Character Animation
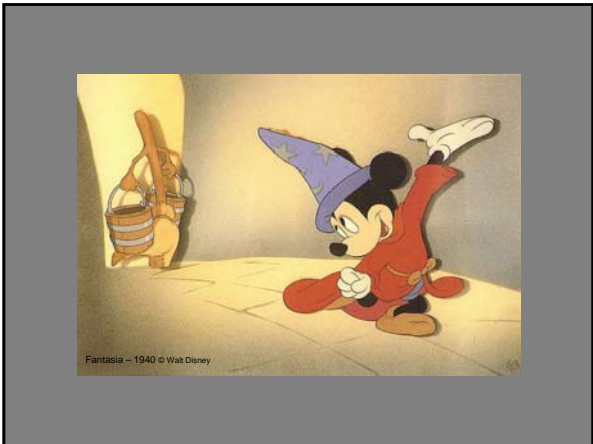
Based on "Principles of Traditional Animation Applied to 3D
Computer Animation", John Lasseter, SIGGRAPH 1987

Three Little Pigs – 1933 © Walt Disney

Snow White & the Seven Dwarfs – 1937 © Walt Disney

Fantasia – 1940 © Walt Disney

Disney Animators

- Sent to special drawing classes to get past standard cartoon formulas.
- Studied models in motion and live films.
- Studied actions over and over.

- The analysis of action became important to the development of animation.
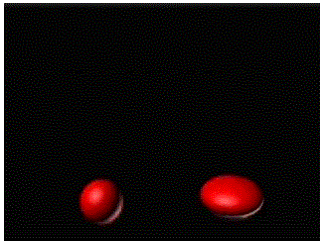
Fundamental Principles

- Squash and Stretch
- Timing
- Anticipation
- Staging
- Follow Through
- Pose-to-Pose

- Slow In / Out
- Arcs
- Exaggeration
- Secondary Action
- Appeal

Squash and Stretch

- Movement changes object's shape.
- The amount defines rigidity.
- Must preserve volume.
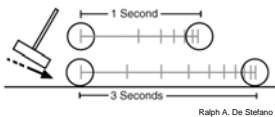- On a face, it connects different parts.

Ralph A. De Stefano
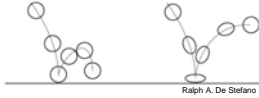
Squash and Stretch

© ACM SIGGRAPH Education Committee

Timing

- Speed of action gives meaning to motion.
- Defines weight and/or intent of actor.
- Realistic behavior more important than looks.

1 Second
3 Seconds
Ralph A. De Stefano

Timing: Effect of Longer Action

Character turns his head and raises the chin slightly. How does the number of
frames influence interpretation? (from few frames to many frames)

- ..has been hit by a tremendous force.
- ..has been hit by a rolling pin.
- ..has a nervous tic or a spasm.
- ..is dodging a rolling pin.
- ..is giving a crisp order "Move!"
- ..is more friendly "Over here".
- ..sees a nice car.
- ..tries to take a look at something.
- ..searches for tea on a shelf.
- ..appraises thoughtfully.
- ..stretches a sore muscle.

Action in Three Parts

- An action occurs in three parts:
  - Preparation → Anticipation
  - Action proper → Staging
  - Termination → Follow-Through

Anticipation

- Anticipation provides:
  - Natural muscular anatomy
  - Device to catch audience's eye (will they see it?)
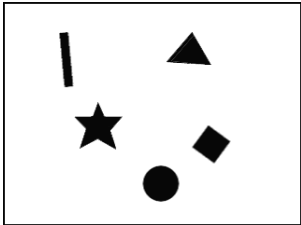 - Direction of audience attention

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Staging

- Present an idea so it is unmistakably clear.
- One idea seen at a time.
- Object of interest should contrast with scene.
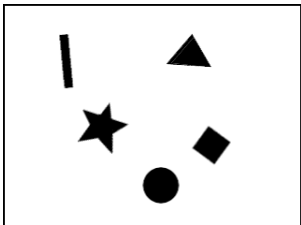 – Sometimes ensured with silhouette.

"Look at this, now look at this, then look at this…"

Staging

Ralph A. De Stefano

Staging

Ralph A. De Stefano

Follow-Through

- Action seldom terminates with a sudden stop.
- They often carry past termination point.
- Lead part initiates motion, other parts follow.
- Lead part stops, other parts stop later.
- E.g. the eyes lead the head, which leads body.
- Sequences of actions should overlap [co-articulation].

Pose-to-Pose

- The method of creating frames:
  - "Straight-ahead" let's animator do one drawing after another from a starting point
    - Slightly zany look for scrambling actions
  - "Pose-to-Pose" let's animator first pose character into key poses and then fill in between.
- Digital animation mostly done "Pose-to-Pose" through hierarchical posing of limbs [layered].

Slow In / Out

- More time spent at the beginning and at the end of an action.
- Initially done because animators wanted audiences to see the action better.
- Achieved expressive "spirited results".

Linear Interpolation
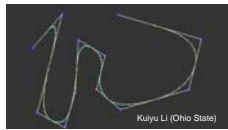
Non-linear Interpolation

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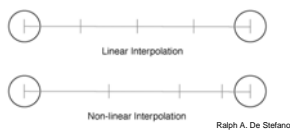
Slow In / Out
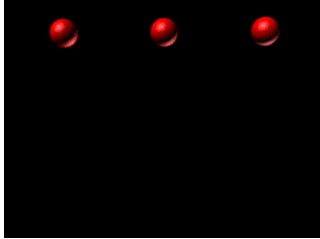
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Arcs

- Action paths are always arcs.
  - Based on swining limbs and thrown object trajectories.
- Achieved with splines.
- Separate motion paths from timing arcs.

Kuiyu Li (Ohio State)

Exaggeration

- Make the essence of an idea bigger.
- Provide a "ground" for comparision in scene.

If he is angry, make him **furious**.

Ralph A. De Stefano

Secondary Action

- New actions can result from an action.
- Can be subtle effects (e.g. Luxor's cord)
- Might still need staging or it gets lost.

© Pixar

Appeal

- Live action actors have charisma.
- Animated characters have appeal.
- Avoid "sameness", "stiffness" and "mirrors".

© Viacom International

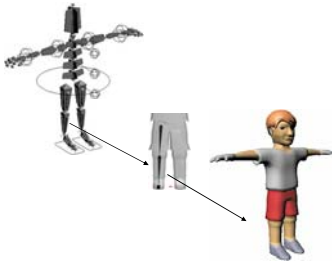## Tying it all together

- Consistent personality
  - An underlying personal story ties all the actions together into a believable whole.
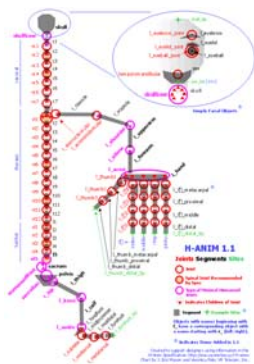 - The actions are merely a view into the inner world of the character.

3D Animation Basics

Preparing a Model: Skeletal Rigging

Joint Animation

Joint Animation