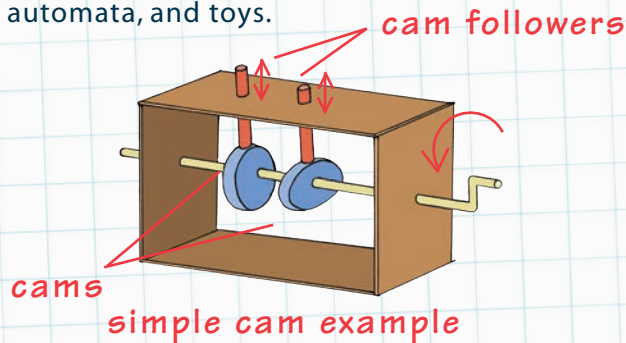


Activity 3

Crank It Up

DESIGN AND CREATE YOUR OWN UNIQUE MOVING SCULPTURE!

Machines help us get work done; some are complex, with lots of moving parts, and others are simple. Cams are one example of a simple machine. They are like gears, but have no teeth and come in lots of different shapes. We use them to convert rotating motion (such as turning a crank) into back and forth motion (such as waving an arm). You'll find cams in everyday objects such as cars, music boxes, wooden automata, and toys.



You'll Need:

- ◆ hot glue gun and hot glue sticks
- ◆ extra wooden skewers
- ◆ optional: decorative elements (e.g., construction paper, pipe cleaners, feathers, markers, cloth, tissue paper)

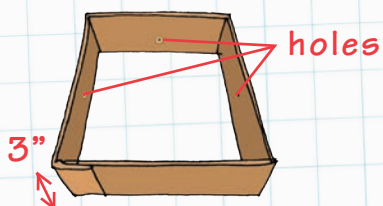
For each small group

- ◆ small cardboard boxes (roughly 6 in. x 6 in. to 10 in. x 10 in.) or one shoebox
- ◆ 1 piece (at least 4 in. x 7 in.) of ¼ in. (or 6 mm) thick foam (available at craft stores)
- ◆ 2 wooden skewers
- ◆ 1 plastic drinking straw
- ◆ masking tape
- ◆ ruler
- ◆ scissors
- ◆ pencil and paper

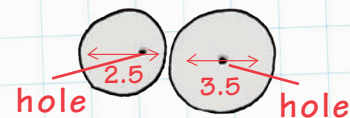
2+ hours

SMART START:

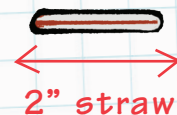
- ★ Before doing this activity with your girls, build your own machine and experiment with different size and shape cams to understand the possible variations.
- ★ Cut each box into frames at least 3 in. tall so there is one for each group. If extra support is needed, cut triangles for the corners.



Each prototype requires two foam circles (3.5 in., 2.5 in. in diameter). The 2.5 in. circle should have an off-center hole.



Each prototype needs a straw cut into 2 in. sections. Make sure to cut extras!



Crank It Up continued

Part 1 Build a prototype

Here's how:

1. Introduce simple machines. Allow girls time to play with or watch videos of automata that use cams. ²Brainstorm a list of machines that use cams.



POINTER: Examples (or videos) of automata and cams can be found on the Exploratorium's Tinkering Studio page (tinkering.exploratorium.edu/cardboard-automata/) or by searching "paper automata" on youtube.com.

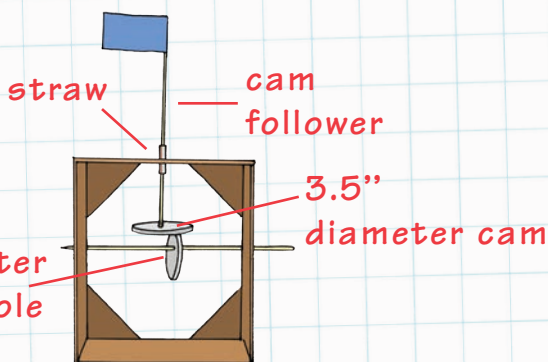
- ★ Try decorating the cam follower so the movement is easier to see.
- ★ Have your girls explore what happens when the cam is rotated.
- ★ Brainstorm what would happen if you change the shape of the cam, the placement of the hole, etc.

3. Analyze. Reconvene the girls into a large group to discuss the different parts of the prototypes. ⁶ What makes the cam follower rotate? What could you change to make the cam follower movement more interesting (the shape of the cam, the location, the number of cams, or the number of cam followers)?

Part 2 Build a complex machine

Use care when working with hot glue.

2. Build a Prototype. Divide the girls into small groups ¹ to build prototypes and learn about how cams and cam followers (a lever that follows the surface of the cam) work together. (See below.)



4. Be creative. Present the **SciGirls Challenge:** Using the prototype as inspiration, brainstorm and then build a moving sculpture that tells a story or performs a task. ³ Examples include machines that mix a cup of chocolate milk, illustrate a concept (a flower growing, a bee pollinating), move a pencil so that it draws on paper, or acts out a favorite story or poem.

5. Share. Have each group demonstrate how their moving sculpture works. Encourage the girls to have fun with the demonstration and use their imagination. ⁴ Make sure each group explains how the different parts work together in the final design. ⁶

Adapted from the Exploratorium's cardboard automata activity at tinkering.exploratorium.edu.

Supported by:



& PPG Industries Foundation

¹⁻⁷ See **SciGirls Seven** strategies on page 3.