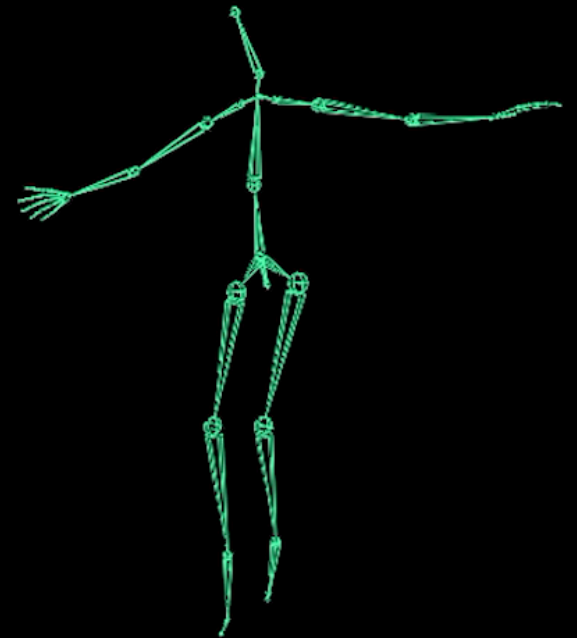# Physical Simulation: Cloth

Rigging & Skinning

Courtesy of libigl / Alec Jacobson   Ng & Kanazawa
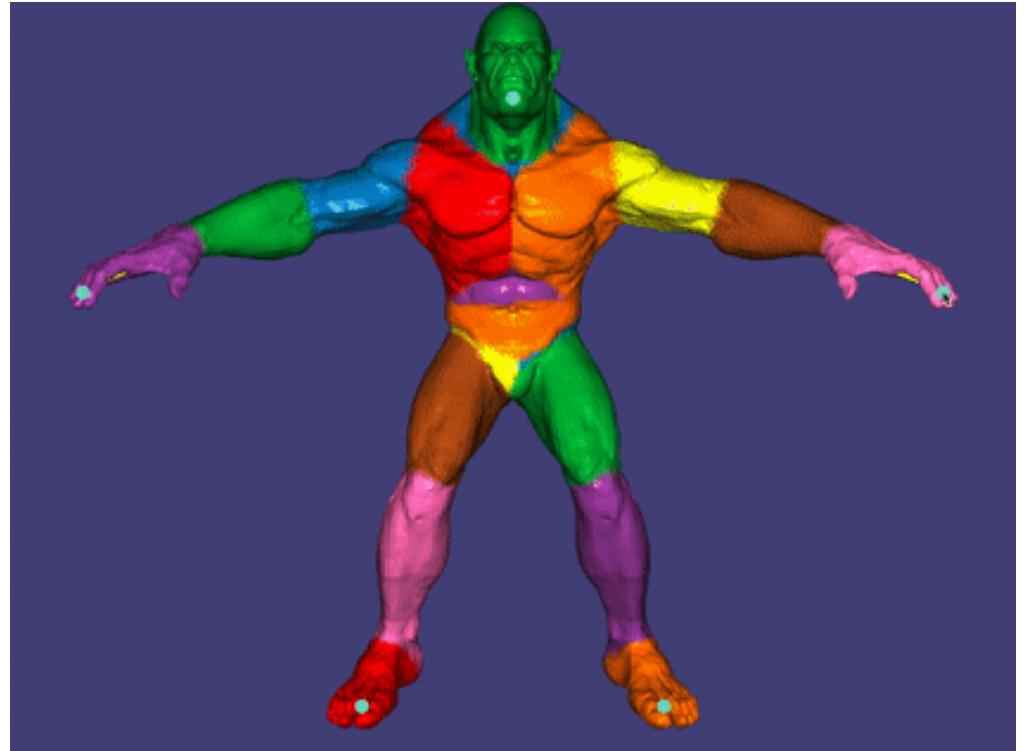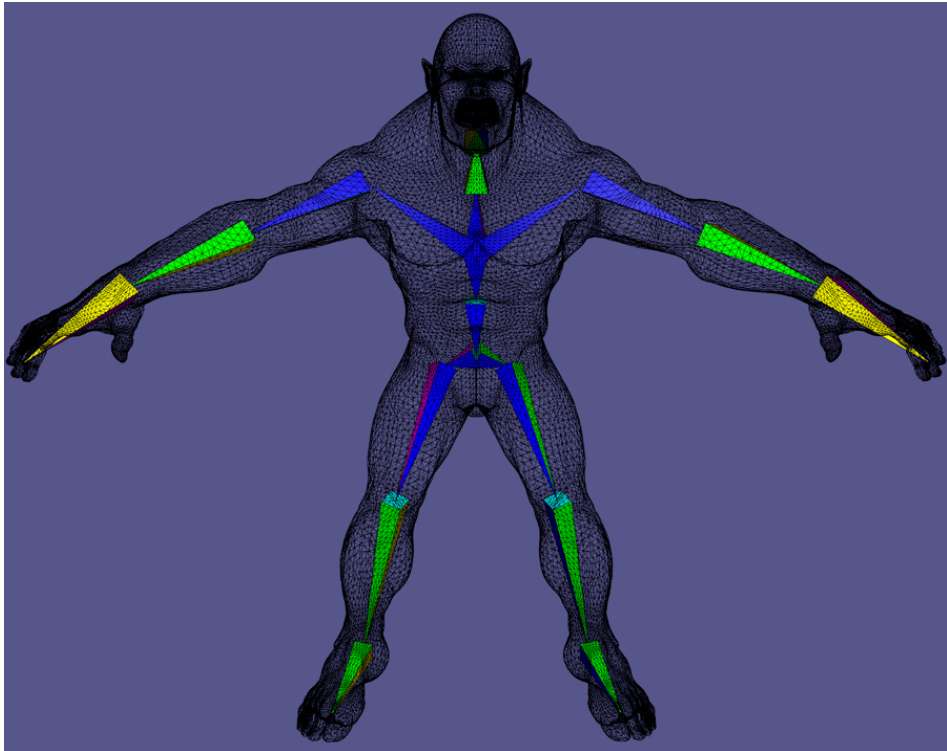
Parametric Models

Motion Capture

Ng & Kanazawa

Animation

"Bring things to life"

- Communication tool

- Aesthetic issues often dominate technical issues

An extension of modeling

- Represent scene models as a function of space

Output: sequence of images that when viewed sequentially provide a sense of motion

- Film: 24 frames per second

- Video: 30 fps

- Virtual reality: 90 fps

Historical Points in Animation

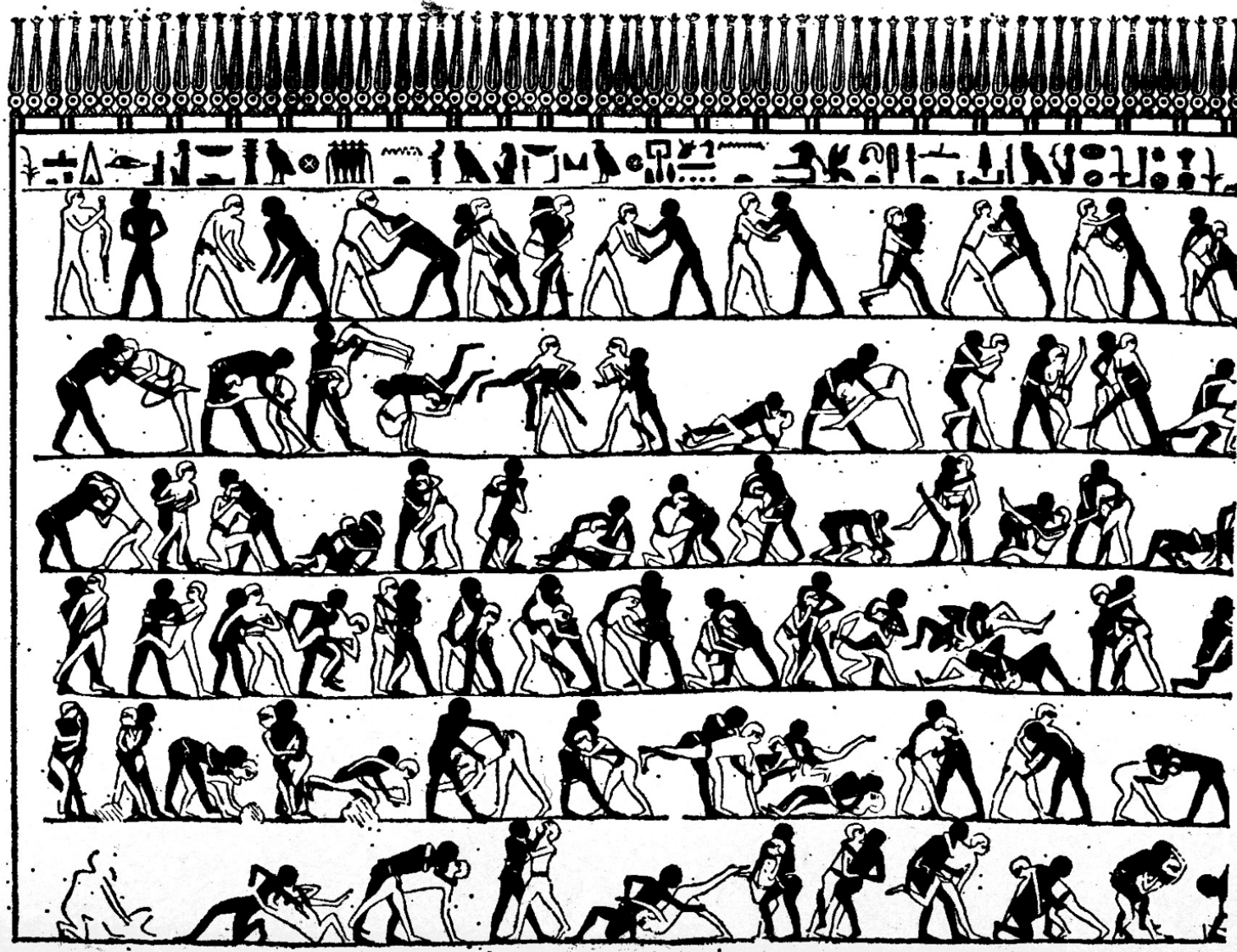(slides courtesy Keenan Crane)

First Animation

(Shahr-e Sukhteh, Iran 3200 BCE)

History of Animation

(tomb of Khnumhotep, Egypt 2400 BCE)
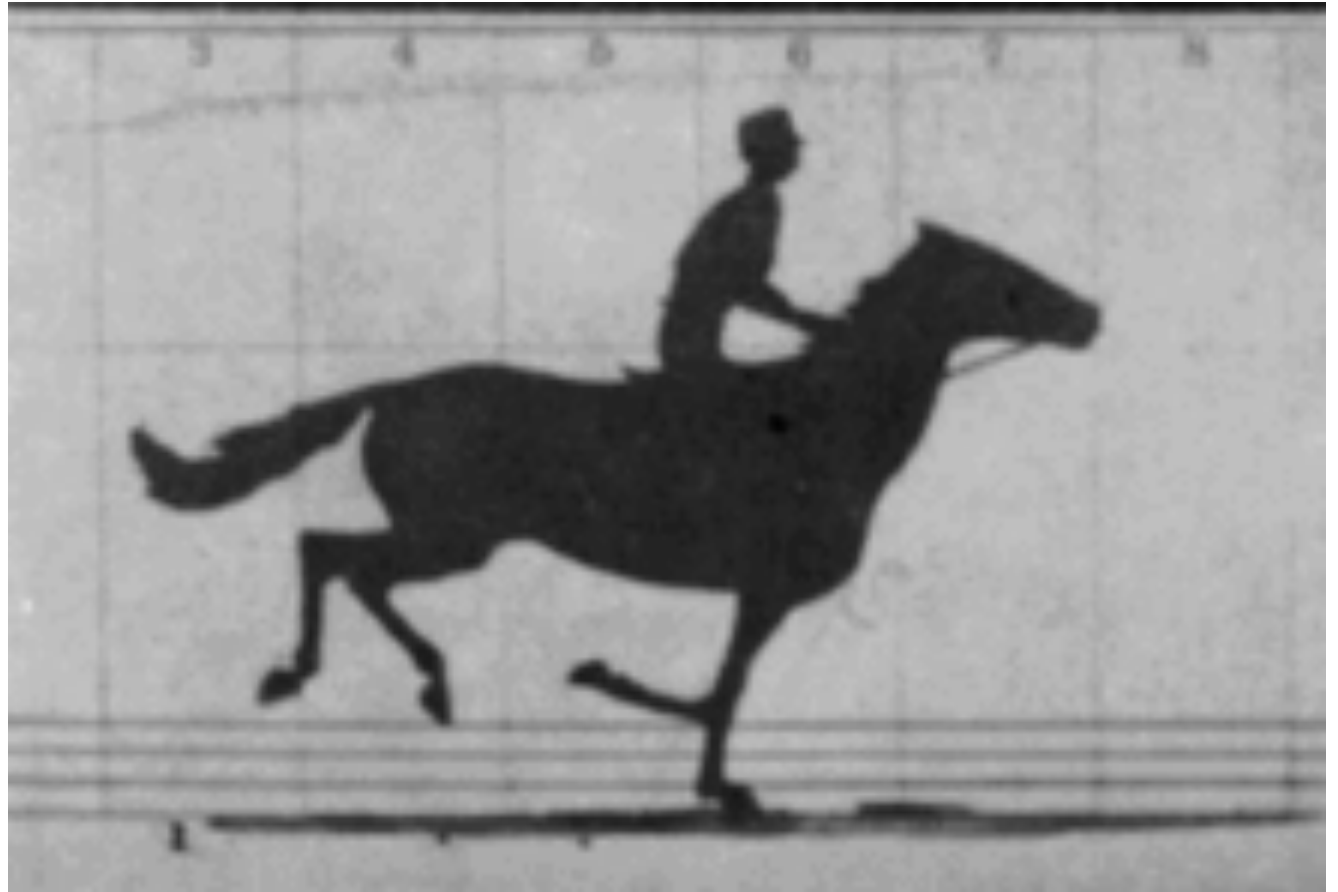
History of Animation

(Phenakistoscope, 1831)

First Film

Originally used as scientific tool rather than for entertainment

Critical technology that accelerated development of animation

Edward Muybridge, *"Sallie Gardner"* (1878)

First Hand-Drawn Feature-Length Animation

Disney, "Snow White and the Seven Dwarfs" (1937)

Hand-Drawn Animation - Present Day

Studio Ghibli, "Ponyo" (2008)

First Digital-Computer-Generated Animation

Ivan Sutherland, "Sketchpad" (1963) – Light pen, vector display
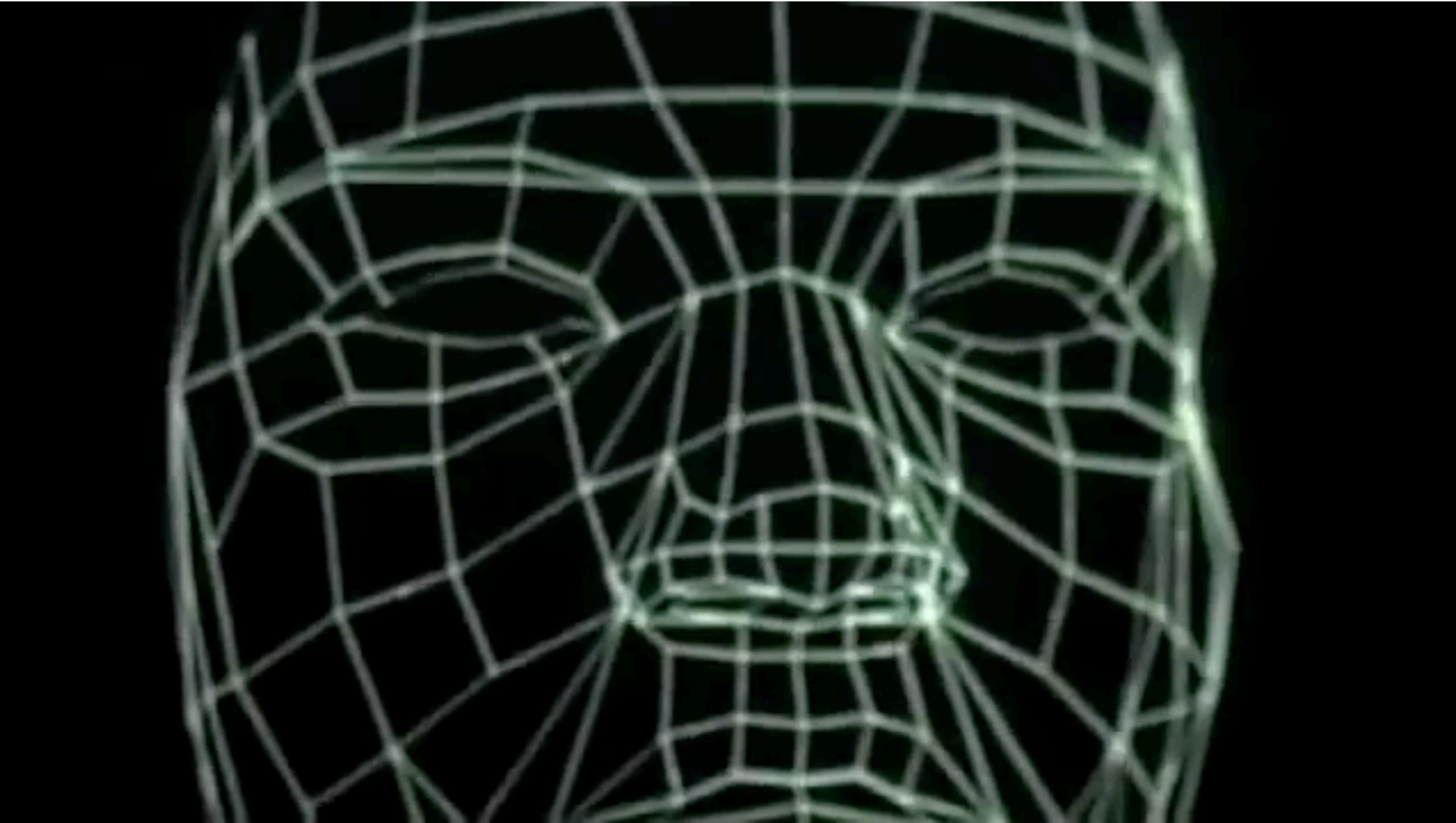
Early Computer Animation
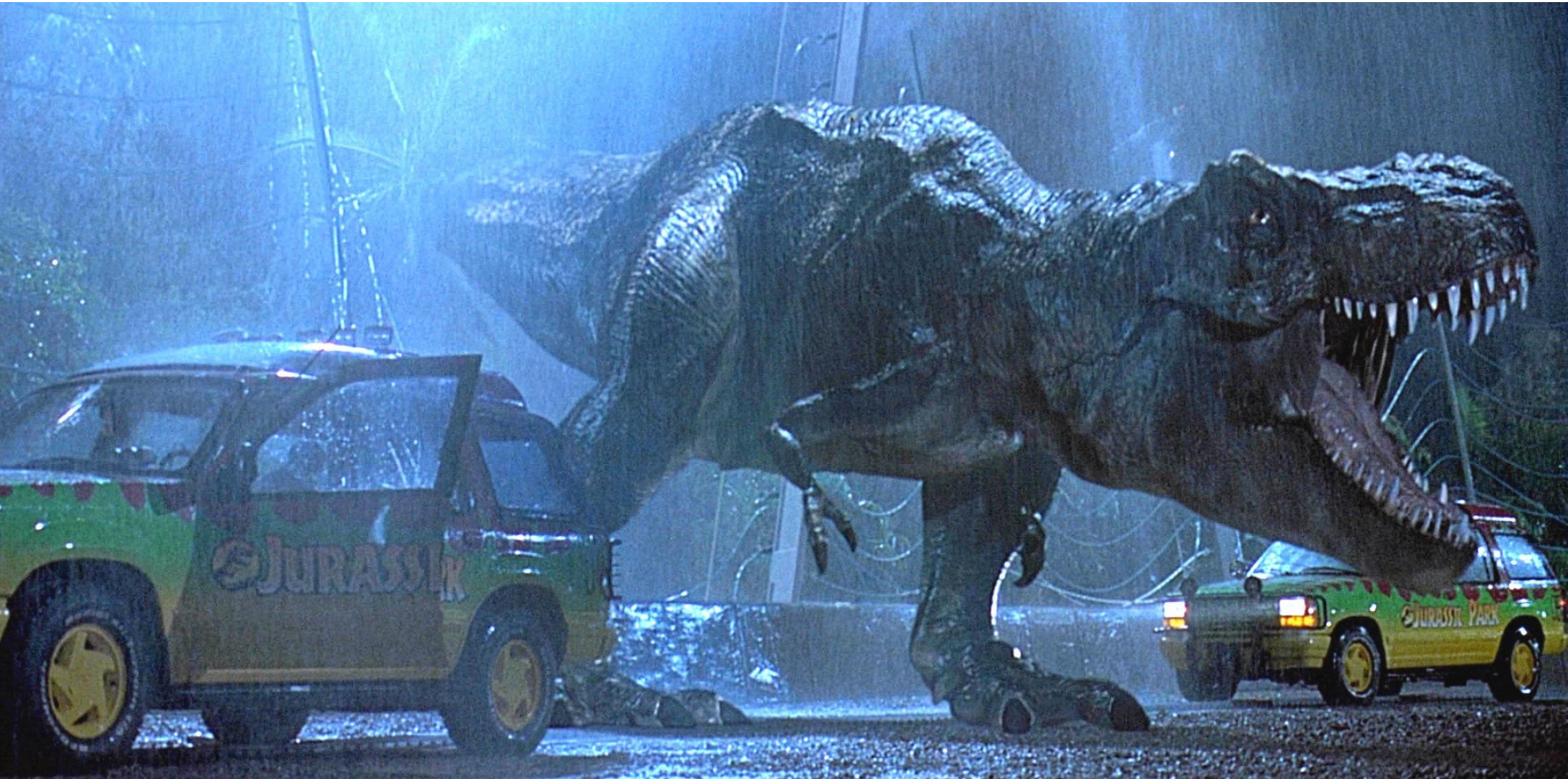

Nikolay Konstantinov, "Kitty" (1968)

Early Computer Animation

Ed Catmull & Frederick Parke, "Computer Animated Faces" (1972)

Digital Dinosaurs!

Jurassic Park (1993)

First CG Feature Film

Pixar, "Toy Story" (1995)

Computer Animation - Present Day

Sony Pictures Animation, "Cloudy With a Chance of Meatballs" (2009)

Computer Animation - Present Day

Animation Principles

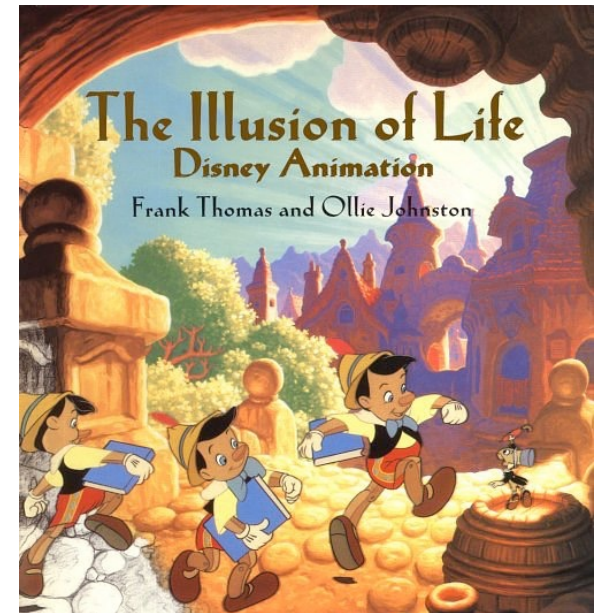(slides courtesy Mark Pauly)

Animation Principles

From

- "Principles of Traditional Animation Applied to 3D Computer Animation" - John Lasseter, ACM Computer Graphics, 21(4), 1987

In turn from

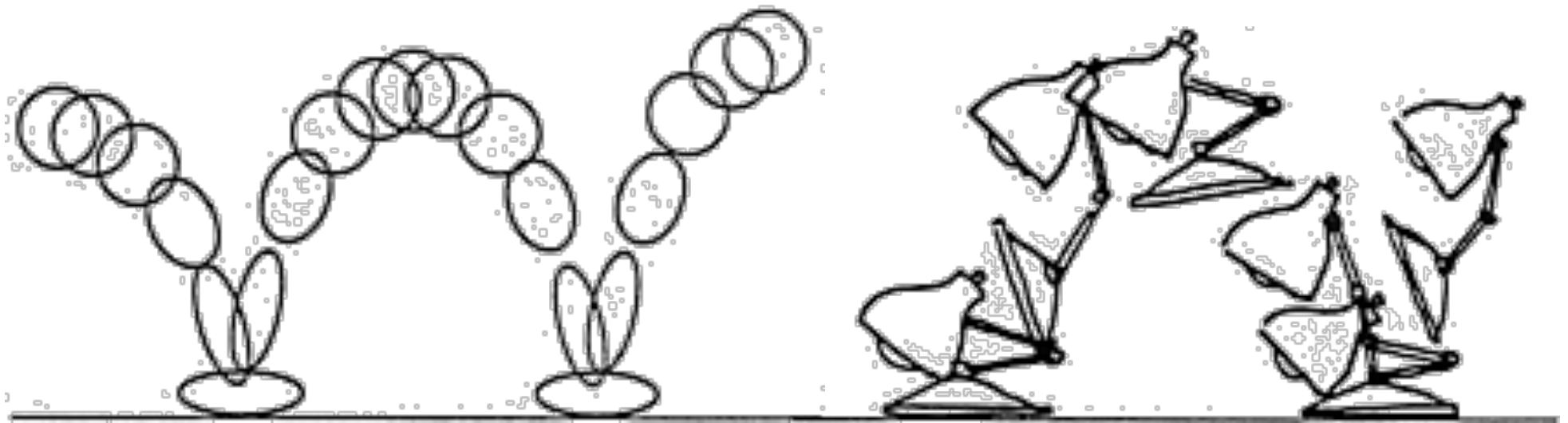- "The Illusion of Life"
  Frank Thomas and Ollie Johnson

Same for 2D and 3D

http://www.siggraph.org/education/materials/HyperGraph/animation/character_animation/principles/prin_trad_anim.htm

Squash and Stretch

Refers to defining the rigidity and mass of an object by distorting its shape during an action.

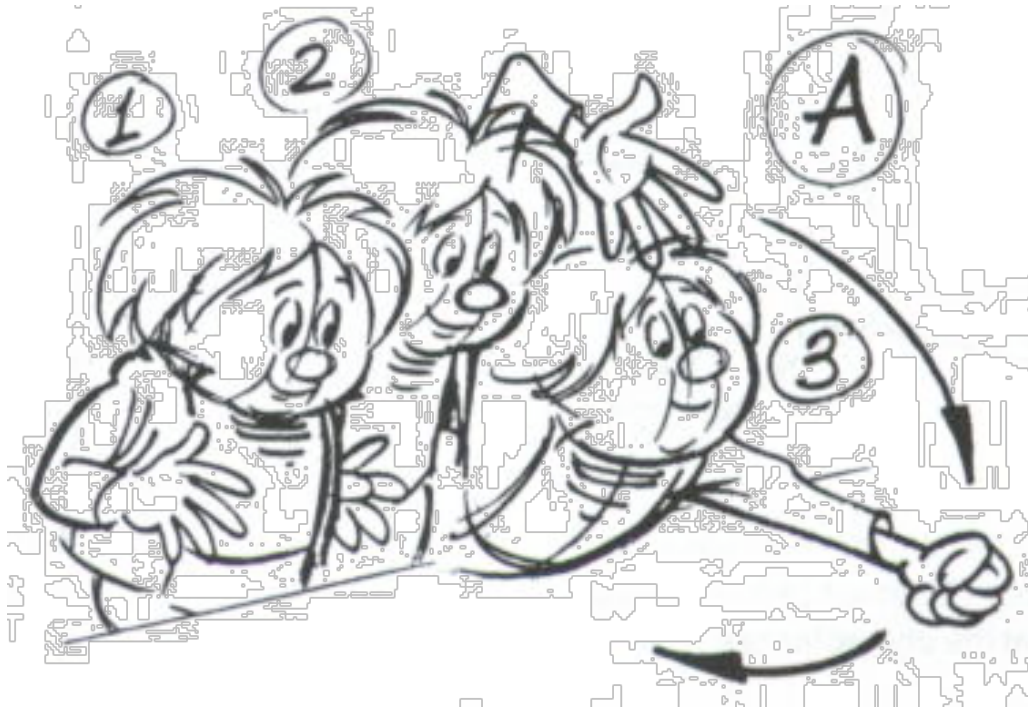Shape of object changes during movement, but not its volume.

Anticipation

Prepare for each movement

For physical realism

To direct audience's attention

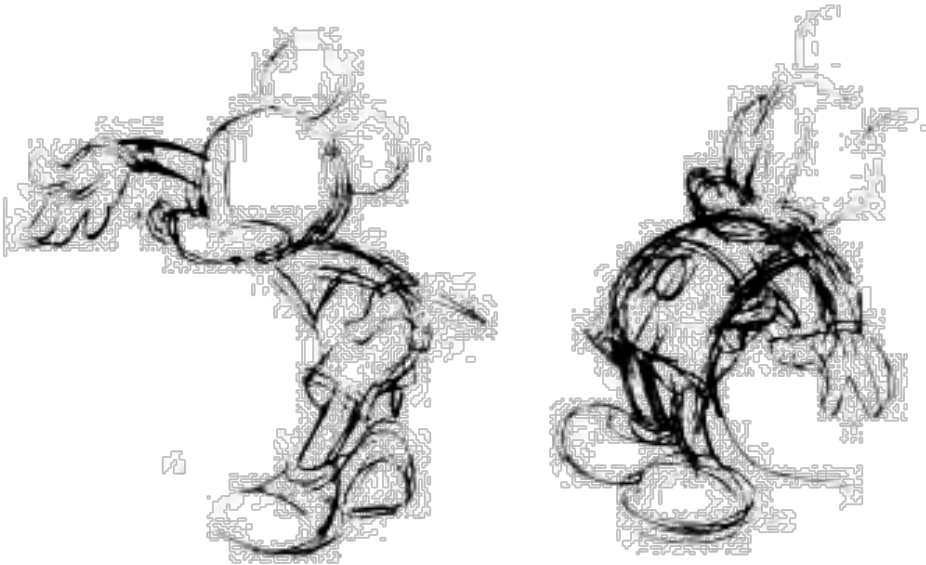Timing for Animation, Whitaker & Halas

Staging

Picture is 2D

Make situation clear

Audience looking in right place

Action clear in silhouette

Disney Animation: The Illusion of Life

Follow Through

Overlapping motion

Motion doesn't stop suddenly
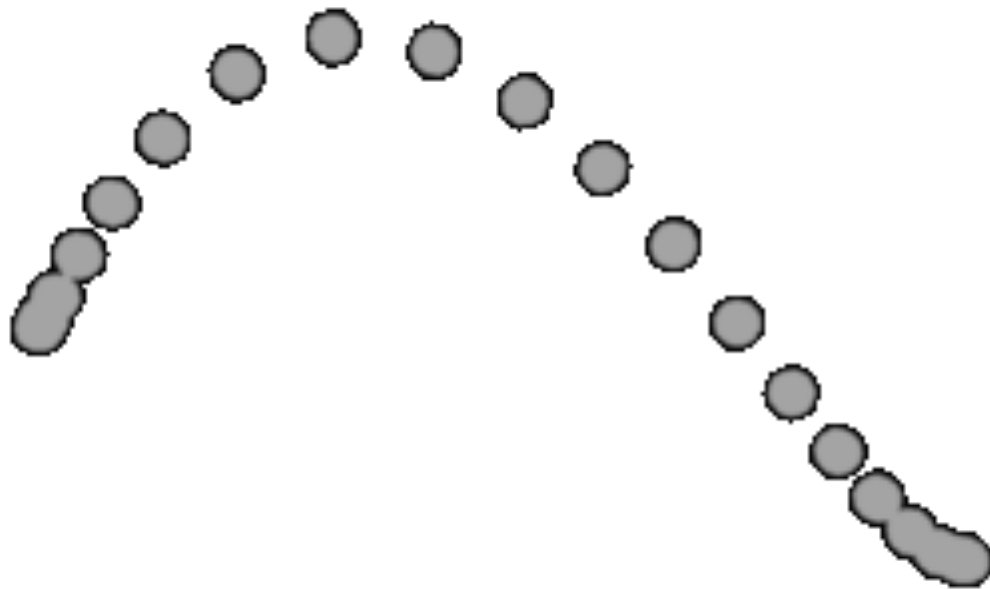
Pieces continue at different rates

One motion starts while previous is finishing, keeps animation smooth

Timing for Animation, Whitaker & Halas

Ease-In and Ease-Out
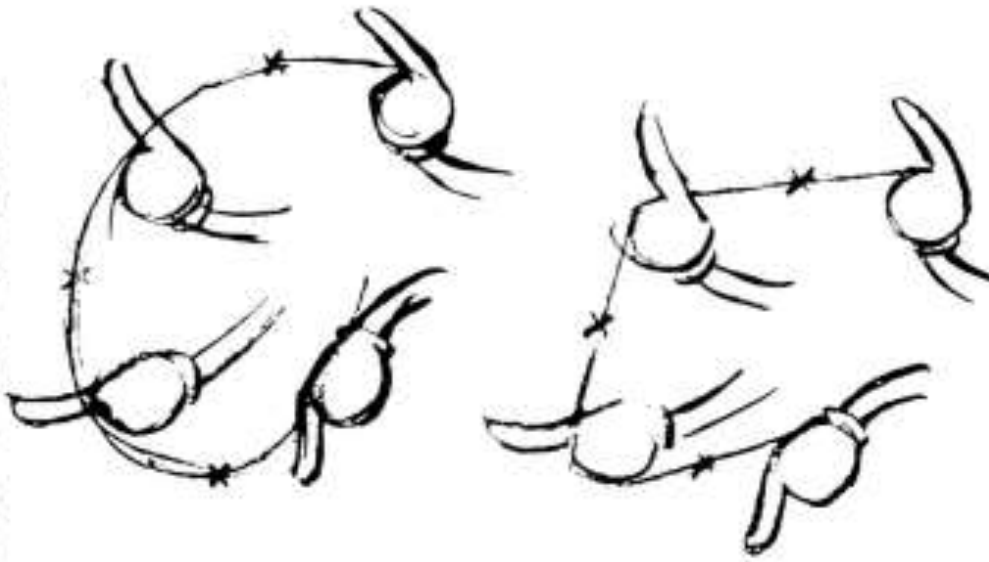
Movement doesn't start & stop abruptly.

Also contributes to weight and emotion

Arcs

Move in curves, not in straight lines
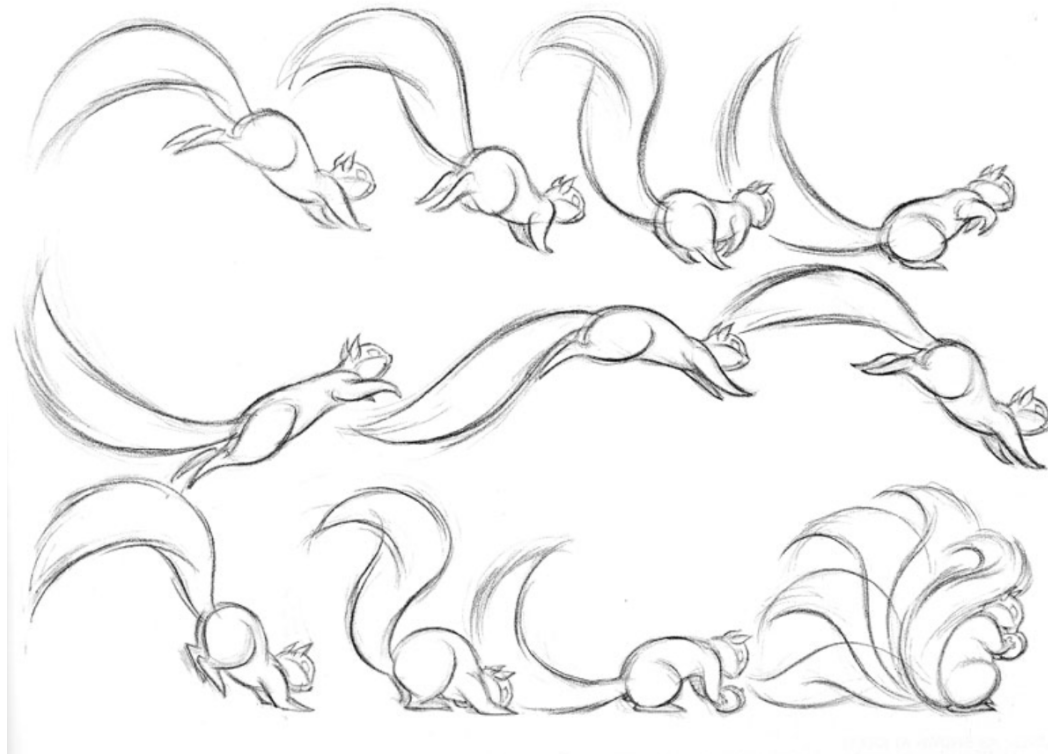
This is how living creatures move

Disney Animation: The Illusion of Life

Secondary Action

Motion that results from some other action

Needed for interest and realism

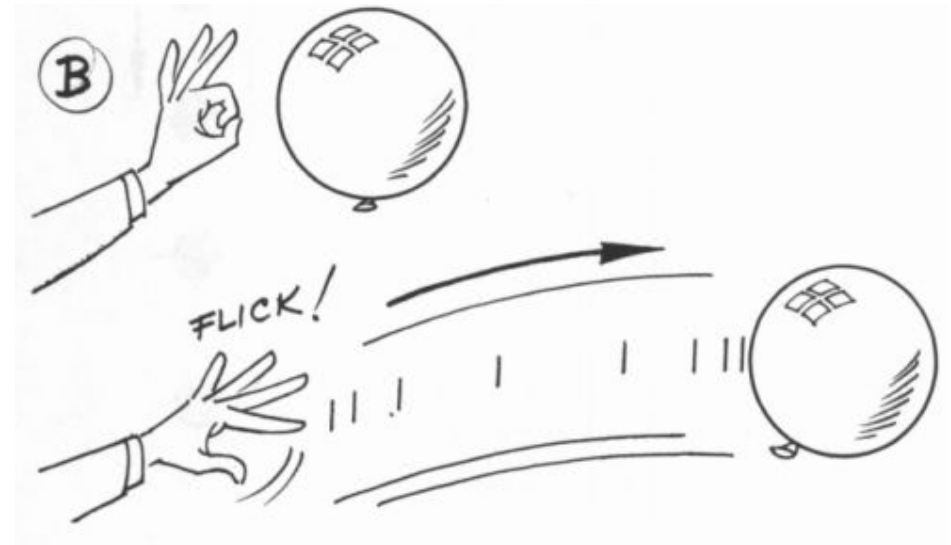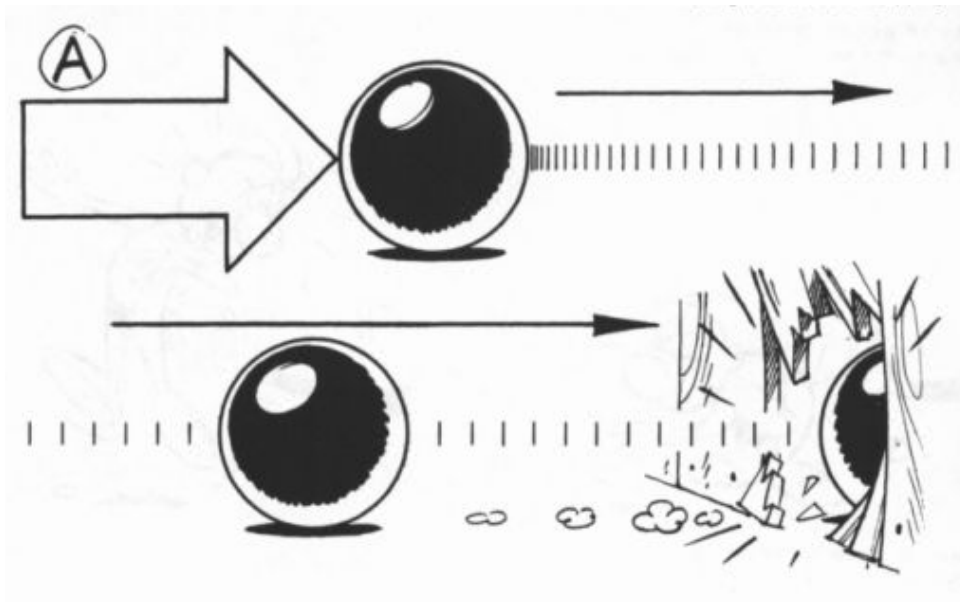Shouldn't distract from primary motion

Cartoon Animation, Preston Blair

Timing

Rate of acceleration conveys weight

Speed and acceleration of character's movements convey emotion
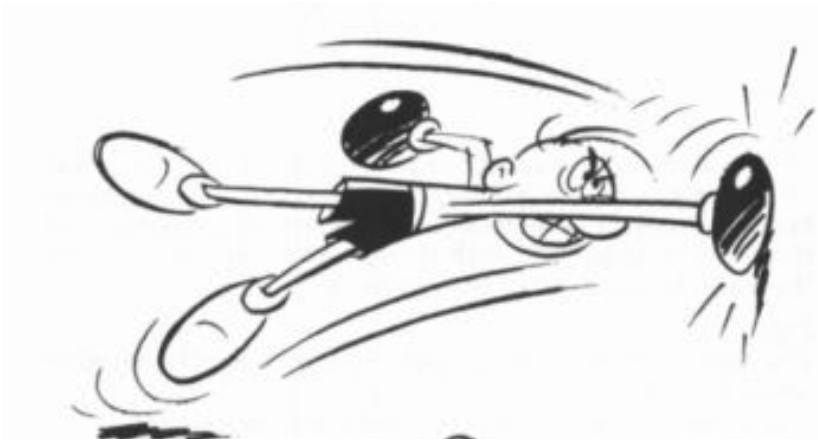

Timing for Animation, Whitaker & Halas

Exaggeration

Helps make actions clear

Helps emphasize story points and emotion

Must balance with non-exaggerated parts

Timing for Animation, Whitaker & Halas

Appeal

Attractive to the eye, strong design

Avoid symmetries

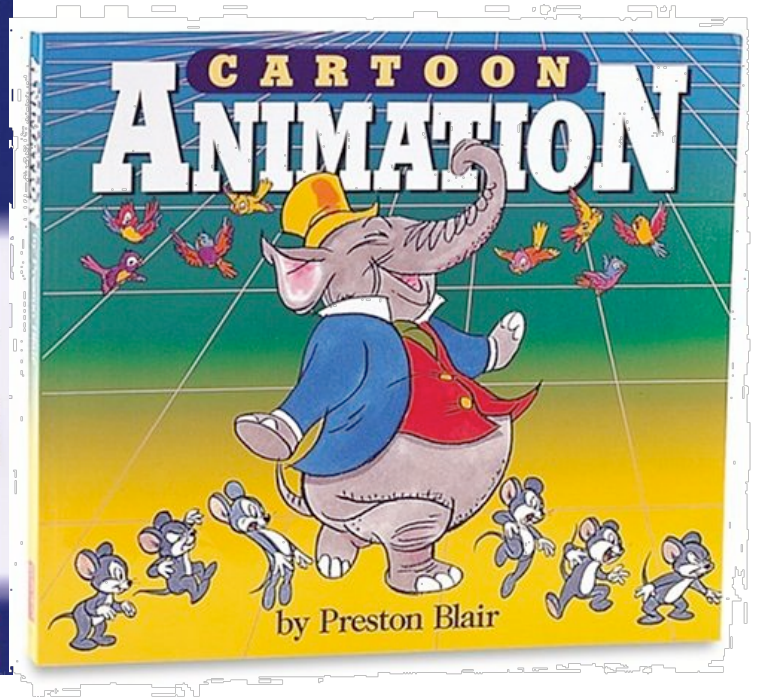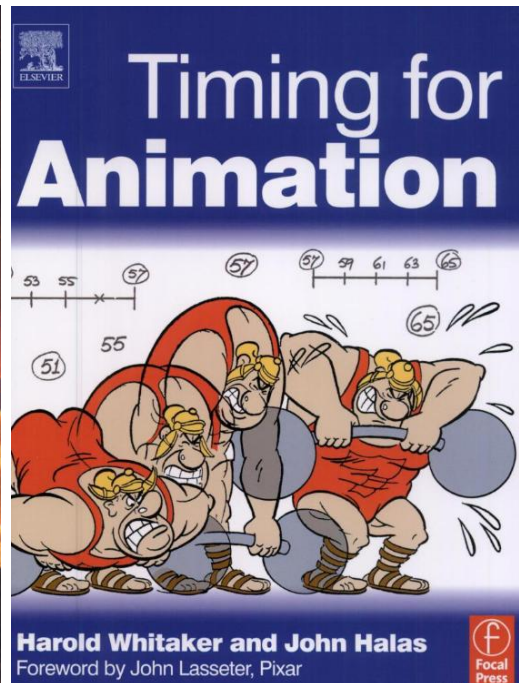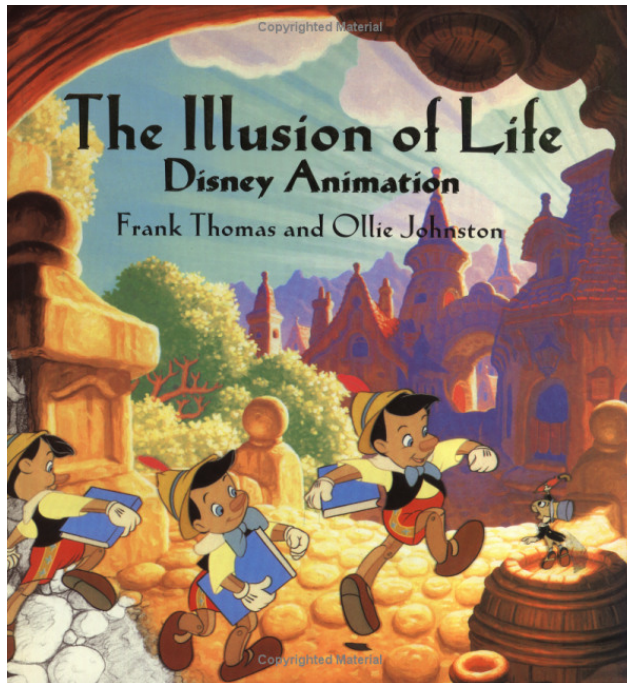Disney Animation: The Illusion of Life

Personality

Action of character is result of its thoughts

Know purpose & mood before animating each action

No two characters move the same way

Further Reading

12 Animation Principles

1. Squash and stretch

2. Anticipation

3. Staging

4. Straight ahead and pose-to-pose

5. Follow through

6. Ease-in and ease-out

7. Arcs

8. Secondary action

9. Timing

10. Exaggeration

11. Solid drawings

12. Appeal

Ng & Kanazawa

12 Animation Principles

Cento Lodgiani, https://vimeo.com/93206523

12 Animation Principles

Applications:

- Movies

- Games

- User interfaces

- ...

Ng & Kanazawa

Computer Animation

Keyframe Animation
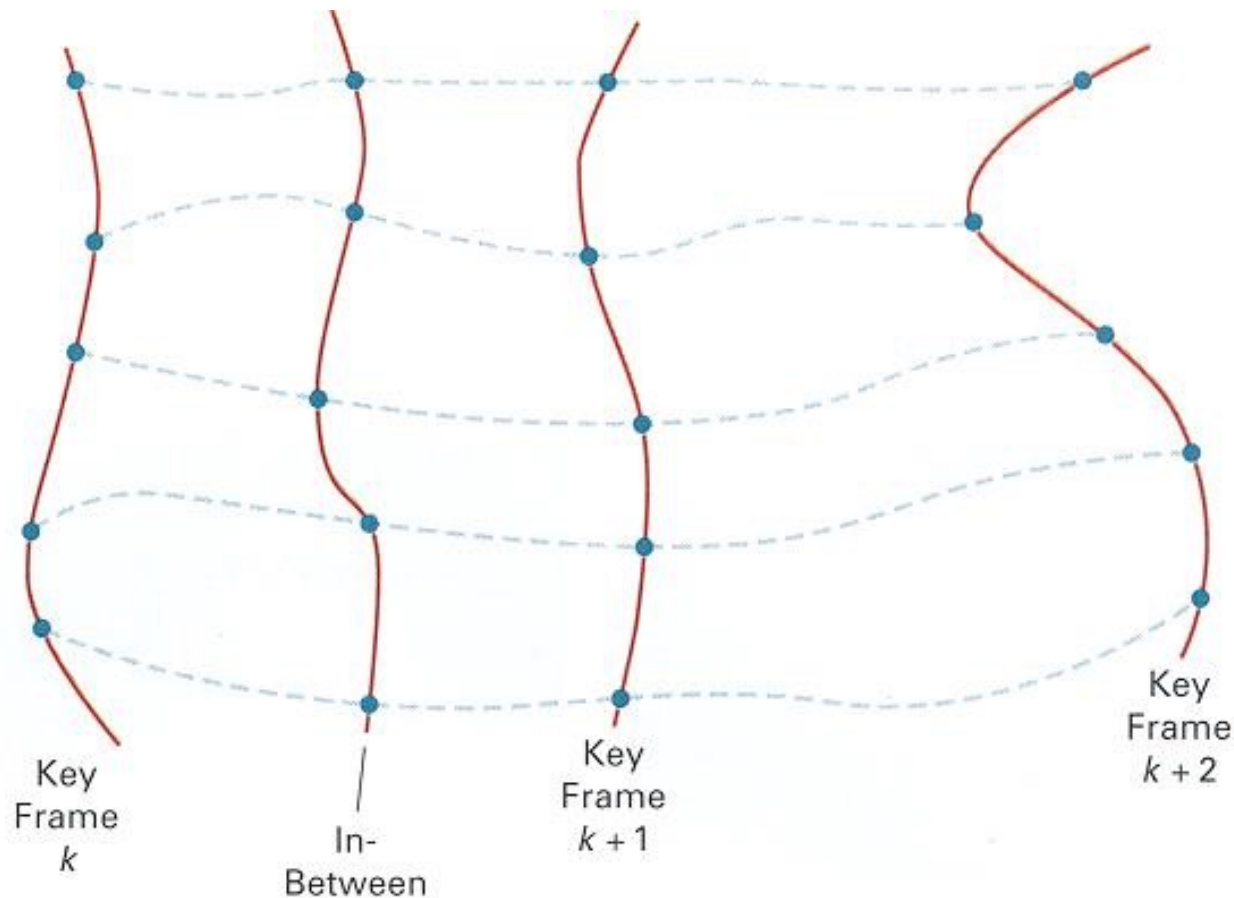
Keyframes

"Tweens"

Animator (e.g. lead animator) creates keyframes

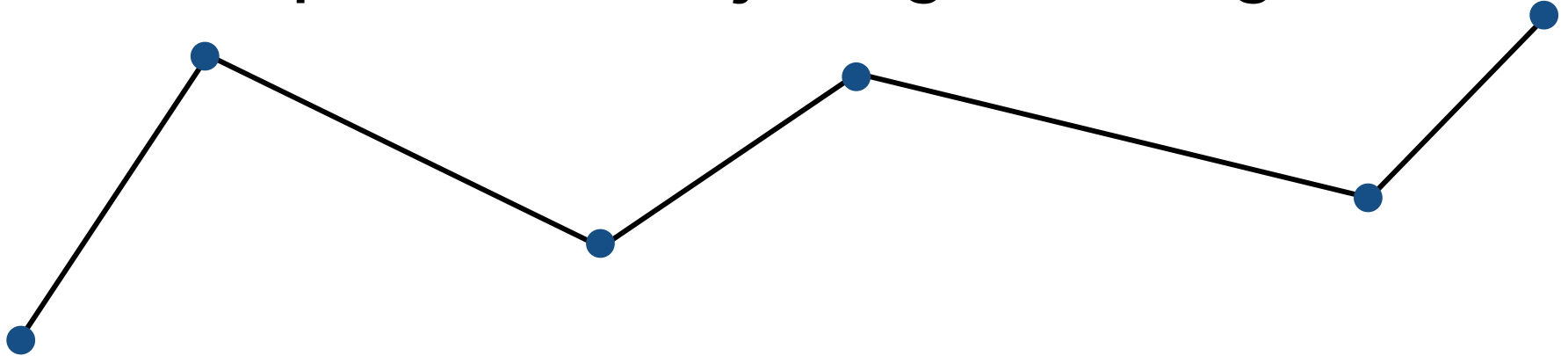Assistant (person or computer) creates in-between frames ("tweening")

Ng & Kanazawa

Keyframe Interpolation

Think of each frame as a vector of parameter values

Key Frame k

In-Between

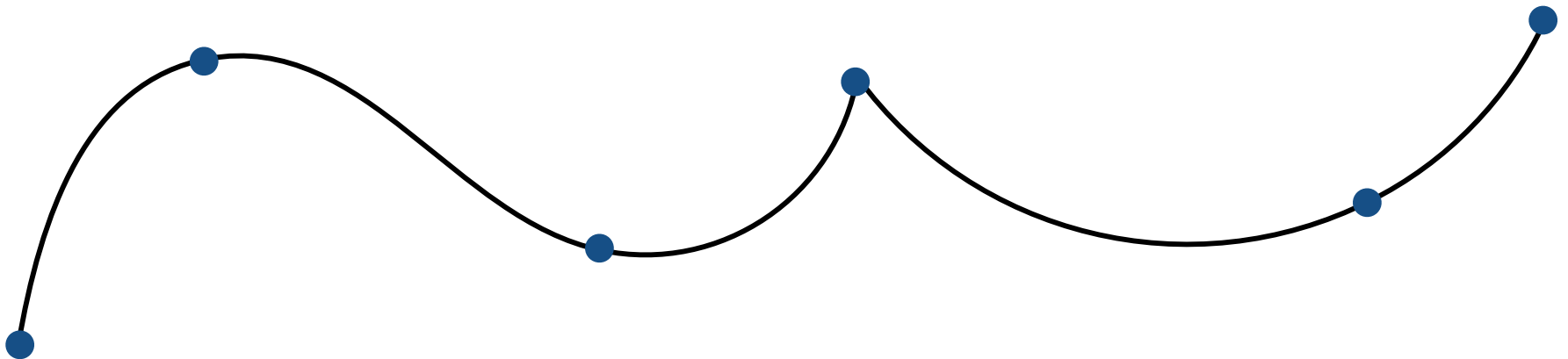Key Frame $k + 1$

Key Frame $k + 2$

Hearn, Baker and Carithers, Figure 16.11

Ng & Kanazawa

Keyframe Interpolation of Each Parameter

Linear interpolation usually not good enough

Recall splines for smooth / controllable interpolation

Next Time: Physical Simulation

Acknowledgments

Thanks to Keenan Crane and Mark Pauly for presentation resources.