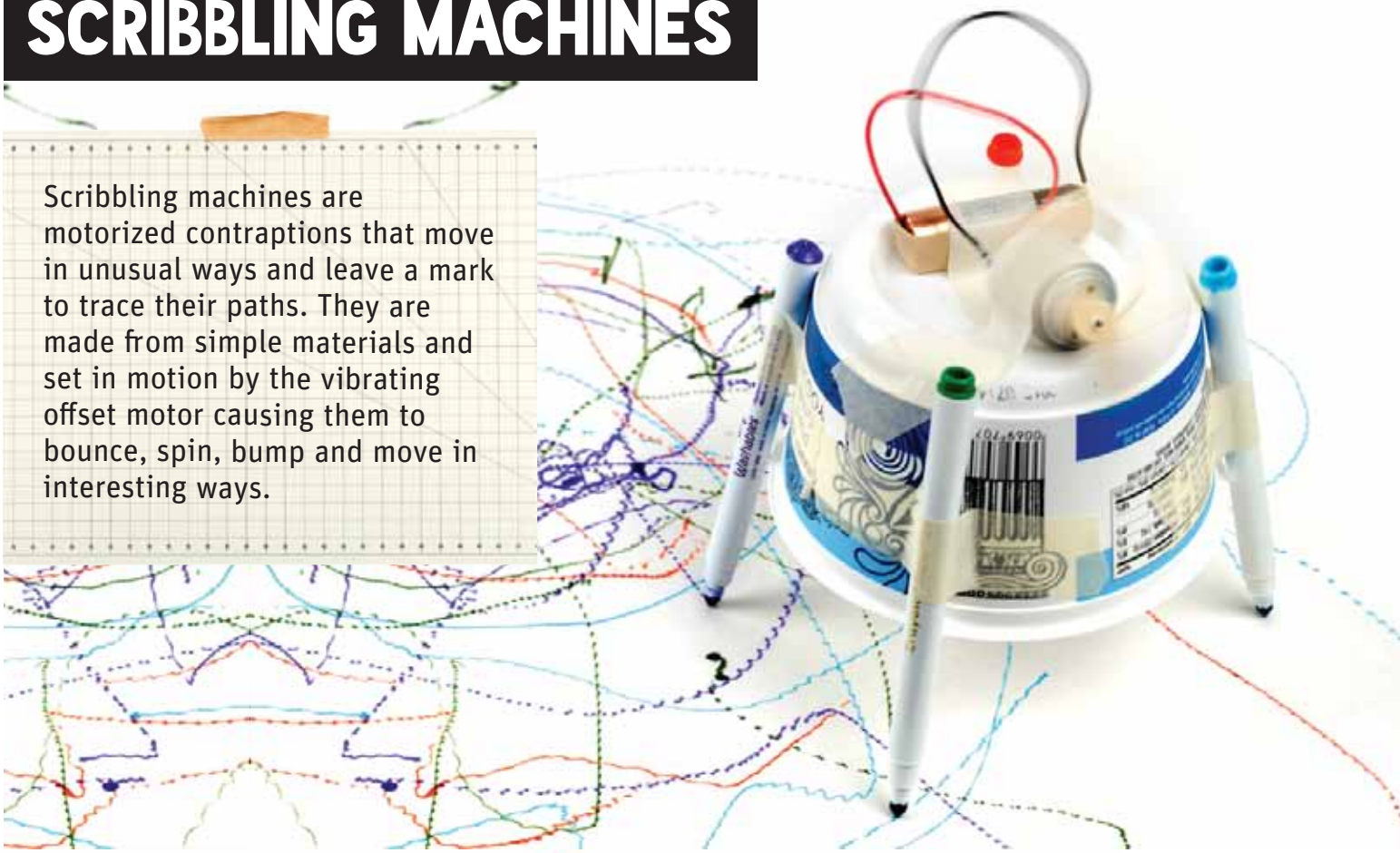
SCRIBBLING MACHINES

Scribbling machines are motorized contraptions that move in unusual ways and leave a mark to trace their paths. They are made from simple materials and set in motion by the vibrating offset motor causing them to bounce, spin, bump and move in interesting ways.



TRY IT!

Collect these things:

Recyclable container such as a strawberry basket or yogurt cup

Markers

AA battery

Masking tape

1.5-3.0 volt motor
(you can find motors in all sorts of toys and common household objects)

A piece of hot melt glue stick

Broccoli band
(thick rubber bands used for produce)

Plus:
Paper for testing

Some other helpful materials:

Clothespins; Popsicle sticks; wood skewer sticks; pipe cleaners; wire; nuts, washers, or other small weights; wire stripper; scissors; small screwdriver; googly eyes.

the tinkering studio

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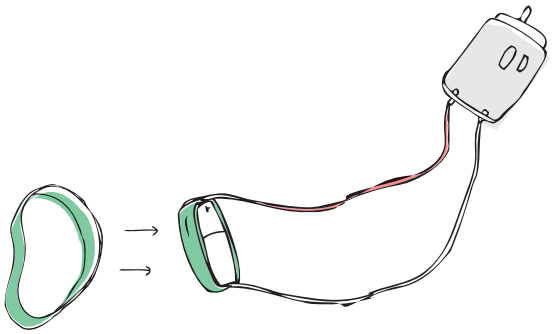
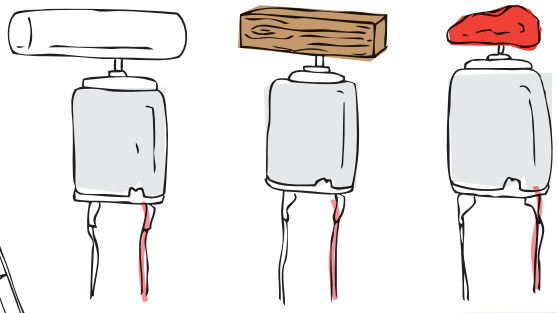
GETTING STARTED

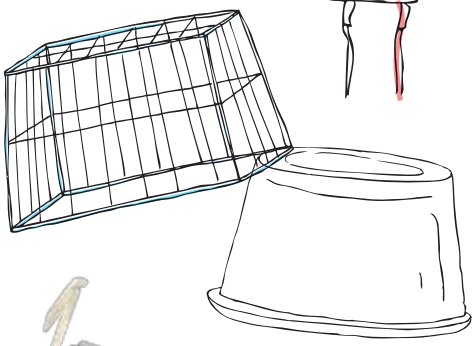
Connect the motor to the battery—a broccoli band is perfect for keeping the leads attached to the motor and still be able to disconnect them when you want to change the motor's position (masking tape can work too if you don't have a broccoli band).





Experiment with ways to offset the motor: try a piece of hot melt glue stick, wood, or clay.

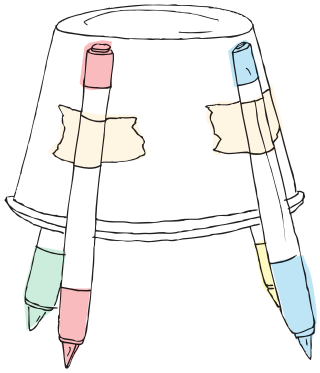
What happens if you change the weight of the offset motor? Or change the length of the arm on the motor? Or change the orientation of the hot melt glue stick?



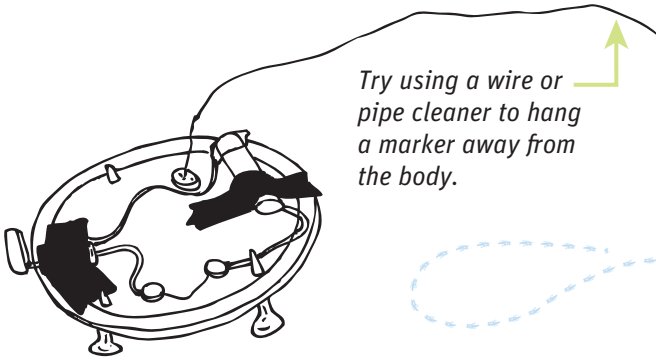
Find or build a base and attach your offset motor to it (try a strawberry basket, yogurt container, or other recyclable container).

TIP: Make sure there is enough clearance for your offset motor to spin

Attach one or more markers to trace the jittering movement of your scribbling machine. Turn it on and make some scribbles!



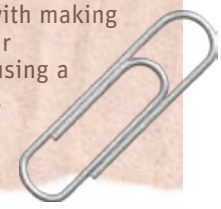
Experiment with different designs: How could you make it go really slow and smooth? Fast and jumpy? Make big and small circles?



Try using a wire or pipe cleaner to hang a marker away from the body.

TAKE IT FURTHER

- **Trace-making materials:** Experiment with using different materials such as paint and paintbrushes, chalk, or pencils to trace the patterns your scribbling machine makes. With chalk you can even scribble on the sidewalk!
- **Natural materials:** Collect items like sticks, leaves, bark, and pods from a park or your backyard. Add them to your machine and set it scribbling outside to see how the natural materials leave different pathways in sand or dirt.
- **Incorporating switches:** Experiment with making a switch to make it easer to turn your scribbling machine on and off. Try using a combination of clothespins, tinfoil, paperclips, brads, craft foam, or other materials.



EDUCATOR ADDENDUM

A note on our philosophy:

The Tinkering Studio is based on a constructivist theory of learning, which asserts that knowledge is not simply transmitted from teacher to learner but actively constructed by the mind of the learner. Constructionism suggests that learners are morelikely to make new ideas while actively engaged in making an external artifact. The Tinkering Studio supports the construction of knowledge within the context of building personally meaningful artifacts. We design opportunities for people to "think with their hands" in order to construct meaning and understanding.

Activity Design (decisions and designs that support a tinkering experience)

Tinkering Studio activities and investigations are designed to encourage learners to complexify their thinking over time. The variety of materials and variables available for experimentation allow learners to enter at a point where they are comfortable starting, and then alter and refine their designs as they develop new ideas. Tinkering activities are often fun, whimsical, inspired, and surprising.

Building a scribbling machine is a playful platform for the learner to investigate concepts at the intersection of art, science, and technology. The pattern and object created are as significant as the process of testing, questioning, and occasionally failing. Here are a few principles that exemplify the design goals of this activity:

- *STEM (science, technology, engineering, and mathematics) education is a means, not an end in itself.* Building a functioning circuit is at the heart of this activity. Participants are intrinsically motivated to construct circuits as a means to making a scribbling machine.

- *Activities and investigations encourage learners to complexify their thinking over time.* The variety of materials and variables available for experimentation allow learners to rebuild and redesign as they have new ideas. Complexity can manifest itself electrically (by adding additional motors or incorporating switches), structurally (by exploring balance or size of the machine), or aesthetically (by focusing on building techniques to create specific patterns).
- *Activity station design enables cross-talk and invites collaboration.* We build scribbling machines at a communal table so that participants can see (and hear) what others are working on. Solutions to similar problems are shared and iterated upon from one builder to the next. New ideas are often inspired by other builders in the space.

Environment (the elements of the space that support tinkering)

In the Tinkering Studio there are many things that we keep in mind when setting up an environment for a successful tinkering activity.

Since learners often work with us for an extended period of time, we try to create a warm and welcoming workspace with comfortable seating, sturdy worktables, and good lighting. We often display exhibits or examples from past projects and current activities throughout the space to seed ideas and provide an introduction to what is happening that day. Materials are easily accessible and in close proximity to the tinkerers. We often work at large, communal activity stations to enable cross-talk and invite collaboration between participants, allowing them to look to each other for answers and solutions.

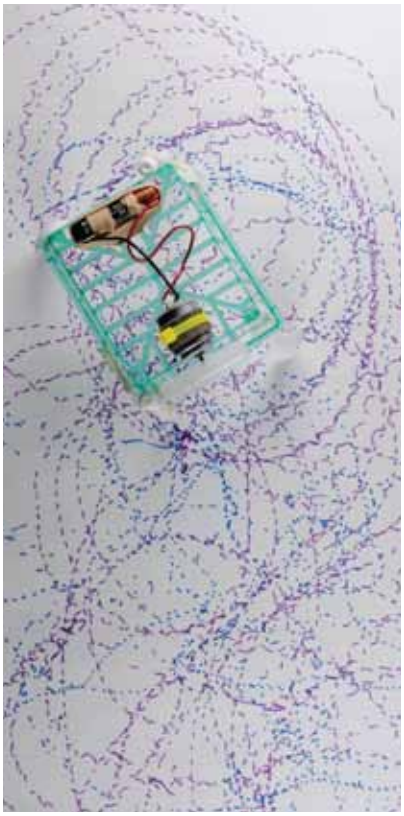
When creating an environment for building scribbling machines, you'll want to prepare spaces for materials, building, and testing. There is a constant back and forth between building and testing, so you might consider how participantswill move within your space to access materials, make changes, and test their machines.

Try the activity beforehand to discover what materials work well for you. Once you've found a good set, consider how you'll want to make them visible and accessible for the participants. It's helpful to keep materials for construction like tape, scissors, markers, and Popsicle sticks on the main building table so they can be accessed quickly. If the participants are working at a large table, having multiple small containers of each item (Popsicle sticks, batteries, motors, etc.) allows them to find what they need to build with without having to reach too far. Materials that are large or used less often (such as the bases made from recycled containers) can be displayed outside the main work area.

Scribbling machines often move erratically and can jump off a table or work surface before you know it! So when testing the machines it can be helpful to have some sort of table barrier. Placing a hula hoop on a piece of butcher paper laid on a table makes a great testing area for making a communal drawing. Placing sheets of paper in the bottom of cardboard boxes (like a cereal box with the front removed) works well for making personal testing stations. Rolling out large pieces of butcher paper on the floor can also work for testing and may result in beautiful group drawings.

Facilitation (the things we say and do to support learning through tinkering)

Facilitation is a way of teaching in which you support the learner's own investigations, questions, and ideas within the framework of an activity. In the Tinkering Studio, we strive to practice a kind of facilitation that respects the individual path of the learner. As facilitators, we watch and wait until the right moment to jump in and offer a hint, a material, or a new way of looking at a problem. As educators, we allow learners to feel frustration and encounter moments of failure as they work with real materials to try to solve their own challenges.



There are many ways that the facilitator can influence the interactions with participants in an activity. We help people get started with the activity by giving a quick sense of the goals. We invite them into the space and introduce the materials and tools they might use. We spark interest and sustain learner's engagement by asking questions about their work and responding to their answers. We support multiple outcomes of the activity and are open to the possibility of new ideas, different solutions, and changing goals of the individual learners. We try to practice a style of facilitation in which we are not teachers who transmit knowledge to passive learners, but rather are guides and co-learners on a path to understanding.

As a facilitator of scribbling machines there are a few things to keep in mind: The first thing you can help a learner get started on is connecting the battery to the motor and observing the difference in motion with and without the hot glue stick. We encourage participants to try and make small changes in the position of the glue stick, its length, or the location of the motor on the body. Once the machine is up and running add pens or markers to trace its path so you can see the motion and promote observation and reflection about why and how the machine creates a specific pattern. After the first machine has been tested, support the learner to complexify her creation with more motors, different ways of holding the pens, or other more complicated ways of making motion. Throughout the experience of building the scribbling machine be sure to emphasize the process of testing and prototyping instead of the creation of a final finished product.

RELATED TINKERING ACTIVITIES

Activity Connections
Try these related activities to develop your own repertoire of tinkering experiences.

Circuit boards: Tinker with electricity using common objects such as batteries, lights, buzzers, motors, switches, and more. This activity provides an introduction to exploring circuits before making a scribbling machine or an opportunity to continue testing ideas that arose after building a machine.

http://tinkering.exploratorium.edu/circuit-boards

Light painting: Create striking images and illusions using nothing more than a camera, a light source, and a little practice. With this activity you can continue to explore trace-making in three-dimensional space with light. You can also incorporate circuit building by using LEDs, batteries, motors, and more to design your own light painting tool.

http://tinkering.exploratorium.edu/light-painting

ARTIST CONNECTIONS

(inspiring connections to the Scribbling Machine activity)

Pe Lang explores regular and erratic motion and the kinetic interaction between different elements to create beautiful artwork. He experiments with inexpensive motors, small magnets, and other raw materials to allow viewers and listeners to appreciate delicate and unpredictable movements and sound. Like scribbling machines, his creations are built from simple systems that generate wildly complex patterns.

http://www.pelang.ch/

Super Awesome Sylvia and **Evil Mad Scientist** teamed up to create a friendly art robot, called a WaterColorBot, that moves a paintbrush to paint your digital artwork onto paper using a set of watercolor paints. To move the paintbrush, there are two motors built into the frame of the robot. Each motor drives a little winch that moves a length of cord attached to a rod that controls either the X or Y position of the brush. This is similar to scribbling machines because it uses science and engineering principles to produce an artistic experience. While scribbling machines create chaotic patterns, the WaterColorBot moves with precision.

http://www.evilmadscientist.com/
http://sylviashow.com/

Bruce Shapiro is an innovator in robotic artwork. He created the Egg-Bot, which uses a stepper motor and a processor to draw patterns on the outside of eggs or other spherical objects. For Bruce, computer-controlled motion is a new frontier for art, but it is also a great teaching tool for exploring electronics, programming, and robots.

http://egg-bot.com/