Momentum & Force of Impact

Squash on Impact

The fluid nature of the balloon makes the squash on impact very pronounced.
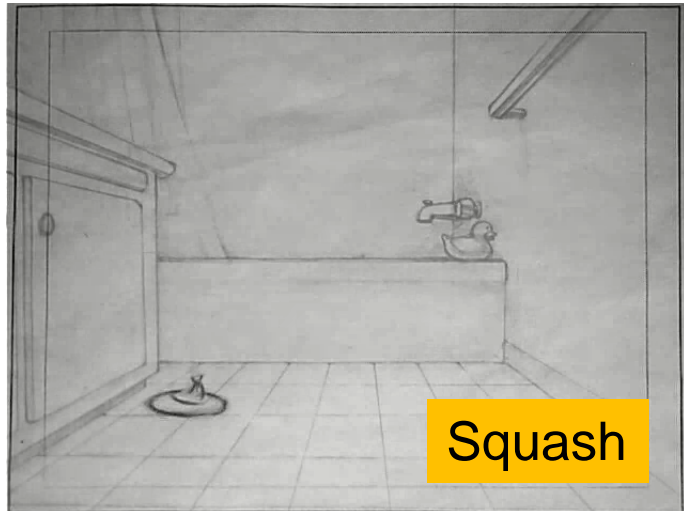
Squash

Waterballoon Drop
squash closeup

Speed: 120 frames per second

Size: Water balloon - 3 inches

www.AnimationPhysics.com

Squash on Impact

Squash on impact also occurs for characters.

Momentum

Momentum of an object depends on:

    * Velocity of the object

    * Weight of the object

Bullet

Rugby Player

Momentum and Force

To stop an object with a large momentum requires either:

- Large force (stopping the object quickly).
- Small force applied for a long time.

Changing an object's momentum depends on both the force *and* the time interval.

Vampire Stake Demo

Place a very heavy brass stake on my chest and strike with a hammer.

Why am I not hurt?

The brass stake's speed is low but it has a large momentum because of it's large mass.
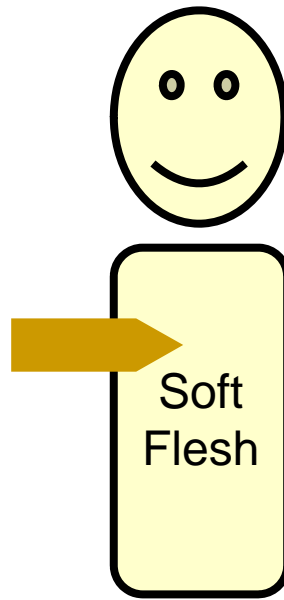
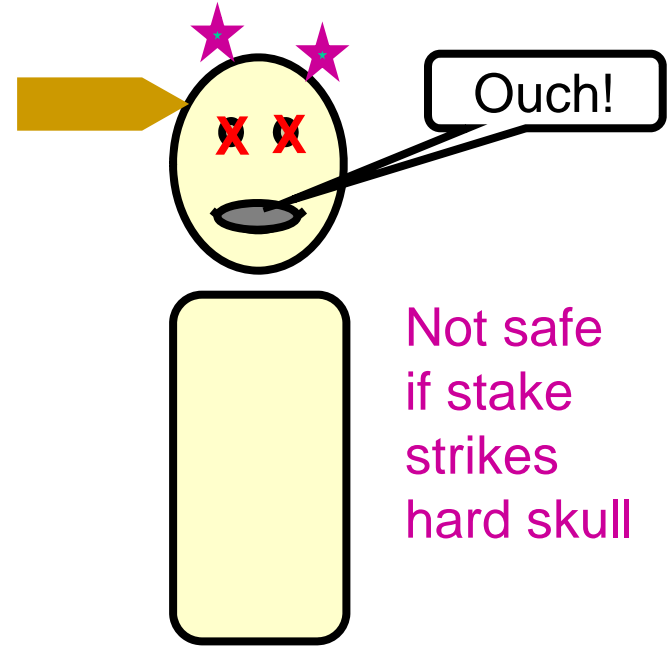# Vampire Stake Demo

Vampire Stake Demo, Analyzed

Egg Throw Demo

Throw a raw egg
as fast as
possible at a
bed sheet that's
held loosely.
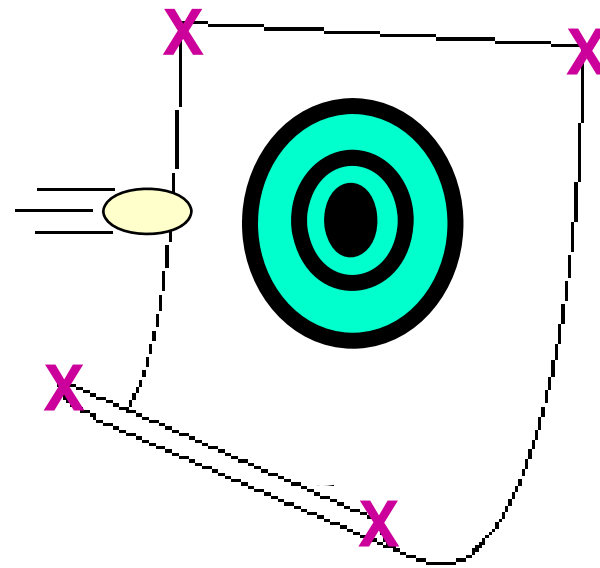
X (Hold here)

Egg Throw Demo

Egg Throw Demo, Analyzed

Maximizing time of impact on the egg minimizes the force of impact

LONG TIME, small force

short time
LARGE FORCE

Automobile Safety

Maximizing time of impact *on the driver* minimizes the force of impact.
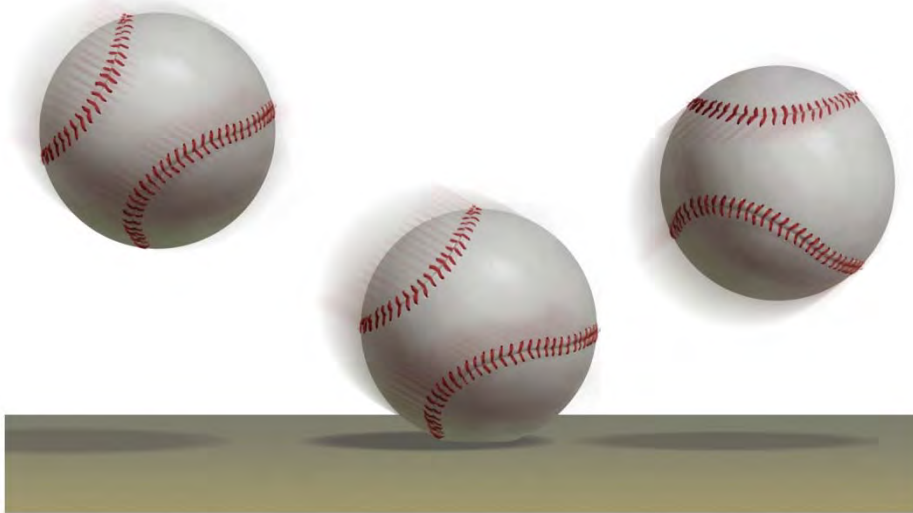This principle used in design of:

Seatbelts

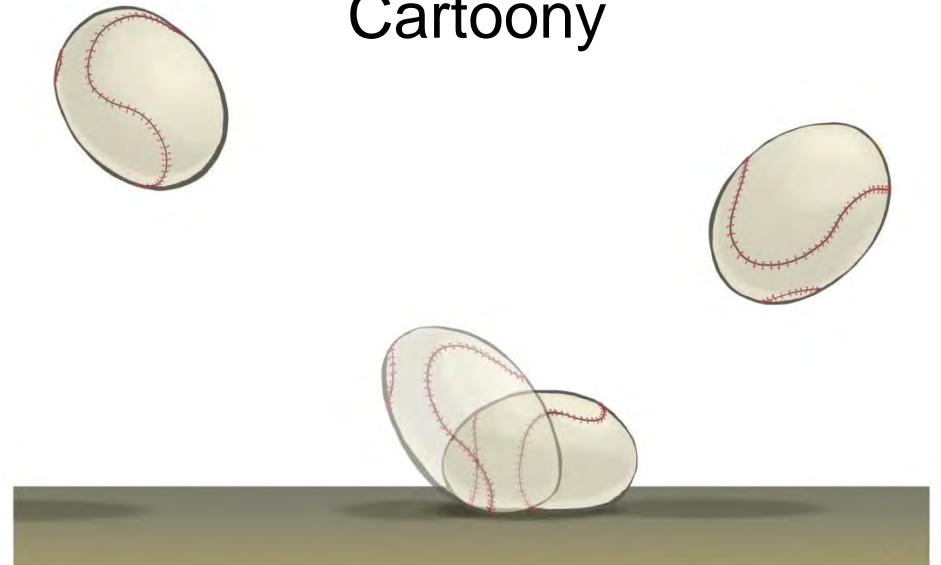**Air Bags**

Crumple Zones

Squash & Stretch on Impact

Squash and stretch makes an impact less jarring visually by extending the time of impact in a believable way.

Realistic

Cartoony

Squash & Stretch on Impact

Squash & Stretch on Impact

Dubois' pose is stretched in anticipation of the landing and has an extended squash on impact to make landing less jarring for the audience.

Summary

- Momentum of an object depends on its velocity and its weight (mass).
- To stop an object with a large momentum requires either a large force applied quickly or a small force applied more slowly.
- When an impact occurs quickly it can be visually jarring since the force of impact is big.
- Squash and stretch is often used to soften the impact in a way that appears natural.