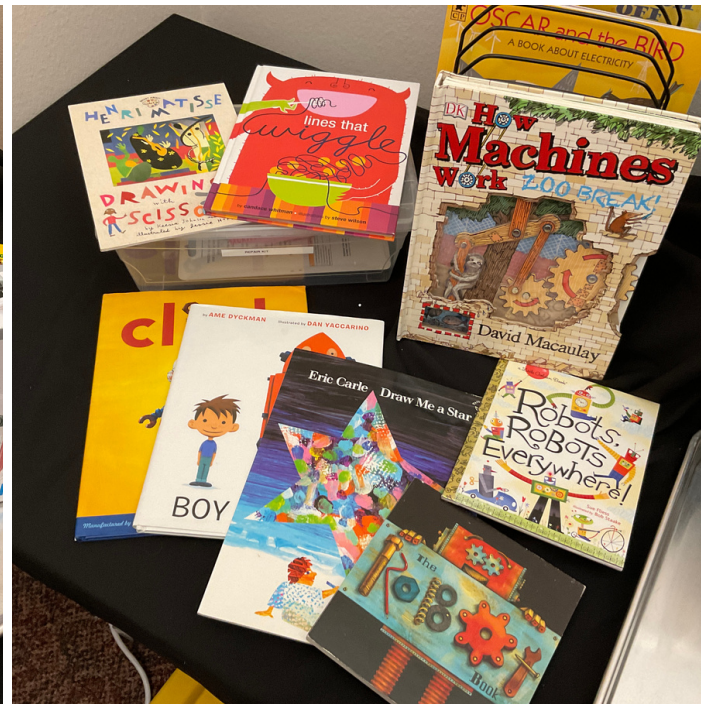
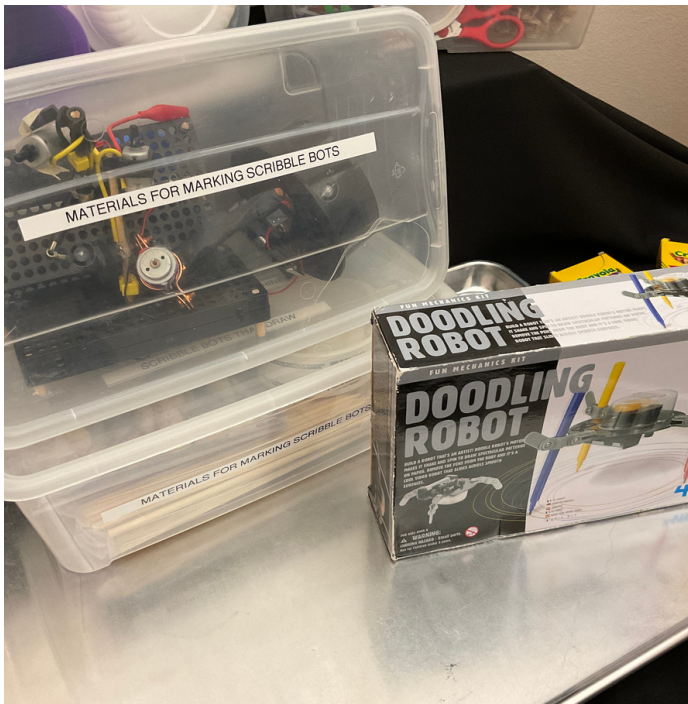


# Art Bots



This kit allows participants to explore circuits with activities fit for a diverse age range. Patrons can even make art with their robots.



## INVENTORY OF TRUNK

### Art Bots

IN	OUT	
		<u>Activity Binder</u>
<input type="checkbox"/>	<input type="checkbox"/>	Librarian Instructions
<input type="checkbox"/>	<input type="checkbox"/>	Inventory Sheet
<input type="checkbox"/>	<input type="checkbox"/>	Booklist/Introduction
<input type="checkbox"/>	<input type="checkbox"/>	Pictures of trunk organization
<input type="checkbox"/>	<input type="checkbox"/>	Questions to Extend Discoveries
<input type="checkbox"/>	<input type="checkbox"/>	Scribble Bots that Draw Activity Guide
<input type="checkbox"/>	<input type="checkbox"/>	Sand Sketching Scribble Machines Activity Guide
<input type="checkbox"/>	<input type="checkbox"/>	Circuit Blocks Activity Guide
<input type="checkbox"/>	<input type="checkbox"/>	Energy Stick Activity Guide
<input type="checkbox"/>	<input type="checkbox"/>	Consumable and Restocking List
<input type="checkbox"/>	<input type="checkbox"/>	Using a Digital Multimeter to Test Voltage
<input type="checkbox"/>	<input type="checkbox"/>	Art Bots Supplement
<input type="checkbox"/>	<input type="checkbox"/>	<i>When It All Comes Together</i>
<input type="checkbox"/>	<input type="checkbox"/>	<i>What Children Gain by Learning Through Inquiry</i>
<input type="checkbox"/>	<input type="checkbox"/>	<i>Making for STEM Success</i>
<input type="checkbox"/>	<input type="checkbox"/>	<i>Background information for teaching electricity at the primary-school level</i>
<input type="checkbox"/>	<input type="checkbox"/>	<i>Curiosity: The Force Within a Hungry Mind</i>
<input type="checkbox"/>	<input type="checkbox"/>	<i>The right question at the right time</i>
<input type="checkbox"/>	<input type="checkbox"/>	Parent surveys
<input type="checkbox"/>	<input type="checkbox"/>	4 laminated activity sheets
		<u>Books</u>
<input type="checkbox"/>	<input type="checkbox"/>	<i>Boy and Bot</i> by Ame Dyckman
<input type="checkbox"/>	<input type="checkbox"/>	<i>Clink</i> by Kelly DiPuccio
<input type="checkbox"/>	<input type="checkbox"/>	<i>Draw Me a Star</i> by Eric Carle
<input type="checkbox"/>	<input type="checkbox"/>	<i>Henri Matisse: Drawing with Scissors</i> by Jane O'Connor
<input type="checkbox"/>	<input type="checkbox"/>	<i>How Machines Work: Zoo Break!</i> by David Macaulay
<input type="checkbox"/>	<input type="checkbox"/>	<i>Lines that Wiggle</i> by Candace Whitman
<input type="checkbox"/>	<input type="checkbox"/>	<i>Oscar and the Bird: A Book about Electricity</i> by Geoff Waring
<input type="checkbox"/>	<input type="checkbox"/>	<i>Robots, Robots, Everywhere</i> by Sue Fliess
<input type="checkbox"/>	<input type="checkbox"/>	<i>Switch On, Switch Off</i> by Melvin Berger
<input type="checkbox"/>	<input type="checkbox"/>	<i>The Robot Book</i> by Heather Brown

### Energy Stick/Ball

- |                          |                          |                |
|--------------------------|--------------------------|----------------|
| <input type="checkbox"/> | <input type="checkbox"/> | 1 Energy Stick |
| <input type="checkbox"/> | <input type="checkbox"/> | 2 Energy Ball  |

### Scribble Bots that Draw/Sand Sketching Scribble Machines

- |                          |                          |                                      |
|--------------------------|--------------------------|--------------------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | Small 1.5v motor with leads attached |
| <input type="checkbox"/> | <input type="checkbox"/> | Battery holders with leads attached  |
| <input type="checkbox"/> | <input type="checkbox"/> | Clothespins                          |
| <input type="checkbox"/> | <input type="checkbox"/> | Corks                                |
| <input type="checkbox"/> | <input type="checkbox"/> | Binder clips                         |
| <input type="checkbox"/> | <input type="checkbox"/> | Buttons/Button-like objects          |
| <input type="checkbox"/> | <input type="checkbox"/> | Half sheet size metal tray           |
| <input type="checkbox"/> | <input type="checkbox"/> | 2 doodling robots                    |

### Circuit Blocks

- |                          |                          |                                       |
|--------------------------|--------------------------|---------------------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | 2 lightbulb blocks                    |
| <input type="checkbox"/> | <input type="checkbox"/> | 1 motor block                         |
| <input type="checkbox"/> | <input type="checkbox"/> | 1 LED block                           |
| <input type="checkbox"/> | <input type="checkbox"/> | 1 bi-color LED block                  |
| <input type="checkbox"/> | <input type="checkbox"/> | 1 buzzer block                        |
| <input type="checkbox"/> | <input type="checkbox"/> | 1 knife switch block                  |
| <input type="checkbox"/> | <input type="checkbox"/> | 1 rocker switch block                 |
| <input type="checkbox"/> | <input type="checkbox"/> | 1 push-button block                   |
| <input type="checkbox"/> | <input type="checkbox"/> | 1 potentiometer (dimmer switch) block |
| <input type="checkbox"/> | <input type="checkbox"/> | 1 photo cell block                    |
| <input type="checkbox"/> | <input type="checkbox"/> | 2 battery blocks                      |
| <input type="checkbox"/> | <input type="checkbox"/> | 18 alligator clip wires               |
| <input type="checkbox"/> | <input type="checkbox"/> | 2 motors with battery packs           |

**To Be Provided by Borrowing Library\***

- |                          |                          |  |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | White butcher or craft paper                     |
| <input type="checkbox"/> | <input type="checkbox"/> | AA Batteries                                     |
| <input type="checkbox"/> | <input type="checkbox"/> | Markers/crayons/pencils                          |
| <input type="checkbox"/> | <input type="checkbox"/> | Masking tape                                     |
| <input type="checkbox"/> | <input type="checkbox"/> | Cardboard cylinders                              |
| <input type="checkbox"/> | <input type="checkbox"/> | Salt   |
| <input type="checkbox"/> | <input type="checkbox"/> | Variety of small plastic containers (Minimum 15) |
| <input type="checkbox"/> | <input type="checkbox"/> | Dowels/Craft sticks                              |

\* Some of these materials are provided in the kit but may be recommended to purchase as they will not be restocked by NMSL in the future.

Checked by \_\_\_\_\_ Date \_\_\_\_\_

Checked by \_\_\_\_\_ Date \_\_\_\_\_



## Energy Stick

### Beforehand

Check that energy sticks work by touching one electrode with one hand and the other electrode with the other hand.

### Materials

- Energy Stick (2)

### Preparation

Set aside energy sticks. These are best used as part of a facilitated introduction or activity and not just placed on a tabletop.

### Questions to Extend Discoveries

Be a human conductor of electricity. Complete the circuit to turn on the lights and make the buzzer sound. Gather participants in a circle. To start, touch one electrode with one hand and the other electrode with the other hand. “What happens?”

Next, have a participant touch one electrode with one hand while you touch the other electrode with one of your hands. Hold hands. “What happens?” Keep expanding the circle. “How many people can be connected in the circle (circuit analogy) and still have the buzzer sound?” If time and interest allows, experiment if it matters where connecting partners touch. Skin to skin on their hands? Elbow to Elbow? Skin to shirt? Hand to nose?...

## Scribble Bots that Draw

Make a motorized contraption that vibrates and moves in unusual ways while marking its path on paper.

### Beforehand:

Check that there are plenty of materials. Check that circuits with motors all work. Check that batteries have enough voltage (good voltage is 1.4v).

### Materials

Premade scribbles machines (10)

Materials to make own scribble machine:

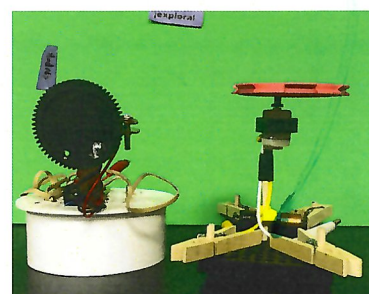
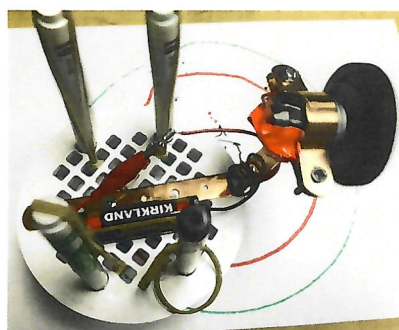
Consumable	Non-consumable
AA batteries	Small 1.5 v motor with leads attached (5)
Markers/crayons/pencils	Battery holders with leads attached (5)
Masking tape -(2)	Clothespins (24+)
Cardboard cylinders that are ~3"x 4" (3)	Binder Clips (12+)
Variety of plastic containers (e.g. yogurt containers and berry baskets) - minimum of 15	Corks
White butcher or craft paper - <b>TO GATHER</b>	Large buttons

Repair Kit (shared with Sand Sketching Scribble Bots) that includes:

- Wire strippers
- Electrical tape
- Multimeter
- Reference sheet for telling a working battery from one that is dead.

### Preparation

Cover the table with paper. Set up 3-4 premade scribble bots. Test them to make sure they work and create lines/scribbles on the paper. Sort and set out a collection of materials from which participants can create their own scribble bot. Sort out the marking tools (i.e. pencils, crayons, markers), and tools needed to attach the marking tools (binder clips, clothespins, masking tape). Preset a few offset motors by pushing a cork onto the motor end. Make sure the cork is offset as in the image.



### Questions to Extend Discoveries

Invite participants to first try one of the pre-made scribble bots and watch how it draws on paper as it vibrates and moves in unusual ways.

If participants want, they can create their own motorized contraption that vibrates and moves in unusual ways while marking its path on paper. Follow directions below.

1. Choose an empty container as the base. Attach battery pack and offset motor.
2. Attach marking tools such as markers, colored pencils or pens to the base with masking tape or Velcro so that it is balanced when you set it on the paper.
3. Test it out by placing your scribble machine on the paper, markers touching the paper. Reconnect the motor and battery wires or turn on the switch.

As participants are exploring or creating a scribble bot, encourage their discoveries. The following questions can be used to encourage and extend discoveries:

- What do you notice?
- What happens when...?
- What kind of marks did your machine leave on the paper? Does it remind you of anything?
- What happens if you take away or add another mark-making tool to your machine?
- Try to make your scribble machine go really slowly and smooth. ... Or fast and jumpy.
- Try to make your scribble machine make big and small circles.



## Sand Sketching Scribble Machines

Make a motorized contraption that vibrates and moves in unusual ways while marking its path in the sand/salt.

### Beforehand:

Check that there are plenty of materials. Check that circuits with motors all work. Check that batteries have enough voltage (good voltage is 1.4v).

### Materials

Premade scribbles machines (10)

Materials to make own scribble machine:

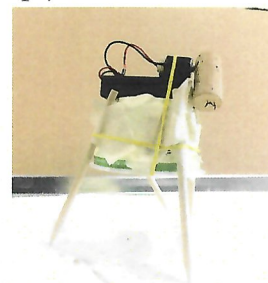
Consumable	Non-consumable
AA batteries	Small 1.5 v motor with leads attached (5)
Dowels/craft sticks/skewers	Battery holders with leads attached (5)
Masking tape -(2)	Clothespins (24+)
Cardboard cylinders that are ~3"x 4" (3)	Binder Clips (12+)
Variety of plastic containers (e.g. yogurt containers and berry baskets) - minimum of 15	Corks
Salt	Large button-like objects
Pool noodle ~4" tall	Half sheet size metal tray

Repair Kit (shared with Drawing Scribble Bots) that includes:

- Wire strippers
- Electrical tape
- Multimeter (1)
- Reference sheet for telling a working battery from one that is dead.

### Preparation

Sprinkle salt/sand into the metal tray so that it covers the bottom. Set up 2-3 premade sand sketching scribble bots. Test to make sure they work and sketch in the sand. Sort and set out a collection of materials from which participants can create their own. Sort out the marking tools (i.e. dowels, skewers, craft sticks, silverware), and tools needed to attach the marking tools (binder clips, clothespins, masking tape). Preset a few offset motors by pushing a cork onto the motor end. Make sure the cork is offset as in the image.





### Questions to Extend Discoveries

Invite participants to first try one of the pre-made scribble bots and watch how it creates paths and patterns in the sand/salt as it vibrates and moves in unusual ways.

If participants want, they can create their own motorized contraption that vibrates and moves in unusual ways while marking its path in the salt/sand. Follow directions below.

1. Choose an empty container as the base. Attach battery pack and offset motor.
2. Attach marking tools such as craft sticks, barbeque skewers, plastic rods, or sticks to the base with masking tape or Velcro so that it is balanced when you set it in the container of salt/sand.
3. Test it out by placing your scribble machine in the salt/sand, marking tools touching the salt/sand. Reconnect the motor and battery wire.

Ask the following questions to encourage and extend discoveries:

- What do you notice?
- What happens when...?
- What kind of marks did your machine leave in the salt/sand? Does it remind you of anything?
- What happens if you take away or add another drawing tool to your machine?
- Try to make your scribble machine go really slowly and smooth. ...Or fast and jumpy.
- Try to make your scribble machine make big and small circles.

## Circuit Blocks

### Beforehand:

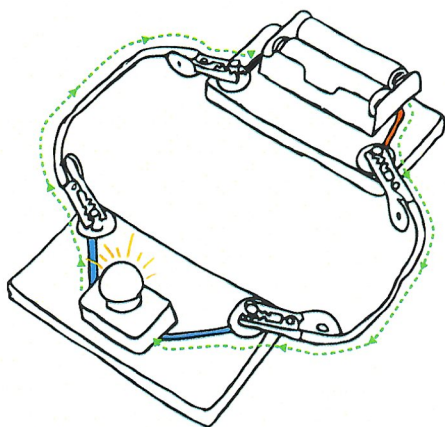
- Check for broken connections and repair.
- Be sure to take out batteries and all bulbs after each program.
- Use the multimeter to check batteries. A good voltage reading is 1.4v or higher.

### Background information and tips for facilitator

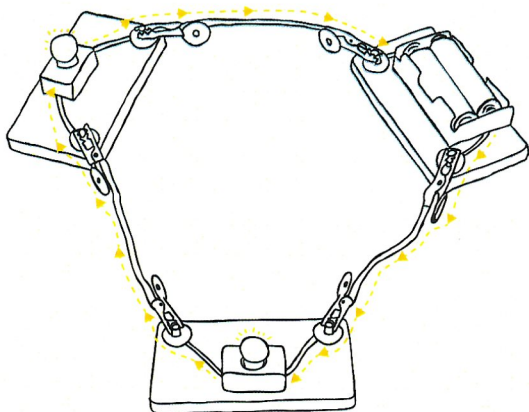
**What is a circuit?** A circuit is a closed loop (like a circle) where electrons flow from an energy source, such as a battery, to the object being turned on, such as a light bulb, and back again. Switches work by breaking the circuit (loop), thereby breaking (interrupting) the connection so that the electrons cannot flow. See graphics below for basic types of circuits.

Images from CIP Learning Store

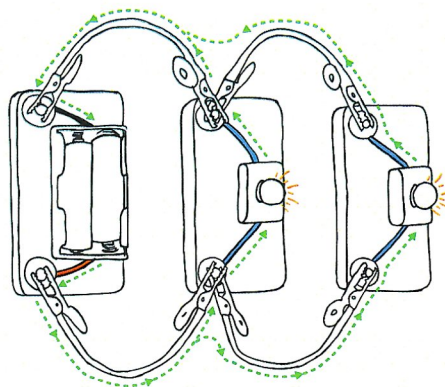
### Simple Circuit



### Series Circuit



### Parallel Circuit



**Batteries Block** is specially designed with a resettable fuse, which protects it from short circuits (which can cause batteries to get very hot and, on occasion, can cause them to catch fire). A short circuit is when a battery is connected back to itself without the electrons traveling through a powering a device such as a light bulb.

#### Materials

- AA batteries
- Circuit Blocks
  - 2 Lightbulb Blocks + extra light bulb
  - 1 Motor Block
  - 1 LED Block
  - 1 Bi-color LED Block
  - 1 Buzzer Block
  - 1 Knife Switch Block
  - 1 Rocker Switch Block
  - 1 Push-button Block
  - 1 Potentiometer (Dimmer switch) Block
  - 1 Photo Cell Block
  - 2 Batteries Block w/ 2xAA batteries
  - Alligator Clip Wires (12 wires total)

NOTE: Batteries should **NOT** be stored in the battery holder. Removing the battery after use will keep the battery holder from being destroyed if a battery leaks.

#### Preparation

Set circuit blocks on the table. Set up prompt.

#### Questions to Extend Discoveries

Invite participants to create a circuit using two wires and the battery so that they turn on something, a light bulb, for example. Encourage participants to see what else can they turn on or off. Use the following questions to encourage and scaffold discoveries.

“Show me what you have discovered.”

“What have you been able to turn on?”

“I noticed to that you made a circle between the battery and light bulb with the wires. What would happen if we made this circle bigger and included another block?”

“How can you turn on two light bulbs?” [Facilitator hint: there are 2 ways.]

**NOTE:** If the battery becomes hot, a short circuit has been created. A basic example of this is when a battery is connected back on itself without traveling through something else to turn on (e.g. light bulb).