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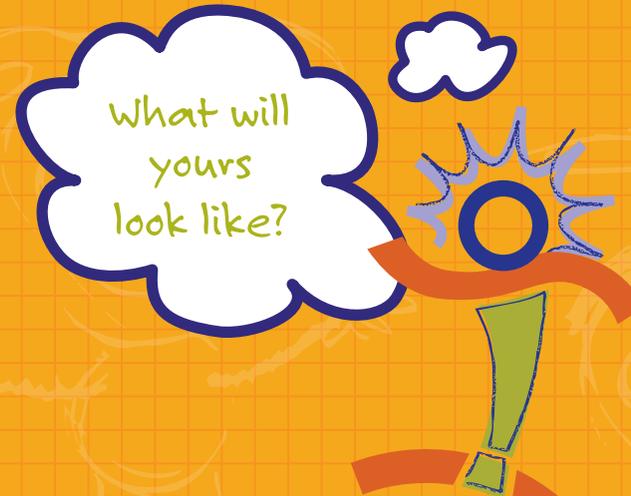
# Invent

a Motorized **Robot**

Spark!Lab is a real place located in the Smithsonian's National Museum of American History. It's a hands-on invention activity center where visitors learn that invention is a process and that everyone is inventive.

Activities incorporate history, science, engineering, technology, and art. A visit to Draper Spark!Lab "sparks" imagination and curiosity, and can be the first step to exploring our own inventiveness and invention in the world around us.

To learn more, visit us at: <http://www.invention.si.edu/try/sparklab>



in collaboration with  
**Creativity for Kids**  
by FABER-CASTELL

**Invent a Motorized Robot #3613000**  
Faber-Castell USA, Inc. • Cleveland, Ohio 44125

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## Inventor's Guide

**WARNING:**  
FUNCTIONAL SHARP POINT

# Did you know that we are surrounded by invention?

Life today is much easier, safer, faster and more convenient thanks to creative problem solving through invention. Since the beginning of time, people have used their imaginations as a way to solve a problem or overcome a challenge...

## Your Challenge:

Robots are everywhere. They are driving cars, cleaning houses, and building buildings. You need a robot to help you through your day. What does your robot do? How does it help your daily life? What does your robot look like?

## A Robot...

is a machine that is designed to perform functional movements or actions. It is sometimes made to look like a human or animal.

**Robot Motor requires two AA batteries – not included.**  
When installing batteries, ask for adult help and assistance.

### BATTERY WARNINGS:

- Insert batteries as shown on battery pack.
- Remove dead or exhausted batteries.
- Do not mix old and new batteries.
- Do not mix standard (carbon zinc), alkaline, rechargeable (nickel cadmium) or lithium batteries.
- Do not recharge non-rechargeable batteries.
- Dispose of batteries safely, following guidelines for your area.



Real inventors follow a process as they create. Learn what the steps are by going through your own journey of invention. You may skip ahead or re-visit a step along the way. Let's begin!

To invent you have to:



### CREATE IT

Build a prototype or model of your idea.



### THINK IT

Have a great idea for an invention.



### TRY IT

Test your invention.



### EXPLORE IT

Investigate inventions and ideas of the past.



### TWEAK IT

Keep improving your idea.



### SKETCH IT

Draw pictures and diagrams to figure out how your invention might work.



### SELL IT

Market your invention to people who might buy it.

# THINK IT

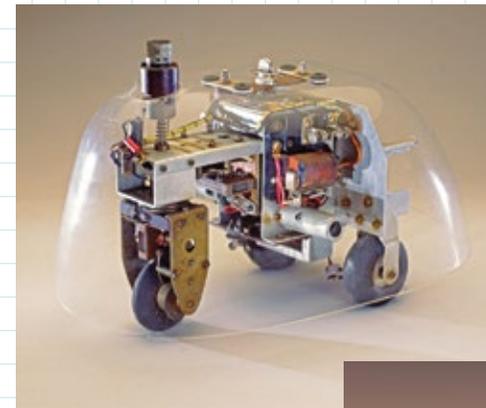
Think about what your robot does and how it does it. Think about all of the ways a robot can help you, your family or the world.

- 1.) What problem could your robot solve?
- 2.) How could life be improved by having a robot?
- 3.) How does your robot move?
- 4.) What does it look like?

# EXPLORE IT

What robots are currently in your house? What do they do, and how can yours be different?

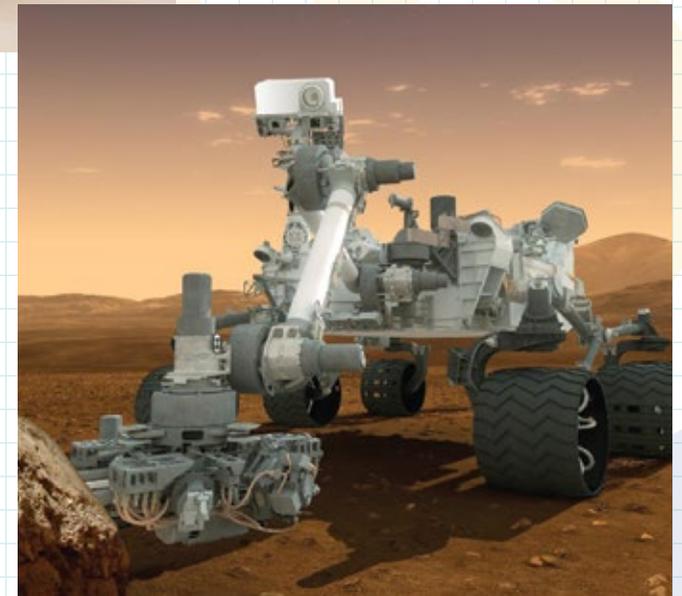
The answer to “what is a robot?” might depend on what time period you are in. If you were in ancient Greece, you might know of a mechanical water clock with moving figures. Or maybe you know of a steam-operated mechanical bird. In the early 20th century, maybe you are reading a book called Rossum’s *Universal Robots* where robots were mechanical men that rebelled against their human masters.



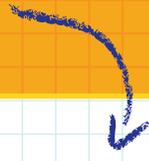
In the late 1940s you would have read news of the experimental machines made by W. Grey Walter from Bristol, England. The tortoise mobile robot is one of his creations from 1951.



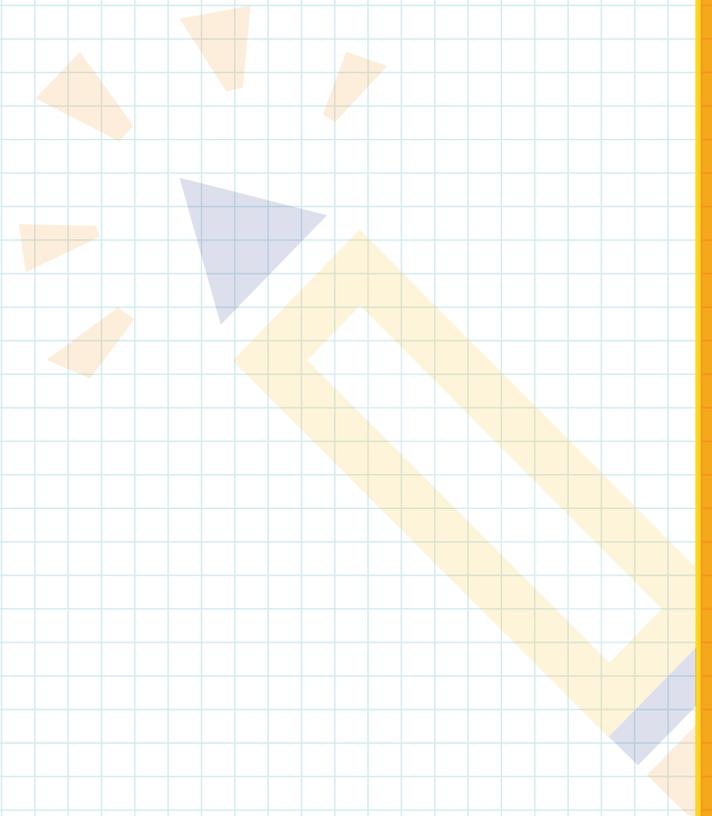
Fast forward to today. Robots vacuum floors, perform surgeries, drive cars, even play ping-pong. The robot *Curiosity* walked on Mars in early August 2010.



# SKETCH IT



Use the space provided to do a few quick sketches of what your robot could look like.



# CREATE IT

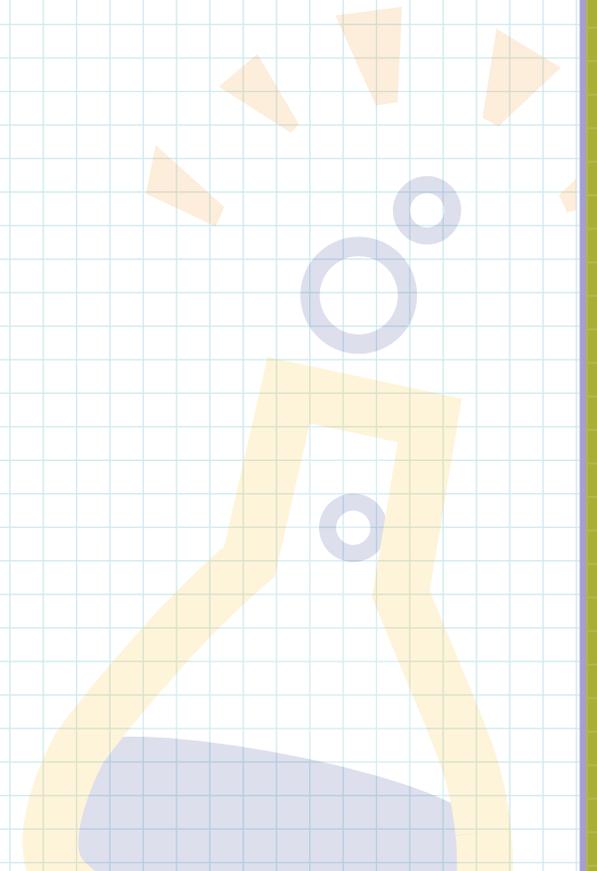
Start putting your pieces together to build your creation. Explore the materials that came in the box.

- Think about which items will help your robot look and work the way you imagine.
- See how the gears fit together. Read ahead to find out how we used these gears with the motor to make our robot move.



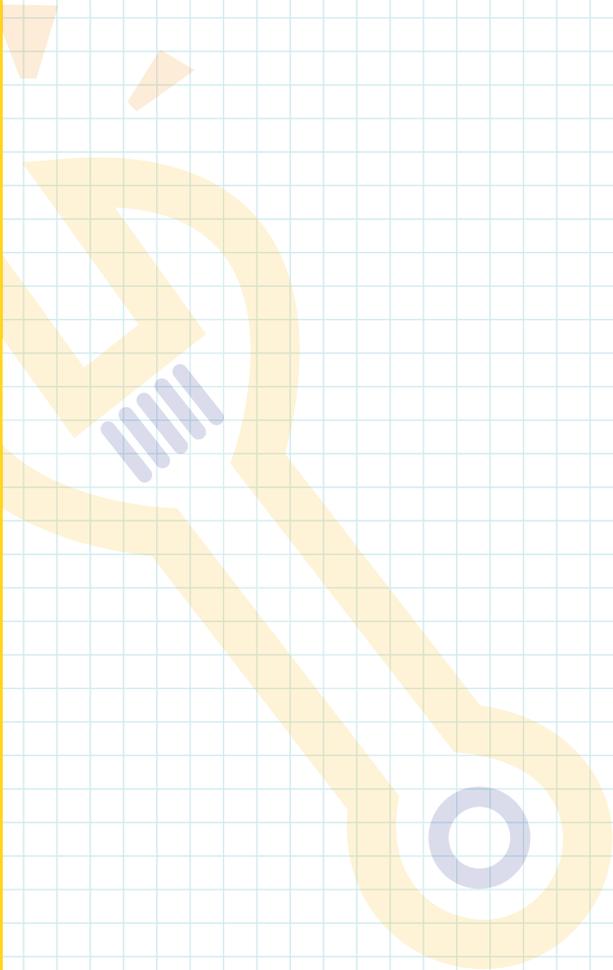
# TRY IT

Does your robot work like you thought it would? If yes, congratulations! If not, think about how you can improve or tweak it.



# TWEAK IT

How could you adjust your robot to make it work better? Make the changes you need.



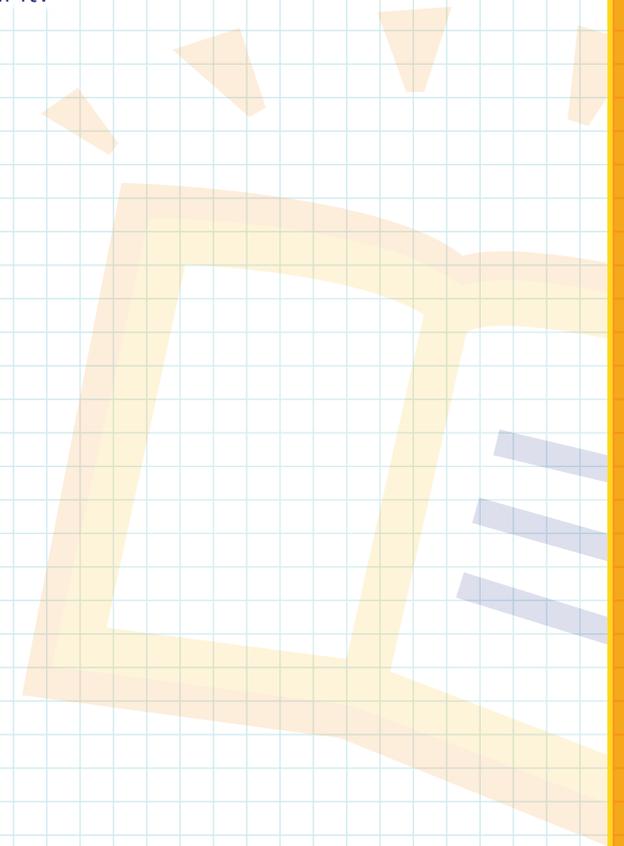
# SELL IT

If your robot were going to be sold, think about these questions. Try talking to your friends and family about your invention to help promote your ideas.

**1.)** Who would buy it and how would you package it?

**2.)** How much would it cost?

**3.)** Where would you sell it?



# Helpful Tips:

Paper sticks – These sturdy sticks can be used to bridge pieces together or with the brads to create movable joints.



Brads can be used to hold pieces in place. Connect the card stock sticks to create joints or use them to connect the wheels to another part. They can also be used as buttons or eyes.

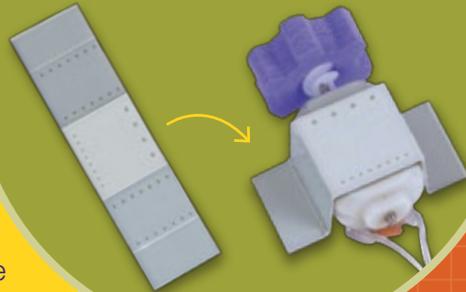


Use the Push Pins to:

- Poke holes for the lights;
- Make a path for the wires to travel through;
- Poke holes for the straws;
- Make an opening for the switch on the battery pack.



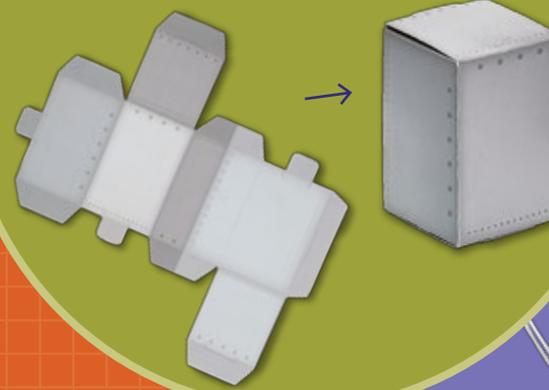
Fold the motor mount card stock piece. Use it with tape, or sticky tabs to hold the motor in place on your robot.



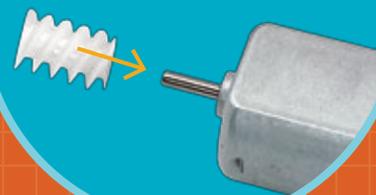
Coated wire can be wrapped, bent, wound and curled. The wire holds its shape and can be used in many different ways.



Fold up the card stock robot parts to use as the body of your robot. Use brads, wire or glue to attach multiple shapes.



Attach the worm gear to the small rod on the motor. This rod spins when the motor is on.

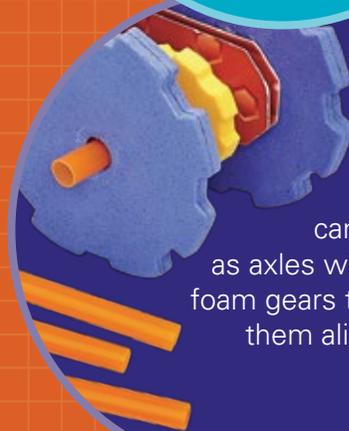


The motor with lights gives your robot motion! The spinning motor can spin anything attached to it. Attach the worm gear and foam gears to make your robot move. (Requires 2 AA batteries.)



4 big gears can be used as wheels or to connect the small gear to create mechanical movement.

Straws can be used as axles with the foam gears to keep them aligned.

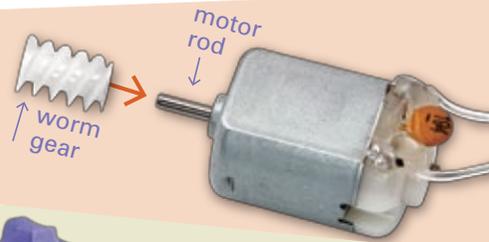


8 small gears can be used to hold the large gears on an axle, or as eyes and decoration.



# How we made our robot move!

**1** Attach the worm gear to the motor rod.



**2** Fit the thick, small gear over the worm gear.



**3** Here's how the large gears fit together with the thick, small gear.



**4** Line up the gears and motor on your robot. Mark their placement for proper fit. Make sure the gears don't hit the robot or wires as they rotate.



**5** Use the push pins to make holes for the lights, a path for the wires to travel or for the motor switch.



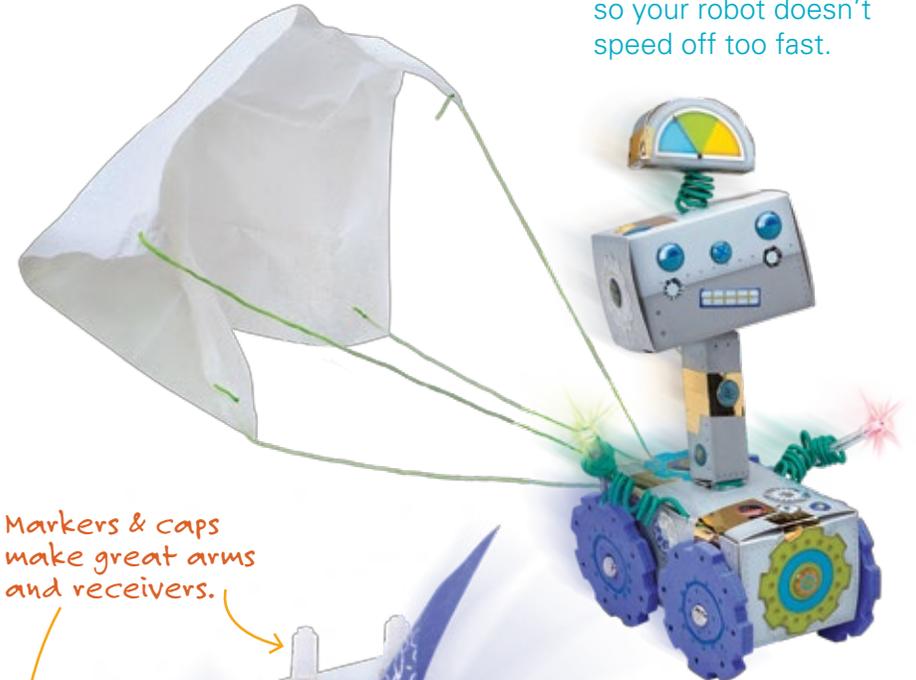
**6** Test your set-up before securing all of the parts in place. Use glue to secure.

# Project Hack!

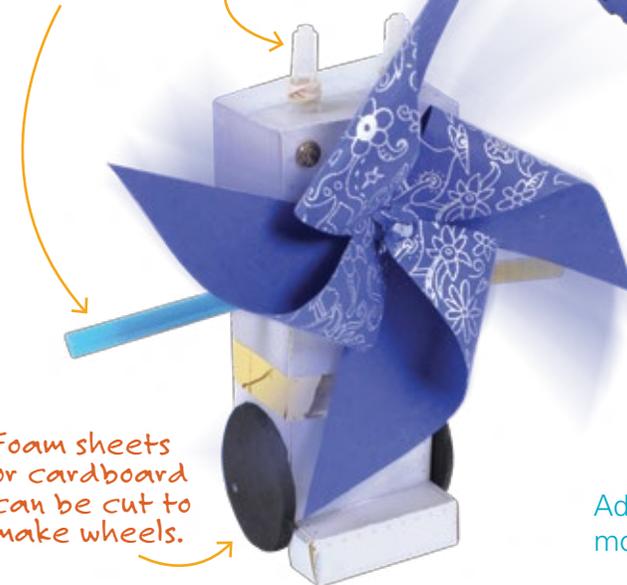
Using items found around the house, try to create another robot or enhance the one you've just made.

Always ask before taking and using.

Use a tissue as a parachute so your robot doesn't speed off too fast.



Markers & caps make great arms and receivers.



Foam sheets or cardboard can be cut to make wheels.

Add a pinwheel to the motor and watch it spin!