Mobiles

When you sit on a see-saw, it's usually with your friend. You can both go up and down. But what if your dad sits on the see-saw? Could you both go up and down? No!

What is the difference? Well, your dad is much bigger than your friend! The see-saw cannot balance.

In this learning at home exercise, we will explore introductory ideas in physics and engineering. We will look at differences in weight and distance, and how those affect balance. But this won't be a diagram or equation—we will explore balance as a way to create beautiful, living sculptures. Alexander Calder became one of the most famous artists of the 20th century by playing with weight and distance!

In this activity we will get crafty while experimenting with weight and distance, and create fun hanging sculptures.

Mobiles

Activity 1: Basic Balance

Objective
An introduction to the physics of balance; using trial and error to intuitively understand how weight is distributed in relationship to a fulcrum point.

Ages: 5 - 9 years

Materials and Preparation
Gather and prepare the following items:

Sticks
Take a walk! And gather some small sticks from outside. Or if you have some sticks at home—be creative! This could be straws, or paint stirrers, or a dowel. We painted our sticks white, which you can paint yours any color—or just leave them as is. Lighter weight works well.

String
This can be yarn or string; thin and strong works well.

Objects for hanging
Cardboard, macaroni, beads, fabric scraps all work well here. We painted our scraps, and poked holes in the cardboard and the fabric scraps in order to thread the string through. Be mindful of keeping things light-ish; but with enough of a variety so that some items feel heavier and others feel lighter.

Preparation
Thread the string through the objects, so that it is a loop that can easily be placed on a stick. (see image below)

Process

1. Take the stick and ask the child to hold it—Can you balance this stick on one finger? Let the child try and experiment, and try to balance the stick on their finger. As they work through balancing the stick—discuss how we try to balance the stick—do you move your finger along different parts of the stick, and intuitively check for balance?

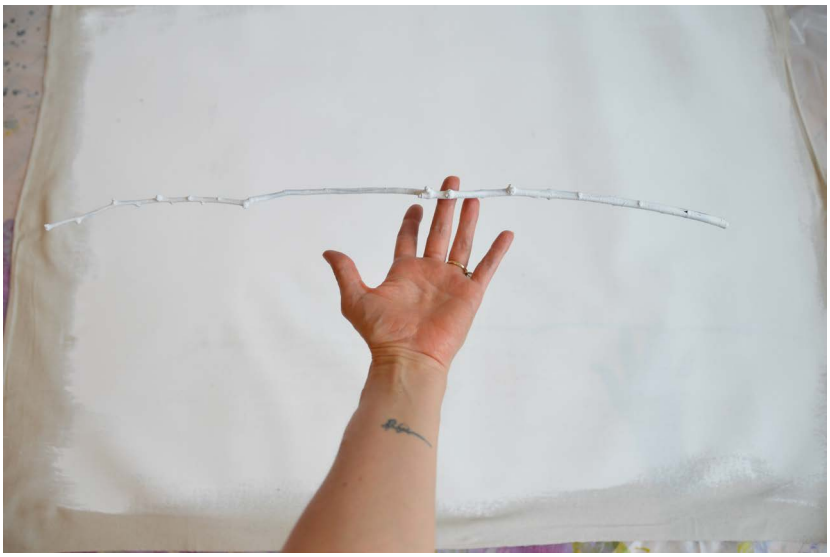
2. When the child (or together with help) can balance the stick on a finger, notice this spot. This is a very special spot on the stick! On either side of this point, the stick is balanced—it appears level and isn't dipping down to either side. *Why is that?* It is because we have balanced the weight.

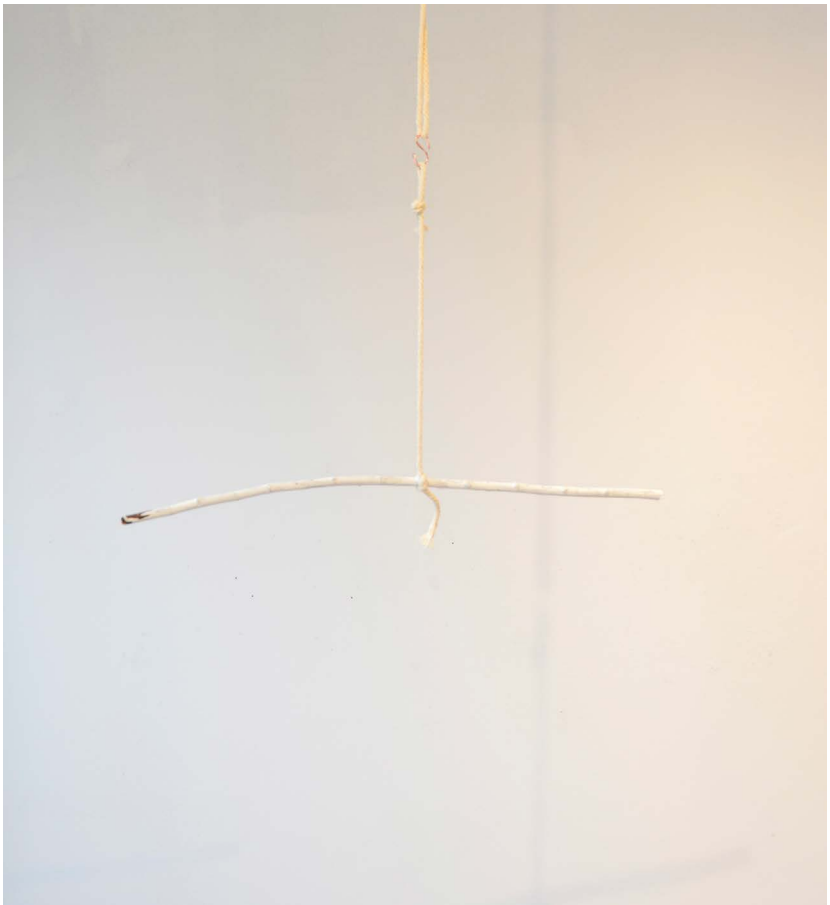
Now if you are using a uniform stick, such as a dowel or a straw, this point will be in the exact middle; however, if you are using a stick from outside, it is likely not in the midpoint. Why?

This special point—the point at which both sides are balanced and we will—is called a fulcrum. Imagine a see-saw... If no one is on the see-saw, it can balance and both sides may be level. But if one person gets on one side, that side will fall to the ground. What happens if two people who weigh exactly the same both get on either sides of the see-saw?

3. When you have identified the fulcrum point, tie a string there; leaving a loop at the top so that you can hang it.

4. Find a spot in the house where you can hang the stick. This could be from a ledge or from a coat rack, or with a hanger. If you hang it from something you may need to secure it with a weighted object. Be creative and find the solution that works with what you have.





5. When the stick on the string is hanging, we can imagine adding items to each side—but we will need to make sure that they are balanced; just like the see-saw!

6. Take two items that you have strung onto string. Ask the child to hold them, one in each hand, and looped on their fingers. *Which one weighs more?*

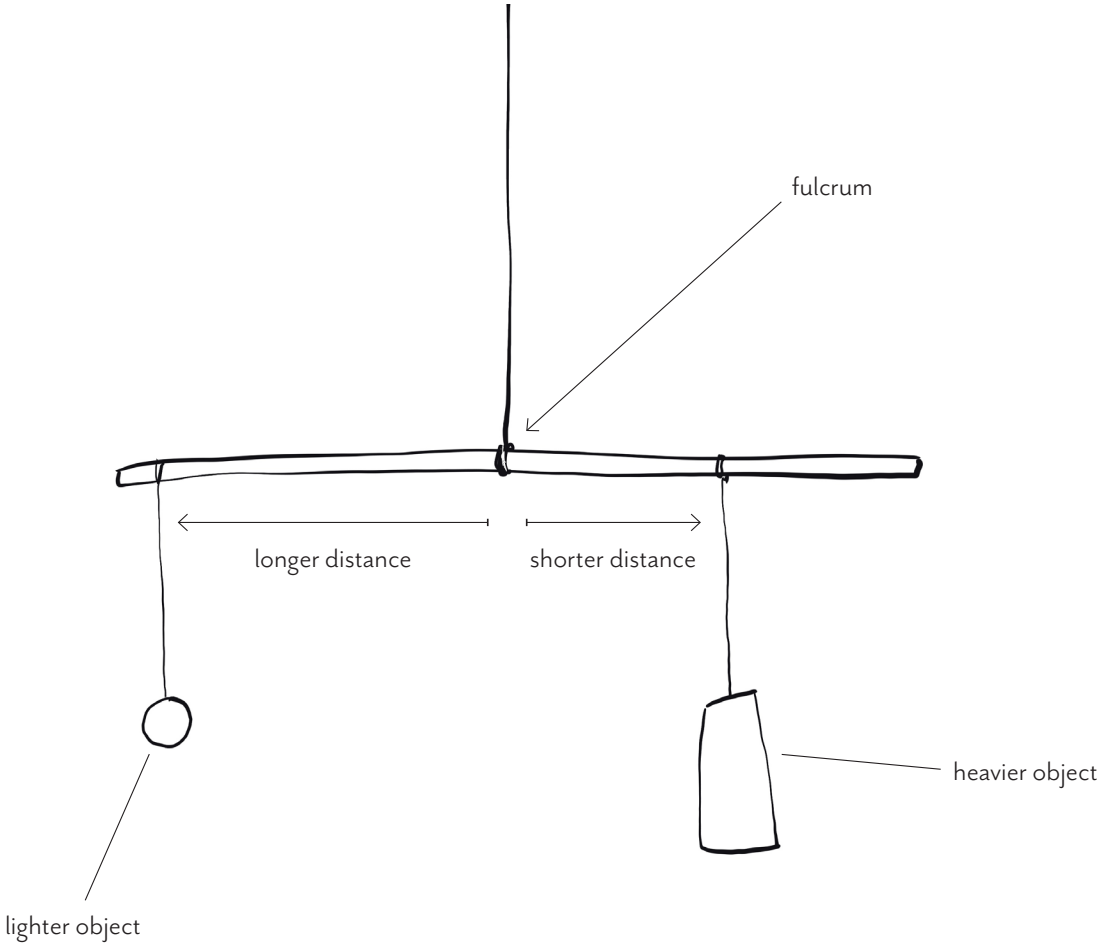
Here's where this gets really exciting! And different from our see-saw example...

We have two objects that we want to hang from our stick, but we want them to be balanced so that our mobile hangs evenly and doesn't go crashing on the ground! But we have two objects that are different weights—one is heavier than the other.

We can place objects on our stick, and these items have weight. **But *where* we place them is also important!**

When we are balancing two items on our stick, where we place them in relation to the fulcrum will affect how the weight is distributed.

Here's what we mean...Take the two items, and carefully (and with the help of another person/parent) loop the items on the strings on the stick. Now, which one is heavier? The further away from the fulcrum, the more the item will pull the stick downward. So we will place the heavier item closer to the fulcrum point. By adjusting the distance from the center, we can balance to objects—even though they have different weights!



When making our mobile, we are aiming to keep the rod horizontal, so that it isn't pulled down in either direction. The heavier an object that we hang from it, the more it pulls that rod down. But it is not just the weight of the object that matters, but also the location at which we place it. So we can balance objects that have different weights, by adjusting where we place it along the stick.

The greater the distance that we place an object from the fulcrum (center) of the stick, the greater the pull it has downward.

Going Further

This works well with older children who can work independently, or with a bit of assistance from parents for the younger ones.

When you have objects balanced on the stick, what more can you add to it? What if you had another stick, with objects hanging from it— just like before—could you find a way to balance new objects on the stick?

TIP

We can think of these additional sticks and items as a single unit, so that each of these elements is first balanced before adding to the entire system.

We want to create equilibrium in each sub-unit, and then consider it like a weight that we add to the entire system. You can see how it becomes complicated very quickly! But we are not concerned with specific measurements, and calculations—rather this activity is meant to stimulate an intuitive exploration in how these concepts work, so that the child is learning through doing, and failing! Be patient, and work slowly, and don't worry if the objects fall—failure is a necessary part of the process!

Extensions

1. Draw a diagram of the mobile
2. Continue to add more objects to the mobile, adjusting the whole system.
3. Take turns, so that it becomes a game, back and forth—each person adding an element, and adjusting the mobile to remain in balance.
4. Create thematic mobiles: space, ocean, airplanes and clouds, etc.