

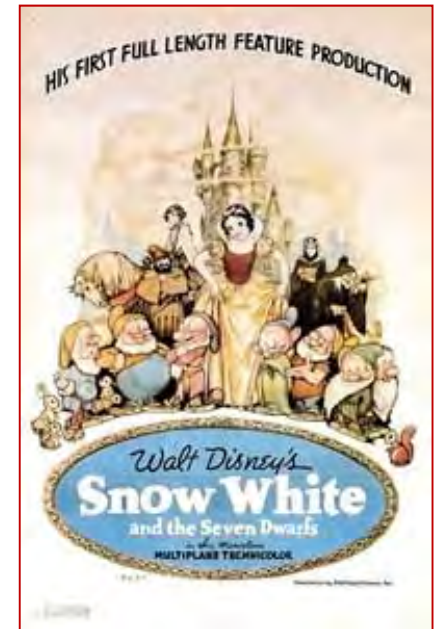
Squash and Stretch



National Science Foundation
WHERE DISCOVERIES BEGIN

Snow White

Disney's *Snow White* was the first full-length feature film using hand-drawn cel animation.



Snow White (1933, 7 min.)



Snow White and the Seven Dwarfs (1937, 83 min.)

Snow White (1933)

<http://www.youtube.com/watch?v=IUsp2XxgZTY>

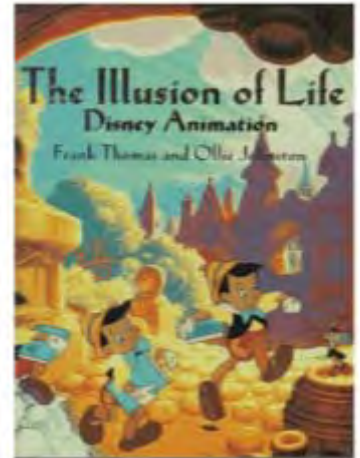


Snow White (1937)



Disney's Principles of Animation

From life studies, Disney animators discovered the #1 principle that was key to adding realism in character animation was “Squash & Stretch.”



1. Squash & Stretch
2. Timing
3. Anticipation
4. Staging
5. Follow Through
& Overlapping Action

6. Straight Ahead &
Pose-to-Pose Action
7. Slow In and Slow Out
8. Arcs
9. Exaggeration
10. Secondary Action
11. Appeal

Basic Squash & Stretch

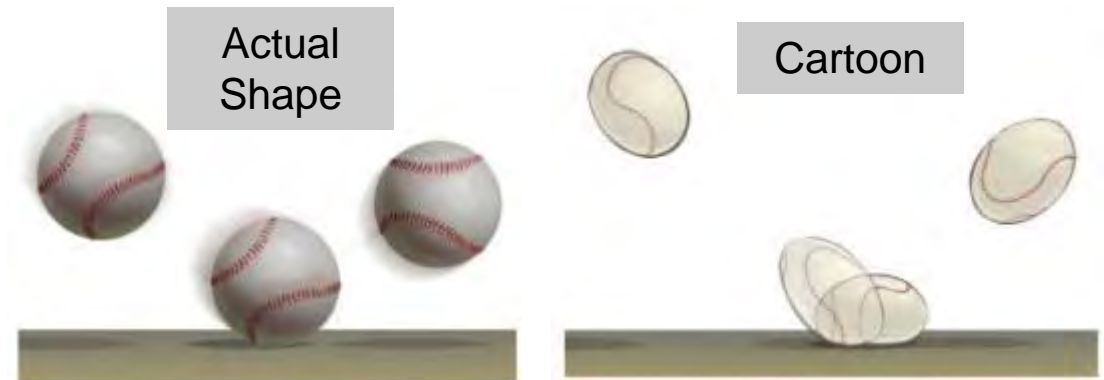
Stretch shows speed due to motion blur.



Actual Shape

As Seen by Human Eye

Basics of squash and stretch are present in even the simple ball bounce exercise.



Squash shows force, such as on impact.

Character Animation

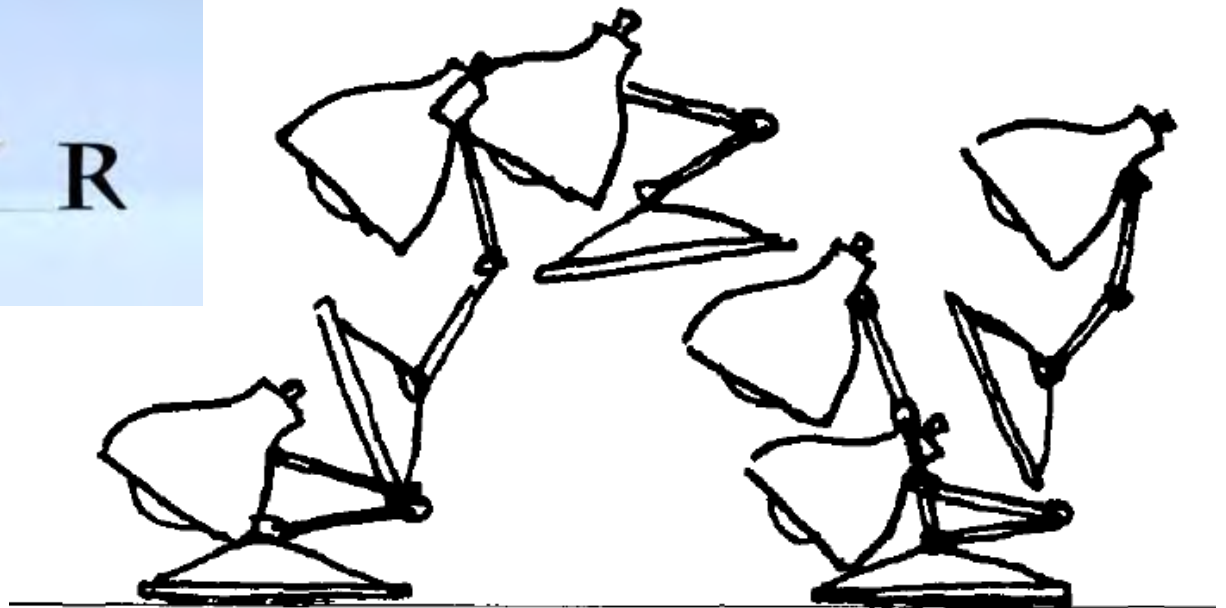
Basic squash and stretch are easy to learn from a bouncing ball but their importance is in how squash and stretch appear in the motion of characters.



From Preston Blair's, *Cartoon Animation*

Luxo Jr.'s Squash & Stretch

“An object need not deform in order to squash and stretch. For instance, a hinged object like Luxo Jr. *squashes* by folding over on itself, and *stretches* by extending out fully.” John Lasseter



Luxo Jr. (1986)

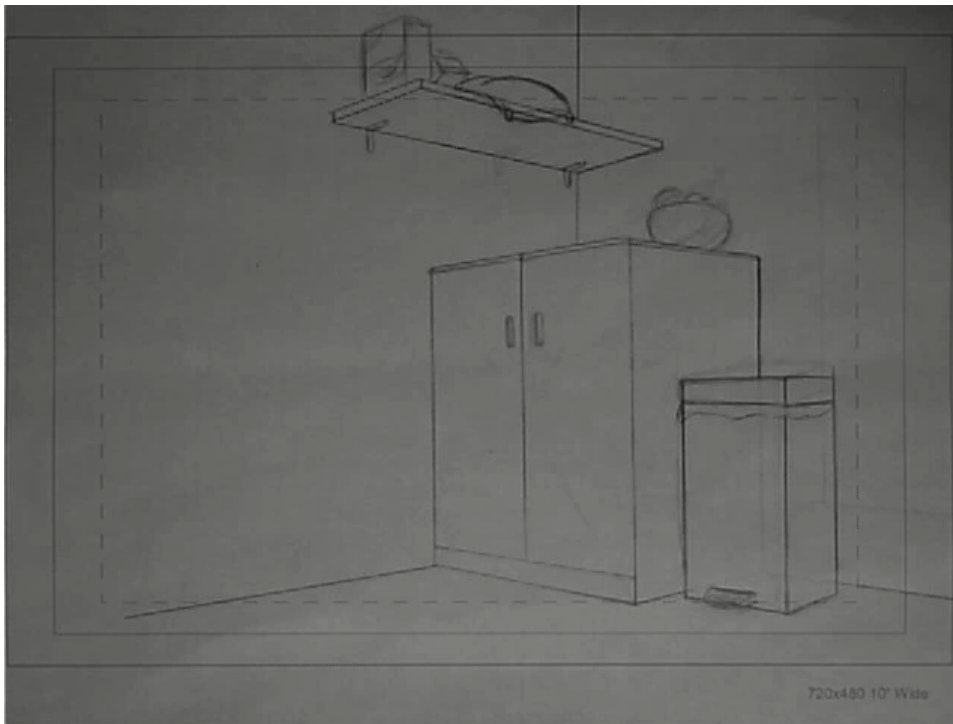
Luxo Jr. was the first CG film nominated for an Academy Award.



<http://www.youtube.com/watch?v=PvCWPZfK8pI>

Sack Drop Exercise

A flour sack has an obvious squash on impact followed by a stretching pop-up.



Sack Drop closeup

Speed: 120 frames per second

Size: Sack - 12 1/2 x 10 x 3 inches

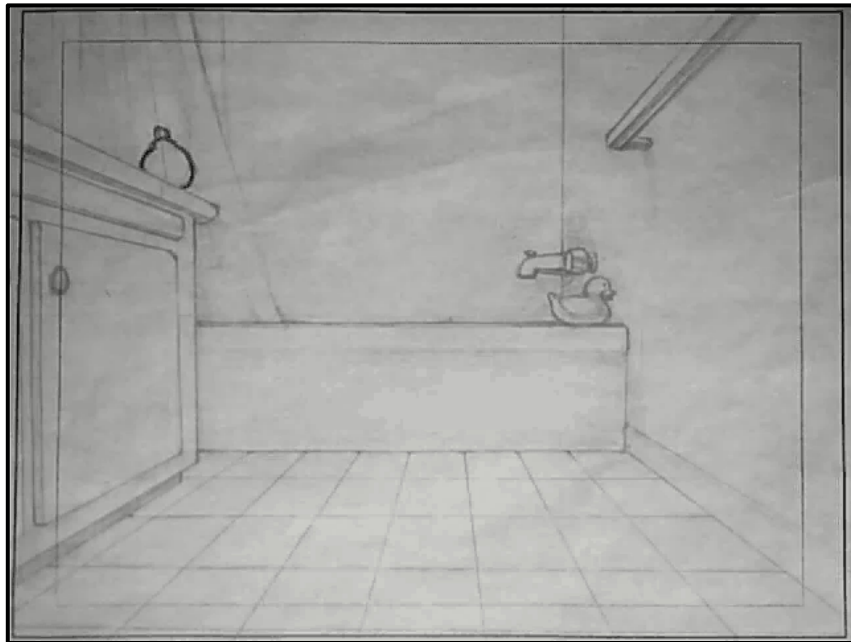
www.AnimationPhysics.com

<http://www.youtube.com/watch?v=l7RRvczm-yk>

<http://www.youtube.com/watch?v=AyMvNYiqOxM>

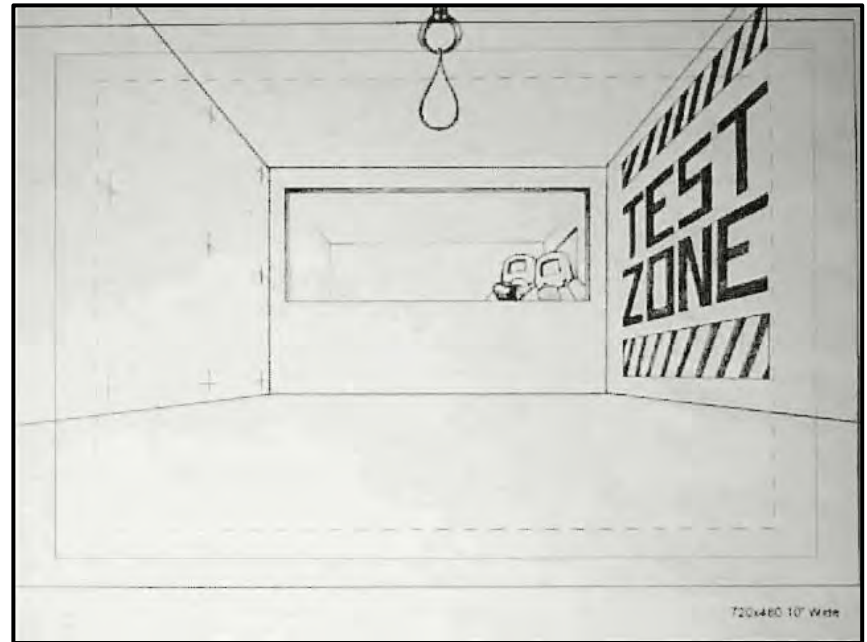
Water Balloon Exercise

Water balloon is a good animation exercise because it moves like an animate character.



By Mai Vu

<http://www.youtube.com/watch?v=ajC1oCZIkQI>



By Ken Calvert

<http://www.youtube.com/watch?v=0yWTJpaoJXI>

Water Balloon Reference

<http://www.youtube.com/watch?v=FI-Mq6BDtMQ>

Waterballoon Drop

Speed: 120 frames per second

Size: Water balloon - 3 inches

www.AnimationPhysics.com

It's always useful to animators to study reference, both live and video.

<http://www.youtube.com/watch?v=XbGVBV3-F48>

The motion of the water balloon is different with every take, yet has a consistent feel.

Waterballoon Drop

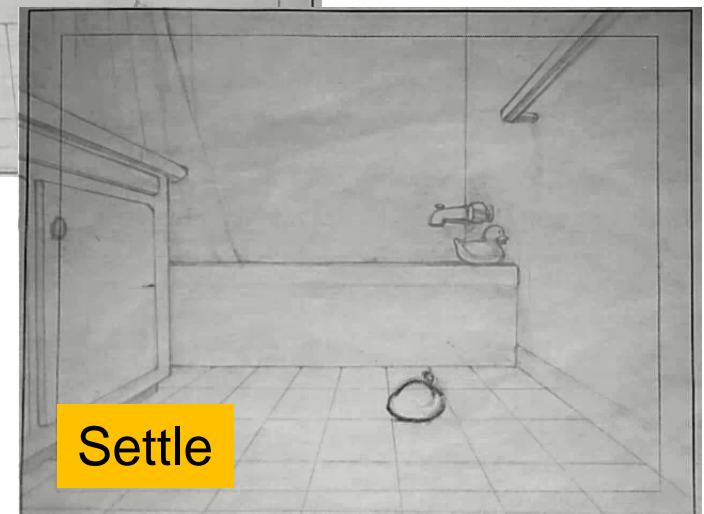
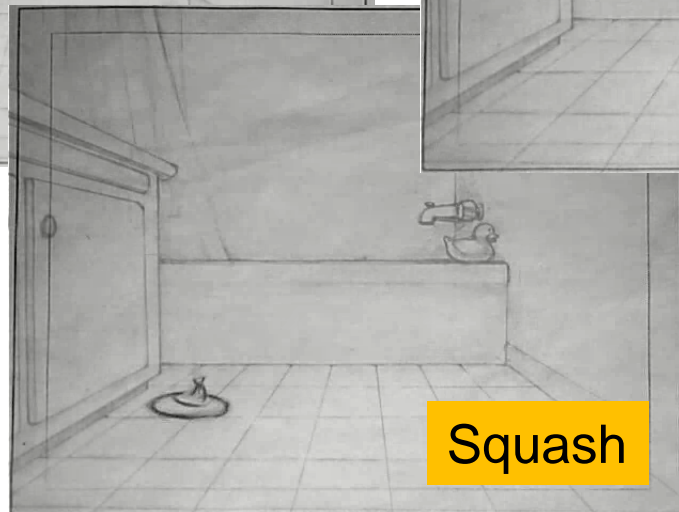
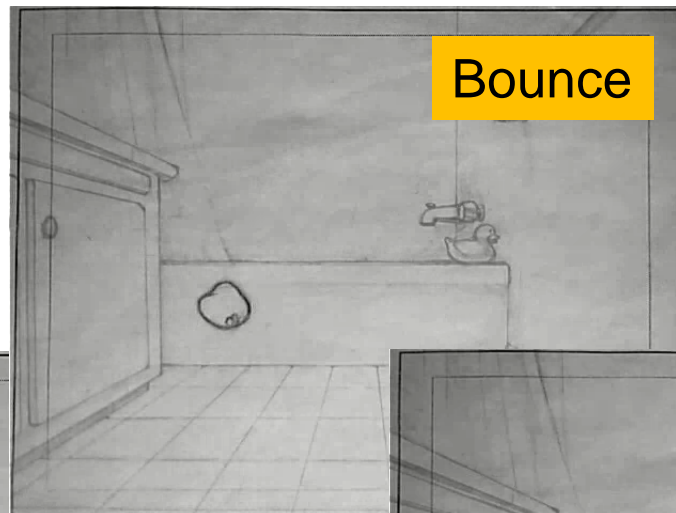
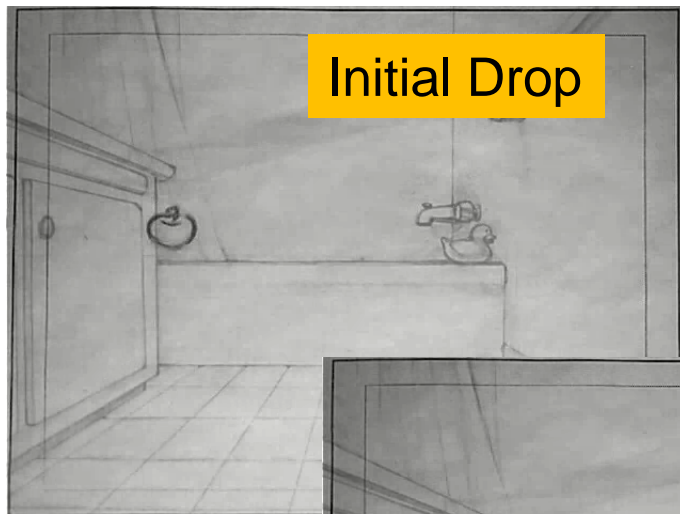
Speed: 120 frames per second

Size: Water balloon - 3 inches

www.AnimationPhysics.com

Elements of a Water Balloon Drop

Let's look more carefully at the physics in each element of a water balloon drop.



Summary

- “Squash and stretch” is the first Principle of Animation.
- Squash and stretch is seen in all types of animated motion, from a simple bouncing ball to complex character animation.
- Even characters with rigid limbs, like Luxo Jr., have squash and stretch from bending joints.
- Animating a flour sack or a water balloon is a helpful exercise leading toward character animation.