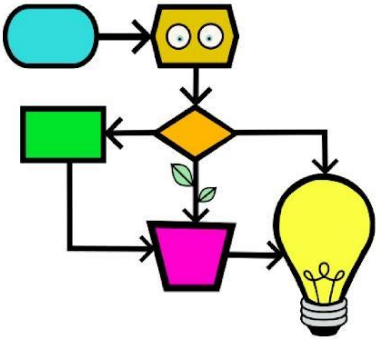
CTprimED

Tinkering with CT - Make a (mini) lightshow



Co-funded by the
Erasmus+ Programme
of the European Union

Summary:
In this workshop, the students will create an analogue light show. First, they experiment with various materials and different light sources to explore how to create light effects. Afterwards, the whole class determines the terms for the light show. Next, they get to work with the materials and create their own light show. When the light show is finished, they then present it to the rest of the class.

Target group: 6-12 years of age

Prior knowledge: Creative thinking, planning, cooperation

Duration: 80 min .
Part 1: Introduction and exploring the materials (25 min)
Part 2: The light show (55 min)
These parts can be taught as separate lessons

Learning goals:
- Students can establish the terms for a group assignment
- Students experiment with light, experiencing how shadows, refraction, and reflection work
- Students learn how to program a light show using icons
- Students learn what an algorithm is

Online/offline: offline

Computational Thinking:
- General skills: collaboration, creativity, inquiry
- CT-foundations: Decomposition, Abstraction and Algorithms
- CT-Concepts**:** program, function, loop, code

Particulars: This lesson must be taught in a darkened room. Otherwise, the light shows will be difficult to see.

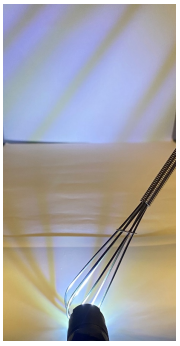
Materials:
The materials below are only a suggestion. Use materials that are already in the classroom, or materials you would not necessarily immediately think of. Please ensure that each group has sufficient materials to experiment with.

- Different light sources (at least 1 light source per student)
  - Flashlights, Bicycle lights, Old lamps, LED strips with remote control, Laser lights
- Craft materials
  - Paper, Cardboard, Scissors, Glue, Masking tape, Markers, Crayons, Adhesive tape, A3 paper

- Reflective material (+/- 2-3 items per group)
  - Aluminium foil, Reflective paper, Glitter paper, (Old) CDs, Mirrors, Disco balls, Prisms, Lenses, Glass, Crystals

Reflection of a glass

- Shading material (+/- 2-3 items per group)
    - Whisk, Colander, Skimmer, Figurines
- Light refraction and colour (+/- 2-3 items per group)
    - Cellophane, Fiberglass rods, Plexiglas rods, Coloured plastic
- Other
    - Pictograms from appendix 1. Approximately 20 "on," 15 "spin" and 5 "blank" per group.
    - If there is not enough space for students to project their light show on the wall/ceiling, they can also do it on white paper on the table. In this case, make sure there is enough white paper for each group.



Shadow of a whisk

Blue light through cellophane

Tip: Use recycled For example old CDs, shoeboxes, colored plastic, etc. Ask the students to material from home. Or ask a Makerspace if they have any extra useful materials/waste!

'Free space'

'Light on'

'Spin light'

Preparation:
Gather the necessary materials. Print a grid (see EN CTPRimED: Grid Lightshow) and enough pictograms (see EN CTPRimED: Make a (mini) lightshow - Pictogram cards) for each group. If the students are proficient at cutting with scissors, then you can choose to have them cut out the pictograms themselves.

Tip: For a digital version of this lesson: 'Make a (mini) (with a Micro:Bit)

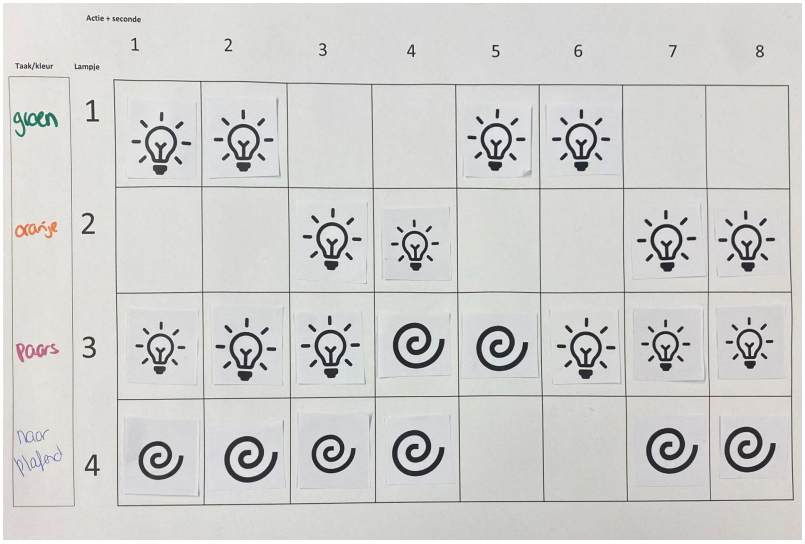
Part 1: Introduction and exploring materials (25 min)

Introduction (10 min):
Explain the following:
'Today we are going to 'program' a light show, only we are not going to do it with computers, but rather on paper. You are going to make the light show in groups using different lights and materials. To start, we will try it once with the whole class.

Programming a classroom light show:
Divide the class into four groups. Give each student a light. Practice turning the light on and off quickly with the students. If this is difficult/not fast enough, then students can place their hand on the light to dim it.

Show the programming grid from appendix 1. Explain that:

- Each digit at the top represents a second/count.
- The lines are the four groups, or four lights.
- The icon, "Light on," means the light is on.
- An empty area means the lamp is off.
- The spiral means "Spin light.'
- Group 1 reads line 1: lamp on, lamp on, lamp off, lamp off, lamp on, lamp on, lamp on, etc.



'Free space'

'Light on'

'Spin light'

When it is clear to everyone, count from 1 to 8 and repeat once.

Explain that this grid is actually a program. This is now being run by a human "computer" but could also be run by a real computer. The icons are functions: a block of code that represents a task. The computer can read this and then knows what to do and when to do it.

Students need the lights for the next task.

> **Tip**: You can leave out the grid for students who are more advanced at programming. Let come up with ways to program the computer with the pictograms. They can also use variables (if... then) and loops.

Experiment and investigate (15 min):
Tell the students that they can now experiment with the materials. Divide the class into groups of 2-4 students and have them experiment in groups with materials, colours and light sources. They can try out all the different light sources, see how to make different colours and which materials make light effects.

> **Tip**: Put a digital timer on the board for example a circle that gets smaller. This students keep track of time themselves

When time is up, the students should sit down. Ask about their experiences: which materials let light through, and which did not? Did they find materials that gave them fun effects or materials that made the light a different colour? Allow some of the students to show some examples.

> **Tip**: If students have difficulty experimenting, can show the examples from appendix 3. After that, let students experiment 5-10 minutes.

Part 2: The light show (55 min)

Set terms (5 min):
Tell the 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 contain. 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? For example:
    - To tell a story
    - A cool TikTok video
    - To the rhythm of a (self-chosen) song
    - To create a certain environment (for example, a forest, sea, or beach)
    - Creating an atmosphere (horror, fairy tale, relaxing, etc.)
- What should the light show contain?
    - What colours should you use?
    - How often should the 8-counts be repeated?
    - What is the minimum number of lights you should use?
    - Which materials should be used?
    - In which room or place does the light show take place?
        - Consider projecting on the ceiling, creating a shadow play, using a disco ball, etc. Examples of the light show can be found in appendix 3.

If most of the class agrees with the terms, then you can write them on the board. Please ensure there is a clear (and short) list of conditions for the students.

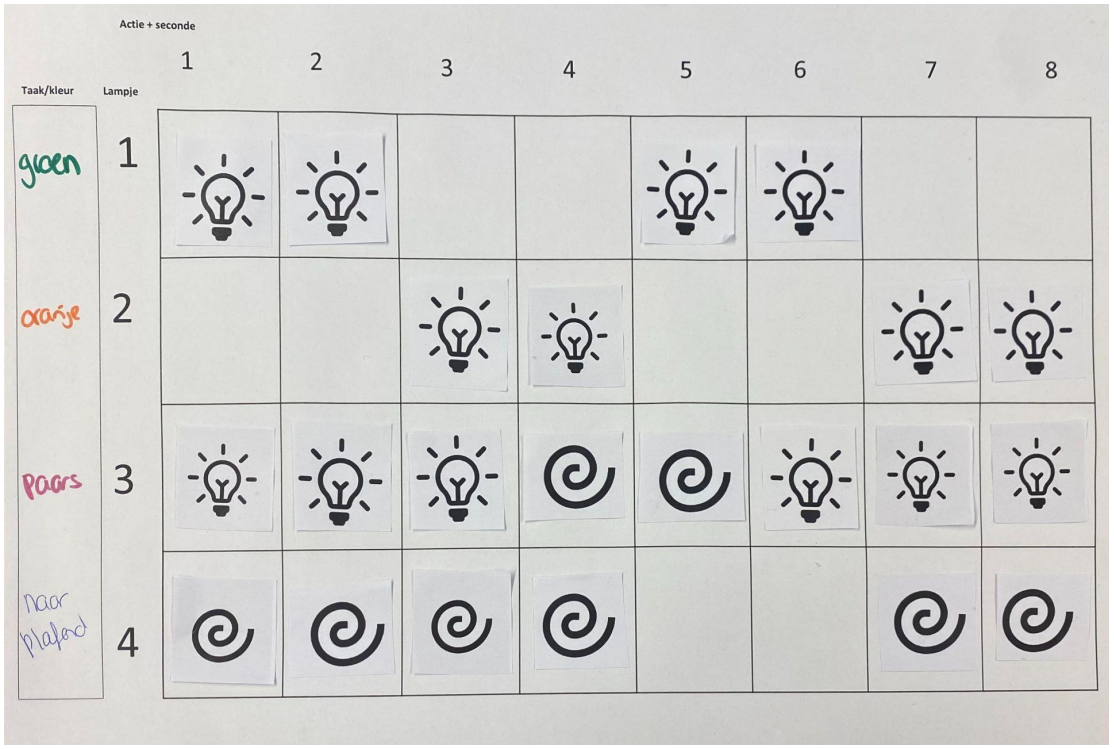
Plan and execute (30 min):
Distribute the pictograms and make sure each group has an A3 grid and glue. Tell the students that they are going to think of, plan and execute the light show. On the grid, they can glue the different commands for the lights using the pictograms. Students can also put special instructions in the task/colour box. Make sure that the students remain clear about the terms by leaving them on the board. Support the students by walking around and helping them to think about the materials and colours if they cannot figure them out on their own. After 15 minutes, indicate to the students that they are at the halfway point and should begin programming the icons.

Tip: Also put a digital timer on the board for this step. This help students 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? Next, have the groups present their light shows one by one. Ask them to first briefly show the plan, before then proceeding to execute the plan. Ask them how they approached the light show and why they did it in this way? Also ask them what they are most proud of?

Closing (5 min):
Have the students clean up and discuss the lesson afterwards. Emphasize that although everyone was given the same assignment, everyone created diverse light shows! Tell the students that they wrote a program using the icons.

Appendix 1: Example grid and pictograms

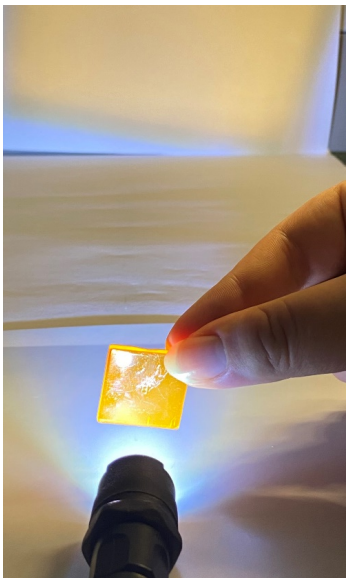


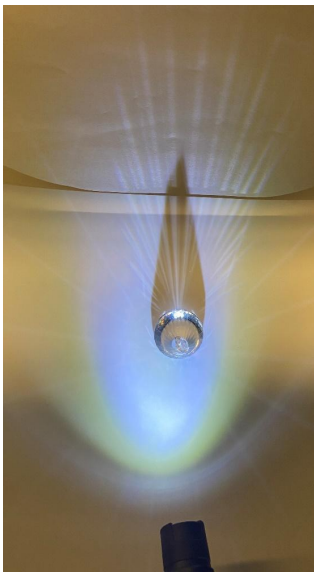
Blank: own interpretation

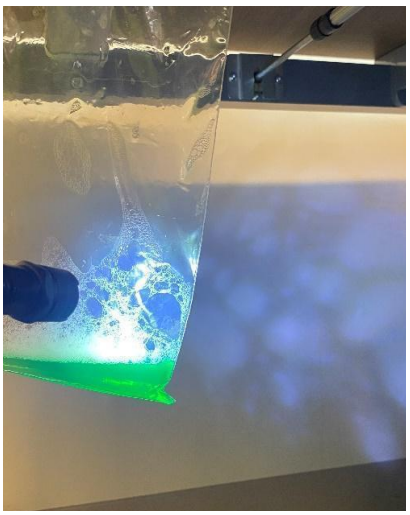
On

Spin

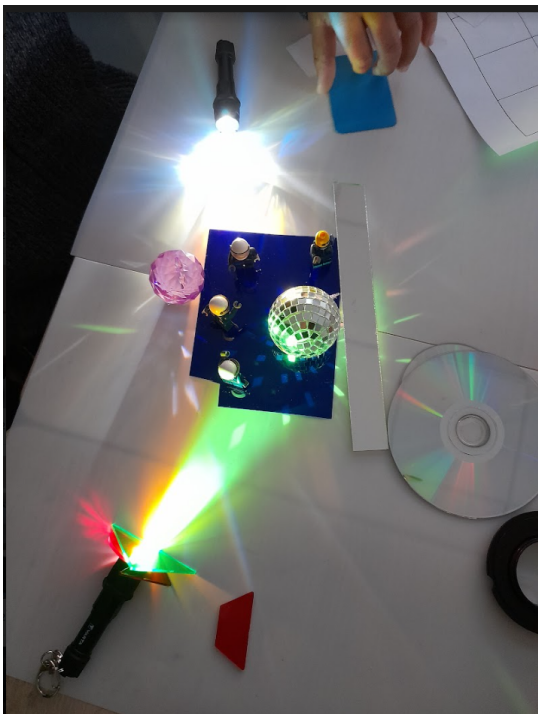
Appendix 2: Example materials

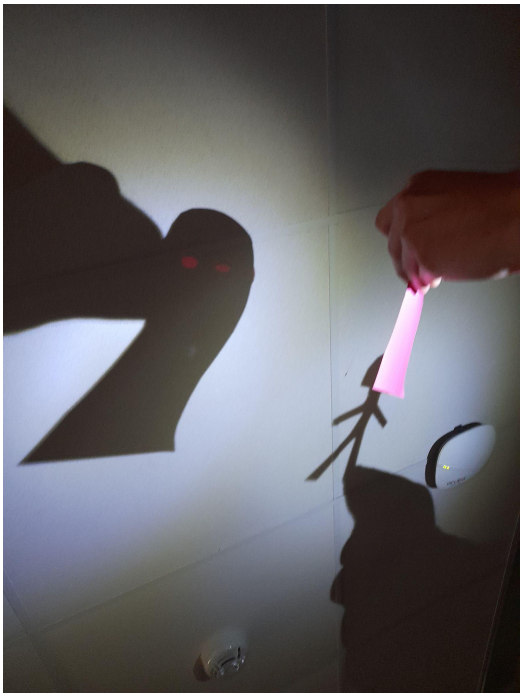






Appendix 3: Light show examples





Colophon

© CTPrimED

This publication is a product of CTPrimED (2021-1-NL01-KA210-SCH-000031319), funded with support from the Erasmus+ Programme of the European Union. This publication reflects the views of the authors, and the Commission cannot be held responsible for any use that may be made of the information contained therein.

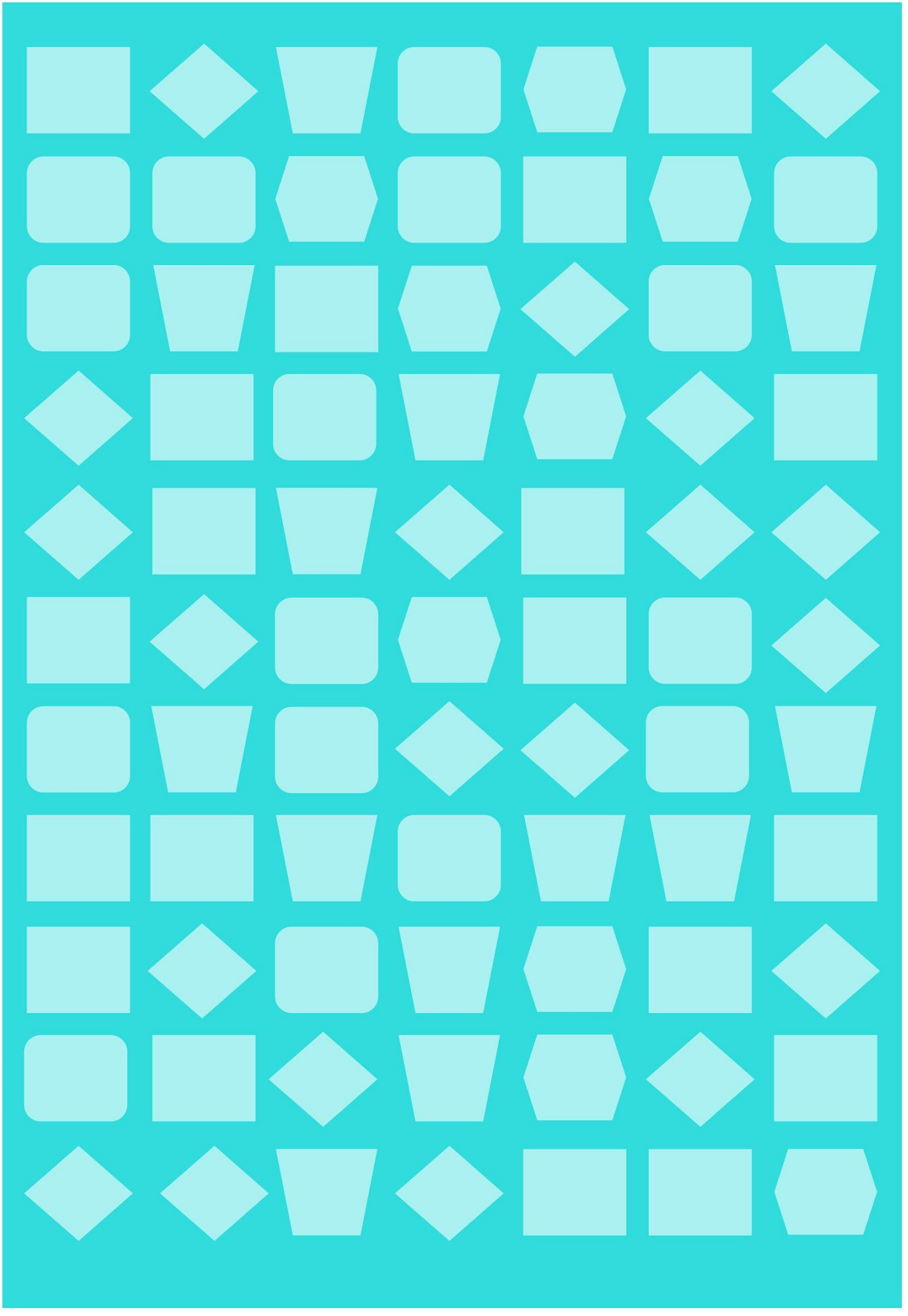
Project Coordinator

NEMO Science Museum, The Netherlands

Partners

Universidad de la Iglesia de Deusto Entidad Religiosa, Spain

Stichting Children's Science Museum Curacao, Curacao

Co-funded by the Erasmus+ Programme of the European Union

Universidad de Deusto
University of Deusto
Deusto