

## Animation Principles

## Animation Objectives

- Expressiveness
  - Artistic expression
  - Extremely hard to automate
- Realism
  - Hard to do by hand
  - Easier to automate, but we lose control



2

## Goals of expressive animation

Make characters move in convincing way to communicate personality and mood

- Walt Disney developed a number of principles
- Computer graphics animators have adapted them to 3D animation

3

## Animation principles

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. Slow in, slow out
10. Exaggeration
11. Appeal
12. Arcs
13. Weight

4

## 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

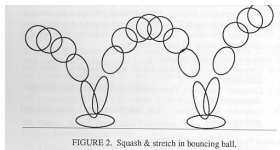


FIGURE 2. Squash & stretch in bouncing ball.

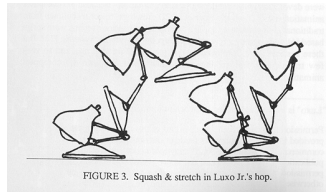
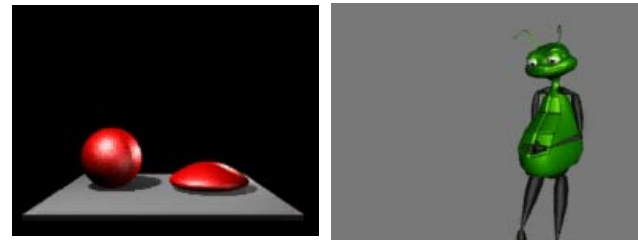


FIGURE 3. Squash & stretch in Laxo Jr.'s hop.

5

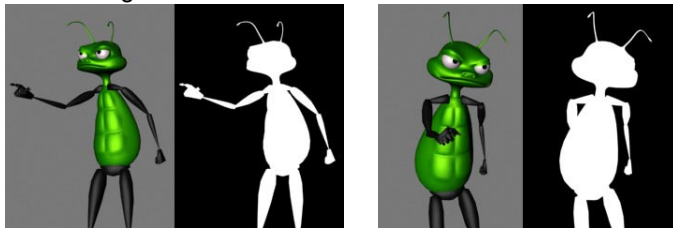
## Squash & stretch examples



6

## 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, character faces  $\frac{3}{4}$  towards the camera, not right at each other



7

## Timing

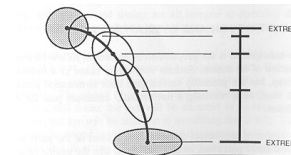
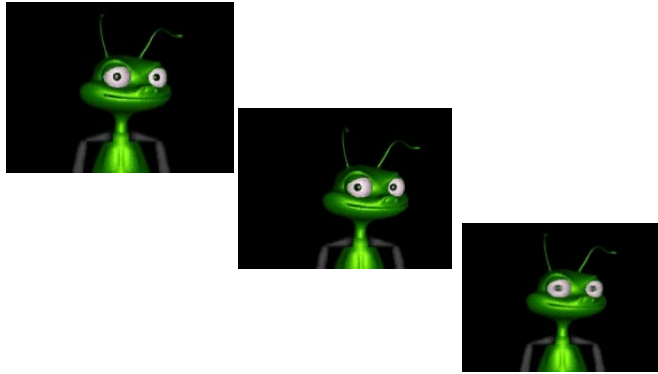


FIGURE 9. Timing chart for ball bounce.

- Timing affects weight:
  - Light objects move quickly
  - Heavier objects move more slowly
- Timing can completely change the meaning of an action

8

## Timing examples



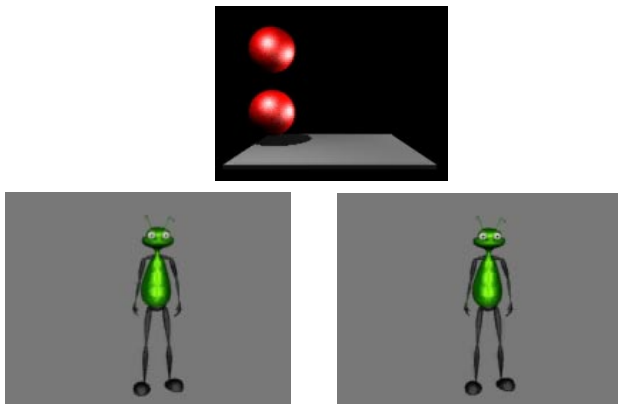
9

## Anticipation

- An action breaks down into:
  - 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
- Amount of anticipation can affect perception of speed and weight

10

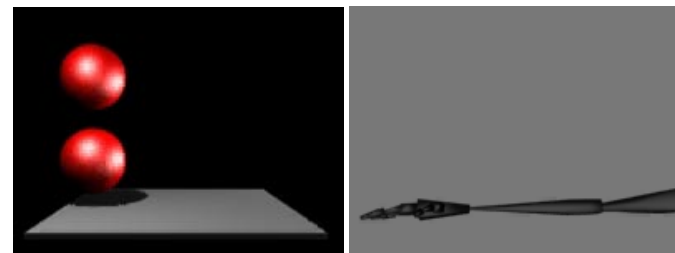
## Anticipation examples



11

## Follow through

- Action seldom come to an abrupt stop
- Physical motivation: inertia



12

## 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.

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

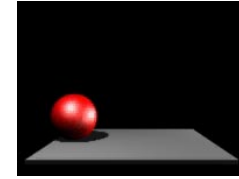
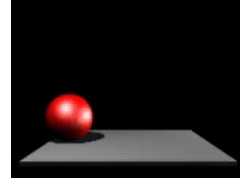
- Close the door
- Lock the door
- Take off the coat

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

13

## Arcs

Avoid straight lines since most things in nature move in arcs



14

## Secondary action

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



15

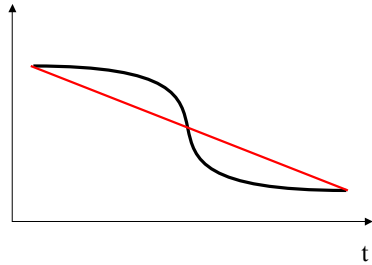
## Straight-ahead vs. pose-to-pose vs. blocking

- 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 key frames and "inbetweens".
- Blocking: computer graphics animators adaptation:
  - Start key-framing at the top of the hierarchy
  - Refine level by level
  - Key frames for different parts need not happen at the same time.

16

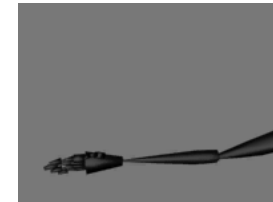
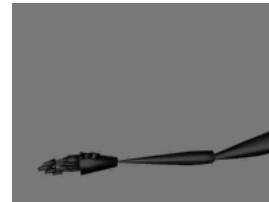
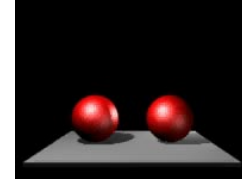
## Slow in, slow out

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



18

## Slow in, slow out examples



19

## Exaggeration

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

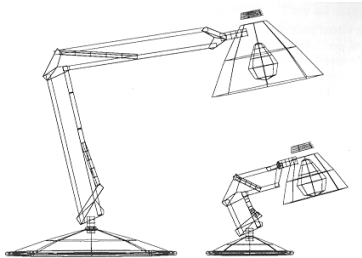


FIGURE 11. Varying the scale of different parts of Dad created the child-like proportions of Luxo Jr.

20

## Exaggeration examples



21

## Appeal

- The character must interest the viewer.
- It doesn't have to be cute and cuddly
- Design, simplicity, behavior all affect appeal.
- Note: avoid perfect symmetries

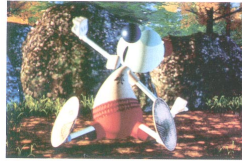
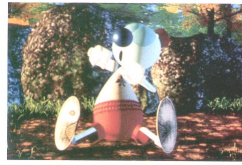
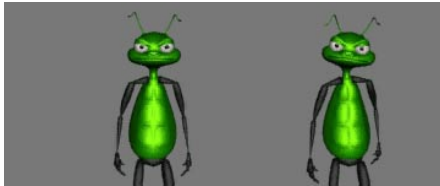
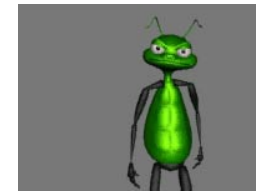
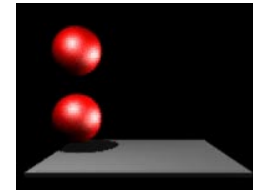


FIGURE 12. Aude's yawn was made more interesting by not duplicating the poses and the action from one side of his body to the other.



22

## Snap



23

## Weight

Combination of Timing, Slow in/out, Arcs, Anticipation, Exaggeration, Squash&Stretch, Secondary motion, FollowThru/Overlap, and Staging



24