Art Bot: Build a Wobbly Robot That Creates Art

Experimental Procedure

This project follows the Scientific Method. Review the steps before you begin.

Build Your Art Bot

1. Watch this video or follow along with the slideshow to build your Art Bot:

Image Credit: Ben Finio, Science Buddies / Science Buddies

Slideshow with step-by-step instructions viewable online.

2. Follow these troubleshooting tips when using your Art Bot:
    a. If your Art Bot stops moving suddenly, check to make sure that one set of wires did not get disconnected. If you did not twist the wires tightly enough, the vibrations may cause them to come apart. If necessary, take off the tape, tightly re-twist the wires, and then reapply tape.
    b. As your robot wobbles around, some pieces may fall off. If necessary, use more tape to reattach them.
    c. Your Art Bot might fall over frequently if it wobbles too much. To make it wobble less, move the popsicle stick so it is more centered on the cork. You may need to adjust the popsicle stick positions you test in the "Test Your Art Bot" section of this project to make sure your Art Bot does not fall over.
    d. Always turn your robot off when not in use to help conserve battery power.

Test Your Art Bot

1. Label three pieces of posterboard by writing in their corners: "Popsicle stick off-center," "Popsicle stick partially off-center," and "Popsicle stick centered."

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2. Put the first piece of posterboard (popsicle stick off-center) down on the floor or on a tabletop. **Important**: Depending on the surface you are working on, you may need to be ready to catch your Art Bot before it goes off the posterboard. For example, you do not want it to fall off a table, or to get marker on surrounding carpet.
3. Take the marker caps off your Art Bot, and place it in the center of the first piece of posterboard.
4. Have your volunteer get the stopwatch ready.
    a. Lift the Art Bot up and turn the battery holder's switch to ON. Be carefully that the spinning popsicle stick does not hit your hand!
    b. Place the Art Bot down in the center of the posterboard. As soon as you put it down, your volunteer should start the stopwatch.
    c. The volunteer should say "Stop!" as soon as the stopwatch reaches 10 seconds. As soon as they say "stop," pick the Art Bot up and turn it off.
    d. If the Art Bot goes off the posterboard before 10 seconds is up, pick it up and turn it off.
    e. If any part of your robot breaks during testing (for example, if a marker falls off), stop testing, fix your robot, and then redo that trial.
    f. Can you make any observations about the Art Bot's motion? For example, does it seem very jerky and wobbly, or does it move smoothly? Does it move fast or slow? Record any observations you make in your lab notebook.
5. Repeat step 4 two more times, on the same piece of posterboard, for a total of three trials.
6. Now, re-tape the popsicle stick to the cork so it is only partially off-center, as shown in Figure 2.

Image Credit: Ben Finio, Science Buddies / Science Buddies

Figure 2. Popsicle stick attached to the cork so it is only partially off-center.

7. Repeat steps 4–5 with a new piece of posterboard.
8. Re-tape the popsicle stick so it is centered on the cork, as shown in Figure 3.

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Image Credit: Ben Finio, Science Buddies / Science Buddies

Figure 3. Popsicle stick centered on the cork.

9. Repeat steps 4–5 with a new piece of posterboard.
10. Analyze your results by looking at your three posterboard pieces side-by-side, along with the observations you recorded in your lab notebook.
    a. Which popsicle stick position made the robot move the fastest? Which one made it move the slowest?
    b. Which popsicle stick position made the robot end up farthest from its starting point within 10 seconds? What about staying the closest to the middle of the posterboard?
    c. Organize your results in a data table like Table 1.
    d. Make graphs of your data.
        i. Make a bar graph with popsicle stick position on the horizontal (x) axis and robot speed on the vertical (y) axis.
        ii. Make a graph with the popsicle stick position on the horizontal (x) axis and final distance from starting point on the vertical (y) axis.
    e. Do your results match your predictions about how the popsicle stick would affect the Art Bot's movement?

Popsicle Stick Position	Robot's Speed (fastest/medium/slowest)	Final Distance from Starting Point (farthest/medium/closest)
Off-center		
Partially off-center		
Centered		

Table 1. Data table for keeping track of how popsicle stick position affects the robot's motion.

Frequently Asked Questions (FAQ)

If you are having trouble with this project, please read the FAQ below. You may find the answer to your question.

Q: Why does my motor fall off my Art Bot?

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A: In order for it to stick, the motor needs to sit *flat* on top of your plastic cup and be firmly pressed against the double-sided tape. Have an adult help you if you have trouble getting your motor to stick.

Q: Why does my cork fall off the motor shaft?
A: Make sure the cork is pressed firmly, almost all the way onto the motor shaft. If you only press the cork partially onto the shaft, it may fly off when the motor starts spinning.

Q: Why does my motor not spin at all?
A: If your motor does not spin at all when you turn your battery holder on, several things could be wrong. Check each of the following:

- Make sure you put the batteries into the battery holder correctly. The "+" signs on the batteries should line up with the "+" signs inside the battery pack. If you get one battery backwards, the motor will not spin.
- You might have pressed the cork *too* far onto the motor shaft. There should be a tiny bit of space between the edge of the cork and the face of the motor. If the cork is pushed all the way up against the motor, the friction might prevent the motor from spinning.
- You might not have completely twisted the motor and battery holder's wires together. Check to make sure the wires from the motor and battery holder are tightly twisted together.

Q: Why does my Art Bot fall over?
A: There are a few things that could make your Art Bot fall over. Check for each of the following:

- Your marker "legs" are loose, and not firmly taped to the plastic cup.
- The markers are not evenly spaced around the cup, causing the robot to tilt to one side.
- The popsicle stick is *too* far off center, causing the robot to wobble excessively and fall over.

Q: Why does my Art Bot slow down when I use it for a long time?
A: Just like any battery-operated toy, eventually your Art Bot will need new batteries. It will gradually slow down as the batteries drain. If you notice your Art Bot slowing down significantly, use two fresh AA batteries and it should return to its original speed.

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You can find this page online at: https://www.sciencebuddies.org/science-fair-projects/project-ideas/Robotics_p014/robotics/build-art-bot?mode=procedure

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