

# Character Animation

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Krazy Kat Goes A-Woong (1916)

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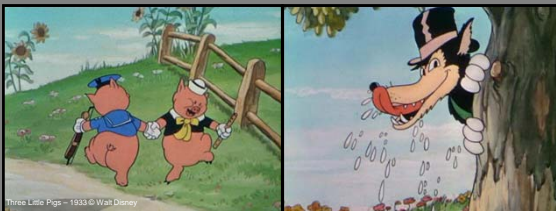
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Three Little Pigs - 1933 © Walt Disney

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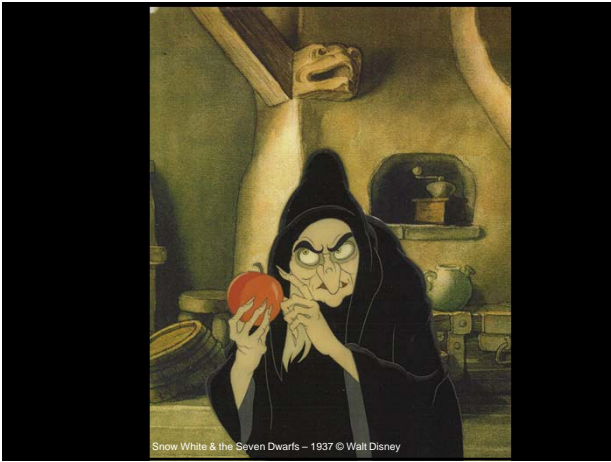
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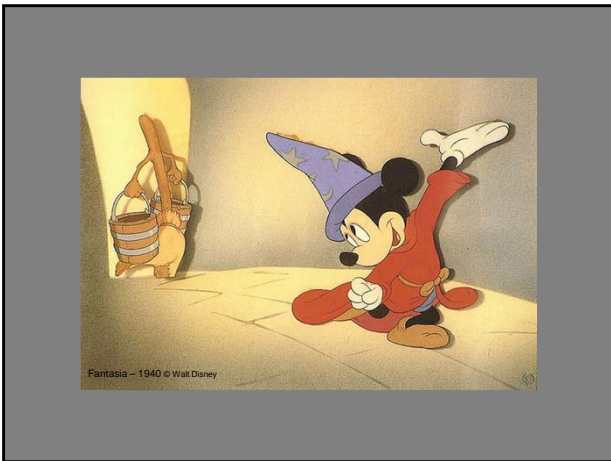
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## Disney Animators

- 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.

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"Principles of Traditional Animation Applied to 3D  
Computer Animation"

John Lasseter, SIGGRAPH 1987

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### 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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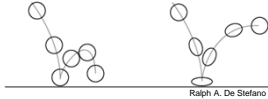
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## Squash and Stretch

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



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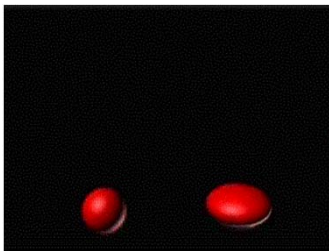
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## Squash and Stretch



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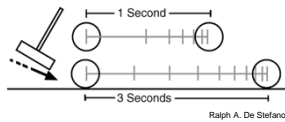
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## Timing

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



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## 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.

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## 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...”

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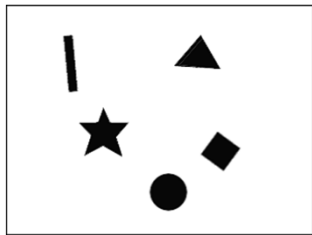
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## Staging



Ralph A. De Stefano

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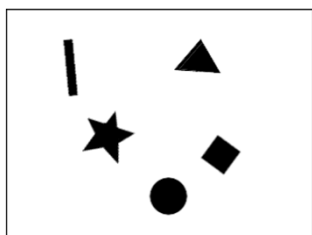
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## Staging



Ralph A. De Stefano

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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).

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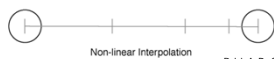
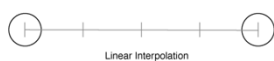
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## Slow In / Out

- 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”.



Ralph A. De Stefano

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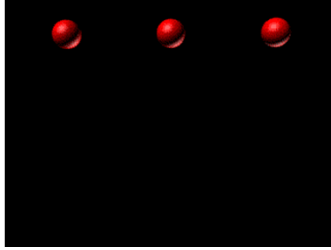
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## Slow In / Out



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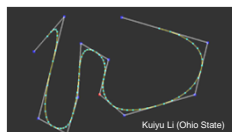
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## Arcs

- 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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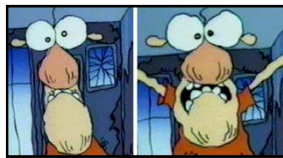
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## Exaggeration

- Make the **essence** of an idea **bigger**.
- Provide a “ground” for comparison in scene.



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

Ralph A. De Stefano

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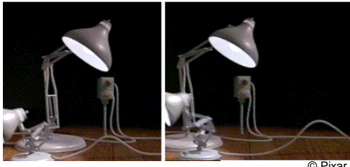
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## Secondary Action

- 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

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## Appeal

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



© Viacom International

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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.



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## 3D Animation Basics

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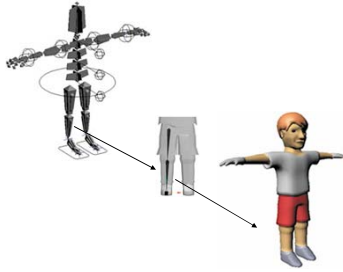
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## Preparing a Model: Skeletal Rigging




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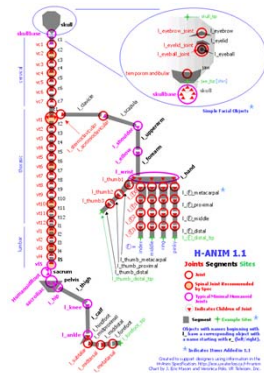
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## Joint Animation




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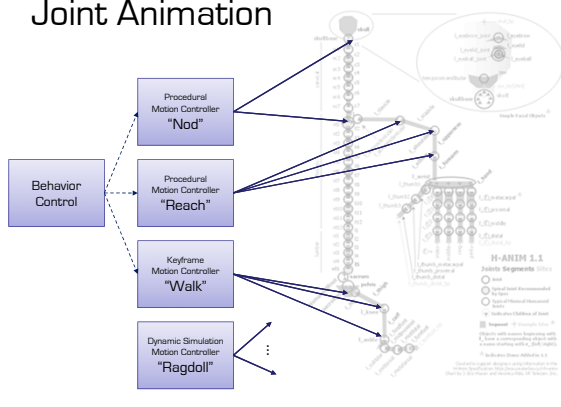
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## Joint Animation




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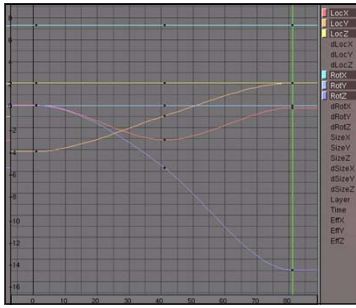
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# Motion Graphs



Blender 3D

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