TECHstyle TALES

Make. Learn. Share.

DAY 2: PLAY ON THE PLAYGROUND

CPX Practice

Families will build their circuit literacy, understand the basics of the Circuit Playground Express (CPX) microcontroller, practice using MakeCode to create code, and develop place-based narratives for their projects.

badges

materials

- Meal and paperware, drinks with lids
- Books
- Paper
- Simple template for sewing a drawstring bag
- 8x10" (or approx. size) felt sheets
- Scissors
- Ribbon
- Needles and thread
- Alligator clips
- Pen, pencils, markers, crayons
- CPX kits and computers
- Sewable LEDs
- Badges

workshop day 2

1. WELCOME & SHARING

Sharing a meal
Sewing practice

2. STORYTELLING

Facilitator shares a storybook or traditional story
Project prompt brainstorm

3. EXPLORING

CPX with a simple circuit
Introduction to CPX microcontroller
Free play on the playground
Project sketch

4. ACKNOWLEDGING

Badges, reflection
Clean up

workshop day 2

MEALTIME & SHARING

30 minutes

Welcome families as they arrive. Post a schedule of the day prominently in the room, on a white board, paper, or projected on the wall. You may ask if anyone had a chance to open up their backpacks and use anything since you last met.

ACTIVITY

As they are eating, invite families to pick out a piece of felt to make a simple drawstring bag. They may choose to pair up with someone in their family, or make one on their own.

They will practice following a template, making starting and ending knots, and sewing a running stitch. Once it is started, this is a project that can be worked on in any down time.

Check in with all families on their progress and help them with sewing, identifying skills other family members may be able to share. Use your best judgement on whether or not sewing will be a good quiet task while listening to stories. If a child has been able to sew one side of the bag, they may be able to continue sewing with little help. If you are noticing more help is needed, you may want to allow more time for this activity.

materials

- Light meal, disposable cutlery, drinks with lids
- Simple Template for sewing a drawstring bag
- 8x10" Felt sheets
- Scissors
- Ribbon
- Needles and Thread

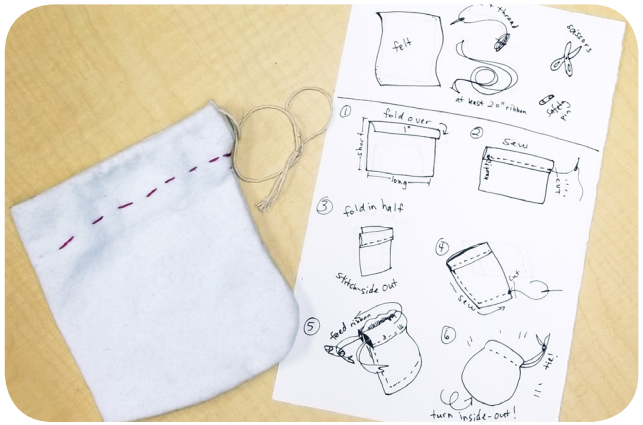
background info

Families will begin making their drawstring bags but will not likely finish during this time. They may continue sewing it through the rest of the series.

The finished bag will be a good base for practicing sewing simple circuits, and it can serve as a useful container for small materials.

set up

Set up food and paper goods on a table.
Arrange any books or supplemental items on a table.
Place sewing materials out on each table or a central table.

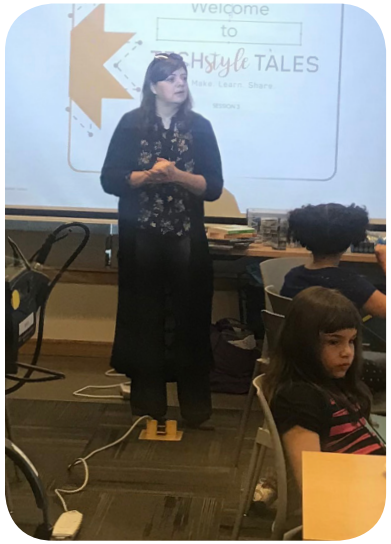


Sewing instructions from family guide and completed drawstring bag

SHARE A STORY

10-15 minutes

Invite a visiting storyteller, scientist, artist, or even a participating family member to come and share an oral story. A story supporting the importance of place, community or family building, learning in everyday life, systems thinking, or learning from challenges will support themes in Tech Style Tales. You may invite participants to continue their sewing practice while listening to stories if it is not too distracting.



Ask follow up questions about the story, such as:
What did the story mean to you?
What details did you notice that you thought were interesting?

materials

Suggested read aloud book:
The World Is Not a Rectangle: A Portrait of Architect Zaha Hadid
by Jeanette Winter

workshop day 2

workshop day 2

PROJECT PROMPT BRAINSTORM

20 minutes

At the end of the last session, we asked families to think about the project prompt at home if they had time. This brainstorm time is meant for families to reflect and gather everyone's ideas about important places. They don't need to come to a decision as a family just yet. Encourage families to use their preferred language or opt to draw their thoughts (see pages 7-8 in family guide).

EXPLAIN

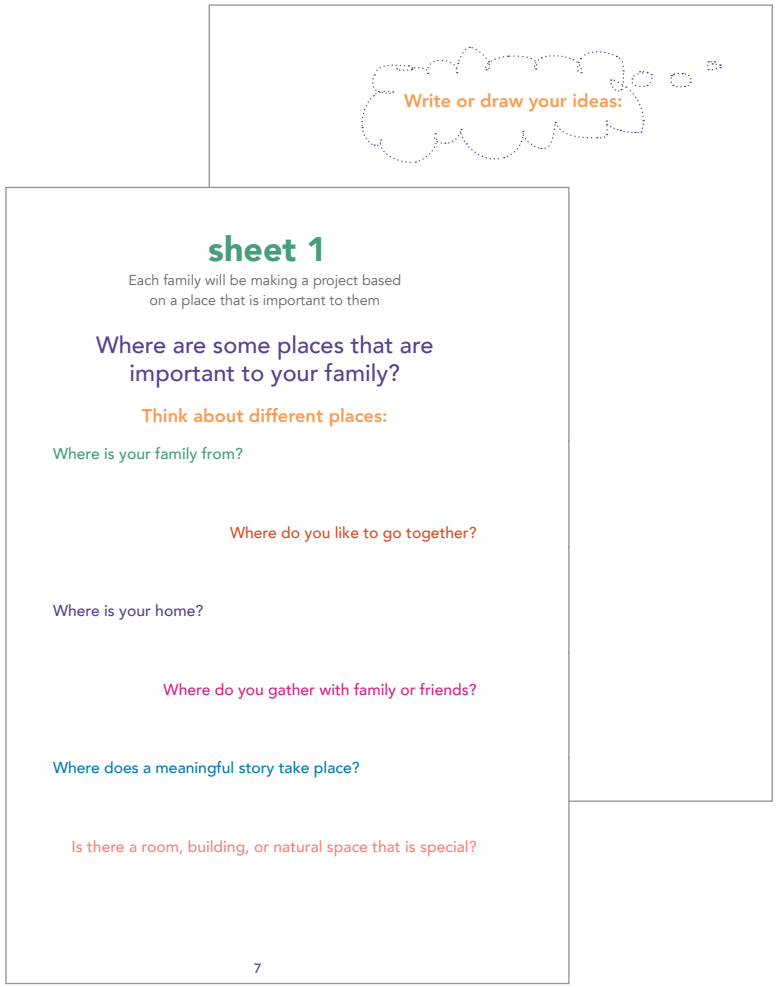
Last session, we showed you an example an e-textile project based on an important place. Take a moment now to write down or sketch some ideas about your important places within your family. Write your answers on the sticky notes. Everyone should contribute ideas about places that are important to the family.

Answer some of these questions as you think about these places.
What are important places for your family? *We want families to think of all sorts of different places.*
Where is your family from?
Where do you like to go together?
Where is your home?
Where do you gather with family and friends?
Where do your meaningful stories take place?
Is there a room, building, or natural space that is special?

After about 15 minutes, invite families to pair up to share their ideas in small groups.

materials

- Session 2 slide deck
- Scratch paper
- Sticky notes
- Family guides
- Pens, pencils, markers, crayons


Write or draw your ideas:

sheet 1

Each family will be making a project based on a place that is important to them

Where are some places that are important to your family?

Think about different places:

Where is your family from?

Where do you like to go together?

Where is your home?

Where do you gather with family or friends?

Where does a meaningful story take place?

Is there a room, building, or natural space that is special?

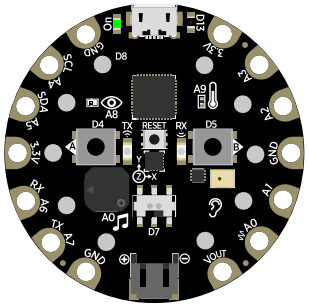
7

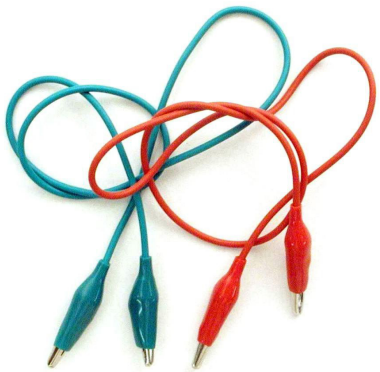
CPX AS A SIMPLE CIRCUIT

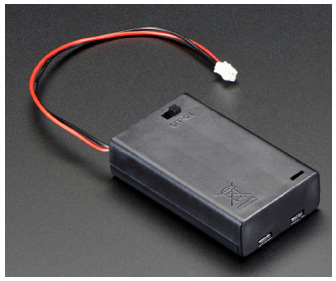
15 minutes

This is a guided group activity using the Circuit Playground Express (CPX) to create a simple circuit as we did using the circuit blocks.

Hand out alligator clips and LEDs, and instruct families to take their Circuit Playground Express kit from their backpacks. Encourage families to take a look at the CPX and get familiar with the pieces.







materials

Session 2 slide deck
CPX (1 per family)
Alligator clips (2-4 per family)
LED lights (sewable, 1-2 per family)

background info

- **Polarity:** Certain electronic components have a predetermined polarity, which means that it matters which way the component is connected in the context of a circuit, such as an LED
- **LED:** Light Emitting Diode; A diode is a component that only allows electricity to pass through it in one direction. If you connect an LED backward, electricity will not be able to pass through it and it will not light up. (Make: Wearable Electronics, p. 8)
- **3.3V** means three and a third volts of electricity is sent from this pin. This is the same way we refer to the positive (+) side of a battery (stored energy). The small coin cell batteries we used also emit 3.3V of electricity.
- **Avoid using VOUT with external LEDs in place of 3.3V** because its voltage is 5V, which is enough to burn out the LEDs
- **In electrical engineering, "ground" (GND) or "earth"** is the reference point in an electrical circuit from which voltages are measured, a common return path for electric current, or a direct physical connection to the earth. This is how we direct the current back to the energy source as we did when connecting to the negative (-) side of the battery.

EXPLORING

The Circuit Playground is an example of a **printed circuit board (PCB)**. There are many little circuits running across the surface of the board that connect the various components and pins to the microcontroller. On the back side the little electrical lines, or traces, are visible. The little gold pads with holes are called pins. We will use these pins to connect to the board. Engage in a very short discussion about this new piece of technology.

ASK

What kinds of things do you notice about this board? Have you used anything like this before? What do you think it might do?

Display an enlarged image of the Circuit Playground (projected or printed large).

EXPLAIN

We're going to locate two pins (or connection pads) on the board first:

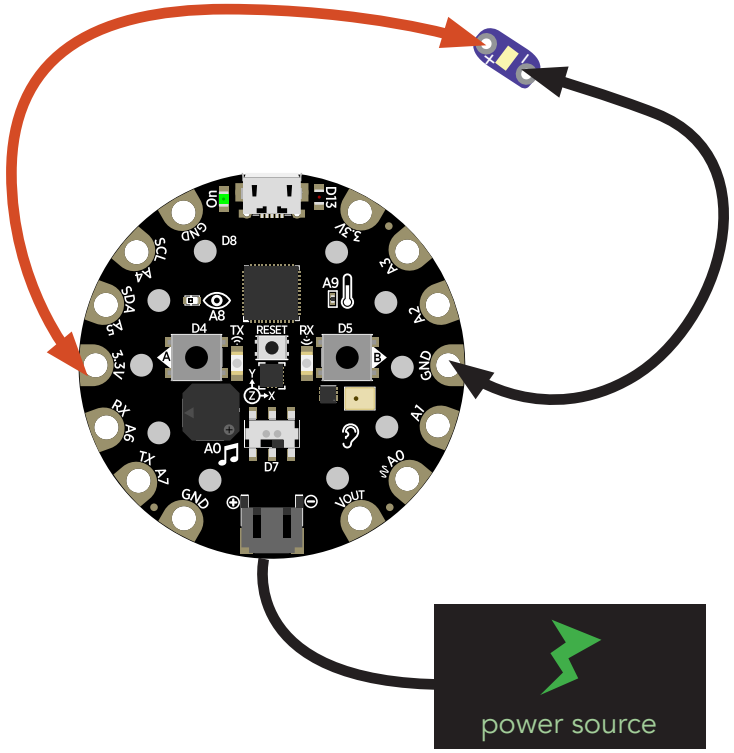
- GND
- 3.3V

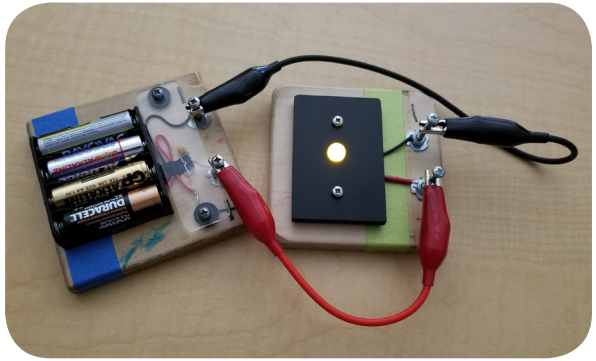
(there are *two* 3.3V pads & *three* GND pads, folks can pick *any* one of each). Indicate so everyone can see.

Connect one alligator clip to each of those connection pads.

Take one tiny LED and connect the other ends of your alligator clips to the tiny LED.

Find the black battery pack in your case and attach it to the CPX. Turn the battery pack switch to ON.





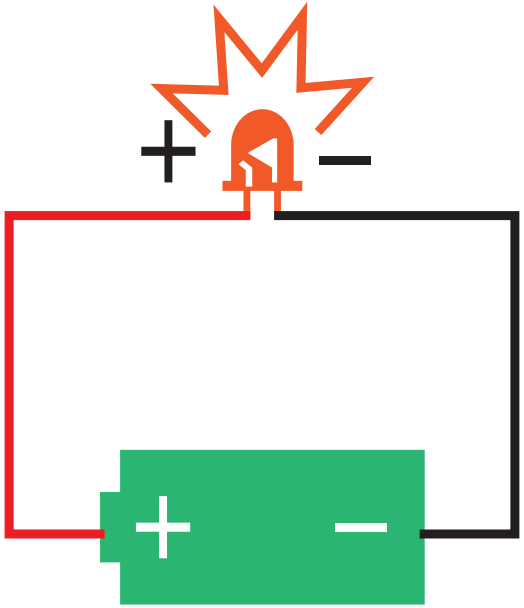
Examples of simple circuits

ASK:
Did your light turn on? If not, what is something you could change? How is this similar to or different from the circuit blocks?

EXPLAIN
The GND pin connects to the '-' on the LED and 3.3V pin connects to the '+' of the LED. As we saw with the circuit blocks, we need to pay attention to the *polarity*, or the connections to positive and negative. If your LED didn't light up, try switching the alligator clips on the LED from one side to the other. Other things to check: battery pack turned on, secure connection with alligator clip, working LED. The connection has to be secure between the metal pads and the alligator clips. If they're not touching well enough, the light may flicker or not turn on.

SAFETY TIPS:

- Be careful not to pinch any skin or small fingers with the alligator clips. Demonstrate how to use alligator clips.
- As with the circuit blocks, always make sure there is a load between the negative and positive sides of the circuit. If the negative (-) side is connected directly with the positive (+) side, a short circuit will be made and it can end up damaging the CPX.

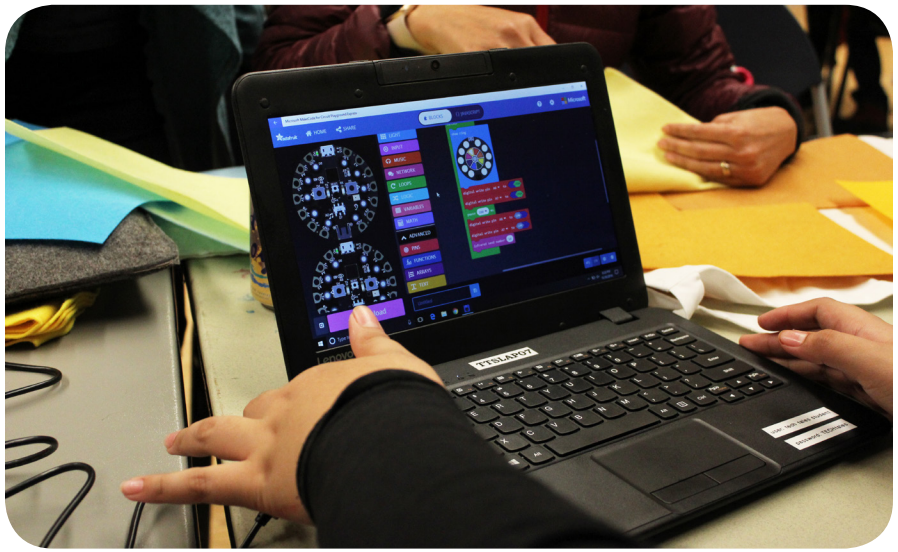


CPX AS A MICROCONTROLLER

15 minutes

Next we move on to a guided group exploration of programming the pins on the microntroller. While you may adapt this activity however is best for you, it is important to make sure that all families learn how to control a pin as an output and upload their code to the CPX.

We have used the power and ground pins to send electricity to an LED, but the Circuit Playground is capable of doing a lot more complex things using the microcontroller. The microcontroller chip is like a tiny brain that we can control with programming. Instruct families to take out and log in to their computers, and to find the USB cord that connects the CPX to the computer.



Using MakeCode for Adafruit

materials

- Session 2 Slide Deck
- CPX (1 per family)
- CPX USB cord
- Laptops (1 per family)
- Mouse (1 per computer if needed)

background info

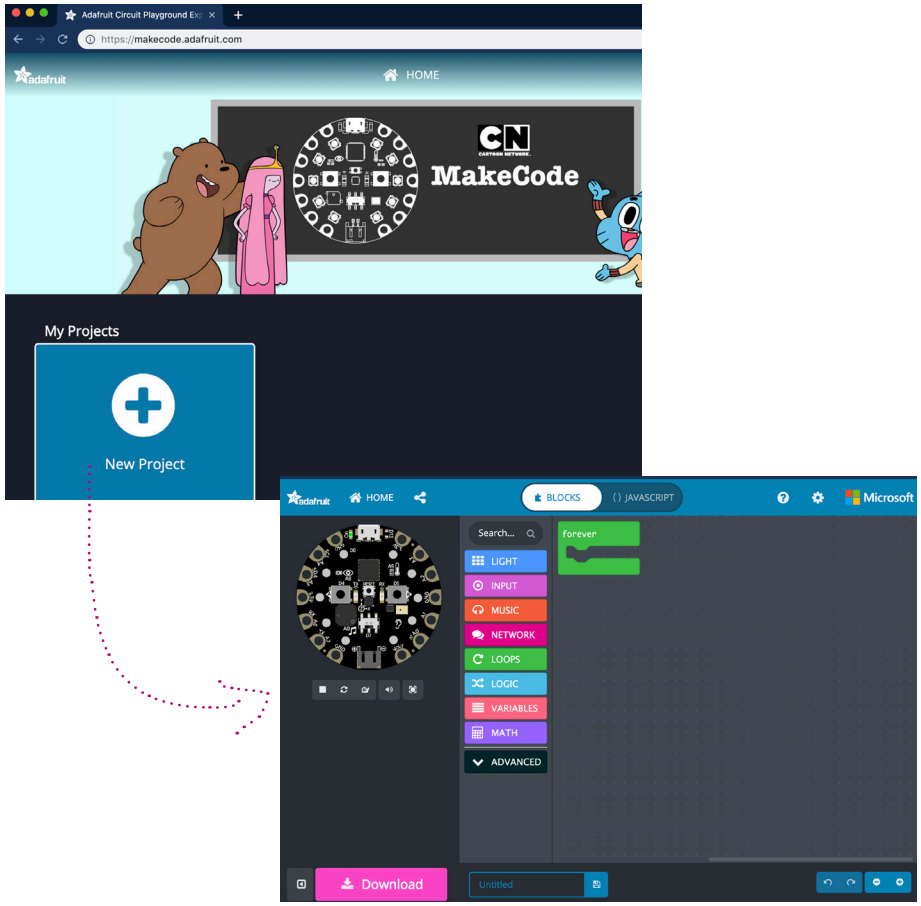
- Make sure that the laptop login information is posted in the room or directly on the computers.
- You may want to provide an additional laptop and/or CPX during the sessions if the family is large and not everyone is able to participate.
- MakeCode online or in the app version requires internet connection to run the visualizer, but will communicate with the board regardless of internet connection.
- **Microcontroller:** a small computer on a single, integrated circuit with a processor, memory, and controllable output and input pins. (*Arduino Wearables, p. 31*)
- We will be referencing "***systems***" throughout this workshop series. There are natural systems in the world like ecosystems, along with human-designed systems like software systems. See the slides to see the computer system that we will be using.
- There may be a wide range of familiarity around using a computer. Be sure to go slowly, particularly at first, and make sure everyone is caught up. Using a trackpad or a mouse may not be familiar to all.
- The free MakeCode desktop app can be installed via the Microsoft store. See the Resources section at the end of this guide for links.

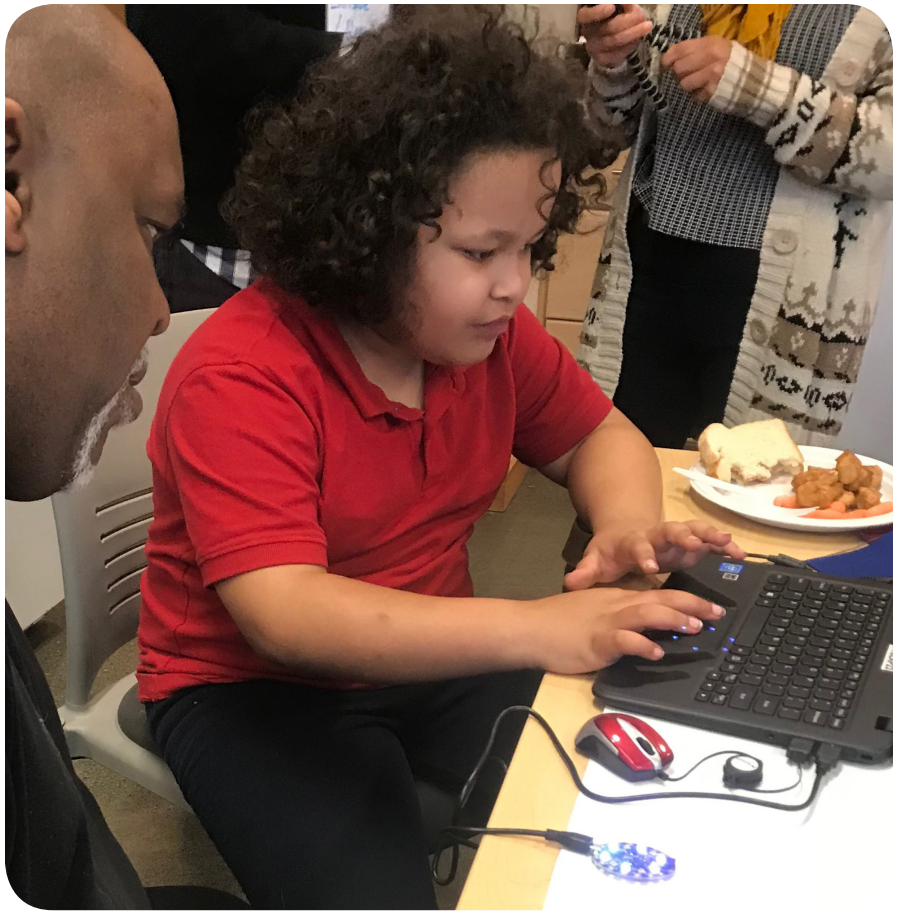
Project your screen to walk through an introduction to MakeCode together.

INSTRUCT

When you're ready, open the desktop app or go to this website:
https://makecode.adafruit.com/

Click "New Project" in MakeCode.





workshop day 2

EXPLORING

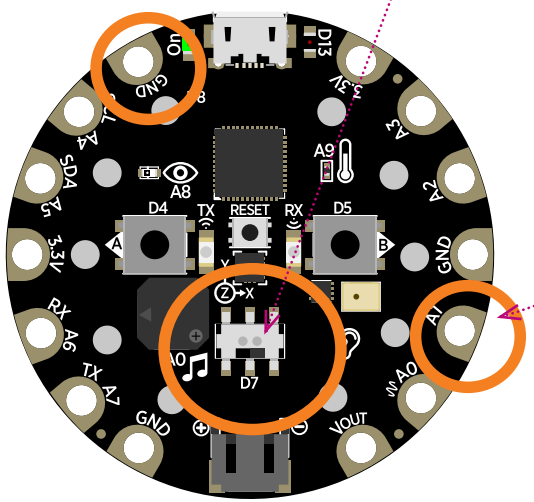
This programming interface is called MakeCode. You may see that it looks similar to Scratch, using visual blocks of code that you can click and drag around. We'll be using this interface to control the Circuit Playground Express (CPX). Advanced users may want to use the Javascript option supported by MakeCode. This guide supports using the block programming interface.

Instruct families to connect their Circuit Playground Express to their laptop with the USB cord.

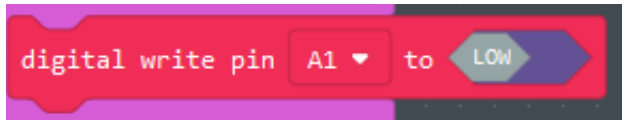
EXPLAIN

We're going to do a few things as a group, then you'll have plenty of time to explore and try things out.

Now we know we can turn on an LED, let's try to turn the LED on and off using a sliding switch on the CPX. Find the tiny little switch on your Circuit Playground (You may need a magnifying glass, or very strong eyes!) (*Wait for all to find the switch*)



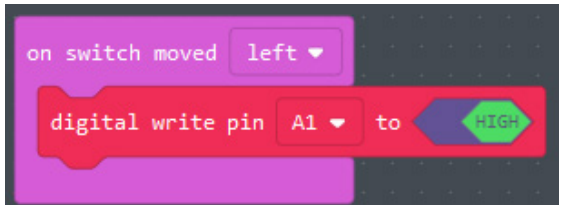
Now, let's use some computer programming to tell the LED when to turn on. Click on the ADVANCED block to expand more options. Click on PINS (red) and look for the block that says DIGITAL WRITE PIN. Drag it over to the blank workspace to the right.



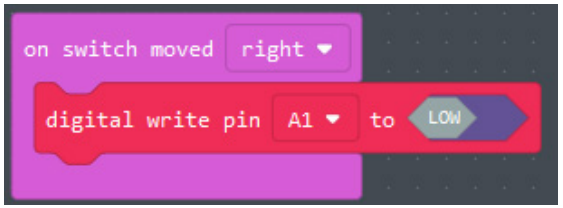
All along the outside of your Circuit Playground are little metal connection pads, or pins. Find the one labeled ***A1***

Unclip your alligator clip from 3.3V and move it to A1. Leave the other alligator clip connected to GND.
In the red code block on your computer, select A1 from the dropdown and move the grey shape from LOW to HIGH (off/on).

Click on the pink menu that says INPUT and find the option for ON SWITCH MOVED LEFT. Drag it over your digital write pin block. It will snap open around the block to enclose it like alligator jaws.



If you right click on that joined block, you can click on DUPLICATE and it will copy both blocks. In that duplicated block, you'll change LEFT to RIGHT in the pink block and change HIGH to LOW in the digital pin block:



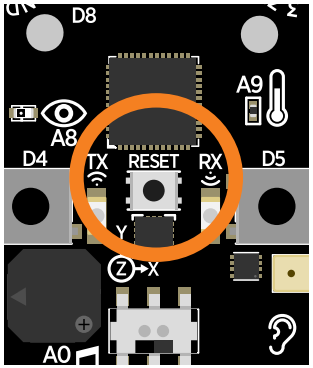
What do you predict what this code will do? Let's see it in action and that may help us understand what we just did.

We need to download our code to sent to the Circuit Playground. Make sure your CPX is connected to the computer with the USB cord.

RESET BUTTON

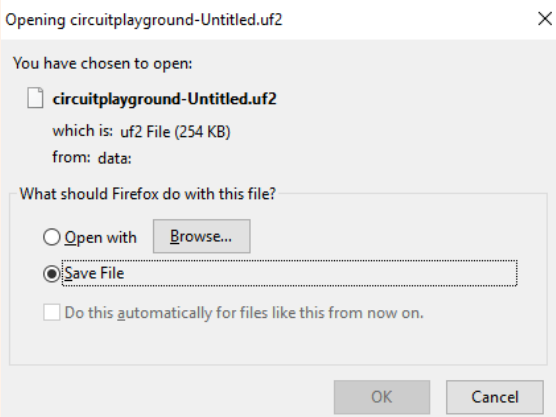
In the middle your Circuit Playground board is a tiny **RESET** button. **Find it and press it once.**

The lights on your board will turn red briefly, then green and that's what we want to see. Also verify the **status LED** is also pulsing red.



Click on the pink DOWNLOAD button.
If you are using the MakeCode app, saving code to the CPX should be as easy as pressing this button.

If you are using the app for the first time, or if you are using the MakeCode website, you will need to follow these additional steps.



A dialog box will pop up asking you whether you want to open with or save file.
Click SAVE FILE.
Click OK.

Find the *.uf2 file generated by MakeCode in your FILE EXPLORER (it will most likely be in the DOWNLOADS folder)

In your computer's FILE EXPLORER (or Finder on Mac computers) locate CPLAYBOOT. It will show up as a drive.

Click and drag your file and drop it onto CPLAYBOOT icon. This pushes your code to the Circuit Playground.

The status LED on the board will blink while the file is transferring. Once it's done transferring your file, the board will automatically reset and start running your code (just like in the simulator).

ASK
It's time to test your code! Can you find the switch again? What happens when you flip the switch? Does it do what you expected? If not, what might have happened? What could you change?

workshop day 2

FREE PLAY ON THE PLAYGROUND

25 minutes

Now that families have written their first piece of code, it's time to play around! They will experiment with the built-in components on the CPX board including light, sound, and sensors.

Post a diagram of the Circuit Playground Express for families to refer to as they experiment. Encourage families to make sure everyone gets a turn programming with MakeCode and to work together. Make yourself availiable for assistance. Walk around the room while folks are practicing with MakeCode and check in to see how they are progressing.

Families should at least get experience programming the neopixel colors and animations. If they wish, they can practice using buttons to activate the lights or sounds by the end of this session.

The following pages include step-by-step instructions for facilitators.

materials

- Session 2 Slide Deck
- CPX (1 per family)
- CPX USB cord
- Laptops (1 per family)
- Mouse (1 per computer if needed)

background info

- This is unstructured time for families to explore the CPX.
- As you walk around the room, try to notice what families are learning so you can facilitate moments of cross-sharing between families.
- You may prefer to provide instruction at each table as needed

EXPLAIN

You may disconnect the alligator clips from the LED if you want. We will be focusing on the components on the board.

The image of the Circuit Playground on the left of the screen visualizes the actions of the code you have written. Before you upload your code, you can preview it with this model.

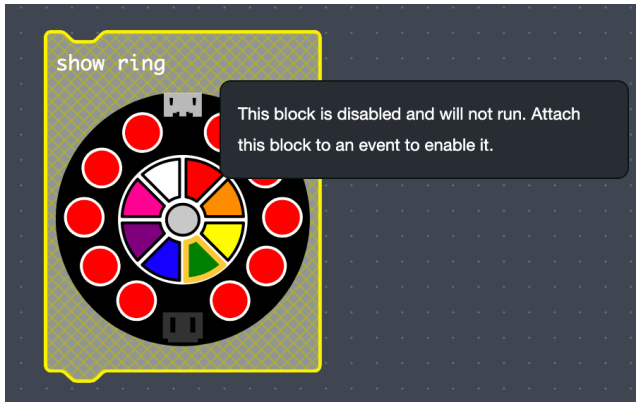
TURNING ON LIGHTS

Make sure you have an empty workspace (gray space to the right) in MakeCode. To remove unused blocks, click and drag them over to the left which deletes them.

There are a number of different ways that you can program the lights on your Circuit Playground.

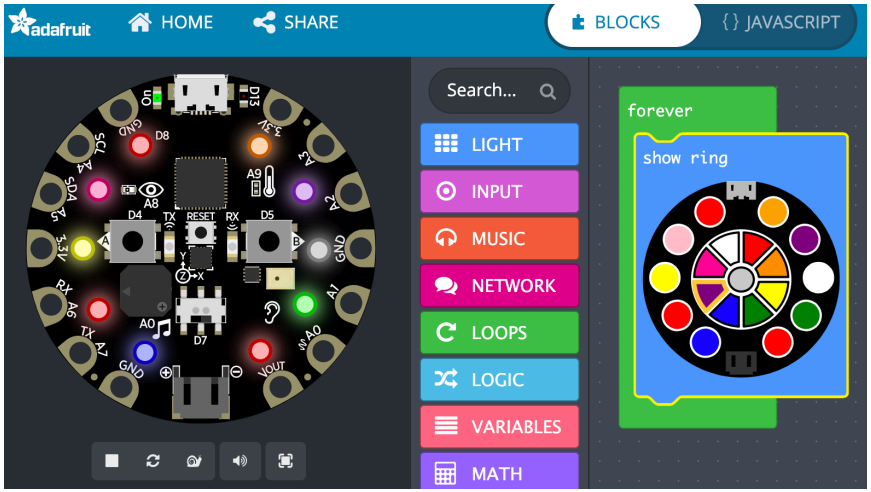
SHOW RING

- Click on the LIGHT block then drag the SHOW RING block into your workspace.



- The SHOW RING block needs to be connected to an **event** block in order for it to run.

- Click the LOOPS menu and drag the FOREVER block over into your workspace. The FOREVER loop is your **event**.



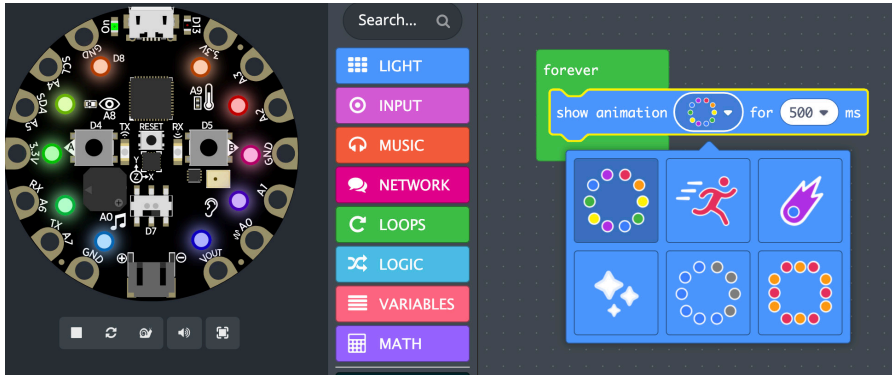
- Drag your SHOW RING block and nest it into the FOREVER loop.

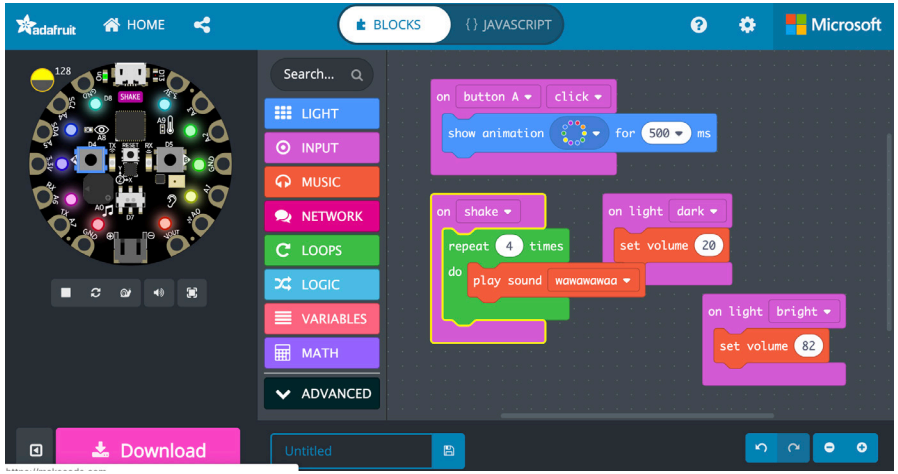
- Now you can change the colors of the Circuit Playground Neopixels (LED ring). The inner circle of colors selects the color that will show on your ring. Once you have selected a color, click on any of the outer circles to change that color, like dipping your paintbrush in paint and applying it a light. The SHOW RING block will look exactly like the visualizer.

EXPLORING

SHOW ANIMATION

- Click on the LIGHT block and drag the SHOW ANIMATION block into your workspace
- Click the LOOPS menu and drag the FOREVER block over into your workspace. The FOREVER loop is your event.
- Drag the SHOW ANIMATION block and nest it into the FOREVER loop.
- Click on the drop down arrow next to SHOW ANIMATION to see other types of light cycles. To change the length of time each animation shows by clicking the number between for and ms.
- **Note* The PLAY icon below the Circuit Playground visualizer starts your code. A green light next to the ON text at the top of the CPX shows the code is running.*





EXTENSION

If time allows, try using the INPUTS to trigger actions with the CPX.

Some ideas:

- Press button A or B to trigger a sound (or light/animation)
- Reaction on motion: use the accelerometer to play a song you program with the music tones
- Change the volume of a tone with the light sensor
- Use your imagination and get creative!

CLEAN UP & BADGES

15 minutes

REFLECTION

Encourage families to continue experimenting with the materials and thinking about how they would like to design their e-textile. Most importantly, they should practice their sewing skills to be ready to start sewing next session.

BASIC SEWING SKILLS REQUIRED:

- Thread a needle
- Tie a starter knot
- Basic running stitch
- Tie a finishing knot

If they have not finished their drawstring bag, invite families to take materials home to finish them up. A magnet is a great way to keep needles from getting lost.

EXTENSION

Another at-home sewing activity is sewing a simple circuit. By now participants have practiced making a simple circuit in several ways. Using their sewable coin battery pack, conductive thread, and a sewable LED, they may sew a working LED onto their own clothes or items they choose to make with felt from the workshop. Next session you may troubleshoot any issues they came across.

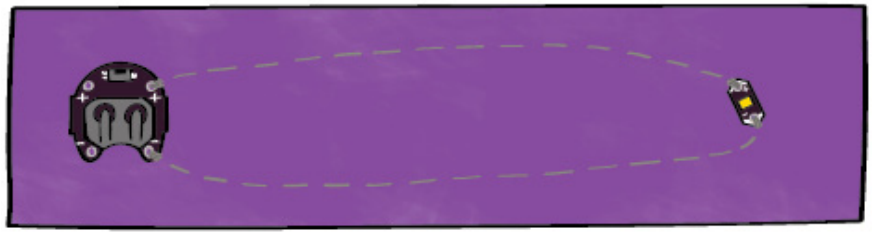
materials

Session 2 Slide Deck
Extra sewing materials
Badges

background info

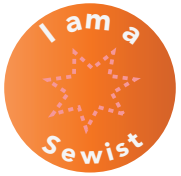
Individuals and families will be able to track their progress and areas of specialization with badges. Badges are awarded for individual work and collaborative family work. The primary learning goal of the badge systems is to make visible to participants potential learning opportunities. In addition, badges allow participants to see each others' developing areas of expertise and may foster collaboration across skill sets.

badges



Example bookmark from http://sewelectric.org/diy-projects/bookmark-book-light/

ACKNOWLEDGING



LOCKING IN ON STRENGTHS

- The purpose of badges in week 2 is to identify the areas in which participants have demonstrated their strengths. For some, this may be the inclusion of skills they are known to have mastered.
- Participants who are drawn to areas of expertise that they identify with start building confidence through these practices.
- With badges we can bridge their existing strengths to new roles by demonstrating crossover skills and practices. For example, in week two a participant may take to drawing the project design. The meticulousness of their outline is very similar to the precision of the computer scientist – they have to make sure everything is in the proper sequence. Only through retelling and revisiting the story are they able to ensure they've captured the right sequencing and detailing - a form of debugging.

MORE RESOURCES

STEM Teaching Tools: Learning STEM Through Design: Students Benefit from Expanding What Counts as "Engineering"
http://stemteachingtools.org/brief/7

5 Tips for Teaching E-Textiles (Sparkfun)
http://blog.sparkfuneducation.com/5-tips-for-teaching-e-textiless

MakeCode for Adafruit desktop app from the Microsoft Store and Chrome:
https://www.microsoft.com/en-us/p/makecode-for-adafruit/9pgzhwsk0pgd
https://learn.adafruit.com/using-circuit-playground-express-makecode-circuitpython-on-a-chromebook/using-makecode

Learning resources for MakeCode and Circuit Playground:

- **MakeCode Course for Circuit Playground Express**
  https://learn.adafruit.com/makecode-circuit-playground-express-course/overview
- **Video: P is for PCB**
  https://learn.adafruit.com/circuit-playground-p-is-for-pcb
- **Overview: What is MakeCode?**
  https://learn.adafruit.com/makecode/
- **Circuit Playground Express Workshop - Chapter 3 - Inputs and Outputs**
  https://www.youtube.com/watch?v=_ND08bOInGc

References

- Hartman, Kate (2014). ***Make: Wearable Electronics: Design, prototype, and wear your own interactive garments, 1st Edition.*** Published by Maker Media, Inc.
- Olsson, Tony (2012). ***Arduino Wearables (Technology in Action), 1st Edition.*** Published by Apress.