

Cardboard Automata

The Cardboard Automata activity was inspired by



Cabaret Mechanical Theatre

PIE Institute shares a playful and inventive approach to teaching science, art, and technology.

Cardboard Automata are a playful way to explore simple machine elements such as cams, levers, and linkages, while creating a mechanical sculpture.



Working with simple materials, this activity is easy to get started, and may become as complex as your mechanical sculpture ideas.

TRY IT! Collect these things:

Cardboard box 15x15cm (6"x6")
scissors, masking tape,

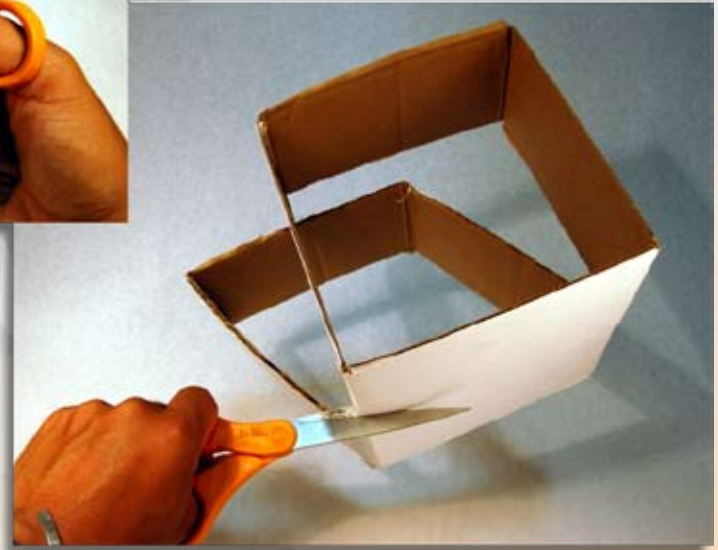


nail or screw, drinking straw, hot melt glue, glue gun, skewer stick, thick (6mm) Foamies* nut or washer (optional), materials for decoration, thin (2mm) Foamies* markers/pens, feathers, pipe cleaners *(craftsuppliesforless.com)

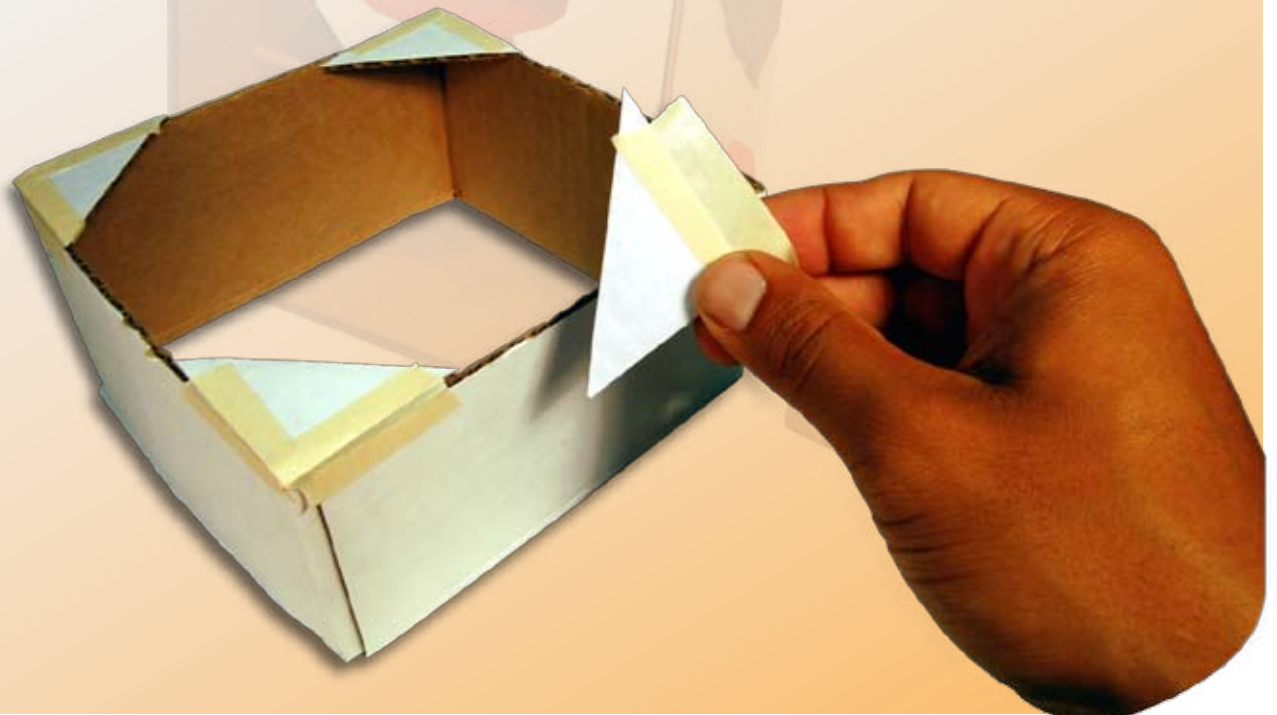
MAKE A FRAME



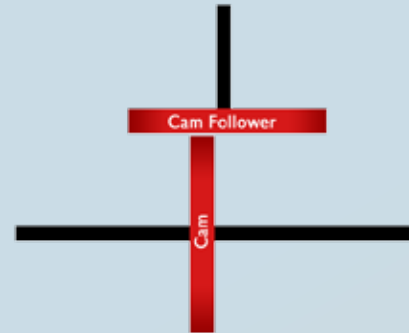
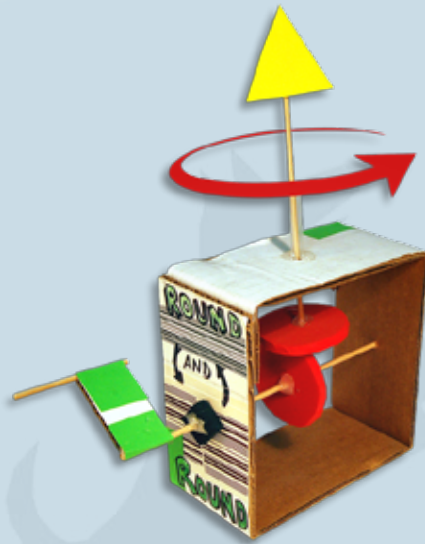
Cut the flaps off the box,
then cut the box in two pieces
(you get two frames from each box)



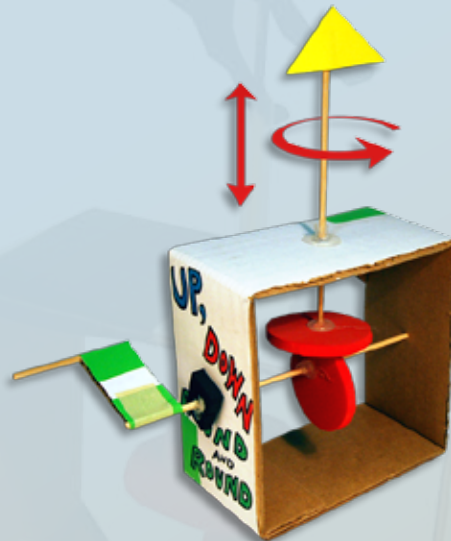
Cut triangles out of the
flaps and tape them into each
corner of the frame for support.



Choose a Motion



Round and Round



Up and Down, Round and Round

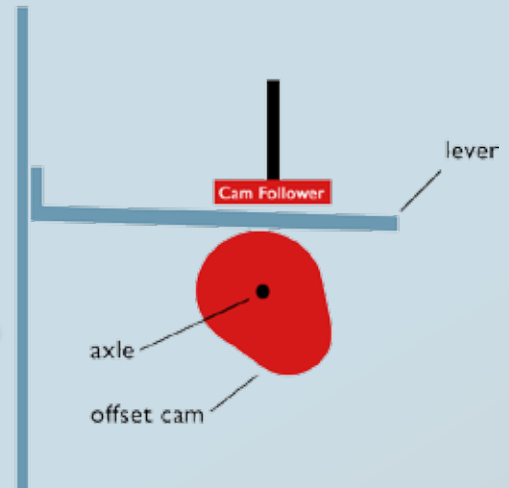


Up and Down, Back and Forth

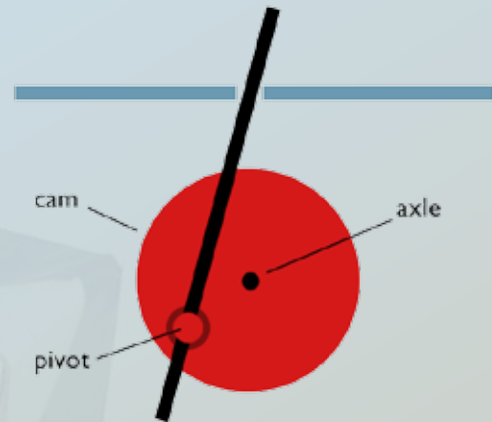
More Options



Up and Down



Side to Side

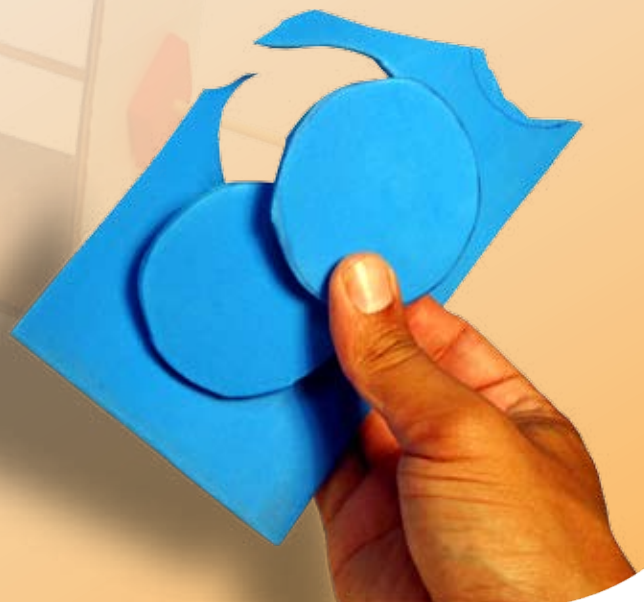


MAKE THE CAMS

Draw your cam and cam follower on the thick Foamie sheet, and cut them out.

The cam should be about 2.5" (6cm) in diameter.

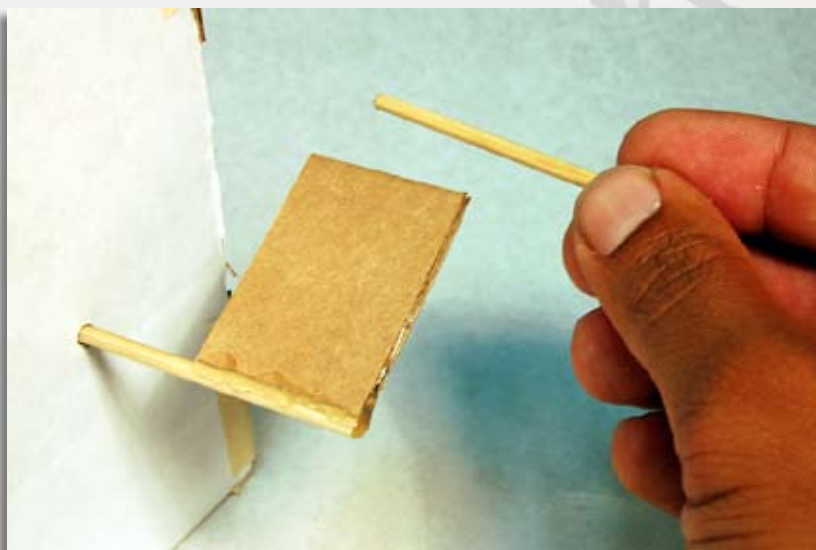
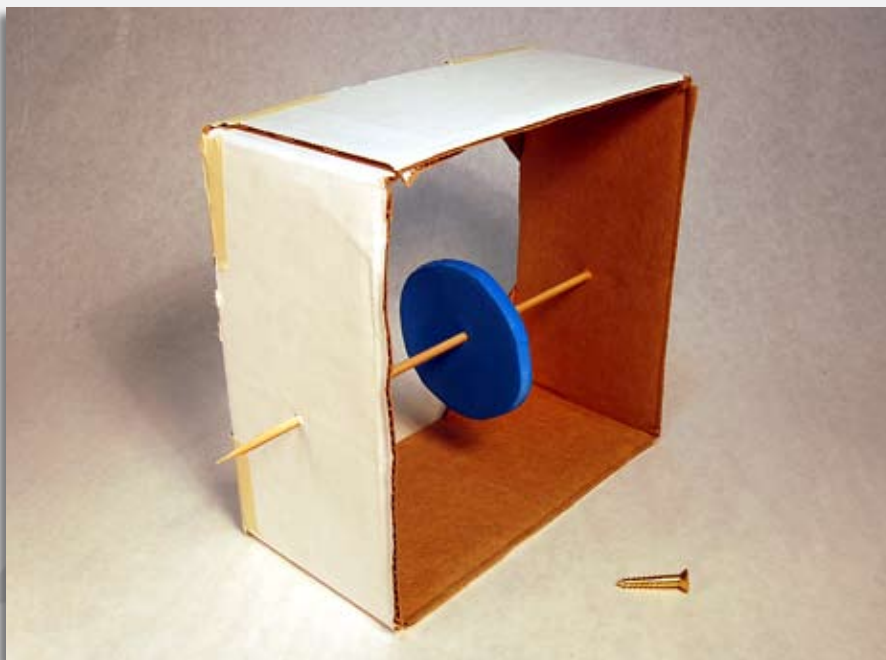
Tip: Cut the cams smoothly, and make sure the cam follower is a little bigger than the cam.



Make the Axle

Put your cam on a skewer stick inside the frame.

Tip: Start the holes in the frame using a nail or screw, and make sure the cam clears the top and bottom of the frame.



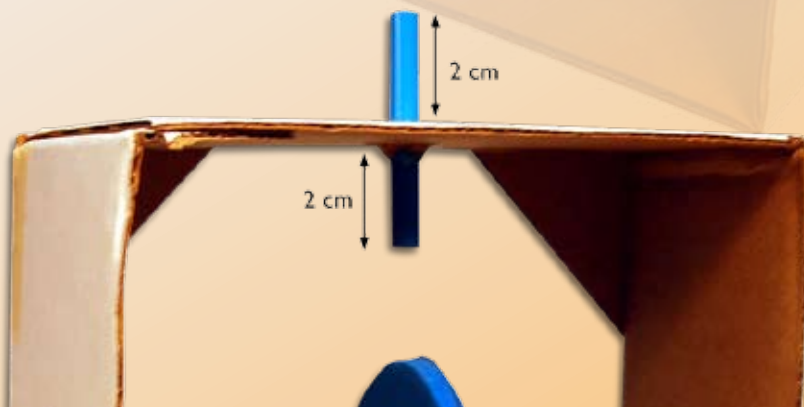
Make the Handle

Glue a small rectangle cut from the cardboard box flap to the skewer stick axle.

Glue a second piece of skewer stick to the end of the rectangle to make a handle.

Add the Cam Follower

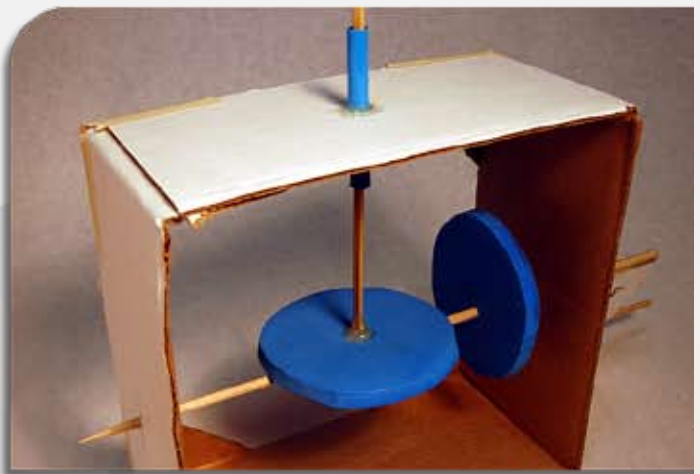
Poke a hole in the top of the frame where you want your cam follower to be located, and insert a drinking straw. Carefully glue the drinking straw in place.



Tip: Use a pencil to make the hole large enough for the drinking straw.

Glue your cam follower on the end of a skewer stick and put it through the straw.

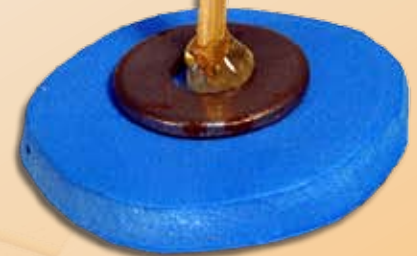
Tip: The straw will keep the skewer stick from falling over.



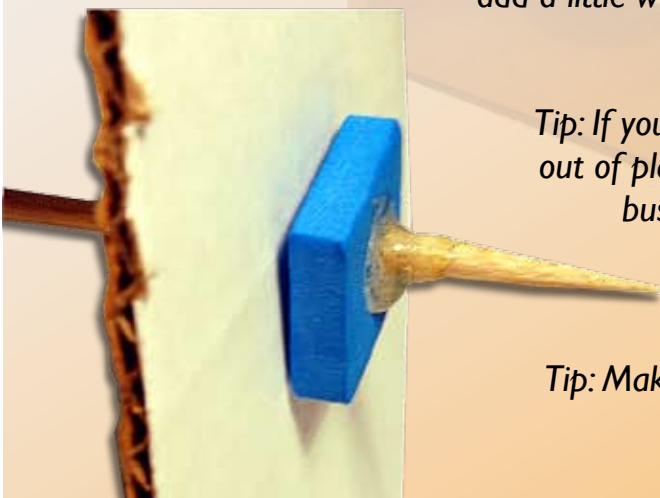
Test it!

Adjust your cam under the cam follower until you get the motion you like, then **GLUE** the cam into place on the skewer stick axle.

Tip: If the cam follower does not fall on the cam, attach a washer or nut to add a little weight.

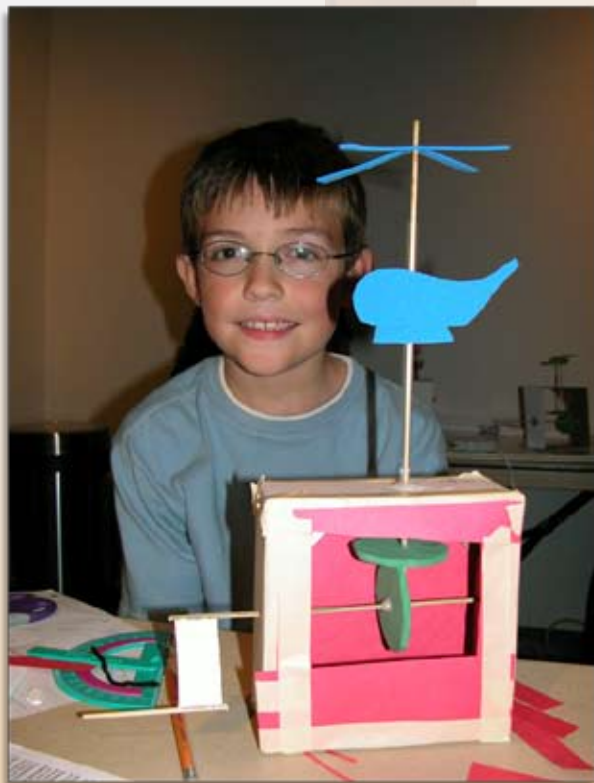


Tip: If your cam and axle move out of place, add a small bushing made from a scrap piece of a thick Foamie.



*Tip: Make sure to glue the bushing to the axle and **NOT** to the frame.*

DECORATE YOUR AUTOMATA



TAKING IT FURTHER

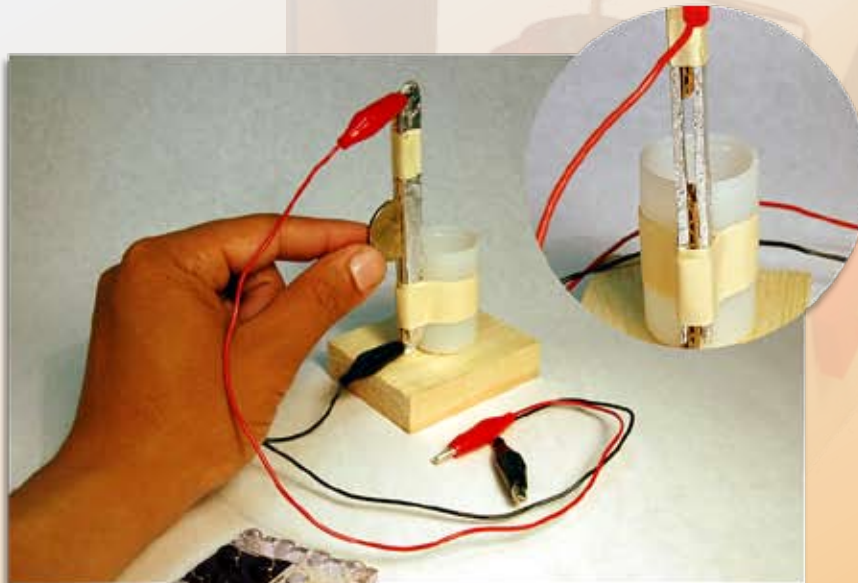
You can build automata out of a variety of everyday materials.



MAKE YOUR AUTOMATA COIN OPERATED:

Make a coin detector switch from three popsicle sticks, aluminum foil, masking tape, and a PicoCricket resistance sensor.

www.picocricket.com



Program a PicoCricket to send power to a LEGO motor when it detects a coin completing the circuit in a coin detector.



The skewer stick axle fits nicely into a LEGO motor.



WHY IS THIS A PLAYFUL AND INVENTIVE EXPLORATION?



- A playful and inventive approach to learning simple machines

This is a playful and inventive way of exploring levers, cams, cam followers, linkages, and other mechanisms.

- Science and art connections

Cardboard Automata are a good example of integrating science and art into an activity. For learners, the narrative, decorated aspects of the automata are as important as the mechanical elements.

- Connections to other activities and the real world

This activity is a good introduction to a variety of mechanisms and systems found in other PIE activities, and in the real world.

RELATED IDEAS

Peter Markey is an artist who often makes whimsical automata out of wood, utilizing cams and cam followers as his main source of movement.

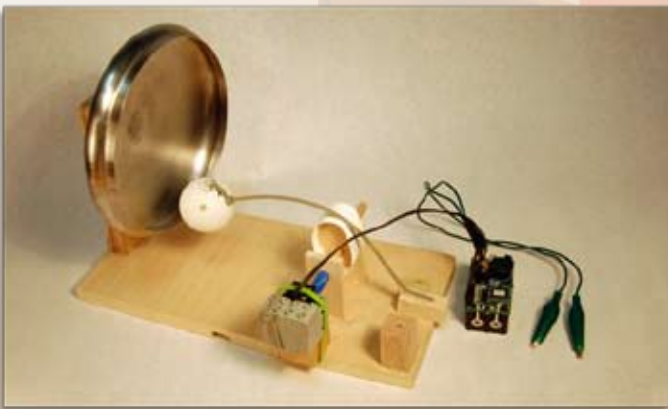
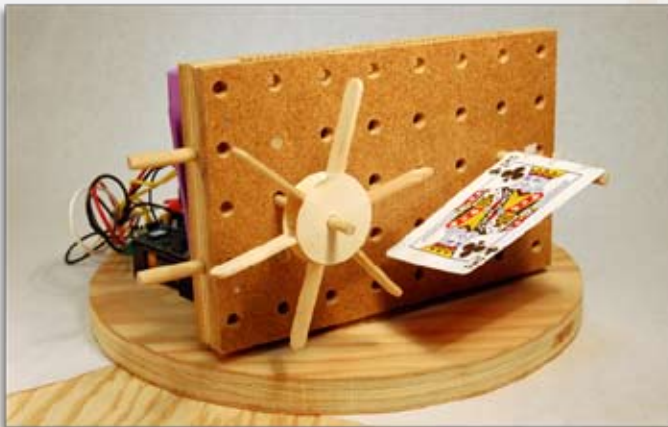
www.focsle.org.uk/first/markey

www.cabaret.co.uk/artists/markey/htm



The Cardboard Automata activity is a good introduction to another PIE activity called Sound Automata. Sound Automata introduce the idea of creating automata out of everyday objects in order to generate a variety of sounds and noises.

Download the [Sound Automata Activity PDF](#) from the PIE website.



This material is based on work supported by the National Science Foundation under Grant No. ESI-04-52567. Any opinions, findings, and conclusions, or recommendations expressed in this material are those of the author(s) and do not necessarily reflect those of the National Science Foundation.