



Lighthouse Community Public Schools

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SCRIBBLE MACHINES

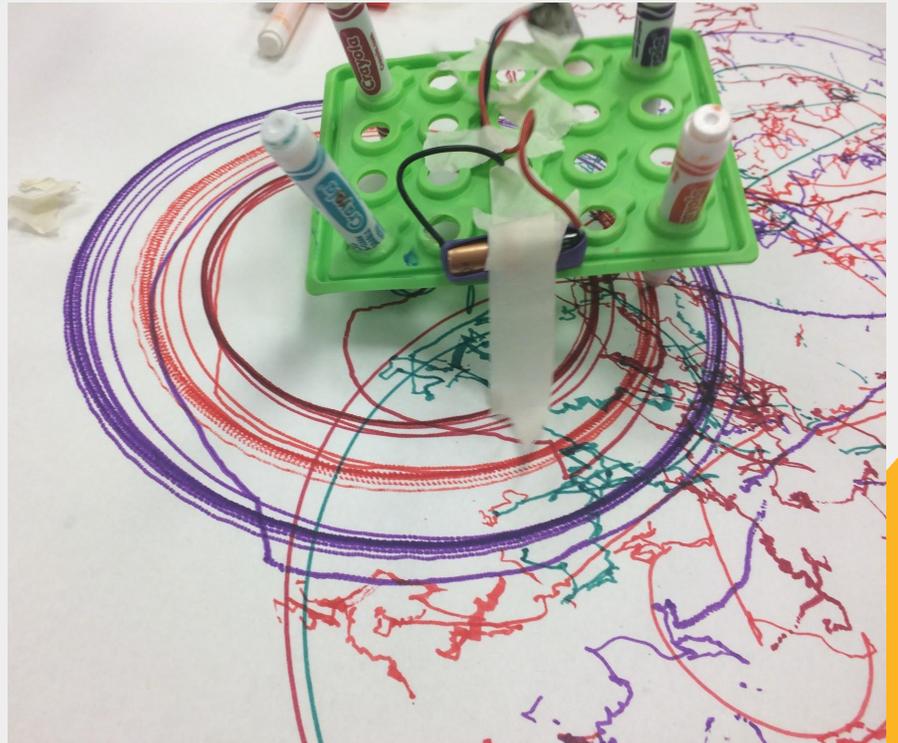
A Guide from the Creativity Lab

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Based on

An activity from the Tinkering Studio



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About This Project

Scribble machines are a low-barrier/high-ceiling project, which integrates art and design with basic science. Students use commonplace items to create a small "bot" that draws as it wiggles about.

Building a scribble machine is an exercise in design, experimentation, persistence, and observation. Students will incorporate basic circuitry into their machines and have the opportunity to be creative in their exploration. This project is structured such that teachers provide minimal instruction, and students learn through the process of design, test, and redesign. We encourage you to customize this project to the needs of your class, but maintain the idea of keeping students engaged through inquiry, and giving them ownership of their learning through exploring.

Our Story

This project is based on a Tinkering Studio activity at the Exploratorium in San Francisco.

Our students in the Creativity Lab explored the questions: what shape will my machine have to be to make a particular kind of mark on the paper? How can I get it to go in a certain direction? Do I want it to draw something irregular or linear? And so forth.....

Our students in the Middle School were given enough freedom to experiment with different materials and enough time to iterate their designs. The activity is structured so that they figure out their own scribble machine with minimal guidance. This guide offers a design for a basic scribble machine, then provides methods for extended learning through data tracking and testing variables.

Materials & Tools

MATERIALS

- Berry Baskets
- Plastic/Paper Cups
- Markers
- DC Motors
- AA Batteries
- Broccoli Bands
- Masking Tape
- Large Paper
- Hot Glue Sticks
- Assorted Craft Materials

TOOLS

- Scissors or cutting tools
- Hot Glue Gun

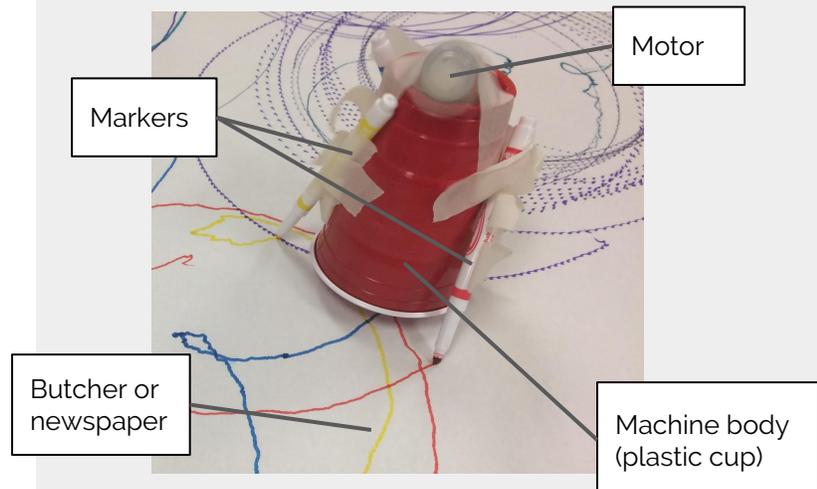
For a detailed list of materials:

lcl.how/ScribbleParts

Learning Targets

- I can create a simple circuit.
- I can track and analyze data.
- I can explore playfully without a preconceived plan.
- I can learn from mistakes and follow unintended paths.

TIME: 45-60 minutes



Context: Before we make...



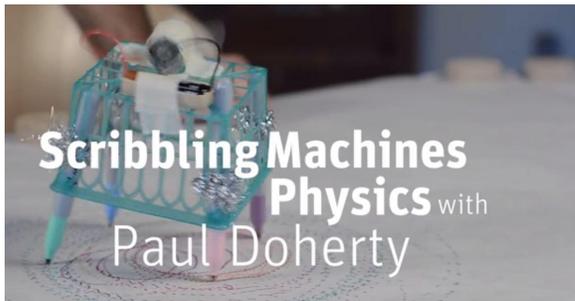
[Maker Education](#) resources for Scribble Machines

This activity is a good example of a low-tech project that works well on its own, but can be made more complex and interactive utilizing the microcontrollers and sensors. Scribbling Machines explore notions of physics that involve acceleration, “stick-slip” friction, center of mass and forces.

Different tutorials can be found online, and are all mainly a derivation from the Exploratorium one.

Further connections can be made to generative, robotic and kinetic art:

[Colossal Drawing Machines](#)
[Art Making Robots](#)
[Programmed Drawing Machines](#)



[The Physics of Scribbling Machine](#)

Material Management

Because creative design is an important element in building a scribble machine, we give students very limited instructions. Introduce students to their project by challenging them to build a machine that scribbles as it moves. Then stand back and let them tinker on their own. Small groups are okay, if students wish to work together.

Cover a large work surface to be drawn on. We often use easel pads, though cardboard and newspaper are cheap alternatives. Place materials at each workspace, so students can easily access and experiment with them.

How to Introduce New Tools & Tech SAFELY

To avoid burning yourself with hot glue, try these kid-invented tips

- Use low heat guns
- Use popsicle sticks, instead of fingers, to push pieces together
- Put glue on the big piece instead of the small piece

This activity doesn't include the use of any dangerous or sensitive materials or tools. Just remember that being organized and having clear systems builds a culture of the respect and care necessary to ensure longevity of the equipment.

Step-By-Step Guide

1. **Prepare your Space:** Cover a large work surface with paper to be drawn on.
2. **Build a Base:** Use tape or rubber bands to secure markers to a berry basket or plastic cup.
3. **Create a Cam:** Cut a hot glue stick to roughly one inch long. Stick the axle of the motor into the hot glue stick, but keep it off-centered.
4. **Prepare a Battery:** Wrap a broccoli rubber band around a battery.
5. **Construct the Machine:** Add the battery and motor to the base. The hot glue must move freely.
6. **Turn on the Machine:** Fit the wires of the hobby motor into the battery, such that each wire touches one of the battery's terminals. This will cause the motor to rotate, and the scribble machine to move. Uncap those markers, and watch it go!



1.



2.



3.



4.



5.

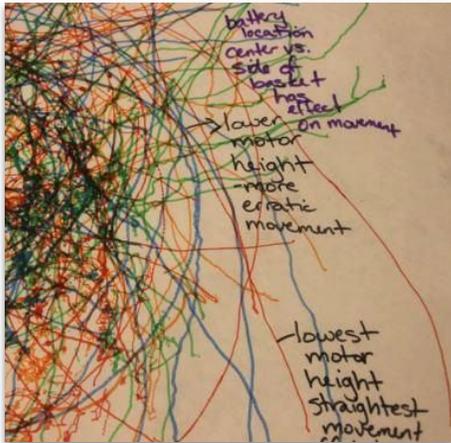


6.

Notes

- This is only one version of a scribble bot - consider not providing strict instructions or examples to allow more creativity from students.
- Keeping the piece of hot glue off-center creates a cam. As the glue stick rotates, the weight distribution constantly changes, which causes the scribble machine to wobble.
- It doesn't matter which wire connects to which terminal of the battery. Reversing the wires will cause the motor to spin in the opposite direction.

Looking Closely



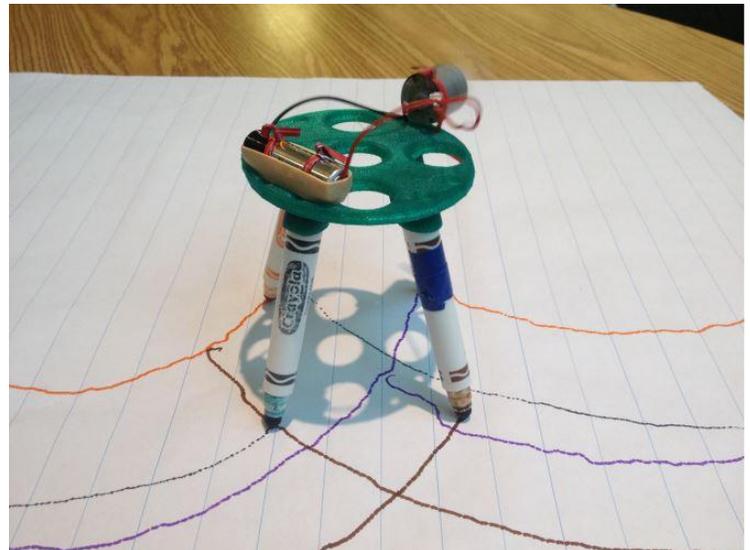
Throughout the class, you may encourage students to walk around the classroom and look at other students' designs, or to pause their work to come together for a discussion. Ask students what they are discovering with their designs, and how they are overcoming any problems. Write their observations on a whiteboard for everyone to see.

A nice feature of scribble machines is the fun, visual data they create. As students' machines begin drawing, have students describe their machine designs by writing directly on the paper beside their scribblers' drawings. After students have recorded one pattern and design, encourage them to try new designs, and see how it alters their scribbles. Then have them record and compare this new data to the old.

Scribble Machines with Older Students

If you have the time and equipment, consider this option for taking your scribble machine lesson plan further:

Ask students to design their own, customized scribble machine. Have them plan out their design on paper with drawings and measurements. They should strive for sturdiness and efficiency of design. Have students build their customized scribblers using CAD software. (We use [Tinkercad](#), free software available online.) Then let them print out their machine, for experimentation. (Tip: Have students print out test pieces for each component. For instance, if they want to create a shaft for the markers to sit in, have them prototype the shaft first, to test its size.)



Guiding Questions

- Has anyone figured out how to make the motor run?
- What happens when you swap which end of the battery each wire touches?
- What is the purpose of the glue-stick? How does off-centering it make a difference to the motion of their scribbler? Why would this be?
- What will adding a second motor do?
- Can you change your design so that it scribbles without the glue stick?
- Can you make your scribbler draw a perfect circle?
- How did everyone attach the different pieces of their scribble machines? Can you make it sturdier? Can you make it more aesthetically pleasing?