

# Center of Mass Demonstrations

AAPT 2023



# Ruler, Static Friction, Sliding Friction

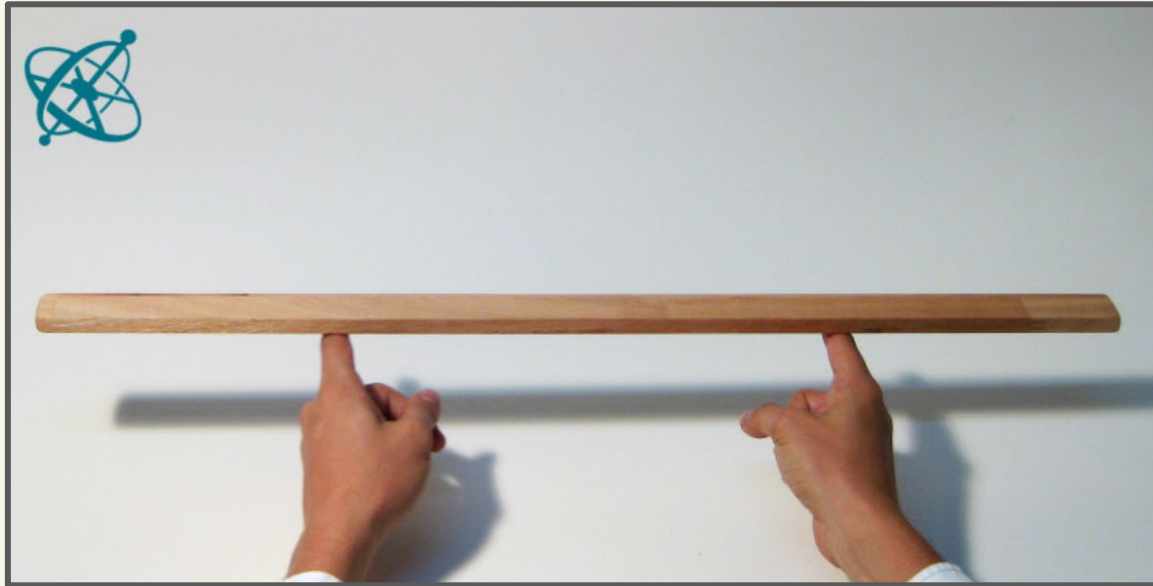


Image credit: [https://www.sciensation.org/hands-on\\_experiments/e5061p\\_selfBalancing.html](https://www.sciensation.org/hands-on_experiments/e5061p_selfBalancing.html)

# Balancing Quarter on Dollar Bill



Video of Dollar Bill: [LINK](#)

# Soda Can Balance

Reference: [LINK](#)



# Jenga Block Tower

Reference: [LINK](#)



# Rolling Uphill

## Honda Cog



Reference: [LINK](#)

# Video of Demonstration





# Can't Get Out of a Chair



[LINK](#) to video



# Can't Get Out of a Chair

*GLUED TO YOUR CHAIR?*



**BET YOU CAN'T GET UP FROM A CHAIR! NO GIMMICKS! NO STRINGS EITHER!**

**THE SETUP:** All you have to do to win is get up from a chair. Sit in a straight-backed armless chair. Keep your back against the back of the chair and put your feet flat on the floor. Fold your arms across your chest. Now, keeping your feet flat and your back straight, try to stand up.

**THE Fix:** We lied about the gimmick. The gimmick is gravity. In the sitting position the center of gravity is at the base of your spine. By trying to stand up with your back straight, you prevent the center of gravity from moving to a position above the feet, which are your support base. Human thigh muscles simply aren't strong enough to compensate for the balance problem during the getting-up period. So you remain pitied to your chair.

[LINK](#) to book

# Can't Lift Leg

**BET YOU CANT JUMP!**

**THE SETUP:** Keep your heels, hips, and shoulders against the wall. Without leaning forward, try to jump. What's the matter? Are your feet stuck to the floor?



**BET YOU CAN'T LIFT YOUR FOOT OFF THE FLOOR!**

**THE SETUP:** Turn your right side to the wall. Turn your right foot and cheek against the wall. Now try to lift your left foot off the floor.

[LINK](#) to book

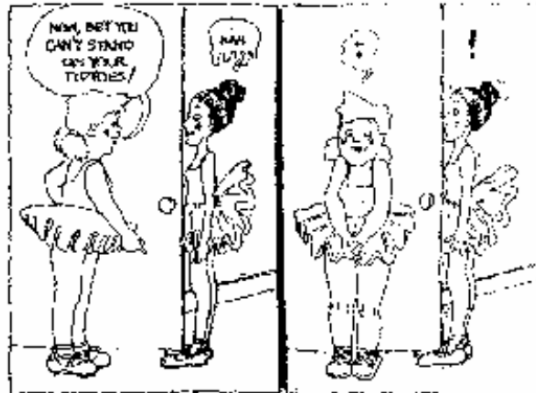
# Can't Stand on Tiptoe

## *ON YOUR TOES*

### **BET YOU CANT STAND ON YOUR TIPTOES!**

**THE SETUP:** Stand facing the edge of an open door. Your nose and stomach should just touch it. Place your feet on either side of the floor slightly forward of the edge. Now try to rise onto your tiptoes.

**THE Fix:** You'll be caught flat-footed on this one. The reason you can't do this trick is because it moves your base of support out from under your center of gravity. In order to stand on your toes, you must transfer the center of gravity forward. To transfer the center forward, you must lean over. The door prevents you from doing this.



[LINK](#) to book

[LINK](#) to worksheet

1. Jenga Block Problem.
1. Minimizing Center of Mass of soda can. (requires calculus\_
1. Balancing Ruler Problem. (requires torque)

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