MoLab Mondays!

Toy Physics: Balancing Bird

MoLab is excited to have the opportunity to stay in touch with our MoFamilies and continue to provide on-the-go, dynamic, hands-on, and inquiry-based science experiences through a mobile laboratory that promotes discovery. Our weekly activities will engage your little investigators with hands-on learning that proves anyone can think like a scientist.

For our ninth installment of MoLab Mondays!, we are going to prove that toys can teach us about the phun of physics! This activity has supplies that will be super easy to round up and it is not messy at all! Enjoy engineering and experimenting with your Balancing Bird!

Tools & Materials:

- Card stock
- Bird template (see page 4)
- Scissors
- Tape
- Pennies
- Markers or crayons (optional)

Creating Your Balancing Bird

- Print the bird template on cardstock. If you do not have cardstock, try printing it on regular paper and gluing it to a piece of thin cardboard like a file folder or cereal box.
- Carefully cut the bird out along the outline. Make sure the bird cutout does not have any folds or creases in it.
- If you feel like it, use markers or crayons to decorate your bird.
- EXPERIMENT BREAK: Try balancing the bird by putting the beak on one finger. Does it stay? If not, where will it balance?
- Use tape to attach one penny to the front tip of the underside of each wing. Try to put them the same distances from the edges on both sides.

- Flip the bird over. Place the tip of the bird's beak on your finger and try to balance it again.

Make Observations and Ask Your Student

- Were you able to balance the bird before adding the pennies? If so, where did you have to place your finger?
- How did adding the pennies change the ability of the bird to balance?
- What explains the difference?
- Try moving your finger around slowly? Will the bird stay balanced?

What's Going On?

For an object to balance, it needs to be supported directly underneath its center of gravity. What is the center of gravity? It is the point where all weight is evenly dispersed, and all the sides are balanced. Before you added the pennies, the bird was not able to be balanced on its beak because the center of gravity is near the middle of the bird. Once you added the pennies, the center of gravity is now located at the tip of the beak which makes it possible to balance the bird on your fingertip.

Dig a Little Deeper

You may have heard of the center of mass which is the mean position of the mass in an object. The center of gravity is the point where gravity appears to act. For most objects, these points are in the same place. But these points are only the same when the gravitational field is even across an object. If you are in a weightless environment, like outer space, center of mass is the correct term. If you hold an object at its center of mass, it will balance.

The Balancing Bird is a great physics toy to demonstrate this phenomenon. It is so well balanced because the center of mass is well planned. It maintains its equilibrium, or balance, at nearly all times. That is why it was able to stay on your finger when you slowly moved it around. Equilibrium is a state which opposing forces are balanced.

Looking at the bird from above (tail towards you), it appears that most of it is 'behind' the balance point. However, the wing tips are just 'ahead' of the beak. The extra weights are in this area just 'ahead' of the beak which is the perfect position to equal the mass of the rest of the bird. Additionally, this location allows the weights to exert a good bit of rotation to the entire bird. It is like having a set of levers that act on the body of the bird, constantly working to return it to a level attitude.

A simple way to find the center of mass in other objects it to find the balancing point. For example, you could try to balance a ruler on your finger. The center of mass for an object that is uniform will be in the exact geometric center. Try finding the center of mass for a broom or a pencil. If the object is an irregular shape, the center of mass will be closer to the heavier end.

Where is your center of mass?

Try This: Bet You Can't

There are a lot of things that the muscles in your body can do, but they cannot do everything. Try this activity which demonstrates that some things that you ask your muscles to do are not as easy as they seem. You just need a straight-backed armless chair

Here is what you do:

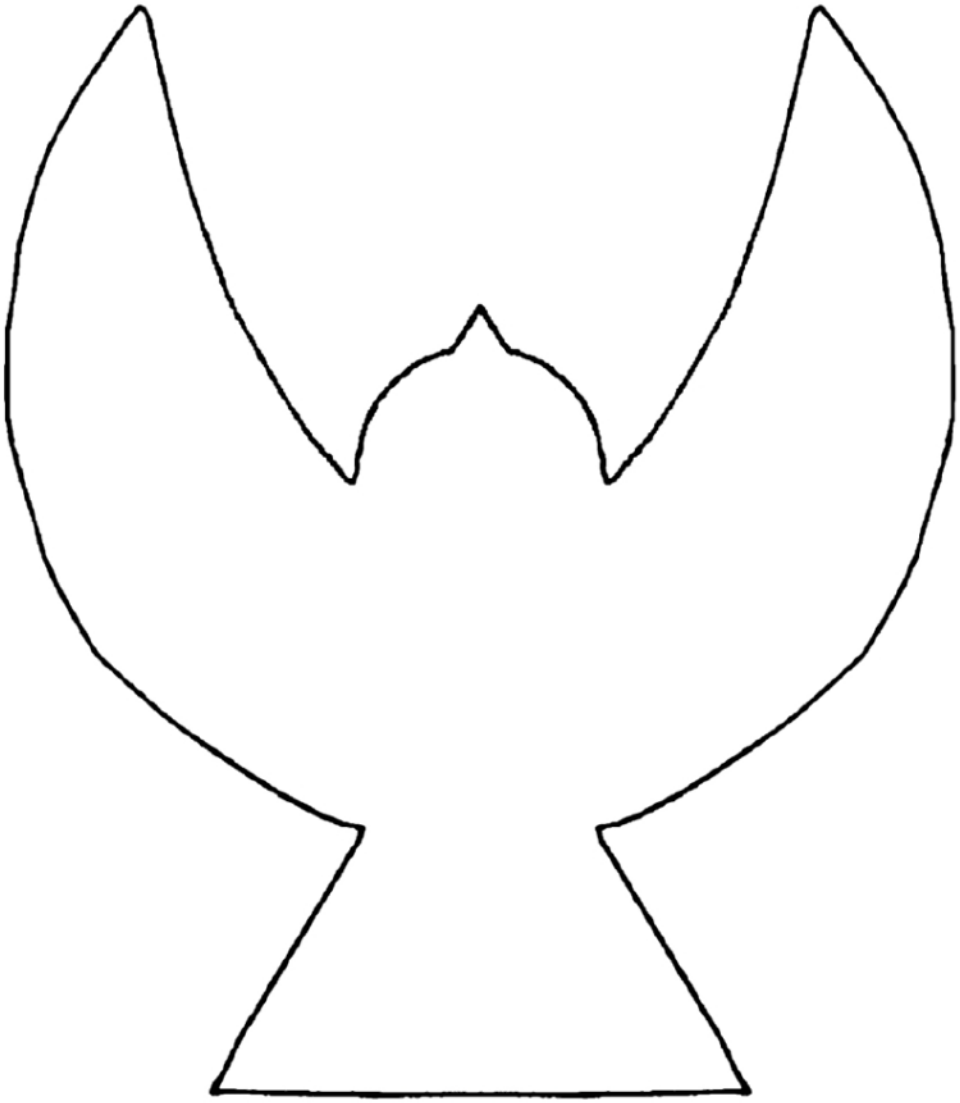
- Sit in the chair. Keep your back against the back of the chair and your feet flat on the floor.
- Fold your arms across your chest.
- Keeping your feet flat on the floor, your back straight, and your arms crossed, try to stand up.

You will not be able to stand up, no matter how hard you try. In the sitting position, your center of gravity is at the base of your spine. The center of gravity is the place where the effect of gravity seems to be concentrated. By trying to stand up with your back straight, you stop the center of gravity from moving to a position over your feet, which are your support base for standing. Human thigh muscles are not strong enough to compensate for the imbalance of the center of gravity produced in this situation, so you remain glued to your seat.

Extension Activity Ideas

- Try balancing your bird on other objects.
- Further explore the center of mass and identify it in other objects. Does the center of mass have to be a physical space? Where is the center of mass in a donut?

Happy Experimenting from MoLab, Inc!



Bird Pattern