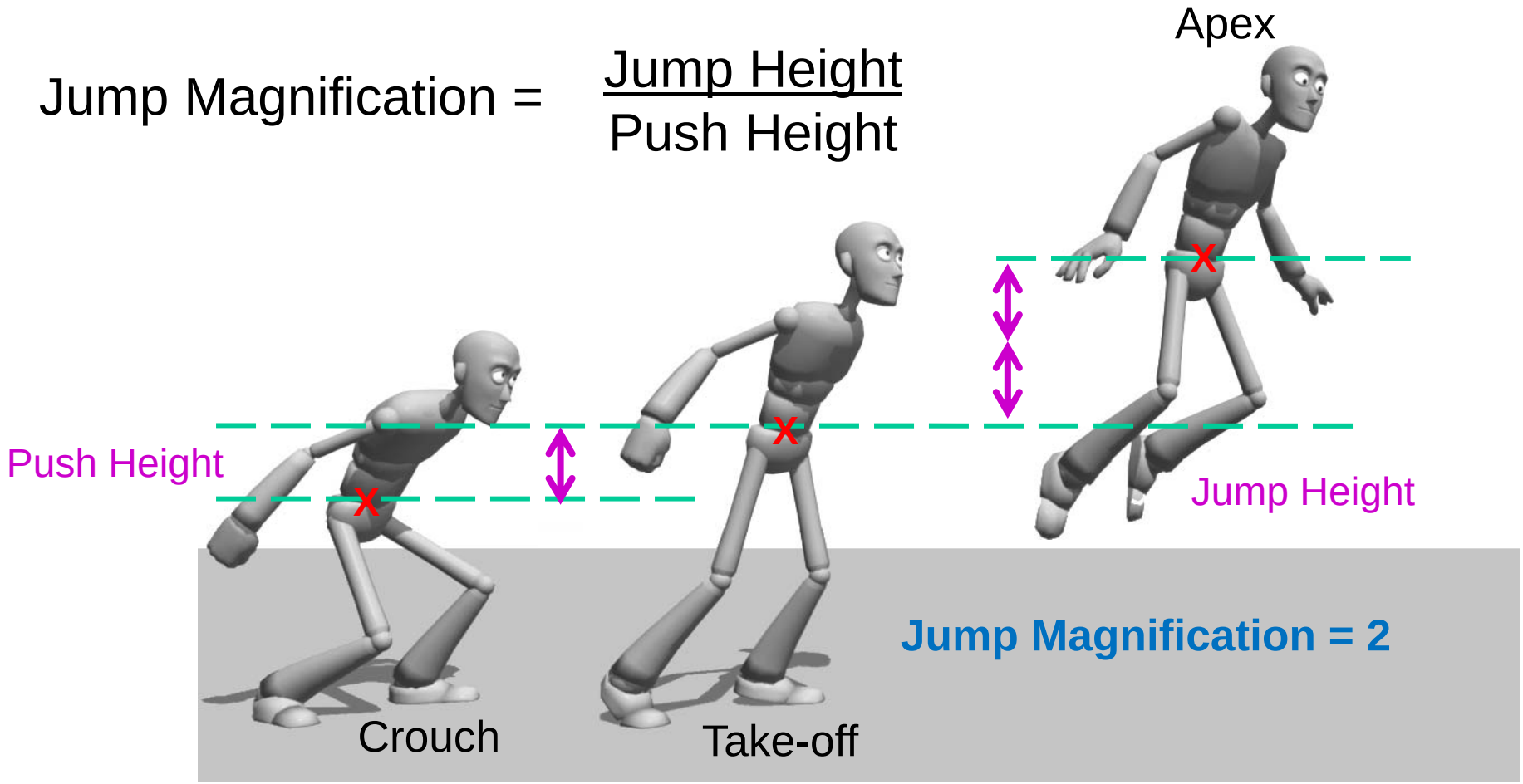
Exceptional Jumps

Jump Magnification

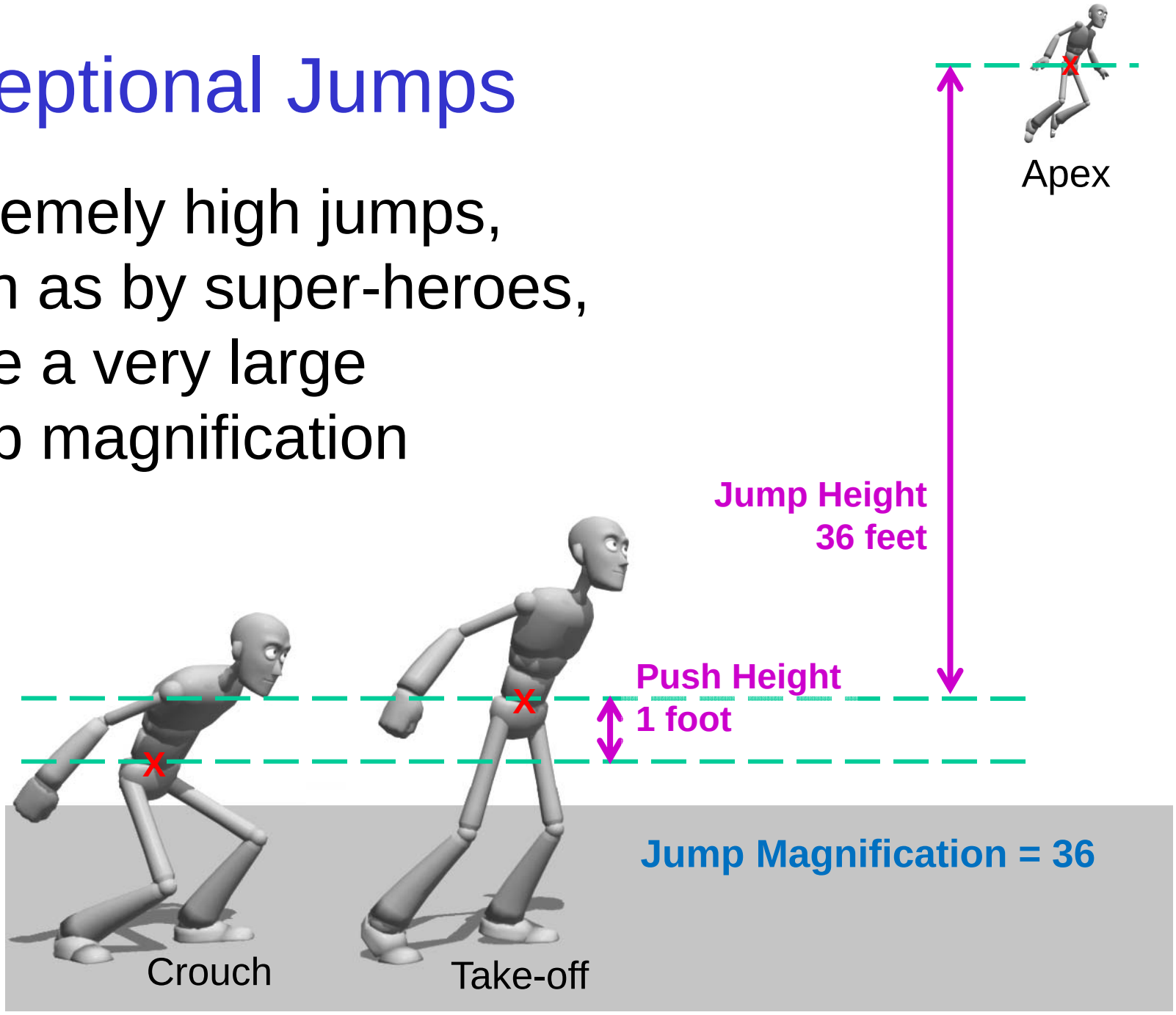
Jump magnification is the ratio of Jump Height to Push Height.

$$\text{Jump Magnification} = \frac{\text{Jump Height}}{\text{Push Height}}$$



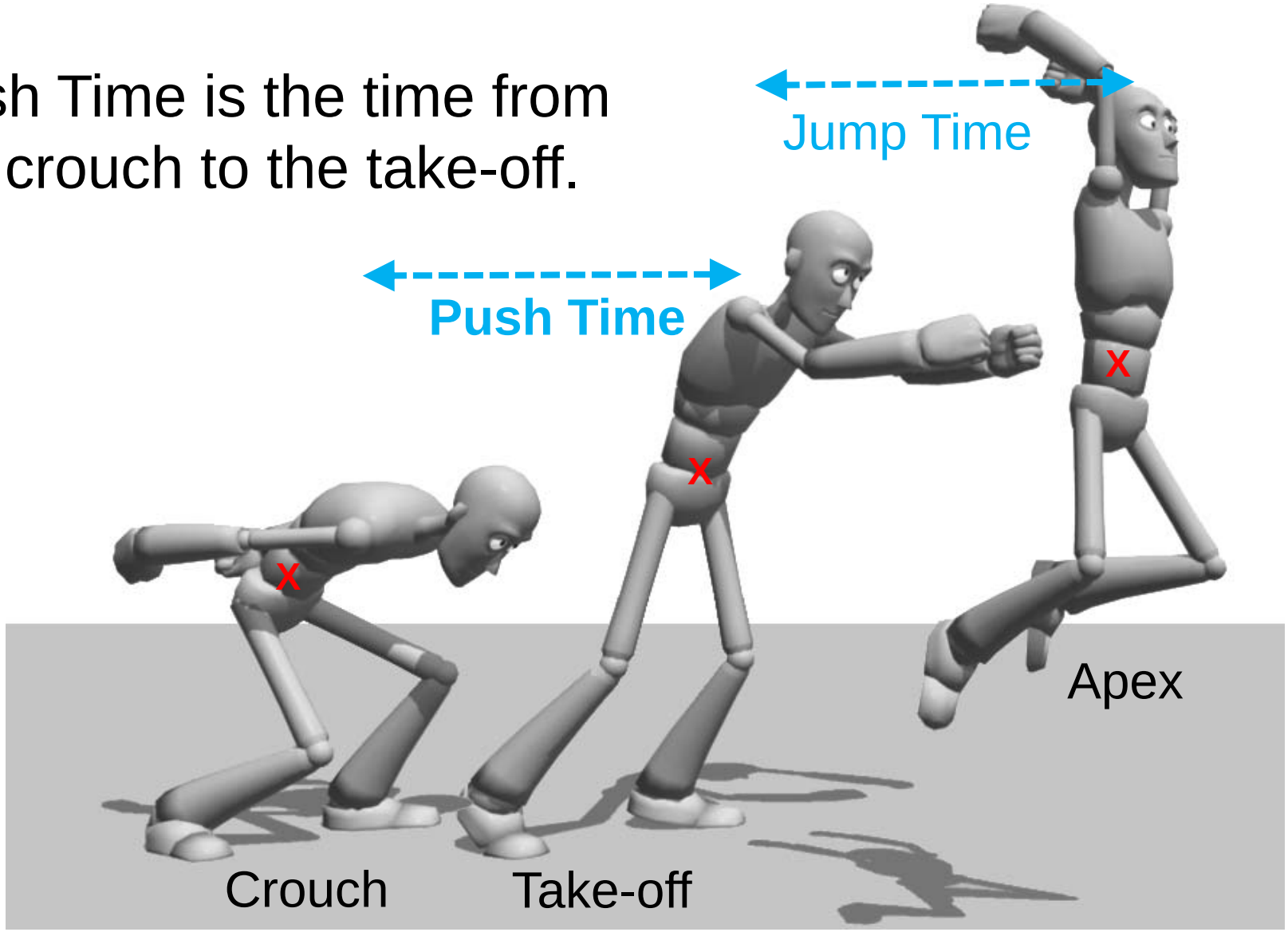
Exceptional Jumps

Extremely high jumps, such as by super-heroes, have a very large jump magnification



Push Time

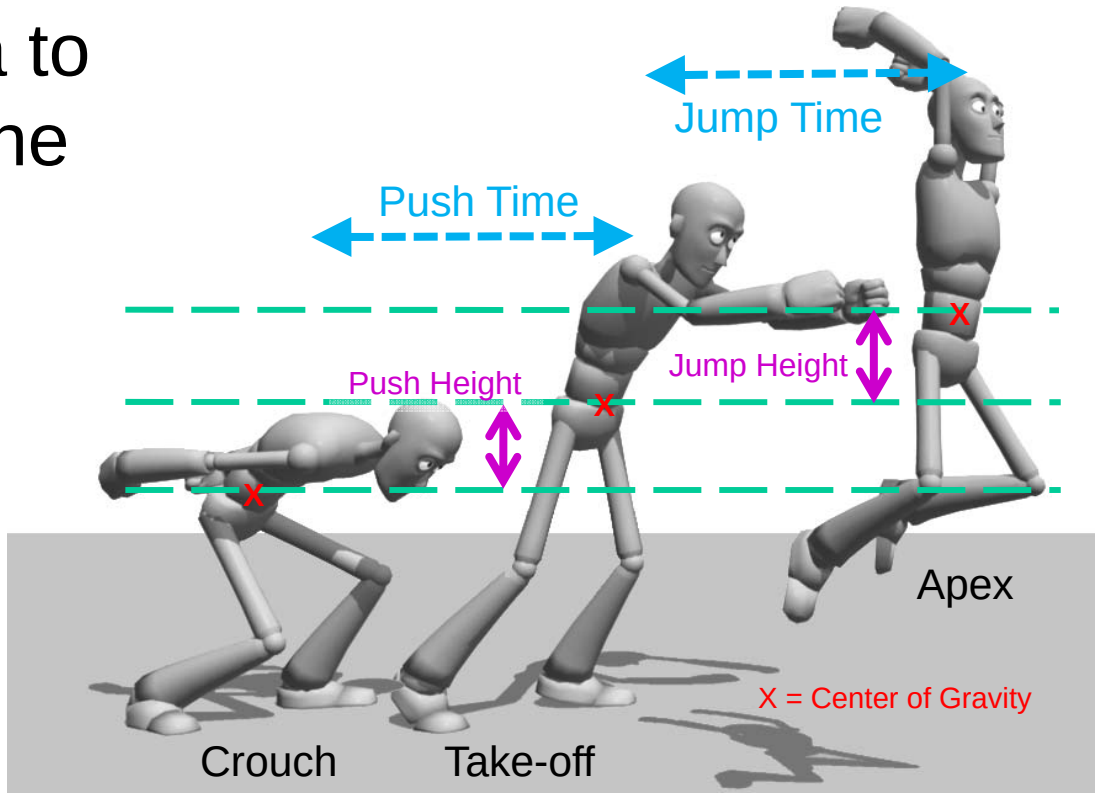
Push Time is the time from the crouch to the take-off.



Formula for Timing the Push

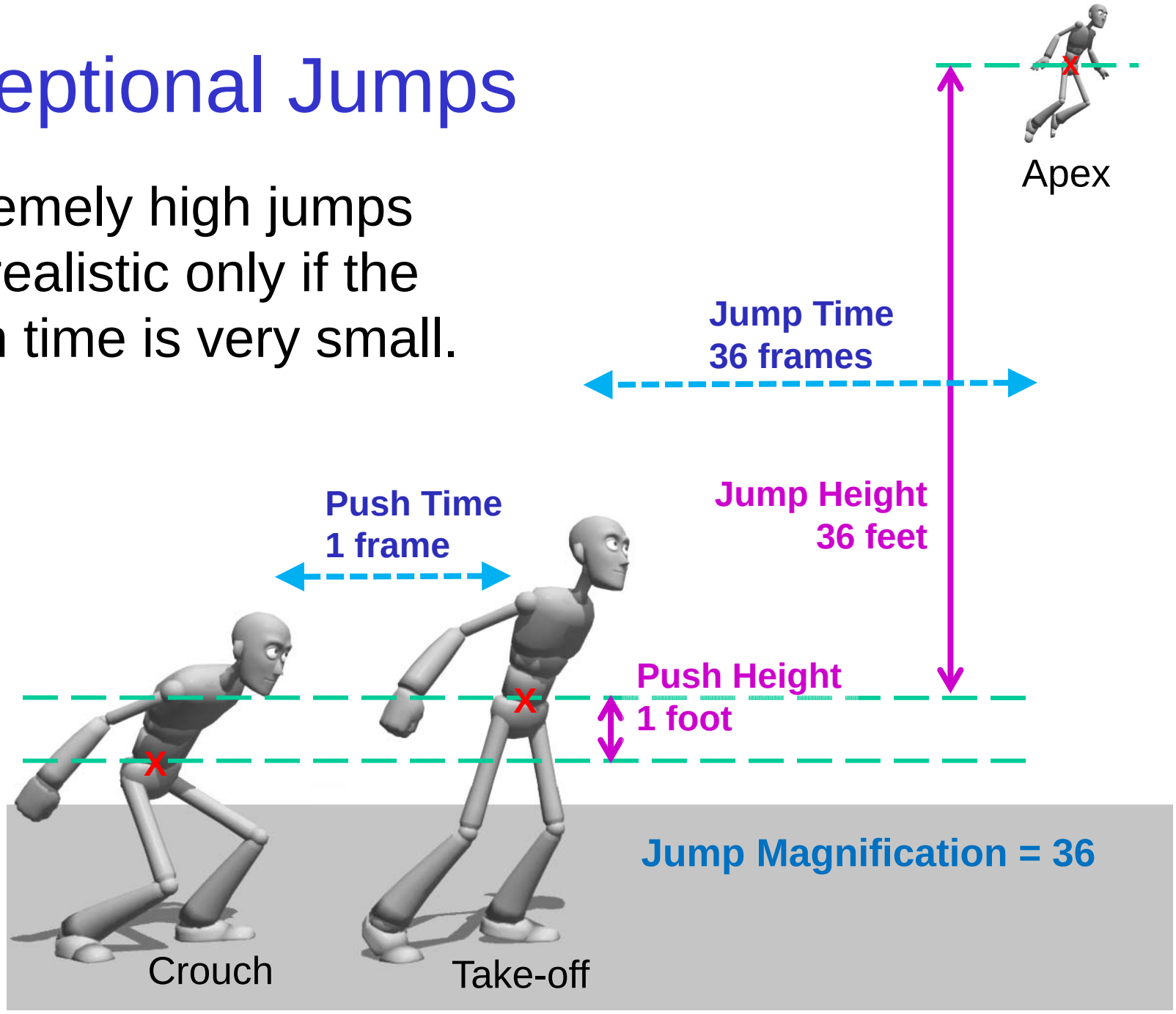
$$\text{Push Time} = \frac{\text{Jump Time}}{\text{Jump Magnification}}$$

Can use this formula to check the timing of the push compared with the jump time.



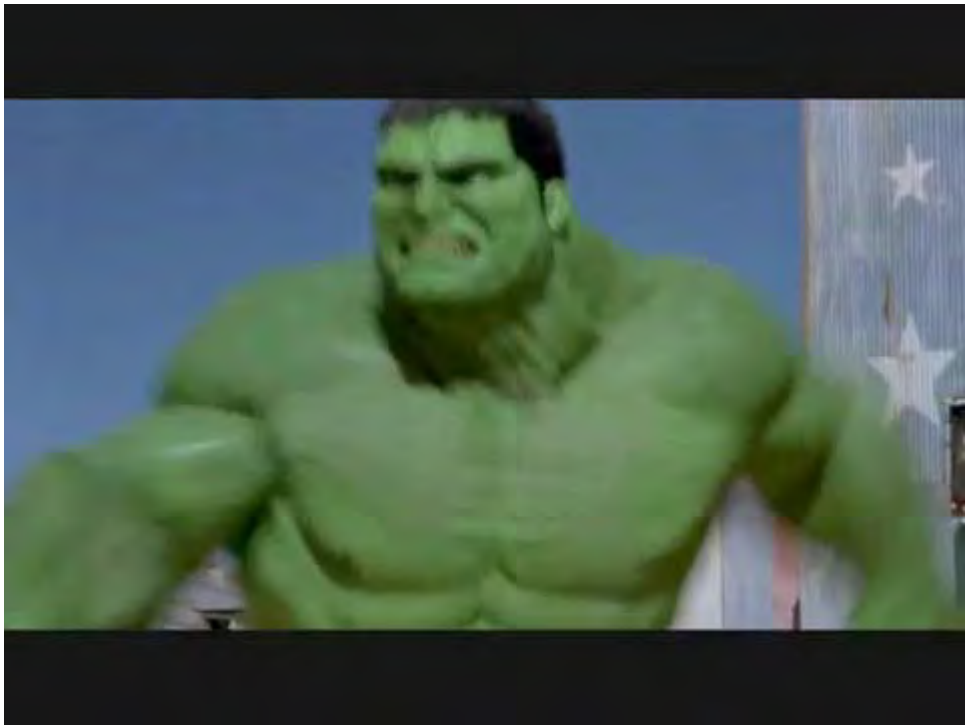
Exceptional Jumps

Extremely high jumps are realistic only if the push time is very small.



Hulk (2003)

Watch the timing of the push on the ground compared with the timing of the jump in the air.



Push Timing

Hulk’s jump isn’t believable since the push timing on the ground is not consistent with jump time in the air.

Using Slow-Motion

Using slow-motion is an old trick for disguising the timing in a super-hero jump.

Jump Magnification for Animals

Small animals are able to perform jumps with exceptional jump magnification

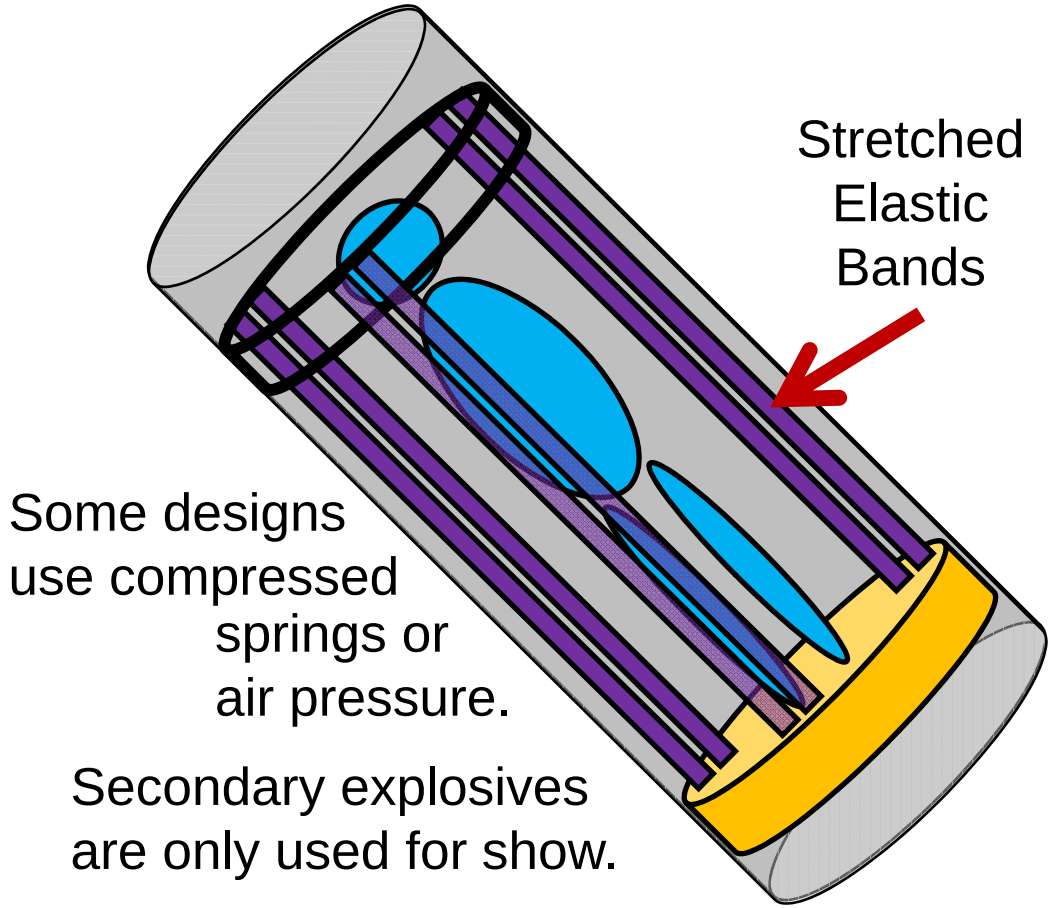
The push time for such jumps is very short.

Enhanced Jumping

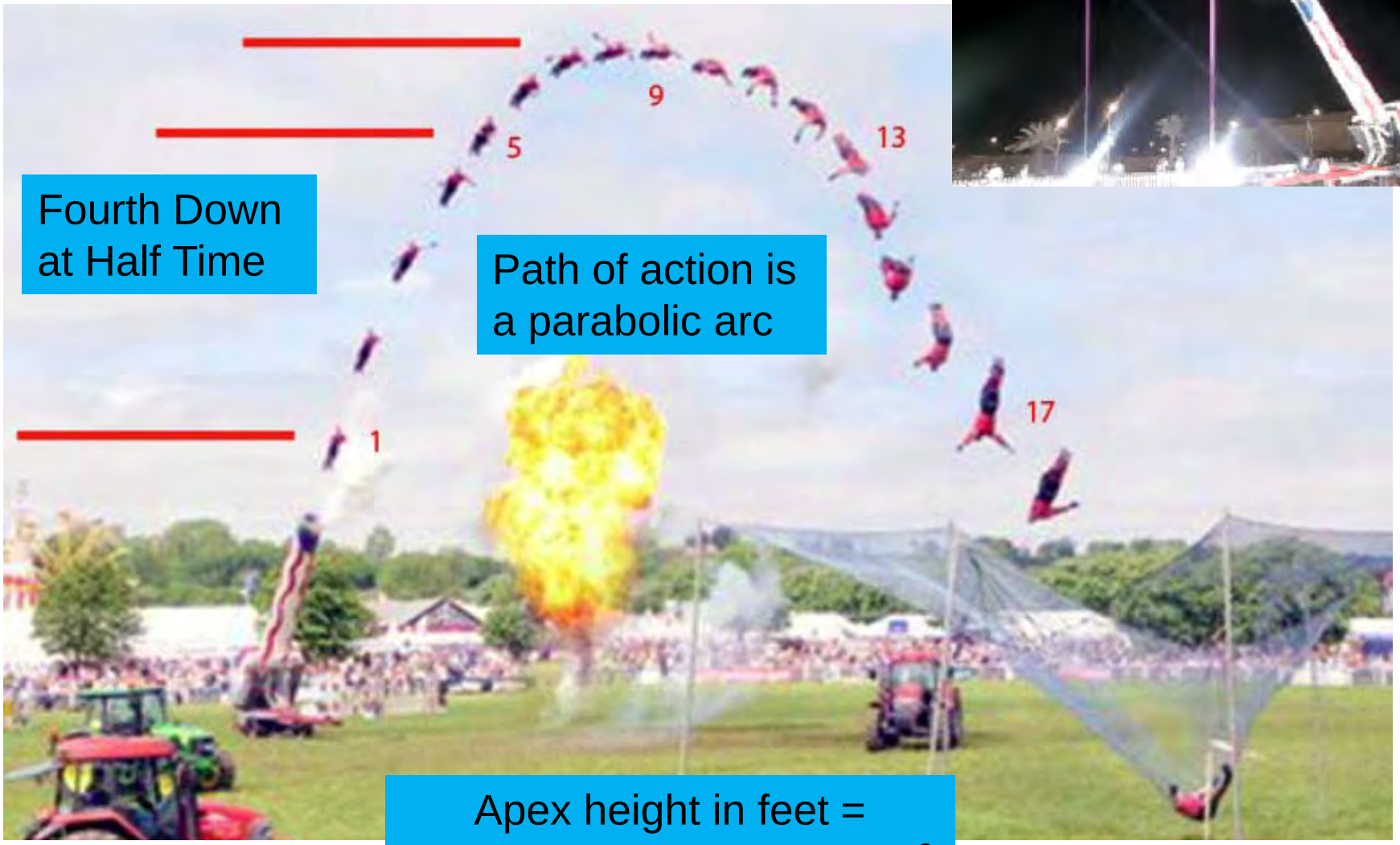
The force on a jumping character can be increased using elastic, spring platforms.

Human Cannonball

Performer is pushed upward on a platform (or on a sled) by stretched rubber bands.



Human Cannonball



Fourth Down at Half Time

Path of action is a parabolic arc

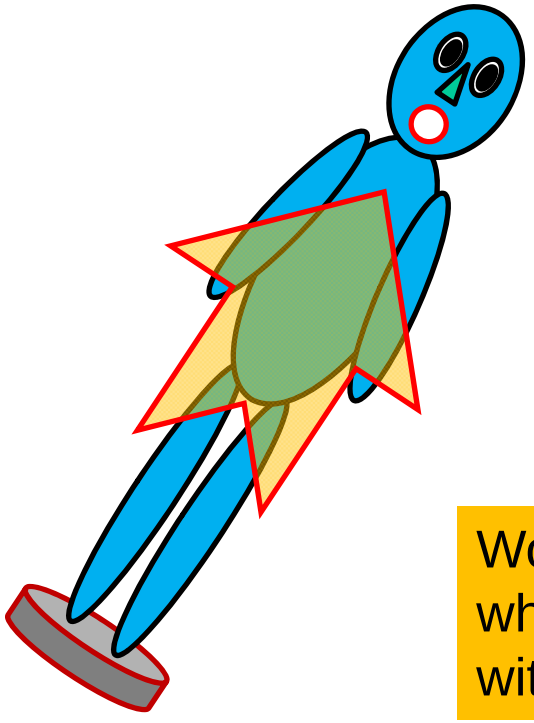
Apex height in feet = $4 \times (\text{Flight time in seconds})^2$

Cannon Range

Range of the cannon is roughly equal to:

(Performer's acceleration in "gees")

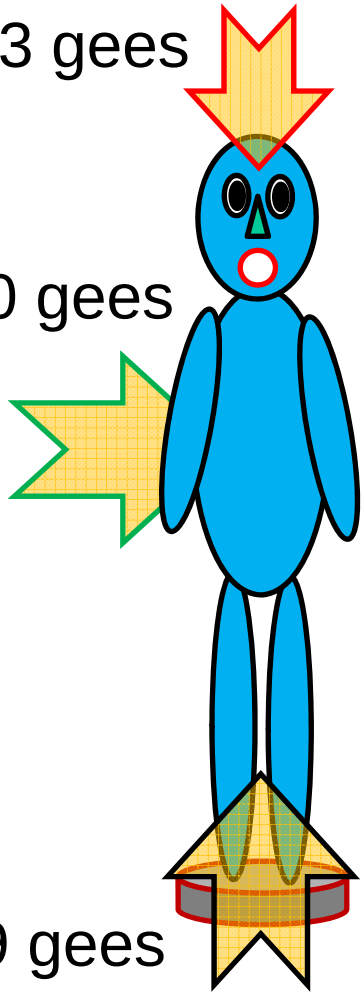
x (Length of the barrel)



A long cannon gives performer a large push height.

World record is about 200 feet, which is range of 30 foot cannon with about 7 gees acceleration.

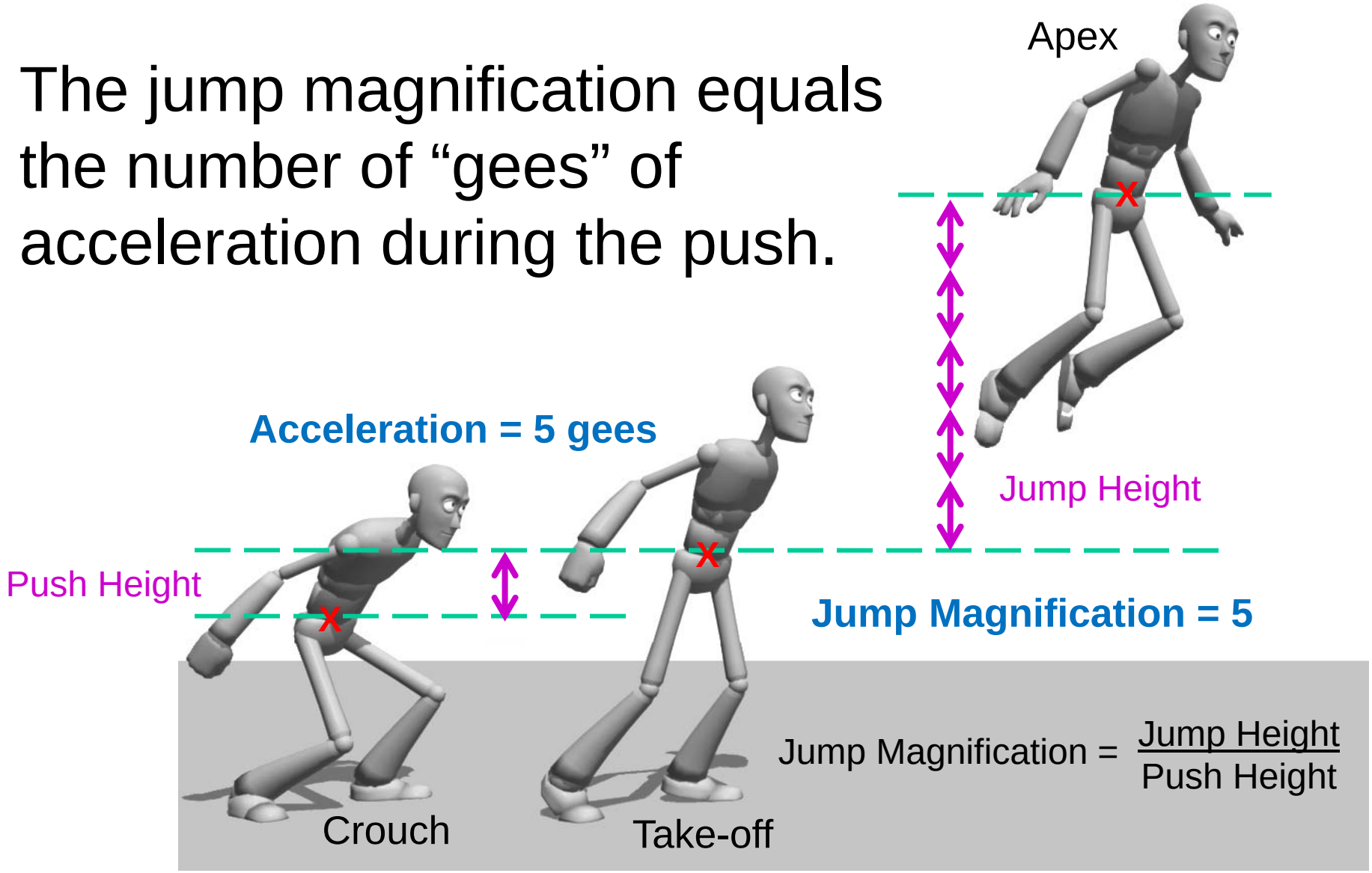
Human Limits for *g*-Force



Colonel John Stapp on a rocket-propelled sled.

Jump Magnification and Gees

The jump magnification equals the number of “gees” of acceleration during the push.



Summary

- Exceptional jumps are characterized by a large jump magnification.
- Push time is very short for a realistic jump with an enormous magnification.
- Using slow-motion is a common trick for disguising the timing of an enormous jump.
- Jumps may be enhanced by launching the character, such as a human cannonball.
- Humans have a limited tolerance to extreme accelerations.