How to Build a Robot

by Amy S. Jones

HOUGHTON MIFFLIN

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HOUGHTON MIFFLIN HARCOURT
School Publishers

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Have you ever wished you had a robot that could do your chores for you? Now you can! Kids and adults around the world have discovered the joy of building robots. Many people build them just for fun. Some kids build robots for school projects. Others work together to build robots in competition. Whether you're on your own or part of a team, a beginner or an expert, building robots is for everyone!

Building robots is a popular hobby for both kids and adults.

Step 1: The Job

The first step in building a robot is deciding what job you want the robot to do. Robots are especially good at jobs that are dull. Unlike people, robots don't get bored. Jobs done around the house are usually repetitive. A robot can do these same jobs again and again, day and night. They don't even have to stop to eat or sleep! Robots also don't mind getting dirty. They will do an unpleasant job over and over without complaining. Below is a list of household jobs ideal for a domestic robot.

This robot's job is painting car parts.

- sweeping, vacuuming, or mopping the floor
- painting the house
- feeding or cleaning up after pets
- picking up clothes
- getting the mail
- watering the plants
- cleaning the pool
- trimming the hedges

Step 2: The Design

The second step in building a robot is planning its design. Many people think that robots have to be shaped like a human. This is not the case. Most robots do not have two arms, two legs, and a head that sits on top of a neck and torso. Robots with that design can easily lose their balance. When people walk around on two legs, they are constantly making minor balance adjustments in their toes, feet, and legs. Robots don't have this natural ability.

Many people are surprised to learn that most working robots are robot arms like this one.

So what does a robot look like? It depends on the job the robot does. Robots that work in the ocean have a smooth, sleek design that helps them move through the water quickly and easily. Robots that paint cars in factories are stationary. These robot arms stay in one place. Only the arm moves up, down, and sideways to do its job. Mobile robots might move around on wheels. However, the designer must be careful that wheeled robots don't tip over. Treads, like on an army tank, are an ideal movement system for robots that run on rough terrain.

The goal is to keep the robot's job in mind when you plan its design. A robot that gets the mail would have to be tall enough (or have an arm long enough) to reach the mailbox. A robot that feeds the dog needs to have an arm strong enough to hold the weight of a scoop of dog food. Remember, a poor design could mean that the robot cannot do its job.

All robots need one or more end effectors. These are tools attached to the end of the robot's arm. End effectors allow a robot to do its job. For example, a robot that paints your house would have a paintbrush as its end effector. Robots can have more than one end effector.

Not all robots have sensors. This is because robots don't always need a sensor to do their job. Others do, however. A robot that vacuums the floor might need a sight sensor. The sensor would "look" for anything in the room that the robot might bump into, such as furniture or a pet. These sensors would then send the data to the robot's computer, or "brain."

Draw It!

Make a sketch of your robot's final design on paper. Then refer to this drawing as you build your robot.

A robot uses end effectors to do its job.

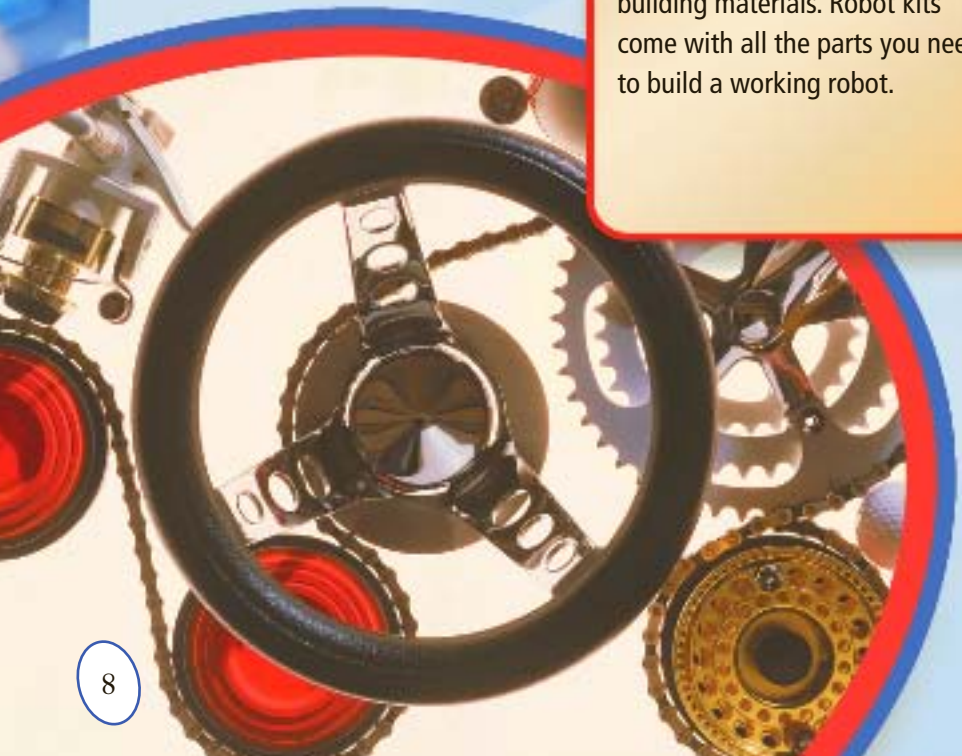
Step 3: The Materials

Next you need to decide what materials you will use to build your robot. Scrap materials are inexpensive and easy to find. Wheels can be taken off of broken toys or old roller skates. Styrofoam trays from vegetable packages at the market are very lightweight. Craft sticks, toothpicks, and toilet paper rolls can be found around the house. Broken toys are also a good place to find working motors and gears. These can be used to make your robot move.

Many people use recycled materials to build their robots.

Robot Kits

You might prefer to buy a robot kit instead of using your own building materials. Robot kits come with all the parts you need to build a working robot.



Step 4: The Drive

Robots must have a drive system. This gives them the power to move. Many small robots run on batteries. They allow the robot to be mobile. Stationary robots can be plugged into an electrical outlet. Some robots are powered by water, air, or even sunlight. If you build your robot out of recycled materials, you will probably need to purchase a battery kit. These are easy to put together and cost very little.

Some robots are powered by electricity.

Step 5: The Computer

Setting up the computer is often the hardest part of building a robot. You have to program the robot so it knows how to do its job. Computer programs give the robot artificial intelligence. Stationary robots are usually close to the computer that controls them. Wires connect the robot to the computer. Mobile robots have built-in computers.

You can learn how to write simple computer programs by reading books. You can also buy software for your computer. You can use the software to program your robot.

One common way to program a robot is by using a teach pendant. A teach pendant looks like a remote control. It connects to both the computer and the robot. Buttons and a joystick on the teach pendant tell the robot to move. You can "teach" the robot a series of motions by describing each movement one step at a time. Once you've "taught" the robot to go through a set range of motions, you can record it as a program in the robot's memory. The push of one button can then send the robot through that programmed range of motions.

Step 6: Programming Your Robot

Suppose your family is going away for the weekend. You need to program your robot to feed the cat. Your robot has a scoop as its end effector. Your program might look something like this:

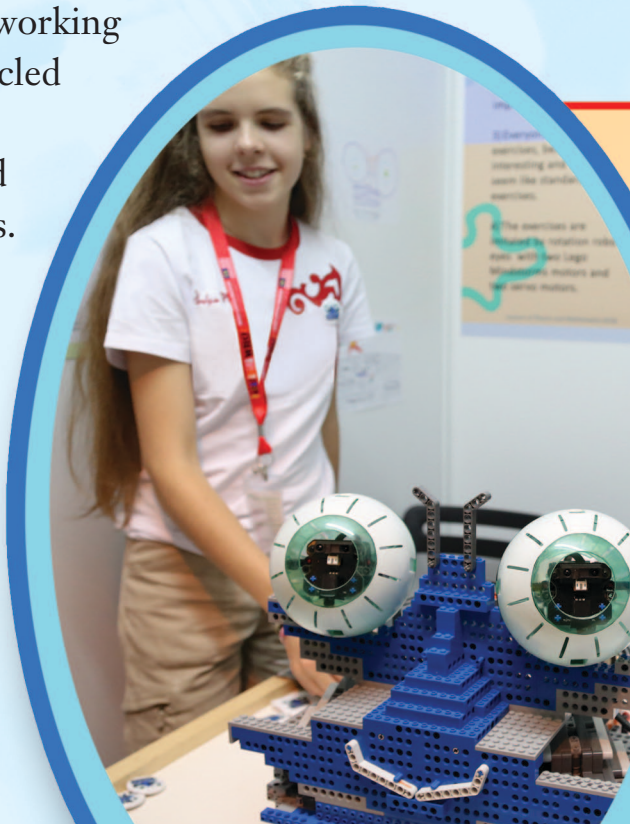
1. Lower the arm six inches.
2. Turn the wrist 360 degrees.
3. Raise the arm six inches.
4. Move the arm to the right four inches.
5. Turn the wrist 180 degrees.
6. Pause for two seconds.
7. Turn the wrist 180 degrees.
8. Move the arm to the left four inches.

This simple program tells the robot to reach into the cat food bag, fill the scoop with food, pull back out of the food bag, move the scoop over the cat's food dish, empty the food into the dish, wait until the scoop is empty, turn the scoop right side up again, then move back to its original starting position.

Robots at School

Many kids work with robots for the first time at school. Some even start learning about robots as early as second grade! One school teaches its second graders all about a robot's systems. Students later use what they have learned with real robots at different stations. At one station, second graders have to program a robot arm. The robot must pick up a ping-pong ball and place it in a cup on the opposite side of the table.

School projects like these can teach children at an early age to love robots. Students might first build a non-working robot model out of recycled materials. As they learn more, students can build a robot that really works. Eventually, they will learn how to write computer programs for robots.



Some students build all different kinds of working robots.

Robot Competitions

Many people use what they have learned about robots in school to enter robot competitions. Participants are asked to design a robot that solves a real-world problem. Teams then work together to design and build a robot. Each team is unique in its approach to designing the robot. Some robot designs are uncanny! Robot competitions take place in different cities and countries. Some offer prizes to the winners. Others are just for fun. Adults and children of all ages can participate in robot competitions.

Join a Robot Club

Robot clubs are great places to get together with other people who share an interest in robots. These clubs invite robot experts to visit. A club will also help its members get robot parts.

Often, the members of a robot club work together to build robots.

The Future of Robots

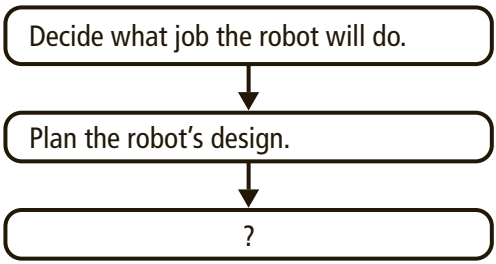
Robots are widely used today. They swim in our oceans. They fly through outer space. They mow our lawns and vacuum our floors. However, they will likely play an even larger role in our future. They will do more jobs for us at home. They will be studied more in schools. Many people will work right next to robots in their jobs.

For some people, robots will become more than a hobby. Robots will become their life's work. People who know how to build robots will be in demand. The future of robots is here. Will you be a part of it?

Robots clean the floor so you don't have to!

Responding

TARGET SKILL **Sequence of Events** How would you build your own robot? Copy the chart below. Write each step in the correct order. Add more boxes as needed.



Write About It

Text to Self Write a paragraph about a robot that you might want to build. Include details about its job, sensors, end effectors, movement system, drive system, and computer.

TARGET VOCABULARY

artificial	literally
data	sensors
domestic	stimulus
inaccessible	ultimate
interaction	uncanny

TARGET SKILL **Sequence of Events** Identify the time order in which events take place.

TARGET STRATEGY **Visualize** Use text details to form pictures in your mind of what you are reading.

GENRE **Informational Text** gives facts and examples about a topic.

Level: T

DRA: 44

Genre:
Informational Text

Strategy:
Visualize

Skill:
Sequence of Events

Word Count: 1,659

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