Makey Makey with Scratch

LESSON PLAN FOR GRADES 8-12

NGSS STANDARDS ALIGNED ALONG WITH DOD CRITICAL TECHNOLOGIES

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Grade Level: 8-12 Estimated Time needed: 90 min

What's included in this lesson plan:

- Learning objective and targets
- Standards alignment
- Materials list
- Teacher guide and student activities
- Extension ideas

NGSS Standards: Middle School

- **MS-PS2-3:** Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
- **MS-PS3-5:** Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
- **MS-ETS1-2:** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- **MS-ETS1-4:** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process.

NGSS Standards: High School

- **HS-PS2-6:** Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
- **HS-PS3-5:** Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.
- **HS-ETS1-2:** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems.
- **HS-ETS1-3:** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs.

DoD Critical Technologies Connections:

- **Semiconductors & Microelectronics:** Students learn how circuits and conductive pathways work using Makey Makey, building a basic understanding of how hardware connects to computing systems. This supports the semiconductors and microelectronics focus on chip design, sensors, and secure electronic components**.**
- **Future Computing Technologies**: Through coding and prototyping, students explore how software and hardware interact. These skills align with future computing technologies, which emphasize innovation in advanced computing systems and efficient software design.
- **Artificial Intelligence:** Using Scratch, students practice coding logic and simple automation, the foundation of artificial intelligence. This connects to national priorities in AI and autonomy, preparing students to understand how machines learn and make decisions.

Estimated Time to complete:

- One class period: 50–60 minutes for introduction, demonstration, guided setup, and one main activity.
- Multiple class periods: 2–3 days, allowing more time for exploration, additional activities, coding extensions, and project sharing.
- Teachers can adjust timing based on grade level, class length, and student experience.

Learning Targets: Middle School

- I can explain what it means for a material to be conductive.
- I can use a Makey Makey to turn an everyday object into a computer input.
- I can create a simple program in Scratch that responds to a conductive material input.

Learning Targets: High School

- I can design and build an interactive project using Scratch and Makey Makey that applies coding concepts (loops, variables, events).
- I can compare Makey Makey to traditional input devices and evaluate its potential real-world applications (assistive technology, prototyping).
- I can troubleshoot coding and circuitry issues systematically and explain my process.
- I can connect principles of conductivity and coding to real-world engineering and technology applications.

Learning Objective:

Students will explore electrical conductivity and human-computer interaction by using Makey Makey kits with Scratch to design and test interactive projects. Through hands-on experimentation, they will apply coding concepts, analyze how circuits work, and connect these ideas to real-world technologies.

Materials:

- Computers:
  - Internet access required
  - Instructor computer with projector
  - One computer per student pair
- Makey Makey kits (one per pair)
- Scratch: Makey Makey packet (one per pair)
- *Optional*: Scratch account (free at scratch.mit.edu)
- Notebook for notes
- Aluminum foil (for Foil Piano activity)
- Blank white paper and graphite (for Bringing Art to Life activity)
- Other conductive materials: fruits, vegetables, metal objects, salt dough, tape, etc.

Note: *Students should be placed in pairs for all activities*

Student Introduction:	***Scripted***

STEP 1: Engage Students

- Ask: "Who *here has heard of the website Scratch?*"
    - Pause and allow students to respond

STEP 2: Explain Scratch

- Say: *"Scratch is a website where you can create your own games, stories, and animations by putting together blocks of code. You drag and drop different blocks to make your characters do things."*

STEP 3: Introduce Makey Makey

- Say: *"Today, we are going to explore how Makey Makey can turn everyday objects into interactive controls for a computer. We will also use Scratch coding to create our own interactive projects!"*

STEP 4: Activate prior knowledge about conductivity

- Ask: *"Before we start, let's talk about electrical conductivity. What does it mean for something to be conductive?"*

    - Allow students to respond. Possible answers: It allows electricity to pass through, lets electrons flow, or completes a circuit.

- Ask: *"Can you think of materials that conduct electricity?"*

    - Allow responses. Possible answers: Metals, water, graphite, certain fruits, etc.

STEP 5: Instructor explanation

- Ask: "Before we start, let's talk about electrical conductivity. What does it mean for something to be conductive?"
    - Allow students to respond. Possible answers: It allows electricity to pass through, lets electrons flow, or completes a circuit.
- Ask: "Can you think of materials that conduct electricity?"
    - Allow responses. Possible answers: Metals, water, graphite, certain fruits, etc.

Instructor Demonstration: ***Scripted***

Step 1: Preparation and Reminder

- Remind students that they do not need a Scratch account to follow along.
- Explain that during the demonstration, students should **watch and take notes only**. Hands-on practice will come later.

Step 2: Open Scratch

- On the instructor computer connected to the projector, open the Scratch website.
- Click the **Create** tab at the top-left corner of the page.

Step 3: Introduce Key Sections

- **Code Blocks:** Located on the top left of the workspace.
    - Tabs: **Code, Costumes, Sounds**
    - Under the Code tab, categories include: **Motion, Looks, Sound, Events, Control, Sensing, Operators, Variables, My Blocks**
    - *Note: Any added **extensions** (bottom-left) will appear in the code area as well.*
- **Start and Stop the Program**: Located at the top right.
    - **Green Flag:** Starts the program
    - **Red Stop Sign:** Stops the program

Deleting Code Blocks: Right-click the block you want to remove, then select **Delete** from the dropdown menu.

Guided Lesson:	***Scripted***

Step 1: Distribute Materials

- Give one **Scratch packet** and **one Makey Makey kit** to each pair of students.
- Ensure students are **working in pairs.**

Step 2: Provide Instructions

- Say: *"Follow along with what I'm doing, and do not work ahead."*
- Say: *"There are multiple projects in your packet that you will work on with your partner, but do not start them yet."*

Step 3: Guided Setup

- Lead students through the first page of the packet: **Set Up Makey Makey**.

Step 4: Explain Circuit Importance

- Say: *"It is crucial that the circuit is closed for Makey Makey to work properly. When the circuit is closed, the Makey Makey can detect the electrical connection and trigger actions in Scratch. This happens when you hold the metal part of the alligator clip attached to the EARTH portion on the Makey."*

Student Activities:

Step 1: Quick Overview

- Before students begin independently, **review the packet** with them.
- Highlight **important instructions and expectations**.
- Show where in the room students can find **supplies** for the different activities.

Step 2: Electric High Five Activity

- Direct students to start with the **"Electric High Five"** page in the packet.
- Encourage them to **follow the step-by-step instructions**.
- Remind students they can **ask for assistance** if they have questions or encounter challenges.

Step 3: Continue with Packet Activities

- Once students finish the Electric High Five activity, allow them to **work through the remaining activities** in any order.
- *Provide **support and guidance** as needed while students explore*

Conclusion:

Step 1: Clean-Up

- Remind students to **pack up their Makey Makey kits and materials** and return everything to the designated area.

Step 2: Review Key Concepts

- Ask students to **share what they enjoyed most** about using Makey Makey and Scratch.
- Reinforce that **Makey Makey turns everyday objects into interactive controls**, and **Scratch allows them to create projects that respond to those controls**.

Step 3: Encourage Exploration

- Suggest that students **continue exploring Scratch** and think about new **interactive projects** they can create.

Extension Activities and Questions:

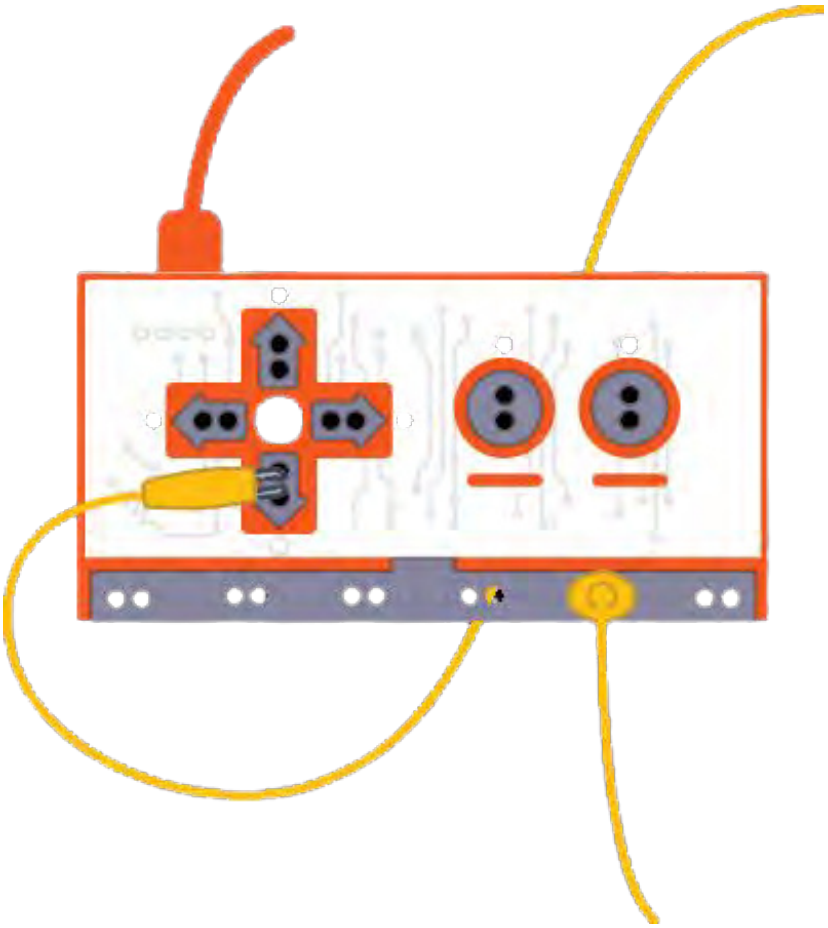
Step 1: Open-Ended Discussion Questions

- These questions can be explored **as a whole group** or **assigned individually**:
    - *"Why do you think certain materials conduct electricity while others do not? What other common items might be conductive?"*
    - *"How does the Makey Makey differ from other input devices like a mouse or keyboard? What makes it unique?"*
    - *"How do you think people use the same principles of conductivity and coding in the real world? Can you think of any real-world devices that might use similar technology to Makey Makey?"*

Step 2: Combine Makey Makey with Other Coding Concepts

- Introduce students to **variables, loops, or other Scratch coding concepts** to make projects more dynamic.
    - Example: Create a **counter** that tracks how many times a conductive object is pressed.
    - Example: Set up a **loop** where pressing an object triggers an action repeatedly.
- Prompt students:
- *"Can you use variables or loops in your Scratch project to track the number of times an object is pressed, or to make the program do something automatically?"*

Makey Makey Cards



Make projects that connect to the physical world with Makey Makey!

Edited for this lesson. Not the same as the original from the scratch website.

scratch.mit.edu

what's in this packet

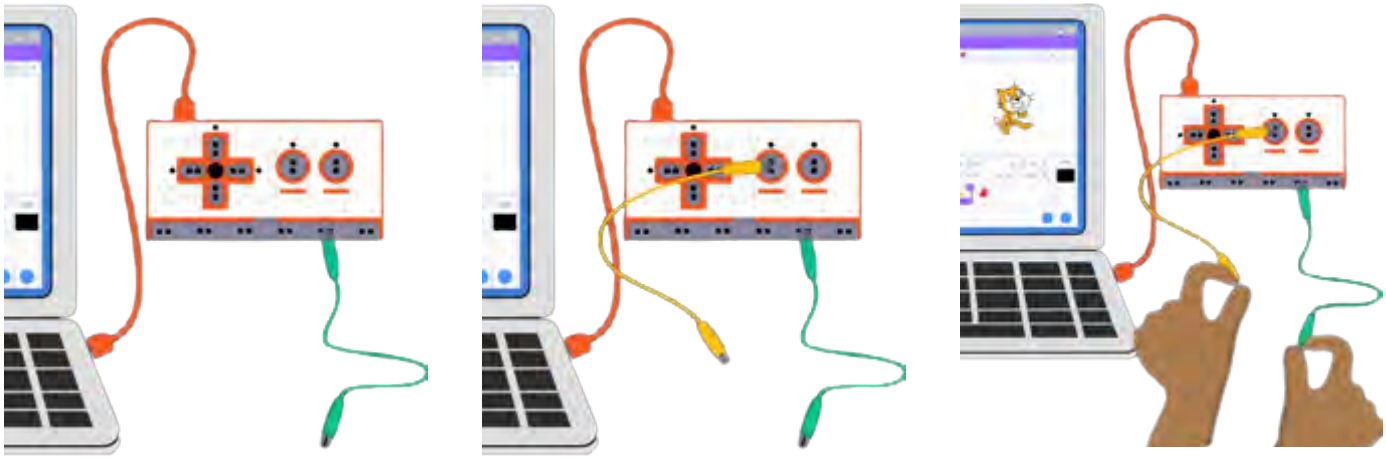
- Set Up Makey Makey
- Electric High Five
- Makey Secret Code
- Foil Piano
- Art Comes Alive

Set Up Makey Makey

Instructions:

- Plug the Makey Makey Board into your computer using the provided cable. You should see a light turn on on the board to know it is connected properly.

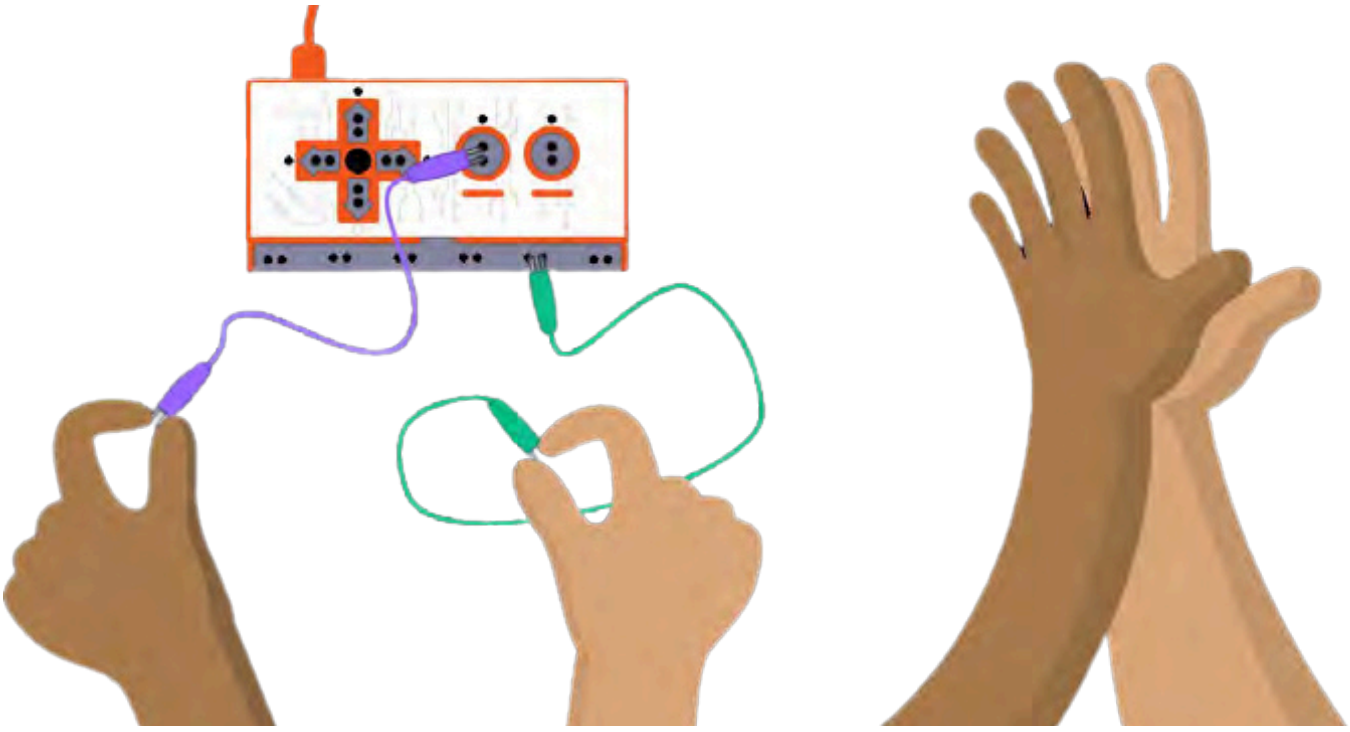
- Open Scratch (www.scratch.mit.edu) and click “Start Creating” to create a new project.



- Connect an alligator clip to any set of holes along the “EARTH” strip on the bottom of the board.
- Connect an alligator clip to any of the holes aligned with a keyboard key.
- Create a practice script to check that it works.
- Close the circuit to make the program register that the keyboard key was pressed. You do this by holding the metal part of each alligator clip (key and EARTH)

Edited for this lesson. Not the same as the original from the scratch website.

Electric High Five



Instructions:

- Connect one alligator clip to EARTH.
- Connect a second alligator clip to a keyboard key.
- Have each person touch an alligator clip and give a high five to close the circuit and see the result!
- In depth instructions on next page.

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Makey Makey

Electric High Five

scratch.mit.edu

GET READY

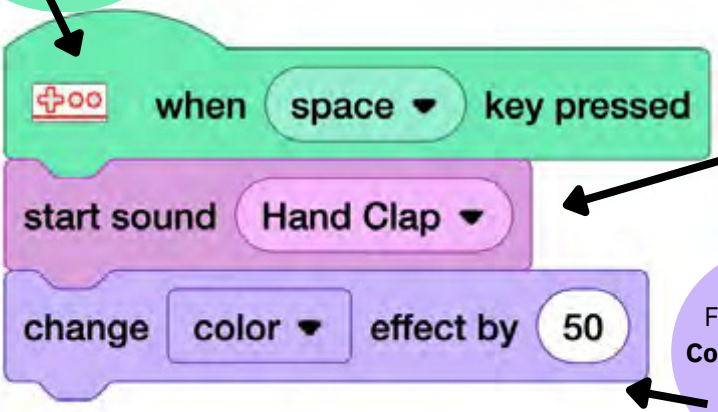
Choose any sprite.

Pico

Find a partner.

ADD CODE AND TEST

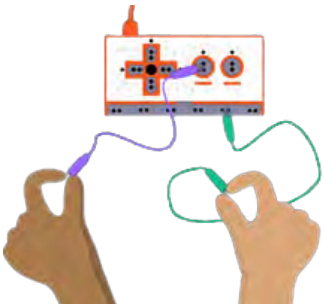
Found in the **Code** tab under the **Makey Makey** extension



Found in the **Code** tab under **Sound**

Found in the **Code** tab under **Looks**

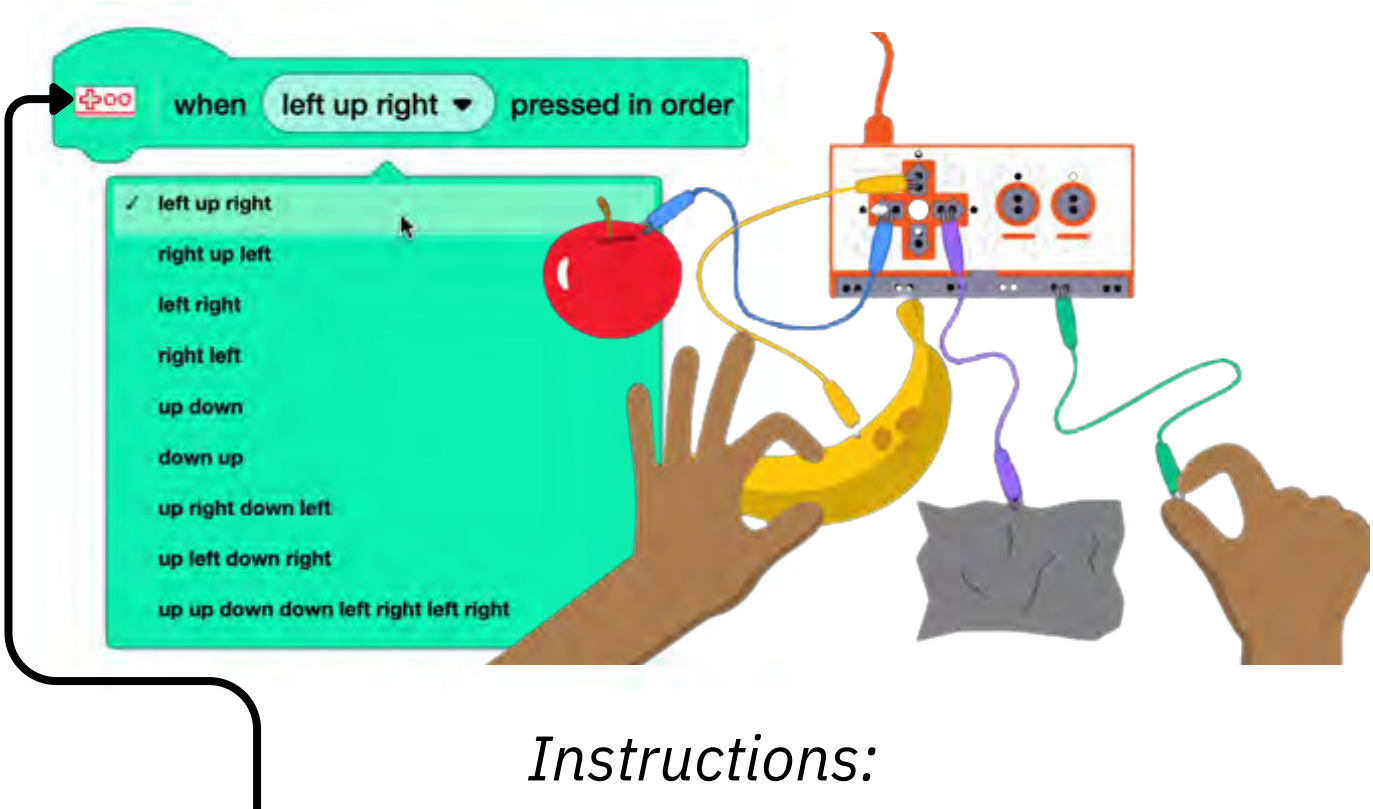
Drag and drop blocks to create a sequence that runs when a key is pressed.



One person holds the alligator clip connected to the keyboard key. The other holds the clip connected to EARTH.

Now, give a high five to close the circuit and run your code!

Makey Secret Code



Instructions:

- Use this block available under the Makey Makey Extension.
- Select a keyboard combination to activate your secret code program.
- Touch the alligator clips or connected conductive objects in the right order to close the circuit and see the result!
- More in-depth instructions on the next page.

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Makey Makey

Makey Secret Code

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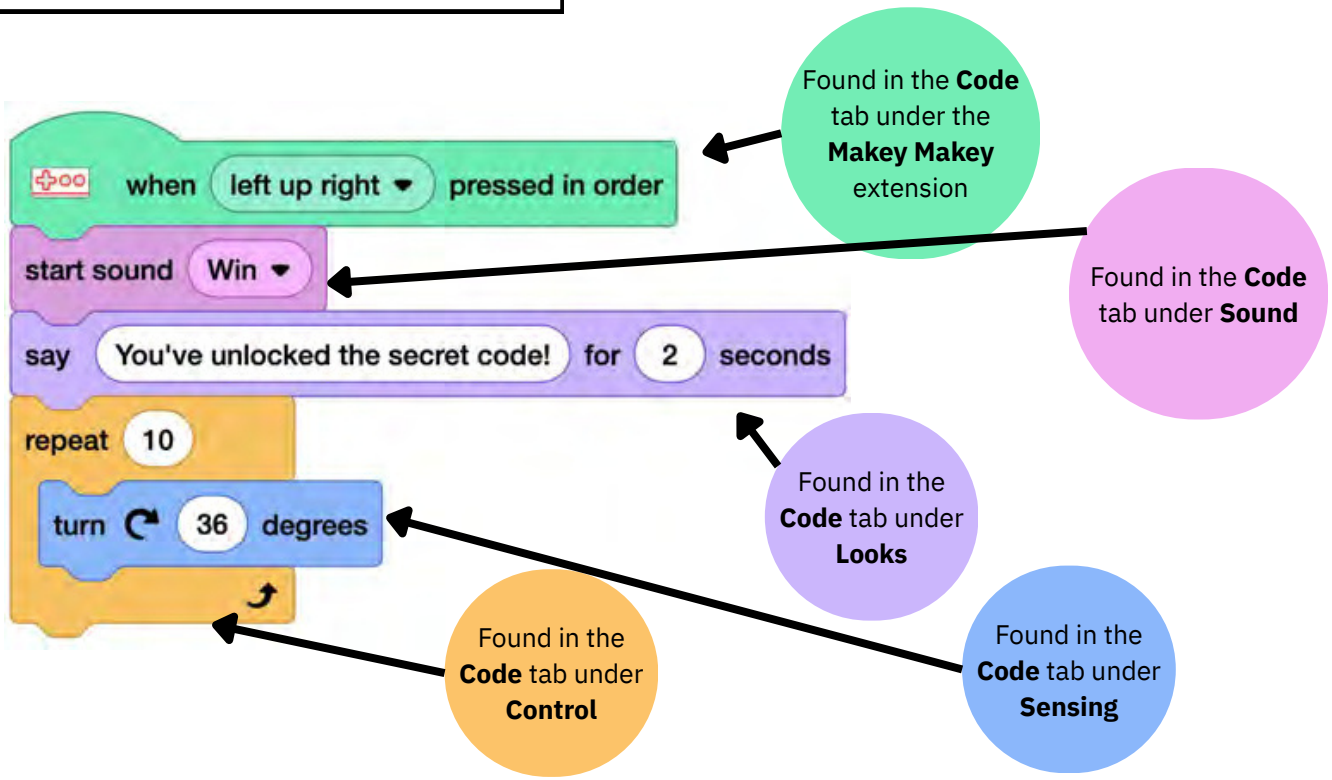
GET READY

Choose any sprite

Pico

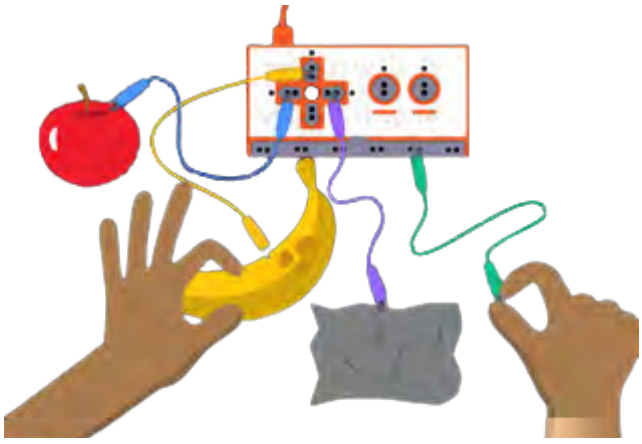
ADD CODE AND TEST

Choose the block combination to activate your program, and write a script to run when received.

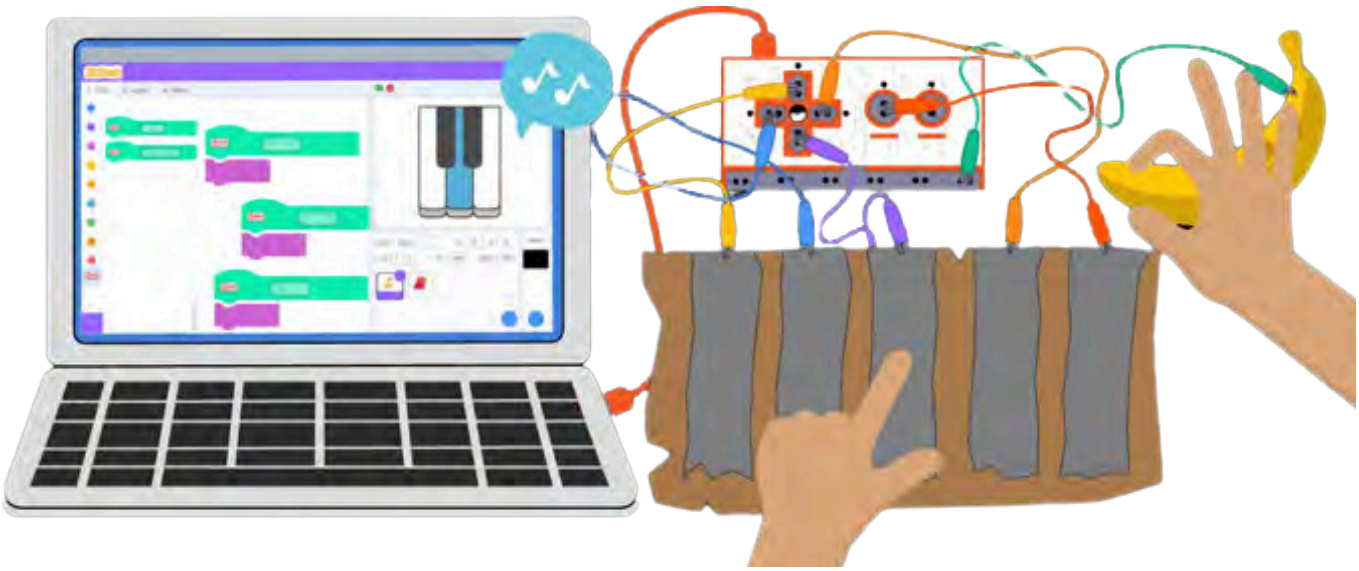


Close the circuit to register each keyboard press by touching EARTH and each keyboard input in order.

Debug your code and test the conductivity of materials by trying actual keyboard keys versus the Makey Makey.



Foil Piano



Instructions:

- Connect one alligator clip to EARTH and various alligator clips to multiple keyboard keys, which will represent various musical notes.
- Code a project so key presses play different notes.
- Use foil, bananas, Play-doh, or other conductive materials as external keys.
- More in-depth instructions on the next page.

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Makey Makey

SCRATCH

Foil Piano

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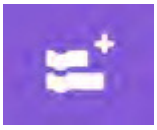
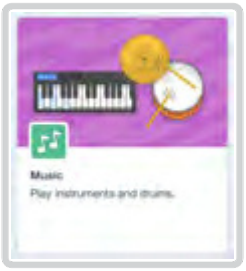
GET READY

Choose any sprite or draw your own.

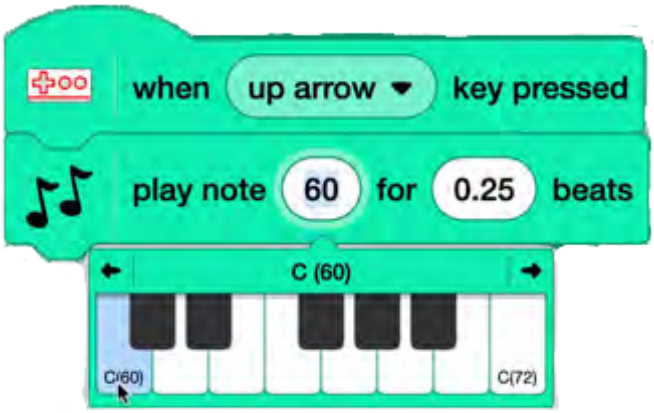


Optional: add the Music Extension.

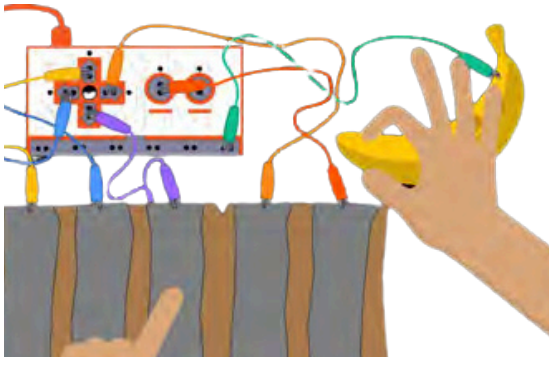


ADD CODE AND TEST

Select note sounds in the Sound library to play when different keyboard keys are pressed. (You can use the Makey Makey extension hat block or the Event hat block.)

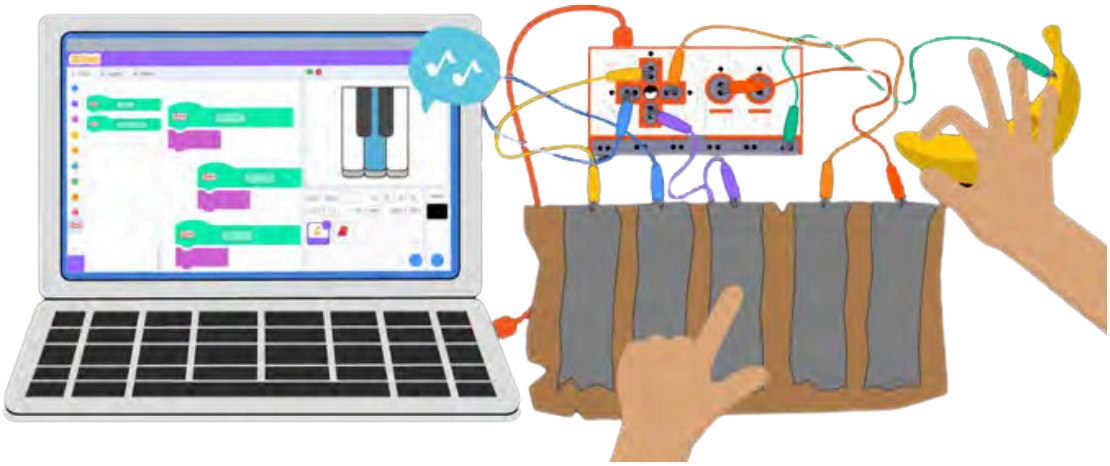


Or add the Music Extension and select notes to play when different keyboard keys are pressed. Notes can be customized for beat count and instrument.



Close the circuit to register each keyboard press by touching EARTH and a keyboard input.

Foil Piano



Instructions:

- Create a drawing, informational sheet, poem, or poster you want to connect to the digital space.
- Use graphite pencil, foil, conductive tape, or conductive paint to create connection points with pieces.
- Use Makey Makey and Scratch to provide additional information when participants interact with your work.
- More in-depth instructions on the next page.

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Makey Makey

Art Comes Alive

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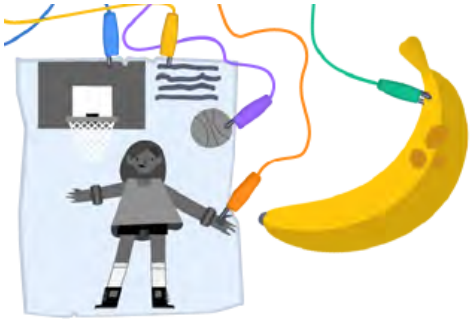
GET READY

Choose any sprite.

Create your drawing.

ADD CODE AND TEST



Connect different pieces of your drawing to alligator clips. Make sure the conductive pieces don't overlap, so only one key is registered as pressed at a time. Don't forget to connect EARTH!

Found in the **Code** tab under **Looks**

Add code to play a sound (like a recording of your voice) or have your sprite say something when different pieces of the drawing are touched.

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Makey Makey