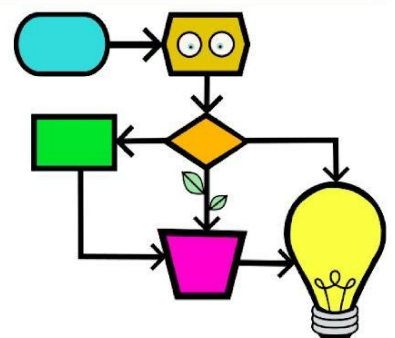
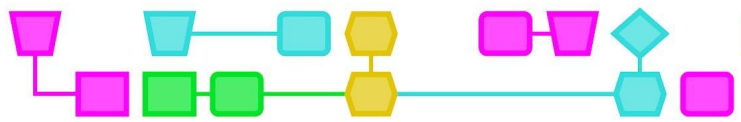


Use CT in a project-
Make a mini light show
(with a micro:bit)



Co-funded by the
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of the European Union



Summary:

In this workshop, students will create a light show using a micro:bit and LED lights. Students are provided with an explanation of how to connect LED lights to the micro:bit and how to program it to turn it on. Students then break up into groups to connect a light themselves, discover what else the micro:bit can do, and experiment with materials using a worksheet. Once they have done this, they determine the terms for the light show along with the rest of the class. Once they make a plan that meets the terms, they can then get to work. Once everyone is ready, the students then present the light show to the rest of the class.

Target group: Approximately 9-12 years of age (Prior knowledge: Sufficient ability to read and write, work with the micro:bit and work in MakeCode (basic programming steps).

Duration: 95 min.

Part 1: Exploring micro:bit and the materials (40 min)

Part 2: The mini light show (60min)

These parts can be taught as separate lessons.

Learning goals:

- Students can agree on the terms for a group assignment
- Students can think about creative material choices
- Students learn how to control LED lights with a micro:bit
- Students learn how to create a mini light show
- Students learn how to create an algorithm

Online/offline: Online (micro:bit and a computer).

Computational Thinking: Pattern recognition, Decomposition, Abstraction & Algorithms.

- General skills: Reading, collaboration, creativity
- CT-skills: Pattern recognition, Decomposition, Abstraction & Algorithms.
- CT-concepts: Using a micro:bit, coding in MakeCode, making an electrical circuit.

Particulars: In this lesson description, we assume that students are familiar with working with the micro:bit. See manual:

https://computationalthinking.education/en/activities/en_CTprimED_Microbit_instruction.pdf

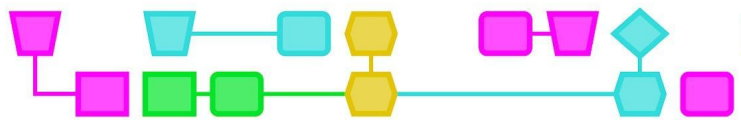
This activity must be done in a partially darkened room. Otherwise, the LED lights are difficult to see.

Materials:

For each group (2-4 students)

- Micro:bit incl. battery and cable (1 per group)
 - A computer/laptop (1 per group)
 - Crocodile clips (minimum of 6 per group)
 - LED lights (around 4 per group)





The materials below are only a suggestion. Use materials that are already present in the classroom, or materials you would not necessarily immediately think of. Please ensure each group has enough materials to experiment with.

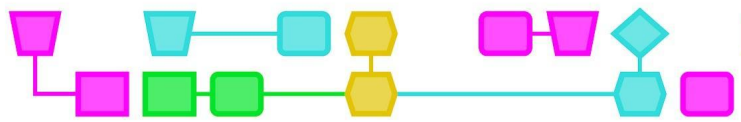
- General
 - Shoe boxes (1 for each group if the room cannot be darkened)
 - White and coloured paper
 - Scissors
 - Glue
 - Markers
 - Crayons
 - Adhesive tape
 - A3 Paper
- Reflective material (2-3 items for each group)
 - Aluminium foil
 - Reflective paper
 - Glitter paper
 - Old CDs
 - Mirrors
 - Disco balls
 - Prisms
 - Camera lenses
 - Glass
- Shading material (2-3 items for each group)
 - Whisk
 - Colander
 - Figurines/Dolls
 - Cellophane
 - Fiberglass
 - Coloured plastic

Preparation

- Make sure all the materials are gathered and that there are sufficient supplies for students to get creative with their light show.
- Make an example of a micro:bit with a connected LED light (see appendix 1: Worksheet Connecting an LED light to the micro:bit). Program it to make the light blink when you press button A.
- Prepare the explanation of how to code the LED light.

Tip: Use recycled materials! For example, old CDs, shoeboxes, coloured plastic, etc. Ask the students to bring these types of materials from home, or ask Makerspace if they have any extra useful materials/waste!

In this lesson we use the micro:bit in combination with LED lights as a programmable light source. Instead of this, you could also use, for example, LittleBits, Lego Spike, Raspberry Pi, LED-strips, Neopixel strips, light switches, flashlights, etc. For an analogue version of this lesson, see: 'Make a light show.'



Part 1: Exploring micro:bit and materials

Introduction (5 min):

Tell students that they are going to create a mini light show using a micro:bit and LED lights. They will first experiment with the materials and then determine the terms of the light show with the rest of the class.

Micro:bit explanation (5 min):

Turn off the lights and show that you can program an LED light with the micro:bit. Show how to attach the crocodile clips and explain that the long leg is the plus side, and the short leg is the minus side. There is a more detailed explanation of electricity in the textbox below.

It is important that students are aware that the plus side must be connected to the positive pin (0, 1 or 2), and the minus side must be connected to the negative GND of the micro:bit. Otherwise, the circuit is not closed, and the light will not come on. You can connect lights to Pin0, Pin1 and Pin2. **Do not connect a light to the third pin '3V'!** If you do, then you may send too much electricity around the micro:bit and overload it.

Explanation of electric circuit with LED and micro:bit:

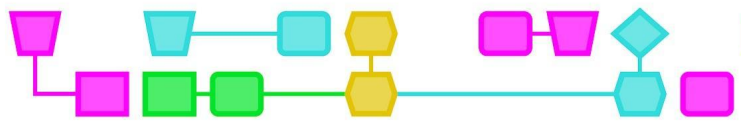
Electricity is a flow of electrons. Electrons are very small particles with a negative electrical charge. When an electrical device is on, the electrons form a circuit. The electrons can flow through the wires of the device. This is called a closed circuit. A circuit always has a source of electricity such as a battery or a plug. The micro:bit has a battery. Each electricity source has a minus side and a plus side. At the minus side, also called the negative pole, there are many negatively charged electrons. Therefore, the negative pole is negatively charged. At the plus side, the positive pole, there are not as many electrons. The plus pole is then positively charged. Electrons always flow from the negative pole to the positive pole, from the place with many electrons to the place with fewer electrons. If the circuit is interrupted somewhere, then the current cannot flow around. Therefore, an electrical device or LED light can only work if the circuit is closed.

Getting started with the micro:bit (10 min):

Divide the class into groups of 2-4 students. Give each group a micro:bit (including battery and cable), 2-3 LED lights, at least 6 crocodile clips and a computer/laptop. Distribute the worksheet Connecting an LED light to the micro:bit (see appendix 1) and have students connect an LED light to their micro:bit using the worksheet.

First, students must attach the light to the micro:bit with crocodile clips, then program the light. Walk around and make sure that each group has at least one LED light turned on. Check that the right clip is on the right leg and that the students understand the MakeCode instructions correctly.

Tip: Are students having difficulty getting the LED lights to work? Display your own MakeCode code on the board that you created in order to turn on the light in your example.



Experiment and investigate with materials (20 min):

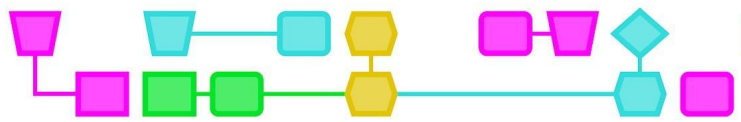
Once a group has connected a light, hand out the worksheet Create a mini light show with the micro:bit - part 1 (see appendix 2). Using this worksheet, students will continue to experiment with the micro:bit. For example, they can look at other functions in MakeCode and see what else they can do with the micro:bit. For example, can they show icons on the screen? Or connect multiple LED lights?

The final step on the worksheet involves students experimenting with materials. Indicate to the students that they have 15 minutes to explore and experiment with the material. Students should think about what might produce a cool light effect and which materials they would like to use for their light shows.

Tip: Put a digital timer on the board, such as, for example, a circle that gets smaller. This will help students to keep track of time for themselves.

Tip: If students have difficulty experimenting, then you can show them the examples from appendix 4. After that, let students experiment again for a further 5-10 minutes.

If you teach the lesson in two parts, then this is the end of the first lesson.



Part 2: The mini light show (60 min)

Briefly repeat what students did in the previous section.

Determine terms (5 min):

Tell students that they are going to determine the terms of the light show with the rest of the class. Terms are requirements that the light show must meet, such as what the purpose of the light show is, how long it should last, and how many light effects it should include. Ask the students what terms they can think of, and have them list things one at a time.

Questions to get the students started:

- What could the purpose of the light show be?
 - Consider the following: telling a story, a cool TikTok movie, to the rhythm of a self-chosen song, create a certain environment (e.g., a forest, sea, or beach), and create an atmosphere (horror, fairy tale, relaxing), etc.
- What should the light show contain?
 - What colours should you use? How many buttons can you press? Which materials should be used?
 - Consider projecting onto the ceiling, creating a shadow play, using a disco ball, etc. Examples of light shows can be found in appendix 4.

When most of the class agrees on the terms you can then write them on the board. In the end, make sure there is a clear (and short) list of terms for the students.

Plan and execute (30 min):

Once the class has collectively determined the terms, students can proceed with the worksheet. The worksheet contains a number of questions that will help students design their light show. For example, what colours and materials they will use or how they want to present the light show. After this, they get to work on creating the light show.

Walk around while students create the light show and make sure they are testing the lights in between. For example, sometimes a crocodile clip may no longer be firmly attached, or they may have put the clip on the wrong leg. Also ensure that students start building with their materials in a timely manner, and that they do not get stuck programming their lights. After 15 min, indicate they are at the halfway point.

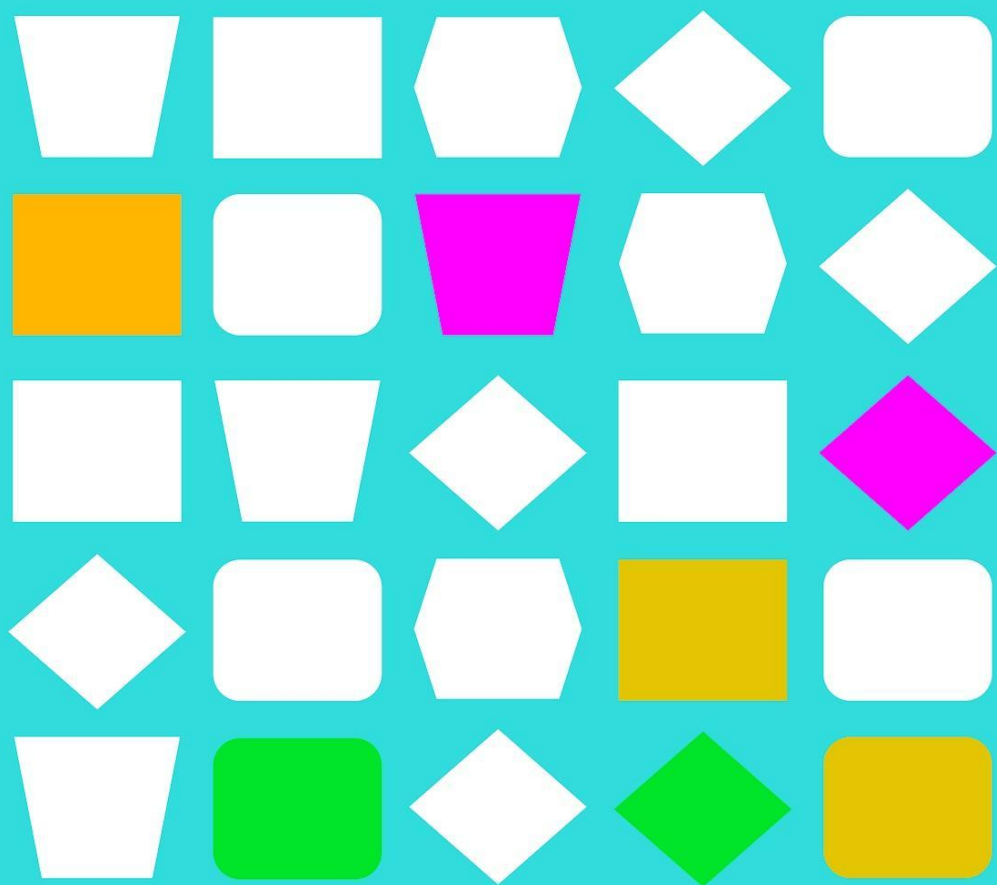
Tip: Also put a digital timer on the board for this step. This will help students to estimate how much time they have left.

Presenting the light show (15 min):

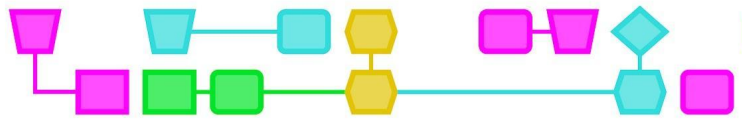
Discuss in class how the programming went. What did they enjoy doing and what problems did they encounter? Then, one by one, call the groups forward to present their light show, or stand around the table with the class if the light show cannot be moved. Ask the students how they went about creating and programming the light show and why? Also ask what they are most proud of?

Closing (5 min):

Have the students clean up and discuss the lesson afterwards. Emphasise that although everyone was given the same assignment, everyone created diverse light shows! Have the students clean up and dismantle their light shows or just put the light shows somewhere so they can be admired for longer.



Worksheets



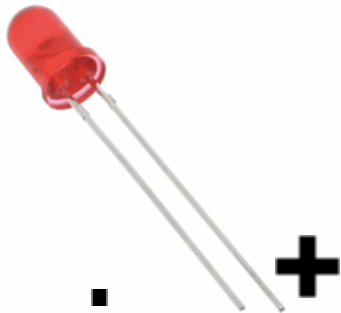
Worksheet - Connecting an LED light to the micro:bit

What do you need?

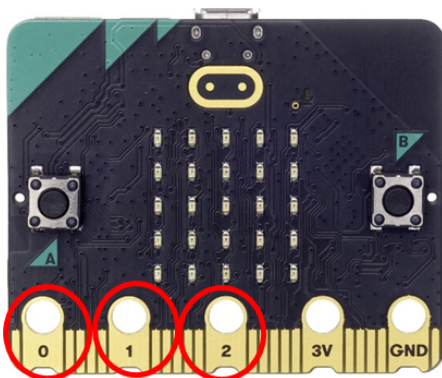
- A micro:bit
 - Battery
 - USB-cable
- Computer/laptop
- LED lights
- Crocodile clips

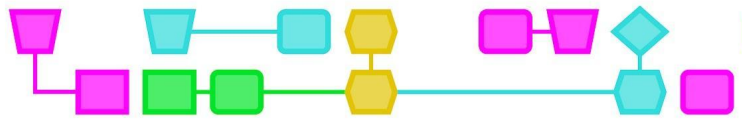
What do you need to know?

1. LED lights are small lights in which a current can only flow in one direction. This is why it is important to connect them correctly. The lights have a long leg (+) and a shorter (-) leg.



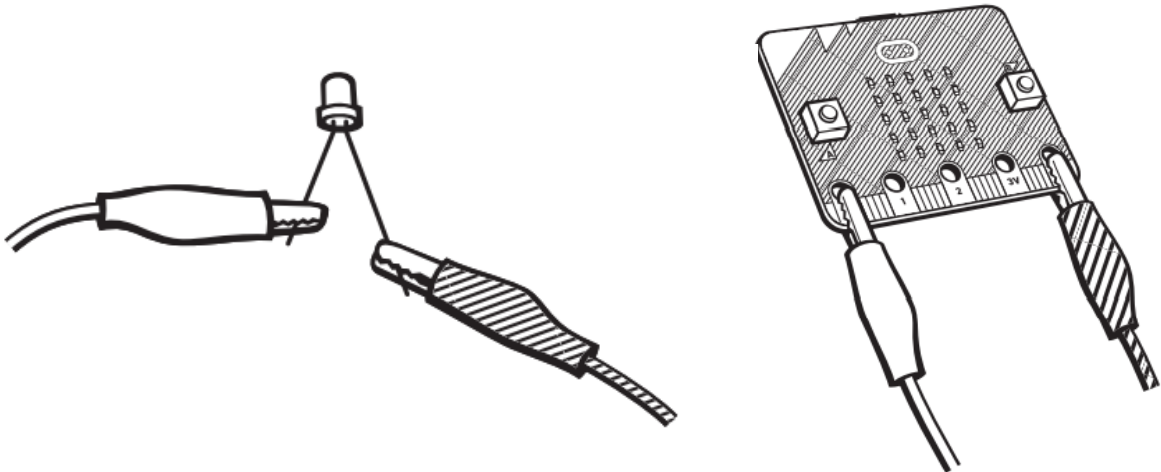
2. There are pins on the micro:bit through which electricity can flow. If you connect the LED light to the pins you can light up the LED.





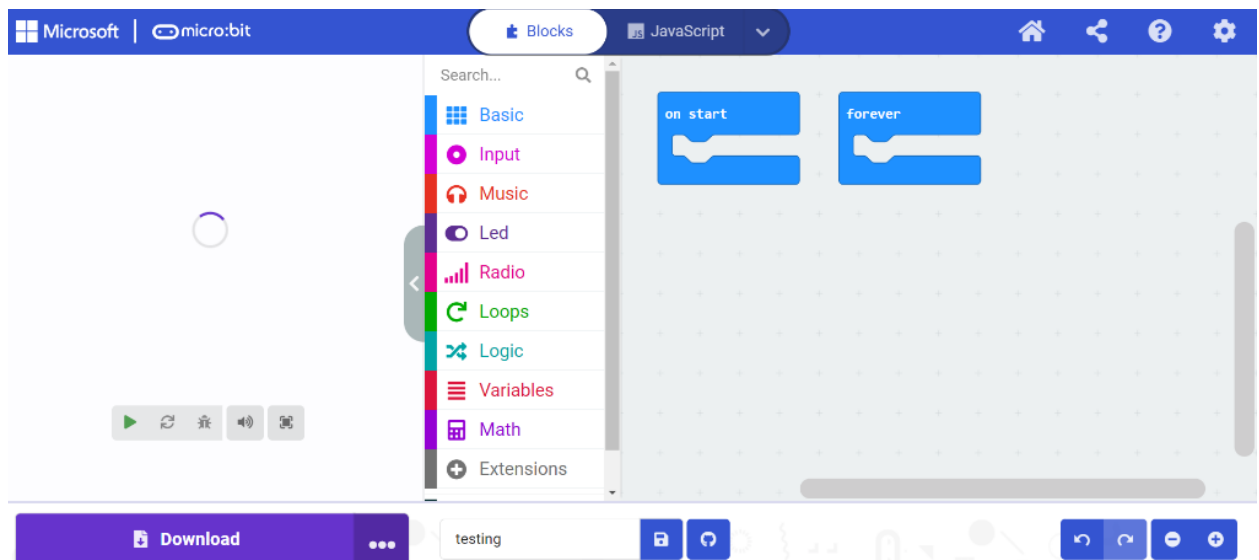
Getting started

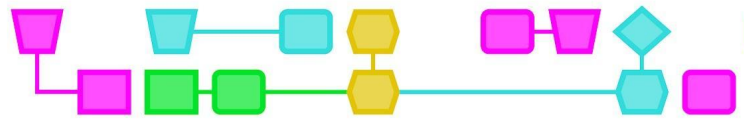
1. Connect one end of the crocodile clip to the long (+) leg of the LED light. Connect the other end to Pin 0.
2. Take the other crocodile clip and connect it to the short (-) leg of the LED light. Connect the other side to GND.



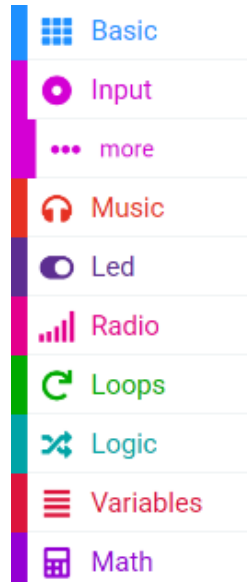
Programming the LED light

3. Connect the micro:bit to the computer.
4. Open MakeCode (<https://makecode.microbit.org/#>) and click on 'New Project.'
5. Give your project a name and then click on 'Create.' You will now see the following screen.

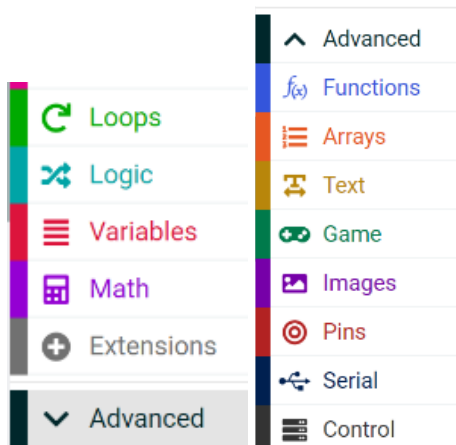




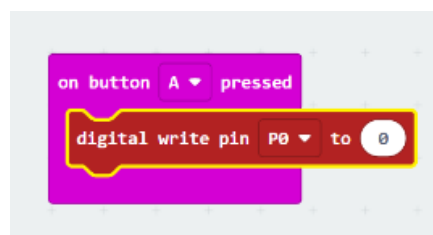
- Go to 'Input' on the left-hand side and choose the block 'On button A pressed.' Drag this to the field in the middle of the screen.

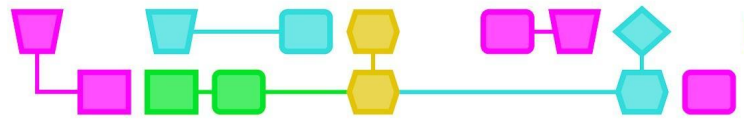


- Click on 'Advanced' and click on 'Pins'



- Choose block 'Digital write pin P0 to 0' and drag this into the pink block.





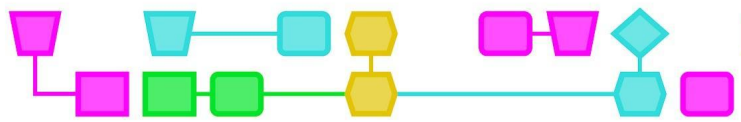
9. Click on the white box with '0' in it and change this to 1.



10. Download the micro:bit code and see if you can get the light to shine by pressing button A!
11. Try connecting multiple LED lights. Each light gets its own crocodile clip to Pin 0, 1, or 2 and GND.

Watch out!

The micro:bit has '3V' on the third pin. Do not connect this to GND! If you do, then the micro:bit may send too much current around and become overloaded.



Worksheet - Create a mini light show with the micro:bit - part 1

In this lesson you are going to create a mini light show using the micro:bit. To get started with this worksheet you should already know how to connect an LED light to the micro:bit. Have you tried this yourself and succeeded? Then continue with this worksheet.

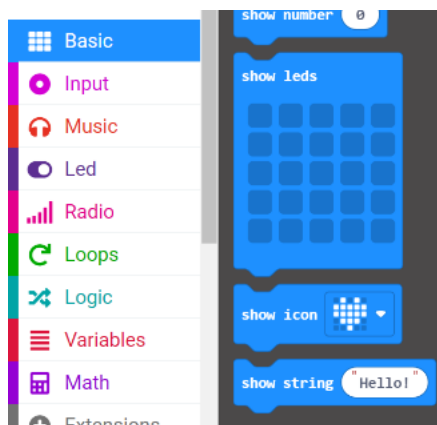
What do you need?

- A micro:bit
 - Battery
 - USB-cable
- Computer/laptop
- LED lights
- Alligator clips
- Materials for the light show

Experiment with the micro:bit

You can turn on a light, but what else can the micro:bit do?

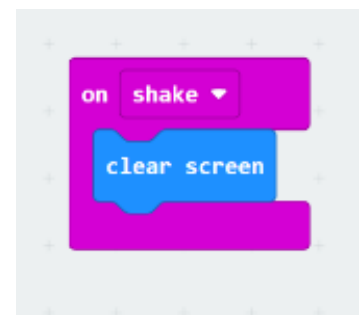
For example, can you make the micro:bit display a cool icon? You can do this by clicking on the 'Show leds' or 'Show icon' blocks under 'Basic.'

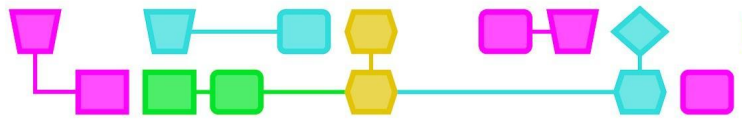


Can you erase the icon by shaking the micro:bit?

You can do this by clicking on the 'on shake' block under 'Input' and adding the 'Clear screen' block under 'Basic'.

Try out what else you can do with the micro:bit!





Experiment with the lights

If you click on 'Pins', then you will see the blocks that control the lights. What can you do with these blocks? Are there more ways to turn on the lights? How many lights can be on at the same time?



There are other options under '... more', but you do not need these for the light show.

Experiment with materials

Which materials can you use for the light show? What would produce a cool light effect? Try it out with your programmed LED light.

Answer the following questions:

1. What do you think is important for the light show? (For example: the light should turn on and off, it should have light effects or that it should look cool).

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2. What is something that you would want to incorporate in your light show? (Think about a particular material, effect, or atmosphere)

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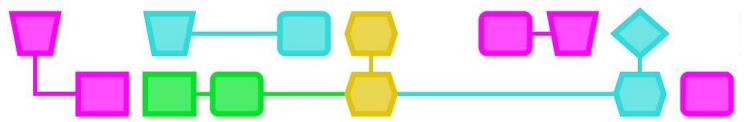
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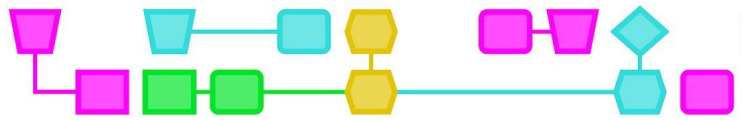
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Once everyone has completed this step, the whole class are going to determine the conditions for the light show. You will then be given a second worksheet.



Worksheet - Create a mini light show with the micro:bit - part 2

You have determined the terms for the light show with the rest of the class. This worksheet will help you to plan the light show and execute it.

Make a light show plan

Use the questions below to determine how your light show is going to look.

1. What is the purpose of the light show? If you have determined this with the class, then you will all have the same purpose.

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2. How are you going to execute this purpose? Think of light effects and colours.

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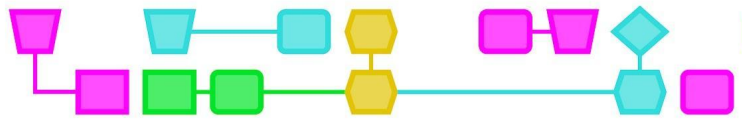
3. Which materials do you need for this? Also think of how many lights you want to use and if you are going to use the screen.

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4. How long do you want your light show to be?

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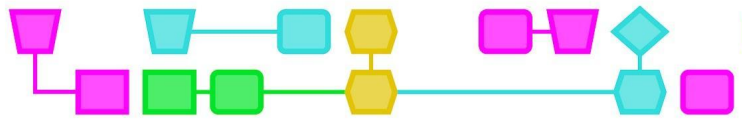
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5. How do you want to present the light show? Think about whether you want to do this on the wall, in a box, under the table or many more places.

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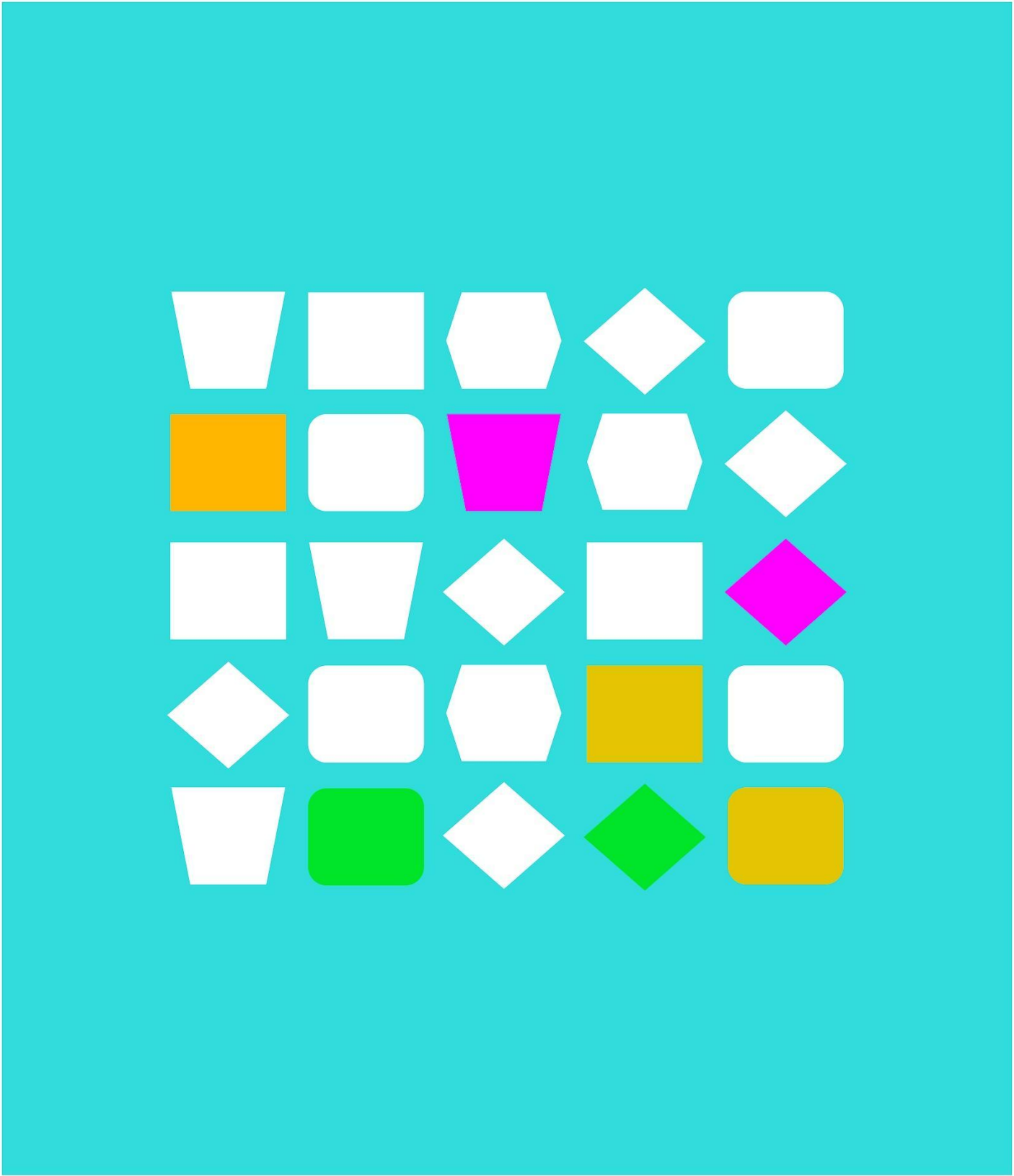
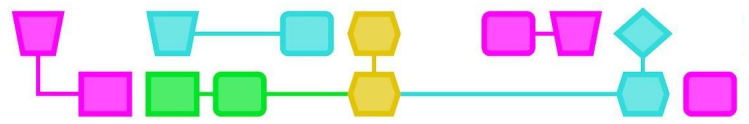
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Program and make the light show

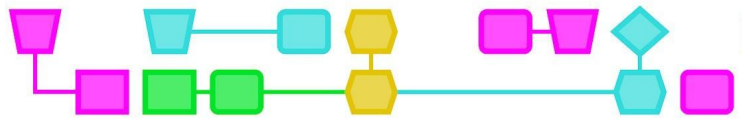
Get started programming your light show in MakeCode. Be sure to test in between so you can see if all the lights are still connected properly. Gather your materials together and get to work!

Present!

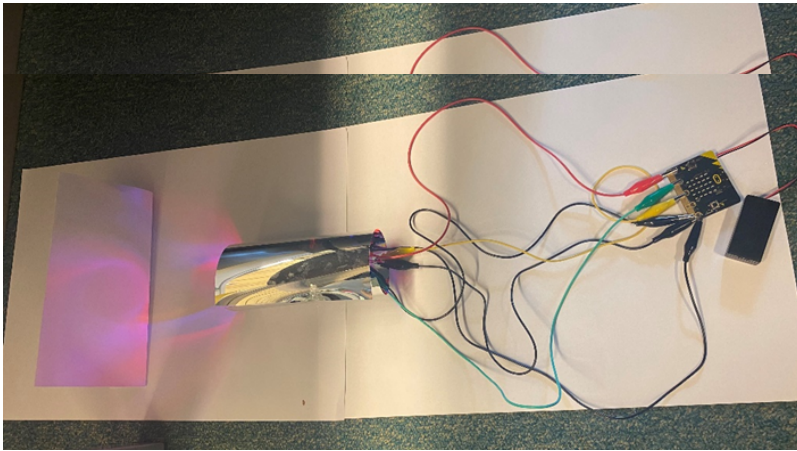
When the time is up you can present your light show to the whole class!

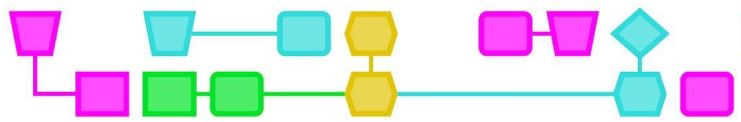


Appendices



Appendix 1: Light show examples





Colophon

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Project Coordinator

NEMO Science Museum, The Netherlands

Partners

Universidad de la Iglesia de Deusto Entidad Religiosa, Spain
Stichting Children's Science Museum Curacao, Curacao



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