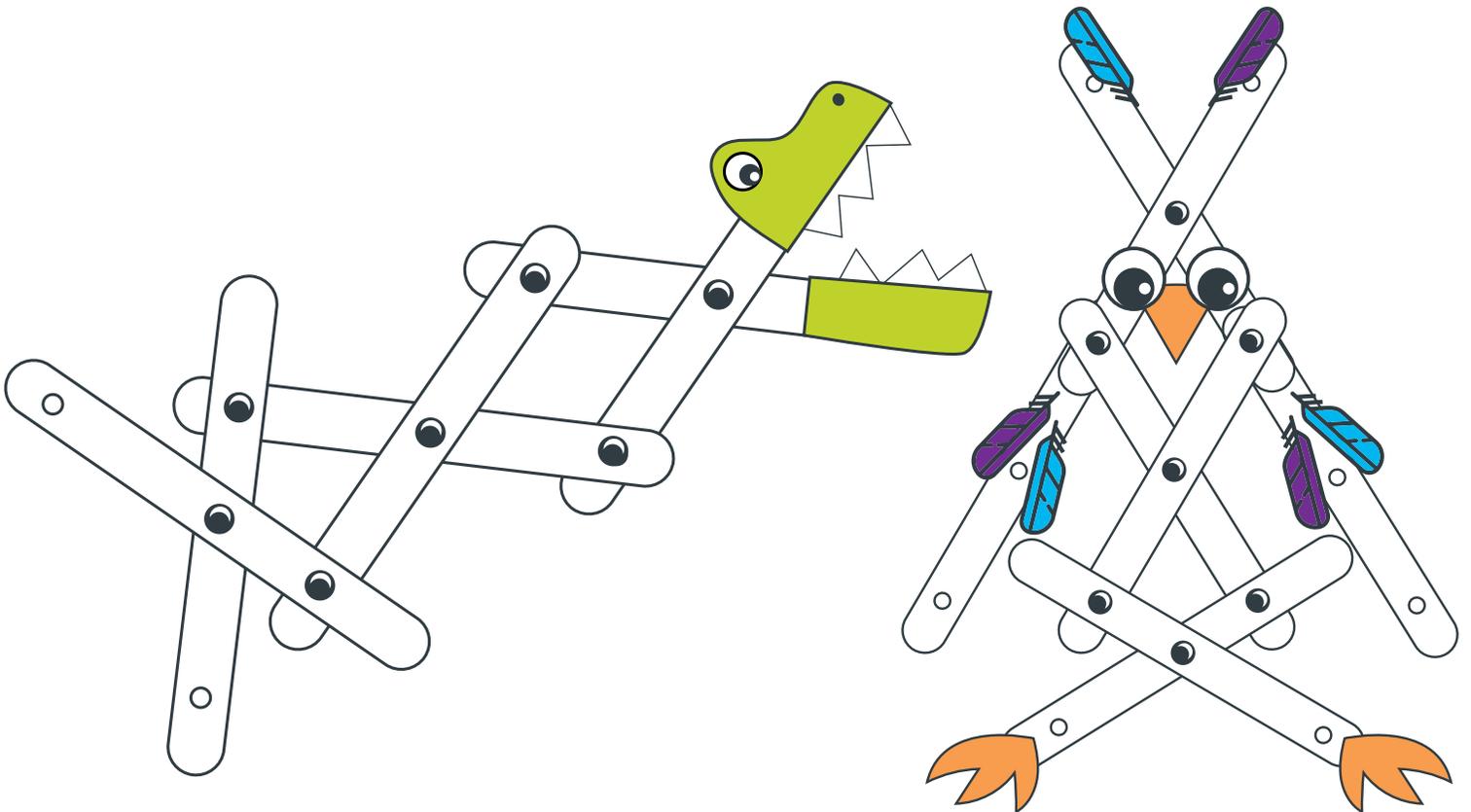




**Who says all the fun has to happen at The Tech Interactive?  
This DIY engineering activity can be done with inexpensive  
store-bought supplies and things you find around the house!**



## Introduction

What do folding chairs, scissors, window hinges and puppets have in common? They all use linkages! Linkages are a group of parts connected by hinges that allow each part to rotate and move. Some linkages, like scissors, are simple, while others can be more complex, like the mechanical characters in amusement parks. This activity is an open-ended exploration of linkages and the types of motion they can create.

## Design Challenge

Design a whimsical creature using cardboard linkages.

Try to create surprising movements (think flapping wings, dancing robots, and chomping sharks).

### Subject:

Design Thinking

### Age:

8+

### Time:

20+ minutes

### Key Concepts:

Engineering design,  
motion, structure, simple  
machines (levers)

## Materials you can use

Find a couple items from each category. Don't limit yourself to the objects on this list. Use whatever you have on hand — be creative!

Structural pieces	Fasteners
<p>Cut cardboard strips from:</p> <ul style="list-style-type: none"><li>• Mailing boxes</li><li>• Cardboard food / drink packaging</li></ul> 	<ul style="list-style-type: none"><li>• Paper fasteners</li><li>• Twist ties</li><li>• Pipe cleaners (chenille stems)</li><li>• Rubber bands</li><li>• Cotton swabs</li><li>• Paper clips</li></ul> 
Items to add personality	Tools
<ul style="list-style-type: none"><li>• Construction paper</li><li>• Yarn</li><li>• Scrap cloth</li><li>• Crafting materials (e.g., googly eyes, pom poms, etc.)</li></ul> 	<ul style="list-style-type: none"><li>• Hole puncher</li><li>• Pencil</li><li>• Tape</li><li>• Scissors or utility knife</li><li>• Hot glue (optional)</li></ul> 

## Instructions

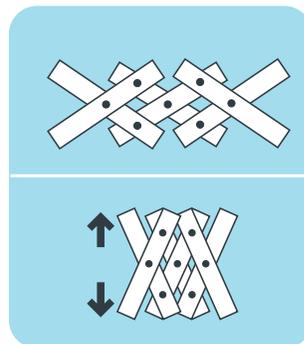
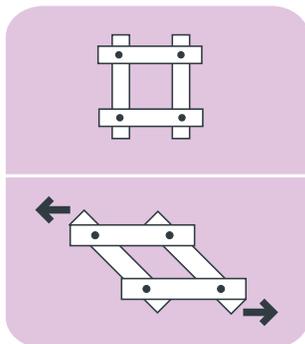
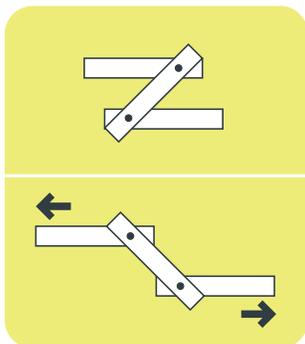
### Prep your materials

- Check out our Materials Prep page at the end of this guide to see our best practices and tips for gathering and preparing materials. This is a great step to do ahead of time so you can get into a creative flow when designing your character!
- To get started, you will need
  - 10-15 prepared cardboard strips
  - 10-20 fasteners (combining different kinds of fasteners is okay)



### Imagine and Explore

- Once you've gathered and prepared your materials, it's time to start exploring some possible motions for your character.
- Try making some of the common linkage designs below or experiment with your own designs. Connect your cardboard strips together using your fasteners as pivot points. Once connected, your strips should be able to rotate freely.
- As you observe how each linkage design moves, imagine possible characters that you could create. Does it have flapping wings? A wiggly head or tail? Bending legs? A mouth you can open and close?



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## Create and Iterate

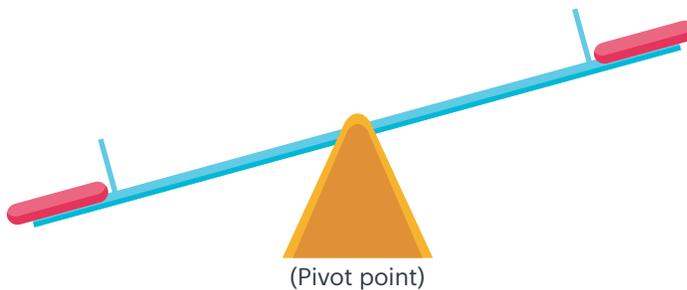
- Now that you've experimented with a few different types of linkages, focus on the character you want to design. Prep more materials as needed.
- Start creating your character with the cardboard strips and fasteners.
- If you find yourself stuck, try experimenting, or iterating, on a simple linkage by connecting more cardboard strips and observe how they change your character's movement.

### Add Personality

- What kind of personality does the motion give your character? Tell your character's story visually with color and accessories.
- Once you're finished, you can share your character and its story with others!

### Top Tips

- Linkages are actually made of multiple simple machines called levers. A lever is a bar that has a hinge, or pivot point, which allows it to rotate. Some common examples are door handles or seesaws.



- If you look at the character you have just created, each cardboard strip (bar) with one or more fasteners (pivot points) is acting as a lever. Connecting multiple levers together by their pivot points is what gives your character its whimsical motion.



### Explore More

- Play with the length of the cardboard strips. Try changing where the strips are connected. How do these changes affect the motion?
- Do different fasteners result in different types of motion? Are there other materials you can use to connect the cardboard strips?
- What can you add to give your design more support?
- How many parts can you control by only moving one strip?
- What other contraptions and designs can you make with linkages?

**Share Your Results!** Keep us posted about your design challenges on social media with **#TheTechatHome**.

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# Preparing your materials

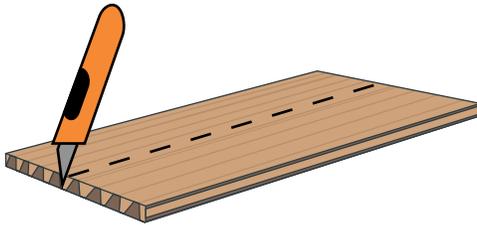
Having materials prepared beforehand allows you to get into a creative flow when making your linkages!



## Cardboard Strips

These steps require the use of sharp tools to cut and punch holes through cardboard. Ask an adult for help with this part!

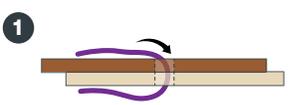
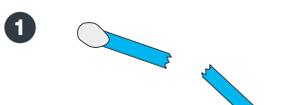
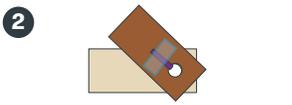
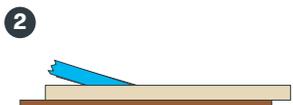
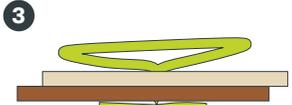
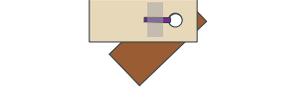
- Cut your cardboard into strips about 1 inch wide and between 4-8 inches long.
  - This can be done with scissors, but if you have one, a utility knife will make the cutting process easier.
  - For a sturdier strip, cut in between the ridges, or corrugation, of the cardboard.



- Punch holes in the middle and at each end of the strip for a total of three possible connection points.
  - If you don't have a hole puncher, place your cardboard on a surface protected by something soft like foam and create a small hole using a thumbtack, nail, or other pointy object. Widen the hole to fit your fastener with a tapered object such as a pencil, screwdriver, or knitting needle.

## Fasteners

Paper fasteners are the easiest fasteners to use for this project, however, if you don't have any available, here are some of the best alternatives we have found using common household materials.

Twist ties or Pipe cleaners (chenille stems)	Rubber bands or string	Cotton swabs
		
		
		

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