Animation principles

CSE 457
Winter 2014

Reading

Required:

- John Lasseter. Principles of traditional animation applied to 3D computer animation. Proceedings of SIGGRAPH (Computer Graphics) 21(4): 35-44, July 1987.

Recommended:

- Frank Thomas and Ollie Johnston, Disney animation: The Illusion of Life, Hyperion, 1981.
- Michael Comet tutorial (source for the ball and green bug examples in this lecture):

  http://www.comet-cartoons.com/3ddocs/charanim/index.html

Character animation

Goal: make characters that move in a convincing way to communicate personality and mood.

Walt Disney developed a number of principles.

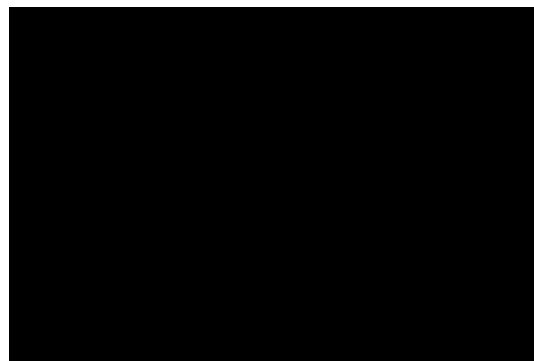Computer graphics animators have adapted them to 3D animation.

Andre and Wally B.

Luxo Jr.

Animation Principles

The following are a set of principles to keep in mind:

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

We will consider each...

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Squash and stretch

Squash: flatten an object or character by pressure or by its own power.

Stretch: used to increase the sense of speed and emphasize the squash by contrast.
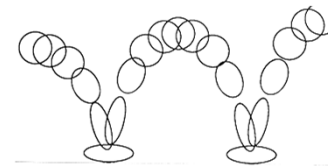
Note: keep volume constant!
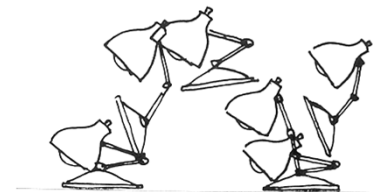

FIGURE 2. Squash & stretch in bouncing ball.

FIGURE 3. Squash & stretch in Luxo Jr.'s hop.
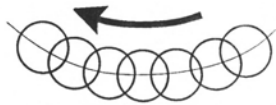
[Lasseter]

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Squash and stretch (cont'd)

FIGURE 4a. In slow action, an object's position overlaps from frame to frame which gives the action a smooth appearance to the eye.

FIGURE 4b. Strobing occurs in a faster action when the object's positions do not overlap and the eye perceives seperate images.
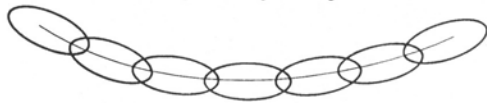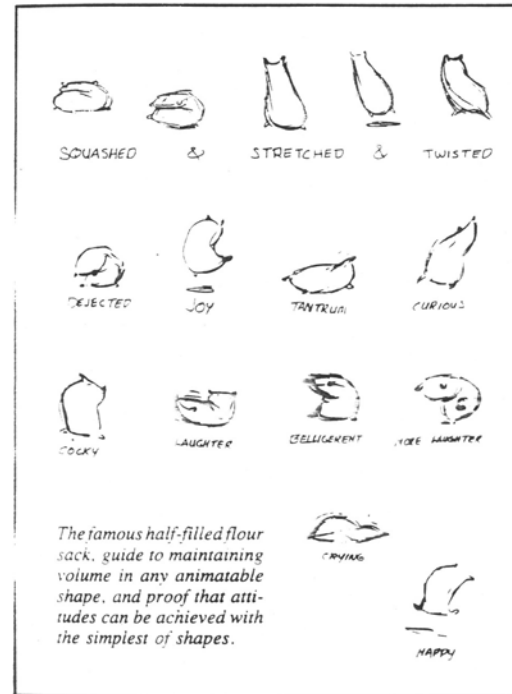
FIGURE 4c. Stretching the object so that it's positions overlap again will relieve the strobing effect.

[Lasseter]

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Squash and stretch (cont'd)

SQUASHED & STRETCHED & TWISTED

DEJECTED   JOY   TANTRUM   CURIOUS

COCKY   LAUGHTER   BELLIGERENT   MORE LAUGHTER

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.

CRYING

HAPPY

[Thomas and Johnston]

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Squash and stretch (cont'd)

1928— Oswald shows determination by lifting his chest with one hand in front and one in back. While the gesture is easily recognizable, it is little more than a diagram of the action.
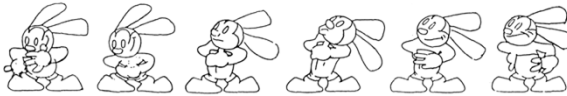
ANIMATOR: Norm Ferguson —Shanghaied

1934— Peg Leg Pete does the same gesture, only now there is more belly than chest involved. This broader action gave the impression of a round solid character with a combination of life and spirit—and fat.
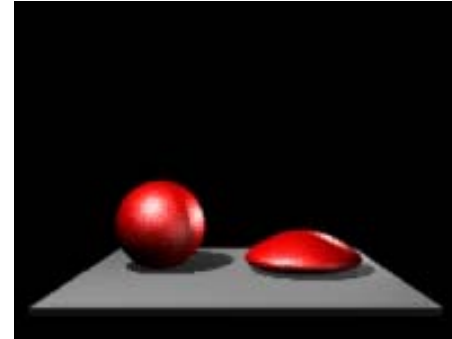
ANIMATOR: Jack Campbell —The Riveter.

1940— The gesture has been done so often by this time that it is almost a gag in itself. An action this broad loses realism, but gains a type of comedy.

[Thomas and Johnston]
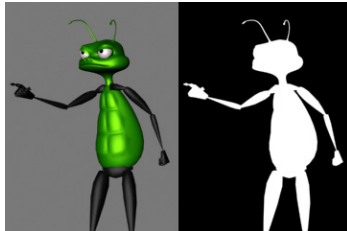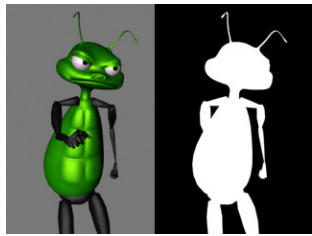
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Squash and stretch (cont'd)

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Staging

Present the idea so it is unmistakably clear.

Audience can only see one thing at a time.

Useful guide: stage actions in silhouette.

In dialogue, characters face 3/4 towards the camera, not right at each other.

Timing

An action generally consists of anticipation, the action, and the reaction. Don't dwell too long on any of these.

Timing also reflects the weight of an object:

- light objects move quickly
- heavier objects move more slowly

Timing can completely change the meaning of an action.

## Timing (cont'd)

The many meanings of a simple head turn:

NO inbetweens   hit by a tremendous force.
ONE inbetween   hit by a brick, frying pan.
TWO inbetweens   nervous tic, muscle spasm.
THREE inbetweens   dodging a thrown brick.
FOUR inbetweens   giving a crisp order (move it!)
FIVE inbetweens   a more friendly order (c'mon!)
SIX inbetweens   sees a sportscar he always wanted
SEVEN inbetweens   trying to get a better look...
EIGHT inbetweens   searching for something on shelf
NINE inbetweens   considering thoughtfully
TEN inbetweens   stretching a sore muscle

[Thomas and Johnston]

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Timing (cont'd)
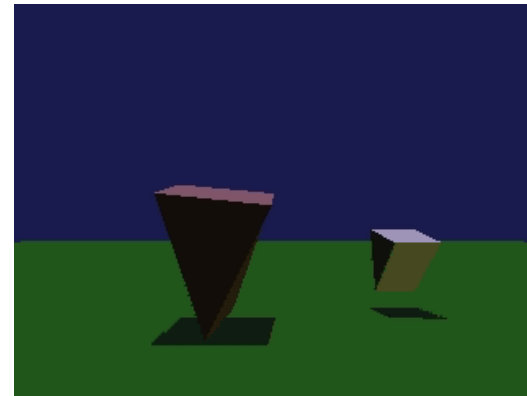
Animation by Ken Perlin.

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Anticipation

An action has three parts: anticipation, action, reaction.

Anatomical motivation: a muscle must extend before it can contract.

Prepares audience for action so they know what to expect.

Directs audience's attention.

Anticipation (cont'd)

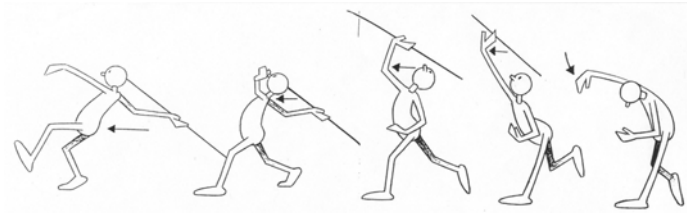Amount of anticipation (combined with timing) can affect perception of speed or weight.
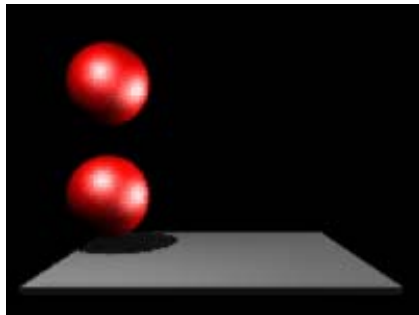
Follow through

Actions seldom come to an abrupt stop.

Physical motivation: inertia

Follow through (cont'd)

Overlapping action

One part intiates ("leads") the move. Others follow in turn.

Hip leads legs, but eyes often lead the head.

Loose parts move slower and drag behind (sometimes called "secondary motion").

Overlaps can apply to intentions. Example: settling into the house at night.

- Close the door
- Lock the door
- Take off the coat
- etc...

Each action doesn't come to a complete finish before the next starts.

The Wrong Trousers

Jurassic Park

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Secondary action

An action that emphasizes the main point but is secondary to it.

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Straight-ahead vs. pose-to-pose vs. blocking

Straight ahead: proceed from frame to frame without planning where you want to be in ten frames. Can be wild, spontaneous.
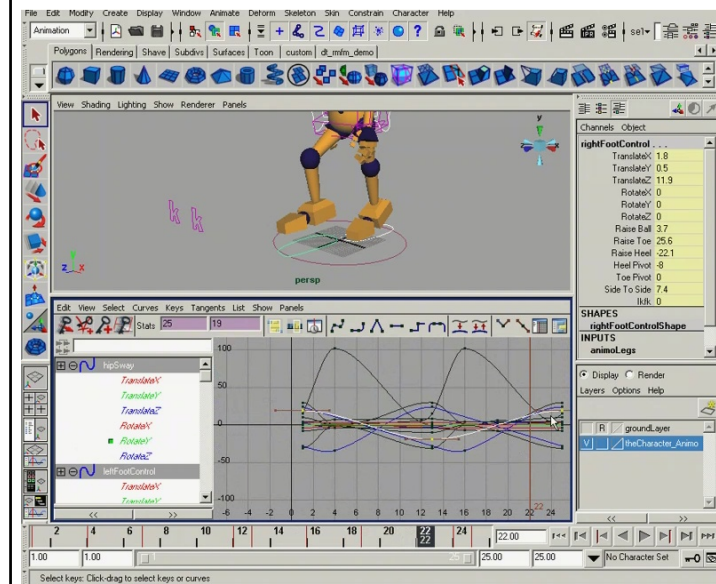
Pose-to-pose: Define keyframes and "inbetweens".

Blocking: Computer graphics animators adaptation

- ◆ Start key-framing at the top of the hierarchy.
- ◆ Refine level by level.
- ◆ Keyframes for different parts need not happen at the same time.
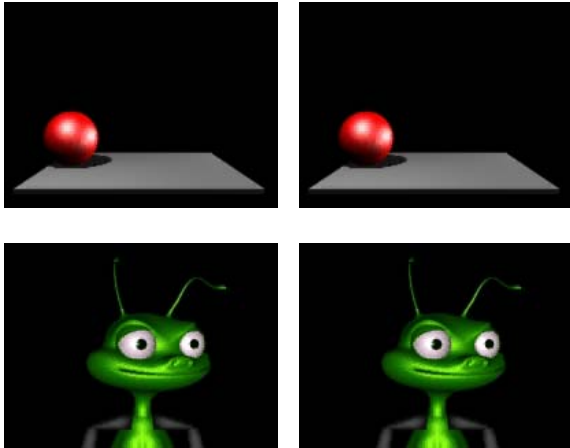
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Straight-ahead vs. pose-to-pose vs. blocking (cont'd)

Screenshot from Maya

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Arcs

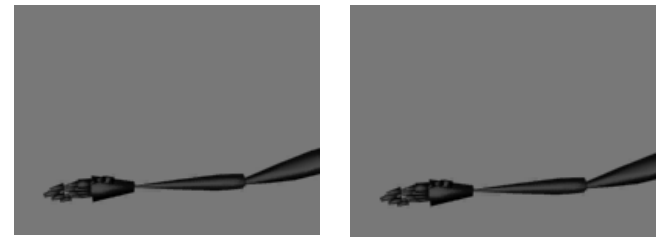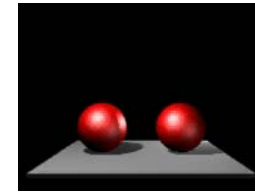Avoid straight lines since most things in nature move in arcs.

Slow in and slow out

An extreme pose can be emphasized by slowing down as you get to it (and as you leave it).

In practice, many things do not move abruptly but start and stop gradually.

Animation for images

Slow in slow out in Photobios

http://grail.cs.washington.edu/photobios/

[Kemelmacher et al. SIGGRAPH 11]

Exaggeration

Get to the heart of the idea and emphasize it so the audience can see it.

Appeal

The character must interest the viewer.

It doesn't have to be cute and cuddly.

Design, simplicity, behavior all affect appeal.
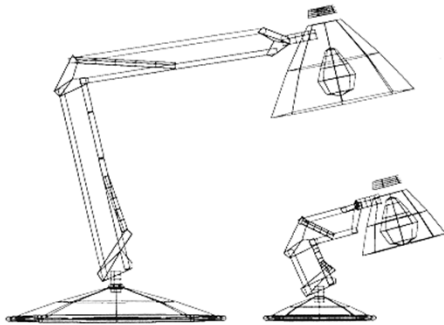
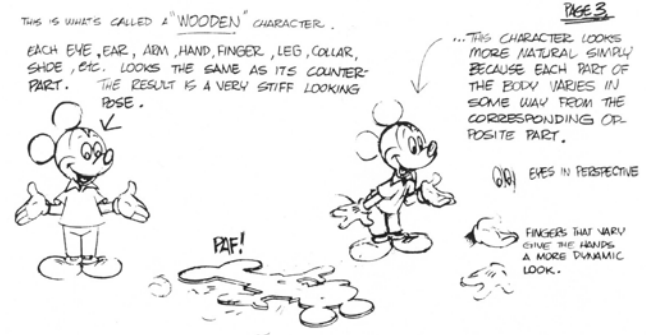Example: Luxo, Jr. is made to appear childlike.

FIGURE 11. Varying the scale of different parts of Dad created the child-like proportions of Luxo Jr.

[Lasseter]

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Appeal (cont'd)
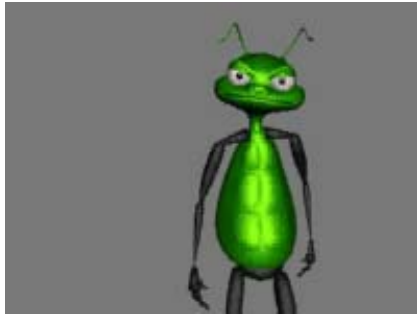
Note: avoid perfect symmetries.

[Thomas and Johnston]

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Appeal (cont'd)

Note: avoid perfect symmetries.

Animation artifact

Animation artifact

- ◆ ***One artifact per group***.
- ◆ Aim for ***60 seconds***…shorter is usually better. Don't make an animation that feels like "slow motion"!
- ◆ ***Snapshot*** due by ***5pm Wednesday, March 12***
  - · Nothing fancy, just something that will help people remember which artifact was yours during voting.
- ◆ ***Artifact*** due by ***9am Thursday, March 13***
- ◆ Audio is permitted, though optional.

Artifact voting:

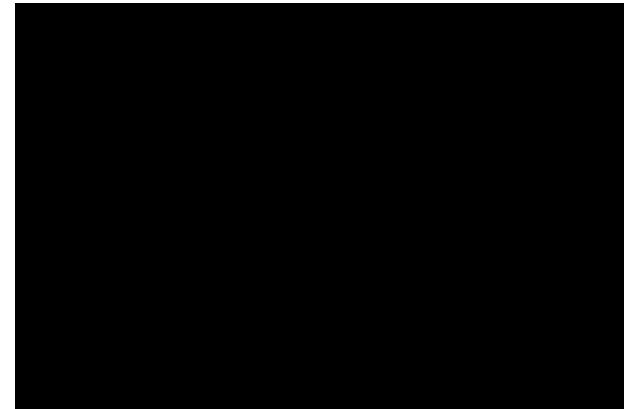- ◆ In-class voting on Thursday, March 13
- ◆ Runners-up: mystery prizes

Animation production

More broadly animation is about making "movies" and encompasses:

- Story
- Art design
- Modeling
- Cinematography
- Motion
- Rendering

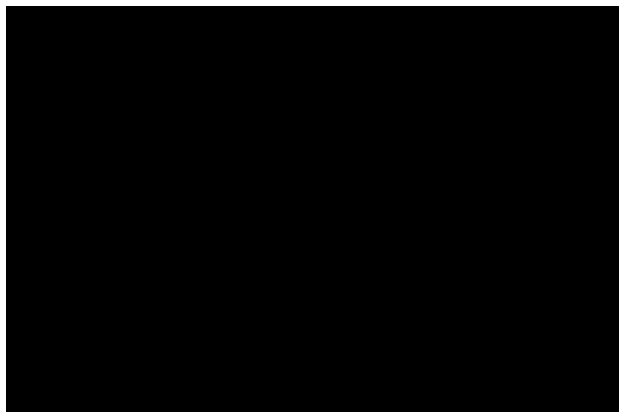## Bug's Life: Storyboards

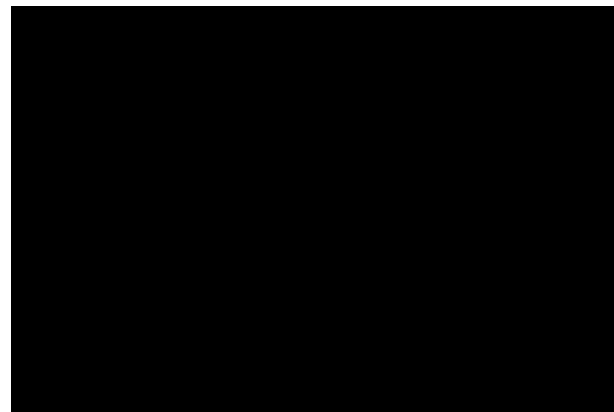**Bug's Life: Modeling, Layout**

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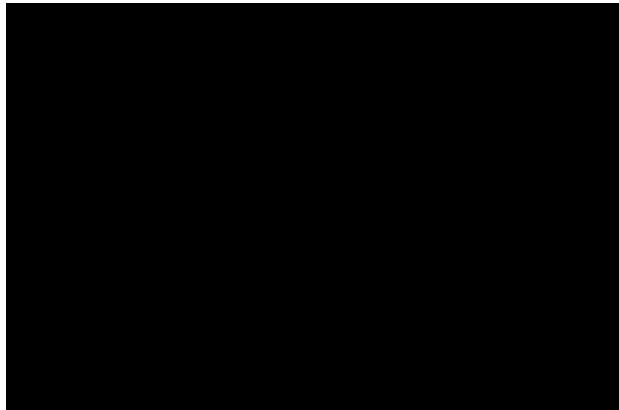**Bug's Life: Animation**

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Bug's Life: Shaders and Lighting