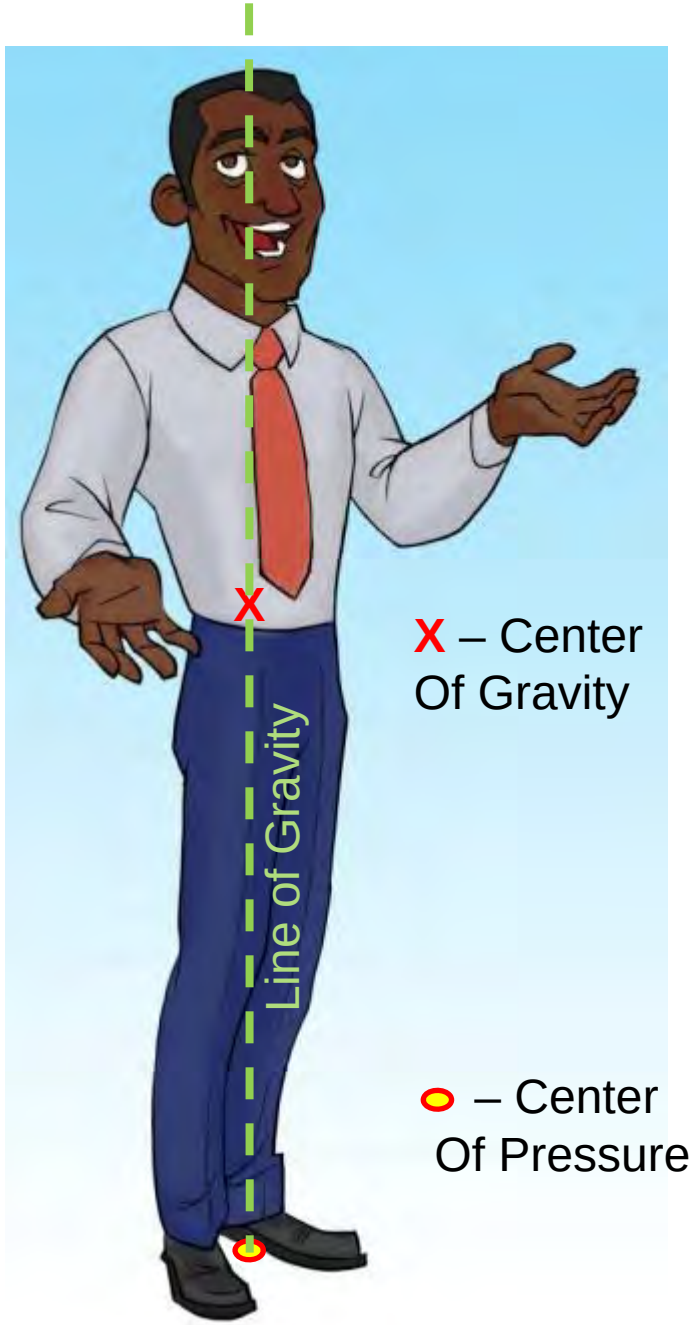
Base of Support

Center of Pressure

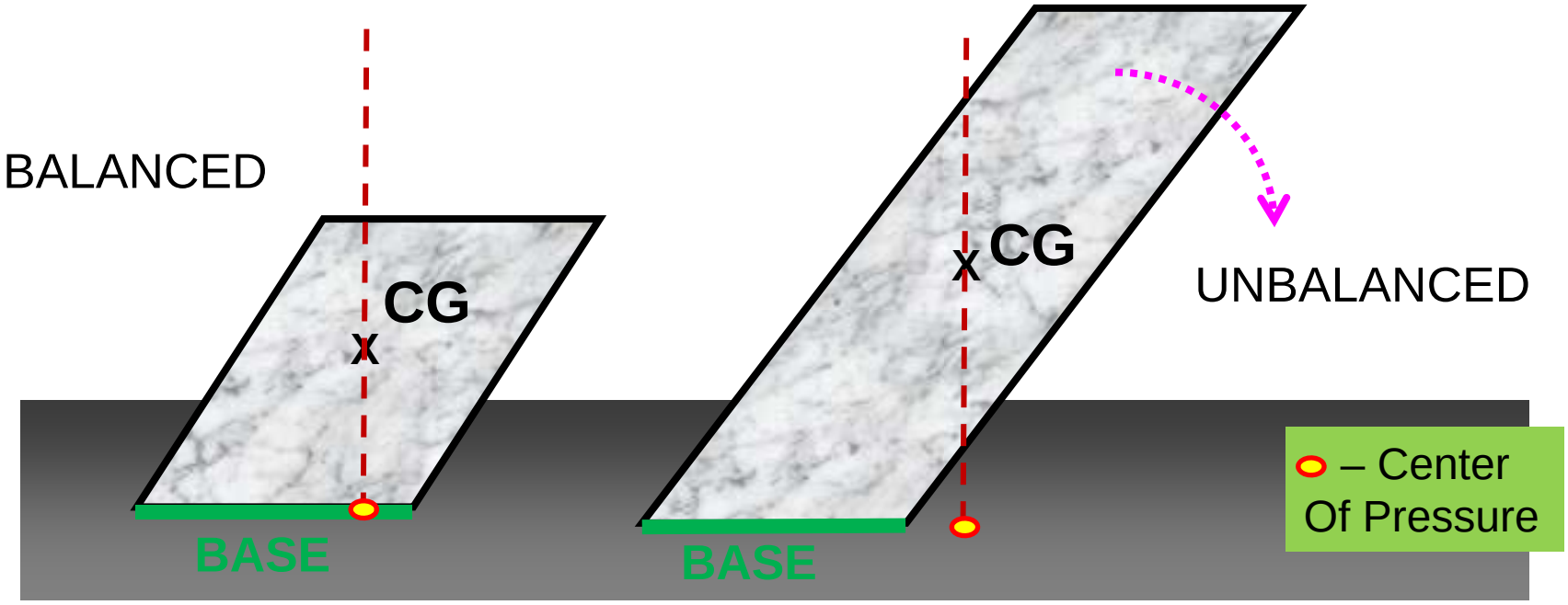
The point where the Line of Gravity touches the ground is called the *Center of Pressure* (abbreviated as CoP).

Center of Pressure is sometimes called Zero Moment Point (ZMP)



Base of Support (BoS)

Object is balanced if Center of Pressure is inside the ***Base of Support***.



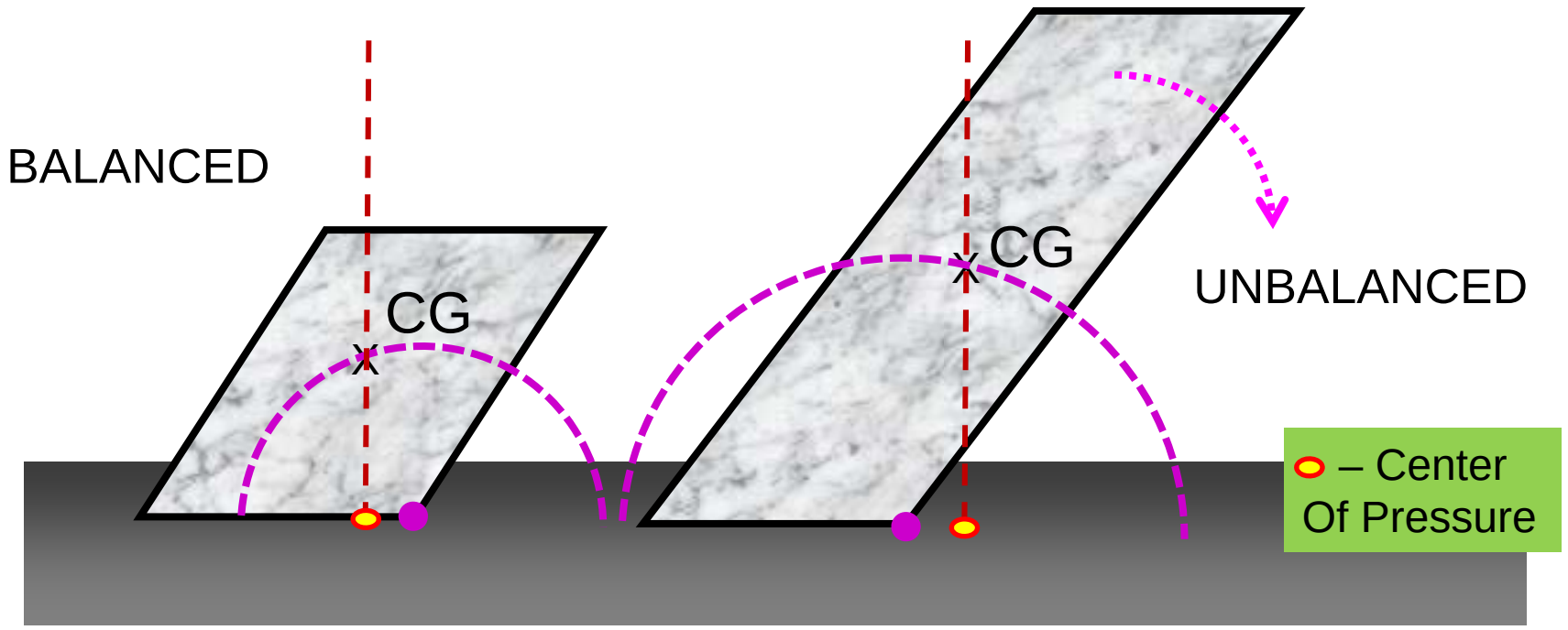
Easy to check for balance by using the Line of Gravity.

Tower of Pisa Model

Center of Pressure & Base of Support

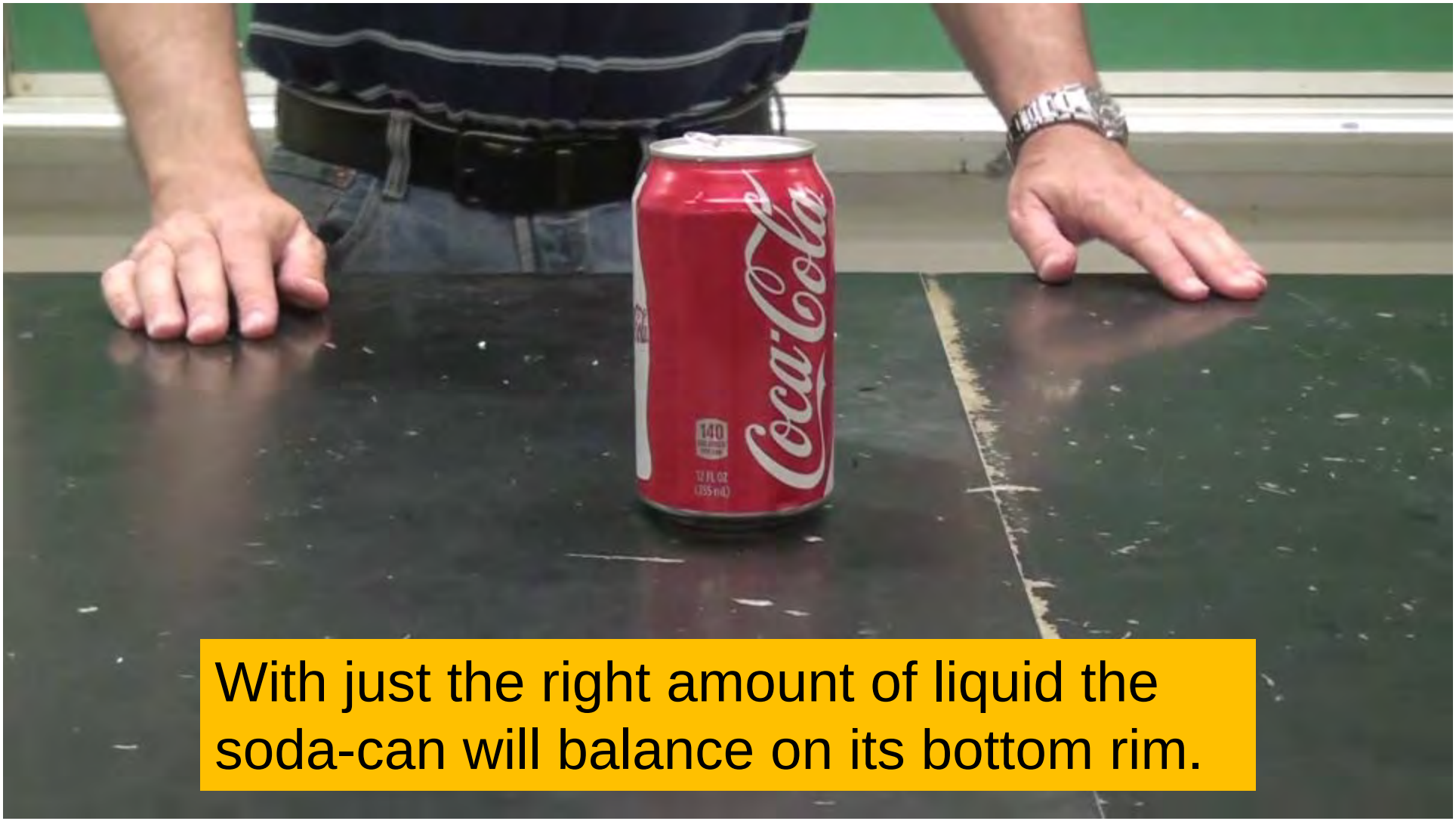
CoP is inside BoS,
so tipping raises CG

CoP is not inside BoS,
tipping lowers CG



Tipping occurs towards the Center of Pressure

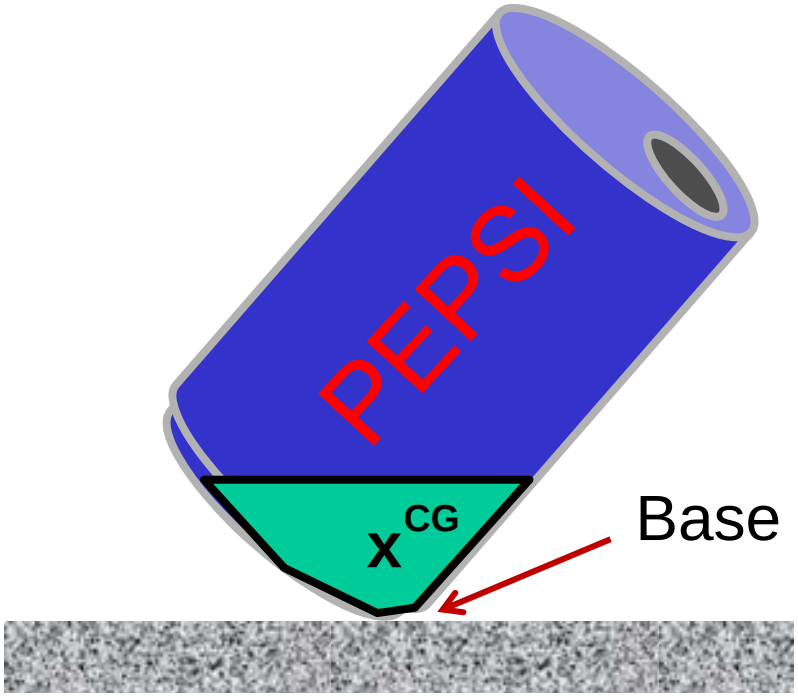
Balance the Can



With just the right amount of liquid the soda-can will balance on its bottom rim.

Balance the Can

The water in the can allows you to balance the can by positioning the CG just above this base of support.

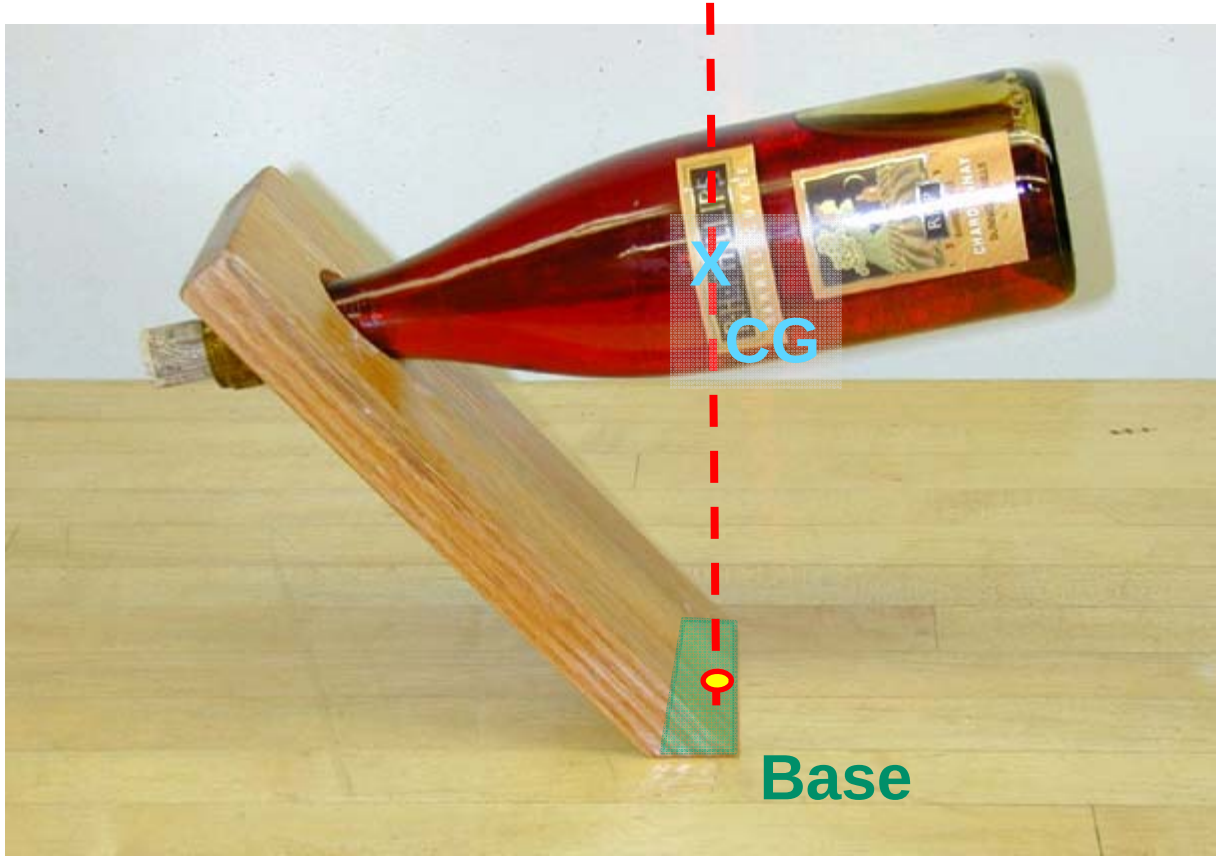


Balance the Bottle

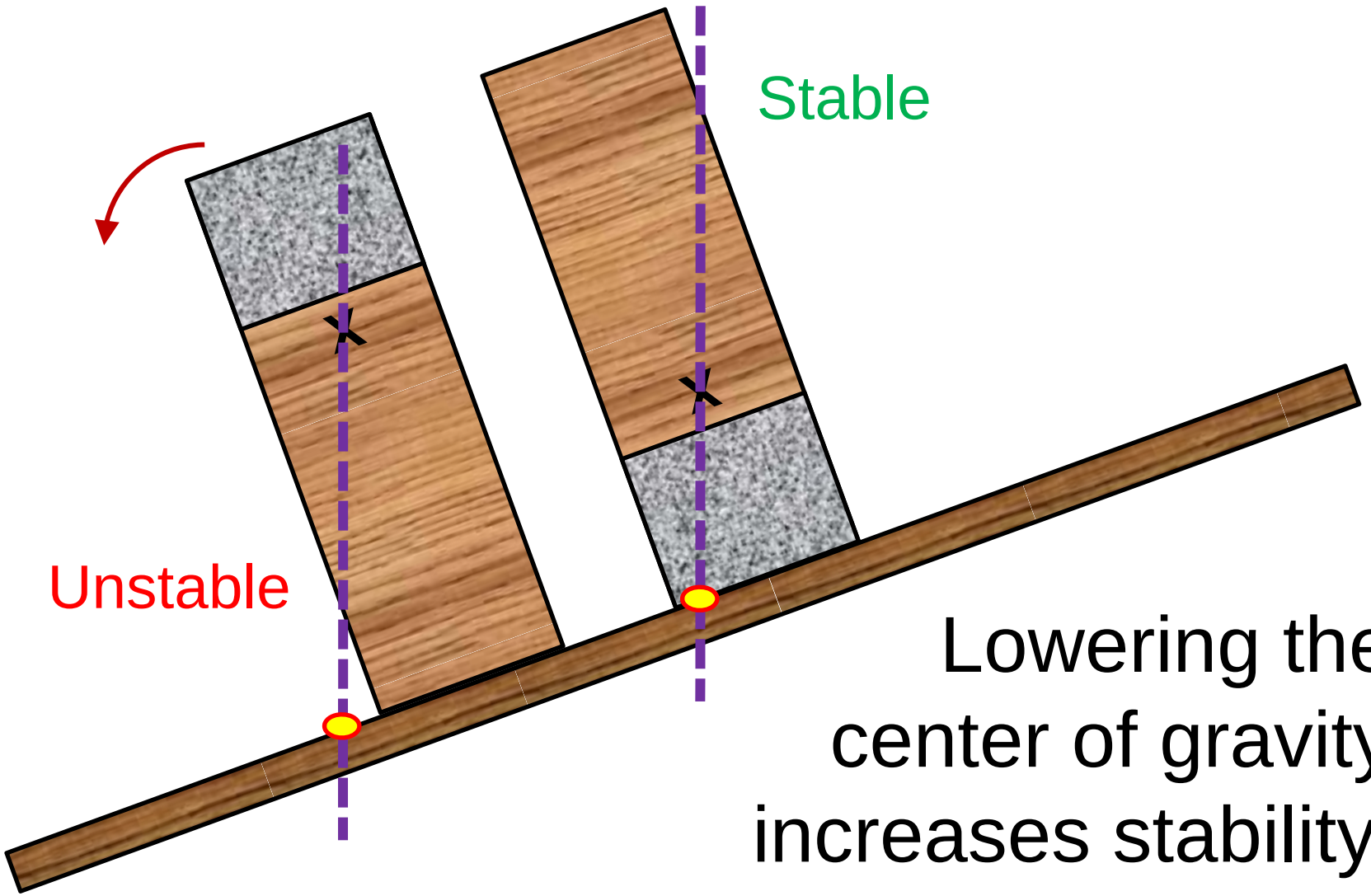
Balance the Bottle

What is the Base of Support?

Where is the Center of Pressure?



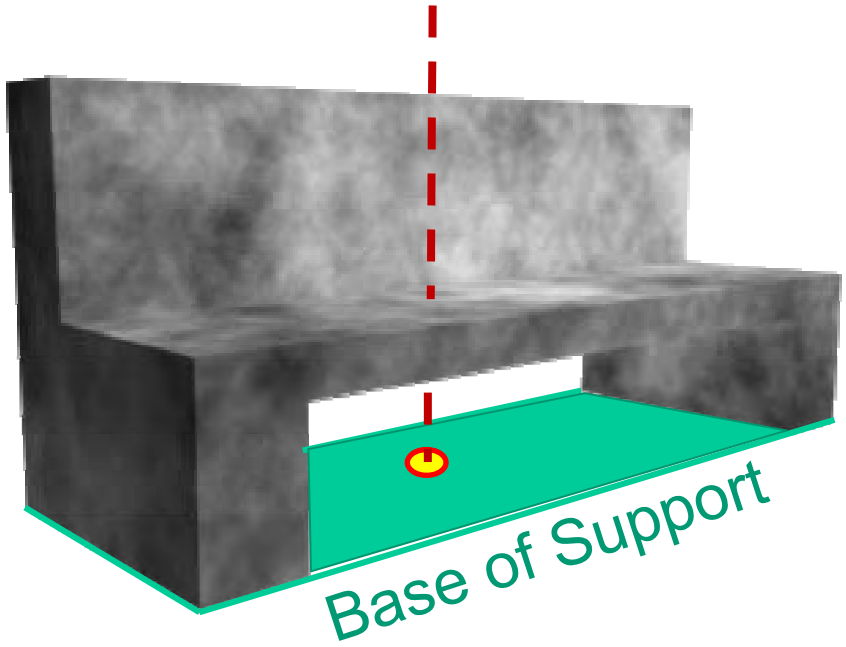
Height and Stability

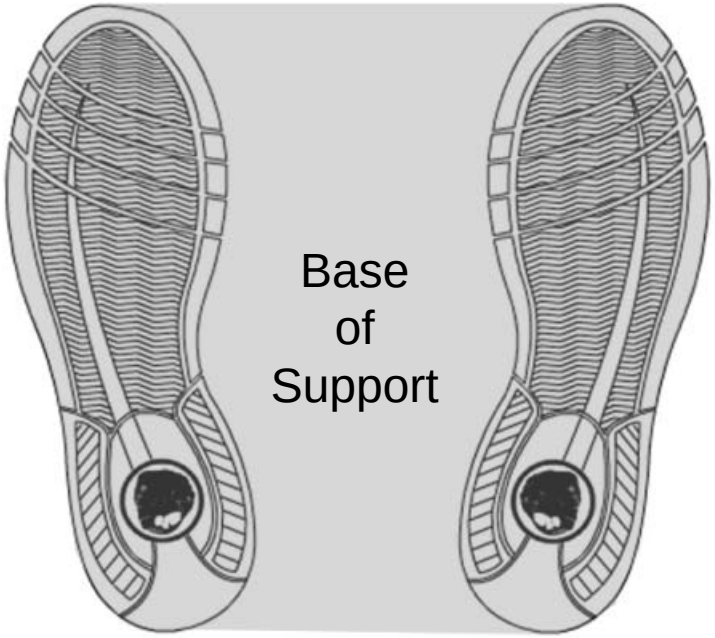


Lowering the center of gravity increases stability.

Character's Base of Support

With more than one area of contact the Base of Support is the area inside the perimeter.

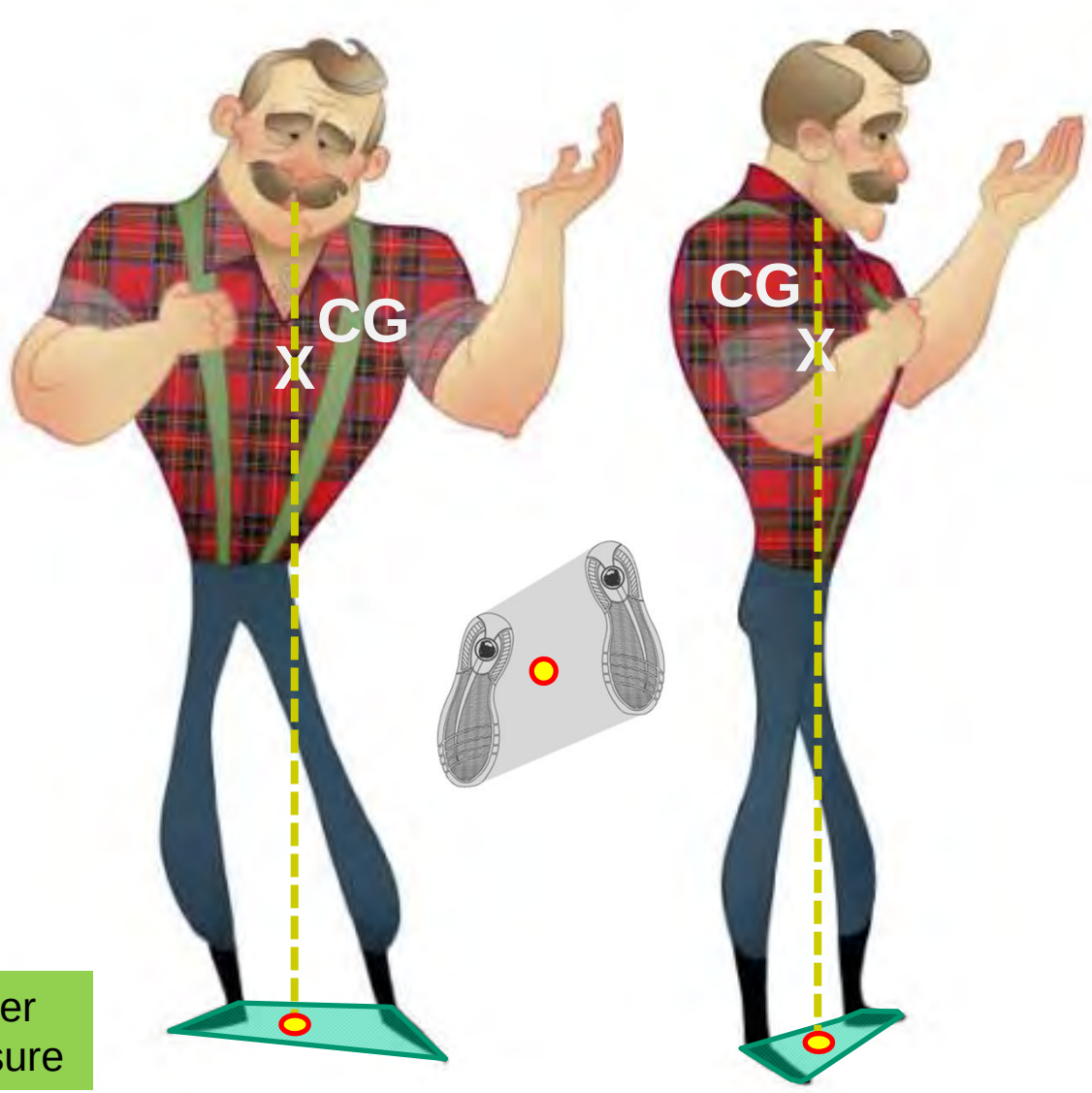




Standing upright, your base of support is the area on the floor around your feet (or shoes).

Balanced Pose

This pose is in balance since the character's center of gravity is over his base of support.



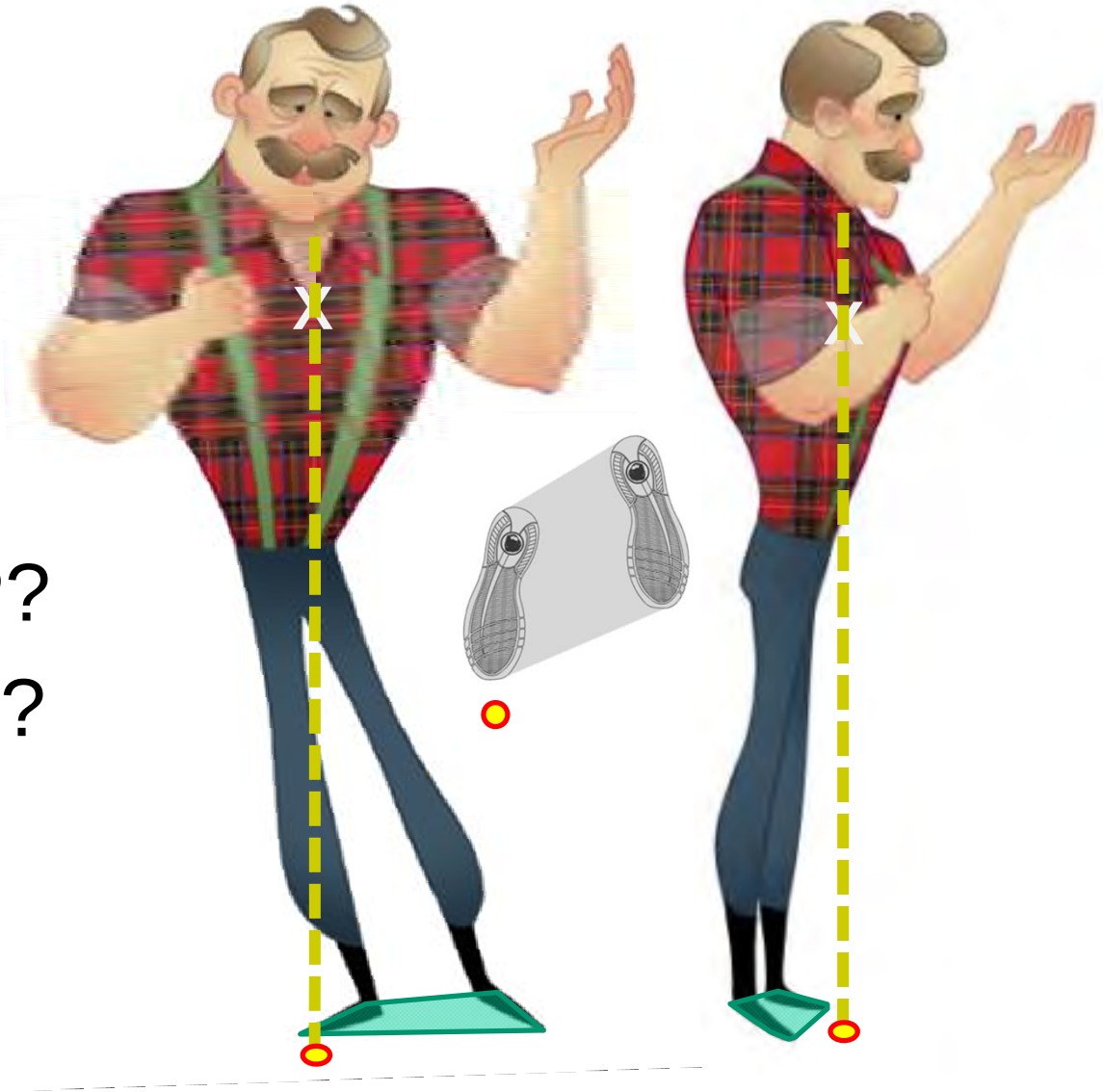
– Center Of Pressure

Unbalanced Pose

This pose is
not in balance.

Where is the CoP?

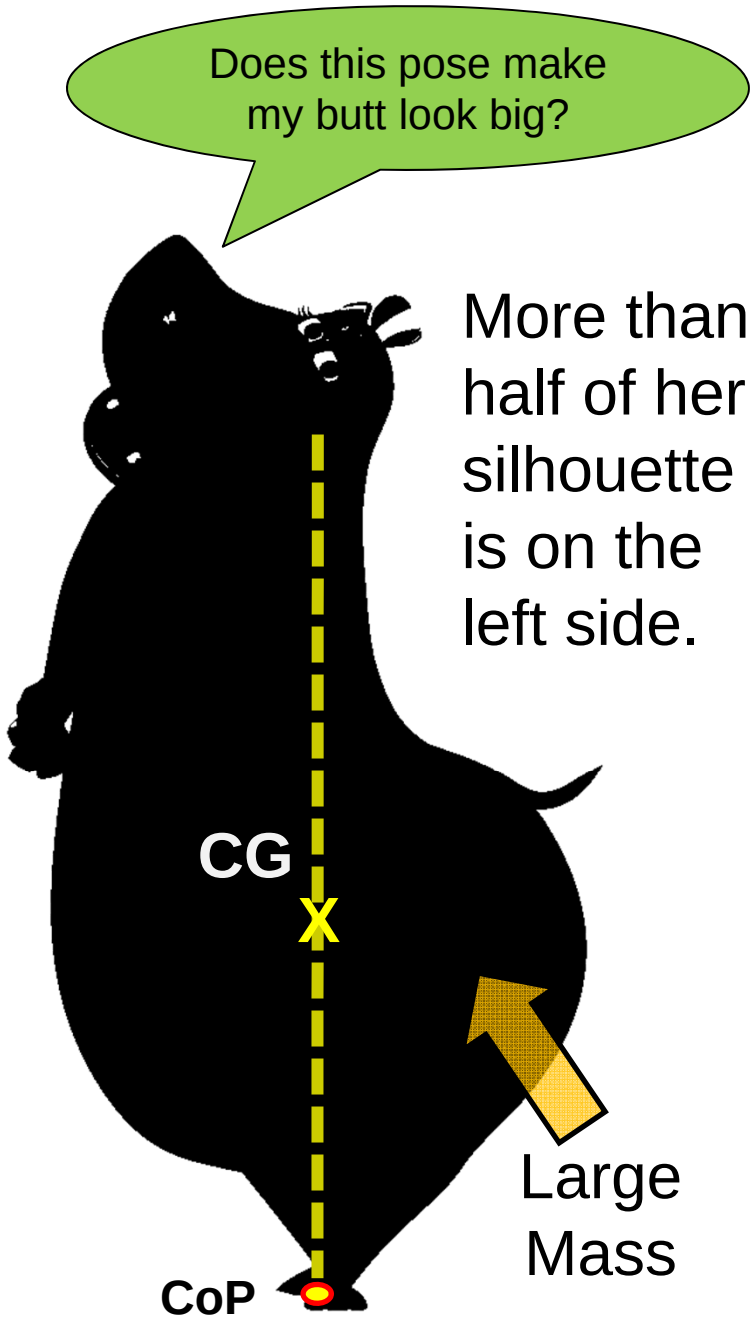
Where is the BoS?



Weight Distribution

The silhouette of this pose suggests that Gloria's lower body (especially her butt) is much heavier than her upper body.

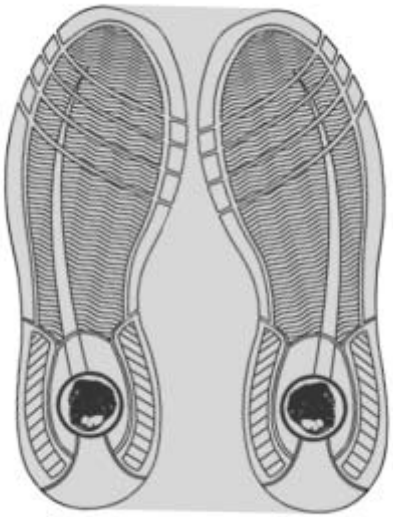
In animating her the lower body should drag (inertia) while her upper body can be more agile.



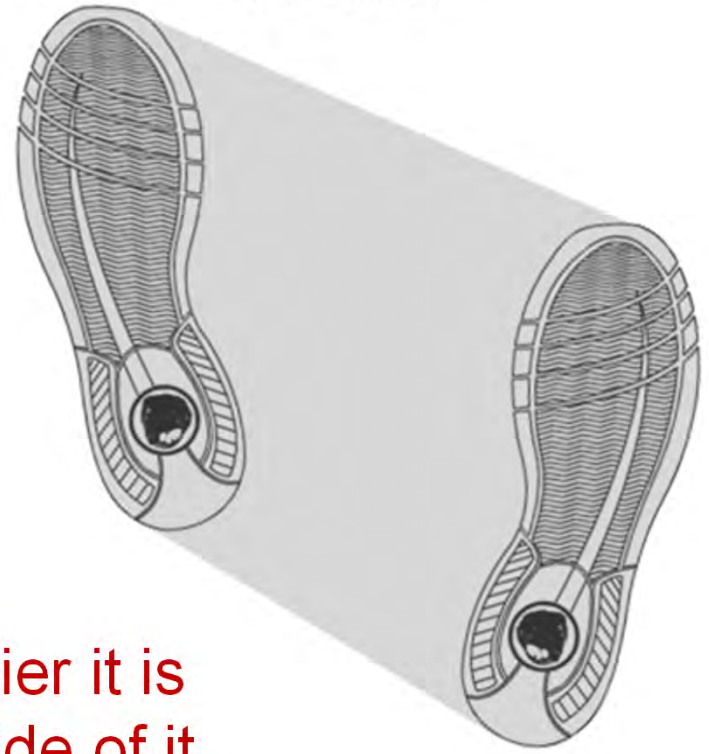
Changing the Base of Support

Can increase or decrease Base of Support.

Feet together



Relaxed

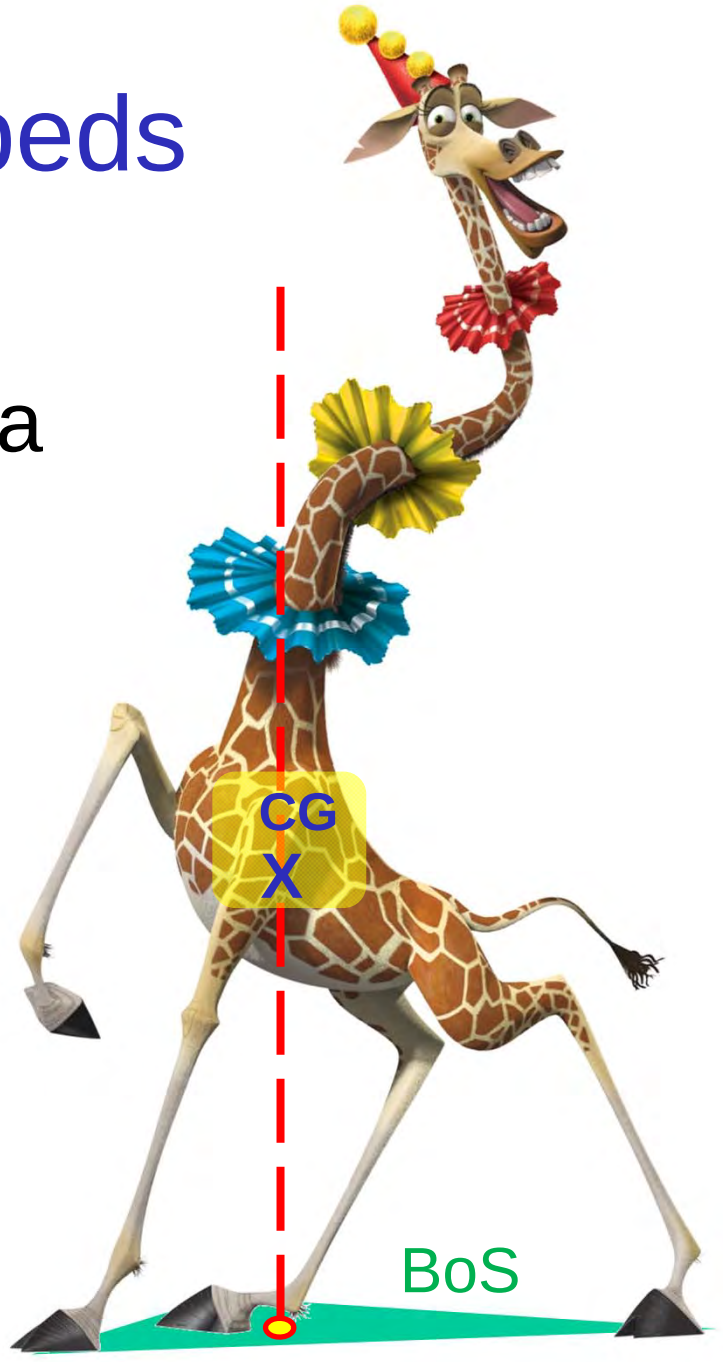


Larger the BoS, easier it is
to keep the CoP inside of it.

Balance for Quadrupeds

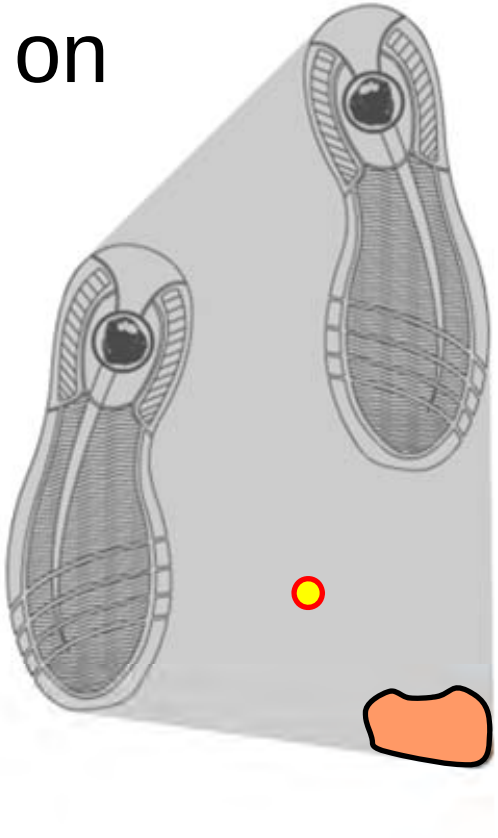
Balance is easy for quadrupeds thanks to a large Base of Support.

Baby giraffe is just learning to stand so it needs a large BoS



Hands and Feet

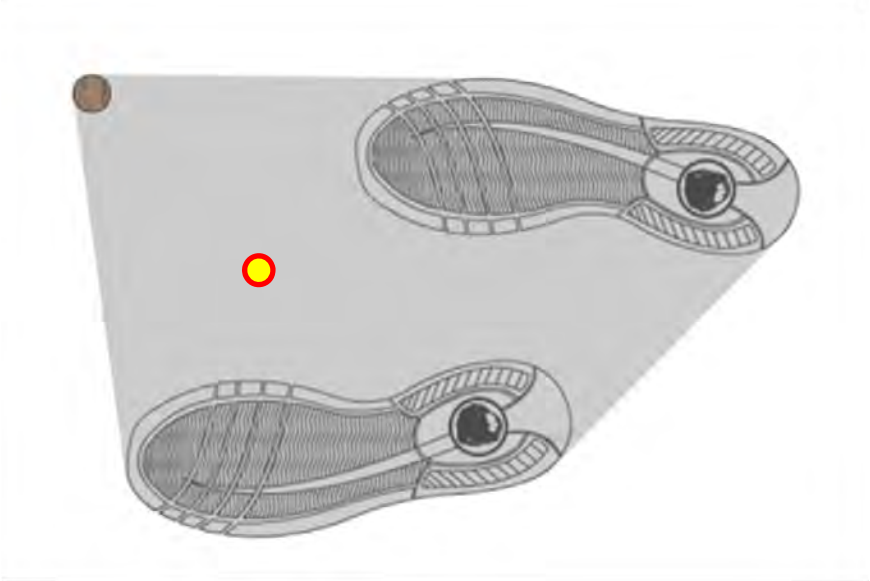
Base of support extended by having one or both hands on the ground.



Using a Support

A cane acts as a third leg, increasing the BoS, which increases stability.

The character leans forward, bringing the CG towards the center of the BoS.



Summary

- Center of Pressure (CoP) is where the Line of Gravity touches the ground.
- Base of Support (BoS) is the area around all points of contact with the ground.
- Character’s pose is in balance if the CoP is inside the BoS.
- The CoP and BoS change depending on the character’s pose.