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
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
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**Squash and Stretch**

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

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![Image of Squash and Stretch example](image-url)
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Timing

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

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

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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

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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).
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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".

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Arks

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

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Exaggeration

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

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

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Appeal

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

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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

Motion Graphs