Animation principles
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CSE 457
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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.

Reading

Required:


Recommended:

- Michael Comet tutorial (source for the ball and green bug examples in this lecture):
  http://www.comet-cartoons.com/3ddocs/charanim/index.html

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...
**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!

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**Squash and stretch (cont’d)**

[Thomas and Johnston]

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**Squash and stretch (cont’d)**

[Thomas and Johnston]
**Squash and stretch (cont’d)**

![Image of squash and stretch example]

**Staging**

Present the idea so it is unmistakably clear.

Audience can only see one thing at a time.

Useful guide: stage actions in silhouette.

![Image of staging example]

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

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**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:*

<table>
<thead>
<tr>
<th>No inbetweens</th>
<th>hit by a tremendous force.</th>
</tr>
</thead>
<tbody>
<tr>
<td>One inbetween</td>
<td>hit by a brick, frying pan.</td>
</tr>
<tr>
<td>Two inbetweens</td>
<td>nervous tic, muscle spasm.</td>
</tr>
<tr>
<td>Three inbetweens</td>
<td>dodging a thrown brick.</td>
</tr>
<tr>
<td>Four inbetweens</td>
<td>giving a crisp order (move it!)</td>
</tr>
<tr>
<td>Five inbetweens</td>
<td>a more friendly order (c’mon!)</td>
</tr>
<tr>
<td>Six inbetweens</td>
<td>sees a sportscar he always wanted</td>
</tr>
<tr>
<td>Seven inbetweens</td>
<td>trying to get a better look...</td>
</tr>
<tr>
<td>Eight inbetweens</td>
<td>searching for something on shelf</td>
</tr>
<tr>
<td>Nine inbetweens</td>
<td>considering thoughtfully</td>
</tr>
<tr>
<td>Ten inbetweens</td>
<td>stretching a sore muscle</td>
</tr>
</tbody>
</table>

[Thomas and Johnston]
Timing (cont’d)

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 initiates (“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.

Secondary action

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

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.
Straight-ahead vs. pose-to-pose vs. blocking (cont’d)

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.

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.

![Image of Luxo, Jr. character](image)

[FIGURE 11. Varying the scale of different parts of Dad created the child-like proportions of Luxo Jr.] (Lasseter)

Appeal (cont’d)

Note: avoid perfect symmetries.

![Image of Mickey Mouse character](image)

[Thomas and Johnston]

Guidelines

- Aim for **30 - 60 seconds**… shorter is usually better. Don’t make an animation that feels like “slow motion”!
- Try to use some of the principles from this lecture.
- See project page for pointer to video creation.
- Audio is permitted, though optional.

Turn in

- One artifact **per group**
- Submit **representative image**, in addition to final video
- Due Thursday, December 7 at **9am sharp**.

Voting

- **Non-anonymous, in-class voting** on Thursday, December 7.
- Extra, extra credit and a **special grand prize** to be awarded!
Animation Artifact

Non-anonymous, in-class voting on Thursday, December 7.

Prizes!
❖ Runners-up: mystery prizes
❖ 2nd place: “Cars 3” Blu-ray
❖ 1st place: “Cars 3” Blu-ray + extra special mystery prize!

Animation production

More broadly animation is about making “movies” and encompasses:
❖ Story
❖ Art design
❖ Modeling
❖ Cinematography
❖ Motion
❖ Rendering