D 3.5 – Training of students in STEAM

Due date of deliverable: 15/11/2024

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Table of contents

Technical References

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1 PU = Public
PP = Restricted to other programme participants (including the Commission Services)
RE = Restricted to a group specified by the consortium (including the Commission Services)
CO = Confidential, only for members of the consortium (including the Commission Services)

Document history

V	Date	Modifications	Author
V0	23/10/2024	The first draft of the deliverable	ACINV
V1	29/10/2024	Methodology - draft	ACINV
V2	06/11/2024	Relation with previous deliverables	ACINV
V3	14/11/2024	Final revision	ACINV

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Abstract of Deliverable

Task 3.5 is designed to prepare students with essential skills, using a gender-responsive approach that encourages equal participation and engagement. In order to do this, in this deliverable ACINV presents a set of draft STEAM activities based on the conclusions and ideas discussed in previous deliverables such as:

- D3.1: Description of STEAM trends in education systems in Europe
- D3.3: Database for e-survey to STEAM students
- D3.4: Current STEAM landscape in academic curricula of 11-18 y.o students

These activities also took inspiration from different workshops attended with other sister projects which discussed the problems when implementing STEAM activities into the curricula and the gender gap regarding this as well.

The activities were developed using a new methodology based on already existing practices (eg: Gagné methodology, PBL, etc) (that from now on will be referred to as **STEAMbrace methodology**) to tackle the challenges highlighted in those deliverables.

This deliverable includes:

- An index of draft STEAM activities that consist of:
    - 15 STEAM activities for school curricula (as an annex at the end)
    - 10 non-academic activities (informal STEAM activities) (as an annex at the end)

Both are for students aged 11-18. Half of these activities are focused on engaging female students, ensuring a balanced and inclusive approach to STEAM learning.

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1. Previous analysis and references

All the work presented in this report is based on the conclusions and studies from previous deliverables. From this, the document will explain how (using the previous results) we have worked on the development of the activities and a method for their application. A brief summary is provided of the objectives and conclusions that were aimed to be achieved in those previous works.

- **D3.1: Description of STEAM trends in education systems in Europe** → A systematic review of European education systems (including education strategies, laws, public-private systems, rural-urban deviation, gender breaks, etc.) It defines a theoretical framework.
- **D3.2 Methodological foundations for the STEAM network (STEAM Alliance for Europe)**
- **D3.3: Database for e-survey to STEAM students** → To determine the degree of inclusion of STEAM in education in 11-18 yo students across EU, an electronic survey to 3000 STEAM students, will be conducted to collect all students' answers and perform the statistical analysis of answers (reported in D3.4).
- **D3.4: Current STEAM landscape in academic curricula of 11-18 y.o students** → determine the degree of inclusion of STEAM in education in 11-18 yo students across EU based on the analysis of the empirical data from D3.3 within the theoretical framework emerging from D3.1.

In this report, we will primarily work with the results provided in deliverable 3.4, as it is in this deliverable, as mentioned in its description, that the information from previous ones is gathered, and from there, the recommendations for the development of the project activities arise, which is our main focus of attention in this work and will be the guidelines for designing STEAM activities.

In the last section "Relation with previous deliverables" it will be pointed out how this presented package of activities and their method cover those guidelines.

2. Methodology

2.1 References and procedures

In this section, we will discuss how the focus on the development of the activities and the bases behind them. To do so we have divided this section into six sub-sections that as a whole will cover the process of thinking about how we approached these activities and how the STEAMbrace methodology takes shape. Below is a brief introduction to each of the sections:

- Methodology bases of STEAMbrace Methodology: Here we present briefly what other existing methods we partially based our method on.
- How disciplines and STEAM areas will be approached: We will discuss the importance of integrating disciplines in STEAM activities, emphasising a transdisciplinary or meta-disciplinary approach that considers both the content and the context, and why we have chosen to do this.
- Context: In this part, we will outline how sessions will be introduced, in which context we expect students to get in touch with the tools presented, and how the STEAM areas will be worked.
- Teaching-Learning sequence: It is here explained the distinction between enabling objectives, essential for activity progression, and support objectives for deeper exploration.
- PLB and Gagné: A brief description of the methodologies mentioned in the previous section "Methodology bases of STEAMbrace Methodology".
- STEAMbrace Methodology: Presentation of the STEAMbrace Methodology and its steps.

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2.1.1 Bases and fundaments

Task 3.5 from the STEAMbrace project, will be carried out following an active methodology, that we will call **STEAMbrace methodology**, so that students engage in meaningful activities where their presence in the session is essential for solving challenges, thus encouraging active student participation. This is presented to tackle different issues that have been pointed out in previous deliverables.

In order to relate the proposed activities to the students' environment and a familiar setting, the **PBL (Problem-Based Learning), CBL (Challenge-Based Learning), and Gangé** methodology have been chosen as the basis of this other new methodology. Following this, students will actively connect the learning acquired in the sessions with their immediate environment, promoting the use of new technologies to solve challenges in familiar situations.

2.1.2 How disciplines and STEAM areas will be approached

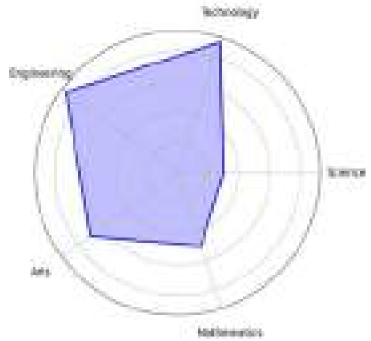
Integration of **disciplines** plays a key role in creating these types of activities. Solving challenges requires knowledge and skills from different disciplines that enable the observation, understanding, and resolution of problems.

In this case, activities will be approached from a (depending on each activity in particular) transdisciplinary or meta-disciplinary perspective, where not only the use of content and skills is required, but also the context in which the activity takes place is of special importance.

We believe it is important to distinguish in this part that this also applies to the different **disciplines of STEAM**: these areas of knowledge (science, technology, engineering, arts, mathematics) will not be approached individually but collectively because in general situations these take part of a whole and can not be separated. Some activities will be centered more in one than other but they will complement each other.

This approach has been informed by discussions and concepts developed in workshops and meetings on related projects, with careful consideration given to the findings in prior deliverables. As noted in previous sections, a comprehensive perspective on STEAM cannot be achieved by addressing its disciplines in isolation. In most real-world scenarios, separating these fields is impractical due to their interconnected nature. These activities are designed to connect students with their surroundings and encourage them to apply what they learn to real-life situations, making an integrated approach essential. This is why in the sections "Activity Index" and "Template of activities" you will find different representations of this approach:

- Activity Index → When searching for the activities you will see that several areas are covered when referring to one activity.
- Template of activities → You will find a radar graph at the beginning of each activity, illustrating the relative 'weight' or emphasis of each STEAM area within the activity. An example is shown on the right.



Both of these points will be further developed in each section.

Another key aspect that we believe is relevant to mention in this section is how the **"A" in STEAM** will be integrated into the proposal. Based on attendance at different workshops and the guidelines provided in previous deliverables, to avoid applying the "A" in a shallow or meaningless way, or limiting it to just "personalisation", we opted for an active use throughout the method. This will be reflected in: creative solutions to problems, exploring the relationship between art and science in various cases, and connecting tools used in artistic settings to other areas, such as 3D and how it can be used to present solutions to certain situations. Also, this will be worked by the materials presented, most of them being “common” objects, and how the students are able to implement their creativity in using those materials to find a way to resolve the proposed issue.

2.1.3 Context

Teaching through socio-scientific issues aims for contextualized learning that emphasizes the social and cultural context in which science develops. To achieve this, students need to understand the procedures, standards, and ways of acting (Sadler, 2009).

In this educational framework, students learn by discussing problems and using evidence-based argumentation to reach conclusions. These problems are designed to have multiple solutions and cannot be solved by relying solely on memorized content.

To support our previous statements, each session will introduce these problems, issues, or themes within a context that includes **relevant situations and information**, as much as possible. This approach helps students connect with the topic and engage meaningfully with the upcoming activity. As mentioned in the previous section, part of this will be achieved (when the topic aligns well with this approach) by one or more of the following initiatives proposed to them:

- **Providing introductory content that encourages students to relate the material to their surroundings**
- **Apply what they’ve learned to real-life situations**
- **Consider other scenarios**
- **Challenge prior assumptions**
- **Reflect on how the topic might impact their future**

It is important to highlight that in this point of context, the activities designed are aimed to improve motivation for **STEAM among girls**, mostly through the inclusion of female role models into this context that is given into the activities, reflecting girls' strengths in flexibility, creativity, and logical reasoning when generating ideas. This approach ensures girls' confidence is reinforced. Also, this will be tackled by proposing different questions and scenarios that will make students more aware of their surroundings and challenge prior assumptions that they may have.

2.1.4 Teaching-Learning sequence

Within the project sequence, a distinction has been made between the acquisition of enabling objectives and support objectives.

Enabling objectives necessary for the development of the activity and the resolution of the challenge will be addressed first. However, throughout the sequence, there will always be activities aimed at support objectives, differentiated into sections such as "Did you know?" and "In addition," which allow for deeper exploration of the subject or even present new challenges to more advanced students who have successfully achieved the previous objectives.

2.1.5 PBL and Gagné

The following table displays the main parts of each methodology that have been used as the base of the STEAMbrace methodology. These parts are referenced below in order to then explain better the new one in the following section:

PBL (Problem-Based Learning) phases: The sequences of the methodology are described below.	Gagné Integration: The Gagné methodology describes a specific series of steps so that learning lasts. All the steps he defined were coded into nine "instructional events."
• Phase 1: Raise the topic • Phase 2: Brainstorming and formulating questions • Phase 3: Define which will be the key question that will be the basis of our challenge • Phase 4: Investigation regarding the topic (use of ICT) • Phase 5: Implement our solution in real environments • Phase 6: Check the effectiveness of the implemented solution • Phase 7: Share results • Phase 8: Evaluate	BEFORE presenting the instructions: Event 1: capture the student's attention Event 2: Tell them what they are going to learn Event 3: Stimulate the recall of relevant prior knowledge WHILE presenting the instruction: Event 4: Present the instruction Event 5: Guided Practice Event 6: Independent Performance AFTER submitting instructions: Event 7: Provide feedback Event 8: Evaluate performance Event 9: Extension and Transfer

Now that the layout on which ideas the STEAMbrace methodology was based were presented, we will continue to explain its phases.

2.1.6 STEAMbrace Methodology

We have integrated our development sequencing with Gagné's methodology and PBL as follows, it is also highlighted in different colours which part references each methodology and whether that instruction is something enabling for the student or is an extension:

Colour references:

- Problem-Based Learning (PBL) Methodology
- Gagné's Methodology
- Enabling
- Extension

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Phase 0 - Activity Planning:

Description of the activity / Necessary materials / Achievable objectives / Ages / Difficulty / Theme / Areas covered / Key competences (EU)

Phase 1 - Discover and Value:

Challenge presentation / Brainstorming / Define the essential question / Research the challenge

Capture students' attention / Explain what they will learn / Stimulate recall of prior knowledge

Phase 2 - Explore:

Learning the necessary tool for solving the challenge (Use of ICT)

Present instruction

Phase 3 - Develop:

Apply a possible solution using the software / Implement the solution

Guided practice / Independent performance

Phase 4 - Think:

Verify the implemented solution / Evaluate

Evaluate performance / Provide feedback

Phase 5 - Share:

Share the work

Extension and transfer

3. Activity index

This index details the organization of activities that will be provided to schools for the initial phase of activity training. These sessions will cover activities for both curricular and extracurricular activities, as specified in the original documents. In about half of these sessions, we will incorporate a gender perspective focusing on women. The sessions will cover various areas of STEAM, often integrating multiple areas within a single session, as detailed in the "AREAS COVERED" section below.

This approach has been informed by discussions and concepts developed in workshops and meetings on related projects, with careful consideration given to the findings in prior deliverables. As noted in previous sections, a comprehensive perspective on STEAM cannot be achieved by addressing its disciplines in isolation. In most real-world scenarios, separating these fields is impractical due to their interconnected nature. These activities are designed to connect students with their surroundings and encourage them to apply what they learn to real-life situations, making an integrated approach essential.

In the index below you may find two symbols to indicate which activities are curricular and which are extracurricular:

→ **Curricular activities**

→ **Extracurricular activities**

TOPICS REFERENCE

RO	Robotics	AI	Artificial Intelligence
G	Games	E	Experimentation
C	Craft	SA	Safety
AR	Augmented reality	IN	Information
AV	Audiovisual	3D	3D modeling

Ages	Difficulty	Curricula associated	Session Name	Type	Topics	AREAS COVERED S	T	E	A	M	Description
11-12	easy	✓	New Species	Connected activity	AI/IN						Do you have pets? A dog, a cat, a hamster? Or what's your favorite animal? While we may all have different answers to these questions, we can agree on certain things, like the fact that a dog usually has four legs, a tail, and fur. But how do we know that a dog is really a dog, or that a parrot is really a parrot? Who decided what is what? In this activity, students will learn how to identify different species using decision trees and apply these criteria to real-life situations getting to know in this part the term "taxonomy". They'll also face the challenge of classifying more complex or unfamiliar animals to test their models, some of which may be native to their region, making the experience more relevant. The activity will introduce the concept of artificial intelligence (AI) as a tool for species classification, leading students to explore the idea of creating and categorizing new species, either through their imagination or using AI-generated images.
	easy		Trapped heat	Hands on activity	E/IN						Have you ever heard of the greenhouse effect? In this experiment, we will investigate how two different gases, including CO2, react to heat. This will be possible through the comparison of the heat capacity of the two gases, allowing us to observe these differences more clearly and gain a deeper insight into the greenhouse effect. Additionally, this process will enhance our understanding of how data is analyzed during experiments to draw meaningful conclusions.
	easy	✓	Rockets	Hands on and connected activity	E/IN						Have you heard of the ESA? What kind of relationship does your country have with this space agency? In this activity, we'll work in teams as ESA aerospace engineers to design and launch chemically propelled rockets, focusing on the use of controlled variables. Before we start, we'll review our countries' historical connections to space exploration to give context to our project. Our mission is to improve the prototype of a small rocket and find the optimal way to launch it using only a chemical reaction and controlled experimentation. Are you ready to take on this challenge? Along the way, we'll also explore the history of the astronaut corps, learn about the first women astronauts, and discover what it's like to spend time in space. Through this experience, we'll deepen our understanding of the physics behind rocket propulsion while strengthening our teamwork and scientific analysis skills.
	medium	✓	Training AI	Connected activity	AI/IN/SA						During this activity, we will dive into the fascinating world of Artificial Intelligence (AI) and programming through a series of hands-on challenges. We will begin by exploring what AI is, how it works, and how it differs from traditional programs. Next, we will learn about programming and the importance of giving clear and organized instructions so that machines do exactly what we want. Finally, we will use Scratch and Machine Learning for Kids to train an AI model capable of classifying passwords based on their security level. Become true experts in digital security, and get ready to outsmart any hacker!

	medium	✓	Inventors in history	Hands on and connected activity	AI/RO/IN	How many inventors can you name quickly? And how many female inventors? This activity explores the world of inventions and their creators, highlighting both men and women who have made significant contributions to science and technology. Students will reflect on how these innovations have changed the world and learn to develop their own creative solutions for future challenges. Using the mBlock programming platform and the Cirkids kit, students will create projects that connect inventions to their inventors, combining research, programming, and robotics. This hands-on approach helps build technological and manual skills, fostering an innovative mindset for the future.
	easy		Hacking street furniture	Connected activity	3D	In this activity, students will explore how to improve urban furniture in their city through 3D design. They will start by analyzing public trash bins to identify ways to make them more functional and sustainable. Then, using the Tinkercad platform and paper prototypes, they will create and test their own redesign ideas. This activity encourages creativity and critical thinking, using technology to find practical solutions to everyday problems.
	medium	✓	Give me a hand	Hands on and connected activity	RO/IN/C	Students will learn about the reality of people with physical disabilities, an issue that affects many but is often overlooked. There are currently an estimated 1.3 billion people worldwide with some form of amputation or disability. Thanks to technological advancements in recent decades, significant progress has been made to create a more accessible life for them. However, many challenges remain due to limited opportunities, geographical locations, or policies. In this session, we will work on a prosthetic prototype, learning new tools and using robotics to our advantage. We will also investigate about paralimpic female athletes and their stories.
	hard	✓	The magic of mathematics	Connected activity	G/IN	The activity focuses on learning about the history of mathematics and highlighting important female mathematicians who, over time, have made significant contributions that remain relevant today. Additionally, students will work on a fun project in Scratch where they will program a mathematical trick that guesses ages using logical operations. The aim is to show that mathematics is not just formulas and calculations, but also creativity and wonder.
	easy		Building earthquakes	Hands on activity	C	How do earthquakes affect buildings? Students will work in groups to design and build models of sturdy buildings using various materials. Using the Arduino Science Journal app, they will measure the oscillation of their structures and apply solutions to reduce the effects of earthquakes, gaining hands-on experience in engineering and physics.
	easy	✓	Art History	Connected activity	IN	In this session, we will train our computer skills by creating a digital mural on Padlet, where each participant will contribute information about women who have made a significant impact in the history of art. We will research the lives and works of painters, sculptors, photographers, and designers, exploring their careers, their most important works, and the influence they have had on the development of art. This exercise will help us learn about and appreciate their legacy in the artistic field. We will learn how to use Padlet to design a collaborative and visual mural, resulting in a virtual gallery where each contribution showcases a part of the female artistic legacy.
13-14	hard		Motorising magnets	Hands on activity	E	In this activity, we will explore how electricity can be generated using natural factors like magnetism and material conductivity. Students will conduct experiments on magnetic fields and build a simple electric motor. By working in teams, they'll learn about the principles of magnetism and how to apply this knowledge in hands-on experiments. Materials will include magnets, batteries, and wires, allowing students to observe firsthand the fundamentals of electric motors.
	hard		That's a lot of energy	Hands on and connected activity	E/IN	Get ready to build your own anemometer! In this workshop, we will become engineers. First, we will learn about how anemometers work, those devices that measure wind speed. We will use materials like cups and craft sticks to build the structure, and then, with a simple motor, we will make the anemometer harness wind energy to produce a small electric current.

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	easy	✓	Schematized	Connected activity	AI/IN	Have you ever thought about how AI could help you study more effectively and make the most of your study hours? In this activity, you will discover various AI tools that can assist you in gathering reliable and verifiable information, and how to process it to create summaries and outlines for later study. While none of these tools can learn for you, they can save you a lot of time, allowing you to better prepare for your exams. To try our new invention we will apply it on searching information and studying about women in the history of energy.
	easy	✓	Rock, paper, scissors	Hands on and connected activity	C/RO/G	In this activity, students will create and programme a circuit with Cirkids to simulate the traditional game "rock, paper, scissors". Using three LEDs, a light sensor, and a microcontroller, they will learn how to connect and control electronic components. Then, with consumable materials, they will design the structure to make their game even more fun.
	easy	✓	The balance of change	Hands on and connected activity	C/RO/IN	In this activity, we will investigate women in politics, exploring data about countries governed by women or men. We will understand the challenges and learn about equality. With this data, we will program an interactive scale using mBlock, an intuitive platform that will allow us to see how leadership tilts in different countries.
	easy		The voice of history	Connected activity	AI/IN/AV	In this workshop, we will explore the lives and achievements of female inventors like Marie Curie and Ada Lovelace. Each participant will research an inventor and use BlinkShot, an AI tool, to create an animated short about her contributions. We'll also create a unique soundtrack with Suno. Finally, we will present our animation and music, celebrating these inventors and their lasting impact on science and technology.
15-16	medium	✓	Rosalind Franklin: Beyond DNA	Connected activity	IN/3D	With this project, students are encouraged to learn about the life and work of Rosalind Franklin. Thanks to her dedication, carried out in defiance of the prejudices of her time, she succeeded in obtaining, among other achievements, photographs of DNA that made it possible to discern its structure. They will create a 3D model of DNA, and as part of the model-building process, students can complete the secondary DNA strand based on a provided primary strand, explore species differences, and examine genetic mutations. This hands-on approach will deepen their understanding of DNA structure and the significance of Franklin's contributions to science.
15-16	easy	✓	Overcoming Obstacles	Hands on and connected activity	AR/3D	In this activity, students will carry out a detailed analysis of their environment to identify the architectural barriers that limit accessibility for people with disabilities or reduced mobility. The aim is to make them aware of the difficulties that many people face in their daily lives and to propose practical technological solutions. They will design in 3D adaptations for those spaces and then with Merge Cube visualize though their camara if those adaptations are viable.
15-16	medium	✓	Machine vs human	Connected activity	AI/IN	In this activity, you will explore Artificial Intelligence concepts in a hands-on and interactive way using the Machine Learning for Kids tool. You will learn how to train an AI to recognize "Rock, Paper, Scissors" gestures and then, through Scratch and you will program this classic game. This will allow you to develop your digital and technological skills while understanding how a machine can learn and detect patterns. In addition, you will research traditional games from your country and deepen your analysis of the differences between men's and women's professional sports. With this activity, you will gain a more complete understanding of programming, the application of machine learning and the importance of gender equality in sports.
15-16	hard	✓	Safety access control	Hands on and connected activity	RO/AI/SA	In this workshop we will become hospital security programmers using mBlock. Together, we will create a system that detects whether a person is wearing a mask and protective glasses to allow them access to the hospital. Using sensor programming and simple logic, we will set up a "virtual guard" that decides who can enter based on security measures. We will simulate different scenarios to see how our program responds, gaining a closer understanding of how control systems work in real life.
15-16	easy		Packaging of the future	Connected activity	3D/IN	From the marmalade jar to smart packaging with AI. In this session, students will discover the reasons behind the shape, materials and characteristics of packaging. They will learn how new technologies are revolutionising the packaging industry, enabling the creation of adaptive solutions that fit the specific needs of each product and consumer. At the end, students will apply what they have learned to propose and

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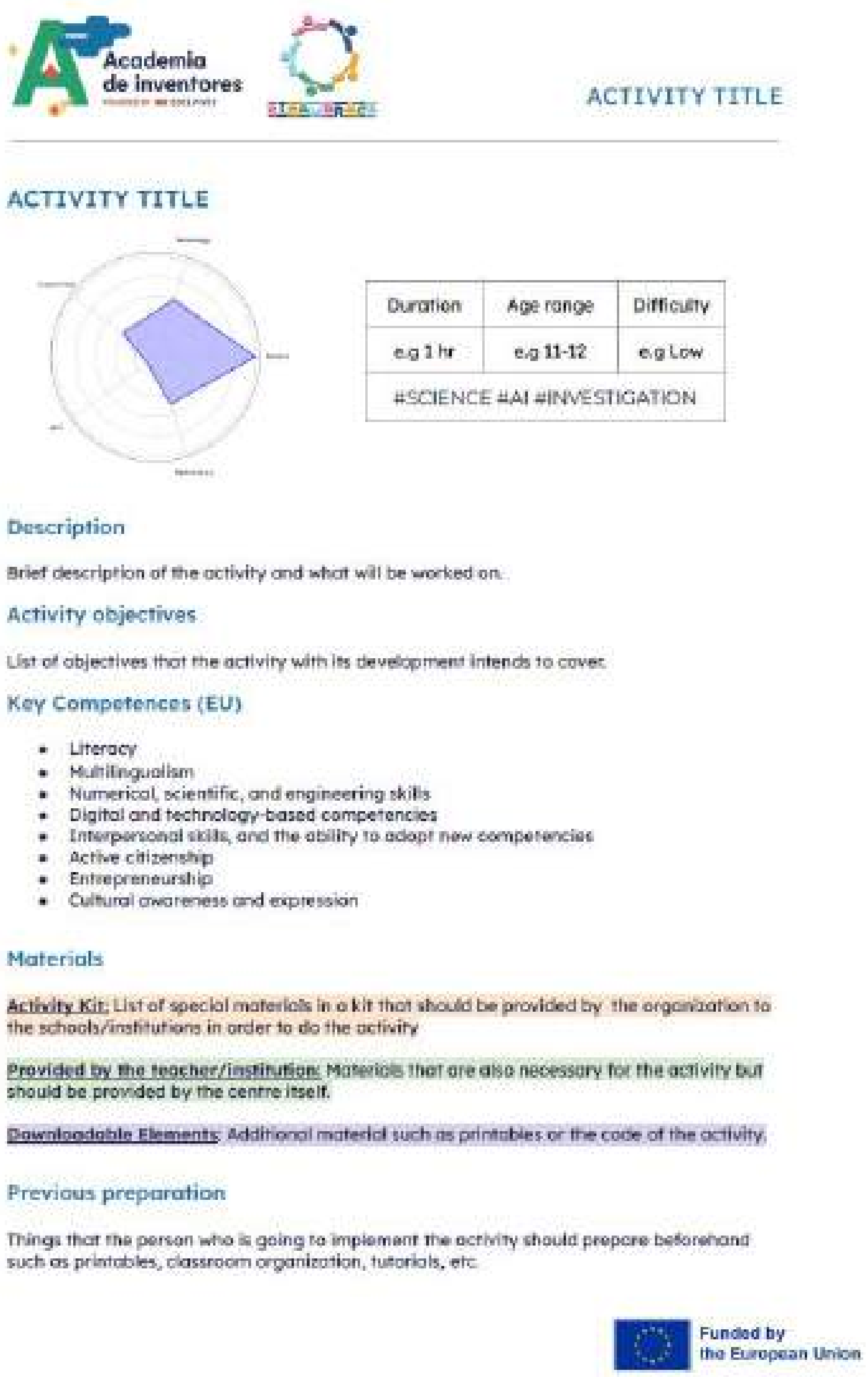
											design their own adaptive packaging.
17-18	medium		Colouring the universe	Connected activity	AV						In this activity, we will explore how astronomers process images of space, assigning colours to different types of radiation to visualise them in an understandable way. Using colour techniques and tools such as GIMP, you will simulate how colour combinations affect our perceptions and how we can replicate the process of 'colouring' images, as is done with pictures of galaxies. In addition, we will look at how people with colour deficiencies, such as colour blindness, perceive these combinations
	hard	✓	Programming music	Hands on and connected activity	RO/C						In this engaging activity, participants will learn how a buzzer works by connecting it to a microcontroller and exploring the principles of sound generation. They will then apply this knowledge to create a homemade speaker using simple materials such as copper wire and magnets. Along the way, they will understand electromagnetism, how vibrations produce sound, and how electric current interacts with magnetic fields. This hands-on experience combines theory with practice, sparking curiosity and fostering creativity in the field of electronics.
	hard		Your pocket assistant	Connected activity	AI						Have you ever imagined what it would be like to have a virtual assistant of your own? In this workshop, we will get hands-on to develop our own AI chatbot using App Inventor. Together we will learn step by step how to design the look and feel and program the responses of our assistant so that it is unique and responds in a natural way. Don't worry if you've never done anything like this before; we'll explore together the logic and creativity needed to bring your chatbot to life. Ready to give your ideas a digital voice? It's time to dive into the world of app programming and discover what you're capable of!
	hard		Real assistant	Hands on and connected activity	RO/AI/C						Have you ever imagined what it would be like to have your own virtual assistant in the form of a robot? In this activity, we are going to build and program an AI assistant that will not only answer your questions, but will also have a physical body made by you. We'll use simple programming tools to bring our assistant to life, teaching it to listen and speak, while learning how AI assistants like the ones we use every day work. Step by step, we'll assemble our robot, decorate it to make it unique, and give it a presence with our programming.
	medium	✓	Weather panel	Hands on and connected activity	RO/AI/C						Ever wondered what it would be like to have a custom weather panel showing real-time data for any city? In this workshop, students will create their own interactive weather panel, learning to program and assemble a circuit that connects to the Internet for instant weather updates. They'll explore how APIs and programming work to access real-time data, building circuits that display temperature, weather conditions, and more. This hands-on activity blends technology and programming, developing skills in electronics, logic, and design.

- This **index** can also be found in a Google sheet document shared with all the partners: activity_index
- And the **activities** itself as annex in this same document or divided by folders into: 002_Activities-T3.5

It is important to note that **all downloadable files** for each activity are stored in the activity's folder and are also accessible via a link provided in its documentation.

4. Template of activities

Each activity will have the same format as shown below, also, it is noted which part of the methodology should be used in each part, this, is for the teacher when giving the lesson or if they would like to use this same template to create another activity, those steps of the methodology are the ones that should be taken into consideration for each section:



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ACTIVITY TITLE

ACTIVITY TITLE

Duration	Age range	Difficulty
e.g 1 hr	e.g 11-12	e.g Low
#SCIENCE #AI #INVESTIGATION		

Description

Brief description of the activity and what will be worked on.

Activity objectives

List of objectives that the activity with its development intends to cover.

Key Competences (EU)

- Literacy
- Multilingualism
- Numerical, scientific, and engineering skills
- Digital and technology-based competencies
- Interpersonal skills, and the ability to adapt new competencies
- Active citizenship
- Entrepreneurship
- Cultural awareness and expression

Materials

Activity Kit: List of special materials in a kit that should be provided by the organization to the schools/institutions in order to do the activity

Provided by the teacher/institution: Materials that are also necessary for the activity but should be provided by the centre itself.

Downloadable Elements: Additional material such as printables or the code of the activity.

Previous preparation

Things that the person who is going to implement the activity should prepare beforehand such as printables, classroom organization, tutorials, etc.

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Phase 0

Activity Planning

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ACTIVITY TITLE

Contextualization and adaptation

Box for complementary tools and exercises, for example:
Watch video - "Video title" + link

Classroom activity

A proposal to the teacher to complement the theory and information that is being given.

Note for the teacher

This box could be used to either give the solutions of "classroom activities" to the teacher or to highlight some important parts of the activity for example things that should be taken into account or tips.

Phase 1

Discover and Value

Activity

Development of the main activity with the objective tools and issues to tackle.

Here may also be used the "Note for the teacher" box in order to specify something about the steps of the activity or anything relevant to its development. In this part, you may also find tutorials or complementary activities.

Phase 2 & 3

Explore and develop

Conclusion and sharing

Closure of the activity, here you may also find the "Classroom activity" box with complementary questions, dynamics, or debate proposals that the teacher may use that are helpful for making conclusions with the participants about the activity and its content.

Also, the project's social media will be linked in this section in case whoever makes the activity wants to share their results.

Project evaluation

This part will be reserved only for the curricular activities. This is because it is aimed at a teacher to formally help evaluate the students. You may find in this section a rubric that links the activity's objectives to their respective key competence (EU) and its evaluation criteria. Example:

Activity Objectives	Key competences (EU)	Evaluation Criteria
Explain what DNA is and how it determines physical characteristics.	Numerical, scientific and engineering skills	Be able to recognise the general structure of DNA and its function.
Relate DNA to how certain physical traits are passed on genetically.		Identify how genetic traits are passed between generations.
Understand the origin of mutations and certain diseases.		Understand where base pairing can go wrong and lead to different types of mutations.
Develop skills in a 3D design environment to apply the knowledge acquired.	digital and technology-based competences	Become familiar with the platform provided and understand how to indicate turns, enlarge shapes, translate them on the different axes, etc.
Learn about very important figures in the history of DNA.	cultural awareness and expression	Become familiar with the history of Rosalind Franklin and her contribution.

Phase 4 & 5

Think and share

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5. Relation with previous deliverables

Regarding the conclusions and issues discussed in previous deliverables, we will now mark down those that this method that has been developed, alongside the theme of the activities and how they were presented, tackles:

Issues indicated in D3.4 regarding results presented in D3.3	Guidelines for designing STEAM activities that were given in D3.4	How is this taken into account in the design of the template, activities, and the developed methodology
The perceived peak of interest in Computer Science and Technology is at 13-14 Programming is more enjoyed at 13-14 and less at 17-18 Low interest in Chemistry	Activities that take benefit of these interests and instill healthy digital habits at this age. Activities and real-life projects conducted by technology and computers but including other STEAM subjects in the mix	(1) The projects presented often relate to real-life situations and to something they can empathize with (Phases 0, 4, and 5 of STEAMbrace methodology). Activities that have more relative “weight” for some of the areas in this age range mentioned before to take benefit of those interests. Transdisciplinary and meta-disciplinary perspective of the STEAM areas into the activities
Interest in Engineering increases with age while robotics decreases	Activities that link Robotics with Engineering in real-life projects for older students	As noted in point (1), this remains the case and is emphasized in activities designed for older students.
Dislike for STEAM themes for a job increase very much with age, especially Art. Art is perceived as the least important STEAM content to teach and it is worse with age Technology, engineering and robotics are the least worked. STEAM topics at school Students perception of their performance in STEAM subjects decrease with age.	Transversal activities and multidisciplinary projects that include Arts and the rest of STEAM subjects at every age	Transdisciplinary and meta-disciplinary perspective of the STEAM areas into the activities
Screen-related activities are popular for free time Very few do maker activities Nearly half of the students do not have attended any STEAM event	Promotion of maker labs (and other STEAM events) to develop projects during their free time	Development of activities thought to be implemented in extra-curricular centres and outside the formal classroom

outside classes Rating in interest for Science decreases with age		
Students feel confident to evaluate or improve ideas generated by other peers Collaboration is a well valuated method of solving problems the least preferred learning methods are 'individually' or 'through competitions' 'On their own' and 'through video games' are not preferred ways of learning	Collaborative (noncompetitive) activities and projects	Many of the activities planned are designed to be carried out in groups. This will be specified in the preparation section of the activity template so that the facilitator of the activity encourages teamwork.
Creativity is the skill to solve problems in which students are less confident and the one which evolves the least with age	Promote creativity in the STEAM activities for solving complex problems	Transdisciplinary and meta-disciplinary perspective of the STEAM areas into the activities
Mathematics is the most worked STEAM topic at school The use of Mathematics decreases with age	Integrate parts of the curriculum about Mathematics in STEAM activities	Transdisciplinary and meta-disciplinary perspective of the STEAM areas into the activities
Technology scales the best among STEAM subjects students want to learn Internet of things, virtual reality and AI scale the best among technologies students like to learn.	Use technology as the backbone in the design of activities that include all other STEAM skills	Transdisciplinary and meta-disciplinary perspective of the STEAM areas into the activities
Art scales the worst among STEAM subjects students want to learn	Promote the transversal role of Art in STEAM activities	Transdisciplinary and meta-disciplinary perspective of the STEAM areas into the activities
'Practical exercising' is the most preferred way of learning by students, while 'Theoretical content' is the least preferred Students like the most learning through 'experimental activities in-class' or 'outside'	Practical and experimental activities	Most of the activities will be complemented with "Hands-on activities". In the activity index teachers and students will be able to identify the ones that have more practical and experimental approaches.
STEAM and educational robots are the most difficult subjects to find materials about	Design more activities about STEAM and robots	Transdisciplinary and meta-disciplinary perspective of the STEAM areas into the

		activities
More than 20% of students at any age can apply nothing or a little STEAM in daily life Students have not a strong feeling of being able to apply STEAM in daily life	Activities linked to real-life situations	2.1.3 Context
CRO, GER, ES and PT have greater percentages than the average on jobs not related to STEAM EN has the greatest percentages of jobs related to Science, Technology and Robotics SW has the greatest percentages of jobs related to Mathematics, Engineering and Arts EN has the greatest percentage of higher degree studies Higher salaries in EN, GER, SW	Adapt activities to the needs of each country	There are in most activities, complementary dynamics that include searching for information about the topic issued specifically for their environment or comments on information about different countries. However, most of the activities were developed so that the facilitator can adapt them to their surroundings easily, but this is an initiative that the facilitator must carry on personally.
STEM studies rank worse among girls‘ preferences than among boys’; and worse at higher age Many more (difference greater than 50%) boys than girls among students that selected Engineering, Computer Science and Robotics Boys have attended more events about technology and robotics than girls	Activities aimed to improve motivation for STEAM among girls though peer mentoring, inclusion of female role models, and social and family support	2.1.3 Context
ART studies rank better among girls‘ preferences than among boys’ Many more (50%) girls than boys among students that selected Art Girls prefer music, reading, drawing, fashion, and beauty more often than boys Girls have attended more events about art than boys	Activities aimed to improve motivation for art among boys	Transdisciplinary and meta-disciplinary perspective of the STEAM areas into the activities
Screen related activities are very popular, but video games more	Balanced use of digital devices in activities attending to different	2.1.3 Context

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among boys while social media and movies more among girls	motivation by gender	
Girls perform better than boys in flexibility and creativeness when generating ideas Girls perform better than boys in generating concrete, reasoned, logical and improved ideas Creativity is the skill to solve problems in which students are less confident; but girls are more confident than boys	Balanced requirements of skills in activities attending to gender diversity	2.1.3 Context

6. Bibliography

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Annex: Activities

Order of appearance:

1. New Species
2. Trapped heat
3. Rockets
4. Training AI
5. Inventors in history
6. Hacking street furniture
7. Give me a hand
8. The magic of mathematics
9. Building earthquakes
10. Art History
11. Motorising magnets
12. That's a lot of energy
13. Schematized
14. Rock, paper, scissors
15. The balance of change
16. The voice of history
17. Rosalind Franklin: Beyond DNA
18. Overcoming Obstacles
19. Machine vs human
20. Safety access control
21. Packaging of the future
22. Colouring the universe
23. Programming music
24. Your pocket assistant
25. Real assistant
26. Weather panel

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NEW SPECIES

Duration	Recommended Age	Difficulty
2 hrs	11-12	Low
#SCIENCE #AI #RESEARCH		

Description

Do you have pets: a dog, a cat, a hamster, etc.? What is your favourite animal? I'm sure we will all have different answers to these questions, but we will all agree on certain things: that a dog has (usually) four legs, a tail, two ears, etc... But how do we know that a dog really is a dog, or that a parrot is a parrot? Who said what's what? In this activity, we will learn not only to identify species but also to apply these criteria to our everyday life with decision trees. But... If we have to classify a new species? We will also learn about machine learning and its application to this field.

Activity Objectives

- Foster interest in new technological tools
- Develop scientific curiosity
- Understand the concept of decision trees and their use

Key competences (EU)

- Digital and technology-based competencies
- Numerical, scientific, and engineering skills

Materials

Provided by the teacher/institution:
- Computer with internet connection

Downloadable Elements:
- Animals sheet printable 1
- Animals sheet printable 2

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Previous Preparation

- Print out animal sheets.
- Ensure that computers are working and have access to the Internet

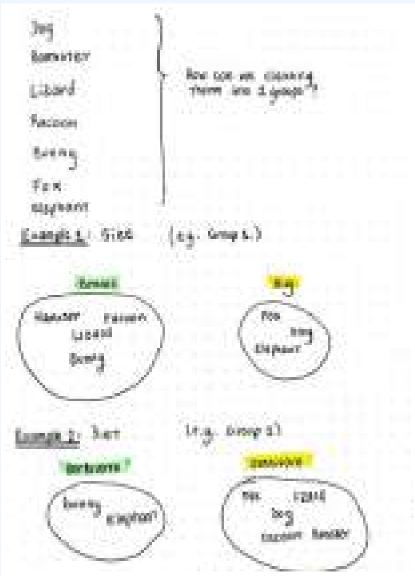
Contextualization and adaptation

Do you have pets: a dog, a cat, a hamster, etc.? What is your favourite animal? I'm sure we will all have different answers to these questions, but we will all agree on certain things: that a dog has (usually) four legs, a tail, two ears, etc... But how do we know that a dog really is a dog, or that a parrot is a parrot? Who said what's what?

Classroom Activity 💡

Ask the students to each name their favourite animal or pet they have at home (about 15-20 animals is fine) and write them all down on the board.

Divide all students into groups of 2-3 participants (ideally 4-6 groups are fine to work with, and **these groups will be kept for the rest of the activities**) and ask each of the groups to put these animals into 2 different categories. How would they think of separating them? By size? By whether or not they have fur?... The same animal can't be in two different categories. Here are two examples:



This practice of grouping animals reflects a basic application of **taxonomy**. Taxonomy is the branch of science concerned with the classification of all living organisms into systematically organised groups based on shared characteristics and genetic relationships. These categories help us to understand not only the visible differences but also the evolutionary connections between different species. Far from being a defunct branch of science, biologists continue to identify and discover new species every year. So far, more than 1.5 million species have been identified, but some studies indicate that these only account for 10-20% of the total, leaving around 86% of the planet's species undiscovered.

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Artificial intelligence (AI) is an area of computer science dedicated to the development of tools capable of solving problems and analysing information. **Machine learning** is a branch of AI that aims to create systems that can learn and improve over time from data. In this project, we will explore decision trees, a type of machine-learning algorithm. Decision trees mimic the human decision-making process by breaking down a problem into a series of sequential questions or decisions. These trees are very useful tools for classifying data and solving various problems, such as animal identification.

See Video 📽️:

The following video (subtitles are available) shows in a graphic and didactic way how these types of intelligences are trained. In today's session, we will try to develop them on a smaller scale.

[How AIs, like ChatGPT, Learn]

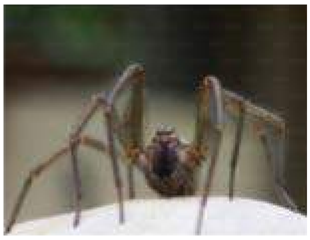
Activity

Building a Decision Tree:

Explain that they are going to build a decision tree to classify different animals, but initially **we will only use their physical characteristics** to group them and create it. We will start with the following animals (Printable at the end):





Assuming we know NOTHING about these animals (what they eat, where they live, their

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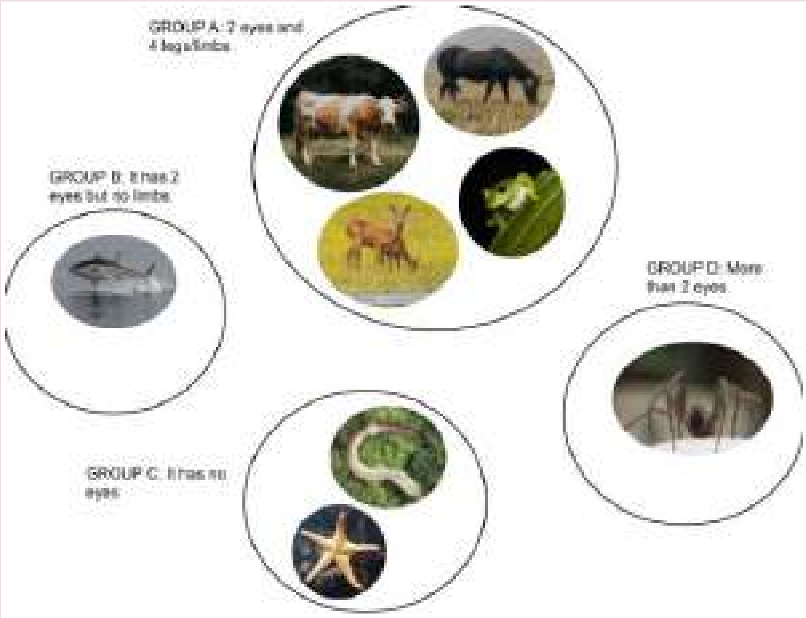
names, etc.), **how would you group them into 4 groups?**

Note For The Teacher 📝

It is to be expected that each classification into 4 groups will be different, or at least most of them, as there are many ways of deciding to classify them. The following is an example:



Once we have our 4 groups, we will proceed to create a decision tree in which we can classify any other creature within these created groups.

Note For The Teacher 📝

The following is an example for the case of the above groups. However, it is to be expected that each classification table of beings is unique. This is because each student or group is likely to use different sorting characteristics:

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Challenge with More Complex Animals

Give students printables of animals that are more difficult to classify, such as amphibians or birds that can be confused with insects, native to the country, to better contextualise the activity. The teacher will be the only one who knows the correct category of these animals as well as their names and descriptions, which can be found in the 'Note For the Teacher' area.

At this point there will probably be some animals that do not fit well with the decision tree that they originally proposed, **so they will probably have to make some modifications or add some new groups.**

CROATIA

Note For The Teacher 📝

1st - Proteus (Proteus anguinus): An amphibian known as the 'human fish' because of its skin colour. It lives in underground caves in the Balkans, including Croatia, and is difficult to classify due to its extreme adaptations to subterranean life.

2nd - Water scorpion (Nepa cinerea): An aquatic insect that is found in shallow, stagnant water. Although it is known as a 'water scorpion', it is not actually a scorpion, but a heteropteran. Its classification has been complicated by its similar appearance to other aquatic insects and its scorpion-like adaptations, such as its pincer-like forelegs.

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De Arne Hodalič - Author's own work. Uploaded with permission., CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=1923560

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SWEDEN

Note For The Teacher 📝

1st - Ringed seal (Pusa hispida): A marine mammal from the Baltic Sea that is difficult to classify due to its particular adaptations to fresh and salt water.

2nd - Great black-backed gull (Larus marinus): One of the largest gulls in the world, found along the coasts and inland areas of Sweden. The classification of the gull can be complicated by its similarities to other gull species and its varying plumage throughout the different stages of its life.

De Lee Cooper - http://www.nsf.gov/od/lpa/news/press/01/pr0186.htm, Dominio público, https://commons.wikimedia.org/w/index.php?curid=3155513

De Andreas Trepte - Trabajo propio, CC BY-SA 2.5, https://commons.wikimedia.org/w/index.php?curid=10944563

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SPAIN

Note For The Teacher 📝

1st - Ocellated lizard (Timon lepidus): A reptile endemic to the Iberian Peninsula with variations in colour and size that make it difficult to classify into subspecies.

2nd - Iberian desman (Galemys pyrenaicus): Semi-aquatic mammal with habits similar to those of moles, difficult to classify, situated between rodents and insectivores.

De Bernard DUPONT from FRANCE - Jewelled Lizard (Timon lepidus) male found under a stone by Jean NICOLAS, CC BY-SA 2.0, https://commons.wikimedia.org/w/index.php?curid=40770696

De David Perez - Trabajo propio, CC BY 3.0, https://commons.wikimedia.org/w/index.php?curid=7898248

PORTUGAL

Note For The Teacher 📝

1st - Greater mouse-eared bat (Myotis myotis): A bat found throughout the Iberian Peninsula.

2nd - Iberian spadefoot toad (Pelobates cultripes): A particular amphibian that lives in humid areas of inland Portugal. Its appearance is peculiar, with a squat body and a pair of 'spurs' on its hind legs that allow it to dig quickly, which gives it an advantage when it comes to escaping predators and adapting to its environment.

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De Urheber: Manuel Werner, Germany, Wikipedia-Kontakt: http://de.wikipedia.org/wiki/Benutzer:Werner,_Deutschland - first upload in de wikipedia on 21:33, 18. Mär 2005 by Nup, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=205469

De Franco Andreone - see authorization - http://calphotos.berkeley.edu, CC BY-SA 2.5, https://commons.wikimedia.org/w/index.php?curid=5179895

ROMANIA

Note For The Teacher 📝

1st - Danube Crested Newt (Triturus dobrogicus): An amphibian that dwells in wet and marshy areas.

2nd - Banded demoiselle (Calopteryx splendens): A dragonfly-like insect, difficult to classify due to its flight patterns. These dragonflies are seen from mid-spring to early summer, with a single specimen living no more than two weeks.

De Rainer Theuer. - originally uploaded on de.wikipedia.org (file: [1])., Dominio público, https://commons.wikimedia.org/w/index.php?curid=4612865

De Quartl - Trabajo propio, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=16166210

Discuss As A Group 🗣️

Have they needed to modify their decision trees with the new samples?

Have they added branches, how many?

Can you imagine being able to automate this process using AI? What use would it be in real life to create a classification of animals using AI?

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Note For The Teacher 📝

Some possible applications of AI for animal classification where it may be useful (as triggering ideas):

- **It helps to classify unknown species**, e.g. a new species of insect found, etc.
- It helps to identify species within a population that may be **dangerous** or disease-transmitting. For example, if there is a plague of insects that are very similar to each other, but there are a variety of insects that transmit diseases, you can monitor those that show up by taking photos and feeding them to an AI so that it can identify if any of those photos correspond to a dangerous species.

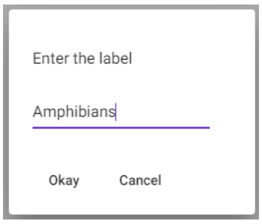
Creating Our Model With Machine Learning:

We are now going to work on creating our own AI for animal identification, for which we can use the online platform: https://advanced.learningml.org/editor/

We will start by indicating that we will create a machine-learning model to recognise images:

Let's first train the artificial intelligence. To do so, click on the following section:

Enter the name of the first group and click 'Okay':



Then, we will create all the necessary groups. Here are five possible groups, for example:

- Amphibians
- Mammals
- Birds
- Insects
- Fish

And then we must upload images in each group, at least 5, that we want our model to take

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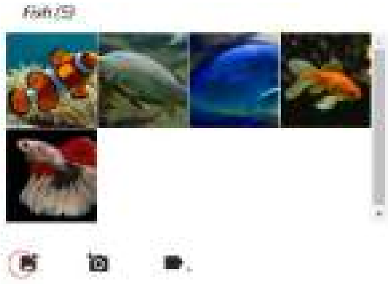
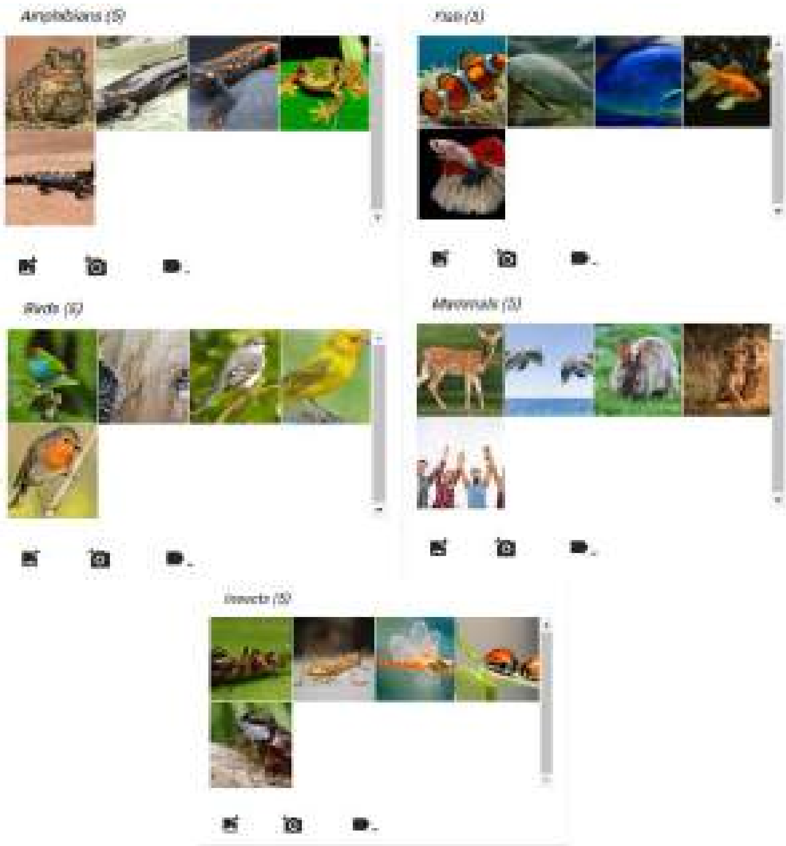
as an example to be able to identify others. Because of this, we must think about which images from each group will be better to identify the group and which ones are more representative in general to be able to compare other animals with them. To upload the images, click on the image below:



Once all the groups have been loaded, we should be left with a classification similar to the following one:



We will then ask the program to train our model; we will do this by clicking on the following button:

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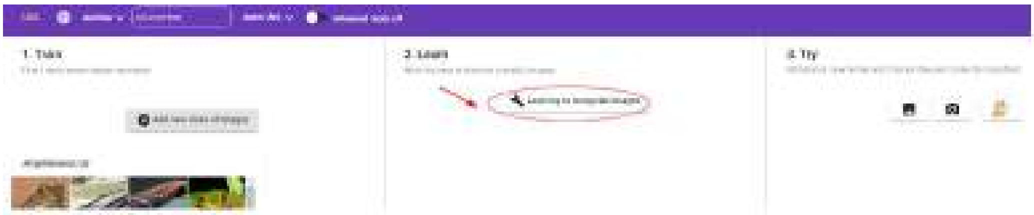
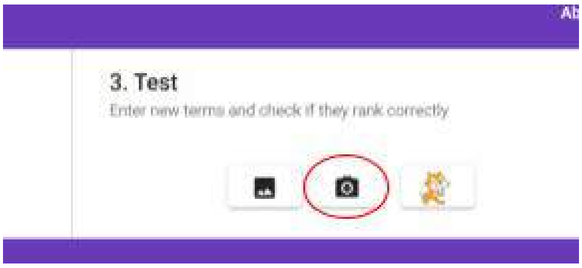
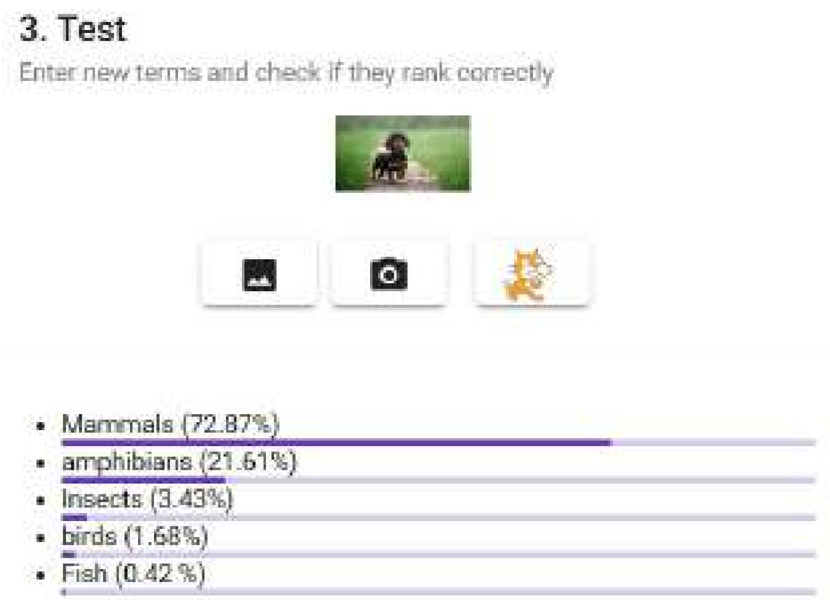


Finally, once the model has been trained, we will upload an image for testing:



Our model will give us the answer to what percentage of certainty it believes that the given animal belongs to that group.



The more images we use to train our model, the more certain it will become about the answers. ¡Let’s give our model a try!

Complementary Activity

We will now test our model with images of ‘strange’ animals. Where do you place them - do they agree with this categorisation - should we add more groups?

For example, we can try with the images:

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De Stefan Kraft - Selbst fotografiert am 20.9.2004 im Sydney Aquarium., CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=657498

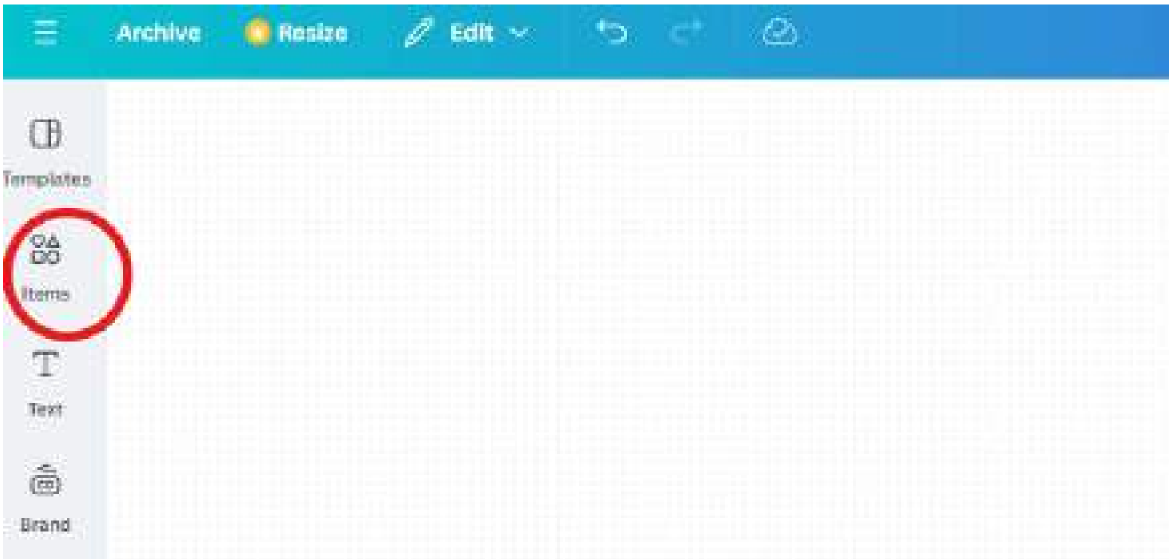
De Angie Torres from Toronto - extra flotation devices, CC BY-SA 2.0, https://commons.wikimedia.org/w/index.php?curid=10724404

Can you think of others to try? What about a shark? What about a dolphin?

Trying Out A New Species:

Now, having understood our model and having trained it enough, we will try to create an artificial intelligence image with Canva: **can create a blank document in Canva and then click on Items > Generating images with IA and you can save those images**

https://www.canva.com/dream-lab



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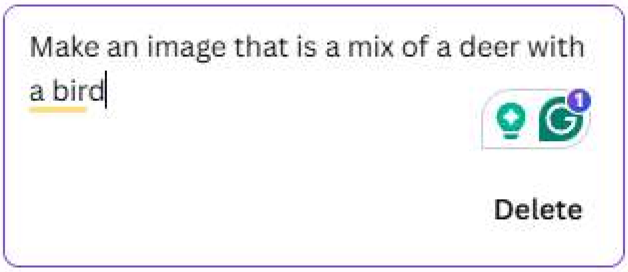

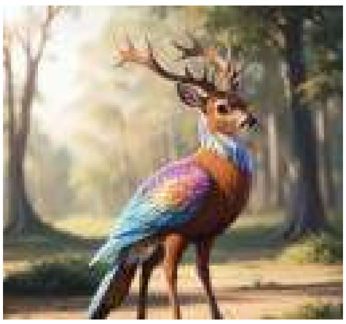

We can save those images and load them to our previous computational model and test in which group it classifies it.

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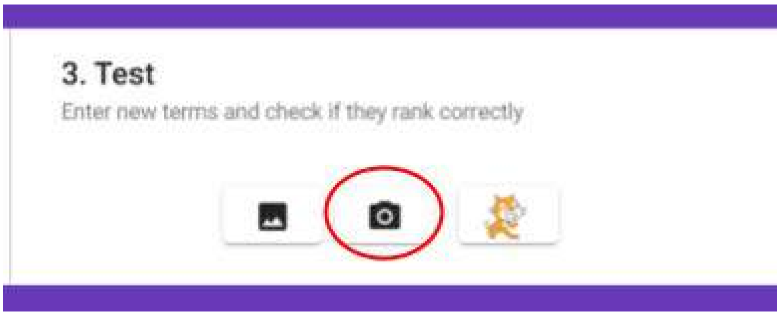
We can also choose to draw it and load a drawing to our computational model, either from a file or from the computer's camera, by selecting the following option:



Conclusion and Discussion

- What have you learned?
- How did you learn it?
- What did you find easier/harder?
- Did you know this kind of trained models, or have you used similar ones for something else?
- Have you used AI for anything outside of school?
- Do you think you could apply what you have learned today to something you use every day or on a recurring basis?

Discuss In Groups 🗣️

How would you think of applying this knowledge to another context?

Do you think artificial intelligence can be useful for things other than education?

We invite you to share your results on social media by tagging the STEAMbrace project:

LinkedIn: https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name

Instagram: https://www.instagram.com/steambrace_eu/

X: https://x.com/steambrace_eu

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Project Evaluation

Activity Objectives	Key Competences (EU)	Evaluation Criteria
Foster interest in new technological tools	Digital and technology-based competencies	The student shows enthusiasm and engagement when exploring digital tools for animal classification and is interested in learning more about the technology used, researching on his/her own or asking relevant questions.
Develop scientific curiosity	Numerical, scientific, and engineering skills	Ability to formulate questions about the characteristics of animals and reflect on the scientific implications of the activity. Compares and reflects on the results obtained when classifying animals, and identifying patterns and differences.
Understand the concept of decision trees and their use		The student contributes to the construction of a coherent and well-structured decision tree. He/she is able to adjust the decision tree according to new samples or data presented. Shows understanding of the use of decision trees as a tool for classifying information.

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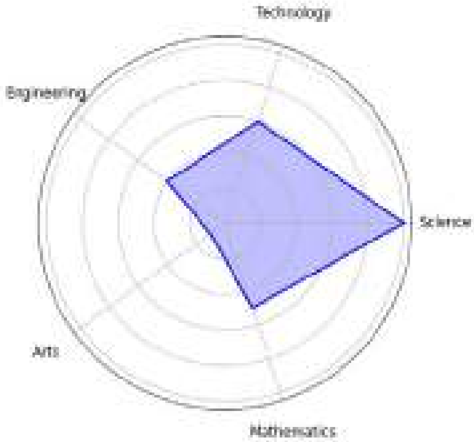
TRAPPED HEAT



Duration	Age Range	Difficulty
1 hr	11-12	Low
#EXPERIMENTATION #SCIENCE		

Description

This activity allows students to explore the greenhouse effect tangibly. Through a simple experiment, they will generate carbon dioxide and compare it to an environment without CO2, observing how more heat is retained in the latter. Students will not only understand a crucial phenomenon in climate change but will also develop key scientific skills. It is a practical and accessible way to connect science with current environmental issues.

Objectives of the activity

- **Understanding the greenhouse effect:** Demonstrate how the presence of carbon dioxide in a closed environment can increase heat retention, replicating the greenhouse effect on Earth.
- **Applying Scientific Method:** Encourage the development of experimental skills by designing, conducting, and analyzing a controlled experiment to compare temperatures under different conditions.
- **Become familiar with technology**: Use digital tools to accurately measure and record temperature data, integrating technology into scientific learning.
- **Develop critical analysis skills.**

Key competences (EU)

- Numerical, scientific, and engineering skills
- Digital and technology-based competencies
- Active citizenship

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Materials

Provided by the teacher/institution:

- Vinegar
- Two kitchen thermometers
- Baking soda
- Spoons
- Modeling clay
- Measuring jug
- Balloons
- Funnel
- Stopwatch
- Large container
- Water heater
- 2 identical bottles (plastic or glass)

Previous Preparation

- Prepare the materials before the start of the activity.
- Distribute the students into groups of 2-3 people.
- Organize the workstations for each group.

Contextualization and Adaptation

Have you heard about the **greenhouse effect** before? On the following page of the European Parliament, you can find information about the current situation in Europe regarding this issue:

https://www.europarl.europa.eu/topics/en/article/20180703STO07123/climate-change-in-europe-facts-and-figures#:~:text=their%20warming%20potential-,The%20EU's%20biggest%20greenhouse%20gases%20emitters%3A%20countries%20and%20sectors,1990%20to%207.3%25%20in%202021.

Short video on the subject:
https://science.nasa.gov/climate-change/faq/what-is-the-greenhouse-effect/

The greenhouse effect is crucial for making Earth a habitable planet. It determines the flow of energy arriving at and leaving Earth. The Sun's energy heats the Earth's surface and the planet radiates energy back into space. However, certain atmospheric gases trap some of the outgoing energy, retaining heat. Without it, the average global temperature would be around -18°C, which would make life as we know it impossible.

Greenhouse gases like CO2, methane, and water vapor trap heat from the Sun in the atmosphere, keeping the planet warm enough to support life. This process is similar to what happens in a greenhouse, where heat is

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trapped to maintain a warm environment. This gases absorb infrared (IR) radiation because of their molecular structure. They have bonds that can vibrate at the same frequencies as IR radiation, meaning they absorb and re-emit this heat energy. Unlike other gases, such as nitrogen or oxygen, which mainly stay transparent to infrared radiation, greenhouse gases trap heat in the atmosphere.

However, when there is an excess of these gases in the atmosphere, as we are seeing on Earth today, it can lead to global warming and climate change. This is because more heat gets trapped, causing temperatures to rise and leading to disruptions in climate patterns.

Interestingly, on other planets, like Mars, the absence of a significant greenhouse effect makes them uninhabitable. Despite being closer to the Sun, Mars has extremely cold temperatures because it lacks enough greenhouse gases to retain heat. It does have some atmospheric carbon dioxide, but almost no atmosphere so the existing one is so thin that it cannot retain energy from the Sun.

On the other hand, Venus is quite the opposite. *Venus is similar to Earth in terms of size and mass, but its surface temperature is about 460 degrees Celsius. This is hot enough to melt lead! The Venusian atmosphere is mainly made up of carbon dioxide, a greenhouse gas. On Earth, carbon dioxide makes up only a tiny fraction of the atmosphere.*[1]

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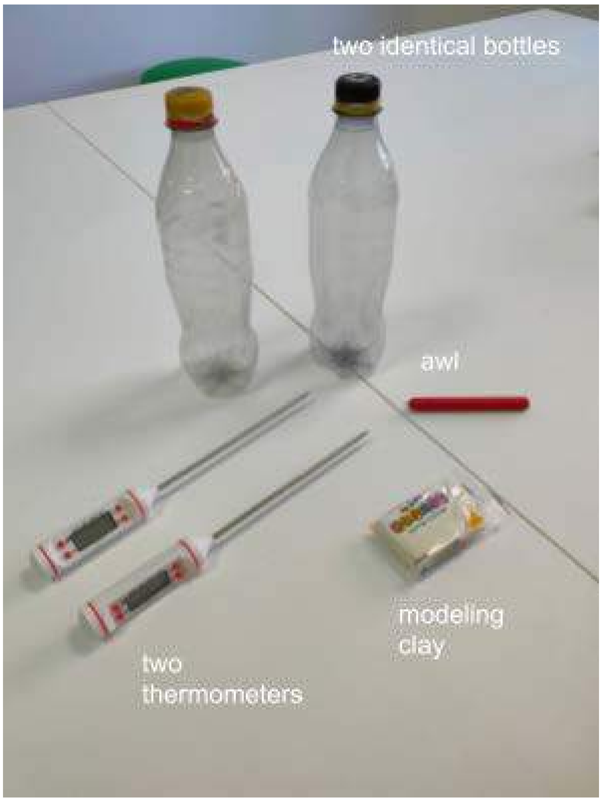
In this activity, we will experiment with two systems and how each one interacts with Infrared radiation in two possible ways:

- Exposing those systems to the sun
- Exposing the systems to incandescent or infrared light

Activity

First, we will prepare the equipment that we are going to work with:



Using the awl, we make a hole in the bottle caps, and through each one, we will insert the thermometer, sealing the outside with modeling clay as shown in the picture (this is done for both caps):

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Use a marker to identify which bottle will contain the CO_2.

Now, we will generate our CO_2. We have two ways to achieve this: one is by blowing into the bottles, as we release it when we exhale, but this would mean that the gas starts with a fairly high initial temperature.

To avoid this problem, we will generate it from a very simple reaction that everyone probably knows: the reaction of baking soda with vinegar. For this, we will need the following elements:

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Approximately 20 ml of vinegar is poured into the bottle, and then about 5 grams of baking soda (one tablespoon) is added, and we wait for the reaction to occur. Once our balloon is well inflated, we bend it a little at the base before removing it to keep it closed (but not tied) to prevent the carbon dioxide we generated from escaping. We will keep it pinched with our fingers at the opening, as shown in the image, to prevent the gas from escaping while we transfer it to another container.

Once we have the CO2 securely contained in the balloon, we will place the tip of it at the opening of the bottle labeled 'CO2':

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And we **immediately** close it to prevent the CO_2 from escaping. It is essential to ensure that the bottle is well sealed.

Another identical bottle will be prepared, but without CO_2, only with air, resulting in:

- Bottle 1: control WITHOUT CO_2
- Bottle 2: contains CO_2

Now we have two possibilities depending on the materials available:

- **Using sunlight ☀️:** We will first turn on the thermometers into the classroom and wait for them to stabilize. When the thermometers have a steady temperature and do not change (they are both in balance with the surrounding temperature), we will place both bottles directly in sunlight and start to record the temperature every 1 minute or 2, we will record this into a copy of the following document: gas_temperature_tracker_v0

- **(OPTIONAL) Using an infrared light bulb 🚨:** We will first turn on the thermometers into the classroom and wait for them to stabilize. When the thermometers have a steady temperature and do not change (they are both in balance with the surrounding temperature), we will place both bottles directly under the infrared light and keep track of the temperatures in both systems every 1-2 minutes: gas_temperature_tracker_v0. Shown below is one possible arrangement for the system, both bottles must be at the same distance from the light source.

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At that moment, we start the stopwatches and begin recording the temperature of each thermometer every 30 seconds in the previously mentioned document.

In it, we will be able to observe the type of behavior that the heating of the gases exhibits. Below, we present (for the teacher only) an experiment that was conducted and the type of behavior we can observe from one system compared to another:

		Control	With CO2
Nº measurement	[t]=seg	[T] = ºC	[T] = ºC
1	0,00	21,6	21,3
2	30,00	22,8	22,3
3	60,00	26	25,6
4	90,00	27,3	28,8
5	120,00	28,8	30,3
6	150,00	30,1	30,7
7	180,00	30,8	31,6
8	210,00	31,3	32,4
9	240,00	31,8	32,6
10	270,00	32	33
11	300,00	32,3	33,3
12	330,00	32,6	33,3

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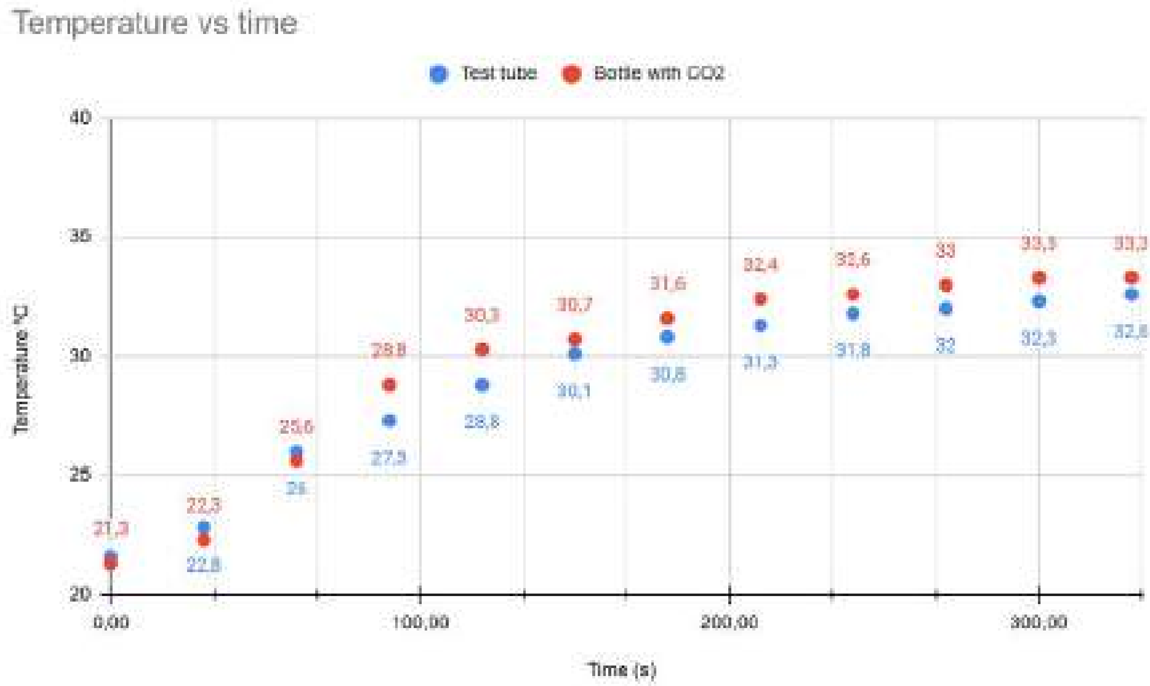

Conclusion and sharing

Once the experiment is completed, some questions are posed for discussion among the groups and participants:

- Which one heats up more?
- Why do you think this is the case?
- Are the results as expected? Why or why not?
- Does it really heat up more all the time?
- Which one takes longer to cool down?
- Would you make any changes to the experiment?
- Do you understand better how greenhouse gases work?

Don’t forget to take a photo of your experience and share it with us!

LinkedIn:
https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name

Instagram: https://www.instagram.com/steambrace_eu/

X: https://x.com/steambrace_eu

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Bibliography and references

European Space Agency. (2003, febrero 14). *Greenhouse effects… also on other planets.* https://www.esa.int/Science_Exploration/Space_Science/Venus_Express/Greenhouse_effects_also_on_other_planets

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Rockets

Duration	Age Range	Difficulty
1,5 hrs or 2,5 hrs	11-12	Low
#SCIENCE #EXPERIMENTATION		

Description

Have you heard of ESA? What kind of relationship does your country have with this space agency? In this session we will become ESA aerospace engineers, with the mission to improve the prototype of a small rocket and find the optimal way to put it into orbit, using only a chemical reaction and variations of our experience by controlling variables. Are you ready to face this challenge? In addition, we will study about the astronaut corps, the first female astronauts and their history, and what it is like to spend time in space.

This session has two duration options: *2 or 3 hrs.*

This is because it is divided into two parts that can be done independently of each other:

- *Experimentation with variable control (2 hr) and 'eyeballing' conclusions*
- *Subsequent analysis of data with software (3 hr) and conclusions with 'good measurements'*

Activity objectives

- Encourage teamwork
- Develop scientific curiosity
- Learn how to develop experiments with controlled variables and understand why it is important to change one variable at a time
- Understand how comparing experimental data allows us to draw conclusions about the behaviour of systems in nature
- (Optional - extended version) Become familiar with a digital environment for recording experimental data

Key competences (EU)

- Numerical, scientific, and engineering skills
- Digital and technology-based competencies
- Interpersonal skills, and the ability to adopt new competencies

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Materials

Provided by the teacher/institution:

- Camera mobile
- Printed rocket template
- Tape
- Scissors
- Jars with water
- 20 ml syringe or small 50 ml plastic beaker, or any measuring instrument that can measure 20 ml
- Effervescent tablets
- Bottle of tablets + stopper
- Skewer stick
- Cardboard
- OPTIONAL: Computer with tracker software (https://physlets.org/tracker/)

Downloadable Elements:

- Rockets printable

Previous Preparation

- Creating working groups (2-3 participants)
- Preparing the materials
- (optional if long version is chosen) Installing 'Tracker' software on computers: https://physlets.org/tracker/
- Activity to be carried out in an open space, ideally with tables prepared to get dirty
- Setting up equipment/devices
- Approximately 4 rocket templates should be prepared per working group

Contextualization and Adaptation

If at this moment we drop a pencil, what happens: where does it fall to?

It will indeed fall to the ground, and so on with many other movements that we can predict very well in our environment. But what makes that movement predictable for us, and why do we know that it will fall to the ground? Surely the word gravity will ring a bell in this debate... In this session we will work on studying how the conditions of our environment change when we do not have it, or at least in very low percentage. For this we will study how astronauts live, who are part of the ESA body, a little of their history, and finally we will prepare our own rockets and we will test by controlling variables how we can make them more efficient.

Watch video 📽️ - "Why Earth is a prison and how to escape it".

We start the session with an introductory video on how we can 'break' the gravitational pull of the earth so that rockets can go into space.

Why Earth Is A Prison and How To Escape It

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This same principle of using energy to make something ‘go up’ will be used by us in a chemical reaction that will give us the energy we need to work on our rockets. But before we do that, let's focus a little more on the very interesting stories behind space exploration.

But... when did we really begin to understand this better as humanity and when did the first breakthroughs come about? Here is a short activity to give you a historical context of how the first giant leaps in space exploration were made.

Classroom activity💡

Research the following topics in order to fill in the blanks:

- **The first unmanned rocket/missile to leave the atmosphere** (during a suborbital flight: a flight at or above 100 km altitude, but during which the Earth is not circumvented in its entirety, but which is nevertheless considered spaceflight because it leaves the Earth's atmosphere, with an agreed limit of 100 km altitude), which would later lead to the development of space rockets, was the _______ (1) developed by _________ (2) during __________(3).
- **The first manned space flight** was the _____________ (4) carried out by ____________ (5) at _______ (6) during the _____________ (7), and thus the first human being in history in space was _________________ (8).
- In 1969 the _______ (9) is the first space flight to land a man on the Moon. _________ (10) is the first astronaut to set foot on the Moon.

Discuss in groups 🗣️

What relationship can you find between the two milestones in space history?
What things or historical context in both cases encouraged the advancement of science in this aspect?

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Note for the teacher 📝

Here are the answers corresponding to the previous blanks:

1. **V-2**
2. **Nazi Germany**
3. **World War II**
4. **Vostok 1**
5. **Soviet Union**
6. **1961**
7. **The Cold War**
8. **Yuri Gagarin**
9. **Apollo 11**
10. **Neil Armstrong**

Now that we've talked a bit about rockets and how they work, can you imagine living without gravity? Let's think about basic everyday tasks; once we manage to overcome the earth's gravitational pull and stay floating, let's analyse how we could do the following things:

- Wash our teeth
- Take a shower
- Go to the bathroom
- Drink water

Here are some videos recorded by astronaut **Samantha Cristoforetti** who will explain in more detail what it's like to live in space for a while.:

Watch videos 📽️:

Hobbies on the Space Station | ESA Astronaut Samantha Cristoforetti
International Space Station bathroom tour
Where do astronauts sleep?

European Space Agency astronaut Samantha Cristoforetti, attired in an Extravehicular Mobility Unit (EMU) spacesuit. Photo credit: NASA. Photo link.

Classroom activities 💡

Research what ESA, the European Astronaut Corps, is and who has been a part of it over the years.

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Is there anything that stands out to you?
Did you know all these astronauts, are there any from your country, and do you know them?
*Did you know the term '**parastronaut**'?*

TIP: You can draw a timeline of when they joined the astronauts by using photos.

Note for the teacher 📝

Students can be asked to use timeline templates in Canva (https://www.canva.com/) and comment a few lines presenting each of the photos:

European Space Agency:

https://www.esa.int/

European Astronaut Corps:

https://es.wikipedia.org/wiki/Cuerpo_Europeo_de_Astronautas

Who belongs to the ***ESA***? Austria, Belgium, Denmark, Germany, Spain, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Luxembourg, Norway, Netherlands, Poland, Portugal, the United Kingdom, Czech Republic, Romanía, Sweden and Switzerland

On the other hand, Croacia, although not yet part of ESA, they are in negotiations to become part of it, and the company Spacemanic and the Society for Out-of-the-Box Education (EVO) launched a project to create, programme and put into orbit the first nanosatellite powered by Croatian know-how and advanced technologies. This satellite is called CroCube, all the information about it can be found on its official website: https://crocube.hr/2024/06/09/novo-lansiranje/

Talking about putting rockets into orbit... What things do you think are important when sending something into space? We can consider different issues:

- Fuel
- Weight
- Launch location
- etc. Can you think of anything else?

In any experiment we conduct, or any change in most situations, how do you think we should assess how a system responds to a change?:

By changing many things about that system at once? Or by changing one thing at a time?

Do you know what a control experiment or a ***variable-controlled experiment*** is?

For example, if we make a cake and we see that it does not turn out well, as good scientists we should experiment by changing the recipe to find out how to improve it. But could we modify it by changing the original amount of eggs and flour at the same time? In case the cake does indeed turn out better, what made it better: the amount of eggs or the amount of flour? We would not be sure, which is why when we change things in an experiment, it is important to change one thing at a time to be very sure how that change affects our 'cake' or experiment. This is called a 'variable-controlled experiment'.

In today's session we will have to modify a rocket launch protocol to make the rockets fly even higher.

Activity

1) Groups of 3-4 students are formed (better to work in an open space)
2) Each group is given 1 rocket kit
3) The teacher will designate a group that will be in charge of carrying out the 'control experiment'. In order to 'standardise' it, a protocol is introduced that has already been tried and tested and is known to work. Although our aim is to improve it later, the control protocol will be as follows:
    - 15 ml of water
    - One whole, unground effervescent tablet
4) This group will do the '**initial launch**' and the rest should record approximately how long it takes to take off, how many metres it goes up, etc... For this it is useful to have a reference height; For example, stand next to a column that we know is X metres high.

<u>Here's how to make the 'model' launch</u>:

a) The rocket template is cut out and mounted on the vitamin tube. It is important that the tip of the rocket goes from the closed part of the tube, so that our fuel can come out of the back of the tube. Then we go to an open place or a place that can get dirty.

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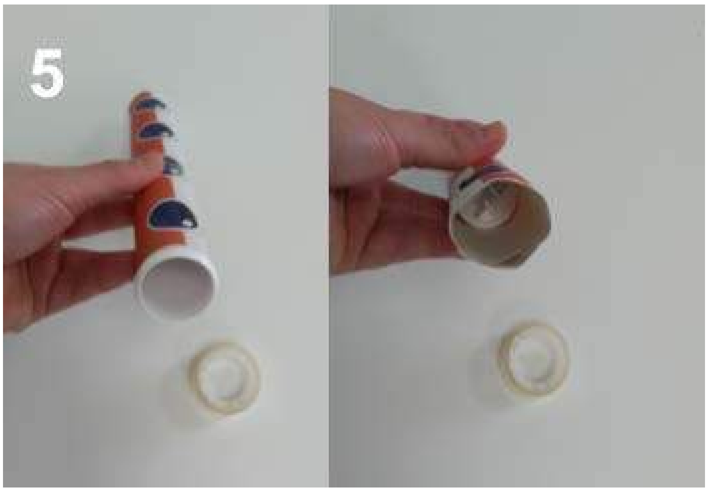

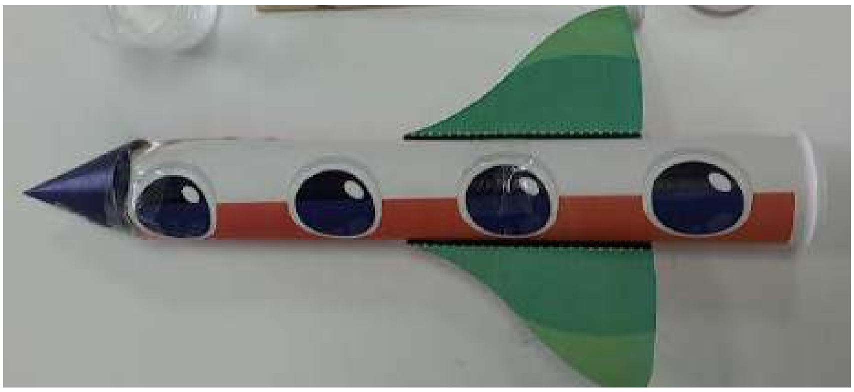

b) Pour 15 ml of water into each beaker.
c) Pour the liquid into the vitamin tube, making sure that the water does not touch the walls as it falls down the tube so that the experiment goes better.
d) We will give each group a wooden rod (like a skewer stick) and they will make a disc to stick on the end of it (it must be of a smaller diameter than the opening of the tube so that it can fit properly inside the cylinder; the image

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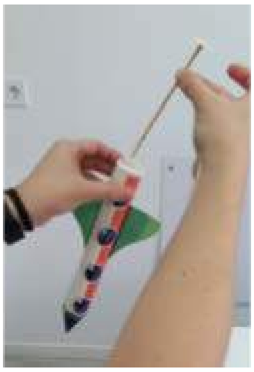
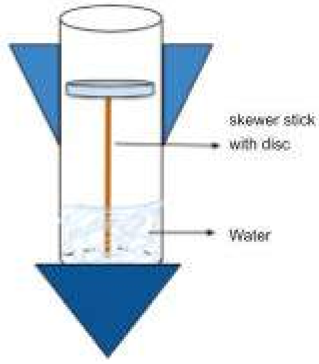
below shows the rod with disc but in this case instead of being made of cardboard it is made of plastic; it can be of any other material you consider) and they will place it as follows::

e) We will hand out 1 effervescent tablet per group and ask them to place it on the disc. It is VERY IMPORTANT that no student knocks down the rocket in such a way that the walls or the disc get wet, otherwise it will start to react before it should.

f) The rocket is then covered (without turning it upside down, i.e. with the open side always facing upwards), ensuring that it is vertical and that the water does not wet the walls. A little force is probably necessary as the wooden stick with the disc usually touches the bottom of the lid, and the lid must be very tightly closed. Then, we give them back to each group and ask them not to knock the rocket over.

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g) At this point, we ask them to come to the table, quickly turn it upside down and leave it resting on the table. We wait for about 30 seconds and the rockets will fly off.
h) We ask them to collect all the rockets, rods and caps that have been blown away and place everything in a basket designated for dirty things.

5) On the other hand, the other teams will work on modifying one parameter per group to see if they can get the rocket to fly higher, take less time to take off, etc. Some IDEAS are left below if the starting point is complicated, but the goal is for the students themselves to come up with them:
    - Group 1: Change the amount of liquid
    - Group 2: Change the type of liquid
    - Group 3: Grind the tablet
    - Group 4: Hacer más puntiaguda la punta del cohete
    - ETC
6) Compare results
7) ***OPTIONAL***: If you wish, you can do a longer version of this activity in which the students record the launches with their mobiles from a distant location and using a reference measurement, and after recording all the launches, analyse them using the tracker application and see if the 'naked eye' observations coincide with those of the data analysis. To do this, they will have to buy the graphs together and check the maximum height reached by each one of them..

ANNEX: Tutorial: Tracker Video Analysis

Note for the teacher 📝

Explicación química del lanzamiento

Has anyone ever taken a medicine for a tummy ache that when you put it in water, bubbles come out?

Essentially, we did that in this experience: we used an effervescent pill to make our rocket fuel work. But why does it fly? Here we can let the children answer why for a little bit and then we can give an explanation.

What do the effervescent tablets release when you put them in water? Bubbles. And what do those bubbles have in them? When you blow a bubble blower and make a big bubble inside it, it has air in it, right? So far so good. But most of the effervescent tablets release carbon dioxide (CO_2) which in the end mixes with the air in the environment. However, when we put one of these tablets in a glass, it doesn't fly away; why? In the case of the glass, it is open at the top, so the CO_2 inside the bubbles that are constantly forming and bursting is released directly into the environment (what you see are CO_2 molecules, not bubbles):

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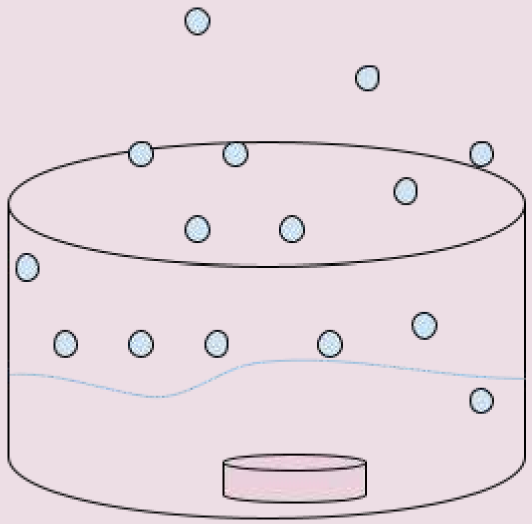

On the other hand, for our rocket, as it is covered (not open), all those CO2 molecules that combine with the air, instead of being released into the atmosphere, start to accumulate inside the covered cylinder that we have prepared. There comes a point when the pressure inside the cylinder is so high, due to the amount of gas accumulated, that the same pressure causes the lid to fly off, as it is not sealed but a movable lid.

Why do you think we use the stick with the disc? We can leave some space for the children to answer what they think, and in general, they tend to answer correctly. The stick with the disc is so that when you put the tablet inside the disc, the reaction DOES NOT HAPPEN, because the tablet is isolated from the water at the bottom of the cylinder, and until we turn it over, there is no contact and the reaction does not occur. It is a way to be able to run the experiment more calmly and not have to do it all so quickly.

Error possibilities (support to the teacher's analysis)

What happens if a rocket doesn't fly? There are several factors that can affect this. It is a good opportunity to comment that experiments do not always go as expected and as scientists it is important to analyse why it did not succeed. You can even ask the children why they think it did not work. In general, it is usually due to the following reasons:

- The lid was not tightly closed, so some gas escaped and the pressure was not high enough for the lid to open by itself.
- The rocket was knocked over and the walls were wet, or even the disc was wet, so the reaction would have started before the rocket was covered and a lot of air would have been lost to the atmosphere.
- Some of the tablets are a bit old or wet and do not have as much effervescent effect.

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Conclusion and sharing

- What have you learned?
- How did you learn it?
- What was the easiest/hardest for you?

Debate in groups 🗣️

What kind of change of variables was most effective in making the rocket fly higher?

Would you think of applying this method of controlling variables to other aspects of our surroundings?

If you had to modify the experimental process to make it more efficient, what would you do?

What did you know about ESA astronauts before this session, and what has caught your attention?

We suggest you share your results in social media by tagging STEAMbrace project:

LinkedIn: https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name

Instagram: https://www.instagram.com/steambrace_eu/

X: https://x.com/steambrace_eu

Project Evaluation

Activity Objectives	Key competences (EU)	Evaluation Criteria
Encourage teamwork.	Interpersonal skills, and the ability to adopt new competencies	The ability of the group to collaborate effectively, showing good communication, task sharing and mutual support to achieve the objectives of the activity will be assessed.
Develop scientific curiosity.		Students' ability to ask questions, actively explore experimental variables, and show interest in understanding and improving the experiment will be assessed.

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Learn to develop experiments controlling variables and understand why it is important to change one variable at a time. Understand how comparing experimental data allows us to draw conclusions about the behaviour of systems in nature.	Numerical, scientific, and engineering skills	Understanding and applying the concept of variable control in the design and execution of experiments will be assessed, as well as the ability to justify the importance of modifying only one variable at a time to obtain conclusive results, e.g. by analysing and identifying patterns and trends, formulating conclusions based on experimental evidence, recording experimental data, etc.
Become familiar with a digital environment for recording experimental data.	Digital and technology-based competencies	Be able to organise data in a structured way in the digital environment (with the proposed software), using graphs, tables or other means to improve the visualisation and comparison of results, thus being able to analyse data and detect patterns, facilitating the interpretation of experimental results. They can explain the advantages of using a digital environment to record data (accuracy, ease of comparison, etc.) and reflect on how technology improves the scientific research process.

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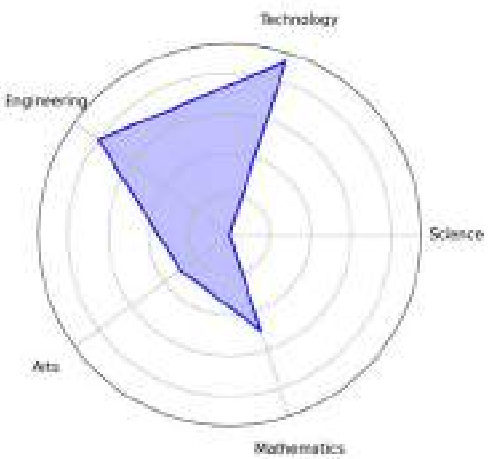
TRAINING AI



Duration	Age Range	Difficulty
2 hrs	11-12	Medium
#SECURITY #AI		

Description

For this activity, we will delve into the fascinating world of Artificial Intelligence (AI) and programming through a series of practical challenges. We will start by exploring what AI is, how it works and how it differs from traditional programs. Next, we will learn about programming and the importance of giving clear and orderly instructions so that machines do exactly what we want them to do. Finally, we will use Scratch and Machine Learning for Kids to train an AI model capable of classifying passwords according to their security level. Become a true digital security expert, and get ready to beat any hacker!

Activity objectives

- Familiarise students with the concepts of **Artificial Intelligence** and **Programming** through practical and reflective activities.
- Introduce the concept of **machine learning** and how AI models can be trained to perform specific tasks.
- Stimulate critical thinking about the implications and risks of using AI in everyday life.

Key Competences (EU)

- Literacy
- Numerical, scientific, and engineering skills
- Digital and technology-based competencies

Materials

Provided by the teacher/institution:

- Computers with internet connection

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Downloadable elements:

- Training templates
- Base project

Previous Preparation

- Create work groups (2-3 participants)
- Download the required materials

Contextualization and Adaptation

What is Artificial Intelligence (AI)?

Classroom Activity 💡 Students are asked the following questions:
- Do you think computers are smart or dumb?
- Are the computers you normally have at home capable of thinking the way you do?
- What do you think Artificial Intelligence is?
- How do you think Artificial Intelligences learn?

Note For The Teacher 📝

Artificial intelligence is the ability of machines to perform tasks that normally require human intelligence. This includes learning, perception, reasoning and decision-making. Unlike conventional computer systems that follow programmed instructions, AI systems can learn from data and adapt to improve their performance over time.

The best answers to the questions posed would be the following:

- *Do you think computers are smart or dumb?* → The computers that everyone can have at home are 'dumb'. They don't know how to do anything unless you tell them specifically what you want them to do. If you don't double click exactly how it understands double clicking, it won't open the file, or even try to rename the document... Computers just follow orders.

- *Are the computers you normally have at home able to think like you do?* → No, the computers you have at home, although they are powerful tools, are not capable of thinking like human beings. They can process and analyse large amounts of data, perform complex calculations and execute programmed tasks efficiently, but they do not have the ability to understand, reason or have consciousness like humans.

- *What do you think Artificial Intelligence is?* → Artificial intelligence, or AI, is when computers and machines can do things that normally need to be done by a person. For example, when a robot can play a game, talk to someone or help you find something on the internet, it is using AI.

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- *How do you think AIs learn?* → AI works because people teach computers to learn from the data provided by people and to make decisions. It's a bit like when you learn to ride a bicycle: at first, you fall off and learn how to keep your balance. Computers learn in a similar way, but instead of falling off, they use a lot of data to 'practice' and get better at what they do.

To gain a better understanding of what Artificial Intelligence is, show the students the following video:

See video 📽️ - "What is Artificial Intelligence? " (subtitles available**).**

What is Artificial Intelligence? | ChatGPT | The Dr Binocs Show | Peekaboo Kidz

What is programming?

Classroom Activity 💡 To understand what programming is, and that one of the most important things when programming is to do things in order, organize in groups and create a very simple cooking recipe.

Write down, step by step, how you would make a macaroni dish.

Note For The Teacher 📝

Programming is the process of writing instructions for computers to do things.

It is like giving orders to a machine to perform specific tasks, such as showing a video, playing a game or solving a math problem.

In order for the students to understand that programming is basically giving instructions to a computer or a computer program... And that an order must always be followed, they are given a simple cooking recipe: to prepare some macaroni.

- Light the fire where you are going to cook it.
- In a large pot, bring to a boil the water required for the desired quantity of macaroni.
- When it starts to boil, add the salt.
- Add the macaroni to the boiling water and cook for the time indicated on the packet.
- Stir occasionally to prevent sticking.
- Once cooked, drain the macaroni using a colander.
- If desired, add the sauce of your choice.

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With this, you should make them think that if they put the macaroni in the pot first and then add the water, but they have not turned on the fire, their intention to cook the macaroni will not come to fruition, because the instructions are in a different order.

With programming it is basically the same: normally the programmes 'don't do things wrong' but we haven't instructed them to do it correctly.

Information On Known AI

Classroom Activity 💡 Choose one of these Artificial Intelligences in groups, look for information about them, and present them to your classmates, so that together you can learn a little more about these applications that you all normally use, but hardly ever really know how they work.

Research the benefits and risks of these Artificial Intelligences:

- Voice assistants: Siri, Alexa, Cortana
- Smartphones
- Home automation
- GPS and in-car geolocation
- E-commerce, online shopping

Note For The Teacher 📝 The main idea of this activity is for students to look for and learn more about the Artificial Intelligences presented to them, with an emphasis on how they work, where these systems get their data from, the risks of giving too much information to these assistants...

Most Used Passwords

Classroom Activity 💡 Reflexion activity:

Knowing what kind of passwords are considered secure, what do you think about the most used passwords in the world?

1. 123456: This is the most commonly used password and therefore the most vulnerable.
2. 00000000: Another common numerical sequence that is easy to guess.
3. password: An obvious and predictable choice that should never be used.
4. birthday: Anyone who knows you knows your birthday.
5. qwerty: This keyboard sequence is well known and easy to remember, but also very insecure.
6. admin: Although it is a default password that is often changed, some users keep it, making it an easy target for attackers.

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Note For The Teacher 📝

A **strong password** is one that is difficult to guess or crack, even for automated tools such as **brute force attacks** or **dictionaries**. To be strong, it must meet certain criteria that increase its complexity and make it much more difficult to hack. Here are the characteristics of a secure password:

1. **Adequate length**: It must be at least **12-16 characters** long. The longer it is, the harder it is to crack.
2. **Combination of characters**:
   - **Upper and lower case letters**: Using a combination of upper and lower case letters makes it harder to guess.
   - **Numbers**: Include random, non-sequential numbers (e.g. do not use '1234').
   - **Special characters**: Including symbols such as !, @, #, $, %, etc., adds an extra layer of security.
3. **No common words**: Avoid using easy-to-guess words such as **'password'**, **'123456'**, or **'qwerty'**. Attackers use dictionaries of common words to quickly guess passwords.
4. **Do not use obvious personal information**: Avoid using birth dates, names of family members, or any other information that can be easily known about you.
5. **Randomness**: The password should be as random as possible, with no predictable patterns. An easy way to generate strong passwords is to use a **password manager** that creates random strings of characters.
6. **Two-factor authentication (2FA)**: Even if the password is secure, adding an extra layer of protection, such as a code that is sent to your phone or email, will make your account even more secure.

Make the class think about the fact that many people use very insecure passwords.

Activity

Scratch Tutorial:

Prior to this activity, students should be familiar with the Scratch platform.

Machine learning for kids Tutorial:

In this session, students will be introduced to the Machine Learning for Kids platform.

Step 1. Access The Platform

This tool is entirely web-based and does not require anything to be installed or configured to be used.

To access the platform learners will search in a browser for the following web page: https://machinelearningforkids.co.uk/

While accessing the website they can be given information about it.

Machine Learning for Kids is a tool designed to introduce machine learning through hands-on training and buiding experiences.

It consists of a simple guided learning environment to train machine learning models capable of identifying text, numbers or images.

This complements existing efforts to introduce and teach programming to children by adding these models to Scratch, allowing them to create projects and build games with the machine learning models they have trained themselves.

Machine learning is everywhere. We use machine learning systems every day like spam detection filters, recommendation systems, language translation services, chatbots, digital assistants or search engines.

When accessing the platform you will see an interface like the one in the image below. We will instruct students to use the Get Started button to log in.

After this, it will give you different methods to access. To speed up the workshop, *we recommend* that you use the option to try without registering as it allows you to make use of all the platform's functions except for saving linked to an account.

Step 2. Create a project

Once inside the platform you will create a new project using the 'Add a new project' button.

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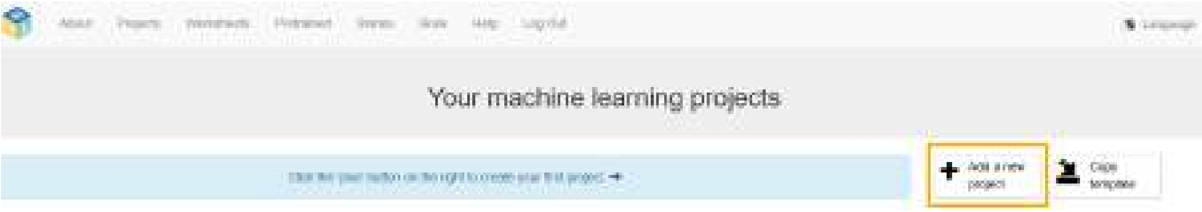
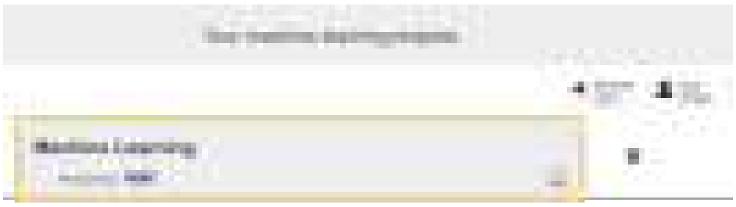


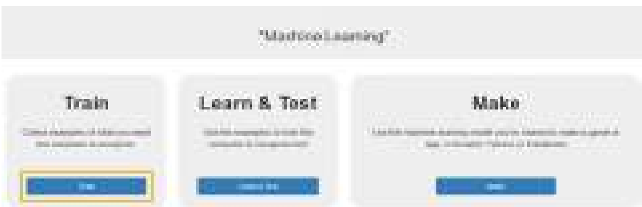
You will have to add a name to the project, which may be different from the one used for the example image. However, both the project type and the saving mode must be the same as the one shown in the image.

Step 3. Train AI

Once the project has been created, you can access it by clicking on its name.



The first thing you need to do is to train your AI.



Our AI will be in charge of classifying the passwords we check according to their security, so we have to create 4 labels: High secure, secure, low secure and not secure.

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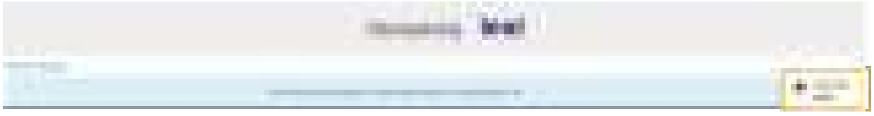
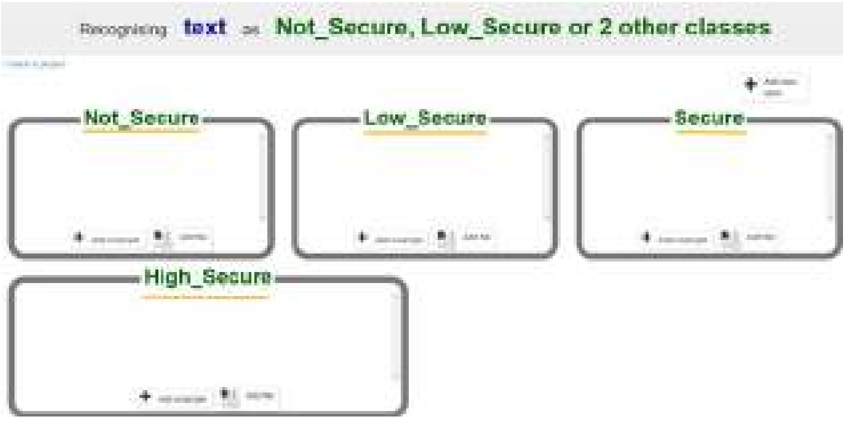


It should look something like this.



Once the labels are created, your AI needs you to give it examples of each type so that it can extrapolate what makes a password more or less secure. The more examples you add the better the AI will classify; but it is important that all the categories have the same number of examples so that it does not choose one category just because it finds more matches due to the number of different examples.

Step 4. Getting To Know Safer Passwords

To create suitable examples, it is time to explain what makes one password more secure than another. On the one hand, there is the length of the password and on the other hand, the combination of uppercase letters, lowercase letters, numbers and special characters.

with the use of a single computer source: [5]

Type of characters	Allowable number of characters to create a password	3 character password	6 character password	8 character password	12 character password
		Time necessary to decrypt a password	Time necessary to decrypt a password	Time necessary to decrypt a password	Time necessary to decrypt a password
Lower case letters only – the Latin alphabet	26	0,02 s	5 min	58 h	3000 years
Lower case letters only – the Latin alphabet and digits	36	0,04 s	36 min	32 days	150000 years
Upper and lower case letters – the Latin alphabet and digits	62	0,2 s	15 h	7 years	100 million years
Upper and lower case letters – the Latin alphabet, digits, special characters	94	1 s	8 days	193 years	Longer than the Earth exists

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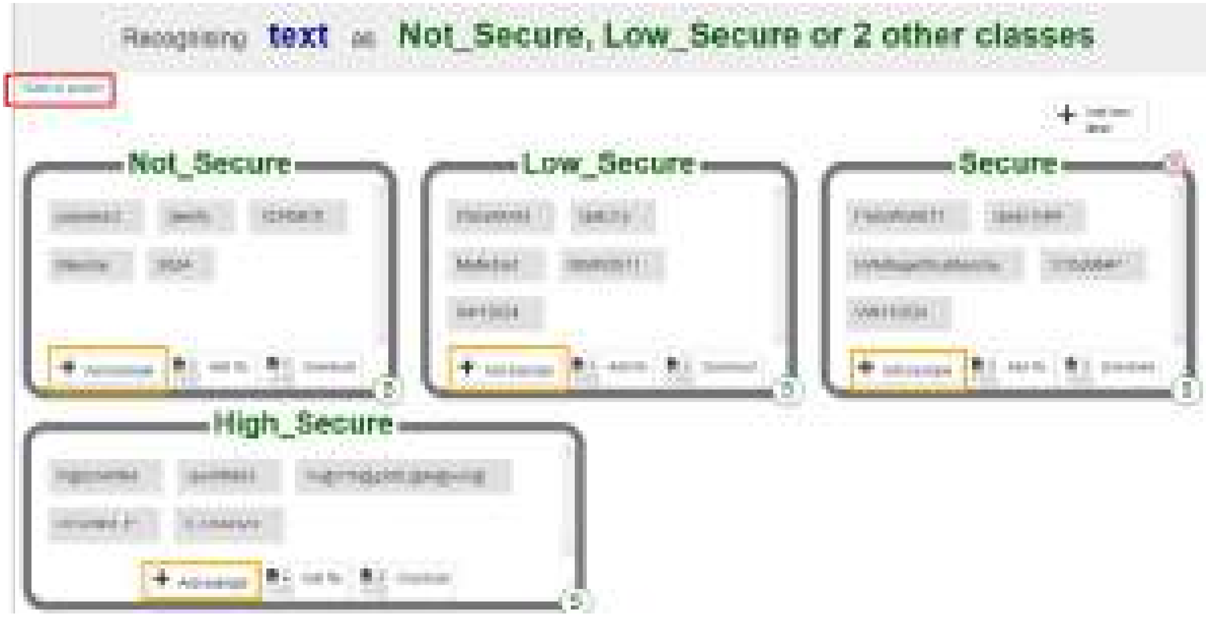
In addition to this, there are some passwords that are very common because of how easy they are to remember for anyone. Because of this, these are also included in most hacking dictionaries and are therefore not at all secure, such as 'password', '1234567890', and 'qwerty'.

Step 5. Adding password examples

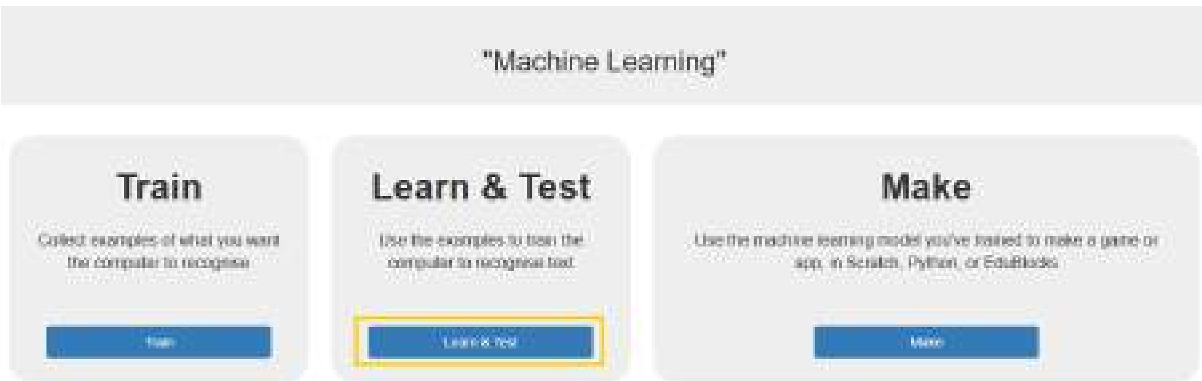
To add examples to the list we will use the 'Add example' button. If we make a mistake in any of them, by placing the mouse over it, an X will appear and we will be able to delete it.

You will need at least 5 examples in each label. But the more the better, and if they are similar to each other to apply what you have learned to make a password more or less secure, this will help the AI to judge properly when we finish the training.



Step 6. Finish Training

When you are satisfied with the number of examples, click on 'Back to project' to finish the training in the 'Learn & Test' section.



Click on the 'Train new machine learning model' button and wait. It will take about 1 minute.

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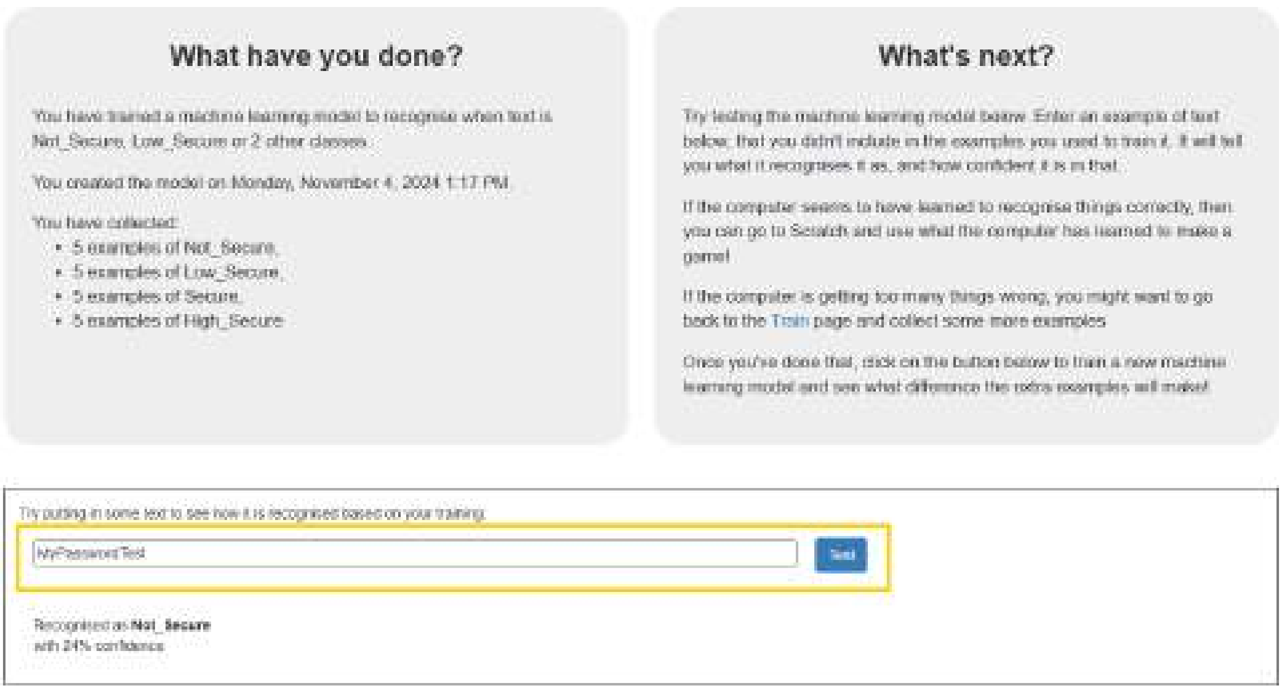
Step 7. Testing Our Training

Once trained, you can test your AI. With each attempt, depending on how similar it finds our try to the examples it has saved, it will give us a confidence percentage. If it is wrong or if the confidence level is too low, we should add this attempt to the list of examples of our AI and retrain it to make it smarter.

When you are satisfied, use the 'Back to project' button to integrate your AI into Scratch.



Scratch Programming

Step 1. Scratch Integration

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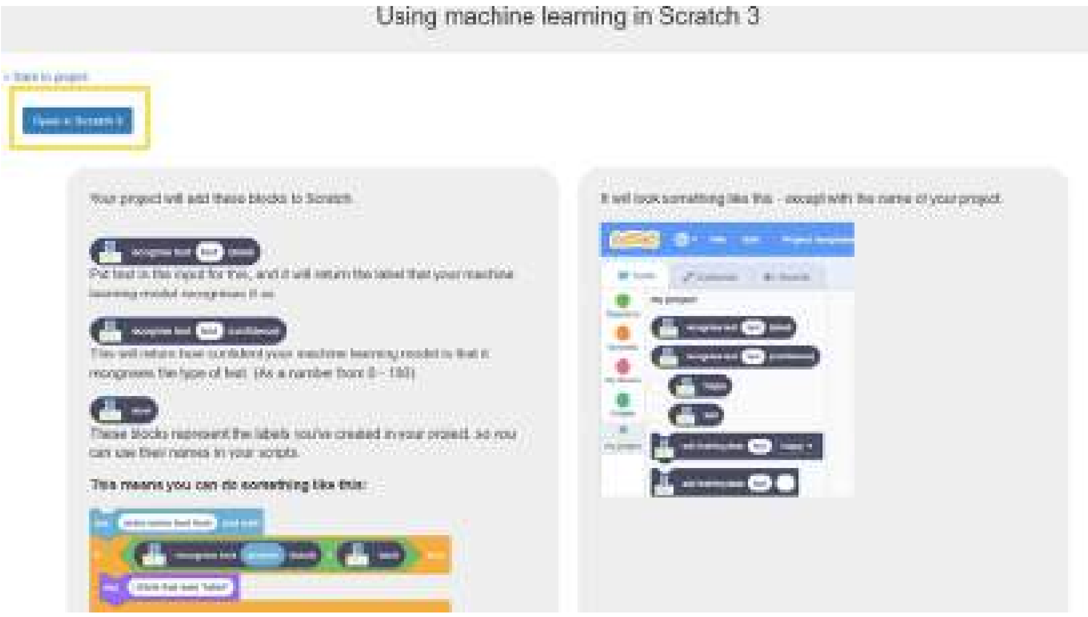
Accederemos al apartado Make.

Select the Scratch 3 platform.

And open the application.



Step 2. Use A Template.

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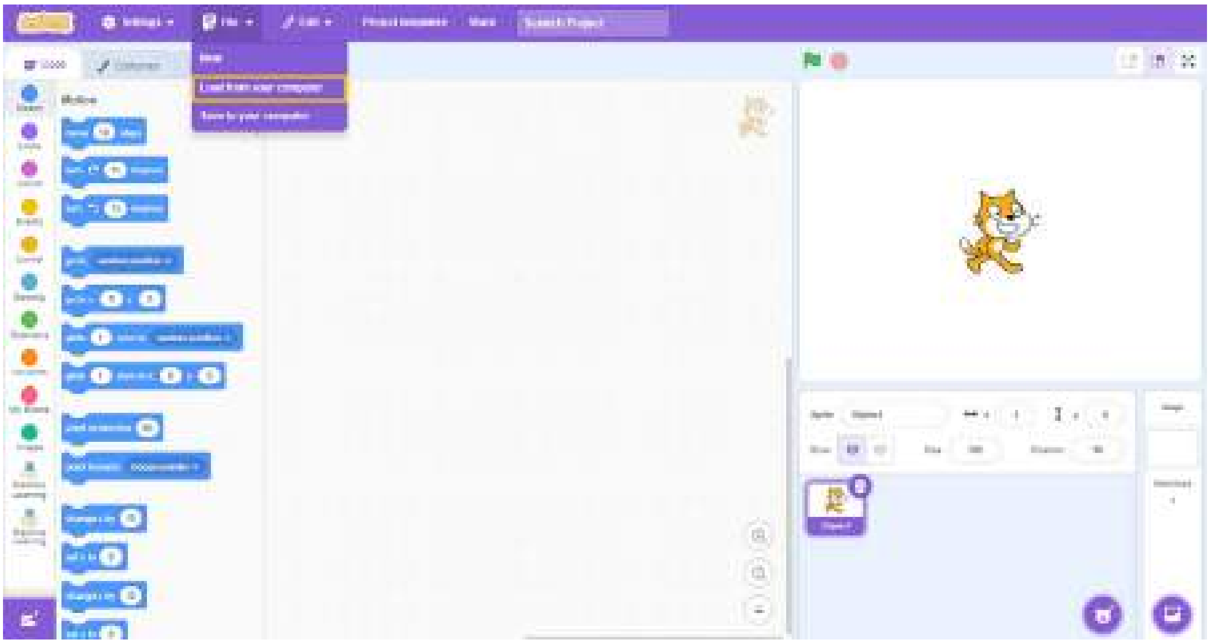
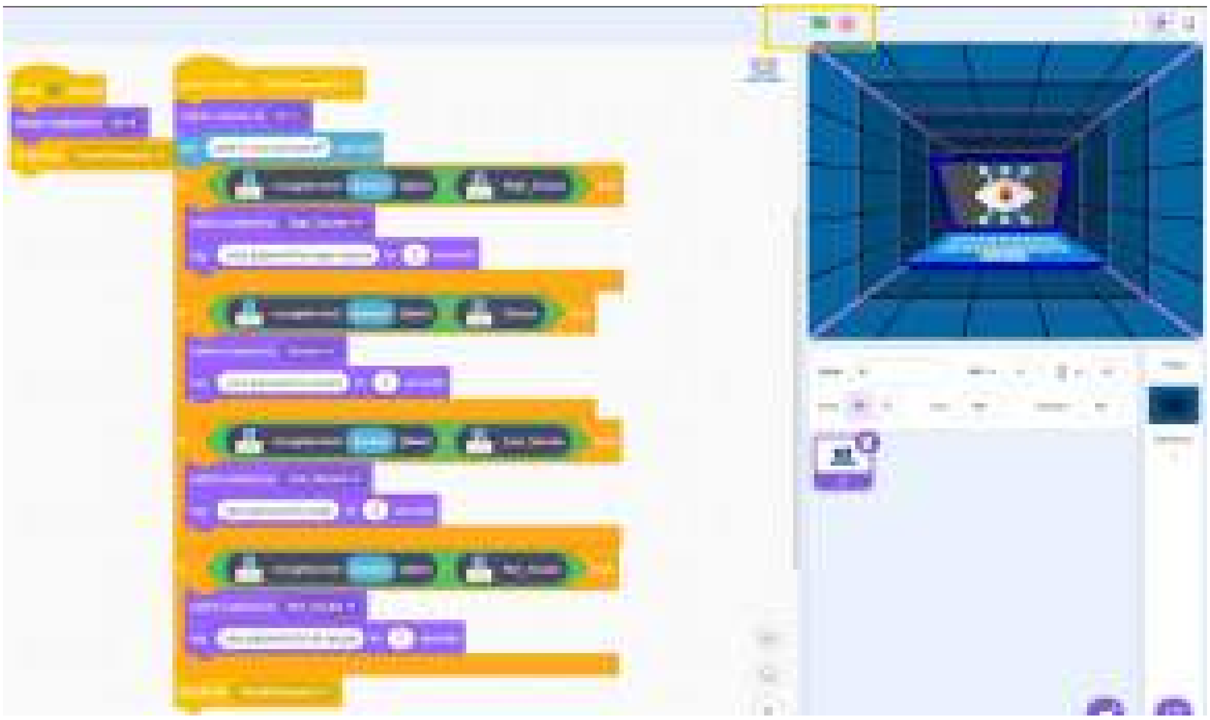
You are going to import the 'Base Project', by clicking File -> Load from your computer and you will have to search with the file explorer for the base project.



Once open, you can press the green flag and check that your AI is working by testing passwords and editing the project until the session times out.



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Conclusion and sharing

Today we explored how **Artificial Intelligence** and **Programming** work, learning that computers cannot think like us, but they can be trained to perform complex tasks if given clear data and examples.

Discuss 🗣️

Do you think AI will be able to think independently in the future? Why?

What challenges did you encounter when training your AI and how did you solve them?

What do you think about the benefits and risks of using AI in our daily lives?

In what other areas of life or in what types of jobs do you think an AI similar to the one you trained today could be used?

Share your work with us by mentioning us on our social media!

LinkedIn:
https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name

Instagram: https://www.instagram.com/steambrace_eu/

X: https://x.com/steambrace_eu

Project Evaluation

Activity Objectives	Key competences (EU)	Evaluation Criteria
Familiarise students with the concepts of **Artificial Intelligence** and **Programming** through practical and reflective activities.	Literacy Numerical, scientific, and engineering skills	Students understand the basic concepts of AI and are able to explain the difference between AI and traditional programming.
Introduce the concept of **machine learning** and how AI models can be trained to perform specific tasks.	Digital and technology-based competencies	Students manage to train their AI model in Machine Learning for Kids and understand how to add examples and retrain the system.
Stimulate critical thinking about the implications and risks of using AI in everyday life.		Check if students participate in the final discussion and are able to reflect on the pros and cons of using AI in various situations.

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		Assess students' ability to identify and discuss real-life examples of AI in their everyday life.

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INVENTORS IN HISTORY

Duration	Age Range	Difficulty
2 hrs	11-12	Medium
#PROGRAMMING #CRAFT		

Description

How many inventors can you name fast? And how many women inventors?

In this activity, we will dive into the fascinating world of inventions and their creators, exploring both men and women who have left their mark on the history of science and technology. We will reflect on how their ideas have transformed the world and how, through creativity and innovation, we can generate our own solutions to the challenges of the future. Like the great inventors of the past, students will learn to think critically and creatively about how their own inventions could impact society.

*To bring this to life, students will use the **mBlock** programming platform to develop a project that links each invention to its inventor. Through the use of the **Cirkids** kit, they will be able to make their projects a reality, merging research with programming and robotics. This multidisciplinary exercise will allow them to experiment with creating an invention while developing manual and technological skills, preparing them to approach the future with an innovative and sustainable mindset.*

Activity Objectives

- Familiarise students with the great inventions that have transformed humanity, understanding their impact on society.
- Foster curiosity and interest in historical knowledge of technology and science.
- Foster creativity and innovative thinking in students, encouraging them to imagine their own inventions and understand the creation process.
- Highlight the role of women in the field of invention and technology, encouraging the recognition of their historical contributions.
- Introduce students to programming and simple electronics.

Key Competences (EU)

- Literacy
- Numerical, scientific, and engineering skills
- Digital and technology-based competencies
- Entrepreneurship
- Cultural awareness and expression

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Materials

Activity kit:

- Microcontroller
- Servomotor

Provided by the teacher/institution:

- Cardboard
- Scissors
- Glue
- Adhesive tape

Downloadable elements:

- Template (pdf)
- EmptyInventors (mBlock)

Previous Preparation

- Create working groups (2-3 participants)
- Download the necessary material
- Install mBlock software or prepare the online platform

Contextualization and Adaptation

Great Inventions In History

See Video 📽️ - "7 Inventions That Changed Humanity".
7 Inventions That Changed Humanity Forever

Classroom Activity 💡 Watch the video and reflect on the great inventions in history.

Note For The Teacher 📝 With this activity, students will be introduced to the wonderful world of inventions throughout history, from the wheel and all that humanity has achieved thanks to it, to the invention of the Internet, which is so important for humankind at the moment.

What would you like to invent?

Classroom Activity 💡 In groups, you will start the following activity by answering a question: Have you ever thought of something that you think could be very useful?

Write down your ideas! If it is something physical, you can draw a diagram to make it easier to explain later.

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Once finished, present it to the rest of the class, so that your classmates can give you feedback on your idea... And who knows how far you can go?

Note For The Teacher 📝

You never know where the next great, revolutionary, brilliant idea, or the great invention of our age might come from, so you should do the following exercise:

What would you like to invent?

You should answer the following questions:

- What would you like to invent?
- What needs would this invention address?
- Who could use this invention?
- What design would it have?
- What would you like it to be called?

Write down all these questions on a piece of paper and answer them. It can be a physical invention, a mobile application... Whatever you can think of.

When you think of an idea or an invention, you should always ask yourself these questions, to find out if the idea is really going to be useful for society, or if you need to change it so that it can really be used.

A very funny part of the creative process is the design of the idea, so you should create a small sketch, an explanatory drawing of the idea you have had.

Who are some of the great women inventors?

Classroom Activity 💡 Unfortunately, it is common not to know who created or invented most things, and when it is a woman, this is even less likely to be recognised. For this reason, in the following exercise, you will need to **research** women inventors from your country and discover what they invented.

Then share your findings so that, together, you can learn more about the women inventors in your country's history.

Note For The Teacher 📝

Throughout history, both women and men have made scientific and technological advances... But we are often unaware of who has invented or manufactured everyday things that we can all use in our daily lives.

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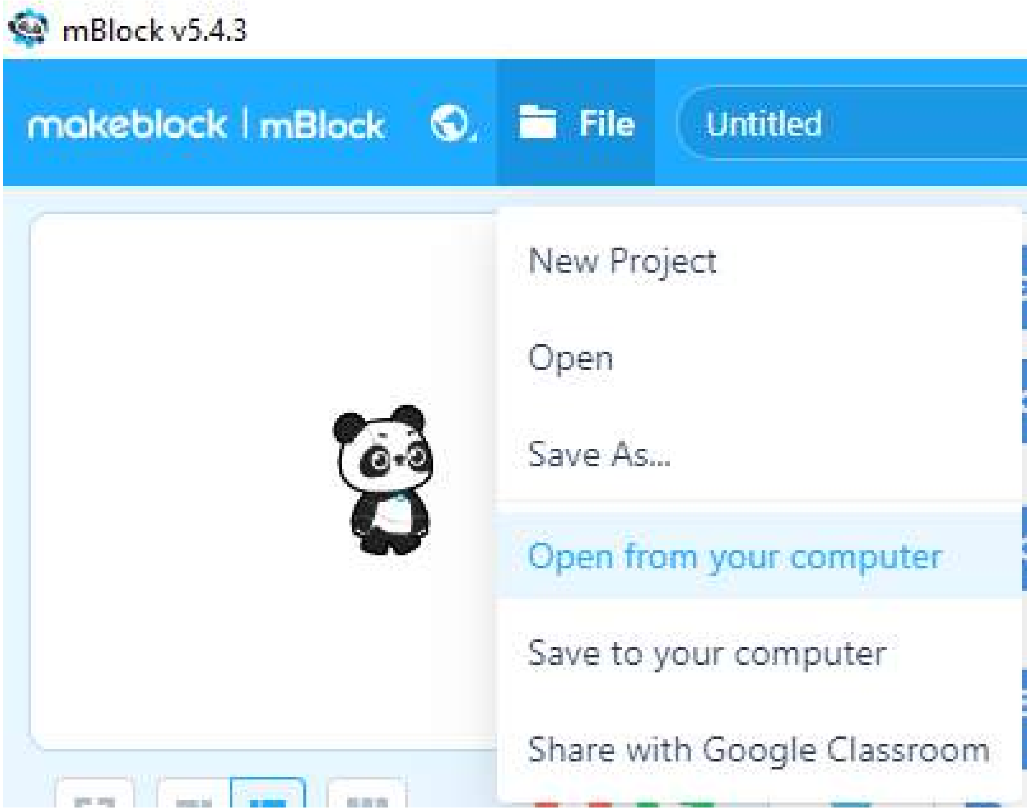
Activity

Designing The Interface:

Step 1 - Importing our characters

Using the Mblock platform you are going to learn about great inventors of history. In this activity you will have to match the inventor with his/her invention, and research about them, to introduce all the information in your mBlock software.

The EmptyInventors.mblock file has been provided for you to import into mBlock, and you can start working.



It is very simple, just click on File → Open from your computer, and import the EmptyInventors.mblock file.

Step 2 - Environment description

In this activity, you will have 5 important people in the history of mankind because of their inventions, and the 5 most relevant inventions of these people, as you can see in the mBlock scenario:

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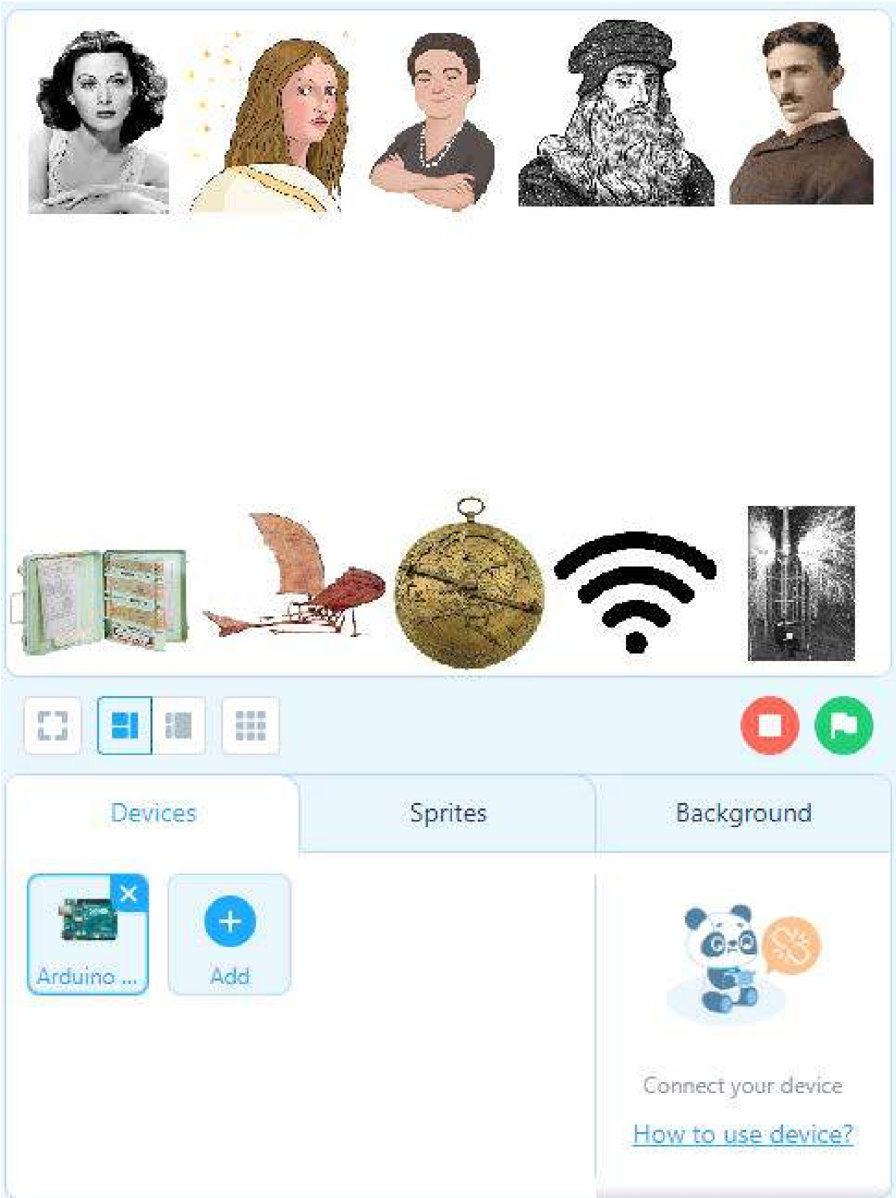

On this occasion, you will also be working with the Cirkids briefcase, which will help us to carry out one of the proposed activities thanks to the servo. We will be able to point out the invention corresponding to that inventor, thus learning history and electronics at the same time.

In the Sprites area, we have all the characters necessary for you to carry out the activity:

Step 3 - Text-to-Speech extension:

In this activity, not only will you see how objects interact on the screen, but mBlock can make these characters speak, so that you can listen to them.

You will see how the inventors and their inventions are presented when you click on them, thanks to the Text to Speech extension that has already been added to the template that you have open on your computer.

You can try clicking on the speak hello instruction so that you can listen to the program speak, and make it say what you type.

Step 4 - Starting the program

You are going to have to program all the objects in the software. You will see, however, that it is very simple, because once you have done it in one, then all you have to do is modify positions and variables in the others.

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Below you can see the code of Hedy Lamarr:

When you click on the green flag, the character will be placed in its position (x:-190 y:120) and displayed.

When you click on this inventor, you will make it sound like a woman, and it will say I am... in this case, Hedy Lamarr. If you have not clicked on any other inventors, i.e. the choice variable is 0, you will set the Choice1 variable to 1 (because this is the first inventor you are working on).

Finally, at some point, this inventor will receive a Hide1 message, telling Hedy Lamarr to hide.

Note For The Teacher 📝
The mBlock sprites can communicate with each other through messages. One of the sprites can send a message, and another can receive it, and so they communicate with each other to give orders to each other. In this case, at some point, the scenario will send the message to hide character 1 through the message called Hide1.

Next you will see the programming of the rest of the inventors, and you must duplicate the code from one character to another, and change only what is different:

Note For The Teacher 📝
To be able to duplicate the code, you just have to drag the pieces from the main one (When ...) to the next object and drop them, and so the codes are duplicated.

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Step 5 - Programming the inventors

Hypatia of Alexandria Code

Ángela Ruiz Code

Leonardo Da Vinci Code

Nikola Tesla Code

(You must change the character's voice, name, position, and the number of the Choice1 variable for each character. And don't forget to change the message received.)

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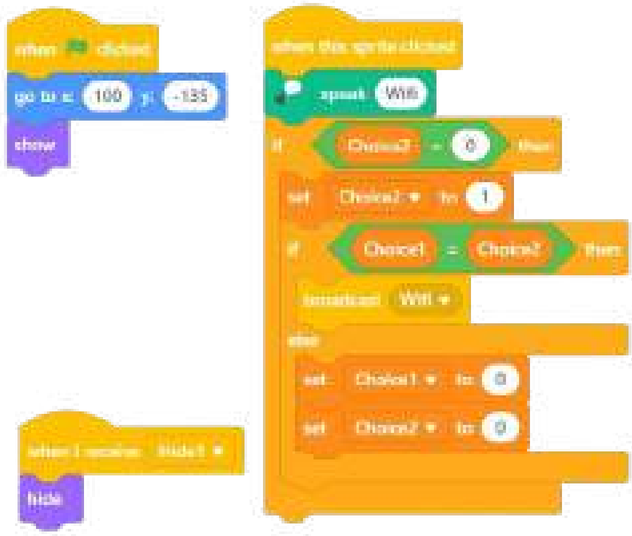
Step 6 - Programming the inventions

Now you have to programme the inventions of each of the inventors.

You can see that when you click on the green flag, the objects are not in the same order as the inventors, so that if you leave the programming to your colleagues, it is not too easy to know which inventor invented what.

Wifi Code



When you click on the green flag, it will be put in place (x:100 y:-135) and displayed.

When you receive the Hide1 message, it will have to be hidden.

When you click on the object, it will say that it is Wifi, and if no object has been clicked (i.e. Choice2 is 0), set the variable Choice2 to 1 (because it is the invention corresponding to inventor 1). In this case, if the two variables Choice1 and Choice2 are the same, you have succeeded, and send the Wifi message; but if they do not match, you must set the two variables back to 0.

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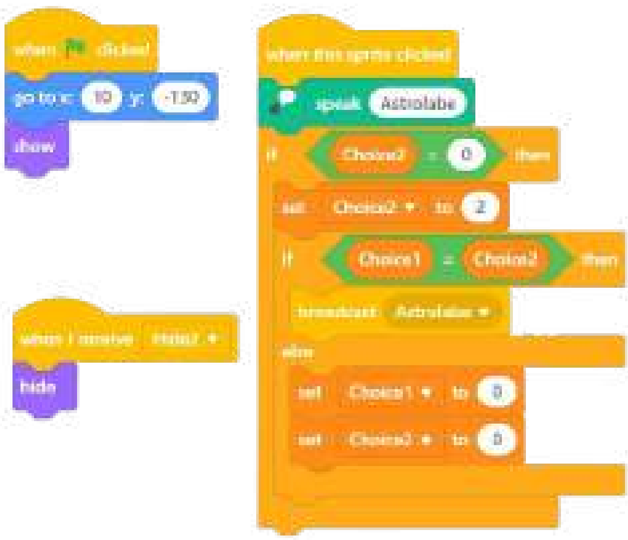
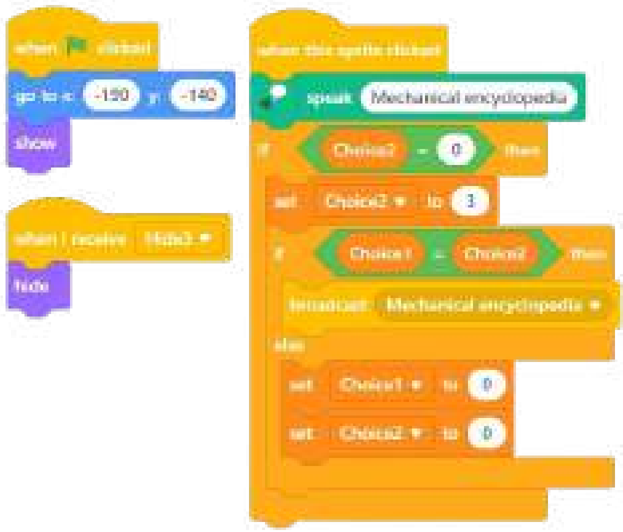
Step 7 - Programming the inventions

Astrolabe Code



Mechanical encyclopedia Code



Flying Machine Code

Tesla Coil Code

(You must modify the position of the invention, the name of the invention, the Choice2 variable and the message to send.)

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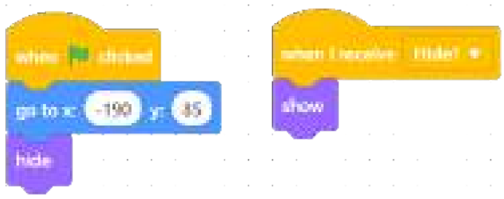
Step 8 - Programming inventors and their inventions

These sprites will help you to remember which Invention each Inventor has invented.

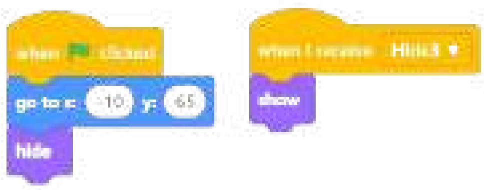


Pressing the green flag puts it in place, but hides it, and when you receive the Hide1 message, it will be shown.

Inventor2 programming

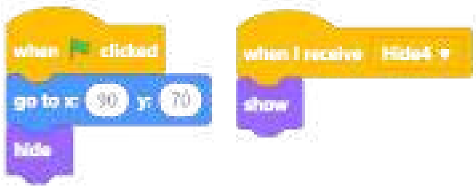
You must change its initial position, as well as the message that is received, and now it will no longer be Hide1 but Hide2.

Inventor3 programming



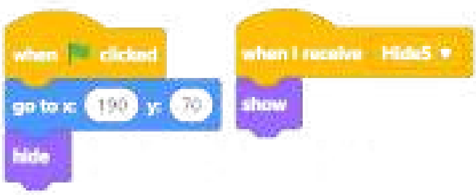
You have to change its initial position, as well as the message that is received, and now it will no longer be Hide1 but Hide3.

Inventor4 programming



You must change its initial position, as well as the message that is received, and now it will no longer be Hide1 but Hide4.

Inventor5 programming



You must change its initial position, as well as the message that is received, now it will no longer be Hide1 but Hide5.

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Step 9 - Research about inventions

Classroom Activity 💡 In this exercise, you will not only learn about programming and electronics, but you will also have to become researchers yourselves. You will have to look up information about the different inventions that have been proposed to you, as you will need this information to complete the programming that we will add to the scenario.

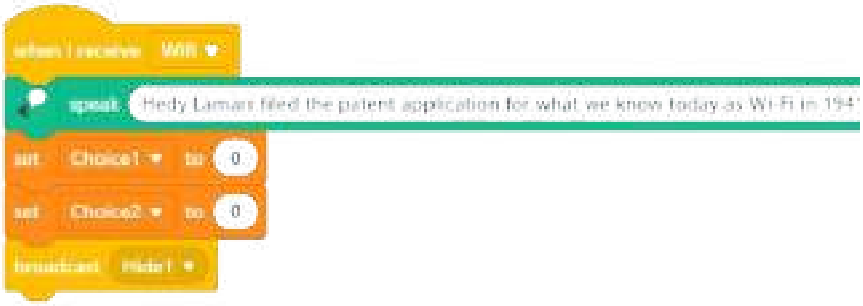
You should look for information about:

- Hedy Lamarr and how her invention helped you to enjoy wifi or bluetooth
- Hypatia of Alexandria and her astrolabe (astrolabe)
- Ángela Ruiz, as a precursor of the ebook, with her Mechanical encyclopedia
- Leonardo Da Vinci and how he devised his Flying Machine
- Nikola Tesla and his coil, as well as all the advances he made in electricity

Save all this information, so that you can copy it later into the text boxes of the "Text to Speech" extension that you are going to use below.

Step 10 - Programming the scenario

In this activity, the scenario is not decorative but will serve as a narrator of all the information you have found out about inventions and inventors.



At the beginning, you have to set the Choice1 and Choice2 variables to 0, because you have not yet chosen any inventor, nor any invention, and you will have to choose the language of your activity, which in this case is English.

As you have already done on other occasions, when you receive the Wifi message, the programme will have to narrate the information collected about this invention, and the variables must be set to 0 again. The programme will send the message again so that Hedy Lamarr and the Wifi will hide and Inventor1 will appear.

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Step 11 - Programming the rest of the scenario

You can duplicate the code you have just created by right-clicking on the item When I receive... to generate the following codes:

You will change the messages that are received, the text about the inventions, and the message they send. In these cases, they receive Astrolabe and send Hide2, and in the next one, Mechanical encyclopedia is received and Hide3 is sent.

You will change the messages that are received, the text about the inventions, and the message they send. In these cases they receive Flying Machine and send Hide4, and in the next one, Tesla Coil is received and Hide5 is sent.

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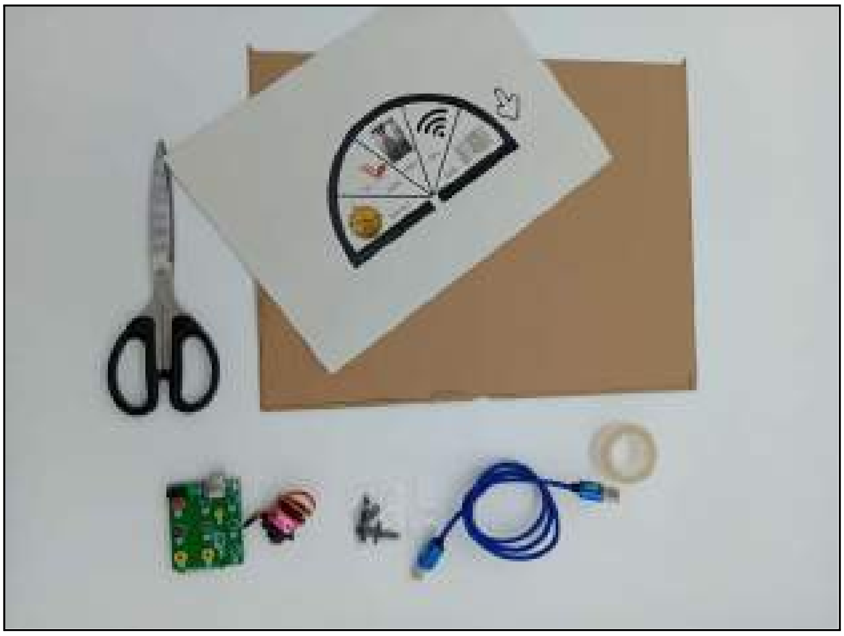
Step 12 - Creating the timeline

You will need the Servo.pdf resource and you have to paste it on a piece of cardboard. You need to make the necessary cuts to place the servo from the Cirkids Kit, so that everything looks like this:



Glue the timeline onto the cardboard and cut it to shape - remember to leave a hole for the servo motor!

You can build a small stand for it to stand upright.

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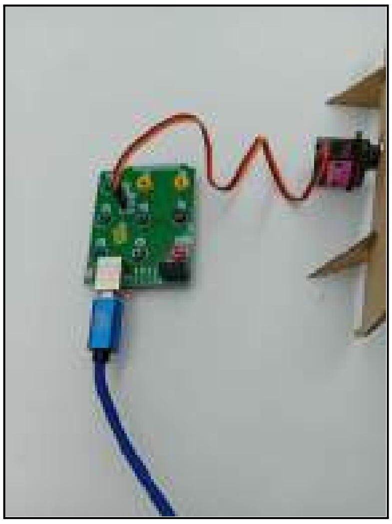
Position the servo after attaching the arrow to the servo arm.

Connect the wires on the back and it's done!



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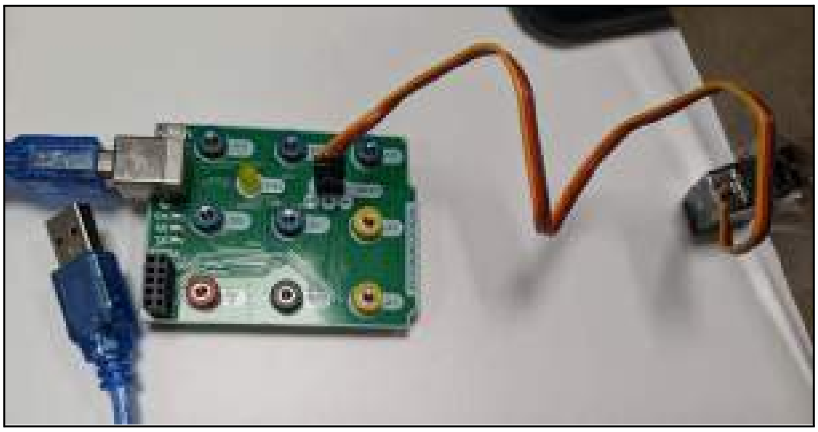
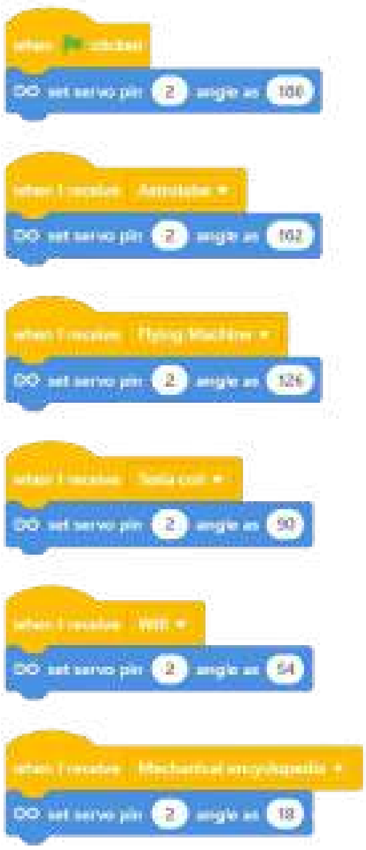
The servo must be connected to the Cirkids controller as follows:



Once you have finished this setup, you will move on to programming the Arduino device.

Step 13 - Programming Arduino UNO

This is the last part of the program. You are going to program the Cirkids controller, with the mBlock Arduino UNO extension.



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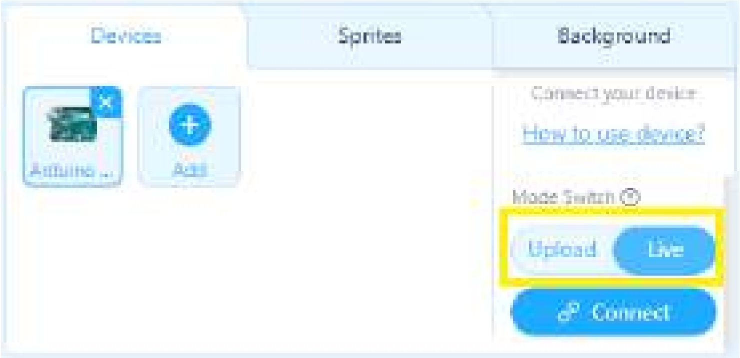
The programming is simple: at first, the servo should be placed in the 0° position, and as the different messages are received, it will be placed in the corresponding angles to mark each of the inventions that you are learning.

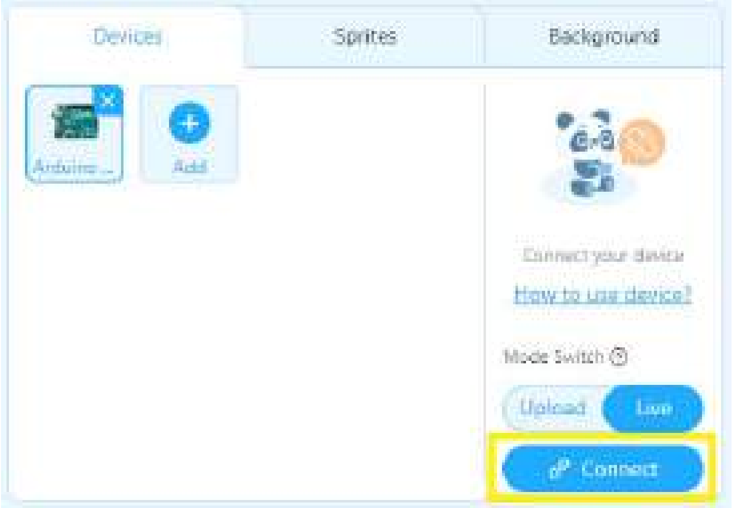
Step 14 - Connect the device

Once you have finished the program, it is time to connect it to the timeline.

The connection to the device will be made through the serial port and in 'live' mode. You will probably need to update the firmware of the device to connect correctly. Below, you will find the necessary steps to do so.



In order to be able to interact with the elements on the screen, the device must be connected in 'live mode' and once you have made sure of this, click 'connect'.



To see the devices you can connect to, click 'Allow all connectable devices'.

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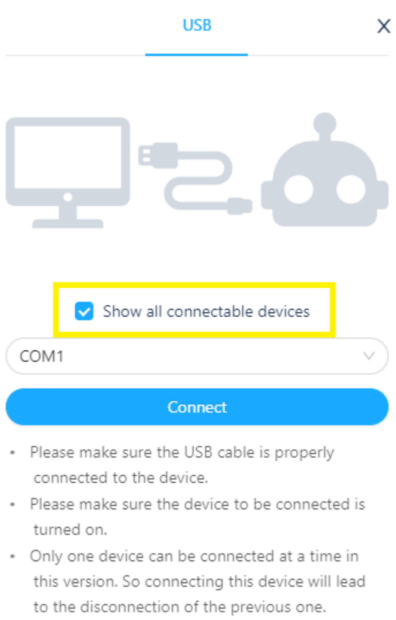

And you will have to choose your device from the drop-down list.

Once you have done this, click on ‘Connect’.

It is quite possible that the first time you do it, you will have to update the device.

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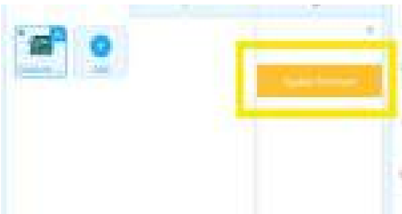

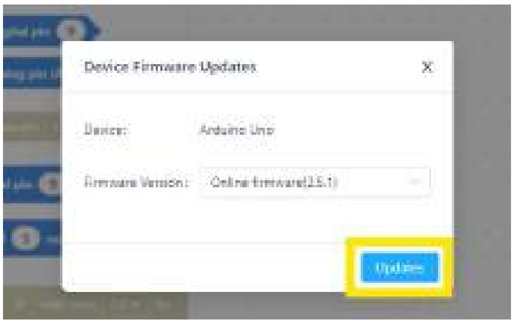

If it has been disconnected, you have to reconnect it and it will be ready.

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Once you have completed all these steps, you can click on the Green Flag, and test everything you have achieved.

Note For The Teacher 📝 This process may seem a bit complicated the first time, but it is necessary to connect the device to the program created by the students.

Conclusion and sharing

After all our work, it's time to test our timelines!

Final Discussion 🗣️

Which one of the inventions that you have researched seems most impressive to you and why?

What do you think the world would have been like if that invention did not exist?

Why do you think the story of many female inventors has been less well known than that of male inventors?

Which of the inventions presented in class do you think could be developed and applied today?

Share your experience with this activity by tagging us on our social media. We'd love to see your timeline at work:

- LinkedIn: https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name
- Instagram: https://www.instagram.com/steambrace_eu/
- X: https://x.com/steambrace_eu

Project evaluation

Activity Objectives	Key Skills (EU)	Evaluation Criteria
Familiarise students with the great inventions that have transformed humanity, understanding their impact on society through research.	entrepreneurial skills digital and technology skills	Students identify at least five important inventions and briefly explain their impact on society. They make the correct connection between inventors and inventions on the mBlock platform and present the information in their projects.

Foster curiosity and interest in historical knowledge of technology and science.	Numerical, scientific, and engineering skills	They successfully conduct research on inventions and inventors, including lesser-known contributions, and document their findings.
Promote creativity and innovative thinking in students, encouraging them to imagine their own inventions and to understand the process of creation.	Entrepreneurship	Students present original ideas for inventions of their own and answer questions about their usefulness and design. They present their ideas to the class and are able to receive and apply constructive feedback.
Raise the visibility of the role of women in the field of invention and technology, encouraging the recognition of their historical contributions.	Cultural awareness and expression	They include and program the history of women inventors in mBlock, demonstrating an understanding of their importance in history.
Introduce students to programming and simple electronics.	Digital and technology-based competencies	Students understand and apply the basics of programming in mBlock, such as importing files, creating code blocks and duplicating sequences. Students show that they know how to set up and control the Cirkids kit for the servo motor, correctly positioning the hardware and adjusting it on the timeline.

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HACKING STREET FURNITURE

Duration	Age Range	Difficulty
1 hrs	11-12	Low
#3D #TOWNPLANNING		

Description

In this activity, students will explore how to improve their city's street furniture through 3D design. They will start by analysing public litter bins to identify where they can be made more functional and sustainable. They will then use the Tinkercad platform and their paper prototypes to create and test their own redesign ideas. This activity encourages creativity and critical thinking, using technology to find practical solutions to everyday problems.

Activity Objectives

- **Learn to critically analyse** everyday objects to identify problems and generate practical solutions.
- **Become familiar with technology:** use 3D design tools.
- **Develop basic 3D design skills**: using the Tinkercad platform.
- **Learn physical prototyping techniques:** use paper to turn their digital designs into physical models.

Key Competences (EU)

- Digital and technology-based competencies
- Active citizenship
- Entrepreneurship

Materials

Provided by the teacher/institution:

- Computers
- Paper folios
- Marker pens/pencils

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Previous Preparation

- To access Tinkercad you need to have a login account. One account for all the students is enough. (https://www.tinkercad.com/)
- Leave the computers ready with the Tinkercad account created.
- Students must be familiar with Tinkercad. In the Contextualisation section, you will find a link with different videos to easily explain this tool.

Contextualization and Adaptation

Cities and urban spaces are designed to make life easier for all their inhabitants. However, people with disabilities or in certain types of situations often face additional difficulties because spaces are not designed to be accessible. This includes problems related to mobility, perception of the environment or lack of proper understanding of signs and indications.

To mention a few, the following types of disabilities may be encountered:

- Physical disability: is the limitation in movement or coordination due to muscular, motor or skeletal conditions. It affects activities such as walking, handling objects... The lack of ramps, elevators to access public transport, furniture that is too high... are some of the architectural barriers for people with this disability.
- Sensory disability: affects one or more senses. Usually sight (visual impairment) and hearing (hearing impairment). This leads to difficulty in perceiving the environment.
  - **Visual:** Some common barriers are the absence of Braille signs, traffic lights without sound, and streets without tactile pavement guides.
  - **Auditory**: the lack of visual systems for emergencies are important barriers.
- Intellectual disability is the limitation of cognitive functions such as learning, decision making and problem solving. Confusing or non-universalised signs can pose as a difficulty for these people.
- Psychosocial disability: encompasses different mental health conditions that influence the way people relate to others and process emotions.

Making cities accessible to all also enhances the quality of life for **older people, people with temporary disabilities and people with reduced mobility, as well as as well as couples with young children.** A community where every member can thrive and pursue his or her needs and interests is more equitable and united.

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See video 📽️ - “New app Ahoi makes cities more accessible to people with disabilities”.
This video shows an innovative application, whose creator is a person with a motor disability. The app allows anyone to plan their route in advance and thus choose the most accessible paths adapted to their needs.

[New app Ahoi makes cities more accessible to people with disabilities]

You can also see this one showing the process that many visually impaired people go through to cross the street:

[How Blind People Cross The Street Alone]

Before starting the activities, ask the students to participate in a discussion to reflect on possible modifications that could be implemented in their city and share their ideas on how to make it more accessible and inclusive. The following questions can be used to guide the discussion:

- What modifications have been made in your city that you consider successful for the inclusion of people with disabilities?
- What barriers do you consider that a person with a disability faces every day in your city?
- How can the design of street furniture (rubbish bins, pavements, playgrounds, benches, etc.) help overcome these barriers?
- What are garbage bins like? Does anyone have the facility to deposit their garbage? What changes could be made to make them more functional?
- Could we modify the water fountains in the parks so that anyone with disabilities can use them?
- Are playground playgrounds accessible to children with motor disabilities? What modifications would you make?

With all these questions raised and after commenting on them, we will learn how technological tools such as environments to design in 3D can help us to bring to real life designs that we have in our minds in a practical way.

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Activity

1) Tinkercad Tutorial:

Prior to the development of the activity, students must be familiar with the Tinkercad platform: https://www.tinkercad.com/

Below is a list of tutorials that you can spend some time on to better understand the environment in which you will be working:

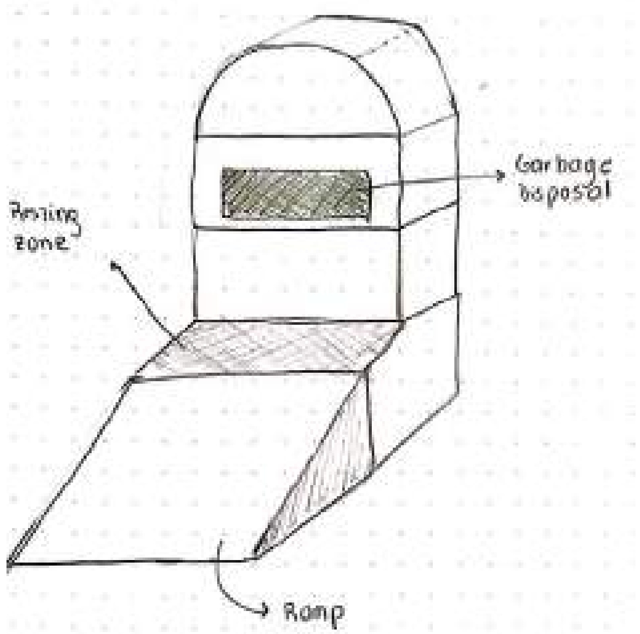
https://www.youtube.com/playlist?list=PL90LC6zq_Lzf9tHyFPzX_9OA35BFTfEBs

It is strongly recommended that before continuing with the activities, the students have made some basic transformations such as those shown in the tutorial, whether it is joining pieces together, rotating, cutting, etc. So that they can have a better use of the rest of the activity.

2) Hacking urban furniture

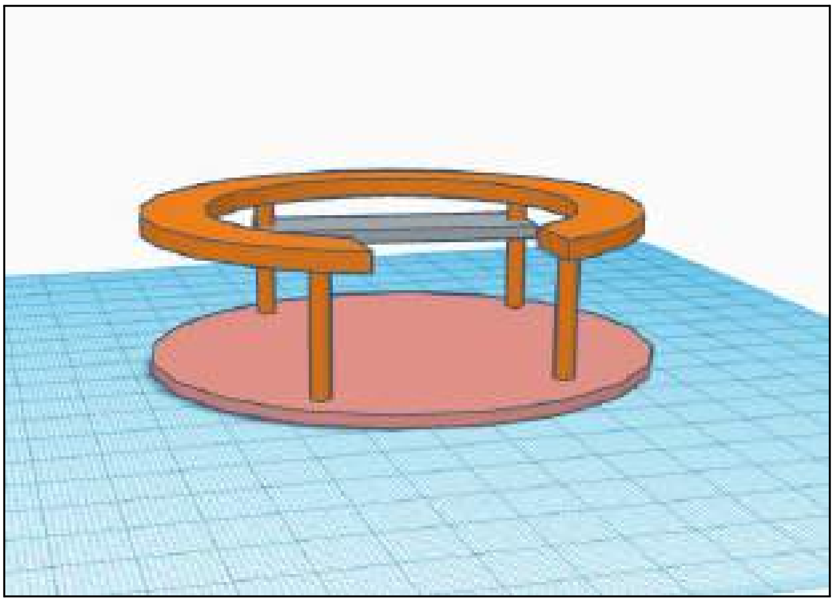
Once students are familiar with the platform, they will be asked to carry out the ideas that emerged during the initial discussion using 3D modelling.

To do this, we propose that **before taking it to 3D you make a small sketch in pencil and paper** of the idea you have in mind, for example as shown below:



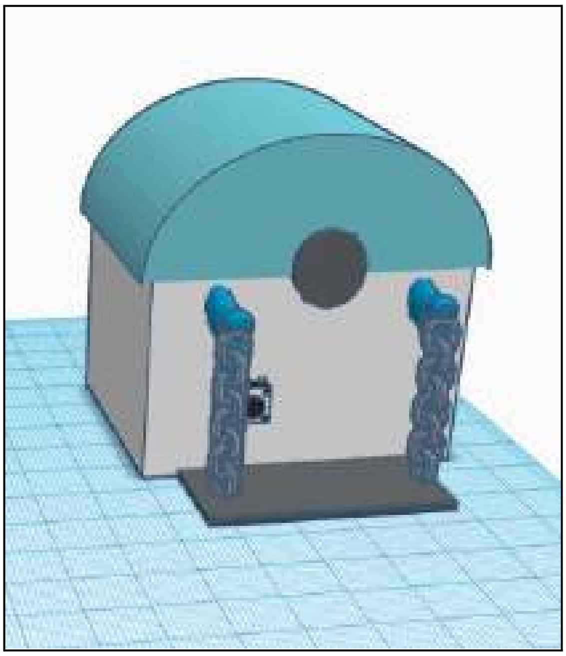
Below are ***some examples*** as a reference of the possible options but the idea is that they are the ones who design.

Accessible recreational area for children in wheelchairs:



Many of the playgrounds have this swing on which children sit and spin. However, in most cases there is no safe space for a child to access with their wheelchair. In this model, there is room to place a wheelchair.

Dumpster with a lifting platform:



Sometimes, the hole to put the rubbish in the containers is too high. For this reason, this model has a platform that goes up when you press the button.

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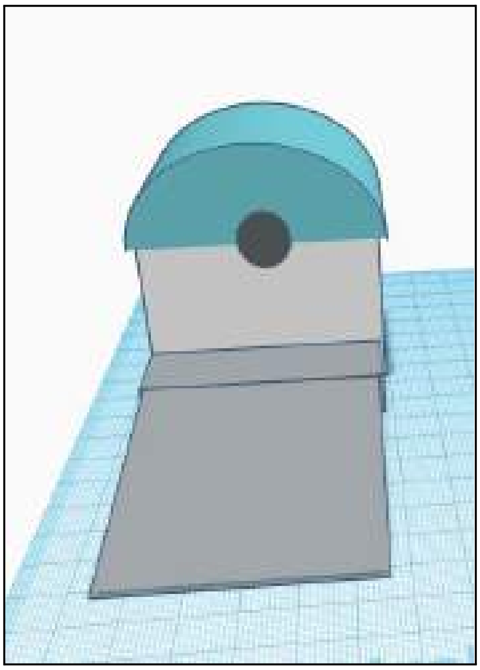
Accessible garbage container for areas with fewer economic resources:



The above solution can be very expensive to apply in municipalities that have low economic resources. In this case, this container could be included with a ramp that facilitates access to the container.

Conclusion and sharing

Once our designs are finalized, we will present them to the other participants of the activity. You must:

- Explain how their proposals improve the accessibility and functionality of the objects they redesigned.

The idea is to be able to generate a space for students to share their ideas and receive feedback and discuss possible improvements to their designs.

Debate 🗣

Can you think of any other type of innovation other than street furniture to improve the adaptability of life in general?

Could you use the tools you have learned about today for other areas? Would it help you to carry out other projects?

How has your vision of urban design changed after carrying out this activity? Do you think technological solutions can really help solve these problems?

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Share your design with us by mentioning us on our networks! We want to hear about your innovation.

LinkedIn: https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name

Instagram: https://www.instagram.com/steambrace_eu/

X: https://x.com/steambrace_eu

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GIVE ME A HAND

Duration	Age Range	Difficulty
1,5 hs	11-12	Medium
#CRAFTS #ROBOTICS		

Description

In this activity, students will learn about the reality of people with physical disabilities, a situation that affects the lives of many people, but in most cases is invisible. Currently, it is estimated that there are 1.3 billion people in the world with some kind of amputation or disability. Thanks to technological developments, great advances have been made in this field in the last decades, allowing for a more accessible life for all of them. However, due to lack of opportunities, geographical locations or policies, there are still many challenges to overcome. In this session we will work on a prototype prosthesis and learn new tools by using robotics to our advantage.

Activity Objectives

- **Awareness-raising:** Understand the challenges faced by people with disabilities and how the environment in which they live affects their opportunities.
- **Applying the scientific method:** Know the types and functions of current prosthetic and assistive devices.
- **Creativity and design**: Use current technological tools to design and propose innovative solutions.
- **Teamwork:** Collaborate in groups to exchange ideas and create effective solutions.

Key Competences (EU)

- Numerical, scientific, and engineering skills
- Digital and technology-based competencies
- Active citizenship
- Cultural awareness and expression

Materials

Activity Kit:
- Cirkids Micro-Controller
- 9G Servo Motor

Provided by the teacher/institution:

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- Cardboard
- Construction Paper

Downloadable Elements:
- Finished code

Previous Preparation

- Have the materials ready before the start of the activity.
- Divide the students into groups of 2-3 people.
- Organise the workstations for each group.

Contextualization and Adaptation

Bionic prosthetics

Note For The Teacher 📝

The aim of this activity is to capture the students' attention by introducing them to the latest technology applied to the world of prostheses and how these are improving the opportunities for people who have some kind of disability.

Watch Video 📽 **- "Bionics are the future of prosthetics".**

Bionics are the future of prosthetics (available subtitles)

Evolving Technology

Since ancient times, even as early as the age of the pyramids, people have been trying to create orthopedic prostheses to improve human life. Although they were rudimentary devices, they marked the beginning of a path of innovation that continues to evolve today. In recent years, thanks to technological advances, prostheses have evolved enormously. Researchers are now working on bionic systems that can pick up electrical impulses from the

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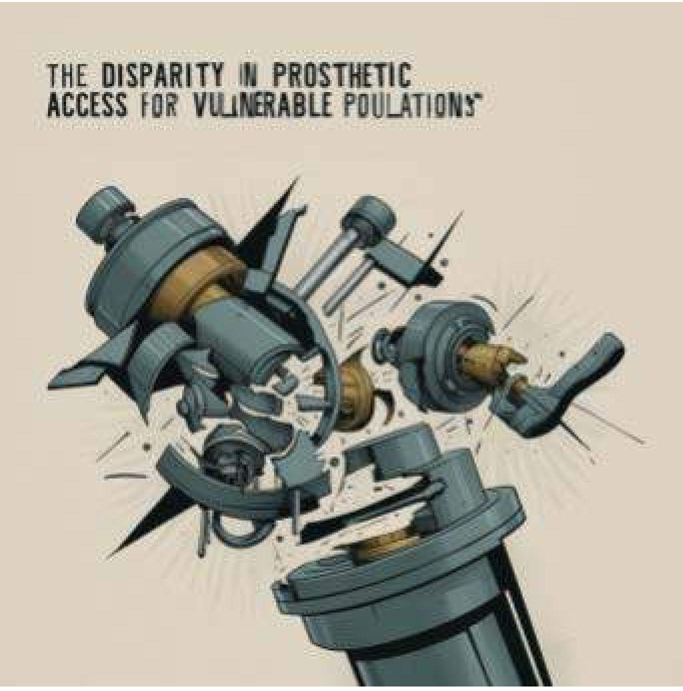
brain, allowing people to control their prostheses almost naturally, opening up new possibilities for a fuller and more independent life.

Classroom Activity 💡

Look for information and arrange it in a **timeline** indicating the most important milestones in the history of prostheses.

Note For The Teacher 📝

With this exercise, students are invited to create a timeline so that they are aware of the origin of the first prostheses and the great technological advances that have revolutionized them in recent years.



Despite great technological advances, **many people are still unable to access these developments**. Worldwide, around 100 million people live without one or more limbs, and 83% of them do not have access to a prosthesis. Robotic prostheses, while life-changing, are very expensive and beyond the reach of many families.

In developing countries, this reality forces people to opt for more traditional solutions. We invite you to investigate current social projects that are working to make these technologies more accessible and bring advanced solutions to those who need them most.

Note For The Teacher 📝

Today there are global movements that seek to facilitate access to prostheses by manufacturing them as 'makers', using inexpensive and accessible technology such as 3D printing and simple components.

For example, a well-known project in Spain is www.ayudame3d.org, driven by a young engineer who has helped more than 500 people in more than 55 countries. Are there any

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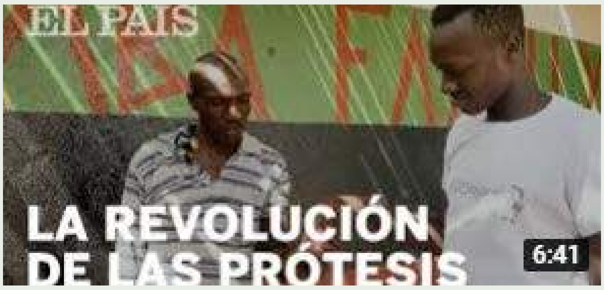
projects of this kind in your country? It is a good resource for students to research about this.

Watch Video 📽 - "Bionics are the future of prosthetics".

La impresión 3D: una pasión o una manera de cambiar el mundo | Dale una vuelta

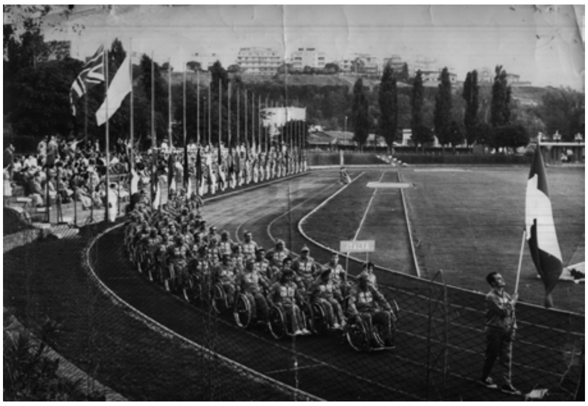
(subtitles available)



Equal Opportunity

In 1960, the **first ever Paralympic Games** took place with more than 400 wheelchair athletes from 23 countries participating.

Over time, technological advances and sporting prostheses enabled Paralympic athletes to achieve ever greater physical performance, allowing disciplines to be adapted to take advantage of these advances.



Italian Team at the Opening Ceremony. [Photo credits]

Classroom Activity 💡

Look for information about athletes who have represented your country. Remember to search in both male and female categories. Is there a **Woman Paralympic athlete** who has represented your country in the Paralympic Games?

Search for information about her and her story.

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Note For The Teacher 📝

Although adapted sport had been around since ancient times, its real push began after the Second World War, when it became a necessity to help wounded soldiers and civilians recover their lives. In 1943, the British government asked Dr. Sir Ludwig Guttmann, a German Jewish doctor who had arrived in Britain at the beginning of the war, to set up a Spinal Unit at Stoke Mandeville Hospital near London.

There, Guttmann began to use sport not only as part of physical rehabilitation, but also as a tool to improve patients' mood and confidence. Over time, that rehabilitation became a form of recreation and competition, and what began in Stoke Mandeville would eventually become the origin of the Paralympic Games.

Activity

<u>Part 1: Building Prosthetics</u>

Step 1 - Create A Prosthetic Hand

Use your hand as a model to create a prosthetic hand out of cardboard. Place the hand on the cardboard and draw its outline. Then carefully cut out the silhouette. Note how the joints in your fingers and thumb are formed: you will need to bend each finger at its joints to make it move like a real hand. Make three bends in each finger and two in the thumb. Do these steps carefully so that your cardboard hand moves correctly.


Step 2 - Add The Elements

Choose straws of your favourite colour and cut 18 pieces of about 1 cm each. Then glue* them onto the cardboard hand.

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Next, cut five pieces of string**, all about the length of the longest finger on the cardboard hand up to the wrist. Glue one end of each string to the top of the fingers and thread each string through the pieces of straw, as shown in the picture. It is preferable to use thicker thread to make it stronger.

*To stick the straws in your hand you can use instant glue, aglue gun or even tape. Use whatever works best for you.

**It is preferable to use thick thread.

Step 3 - Motor Configuration

When you have the ‘tendons’ ready, it is time to place the servo-motor that will drive them all at the same time. Glue the servomotor to the bottom right corner of the cardboard hand, as shown in the picture.

If you prefer, you can also cut out a rectangle of the right size on the cardboard hand to integrate the servo-motor, so that it is firmer and more resistant.

Once in place, add a pencil to the servo-motor arm. To secure it, wrap it with a small piece of tape. This will allow you to apply leverage, moving the ‘tendons’ just enough to close your hand.

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Place all the elements as shown in the picture. However, you may need to make small adjustments when you start programming the movements. For this reason, we recommend fixing the servo-motor arm with pressure only, without adding screws, to make it easier to adjust if necessary.

Step 4 - Improve The System

So far you are using the thread to close your hand and using the natural flexibility of the cardboard to allow the fingers to return to their original position when the motor stops pulling. You can improve this system by adding rubber bands to the back of the fingers. This will act as a spring and help the fingers to return to their original position more easily.

Part 2: Prosthetic Programming

Step 1 - First Motions

We open the web page: https://www.hello-blocks.com/editor/

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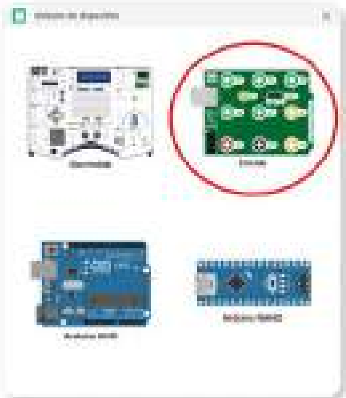

Remember to **install the drivers** in case this has not been done previously. We can find them in Menu > Settings > And go down to Drivers:

Watch Video 📽️ - Cirkids Tutorials + Hello Blocks Platform - (available subtitles)

1- **Cirkids, creando circuitos**

2- **Tu primer invento con: Cirkids**

3- **Circuitos electrónicos con Cirkids**

4- **Cirkids y las conexiones eléctricas**

5- **Saca todo el potencial con Cirkids**

6- **¡Hola Microcontrolador!... con Cirkids**

You can access the tutorial playlist directly at:

Your first invention with CirKids

Hello blocks page: https://www.hello-blocks.com/editor/

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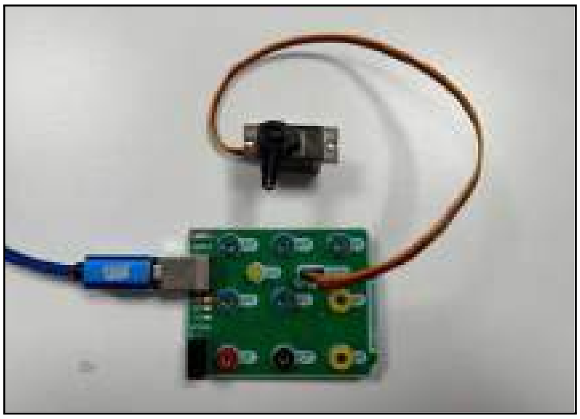
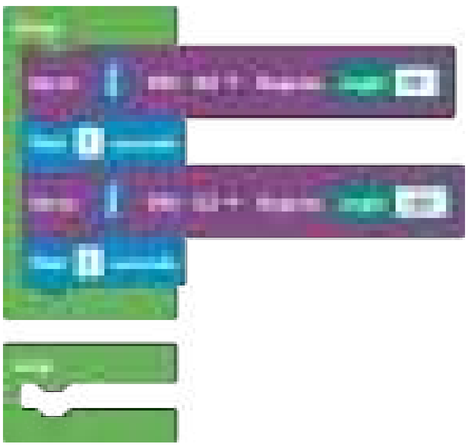
The time has come to give movement to your prosthesis! To do this, connect the servo-motor to the Cirkids microcontroller, following the instructions in the image, and then connect it to the USB port of your computer.



Once everything is ready, try the following codes to verify that they work.

In the first exercise, the instructions are inside the 'setup' function, which will make the hand move only once. This will allow you to make the first adjustments and confirm that the servo-motor arm is in the correct position.



Once the program is uploaded, the servo motor will move only once, until you press the reset button. This way, you can control the movement easily.

When it's working correctly, drag the blocks into the **Loop** function so that the arm repeats the movement continuously. You can customise both the degrees of movement of the servo motor and the time it stays in each position. Adjust the program to your liking until you achieve the optimal performance.

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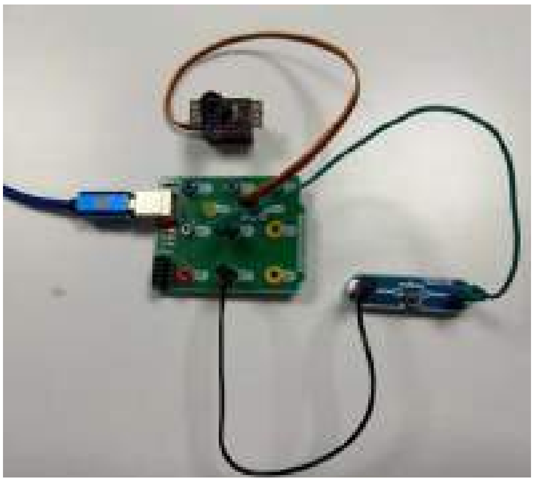
Step 2 - Take Control

To make the use of the prosthesis more accessible, include an external pushbutton to control its movement easily and quickly. To do this, connect the components as shown in the following image.



Using the conditional structure, you can take control of the program by using the external button to modify its behaviour.

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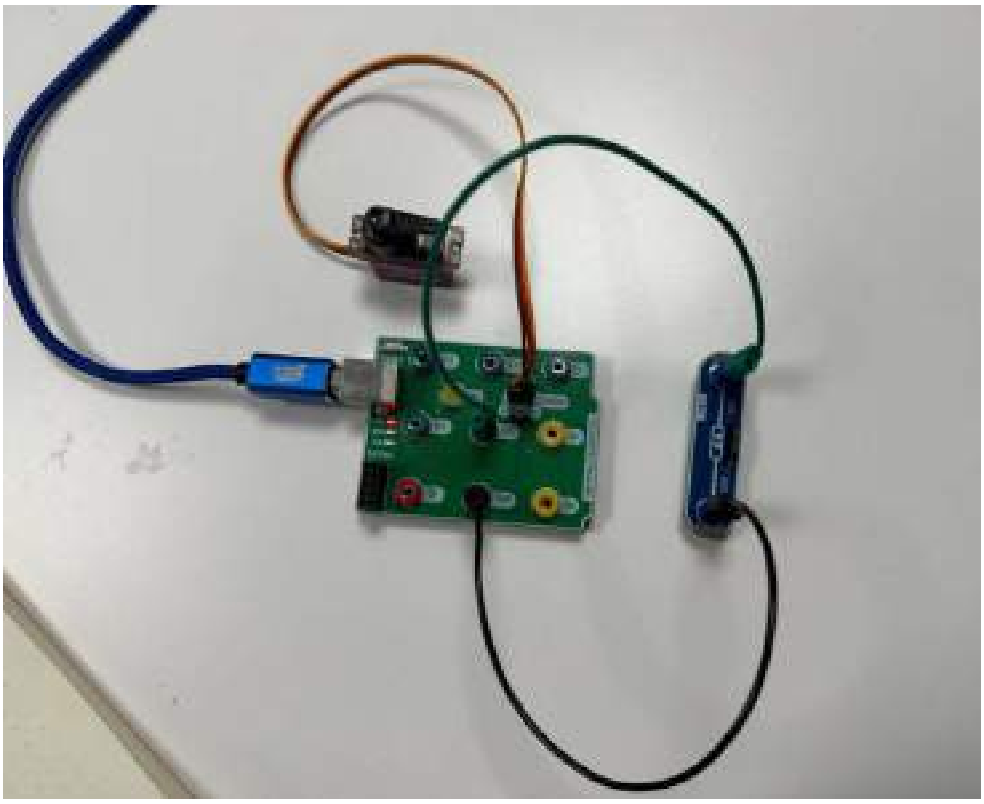
Step 3 - An Affordable Prosthetic

Most prostheses use automatic mechanisms or sensors that allow them to control their movements without the need to activate external elements. In Cirkids you can find the 'Tilt' module, which works like a small tilt-controlled switch.

Modify your previous program to incorporate this new module, so that the prosthesis is controlled according to its position. If the hand is tilted upwards, it should stay open, but when it is placed in a horizontal position, it should close automatically. You may need to add some time blocks so that the user has enough time to get close to the desired object before the hand closes.

Note For The Teacher 📝

This is an example of how you could connect the Tilt sensor, replacing the pushbutton module that you placed previously.



An example of how this works is shown below. A time block has been added at the moment of closing the hand, allowing the user to approach the object to be picked up.

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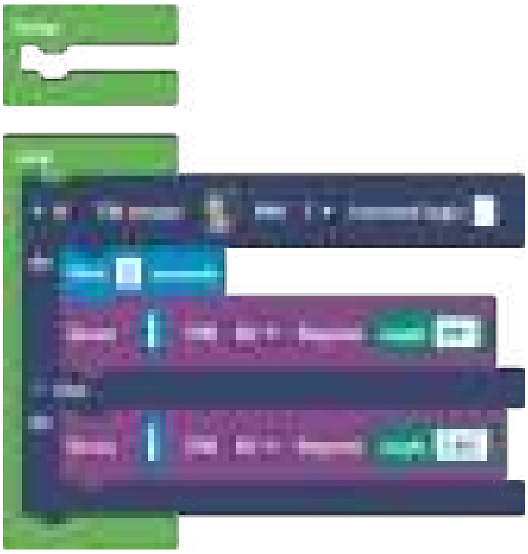

Conclusion and sharing

Each group will present their prosthesis and share their experience of building and programming. This will allow them to showcase their designs and explain the decisions they made along the way. They should talk about:

- The technical difficulties they faced and how they overcame them.
- The added functionalities and how they would improve the prosthesis if they had more time or resources.

Discuss In Groups 🗣️

How could these prostheses help to improve the quality of life of people with physical disabilities?

What other technological tools or innovations could be applied to help these people?

Note For The Teacher 📝

End the session by inviting students to propose an action they could take to raise awareness in the community about the importance of accessibility and technology inclusion, such as information campaigns, presentations at school, or collaborations with local projects supporting people with disabilities.

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We invite you to share your results on social media by tagging the STEAMbrace project:

LinkedIn:
https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name

Instagram: https://www.instagram.com/steambrace_eu/

X: https://x.com/steambrace_eu

Project evaluation

Activity Objectives	Key Competences (EU)	Evaluation Criteria
Understand the challenges faced by people with disabilities and how the environment in which they live affects their opportunities.	Cultural awareness and expression	The student participates in discussion and reflection on the social impact and opportunities that technology can provide for people with disabilities.
Know the types and functions of current prostheses and assistive devices.	active citizenship	Researches and documents important milestones in the history of prosthetics, integrating this information into a precise timeline. Analyses existing social and technological projects aimed at improving access to prostheses, presenting relevant examples.
Use current technological tools to design and propose innovative solutions.	Numerical, scientific, and engineering skills Digital and technology-based competencies	Designs and builds a functional cardboard prosthesis, following instructions and applying improvements as required. Uses elements such as straws, thread and the servo-motor effectively to replicate natural movements in the prosthesis. Documents the development process and performs a critical self-assessment of the prototype, suggesting possible improvements.
Collaborate in groups to exchange ideas and create effective solutions.	active citizenship	Participates actively in group collaboration, contributing ideas and respecting the work of peers. Displays communication and problem-solving skills, sharing responsibilities and helping others to achieve project objectives.

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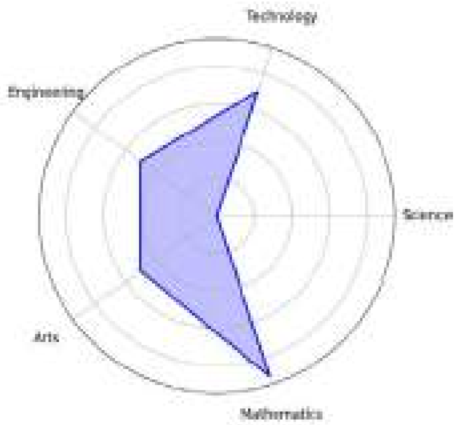
THE MAGIC OF MATHEMATICS



Duration	Recommended Age	Difficulty
1,5 hr	11-12	High
#PROGRAMMING #GAMES #MATH		

Description

The activity focuses on learning about the history of mathematics and highlighting important mathematicians who, over time, have made great contributions that are still relevant today. In addition, students will work on a fun project in Scratch where they will program a mathematical trick that guesses ages using logical operations. The idea is to show that math is not only about formulas and calculations, but also about creativity and wonder.

Activity Objectives

- **Encourage interest in the history of mathematics** by highlighting the contribution of important figures, especially women, and their achievements over time.
- Apply mathematical knowledge in a practical way
- Develop logical and creative thinking skills through programming on digital platforms.

Key Competences (EU)

- Numerical, scientific, and engineering skills
- Digital and technology-based competencies
- Cultural awareness and expression

Materials

Provided by the teacher/institution:
- Computers with internet connection

Previous Preparation

- Make sure computers are operational and connected to the internet

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Contextualization And Adaptation

History Of Mathematics

Mathematics is 'the science that studies the relationships between quantities, magnitudes and properties, and the logical operations by which unknown quantities, magnitudes and properties can be deduced'.

Since the beginning of the history of mankind, mathematics has been used for the most everyday problems of life, such as knowing how many seasons and days have passed, as well as for more complex equations, which have helped to build great historical buildings.

Watch Video 📽️ - "History of Mathematics".
History of Mathematics(subtítulos habilitados)

The Magic Of Numbers And Mathematical Patterns
The aim of this activity is to surprise students with mathematical tricks based on numerical properties and patterns, encouraging their interest in mathematics and showing how certain mathematical concepts can seem like magic when applied in an ingenious way.

'Magic' in mathematics is based on patterns and properties that may seem surprising to the naked eye. Although the things we're about to see may appear to be tricks, everything has a logical, mathematical explanation.

Classroom Activity 💡

The Mysterious Number::

- Ask a student to choose any number, multiply it by 2, add 10, divide the result by 2 and then subtract the original number.
- The answer will always be 5.
- Explain the algebraic reasoning behind this trick: (x→2x+10→2x+102−x=5x \rightarrow 2x + 10 \rightarrow \frac{2x + 10}{2} - x = 5x→2x+10→22x+10−x=5).

Note For The Teacher 📝
Students can be asked to look for more tricks, which they can then apply to the program they are going to make with Scratch. Since the operation will be similar, the only thing they would have to do would be to change the mathematical operations that the software performs.

Great Women Mathematicians In History

Since earliest times, women have been involved in the world of mathematics, but they have not always been acknowledged for their work in this field.

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Classroom Activity 💡 Create working groups and look for **women mathematicians**, and their contribution to the field.

It is interesting to look for women whose advances in the world of mathematics have been so important that their studies are still used today.

You can define a period of history for each of the groups, for example,

- Ancient and Classical Mathematicians
- Mathematicians of the 18th and 19th Centuries
- 20th Century Mathematicians
- Contemporary Mathematicians

Note For The Teacher 📝

An interesting figure to study is Mary Somerville (who later mentored Ada Lovelace). Self-taught in her training, she studied mathematics and astronomy, and in 1835 was elected along with Caroline Herschel as the **first female honorary members** of the Royal Astronomical Society.

"The First Scientist":
Mary Somerville: Scotland's First Scientist

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Activity

<u>Part 1: Designing The Interface</u>

Step 1 - Create The Environment

Using Scratch (https://scratch.mit.edu/), you are going to create a program capable of finding out the age of two different people.

To do this, we are going to create a structure similar to this image.

The program will guess, through mathematical logic, how old two people are.

The mathematical sequence is as follows:

AGE1 **x2** = RESULT1
RESULT1 **+5** = RESULT2
RESULT2 **x50** = RESULT3
RESULT3 **+AGE2** = RESULT4
RESULT4 **-365** = RESULT5
RESULT5 **+115**= XXXX
AGE1=POSITION1AND2
AGE2=POSITION3AND4

To do this, you will have to use 3 sprites and 1 scenario.

First, remove the cat from Scratch, in order to clean up the whole program, and then import the necessary sprites.

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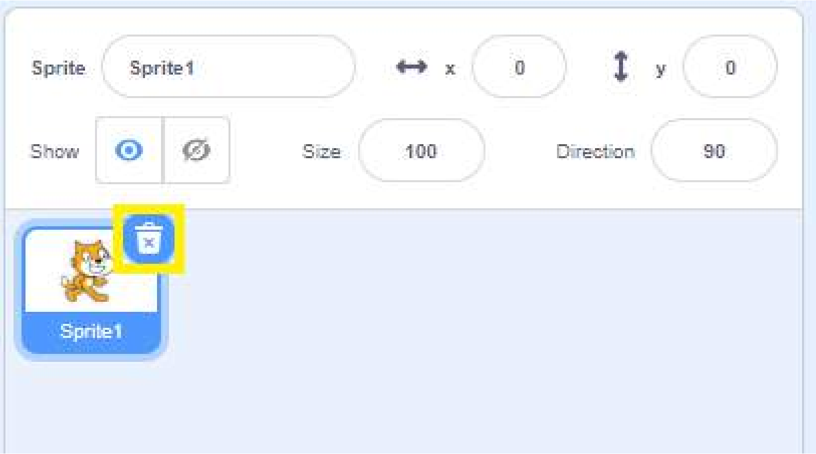
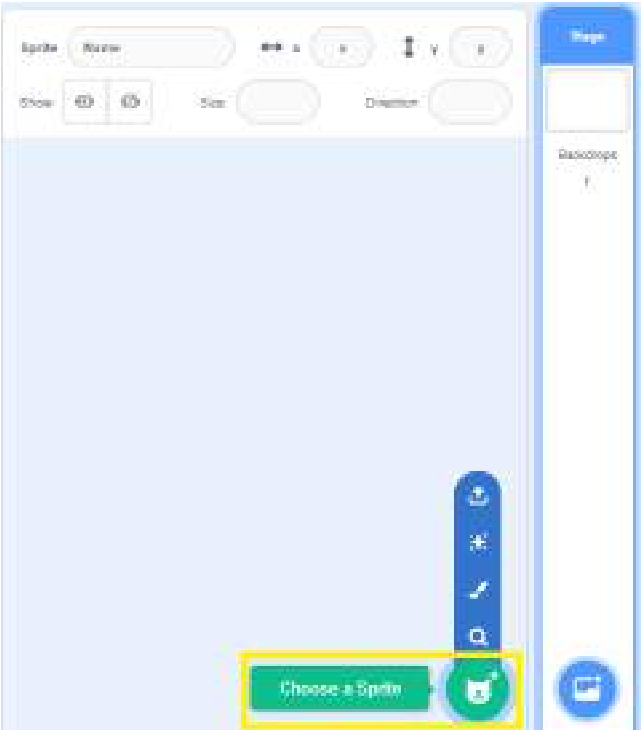


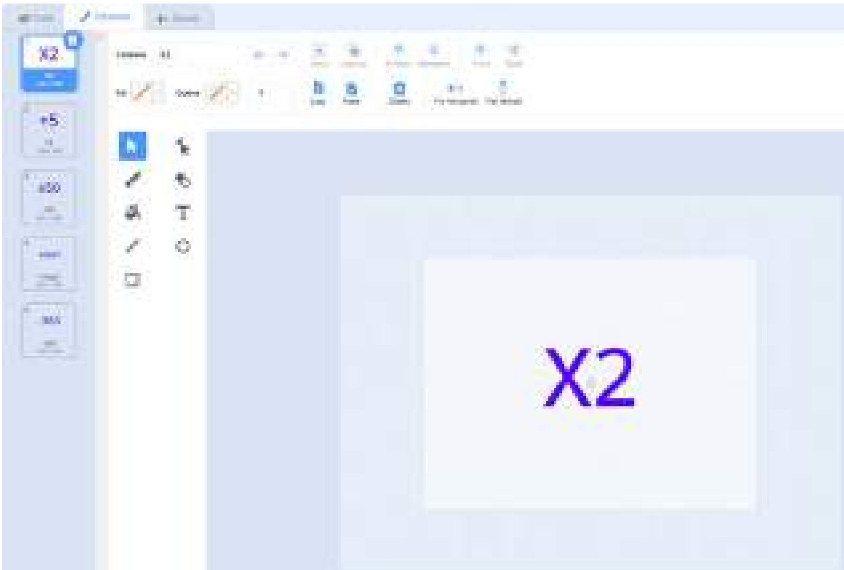
Step 2 - Import And Create Characters

You are going to import the character who is going to do ‘mathematical magic’. For this example, there is a Wizard.



Once you have imported the Wizard object, you will have to create an object from scratch, which will have 5 different costumes:

Inside the Sprite, which you will call Equations, you are going to create these 5 costumes: x2, +5, x50, +Age2, -365



And the last sprite will be the magic effect, which for this example, we chose a star, replicated it many times, and changed the colour of some of them.

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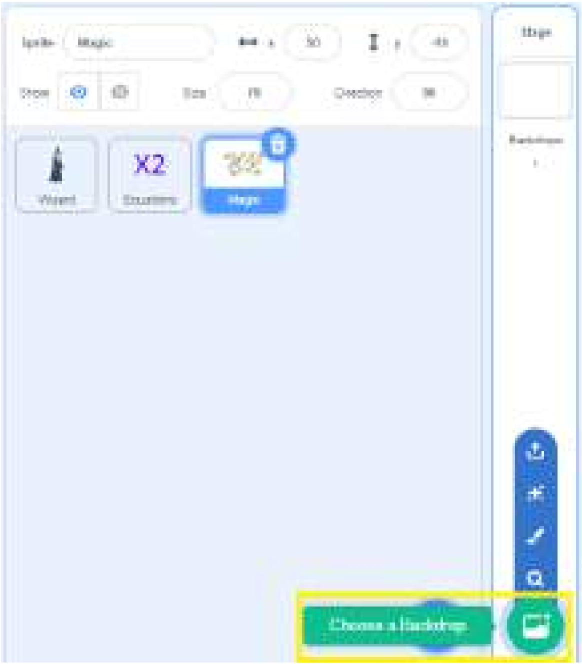
The result looks like this:

And finally, choose the background you want for your ‘mathematical magic trick’.

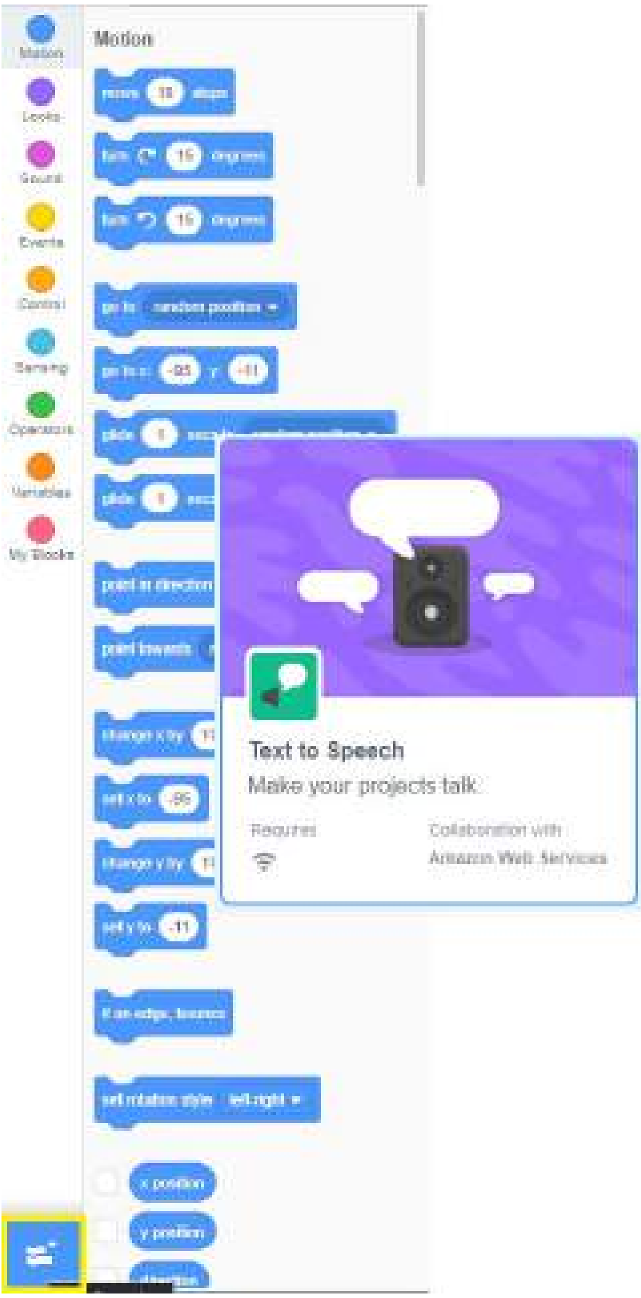


And with that, you will have the necessary objects ready for your mathematical trick.

Part 2: Program The Mathematical Trick

Step 1 - Add Required Extensions

Throughout the program, your wizard will be speaking, both in written and spoken form, which is why you will need to import the Text to Speech extension.



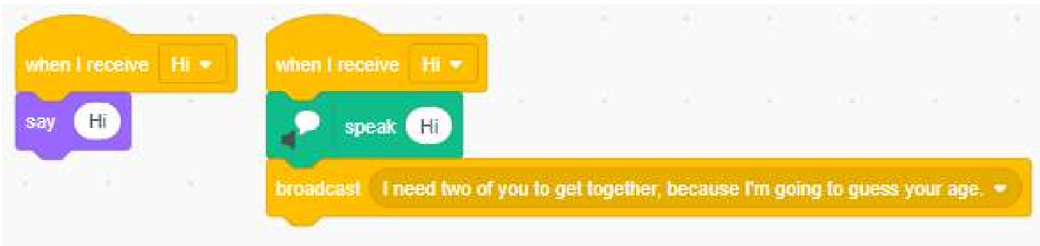
Step 2 - Program The Wizard

To begin, you will place the magician in his position, select the language of your program and finally, the voice of your character. You can choose between different options offered by

Scratch (alto, tenor, squeak and giant). And finally, you will start sending messages; the first one will be used to say 'Hi!'

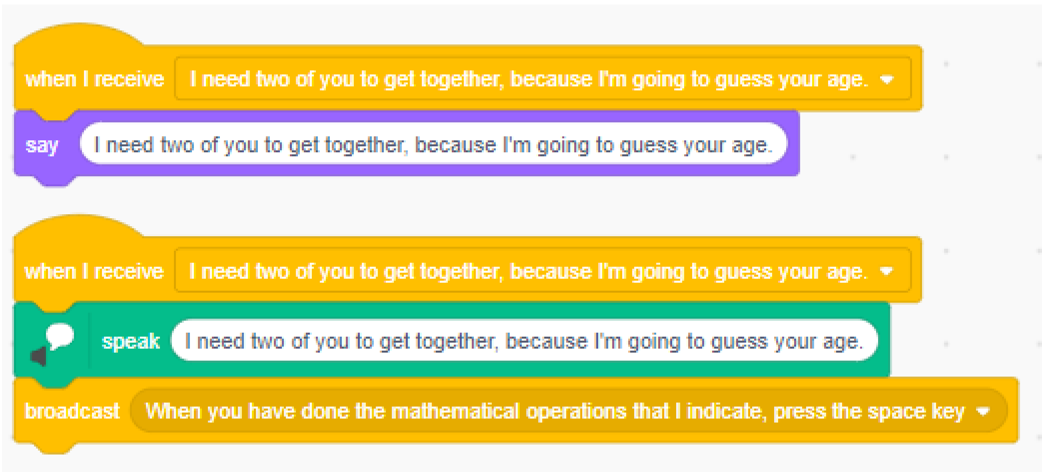
Throughout the program, you will have to make the wizard speak orally and in writing, so you will copy and paste the dialogues to make it quicker and easier for you.

When you receive the 'Hi' message, he will have to say it, and send the following message:



He is going to explain what you are going to do. In this case, he asks for two people together, because he is going to find out the age of the two of them through mathematical operations.

“I need two of you to get together because I'm going to guess your age.”



Now the wizard is going to ask you to press the space key when you have the mathematical operations ready, so that he can continue.

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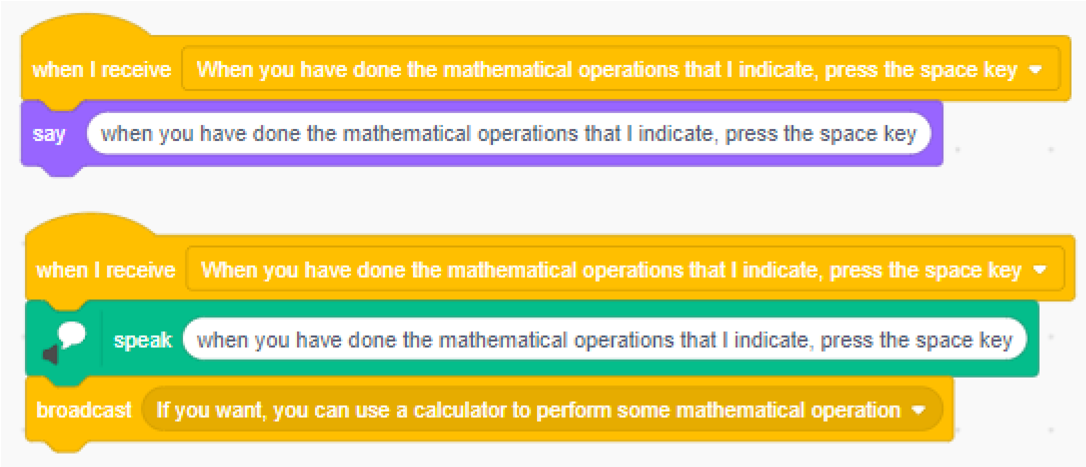
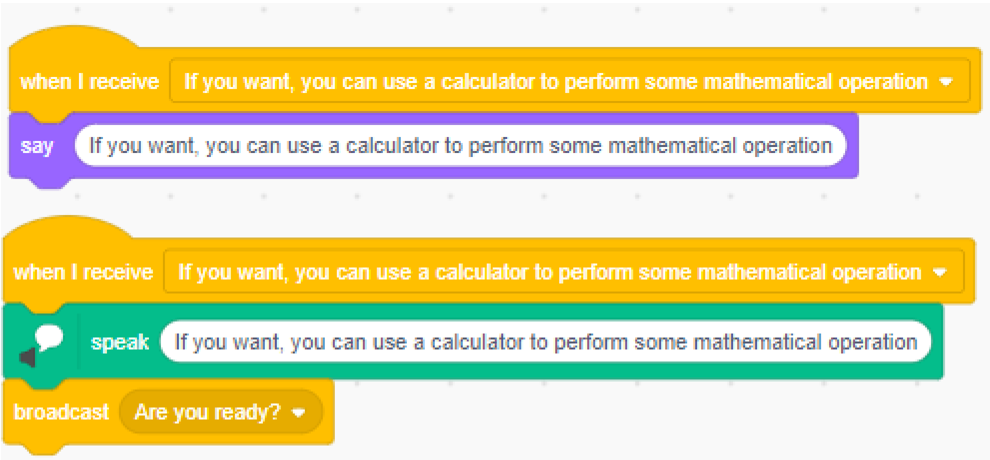
“When you have done the mathematical operations that I indicate, press the space key”



The wizard is going to tell you that you can use a calculator to do some operationsif you want to.

“If you want, you can use a calculator to perform some mathematical operation”



And now he will ask if you are ready to begin.

“Are you ready?”

And he will wait for you to press the space key before sending the next message.

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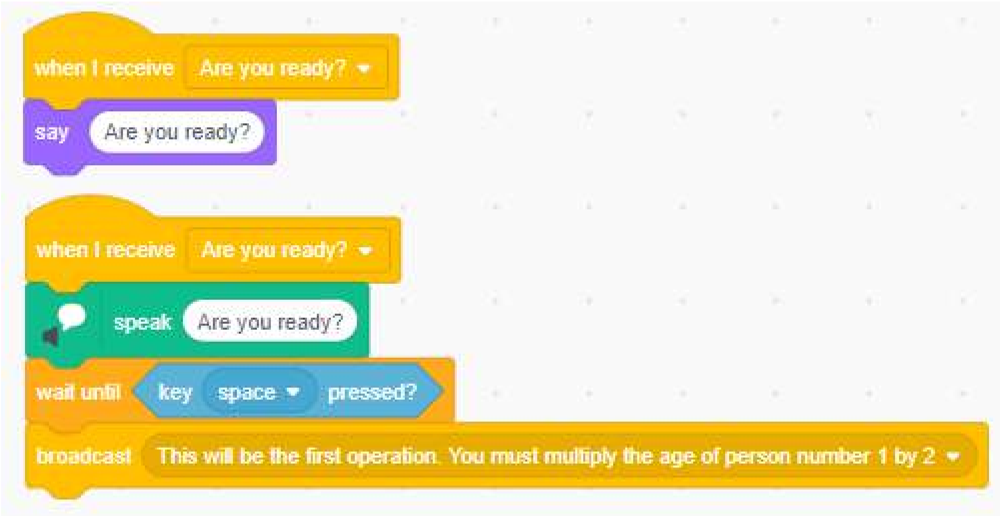
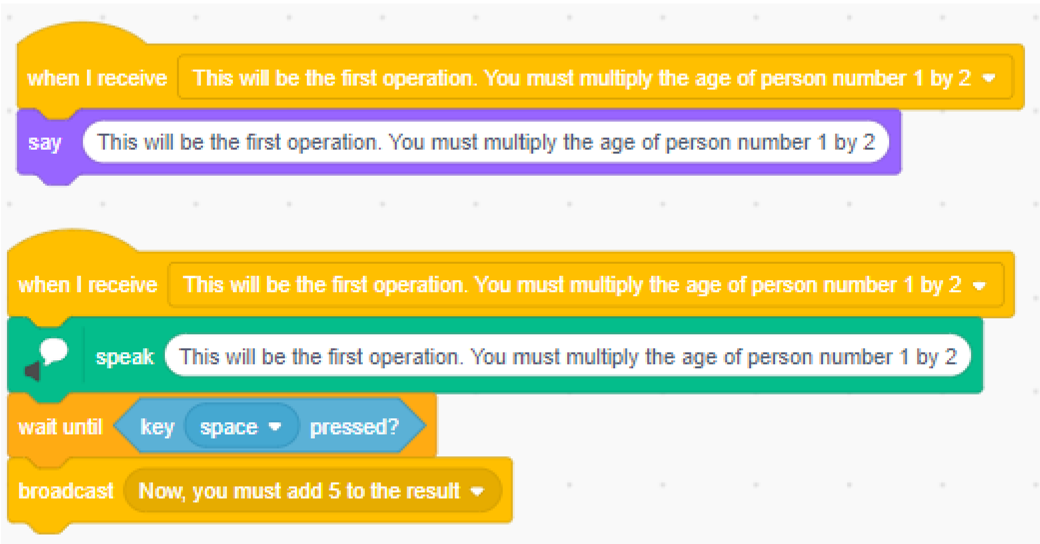


The first operation is to multiply the age of person number 1 by 2.

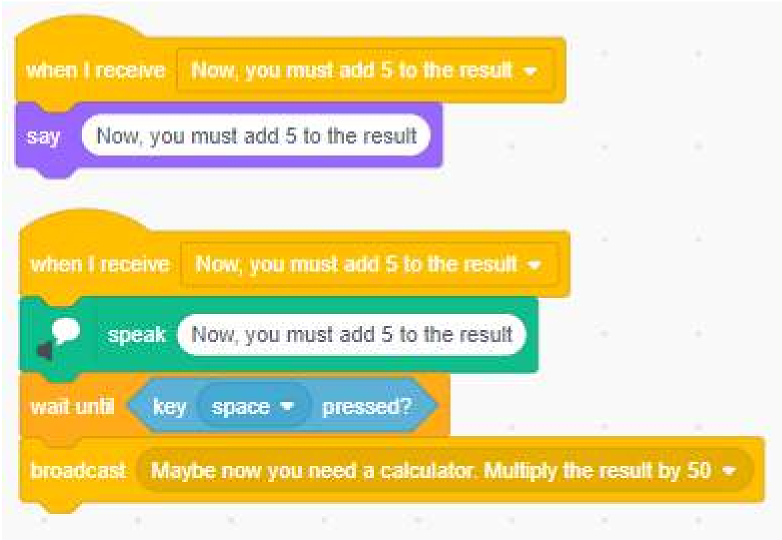
“This will be the first operation. You must multiply the age of person number 1 by 2” and he will wait again for you to press the space key to send the following message.



Now, you must add 5 to the previous result.

“Now, you must add 5 to the result”

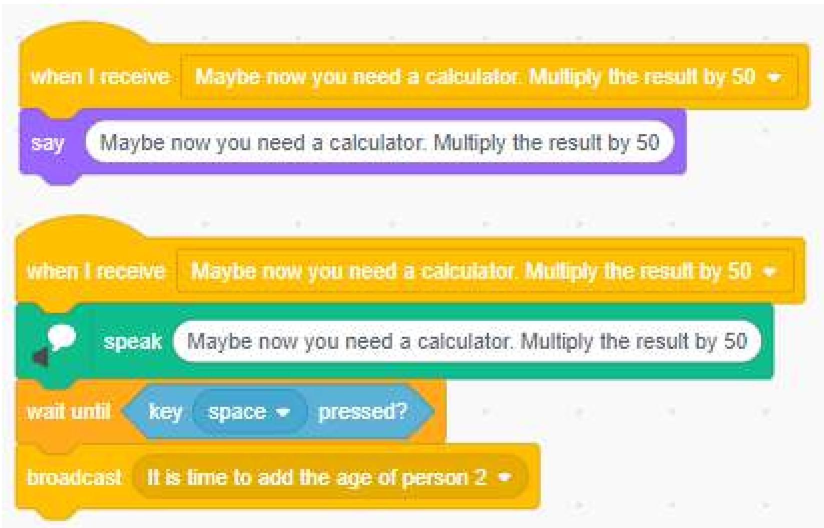
And he will wait again until you press the space key to continue, to send the next message.



For the next operation, the program will let you use the calculator, because you have to multiply the result by 50.

“Maybe now you need a calculator. Multiply the result by 50”

Once again the wizard will wait for your answer with the space key.



Now person 2 will come into play, because his or her age must be added:

“It is time to add the age of person 2”

And he will wait again until you press the space key to continue, to send the next message.

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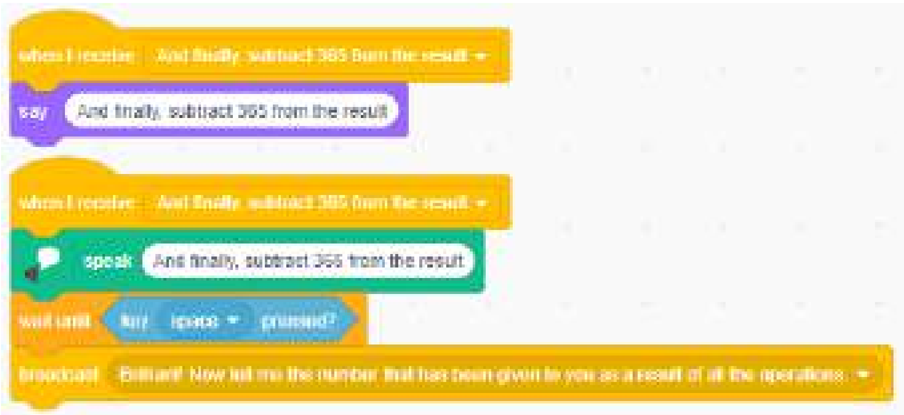
And the last thing will be to subtract 365 from the result you have just calculated.

“And finally, subtract 365 from the result”

Of course, he will wait until you press the space key.



Now, you have to enter the result of the operations, and for this you are going to use the 'ask' function that is inside ‘Sensing’ and that asks you to enter the final number in the dialogue box.

“Brilliant! Now tell me the number that has been given to you as a result of all the operations.”

The program will wait until you enter your answer, that is, that the answer is ‘nothing’ and you have to create the variable 'Answer+115', so that you can now set it to the user's answer + 115.

This operation will not be seen on the screen, but the program will do it internally.

It will send the following message to continue:

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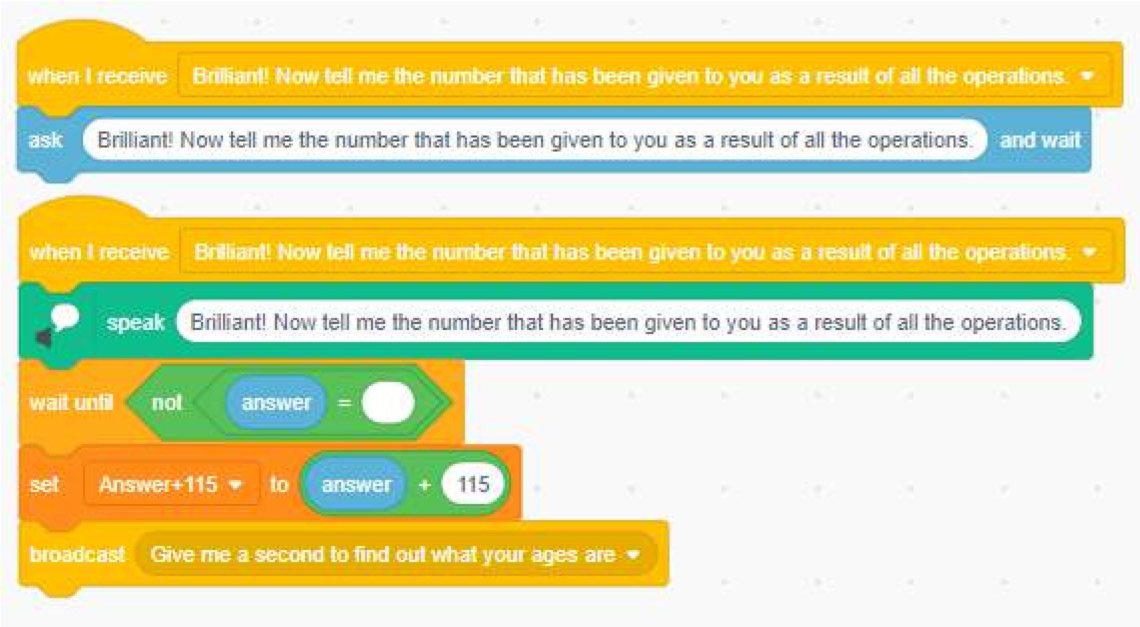
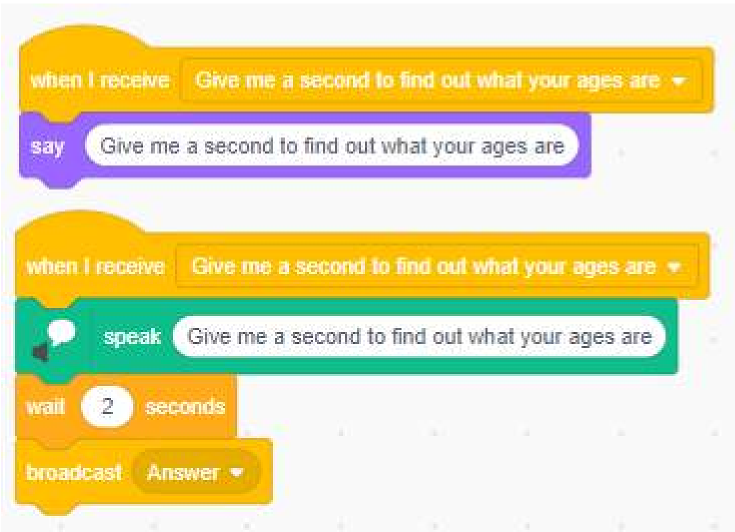


The wizard will ask you for time to do his magic and find out the ages:

"Give me a second to find out what your ages are"

He will wait 2 seconds and sent the next message:



Finally, you'll get the 'Answer' message.

You have to create the variables Age1 and Age2 and set the variable Age1 to the union of character 1 of the variable Answer+115 and character 2 of the variable Answer+115.

Set the variable Age2 to the union of character 3 of the variable Answer+115 and character 4 of the variable Answer+115.

Finally, the sound 'Magic Spell' should be played at the end of the magic trick.

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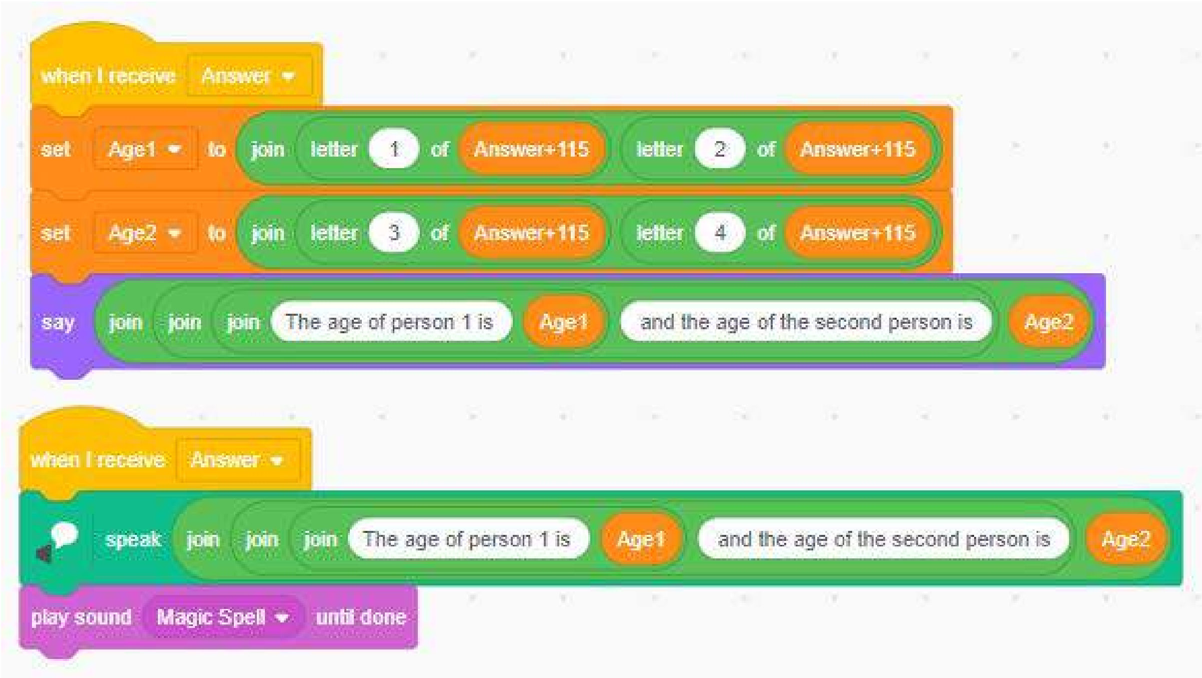


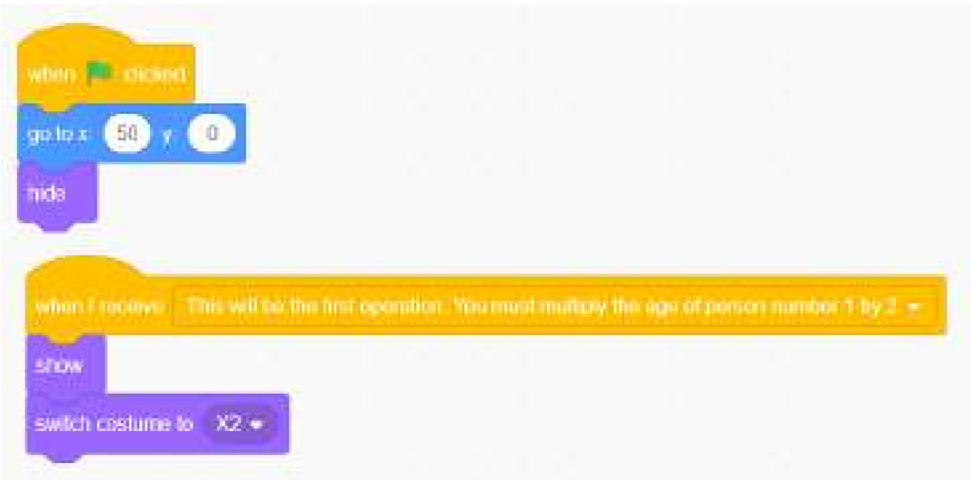
You can test the program now if you want, before going on to programming the equations and the magic object.

Step 3 - Program The Equations

The hardest part is done, so now you are going to make your program more attractive and more magical.

The equations are put in place, and hidden.

Depending on the messages they receive, they will be shown, with their corresponding costume.



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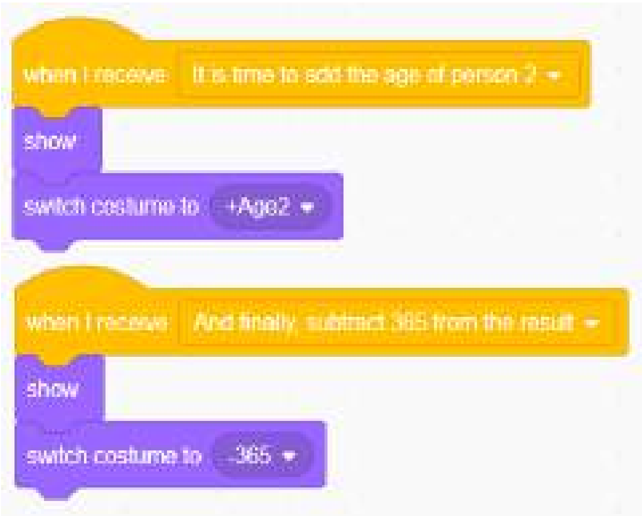

Finally, with the message where the magician asks you for the last result, the equation should be hidden.

Step 3 - Program The Magic Object

At last, this sprite will appear when the equations object is not on the screen.

All the while, the colour of the object will change, which is why you have painted the different objects in different colours, for a more magical effect.

When you receive the 'Hi' message, it should be displayed.

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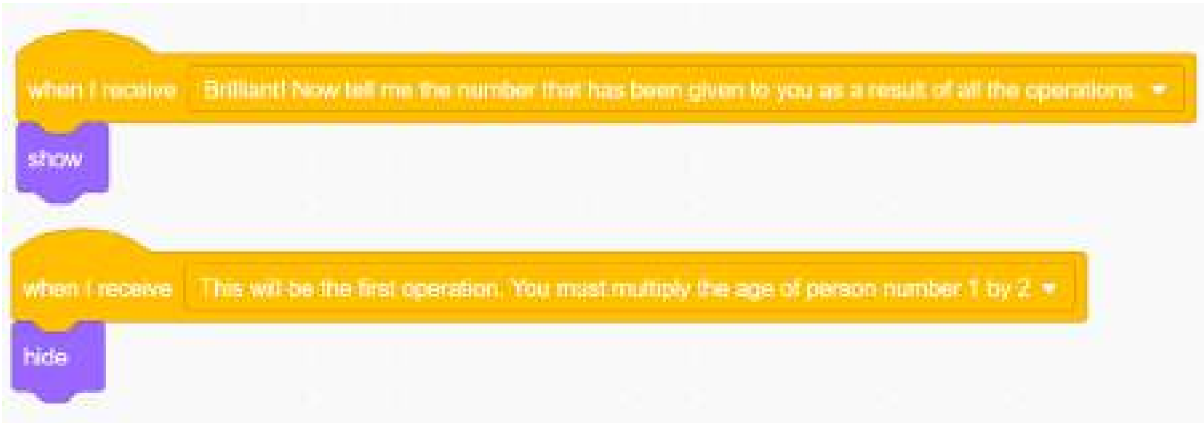
And with one of the messages it should display, but with the other one it should hide.



To finish, just hit the green flag, and let the magic happen!

Conclusion and sharing

> **Note For The Teacher** 📝
> Lead a discussion about how mathematics is not just about calculations and formulas, but also about creativity and surprise. What did you learn about using mathematical patterns and properties to surprise others?

> **Classroom Activity** 💡
>
> Each group of students should present their Scratch project to explain how they programmed the wizard and how they implemented the mathematical sequence. This step helps them practice communicating technical ideas clearly.

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Discuss In Groups 🗣️

What was the most complicated step in programming the wizard?
What would you improve or add to the project?
How can this project help to better understand mathematics or logic?

Show us your work via social media!

- LinkedIn: https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name
- Instagram: https://www.instagram.com/steambrace_eu/
- X: https://x.com/steambrace_eu

Project Evaluation

Activity Objectives	Key Competences (EU)	Evaluation Criteria
Foster interest in the history of mathematics by highlighting the contribution of important figures, especially women, and their progress over time.	cultural expression and awareness	Active participation in research and discussion on historical mathematical figures, especially women. Ability to identify and explain the impact of the mathematical developments of the figures studied today.
Apply mathematical knowledge in a practical way.	Numerical, scientific, and engineering skills	Ability to apply correct mathematical operations in the development of the age-guessing trick. Understand and explain the workings of the mathematical sequence used in the project.
Develop logical and creative thinking skills through programming on digital platforms.	Digital and technology-based competencies	Appropriate use of code blocks in Scratch to implement the logical sequence of the mathematical trick. Ability to solve programming problems independently or in teams, demonstrating logical thinking.

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BUILDING EARTHQUAKES

Duration	Recommended Age	Difficulty
1 hr	11-12	Low
#CRAFTS		

Description

How do earthquakes affect buildings? Students will work in groups to design and build models of resistant buildings using a variety of materials. Using the Arduino Science Journal app, they will measure the oscillation of their structures and apply solutions to reduce the effects of earthquakes, gaining hands-on experience in engineering and physics.

Activity Objectives

- Understand seismic phenomena, their origin in the movement of tectonic plates and how they affect structures.
- Learn about the principles of earthquake-resistant construction, such as damping of oscillations and seismic isolation.
- Encourage creativity and teamwork.
- Develop technological skills using the Arduino Science Journal application to measure and analyse the oscillations of their constructions.

Key Competences (EU)

- Numerical, scientific, and engineering skills
- Digital and technology-based competencies
- Active citizenship

Materials

Provided by the teacher/institution:

- Mobile with Arduino science journal installed
- Shoe boxes
- Sheets of cardboard or paper larger than the box
- Marker pens

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- Tape
- Rubber bands
- Paper clips or pins
- Cotton
- Straws
- Pipe cleaners
- Thread
- Springs
- Ruler
- Scissors

Previous Preparation

- Ensure that the mobile phones have the Arduino Science Journal app installed and are working properly.
- Prepare the materials.
- Check the complementary resources.

Contextualization and Adaptation

In this session we will work on earthquakes and earthquake engineering.

Earthquakes are natural phenomena caused by the movement of tectonic plates beneath the Earth's surface, and their force can have a major impact on the buildings and structures we construct. Throughout history, engineers and architects have developed ways to make buildings more resistant to these movements, which leads us to explore earthquake-resistant construction.

In this activity, we will not only learn how earthquakes happen, but we will also become engineers. We will design and build our own models of buildings and see how different materials and solutions can help make them more resistant during an earthquake. To do this, we will use an app called Arduino Science Journal, which will allow us to measure the oscillation of our structures and see how engineering can mitigate the effects of an earthquake.

Watch video 📽️

Below are some videos that can be watched as a complementary experience. They illustrate visually the effect of seismic movements in different situations.

Aislamiento sísmico con Losa_Video 3D.wmv
Simulador de subducción y terremotos
(티이솔루션) Principle of Tuned Mass Damper(TMD) Technology -Pendulum type
https://www.youtube.com/shorts/HSJ9PQZg6BU

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Activity

In the workshop, the class will be divided into groups. Each group will have a shoebox and a base that will allow us to simulate the earthquake by moving horizontally on one axis. The teacher will demonstrate how the mobile picks up the oscillation of the box on the surface and will show the students how by using objects such as markers or straws that allow the box to roll, the oscillation decreases. This occurs because the transfer of movement between the base and the box is reduced, demonstrating that the most effective way to avoid damage to a building is to make sure that it does not move with the ground.

The students will be invited to develop their own system for the box to survive the earthquake, as the markers are not a perfect solution because the box can move over them freely. To do this, they will be provided with a series of materials that can be used for this and to decorate their house if they wish. At the end of the workshop they will be able to check which has proved to be the most efficient system.

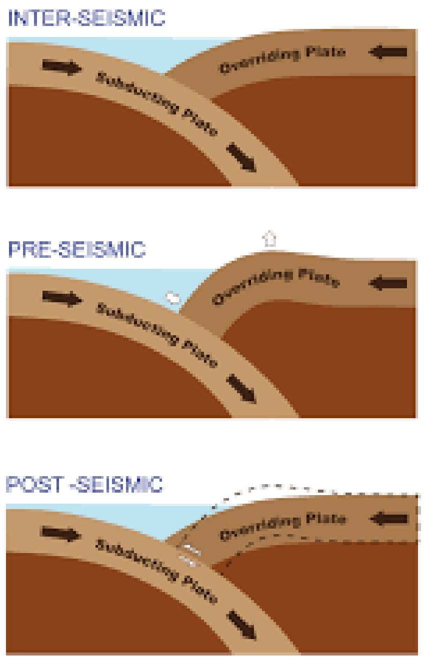
Step 1 - Divide The Classroom Into Engineering Groups

We divide the class into groups depending on the number of boxes and students. A good ratio would be 3 or 4 students so that everyone can work simultaneously on their structures.

Step 2 - Explain The Earthquake Phenomenon

Earthquakes are produced by the constant movement between tectonic plates that produce friction and deformations that accumulate enormous amounts of energy. When this energy is released and exceeds the elastic limit of the rocks, it produces a rapid and violent fracture that causes the earthquake.

This can be visualised by bending a ruler: when it is released, it shakes and oscillates. We can imagine what would happen if there were buildings standing on top of it.



Step 3 - Explain Earthquake-Resistant Construction

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At this point the teacher will use one of the boxes and the bases to explain how an earthquake affects the constructions. To quantify this we will use the Arduino Science Journal application, where we will create a new experiment and **select the accelerometer on the Y axis**.

Pegaremos con un poco de celo o cinta de doble cara el móvil a la caja para que recoja la oscilación de esta y no la suya propia, colocaremos la caja encima de la base y moveremos desde un lateral hacia delante y detrás repetidamente para simular el terremoto.

Ahora que hemos conseguido una medición de lo que sería un terremoto sin utilizar ninguna medida para mitigar su efecto en un edificio vamos a ver los diferentes elementos que se aplican en la construcción a prueba de terremotos.

To build an earthquake-resistant building, engineers design structures that can withstand the horizontal forces of an earthquake. Since earthquakes release large amounts of energy and load buildings sharply from one direction, an earthquake-resistant structure must also be able to move in the opposite direction.

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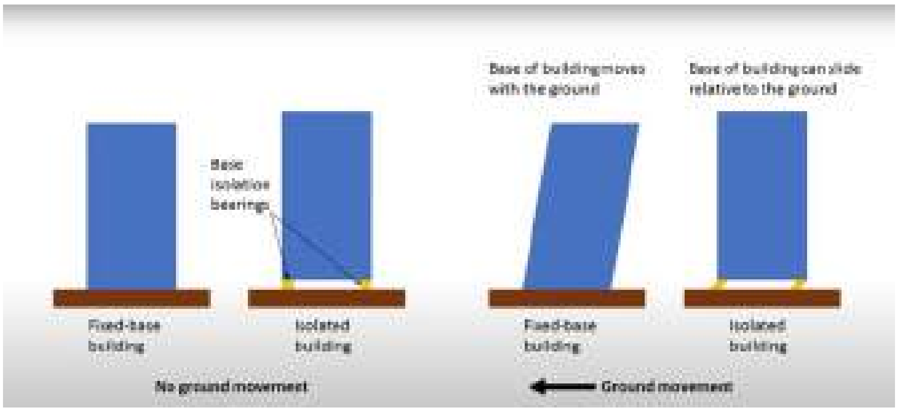

One way of counteracting horizontal seismic forces in the ground is, on the one hand, to place the foundations of a building above the surface level and, on the other hand, to separate them from the subsoil with the help of elastic rubber bases composed of layers of steel, rubber and lead. When the subsoil moves during the earthquake, the anti-seismic supports vibrate next to it and absorb most of the kinetic energy, affecting the building less, in a similar way to the shock absorbers of a car.

We can test this with some markers under our box. If we repeat the previous experiment we will see that the oscillation is significantly reduced. This happens because not being rigidly anchored to the ground, the box has to remain at rest according to Newton's 1st law: every object at rest will remain so until a force affects it. However this system is not perfect because the house can easily come off its foundations.

Another way to dampen a building is to use a huge swinging pendulum as in the 101 skyscraper in Taipei. In this case, a 660-tonne steel sphere hangs from steel cables, and

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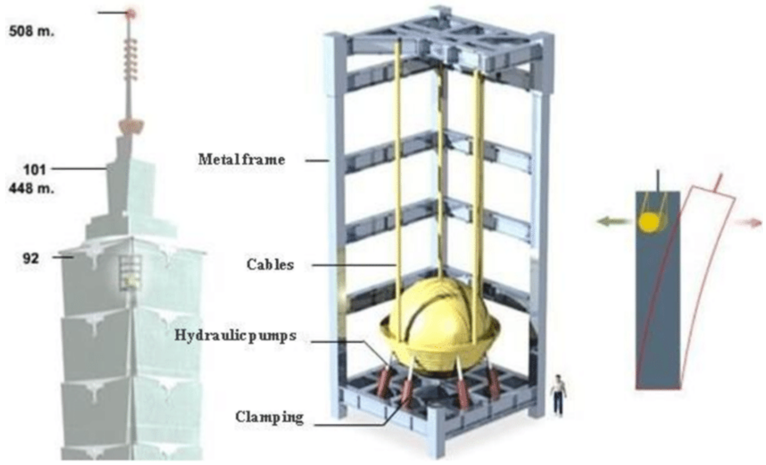
when the building starts to swing, the sphere, due to the inertia of its mass, also swings and acts in the opposite direction to the earthquake forces, helping to stabilise the structure.



Step 4 - Build Earthquake Models

Now you are going to create your own model and think with what you have learned how you can reduce the oscillation of a building using the materials we have here. The objective is that the house stays static in one area without moving out of the cardboard and oscillates as little as possible.

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They can decorate the boxes to make sure everyone in the group has tasks to do, but the priority and focus should be on designing a system to prevent an earthquake. Below are some examples that can be shown to students to inspire them.

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Conclusion and sharing

At the end of the activity, the groups will test the models created by others and compare all the results with each other.

They should also discuss which worked better, which worked worse, why they think this is the case and what they would do to improve it.

Discuss in groups 🗣️

What are the consequences of earthquakes in large cities? How do they affect infrastructure and people? Do you think that all cities in the world have the same difficulty recovering from a natural disaster? Why or why not?

What other prevention and safety measures do you think are important to protect people during an earthquake or other natural disaster?

We invite you to share your results on social media by tagging the STEAMbrace project:

LinkedIn:
https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name

Instagram: https://www.instagram.com/steambrace_eu/

X: https://x.com/steambrace_eu

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ART HISTORY

Duration	Age Recommended	Difficulty
1 hr	11-12	Low
#ART #AI #INVESTIGATION #AUDIOVISUAL		

Description

In this session we will train our computer skills by creating a digital mural in Padlet, in which each participant will contribute information about women who have had a significant impact on the history of art. We will research the life and work of women painters, sculptors, photographers and designers, exploring their careers, their most relevant works and the influence they have had on the development of art. This exercise will allow us to get to know and value their legacy in the artistic field. We will learn how to use Padlet to design a collaborative and visual mural, thus finally obtaining a virtual gallery where each contribution will show a part of the female artistic legacy.

Activity Objectives

- Recognise the impact of women in art history
- Develop research skills
- Encourage creativity and digital design
- Encourage teamwork

Key Competences (EU)

- Literacy
- Digital and technology-based competencies
- Cultural awareness and expression
- Interpersonal skills, and the ability to adopt new competencies

Materials

Provided by the teacher/institution:
- Computer

Downloadable Elements:
- [Printable arrow-joining activity]

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Previous Preparation

To access Padlet and participate in the activity, each student must log in using a Google account. They should also print out the arrow-joining activity.

Contextualization and Adaptation

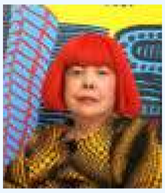
Did you know that a woman was the first to paint a self-portrait that is considered a masterpiece of Western painting? She was **Frida Kahlo**, who not only revolutionised art with her unique style, but also shattered the conventions of her time by depicting her own suffering and identity in such a profound way.

As well as Frida Kahlo there are other female artists whose works have been recognised worldwide as conveying a message through their vibrant colours. To name just a few: Georgia O'Keeffe, Yayoi Kusama, Artemisia Gentileschi, etc.

Classroom Activity 💡

Let's see how much we know about the art world. Connect with arrows the corresponding artist with her work; first, with h the general knowledge and culture that we have on this subject; and then, after researching about each one:

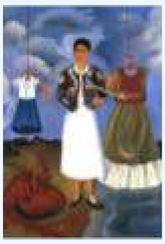
Frida Kahlo



Yayoi Kusama

Artemisia Gentileschi

Helen Frankenthaler



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Note For The Teacher 📝

Here's the solution:

This activity offers a great opportunity to discuss what kind of artistic styles they know: Is there only one style, can a work only be a painting, what other types of works are there, and what styles are there?

Classroom Activity 💡

In the website **Google Arts & Culture:** https://artsandculture.google.com/, we can explore countless artists, learn about their works and get to know some relevant facts about their biography.

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Each student will choose 3 or 4 artists and write down curious facts about their life and work. In addition, they will compile the names of their most relevant works in order to include them on their digital wall.

Teachers are invited to watch the following videos explaining the interface of the two main applications that will be used in this activity: Padlet and Google Arts & Culture.

Watch Video 📽 - "Introduction to Padlet":
Introduction to Padlet: Getting started for absolute beginners

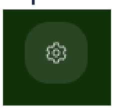
Watch Video 📽 - "Google Arts & Culture Tutorial":
Google Arts and Culture Tutorial

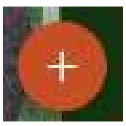
Note For The Teacher 📝

Padlet is a digital platform for creating and sharing collaborative online walls or boards, where information can be organised and presented visually. It is especially useful in educational contexts, as it allows students and teachers to collaborate in real time and add a variety of content, such as text, images, videos, links and documents, in a 'post-it' or 'card' format that are placed on the board.

Activity

Create The Portfolio In Padlet

1. First choose a **background** for your portfolio by going to the settings section on the right hand side of the screen..  You can choose from many default backgrounds and you can even import your own background. To create a custom background, you can use the following link https://www.blinkshot.io/ which is a web application for instant image generation by AI.

2. It's time to start adding entries to your digital wall. To do so, you can click on the symbol  in the bottom right-hand corner of the screen or by double-clicking on any free area of the wall.

   A window will open in which we can choose from a multitude of resources to import to our wall: images from the internet, links, youtube videos, drawings...

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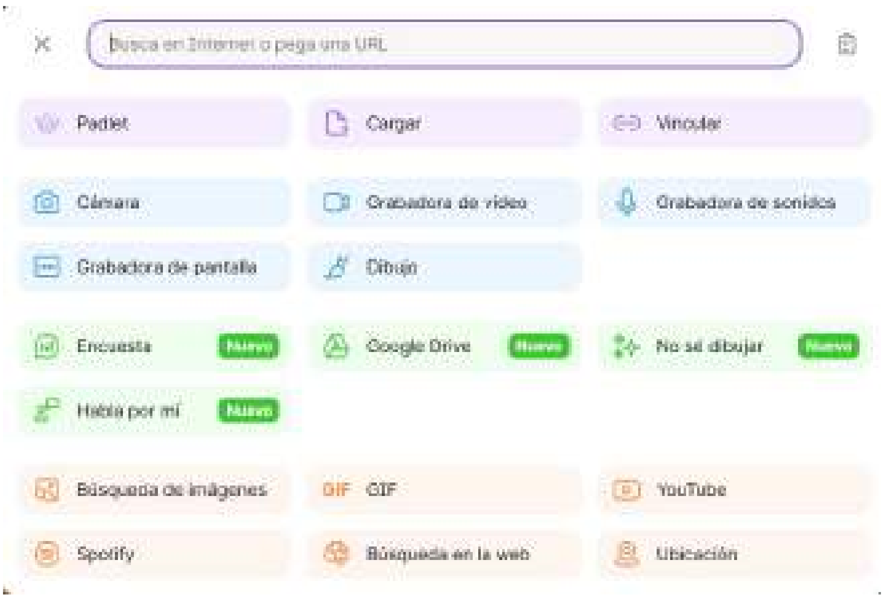

The ‘I don’t know how to draw’ allows you to generate any drawing by AI. You can use it to generate portraits of the artists you have researched.

3. Create a post for each artist, including a **portrait** and a **brief description of their biography**. You can add colour to mark each artist with their work by clicking on the three dots in the top right-hand corner of each publication.

4. Afterwards, surround the artist's entry with **posts of each of her most outstanding works**, in the form of a mural.

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5. You can include **voice recording** entries, reading the texts on your wall and thus make it inclusive for visually impaired people.

Example Of A Padlet:

Share the portfolio

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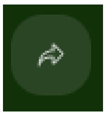
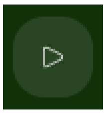
Once you have completed your portfolio, you can share it with your colleagues and comment on the entries you like best.



You can do this via a link or even a QR code.

You can also share it as a slide show.



Conclusion and sharing

Classroom Activity 💡

The students will comment (by presenting the mural they have made) on the artists who have most caught their attention, explaining why, and explaining a little of the research they have carried out.

Discuss In Groups 🗣️

Why do you think some women artists were historically less recognised than their male counterparts?

How has the representation of women in the art world changed over the centuries?

What role does art play in social change and how do you think these artists contributed to it?

You can do a little **research** to compare the situation of women artists in the past with today. Have conditions improved? What challenges remain?

We invite you to share your results in social media by tagging project STEAMbrace:

- LinkedIn: https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name
- Instagram: https://www.instagram.com/steambrace_eu/
- X: https://x.com/steambrace_eu

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Project Evaluation

Activity Objectives	Key Competences (EU)	Evaluation Criteria
Recognise the impact of women in art history	Cultural awareness and expression	Accurate identification of relevant female artists and their main works in the digital mural. Express personal reflections on the importance of women's contributions in the artistic field.
Develop research skills	Literacy	Ability to select and synthesise information about the life and work of the artists in a clear and structured way.
Encourage creativity and digital design	Digital and technology-based competencies	Personalisation of the digital mural in Padlet, with creative use of colours, backgrounds and images to present information in an attractive way.
Encourage teamwork	Interpersonal skills, and the ability to adopt new competencies	Ability to coordinate with others in the collection and presentation of information in the shared Padlet.

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MOTORISING MAGNETS

Duration	Age Range	Difficulty
1 hr	13-14	Medium
#SCIENCE #EXPERIMENTATION		

Description

Have you ever wondered how electricity is 'created'? How could we use it to our advantage? Could we use it to move things?

In this activity, we will learn how with natural forces such as magnetism and the conductivity of materials, we can create an electric motor almost by accident, and we will look at its fundamental characteristics.

Activity Objectives

- Conduct experiments on magnetic fields
- Conduct experiments on motors
- Apply knowledge of magnetism to build a simple motor

Key Competences (EU)

- Numerical, scientific, and engineering skills

Materials

Activity kit:

- Materials for magnetic field activity (magnets)
- Copper coils
- Permanent magnets

Provided by the teacher/institution:

- Lighter
- Sheets of paper
- Steel wool
- Paper clips

- D-type battery
- Sandpaper

Previous Preparation

- Have the materials ready for the practical activities on magnetic fields and motor construction
- Review the activity on magnetic fields

Contextualization and Adaptacion

What do windscreen wipers, CD players, DVD recorders, blenders, ice machines, laptop computers and walking toys have in common? They all contain electric motors. In fact, you can walk around your home and find many electric motors hidden in electrical devices, appliances and toys in every room. Electric motors are an important, even vital, part of our world today. They are everywhere! Almost every mechanical movement you see around you is caused by an alternating current (AC) or direct current (DC) electric motor.

But you may have wondered how do these electric motors work?

To answer this question, let's ask another one first:

Have you ever played with magnets? If so, you are well on your way to understanding how simple electric motors work.

By understanding how a motor works, you can gain quite a bit of knowledge about magnets, electromagnets and electricity in general. **An electric motor produces motion using magnets.** If you have ever experimented with magnets, you will know that the basic rule of magnets is that opposite poles attract and equal poles repel.

Magnets produce a **magnetic field** with a north and a south pole. If you try to bring the north poles of two magnets together, they will not do that. Instead, they will repel each other. The same is true if you try to bring two south poles together. However, if you bring the north pole of one magnet close to the south pole of another magnet, they will attract each other and stick together. In short, equal poles (north-north or south-south) repel, opposite poles (north-south) attract. The stronger the magnets, the more powerful the attraction/repulsion between them.

Magnets modify the space around them, but in normal conditions we cannot see this modification. We can sense that this is the case since magnets often affect things 'at a distance' as shown in this video:

Magnets - attracting and repelling (slow motion)

Let's test it, play a bit with the magnets to see if they attract or repel each other.

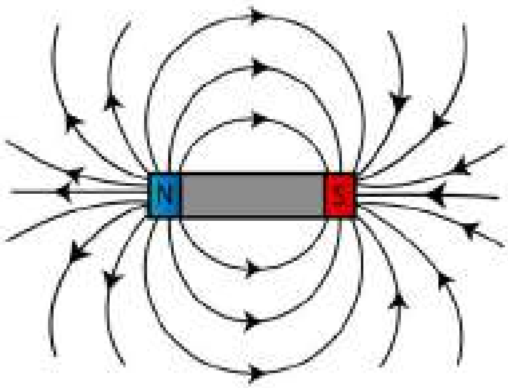
Discuss 🗣

Why do you think this happens? Why do they attract or repel each other, depending on how we arrange them? What does it mean?

Activity

Magnets and magnetised objects, like an electric current, generate a **MAGNETIC FIELD**. This field influences its surroundings, especially affecting those materials that are susceptible to magnetisation.

Magnets have poles where this field is 'born': it 'goes out' at one pole and 'comes back into' the magnet at the other. Normally you cannot see it, but we can draw it. For a rectangular magnet its magnetic field looks something like this:

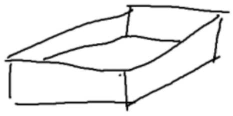


Is it possible to look at these magnetic fields directly, beyond simply knowing that they exist because magnets attract each other?

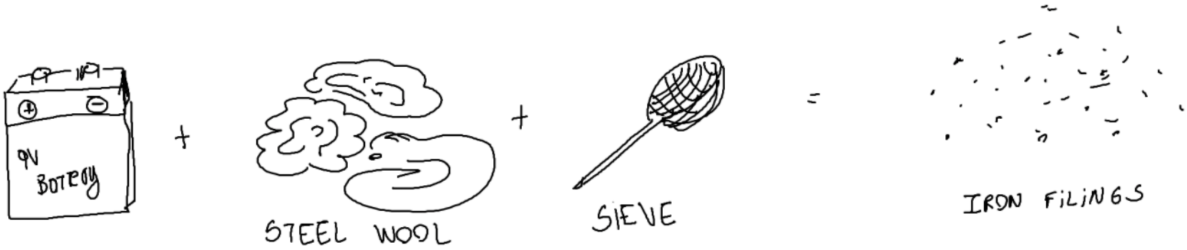
The answer is YES, we can draw them. To do this, we will use different small things that react to this field to generate a drawing. We are going to create our own particles that react to the field using ‘iron filings’:

1º) We get a A4 paper

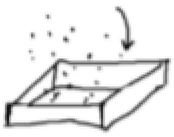
2º) Fold it to make a box



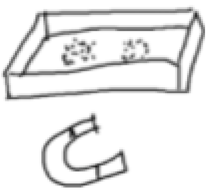
3º) Create iron filings usig steel wool



4) Put the iron filings into the box



5º) Put the magnet under the box. What do you see?



Does it make a Pattern?

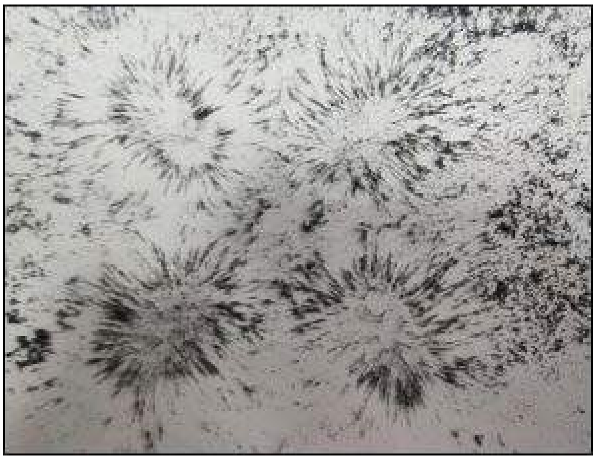
Discuss 🗣️

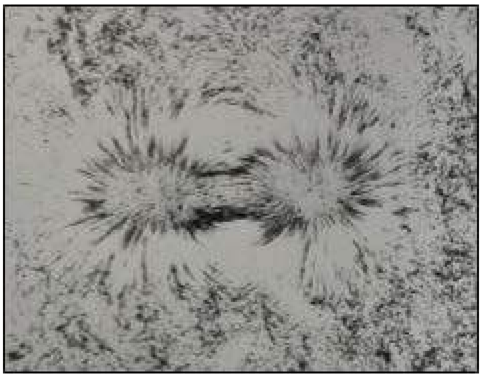
What did you see when you brought the magnet close to the particles created?

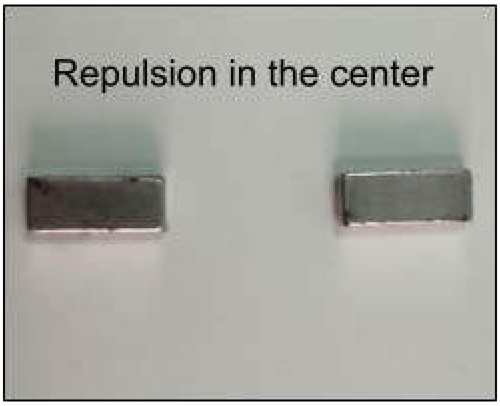
Do you think it will be the same for all magnets?

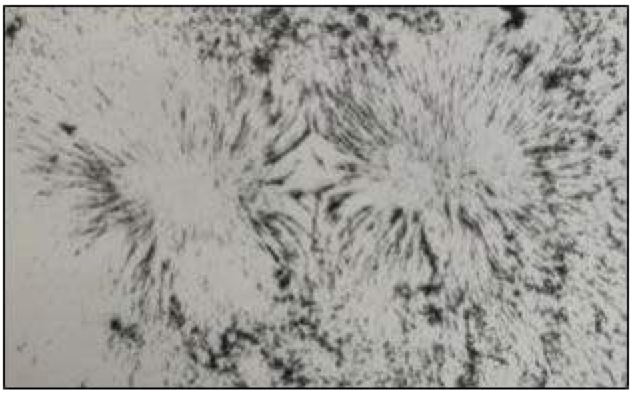
Put forward your hypotheses.

Below are some configurations of magnets to observe how they interact at the magnetic field level when attracting or repelling each other. For this part of the experiment, it is recommended to fix the magnets to the table with adhesive tape, as sometimes iron filings can stick to the magnets in an unwanted way and hinder the observation. Keeping the magnets securely attached will facilitate the work and allow for a more precise handling during the experiment.







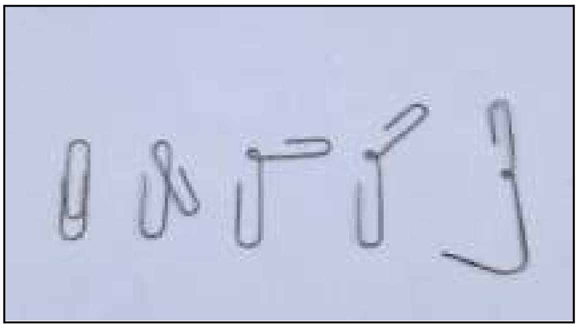


Now, knowing that these fields exist, and harnessing the chemical energy of a battery, we will create our own **MOTOR**. We will learn how to build a simple electric motor and study how simple changes affect the rotation of the motor.

We will use the following materials:

Procedure:

1) Bend the clips to make supports for the wire.



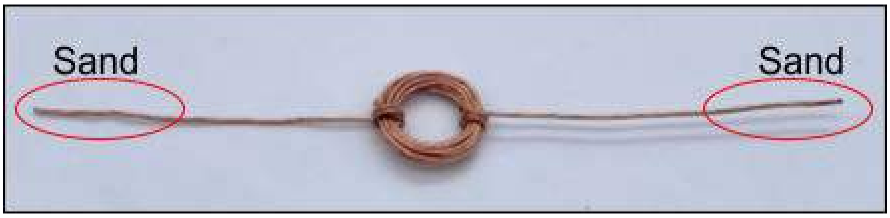
2) Tape the clips to the ends of the battery.


3) Wrap the wire around the marker 10 times to make a coil.

> **TIP** 💡
>
> For the coiling part, it can be useful to make the turns of the coil on a pencil so that it keeps the round shape better.

4) Cut, leaving about 3cm of wire at each end.
5) Wind the ends so that the coil keeps its shape.

6) Thoroughly sand the coating off one end of the wire, but not the whole end, just a portion of the terminals, as shown in the figure below.



7) Put the wire into the clip holders. Make sure that it can rotate freely. If not, adjust the shape of the wire.
8) Put the magnet underneath the coil - your motor may start running immediately! If not, give it a push to get it to start turning.

Discuss 🗣️

How do you think the motor works, and what conclusions do you draw?

What happens if you change the number of magnets or the size of the coil?

An **electric motor** **converts electrical energy into motion** using the magnetic properties of attraction and repulsion. To do this, it combines a permanent magnet, which always has a magnetic field with a north and south pole, and an electromagnet, which only produces a magnetic field when an electric current flows through its coil. Unlike the permanent magnet, the electromagnet can control the strength of its magnetic field by changing the amount of current or by making multiple wire turns. This design allows electric motors to operate, creating the rotation needed to run various devices.

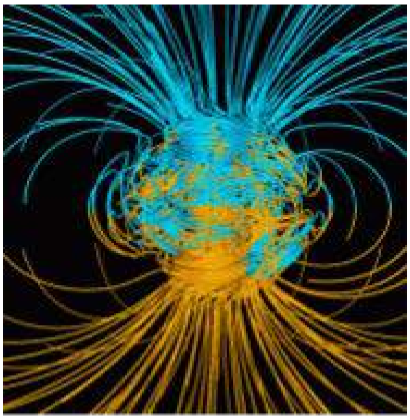
Broadly speaking, the electric motor works because when current flows through the coiled conductor, a magnetic field is generated in a very peculiar way:

[Magnetic field of a coil explained]

[Magnetic Field of a Coil] (minute 1:18)

This field interacts with the magnetic field of a permanent magnet (the one attached to the battery), which causes the two magnets to attract or repel each other depending on the polarity. The force of attraction and repulsion causes the electromagnet to rotate. To keep the motor running continuously, the current flow is controlled so that the forces always push the electromagnet in the same direction, allowing the motor to keep turning and convert electrical energy into motion.

Another interesting fact to work on as we finish this session is to mention that the **earth itself is a large magnet**, which has magnetic north and south poles opposite to each other.



Public Domain,
https://commons.wikimedia.org/w/index.php?curid=1712490

The Earth's magnetic field allows us, among many other things:

- *To have an atmosphere*
- *To protect us from external radiation, especially from the sun and cosmic rays.*

In conclusion: Let's hear it for magnets!

Conclusion and sharing

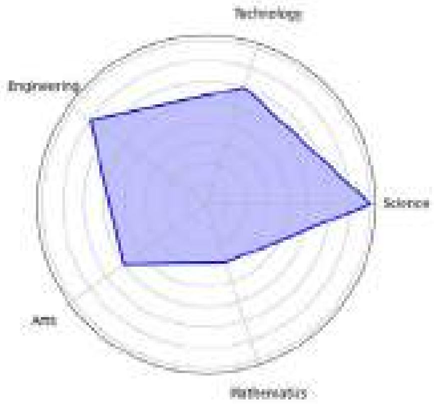
Discuss and Comment 🗣️

1. What would happen if we took away the Earth's magnetic field? How would it affect life on Earth? Let's think... Are there other things we know about that we can reference?
2. What was the most surprising thing about seeing how magnets interact?
3. Do you think the earth as a big magnet is useful to us for something else? How can we find our way around, with what instrument, and how do you think it works? → Hint: it shows us the cardinal points.
4. What do you think would happen if we bring a compass close to a magnet?

Show us your engine running by tagging us in social media!:

- LinkedIn: https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name
- Instagram: https://www.instagram.com/steambrace_eu/
- X: https://x.com/steambrace_eu

THAT’S A LOT OF ENERGY



Duration	Recommended Age	Difficulty
1,5 hrs	13-14	High
#SCIENCE #CRAFTS #PROGRAMMING		

Description

Get ready to build your own electricity-generating anemometer! In this workshop, we will become wind engineers. First, we will learn about the functioning of anemometers, those devices that measure wind speed. We will use materials such as cups and depressors to build the structure and then, through a simple motor, we will make the anemometer harness wind energy to produce a small electric current.

As the wind blows, we will see how the motor transforms kinetic energy into real electricity. In addition, we will learn key concepts in physics and electronics, and at the end, we will test the anemometer outside to see how it measures the force of the wind and generates energy.

Activity Objectives

- Understand the concept of wind energy and its conversion into electricity.
- Become familiar with the operation and construction of an anemometer.
- Explore basic concepts of physics and electronics.
- Develop construction and problem solving skills.
- Encourage teamwork and learning by doing.

Key Competences (EU)

- Numerical, scientific, and engineering skills
- Digital and technology-based competencies
- Active citizenship
- Entrepreneurship

Materials

Activity Kit:

- Micro Controller
- Motor
- Connection Cables

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- Buzzer

Provided by the teacher/institution:

- 4 small cups
- Large cups
- Cardboard
- Craft Sticks
- Optional: paint for decoration, EVA foam sheets, colored construction papers,...

Previous Preparation

- Create of working groups (2-3 participants)
- Prepare the materials
- Install the hello,blocks! drivers if you have not worked with the Cirkids microcontroller before (https://www.hello-blocks.com/editor/).
- Set up the equipment/devices

Contextualization and Adaptation

Choose The Best Renewable Energy

In this session we will work on renewable energies and how to understand roughly why a form of energy is selected for implementation in some places and not in others.

Participants are invited to look for information on the type of energy that their country presents in the application:

Application - Electricity Maps
https://app.electricitymaps.com/zone/ES?lang=es

Do you think it makes sense given the climatic conditions of the site?

It is also recommended to watch the following video:

Watch Video 📽️ - "Can 100% renewable energy power the world? - Federico Rosei and Renzo Rosei".
Can 100% renewable energy power the world? - Federico Rosei and Renzo Rosei

Classroom Activity 💡

- Think of at least 5 different types of renewable energy. Ideally, you should choose energy sources that are within a radius of 200 kilometres from where you live. For this you can use the Electricity maps website where you can see what percentage of electricity in each country is produced by renewables and which is the most used.
- Look for information on which is the most efficient and which has the least impact on the environment where it is installed.

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- Each group chooses one renewable energy from this list and makes a presentation to defend why it is the best. Remember to put your ideas in order and substantiate your research.

Note For The Teacher 📝 Divide students into groups to do this activity efficiently. The aim of this exercise is to analyse the different renewable energies, all their advantages, and to find out which is the most suitable for each location according to the local conditions. We also want the students to learn to defend and present their ideas in an orderly and well-founded way.

Sketch design and role-playing as 'wind engineers'

For today's activity we will focus on wind energy.

To find out if a site is suitable for installing such generators, we first need to know if it has the necessary resources to do so, such as a sufficient amount of wind to make it profitable.

Could we be able to measure this amount by creating our own weather station?

Classroom Activity 💡
- Knowing what an anemometer is, in the same groups as in the previous activity, make a sketch of the anemometer before building it, indicating where the cups will be and how the motor will work. Try to anticipate possible design problems.
- Innovation in the design of the prototype and originality will be highly valued.
- Role-play as 'wind engineers': Students will act as engineers who have to explain to 'clients' (other classmates or teacher) the design of the anemometer and how it will generate electricity.

Note For The Teacher 📝 This activity aims to encourage creativity, teamwork and problem anticipation. In addition, role-playing facilitates the understanding of the device's functionality and reinforces learning through explanation in an entertaining context.

Activity

Watch Video 📽️ - Cirkids Tutorial + Hello Blocks Platform - (available subtitles)

1- **Cirkids, creando circuitos**

2- **Tu primer invento con: Cirkids**

3- **Circuitos electrónicos con Cirkids**

4- **Cirkids y las conexiones eléctricas**

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5- **Saca todo el potencial con Cirkids**

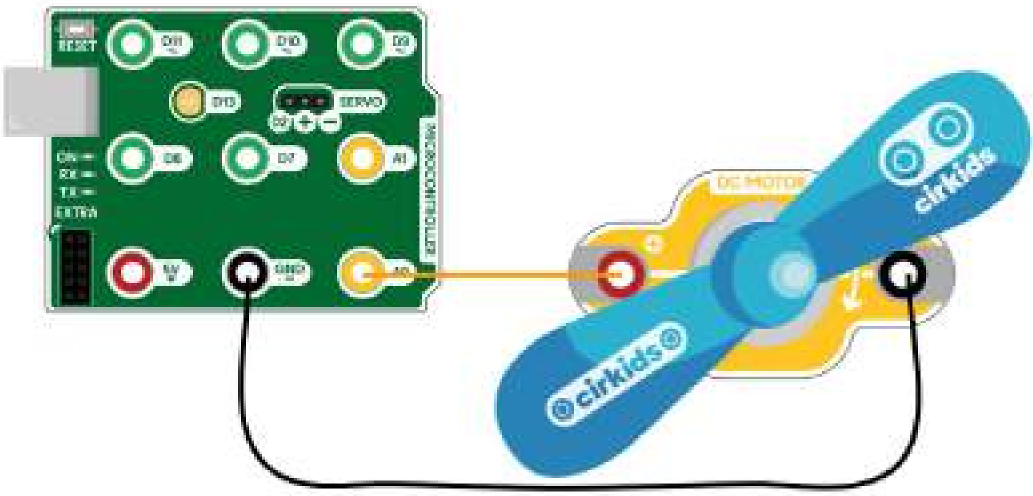
6- **¡Hola Microcontrolador!... con Cirkids**

You can access the tutorial playlist directly at: **Your first invention with CirKids**

Step 1 - Connect The Components

The Cirkids motor is often used as a fan; however, on this occasion it will be the key element of an anemometer. When rotating, the motor generates an electric current, and is often used as a dynamo, alternator or wind generator. This motor has the ability to function as an actuator, generator and even a sensor. In this case, it will become the centrepiece of the anemometer, capable of generating a small electric current in the wind. Although this current cannot power other devices, it is sufficient for use as a sensor.

To check it works, connect the components following the diagram shown in the image.



Warning:

The cirkids motor can only be activated by using the power supply terminals (5V) and (GND) on the cirkids microcontroller board or by using the battery holder to supply the power.

Step 2 - Display Values

Once the components are connected, load the following code that will display the values collected by the analogue input on the serial console.

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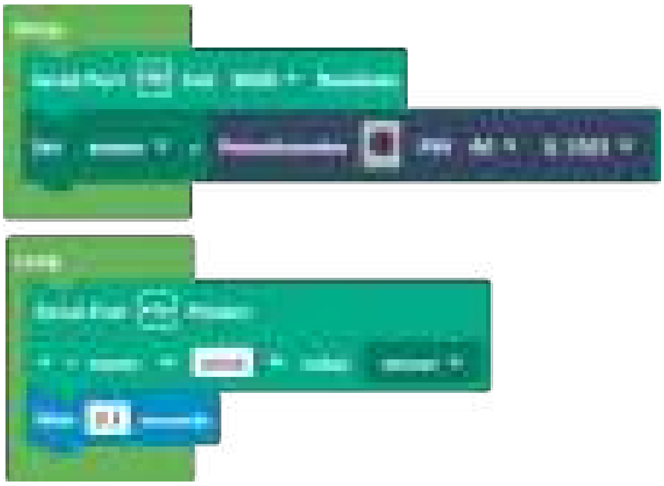

Once the code is loaded, run the console monitor and select the graph tab to display the values obtained by the motor. Note down the maximum values and observe the direction of rotation required to display them correctly.

Note For The Teacher 📝
In the Hello,blocks! platform, there is no specific block for analogue input, so we use the potentiometer block to obtain the reading of the A0 pin. This block, by default, returns values on a scale from 0 to 100%. However, due to the low variation of values produced by the weak signal from the motor, we have decided to change to a scale of 0 to 1023 to obtain a higher resolution and display the information more accurately.

The motor will only return information when it rotates in the correct direction. The students will see that, with the original propeller, it is very difficult to turn the motor using only the wind, so they will have to use their hands to turn it.

Step 3 - Build The Anemometer

To move the engine with the force of the wind, you should replace the propeller with a craft sticks anemometer. Thanks to its three or four blades, mounted at the end of the horizontal

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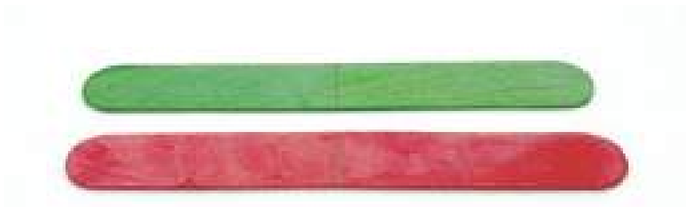
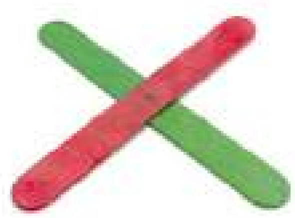
arms and centred on the shaft, the anemometer is able to measure the horizontal wind flow in any direction.

Note For The Teacher 📝
The images show the proposed materials, although they can be adapted to the resources available in the classroom to achieve a similar performance.

Step 4 - Create The Structure

Since the blades of the anemometer will rotate rapidly, it is very important that all the elements are centred to avoid possible vibrations. Remembering the leverage effect, the greater the distance between the blades and the centre of the shaft, the less resistance to movement they will offer.





This time we mark the centre of these two 15cm craft sticks at 7.5cm. Then we glue the two sticks together with white or contact glue.

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Step 5 - Movement Shaft

Once you have built the cross that will support the blades of the anemometer, take the opportunity to mark its centre point. Then, use a pointed object to create a hole through both pieces of wood. Once marked, remove the propeller from the Cirkids motor and try to insert the motor shaft into the base of the anemometer. Both components will be held together by pressure, so repeat the process as many times as necessary until you get a firm connection between the two parts.

Note For The Teacher 📝

This can be the trickiest part of the session, as you need to create the hole carefully. If you overdo it and the hole is larger than the shaft, the shaft will rotate freely and will not work properly.

Step 6 - Add The Blades

At this point, you must create the anemometer blades, which will be responsible for capturing the wind force and transmitting it to the motor shaft. It is important to position the blades so that the motor rotates in the correct direction, as indicated by the arrow on the module's PCB. If you use bowls or cups, as in the example shown, remember that the deepest part of the container will be in charge of collecting the wind and pushing the motor in that direction.

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To take advantage of the leverage effect mentioned above, glue the blades to the ends of the base.

Step 7 - Create The Base

With all the elements connected, find a base to support the structure so that it can rotate freely during the tests.

Note For The Teacher 📝
You can use the connection terminals and pass them through the cup to hold all the components.

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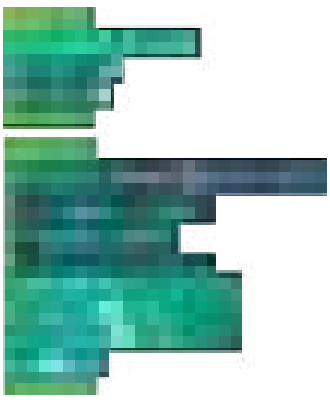
Step 8 - Take Measurements

Once all the components are ready, go back to programming in Hello,blocks! to analyse the values obtained.

Note For The Teacher 📝
If the blades are mounted the wrong way round and the motor turns in the wrong direction, you can swap the connection cables with each other to correct this and get the correct values.

Step 9 - Record Values

Once you have visualised the data provided by the anemometer, it is time to improve the program. Modify your code following the example shown. Before loading the program to test its operation, discuss what you think the expected result will be.



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Note For The Teacher 📝
The code has been modified by adding a new variable with the value MAX, which together with the structure conditions has the function of registering the maximum value collected by the sensor. When included in the Plotter function, this maximum value will be reflected as a continuous red line as a reminder of the highest reading.

Step 10 - Create Alarms

With the maximum values detected by the anemometer, add two indicators to your program. First, the on-board LED 13 should stay on when the anemometer is in motion. In addition, a buzzer connected to a digital pin on your microcontroller should alert the user when the anemometer reaches high values, close to the limit you have previously recorded.

Note For The Teacher 📝
Below is an example of possible code where the two new conditional structures and a global variable to record the trigger value for the audible alarm have been included.

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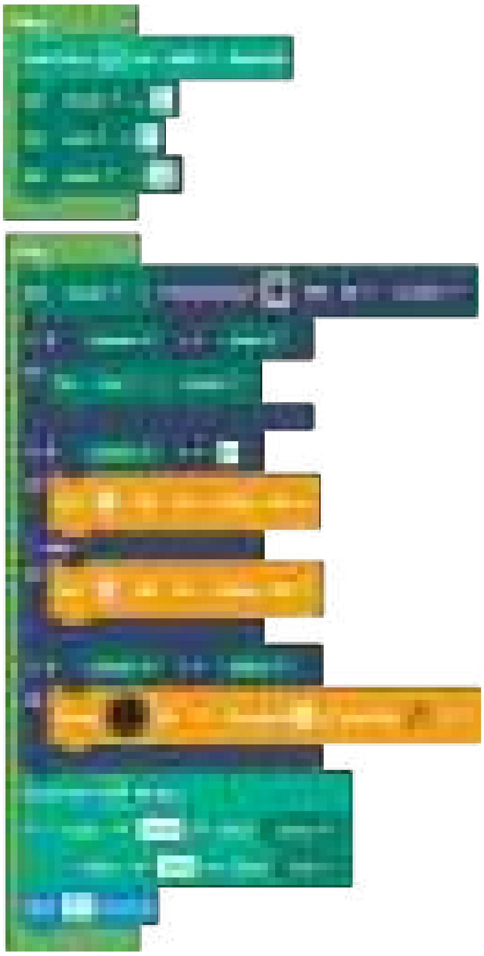

Conclusion sharing

Today, we learned that wind power is a powerful source of renewable energy that can be harnessed in ingenious ways. But in order to do so, we must know that it will be feasible to have wind power wherever we are going to install it. By building and testing our own anemometer, we not only gained a better understanding of how electric generators work, but also discovered how it is possible to measure and use wind power for practical purposes.

Discuss In Groups 🗣️

What would you change in the design if you were to repeat the project?

Do you think renewable energies will be able to completely replace fossil fuels in the near future? Why or why not?

How do wind turbines impact local wildlife and what measures can be taken to minimise these impacts?

Were there any renewable energies that you were not aware of or did not know about their impact?

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How did your anemometers perform?

We invite you to share your results on social media by tagging the STEAMbrace project:

- LinkedIn: https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name
- Instagram: https://www.instagram.com/steambrace_eu/
- X: https://x.com/steambrace_eu

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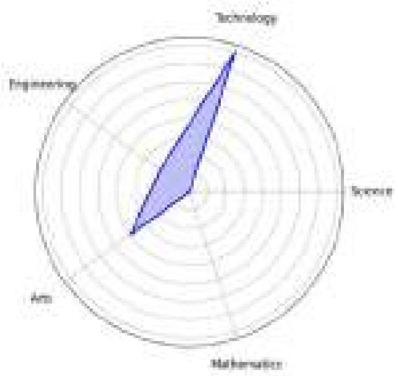
SCHEMATIZED



Duration	Age Range	Difficulty
1 hr	13-14	Baja
#IA #INVESTIGATION		

Description

Have you ever considered how AI could help you study better and make the most of your study time?

In this activity, you will discover various AI tools that can help you gather accurate and verifiable information and how to process it to create summaries and outlines for later study. None of them can learn things for you, but they will allow you to save a lot of time to better prepare for your exams.

Objectives of the activity

- Learning about prompting to handle large amounts of information
- Discovering new study techniques and learning tools
- Learning about how AI works

Key Competences (EU)

- Literacy
- Digital and technology-based competencies

Materials

Provided by the teacher/institution:
- Computers with an internet connection

Previous Preparation

- If students do not have their own accounts, specific ones should be created for their use in signing up to the AI tools we are going to use, specifically Gitmind, which is the only one that cannot be used without registration and has a limited number of daily tokens.

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Contextualization and Adaptation

What are your thoughts on AI?

Classroom activity 💡The following questions are posed to the students.
- Do you think computers are smart or dumb?
- Are the computers you have at home capable of thinking like you do?
- What do you think Artificial Intelligence is?
- How do you think Artificial Intelligences learn?

Notes for the teacher 📝
Artificial intelligence is the ability of machines to perform tasks that normally require human intelligence. This includes learning, perception, reasoning, and decision-making. Unlike conventional computer systems that follow programmed instructions, AI systems can learn from data and adapt to improve their performance over time

The most accurate answers to the questions posed to the students would be the following:

- Do you think computers are smart or dumb? → The computers that each of you may have at home are "dumb". They don't know how to do anything unless you specifically tell them what you want them to do. If you don't double-click, exactly how it understands the double-click, it won't open the file, or it might even try to rename the document... Computers only follow orders.

- Are the computers you have at home capable of thinking like you do? → No, the computers you have at home, although they are powerful tools, are not capable of thinking like human beings. They can process and analyze large amounts of data, perform complex calculations, and execute programmed tasks efficiently, but they do not have the ability to understand, reason, or have consciousness like humans.

- What do you think Artificial Intelligence is? → Artificial intelligence, or AI, is a technology that allows computers and machines to do things that you'd normally need a person to do. For example, when a robot can play a game, talk to someone, or help find something on the internet, it is using AI.

- How do you think Artificial Intelligences learn? → AI works because people teach computers how to learn from the data they have been provided with and how to make decisions based on it. It's a bit like when you learn to ride a bike: at first, you fall and learn how to balance. Computers learn in a similar way, but instead of falling, they use a lot of data to "practice" and get better at what they do.

To help the students to better understand what an AI is, we'll show them the following video.

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¿How does everyone study?

Discuss and research together 🗣️

We ask students what study methods they use: Do they make summaries? Do they watch videos on the topic? Do they just read the text?...

We will also ask them if this changes from subject to subject. Do they think there are better ways to study each one?

Do they know any standardized study methods? Example: Pomodoro - Cornell Method - Concept maps - etc. → **Research** different study methods and present some

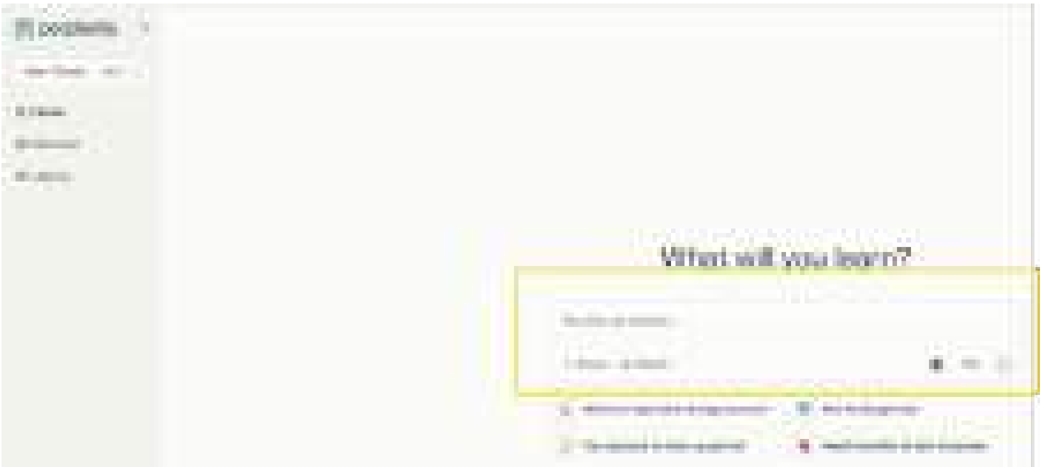
Activity

Searching for information

For this activity, students are asked to search for information about **women in the history of energy**, for this they will use 2 AIs, and finally, present the information collected and comment on the way they present it.

-Perplexity: Is a chatbot based on ChatGPT with search engine functions similar to Google, you can ask it to search for information, summarize it or present it in the way you think is most appropriate. One of its advantages over other AIs and search engines is that it provides the links it has used to obtain the information, so you can verify the accuracy of this information.

Step 1. Go to perplexity.ai.



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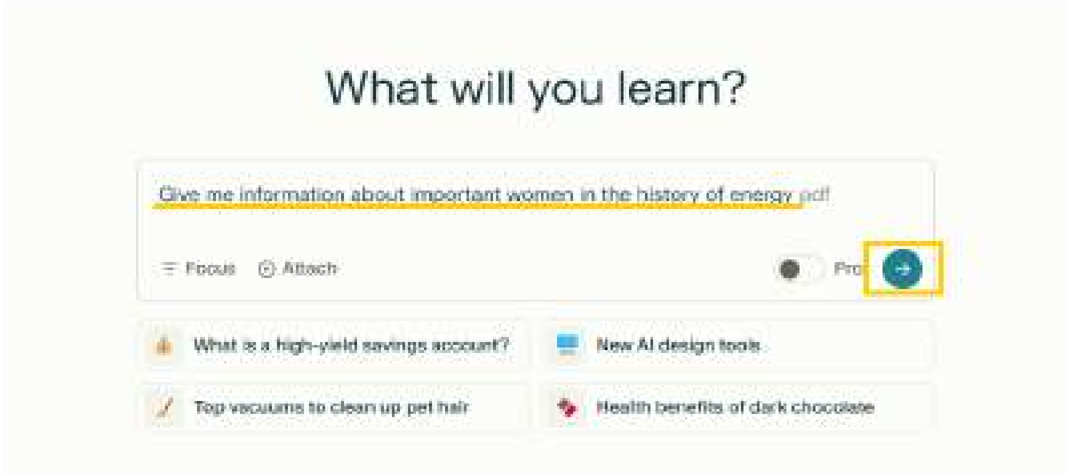
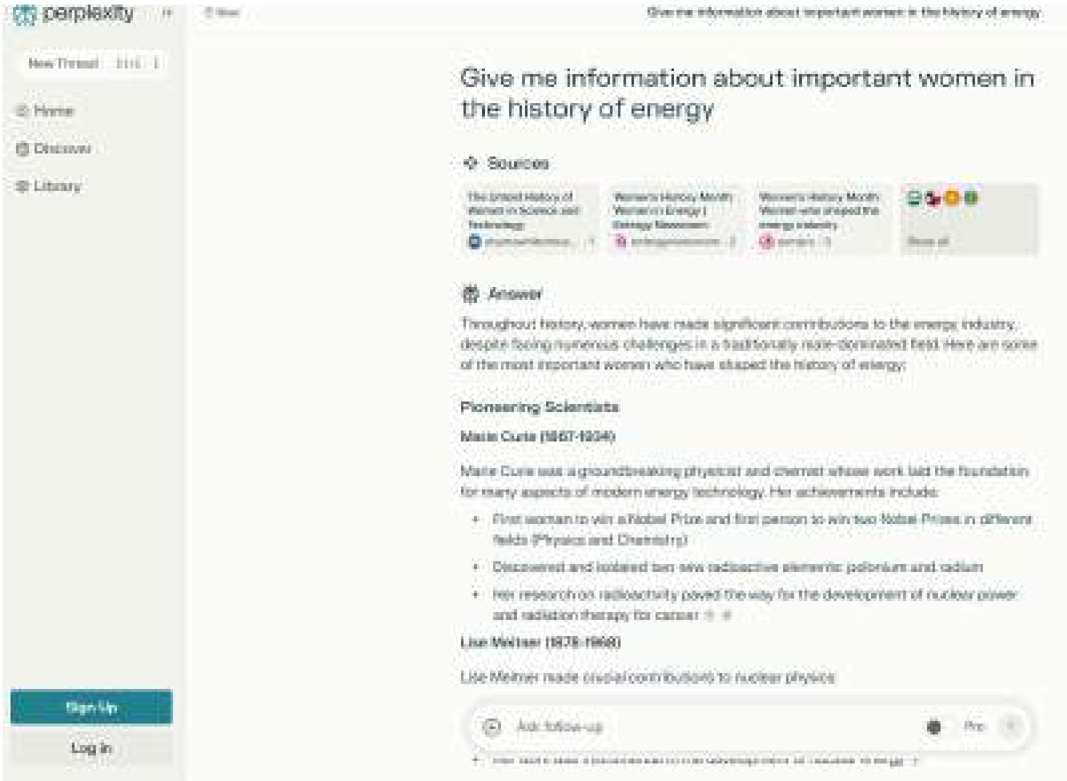
Step 2. Create a prompt with the query you want to ask.



Step 3. Review the information and the sources it has used to generate it, if you are convinced, save it in a text document and if not, you can continue making corrections or requesting that it summarize the text further.



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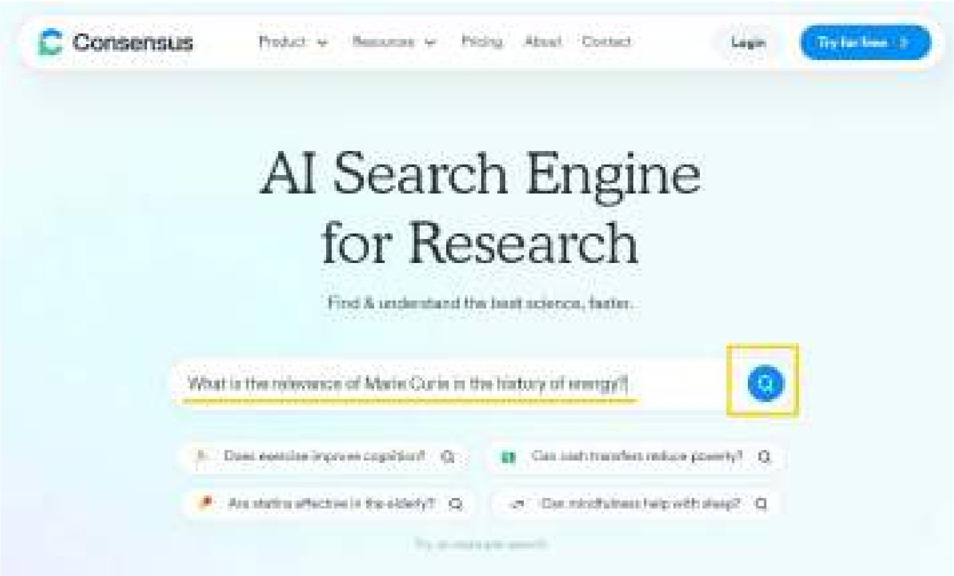
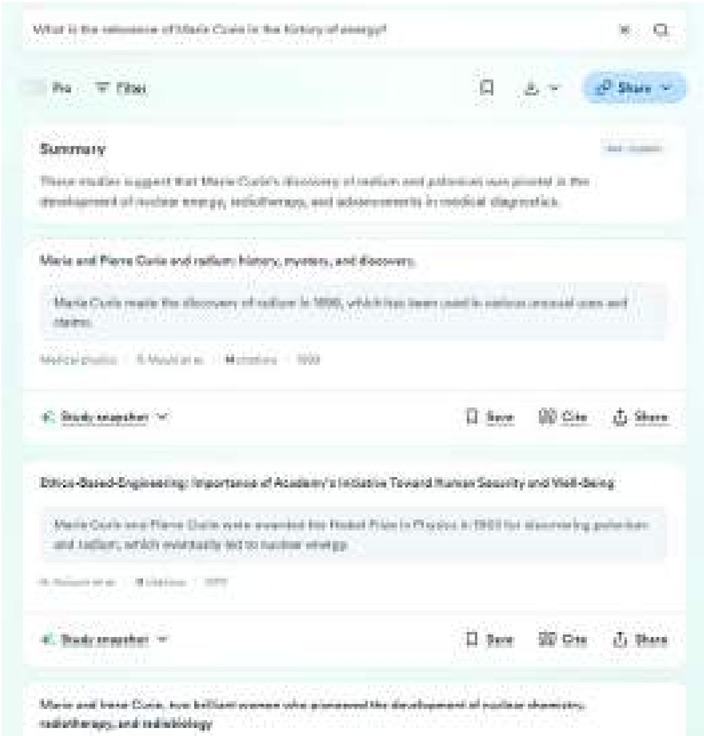
-Consensus:.Is an AI trained on a vast amount of scientific data and documents, perfect for ensuring that you use correct data or, in the case that a topic is subject to debate by the scientific community, seeing the arguments for and against different positions and their degree of acceptance by the scientific community.

Step 1. Go to consensus.app and write the prompt you need.



Step 2. Review the scientific articles and ask perplexity to summarize them or add them to the information you already have.



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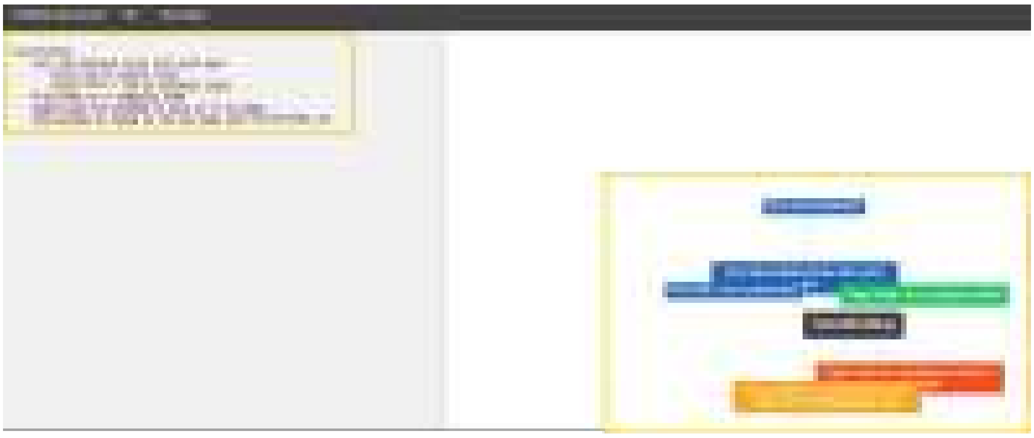
Organizing information

Now that you have gathered a lot of information, we need to structure it in a more visual way to help you study it later. To do this, we will use two different AIs depending on the result you want to obtain.

-Tobloef: This AI tool allows you to generate mind maps simply by using the tab key to separate ideas into levels. Additionally, we can pass a template to an AI like Perplexity to have it do the work for us directly.

Step 1. Go to tobloef.com



Step 2. Ask Perplexity to generate a list of concepts using the Tobloef example and the information you pass to it later, following the logic of Tobloef.

Please organize the following information into a mind map structure using the Text2MindMap format. Use the following guidelines:

1. Use tab indentation to create hierarchies:
    - Press Tab to indent lines for subtopics
    - Press Shift + Tab to unindent lines for higher-level topics
2. The first line should be the main topic or central idea.
3. Use short, concise phrases for each node.
4. Create a logical hierarchy of ideas, with more general concepts at higher levels and specific details in lower levels.
5. Aim for a balanced structure with 3-7 main branches.
6. Use consistent formatting throughout the mind map.

Please format the information I provide below into this tab-indented structure, ready to be input into Text2MindMap:

[Insert your information here]

Remember, the resulting structure should be easily convertible into a visual mind map, where:

- Nodes can be dragged to reorganize them
- The mind map can be saved as an image by right-clicking

Women in Energy History
Pioneering Scientists
Marie Curie (1867-1934)
First woman to win Nobel Prize
Discovered polonium and radium
Research on radioactivity
Lise Meitner (1878-1968)
Discovered nuclear fission
Calculated energy from fission reactions
Electrical Engineering Trailblazers
Edith Clarke (1883-1959)
First female electrical engineering degree from MIT
Invented Clarke Calculator
First female electrical engineering professor at UT
Solar Energy Innovators
Mária Telkes (1900-1995)
Designed first solar-powered house
Invented solar still for water purification
Groundwork for modern solar heating
Energy Efficiency and Heating
Alice H. Parker (1895-1920)
Invented gas-heating furnace
Paved way for modern home heating
Contemporary Leaders
Hazel R. O'Leary (1937-present)
First female U.S. Secretary of Energy
Advocated for renewable energy
Supported black colleges in environmental fields

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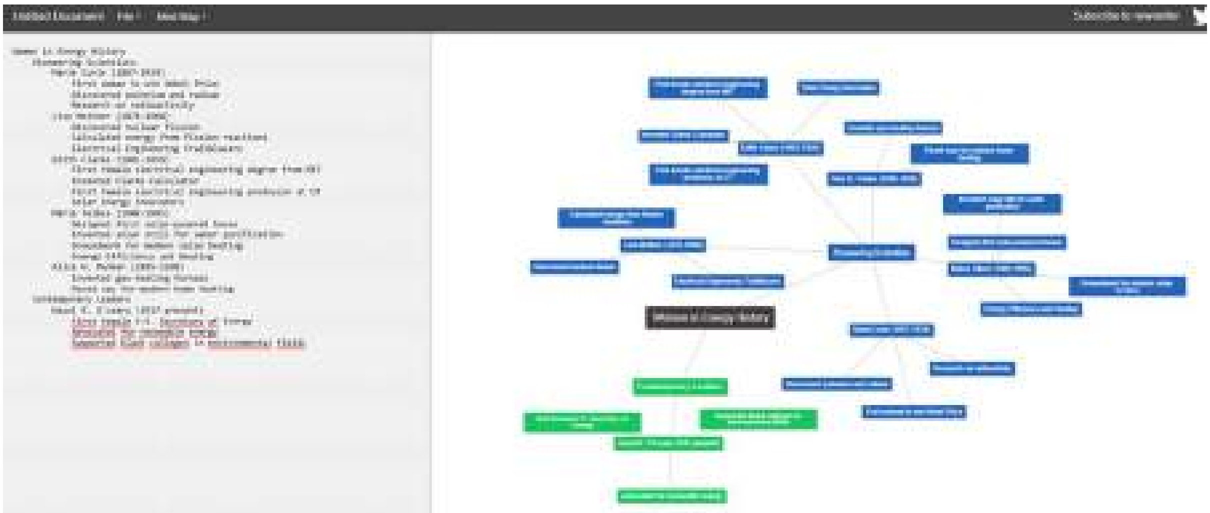
Step 3. Paste this information into Tobloef

Step 4. Using the tab key, organize the information and modify it if you consider it necessary.



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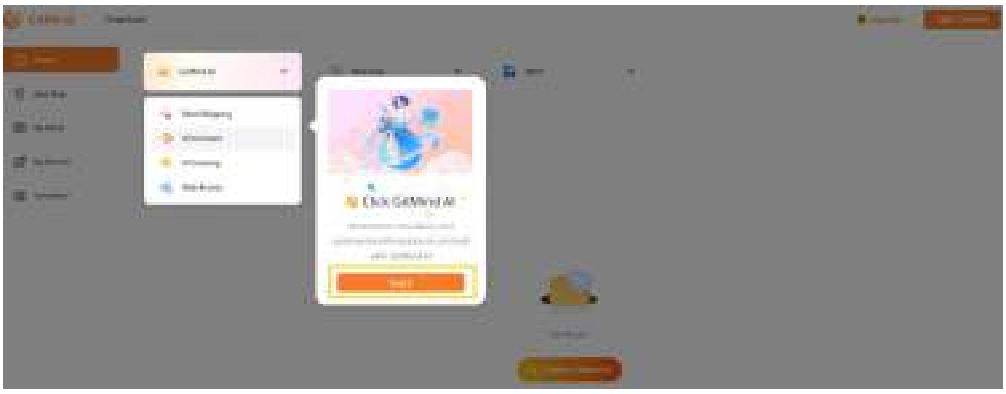
-GitMind: This tool integrates both the capabilities of Perplexity and Tobloef into one but has a credit limit. In addition to allowing us to make more types of diagrams and even flowcharts, we can set a main topic and just with that, it generates a whole outline or even from a text document that we attach to it.

Step 1. Go to gitmind.com

Step 2. Skip the tutorial



Step 3. Sign in using an account

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Step 4. Choose Gitmind AI in order to use the full potential of this tool

Step 5. Select mind mapping and create a prompt for it to generate an outline based on it. It can be a simple one as you have done before or you can pass it all the information you have gathered for it will create an outline based on it. Depending on the difficulty of the tasks the consumption of credits will be greater or lesser, every day these credits are renewed.

Step 6. Once it has processed the prompt, it will ask you to validate the outline it has generated with a distribution similar to what you have done manually in Tobloef. Modify what you consider necessary and once you are ready press the Generate button at the bottom to generate the outline.

Step 7. Edit the outline, you can change both the appearance and the type of visual distribution that you think is most suitable. To do this, go to the magic wand icon and in the theme section you can change the main color of the outline and in layout you can edit the layout.

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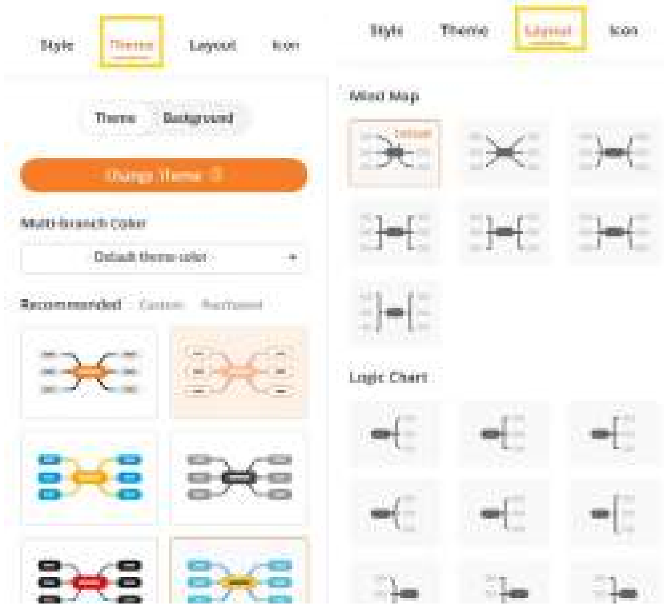

Conclusion and sharing

> **Classroom activity** 💡
>
> We started this session with a question "What is your opinion about AI?".
>
> Now, after learning how to use these new tools, has your opinion about AI changed? Did you know these tools?
>
> Do you think we could apply this to learn non-academic things? For example, if we wanted to learn about photography, could it help us?
>
> Do you usually verify the information you find on the internet with other sources? Do you think you will start doing it more from now on?
>
> To finish, present all the information you found about women in the history of energy. Does the name **María Talkes** sound familiar to you now?

We can conclude that, although AI cannot learn for us, it can optimize and improve our way of studying, making it more efficient and organized.

Do you think that AI, as time goes by and it develops, will be a more reliable source of information than a traditional search engine?

We suggest you share your results on social networks mentioning the STEAMbrace project:

- LinkedIn: https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name
- Instagram: https://www.instagram.com/steambrace_eu/
- X: https://x.com/steambrace_eu

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Project evaluation

Activity Objectives	Key competences (EU)	Evaluation Criteria
Learning about prompting techniques to manage large amounts of information	Digital and technology-based competencies	Ability to formulate clear and specific prompts to obtain relevant results from AIs. Ability to assess the quality and accuracy of the information provided by the AI, including reviewing sources.
Discover study techniques and tools	Literacy	Effective application of AI tools such as Perplexity and Consensus for information search and analysis. Creativity in presenting organised information, using diagrams, concept maps, and other visual resources.
Learn about how AIs work	Digital and technology-based competencies	Reflection on how AIs can optimise and improve study methods, particularly in relation to the use of information and organisation. Awareness of the limitations and advantages of the AI tools used (for example, the need to verify the information obtained).

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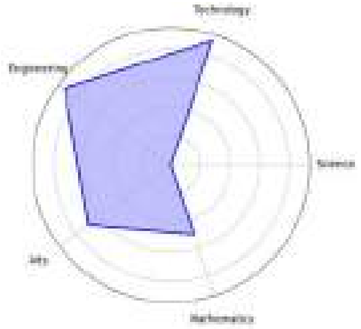
Rock, paper, scissors



Duration	Age Range	Difficulty
2 hrs	13-14	Low
#GAME #PROGRAMMING #ROBOTICS		

Description

In this activity, students will create and programme a circuit with Cirkids that simulates the mythical game of rock, paper, scissors. Using three LEDs, a light sensor and a microcontroller, they will learn to connect and control electronic components. Then, using expendable materials, they will design the structure to make their game even more fun.

Activity Objectives

- Develop basic programming and logic skills
- Become familiar with electronic components and their connection and integration into a circuit.
- To understand how some electronic components work
- Encourage creativity
- To promote teamwork and problem-solving

Key Competences (EU)

- Numerical, scientific, and engineering skills
- Digital and technology-based competencies
- Interpersonal skills, and the ability to adopt new competencies
- Entrepreneurship

Materials

Activity kit:

- Microcontroller
- Led
- Bicolour LED
- Led flash
- Connection cables
- 10k resistor
- Light sensor
- Buzzer

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Provided by the teacher/institution:

- Computers
- Cardboard
- Scissors
- Glue
- Optional: paper and paints for decoration

Downloadable elements:

- Complete programme

Previous Preparation

- Creation of working groups (2-3 participants)
- Preparation of materials
- Installation of the hello,blocks! drivers, if you have not worked with the Cirkids microcontroller before
- Configuration of the equipment/devices

Contextualization and Adaptation

Researching the history of gambling

Gambling has been an integral part of human culture throughout history, manifesting itself in various forms and contexts. One of the earliest recorded examples of gambling appears in ancient Sumer around 3000 BC. The Sumerians used astragali (animal ankle bones) to perform games of chance, as well as predictions in religious ceremonies. Because of their irregular shape, astragali could fall into various positions when thrown, thus providing an element of uncertainty similar to modern dice, of which they are a predecessor.

Rock, paper, scissors is one of the world's most popular games of chance and strategy. Its origin dates back to Han Dynasty China (206 BC-220 AD). The game moved from China to Japan and from there to the West in the 20th century, becoming very popular all over the world and widely used to decide who, among a group of people, has to perform a certain task. **What other games of chance do you know?**

Classroom Activity 💡Ask students to make a list of the games of chance they know. Are any of these games digital (e.g. magic 8-ball)?

Watch video 📽️ **- 'Gambling and mathematics'. (subtitles enabled)**
Los juegos de azar y las matemáticas.

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Using mathematics to our advantage

We are going to learn how the game of ‘Rock, Paper, Scissors’ between people have little to do with chance and a lot to do with mathematics and strategy.

Classroom Activity 💡Let's learn how the game of ‘Rock, Paper, Scissors’ between people have little to do with chance and a lot to do with mathematics and strategy.

Watch video 📽️ - “The Way To Win Every Rock Paper Scissors Game”.

https://www.youtube.com/watch?v=yy6PwbO6chc

Note for the teacher 📝After watching the introductory video, students divide into groups and discuss whether there is a way to use probability to our advantage to win games of chance.

Creative design and planning activity

Classroom Activity 💡Hand out expendable materials (cardboard, paper, tape, etc.) and set up a short design activity in which students draw or construct a sketch of the support for their game. They can think about what the physical presentation of their ‘Rock, Paper, Scissors’ circuit would look like to make it more fun and interactive.

At the end, let them explain their ideas to the group, encouraging creativity and personalisation of the project.

Note for the teacher 📝This activity aims to encourage creativity by encouraging students to make an original sketch of what will later become their programmed game support. Where will the wires go? How will the microcontroller be attached?

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Activity

Watch video 📽 - Cirkids' tutorials + Hello Blocks platform - (available subtitles)

1- **Cirkids, creando circuitos**

2- **Tu primer invento con: Cirkids**

3- **Circuitos electrónicos con Cirkids**

4- **Cirkids y las conexiones eléctricas**

5- **Saca todo el potencial con Cirkids**

6- **¡Hola Microcontrolador!... con Cirkids**

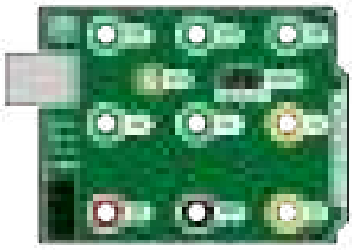
You can access the list of tutorials directly at:

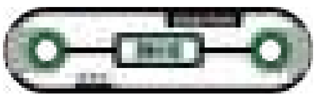
Your first invention with CirKids

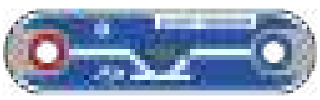
Hello blocks platform: https://www.hello-blocks.com/editor/

1. **Measuring the light level**

In order for the system to detect when the user is making a move, we are going to use a light sensor, so that when the player extends his hand and partially covers the sensor, the light intensity received by the sensor decreases, which can be used as a signal to start the game.







Use these elements to design a circuit that detects the ambient light level. The positive pole of the light sensor must be connected directly to the 5V terminal of the microcontroller. As for the negative pole, it will be connected, on the one hand, to an analogue pin (A0 or A1) and, on the other hand, to GND through the resistor.

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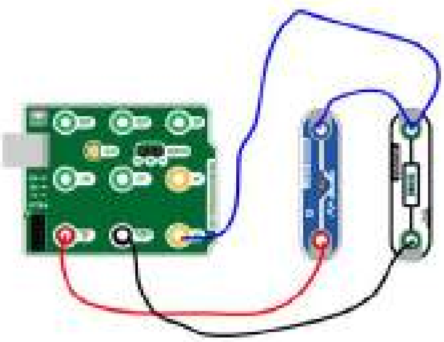
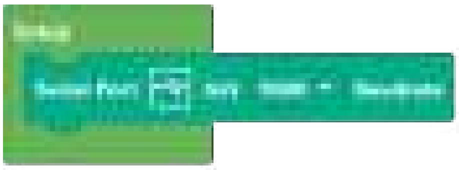
Solution to the circuit:

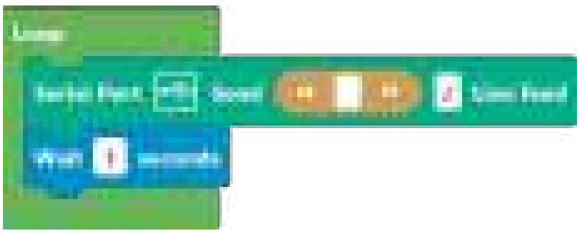


For the light level received by the sensor, you will have to convert this magnitude into a numerical value. To do this, you must use the communications built into the Cirkids microcontroller module.

To activate the serial port, go to the Hello, Blocks! platform and add the ‘Initialise’ block to the ‘Initialise’ block, which is located in the ‘Serial Port’ block group.



Now include in ‘Loop’ the blocks ‘Serial Port Send’ and ‘Wait’.



Also include the ‘Light sensor’ block so that when the monitor starts up, it displays the data from the light sensor.

Next, connect the microcontroller to the computer with the USB cable and click on ‘Connect’ at the top of the Hello, Blocks! screen, then run the programme by clicking on the ‘Upload’ button, and then open the monitor.

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Note for the teacher 📝

In this and the following activities, the serial monitor will be used so that the microcontroller sends the data received by the sensor to the computer. Once the process of sending data is known, we will proceed to obtain the data from the light sensor, which will be used later to complete the project.

It is important to emphasise that the ‘Start Serial Port’ block must be added to the ‘Initialise’ block whenever communication is to be used.

The ‘Serial Port Send’ block allows you to write text or send data from the microcontroller to the computer. This can be confusing for students at first, so they should be told that this code runs on the microprocessor on the board, so ‘Send’ implies sending data to the computer, not the other way around.

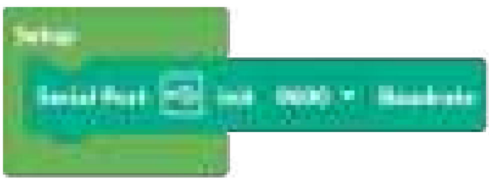
The result of this simple program is that the text written in the block is displayed on the serial monitor at one-second intervals. Teams can do various tests, changing the text and the waiting time, to see how the result changes when the programme is run.

It is useful to explain to the students that the serial monitor is a screen on which they can see the information that the microcontroller sends to the computer, or the information that is sent to the microcontroller.

In this part of the programme, the value corresponding to the ambient light level will be obtained. It can be suggested that they change places to see how the values change. The value corresponding to the luminous intensity is necessary so that, later, when the light sensor is covered with the hand while playing, the change in the intensity values can be assessed.

Once the value corresponding to the luminous intensity is known, the serial port blocks can be eliminated, sending them to the bin.

The program to be implemented is as follows:



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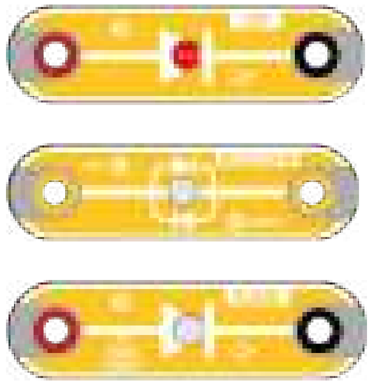
2. Activation of the LEDs

Now you are going to add 3 LEDs to your circuit. They will represent the three figures of this popular game: rock, paper, scissors.



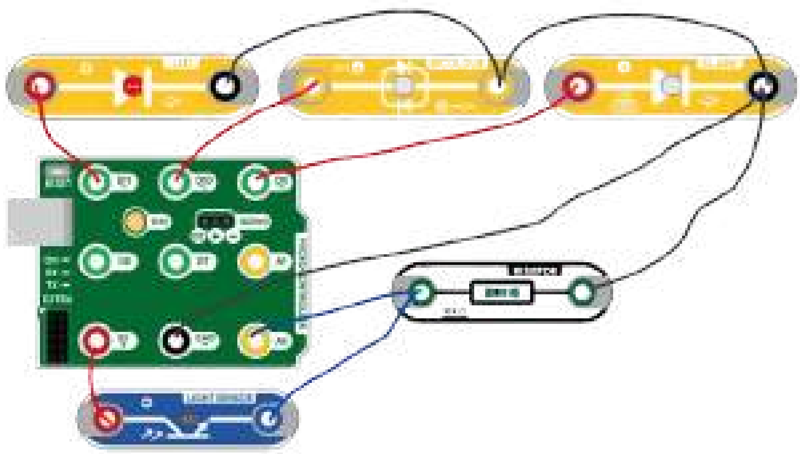
Connect the positive pole of each LED to a digital pin and the negative poles to GND.

Note for the teacher 📝

In this circuit, the three LEDs shown must be connected to the microcontroller. To do this, the positive pole of each LED must be connected to one of the digital pins of the microcontroller, and the negative pole must be connected to GND. In the case of the bicolour LED, it can be connected in two ways, depending on whether it is green or red, and the students can choose which colour they want it to light up. To make it light up green, the terminal marked as green will be connected to the digital pin and the terminal marked as red will be taken as negative or vice versa.

The proposed circuit is shown in the figure, and the two-colour LED is connected so that it lights up green. The pins selected are: D11 for the red LED, D10 for the bicolour led and D9 for the flash led.

Circuit solution:



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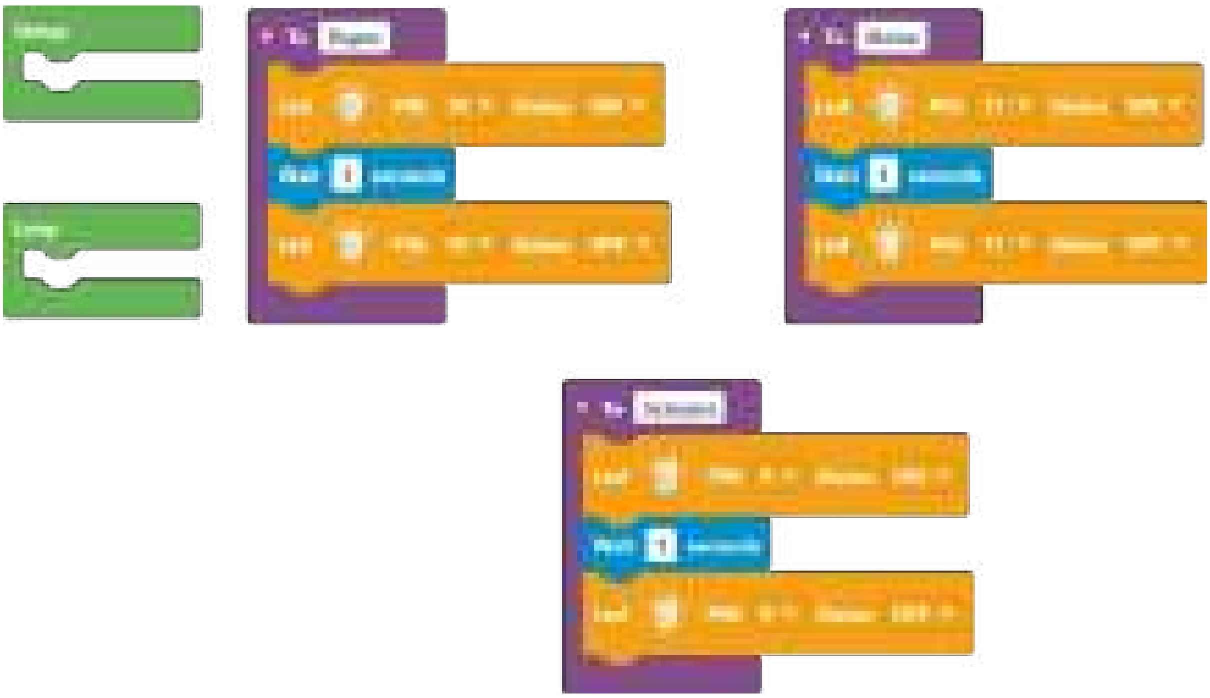
3. Functions

Program three functions that turn the LEDs on for one second and then off. The LEDs will represent the three options in the game:

- Stone: Red LED
- Paper: Bicolour green LED
- Scissors: Led flash

Note for the teacher 📝

For each function, the LED block must be added by choosing the correct pin from the drop-down menu and selecting the ON state. Next, the 1-second wait block must be included, and finally, the LED block must be duplicated, changing the status to OFF.



4. Random variable

The condition that must be fulfilled for one of the LEDs to light up is that the light level detected by the circuit is lower than the ambient light level.

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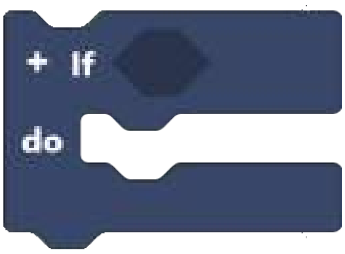

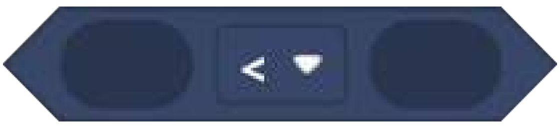

When this happens, the numeric variable will be updated, changing the stored data to a random number within the range you program.

Note for the teacher 📝

The conditional

To be able to relate the digital input and output signals, it is necessary to use a logical programming structure. In this case, you are going to use the conditional. The conditional allows you to decide what the program will do depending on the result of a logical operation; for this reason, in Hello, Blocks! the conditionals are in the Logic section of the block menu.

This structure works like a conditional sentence in English: if the condition of the first part of the sentence is fulfilled, then the action included in the second part of the sentence is carried out. In all other situations, nothing will happen.

Use of variables

In the programming of any machine, it is essential that it can store information, either permanently or temporarily, in order to work with it. The temporary working information of a program, with which the machine has to work, is stored in reserved spaces called

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variables. They are memory spaces, with an assigned name, containing a specific type of data.

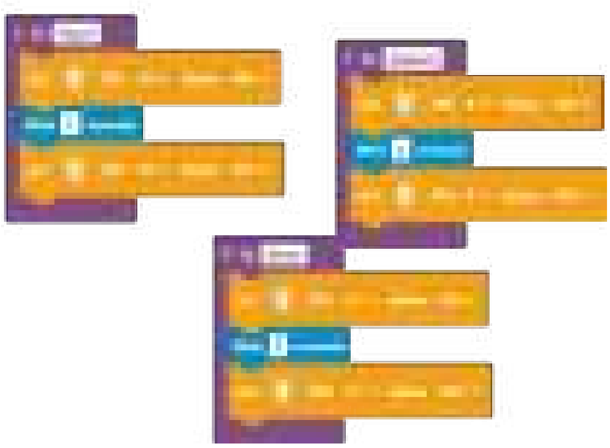
Variables are memory spaces, with an assigned name, containing a specific type of data. There are many types of variables, depending on the data they can hold.

The variables in Hello, Blocks! are listed in the corresponding section of the left menu.

The random numbers must be between 1 and 3, as the game has 3 figures, corresponding to numbers 1, 2 and 3, respectively.

The teams must choose a value that activates the programme. This value will depend on the light and dark conditions in the classroom. In the solution offered, a value of 3 has been used, so that the LEDs are switched on for lower values. In case the value chosen is high, the LEDs will be constantly switched on, so it would be necessary to readjust the value.

A possible solution to the proposed programme is shown below.



Complete the block so that, depending on the random number stored in the variable, each of the functions is executed, i.e. each of the LEDs connected in the circuit is switched on.

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Note for the teacher 📝

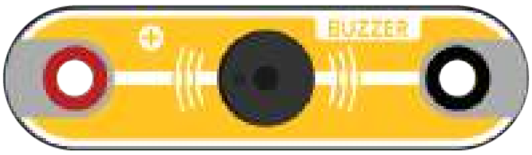
To design the programme, the If… to do block must be used. To add the If… to do option, click on the + symbol.

The result of the proposed programme is shown in the figure below.

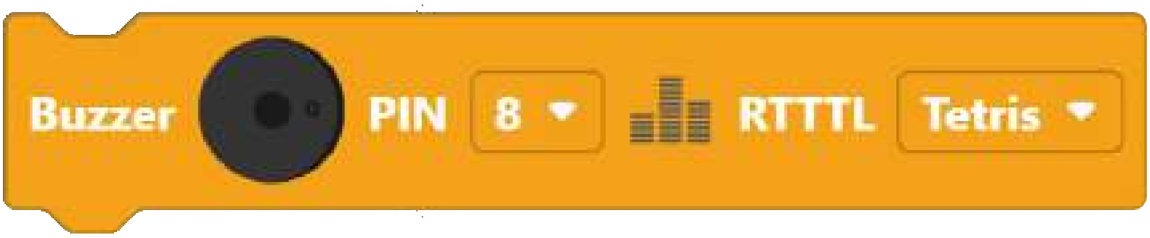
5. **Initial melody:**

If you want your game to greet you with an opening melody, you must include a buzzer in the circuit and program it.

First, add the buzzer to the track.



Where do you have to include the next block to program an initial melody, in 'Initialise' or in 'Loop'? Discuss the solution and when you have it, upload your programme.



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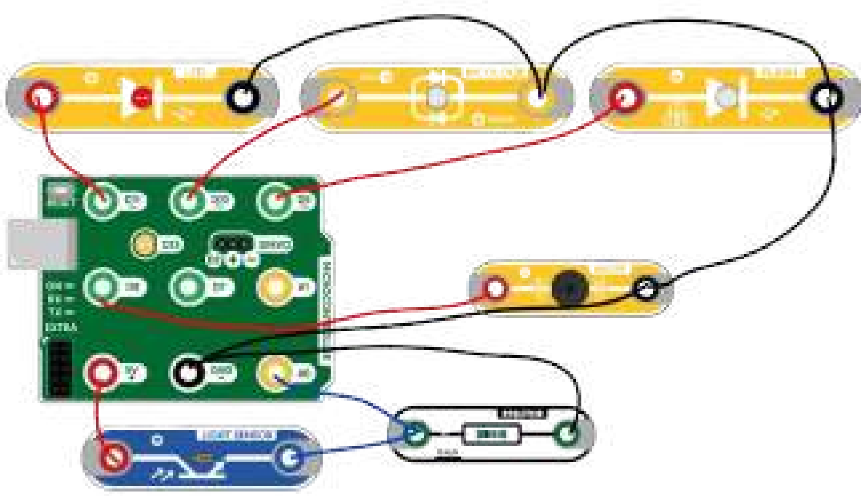
Note for the teacher 📝

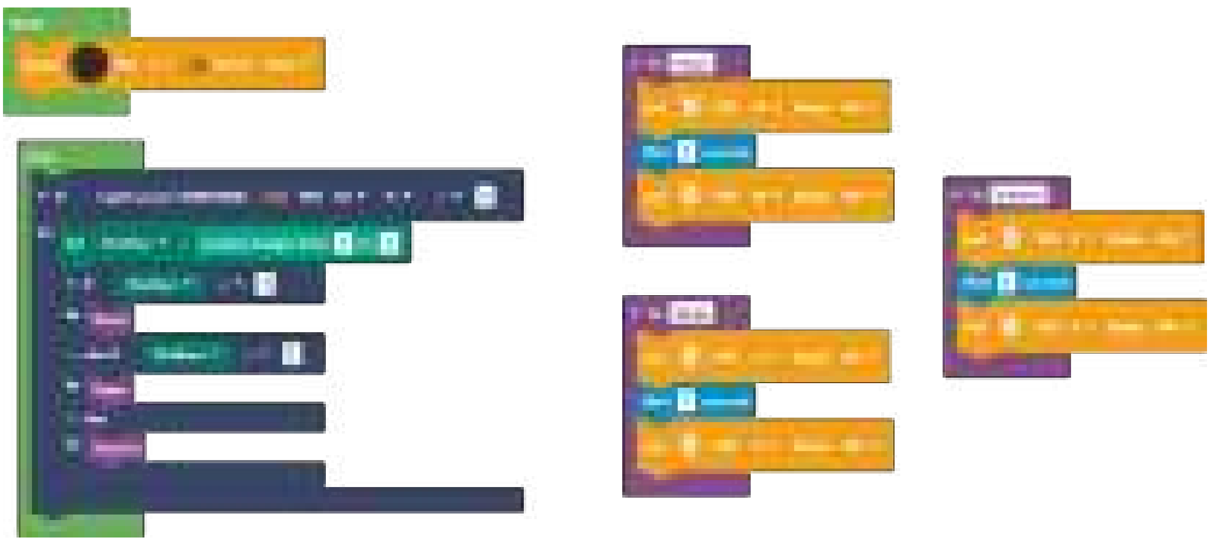
In this case, the buzzer block must be included in the 'Initialise' function, so that it only sounds at the start of the program. Otherwise, it would sound non stop.

The correct assembly of the circuit is shown in the figure below:



One of the possible errors that can occur when working with this block for the first time is not updating the pin of the component. In this case, the buzzer has been connected to digital pin 8, so it must be updated in the drop-down menu. The negative pole of the buzzer has been connected in series to the LEDs. On the other hand, you can also choose the song of your choice from those available in the drop-down menu.

The programme to be implemented to make it behave as required is as follows:



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6. Final details

Once you have the circuit programmed, use cardboard or cardboard to form your invention and play Rock, Paper, Scissors against it.

Note for the teacher 📝

Once you have the circuit programmed, use cardboard or cardboard to form your invention and play Rock, Paper, Scissors against it.

The underlying purpose of this activity is the implementation of the circuits previously designed by the students for the creation of a game against which to play 'rock, paper, scissors'.

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Conclusion and sharing

Classroom Activity 💡

Once all groups have completed and tested their Rock, Paper, Scissors circuits, students can share their games and perform a series of interactive tests. Each team will be able to test their game against the others to see how the different designs work and compare them. This is a key moment to reflect on the process and decisions made during the project: which solutions were most effective, how did they manage to solve the problems that arose when programming and connecting the circuits?, etc.

Classroom Activity 💡

If there is time left in the session, you can propose to organise a small Rock, Paper, Scissors 'competition', in which each group plays against the robots of other teams.

Discuss in groups 🗣️

What changes in programming or physical design do you think would have improved the gaming experience for players?

Was the programming part or the component connection part more difficult? Why?

What additional features do you think they could add to make it more attractive or functional?

What other types of games or devices do you think you could create using the same principles and techniques learned in this activity?

Do you think that what you applied today could be applied elsewhere?

We propose you to share your results in networks mentioning the STEAMbrace project:

- LinkedIn: https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name
- Instagram: https://www.instagram.com/steambrace_eu/
- X: https://x.com/steambrace_eu

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Project evaluation

Activity Objectives	Key Competences (EU)	Evaluation Criteria
Develop programming skills and basic logic.	Numerical, scientific, and engineering skills.	Correct implementation of the code blocks in the Hello, Blocks! platform, including functions, conditionals, and variable manipulation (such as random number generation).
Understand how some electronic components work.		The circuits were correctly designed and the components (light sensors, LEDs, buzzer, etc.) were working. In case it does not work at first, understand how to test what could be wrong and try to fix it.
Become familiar with electronic components as well as their connection and integration into a circuit.	Digital and technology-based competencies	They properly integrate the physical circuits with the programming on the Cirkids platform, checking that the light values affect the lighting of the LEDs according to the player's move.
Promote creativity.	Interpersonal skills, and the ability to adopt new competencies	Assess the level of creativity in the design of the physical structure of the game.
Promote teamwork and problem-solving.	Entrepreneurship	Teamwork to develop the project, showing skills in distributing tasks, collaborating in problem-solving and communicating ideas.

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THE BALANCE OF CHANGE

Duration	Age range	Difficulty
2 hs	13-14	low
#PROGRAMMING #INVESTIGATION		

Description

Let's combine science and citizenship! In this activity, we will dive into research about women in politics, exploring data on countries governed by women and those led by men. We will understand the challenges and present a broad perspective on equality.

With this data, we will programme an interactive scale using mBlock, an intuitive platform that will allow us to see how leadership tilts in different countries.

Activity objectives

- Develop research skills
- Raise awareness about gender equality
- Strengthen programming skills
- Encourage critical thinking
- Promote teamwork and collaboration

Key Competences (EU)

- Digital and technology-based competencies
- Interpersonal skills, and the ability to adopt new competencies
- Active citizenship
- Cultural awareness and expression

Materials

Activity kit:
- Cirkids microcontroller
- Servo motor
- Connection cables

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Provided by the teacher/institution:

- Cardboard
- Popsicle stick
- Tape
- Scissors
- String or thread
- Optional: paints or markers for decoration

Previous preparation

- Formation of workgroups (2-3 participants)
- Preparation of materials
- Installation of the Hello,Blocks! drivers, if the Cirkids microcontroller has not been used previously.
- Setup of teams/devices

Contextualization and adaptation

Are there more men or women in politics?:

Classroom activity 💡
Haremos una votación a mano alzada entre todos los compañeros sobre si creemos que hay más hombres o mujeres en política. Justifica tu respuesta. ¿Hay más paridad en los países del primer mundo que en el tercer mundo? ¿Puedes nombrar algún nombre de mujeres en política?

Watch video 📽️ - "HOW can more women get into politics?" (subtitles available)
HOW can more women get into politics? - BBC My World

Note for the teacher 📝
With this activity, we aim to assess how much we know about the current situation of women in politics. After an initial vote and interaction, we will watch the video.

Investigate and then debate:

Classroom activity 💡
Next, we will explore global statistics on the representation of women in government worldwide. With this data, we will have a brief debate on gender equality in leadership. How do stereotypes affect women's career growth? Does the so-called 'glass ceiling' exist

Note for the teacher 📝
Through graphs and maps, students will be able to observe the differences by region and country, understanding the context of gender equality in each location. We will moderate

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a constructive debate, prioritising respect, well-founded ideas, and learning from one another.

Activity

📽 **- Cirkids Tutorials + Hello Blocks Platform - (subtitles available)**

1- **Cirkids, creando circuitos**

2- **Tu primer invento con: Cirkids**

3- **Circuitos electrónicos con Cirkids**

4- **Cirkids y las conexiones eléctricas**

5- **Saca todo el potencial con Cirkids**

6- **¡Hola Microcontrolador!... con Cirkids**

You can access the tutorial playlist directly at:

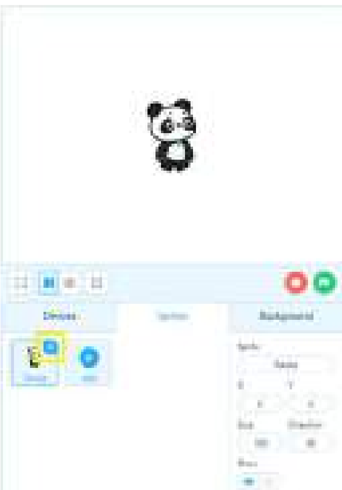
Your first invention with CirKids

Hello blocks page: https://www.hello-blocks.com/editor/

Designing the interface:

Step 1 - Create the necessary Sprites

In order to design your interface, you need to remove the default Panda Sprite that appears in mBlock (https://mblock.cc/).



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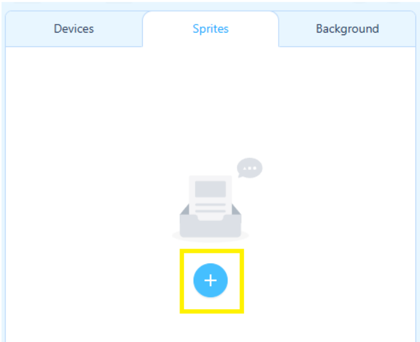
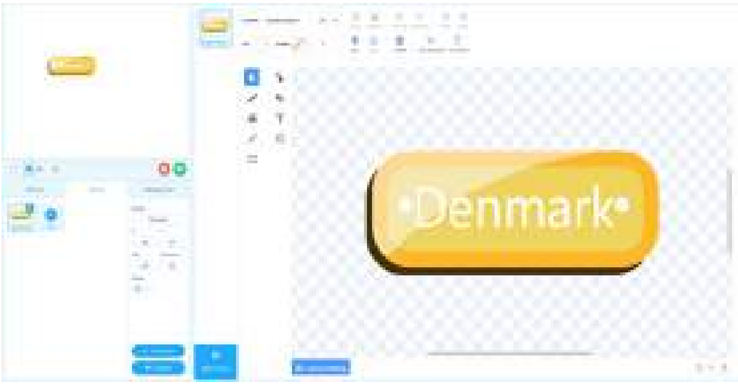
You should choose one of the button icons available in the tool.



Step 2 - Modify buttons

Once you have selected the button you want, you should assign it the name of the first country you chose, so it will look something like this:

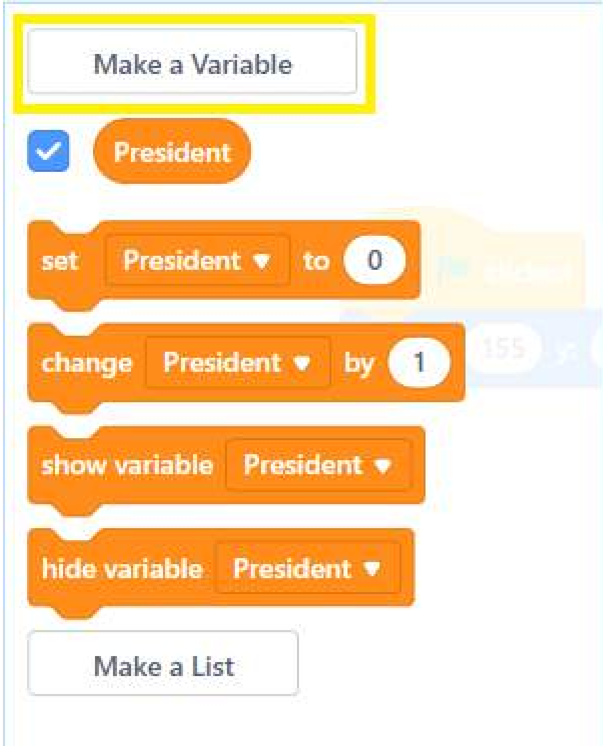


This step should be duplicated until you have all 8 buttons needed for the activity (the 8 countries you selected earlier)

Programming with mBlock:

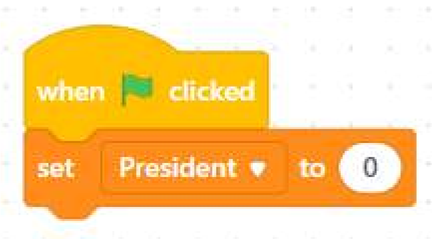
Step 1 - Creating Variables

In this activity, you will only need the variable 'President'. This variable will be changed depending on whether the president of the country is a man or a woman.



Step 2 - Initialisation of variables

This step is very simple. Go to the Background and set the variable 'President' to 0 at the beginning of the program, as no country has been selected yet.



Step 3 - Programming the buttons

According to the example provided, this is the programming logic. In the images shown, the variable corresponding to the gender of the president of each country is displayed. You need to keep in mind that you must change the variable of the object based on whether the president is Male or Female.

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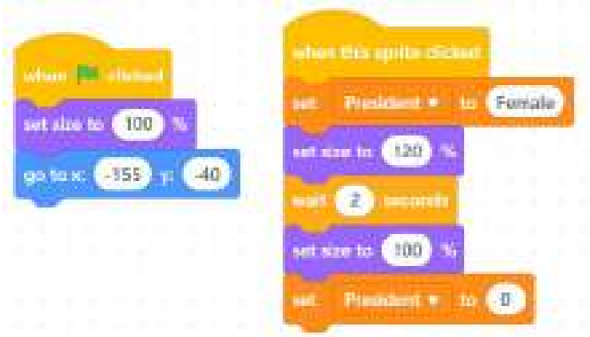
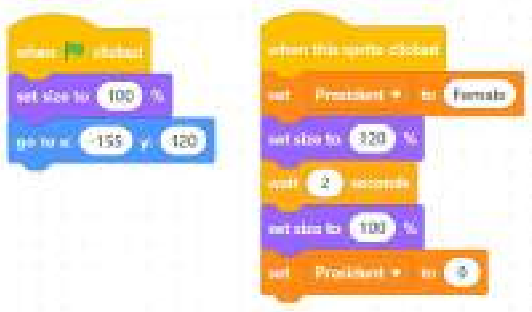
Sprite1 (Denmark)

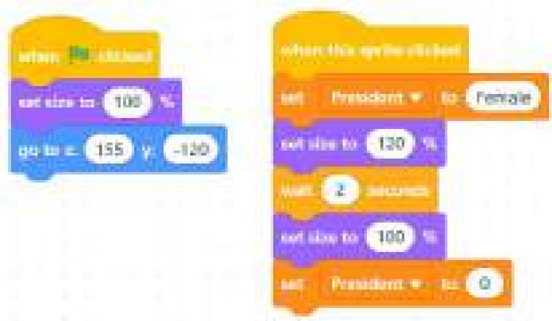
Sprite2 (European Commission)



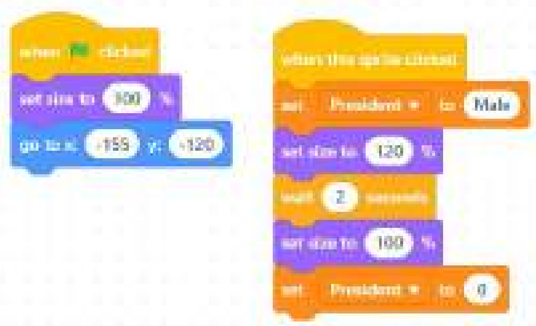
Sprite3 (Latvia)



Sprite4 (Italy)

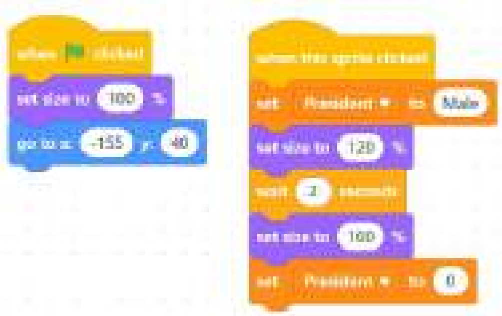


Sprite4 (Spain)

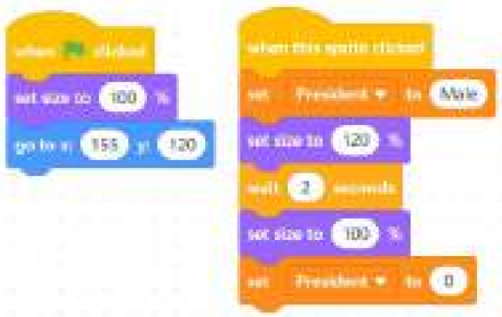


Sprite6 (France)

Sprite7 (Greece)



Sprite8 (Romania)



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Programming the electronics:

Step 1 - Change the device

By default, if you haven't changed it before, mBlock sets the device to CyberPi, which you need to remove.

Step 2 - Choose Arduino

Although you are working with the Cirkids microcontroller, mBlock will recognise it as an Arduino UNO, so that is the device you should select.

Once you've selected it, you need to set it to 'Live mode' so that the computer can interact with Cirkids.

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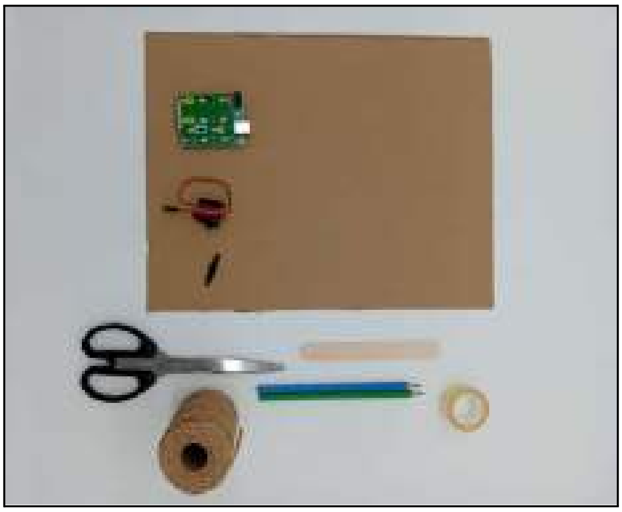
Step 3 - Programming the Device

You will instruct the Servo to continuously check if the variable "President" is set to 0, Male, or Female.

- If the variable is 0, the servo should remain at 90°, ensuring the balance does not tilt towards either side.
- If the variable is Female, it will tilt to 45°, which, in the model you will construct, will represent the side for women.
- If the variable is Male, it will tilt to 135°, which, in the model you will construct, will represent the side for men.

Step 4 - Creating the "Balance of Change"

Once the programming is complete, we will gather the materials to build our interactive balance model.



We will begin by preparing the movable part, which is the servomotor. To do this, we will use the tongue depressor and attach it with tape to the arm of the servo. This will form the top part of the balance, as shown in the image.

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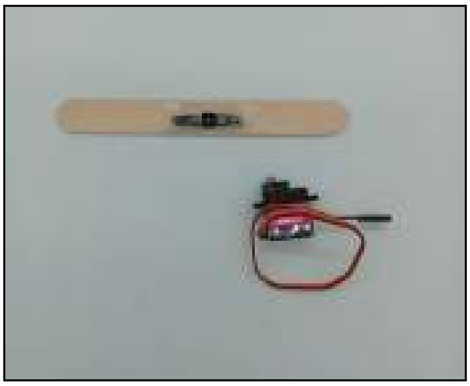
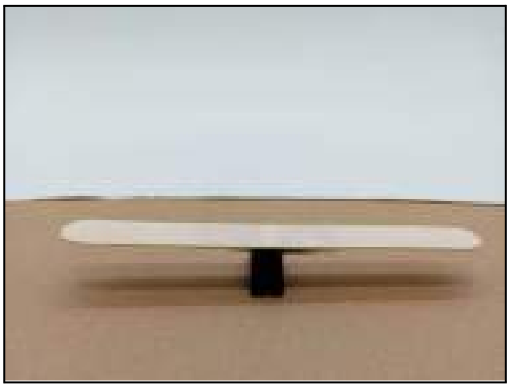


We will make a hole in the cardboard just large enough for the servo to fit. If necessary, you can secure the servo with a little more tape on the back of the cardboard. You can test how the tongue depressor fits once it's attached.



We will attach two small pieces of string or thread to each end of the tongue depressor. Remember, they should be the same length so that our balance scale is evenly aligned!

Finally, all that's left is to decorate and connect the servo to the microcontroller at the back. In the next image, we'll show you an idea of how it might look.

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And it's ready! Now, our balance will tilt towards the female side if the country is led by women and towards the male side if it is led by men.

Conclusion and sharing

Discuss and debate 🗣️

What did you learn while creating an interactive balance on leadership by gender?

What was the biggest challenge you faced using mBlock and Cirkids?

How do you think technology can help visualise data on gender equality?

What conclusions can you extract about the data that you have collected today?

We propose you to share your results in networks mentioning the STEAMbrace project:

- LinkedIn: https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name
- Instagram: https://www.instagram.com/steambrace_eu/
- X: https://x.com/steambrace_eu

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Project evaluation

Activity Objectives	Key Competences (EU)	Evaluation Criteria
Develop research skills	Digital and technology-based competencies	Ability to analyze and interpret global statistics on gender representation in politics. Clarity and depth of the research conducted on gender equality, stereotypes, and leadership roles.
Raise awareness about gender equality	Active citizenship Cultural awareness and expression	Participation in discussions and debates about gender equality in politics.
Encourage critical thinking	Interpersonal skills, and the ability to adopt new competencies	Evaluation of the effectiveness of technology in supporting statements to offer well-founded opinions.
Promote teamwork and collaboration		Active participation in group activities, contributing to the collaborative design and coding process. Ability to communicate ideas effectively within the team.
Strengthen programming skills	Digital and technology-based competencies	Proficiency in using the mBlock platform and its components (sprites, variables, devices). Ability to troubleshoot and solve issues related to the programming of the balance scale.

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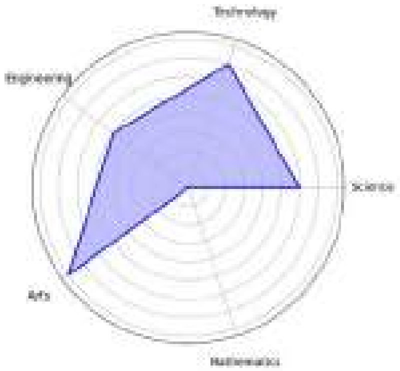
THE VOICE OF HISTORY



Duration	Age Range	Difficulty
1 hr	13-14	Low
#AUDIOVISUAL #IA #INFORMATION		

Description

In this workshop, we will study the brilliant minds of women inventors who changed history. We will explore the lives and achievements of figures like Marie Curie and Ada Lovelace, understanding how their discoveries have transformed the world in science, mathematics, and technology. Each participant will choose an inventor to research their history, their great contributions, and the impact of their work, which will inspire the script for our project.

Then, we will bring these stories to life by creating an animated short with BlinkShot, an AI tool that will allow us to animate their lives and achievements in a creative and visual way. And to make our short even more special, we will create a unique soundtrack with the Suno program. In the end, we will present our animation and original music, celebrating these inventors and learning how their ideas continue to inspire science and technology today

Objectives of the activity

- Develop research skills
- Introduce responsible use of technology
- Develop communication skills
- Foster critical thinking about gender roles in history

Key competences (EU)

- Literacy
- Digital and technology-based competencies
- Active citizenship
- Entrepreneurship
- Cultural awareness and expression

Materials

Provided by the teacher/institution:
- Computers
- TV or projector.

Previous Preparation

In order to access the three AI platforms suggested for this activity, each student must have their own email account.

Given the short duration of the activity, it is advisable to keep all three platforms open beforehand to ensure a smooth workflow for the students.

Notes for the teacher 📝
In order to be fully prepared for this session and to get the most out of Viznoz, it is suggested that teachers watch the following videos prior to conducting the activity:
🔴 Crea un AVATAR GRATIS con IA | Vidnoz AI | TUTORIAL paso a paso
Cómo EDITAR VIDEOS usando VIDNOZ AI 🎬 | Editor de vídeo gratuito con IA

The animated short-film creation app, Viznoz, offers a free version that provides access to numerous resources without any cost. However, it is essential to note that this version limits the creation of short films to a maximum length of **one minute**.

Contextualization and Adaptation

Watch the video 📽️ - "10 great inventions by women":
10 Great Inventions by Women

Classroom Activity 💡
Research a female inventor whose discoveries are still relevant today and gather some information about her life. Then, write a report summarizing your findings.
Consider the following questions as a possible guideline:
- When and where was she born? This will help you understand the time period she lived in and the challenges she faced.
- What was her main invention?
- What problem did this invention solve?
- What impact did it have on society at the time?
- Did she face any obstacles in her career due to being a woman?
- Interesting facts you find noteworthy

Notes for the teacher 📝Throughout history, countless women have made significant contributions to science and technology through their discoveries and inventions. Many of these women were overlooked and marginalized, facing many obstacles imposed by social and cultural norms that limited their access to education and employment. For centuries, fields such as science and engineering were dominated by men, and the role of women in innovation was questioned or outright attributed to the male figures of the time. Despite these challenges, many women persevered and made a lasting impact with their contributions.

Hedy Lamarr, in addition to her fame and renown as an actress, she invented a telecommunications system that established the foundations for today's wireless technologies.

Katharine Burr Blodgett invented anti-reflective coating, a material currently used in camera lenses, computer screens, sunglasses, and more.

Ada Lovelace was the creator of the first computer algorithm and became the first computer programmer in the mid-19th century.

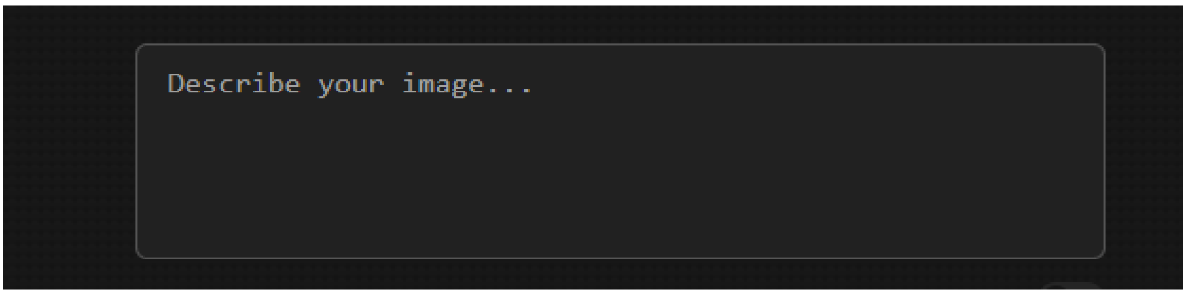
Marie Curie was the first woman to receive a Nobel Prize for her research on radiation and the isolation of radium. She discovered both radium and plutonium.

Ángela Ruiz Robles invented the first mechanical encyclopedia and a forerunner of e-books.

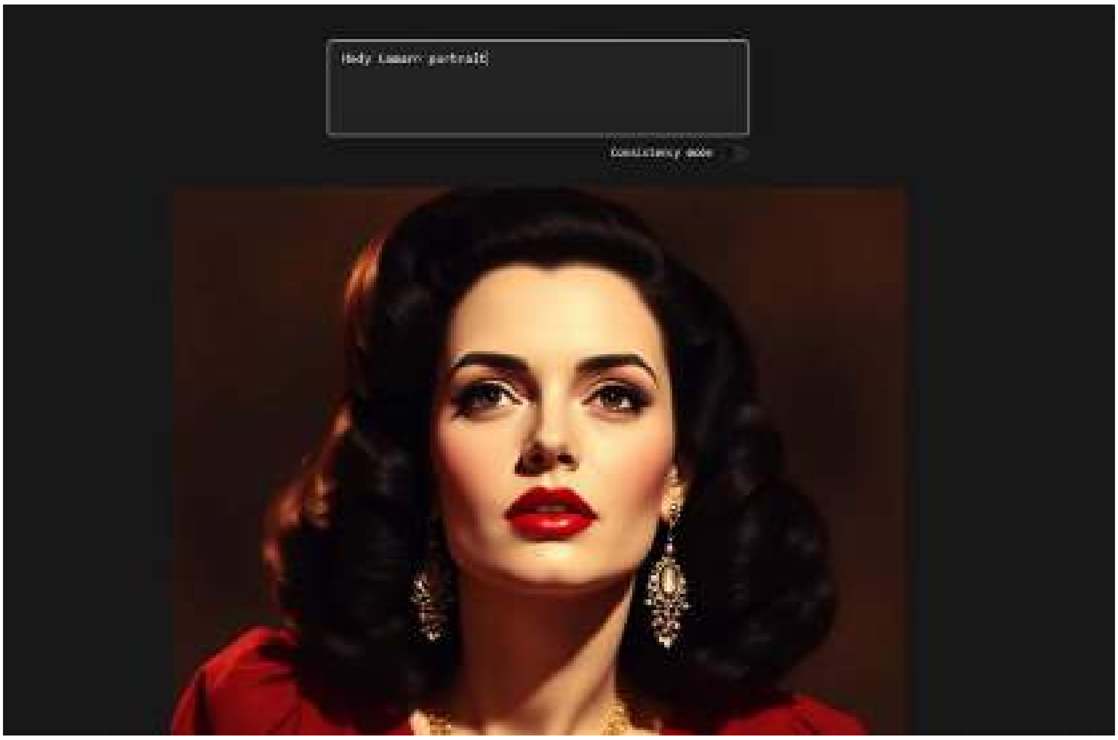
Activity

1. Generate an image

Start by using the online AI art generator BlinkShot: https://www.blinkshot.io/to create a custom portrait of the inventor. This tool allows you to generate a portrait by simply inputting a text description.



For example, to create a portrait of Hedy Lamarr, simply type: *"portrait of Hedy Lamarr."* It's important for the image to be a frontal shot so that when it's time to give it a voice, the result will be as realistic as possible.

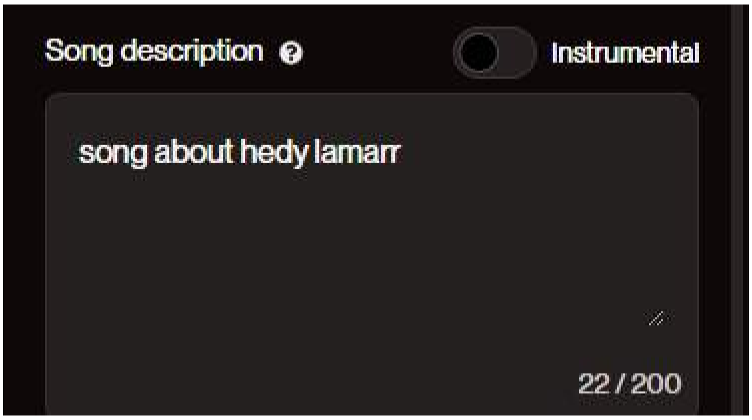


Once you have the image, save it to your computer.

Now that you know how to generate portraits with AI, you can also create images of their time period, their work, etc., to use as backgrounds in your animated short.

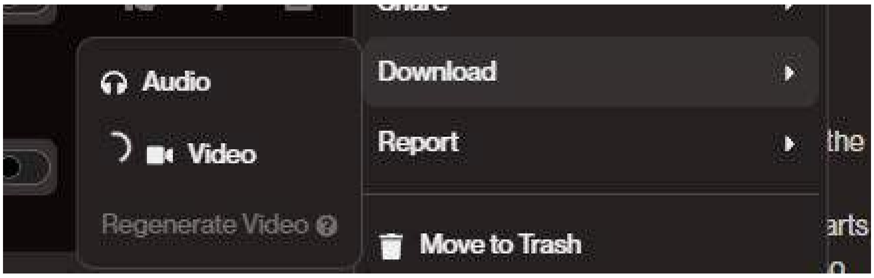
2. Generate a theme song

Now that you have your images, it 's time to create a theme song for your short film. To do this, use the online application **Suno:** https://suno.com/, and enter a brief description of the type of song you want.



By toggling the **Instrumental** switch, you can choose whether you want the song to have lyrics or be instrumental only. In the description, you can also indicate your preferred musical style (pop, rock, etc.). When you click **Create**, several songs will be generated that you can listen to and choose the one you like best

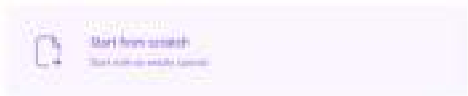
As the song plays, the lyrics will be displayed on the right side of the screen. Once you've selected the song that best suits your short film, it's time to download it. To do this, click on the three dots that appear to the right of the song and select **Download** and **Audio**.



3. Create an animated short

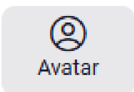
To create your video, go to the online application Viznoz: https://aiapp-es.vidnoz.com/index.html?name=ai and select at the top **Create Video**:

and then **Start from Scratch:**

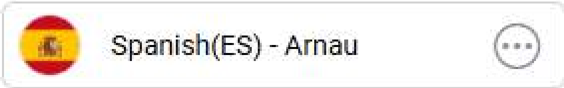


1. Add a background to your short.

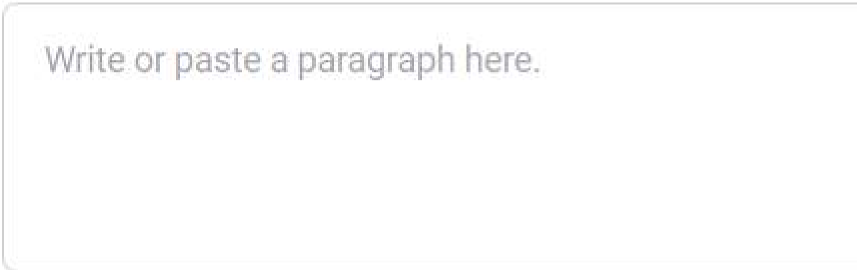
2. Upload your inventor's IA generated portrait and choose the background removal option.



3. Choose your avatar´s voice.



4. In each scene, you should write the text you want the inventor to say. You'll do this by typing the dialogue at the bottom of the screen.



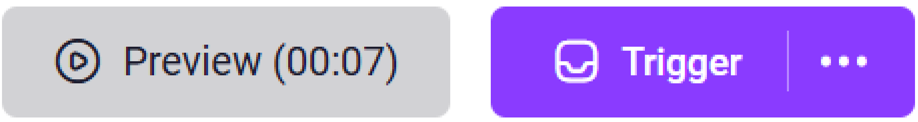
5. Add music or a soundtrack to your video.

6. Remember that the length of the video can't be more than one minute!

4. Creating your animated short:

To see how your video turned out, you can click on **preview**. Keep in mind that your inventor's avatar won't move her mouth until you **generate** the video, so do not think that's something wrong with your previous work.

Once you all have your animated short of your female inventor, it's time to show it to everyone else and discover everything these inventors have to tell you.



Conclusion and sharing

Debate 🗣️

How have the scientific breakthroughs achieved by these women shaped the modern world?

What challenges did you encounter while creating your animated short?

What new insights have you gained regarding the historical context and contributions of your chosen inventor?

Which AI tools were most helpful in your process and why?

Don't forget to take a photo of your experience and share it with us!

LinkedIn: https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name

Instagram: https://www.instagram.com/steambrace_eu/

X: https://x.com/steambrace_eu

BEYOND DNA

Duration	Age range	Difficulty
2 hrs	15-16	Medium
#SCIENCE #RESEARCH #3D		

Description

The aim of this project is for students to learn about the life and work of Rosalind Franklin. Thanks to her dedication, which went against the prejudices of the time, she managed, among other things, to obtain photographs of DNA, from which it was possible to determine its structure. They will create a 3D model of DNA and as part of the model-building process, students can complete the secondary strand of DNA from a primary strand provided, as well as explore differences between species and genetic mutations. This hands-on approach will deepen their understanding of the structure of DNA and the importance of Franklin's work in science.

Activity Objectives

- Explain what DNA is and how it determines physical characteristics.
- Relate DNA to how certain physical traits are passed on genetically.
- Understand the origin of mutations and certain diseases.
- Learn about very important figures in the history of DNA.
- Develop skills in a 3D design environment in order to apply acquired knowledge

Key competencies (EU)

- Numerical, scientific and engineering skills
- Digital and technology-based competences
- Cultural awareness and expression

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Materials

Provided by the teacher/institution:
- Computers with internet connection

Downloadable Elements:
- BlocksCad final code

Previous Preparation

Get familiarized with Blockscad with the tutorials offered in the "Activity" section, and verify that all the computers are running and with internet connection.

Contextualization and adaptation

What colour are your eyes?
Do you have siblings and are they physically similar?
Why do you think so or not?

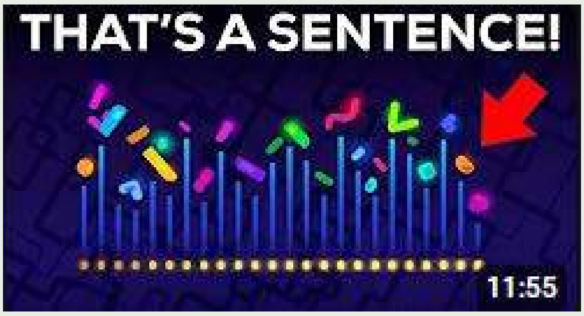
In this session, we will work on the story of how we came to know the molecule in our system that decides whether we are tall, short, light-eyed, dark-eyed, whether we have a disease, whether we will be able to see without glasses, whether we will pass on a hereditary disease to our children, and so on. And we will also investigate the hidden characters behind this discovery.

- *How do you think our body information, such as the colour of our eyes or the shape of our face, is 'programmed' from birth?*

Before answering this, we will watch an introductory video to explain the essential molecules that make up all life around us, and how these molecules have managed to combine with each other in living beings to give instructions for many different processes to create life.

Watch Video 📽 - "The Most Complex Language in the World":

The Most Complex Language in the World



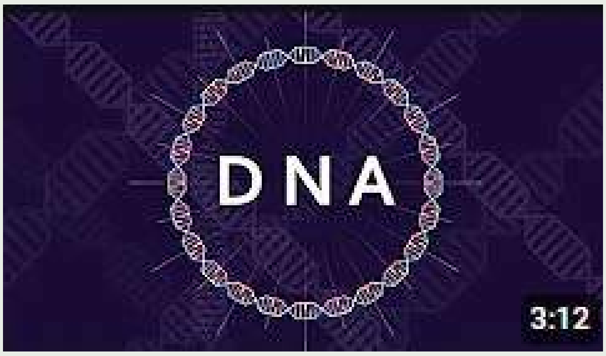
Subtitles available in:
- Spanish

Funded by
the European Union

- English
- Croatian: Select the option to translate automatically
- Portuguese: Select the option to translate automatically

Having watched the video above, we can now delve a little deeper into our subject of study for this session, DNA.:

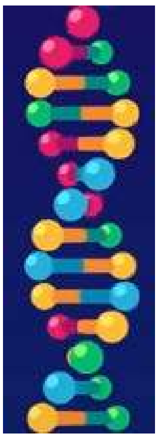
[What is DNA and How Does it Work? - Basics of DNA](#)

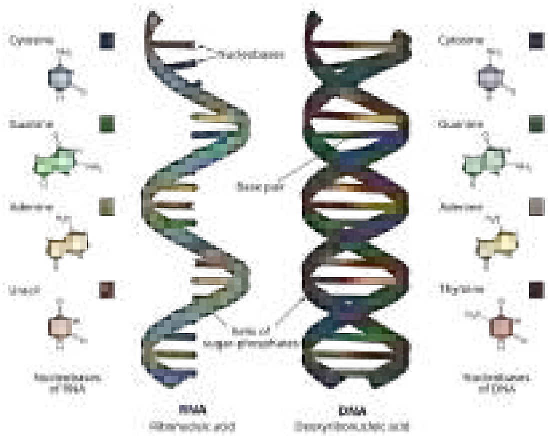


Note For The Teacher 📝

DNA is a macromolecule that contains the genetic information used in the development and functioning of all living things, as well as the hereditary information of organisms. Chemically, DNA is a polynucleotide; each nucleotide consists of a carbohydrate (in this case, deoxyribose), a nitrogenous base and a phosphate group.
Nucleotides are arranged in **two long strands that form a double helix spiral, a ladder-like structure in which the base pairs form the rungs and the sugar and phosphate molecules are the handrails.**

Now that we are a little clearer about what DNA is, where it is located, and what it is used for, we can talk about its shape. In most textbooks we will see it represented as a double helix, dextrorotatory or levorotatory, depending on the type of DNA:

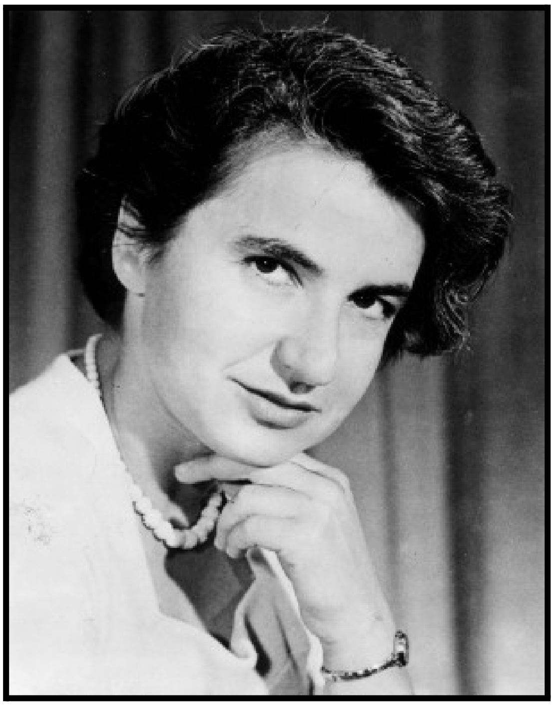




*File:Difference DNA RNA-DE.svg: Sponk / *translation: Sponk, CC BY-SA 3.0 <https://creativecommons.org/licenses/by-sa/3.0>, via Wikimedia Commons*

This shape that DNA takes is called the secondary structure of DNA, and although it may seem obvious to many of you, we have not known what its structure looks like for very long. Thanks to this, we can study and better understand the behaviour of many processes that take place inside our organism, as well as understand the origin of various diseases, and mutations, and even be able to replicate it more easily.

But to whom do we owe the discovery of this structure?



The solution to the **secondary structure of DNA**, published in 1953, is one of the greatest scientific milestones of the 20th century. James Watson and Francis Crick presented a model of the secondary structure of DNA in a one-page paper published in Nature.

However, there is a hidden star behind their publication who, without her, would have been impossible to decipher, and who was not acknowledged at the time by Watson and Crick. In fact, they did not mention her in their Nobel Prize winning ceremony.

Her name is **Rosalind Franklin**, whom we can call "DNA's first female photographer".

Rosalind Franklin (1920-1958) was born in London and was the second of five children.

Rosalind was from a wealthy Jewish family. She attended the best schools and institutions in English society at the time. Her education included a spell at a French school where she studied subjects such as physics and chemistry, which was unusual for women's schools.

She then enrolled at Newnham College (Cambridge University's Centre for women) to study experimental sciences, graduating in 1941.

Subsequently, she registered for a PhD in physical chemistry with Ronald George Wreyford Norrish (Nobel Prize in Chemistry 1967) but in 1942 she accepted a research post with the British Coal Utilisation Research Association (BCURA). Her research **on coal** allowed her to obtain a PhD at Cambridge in 1945.

Classroom Activity 💡

Do some research on science and technology in this era and write a report answering the following questions:

1 - Why do you think she was interested in coal research? What was the context in England that might have prompted government support for coal research grants?

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2 - To what events did science and technology boom in the 20th century?
3 - Which two physical theories revolutionised science in the 20th century and are still valid today, albeit with some changes?
4 - Who discovered X-rays? Which would later be key to Rosalind's development?
5 - What other very significant scientific milestones/inventions have this type of event produced?

Note For The Teacher 📝

The 20th century brought a real revolution in the development of science and technology. Many of the scientific advances during this period were crucial to Rosalind Franklin's scientific development. It is important to convey to students the importance of the scientific revolution that took place in the 20th century in universities, laboratories and specific centres.

The solution to the activity requires students to research the techno-scientific push that occurred in the 20th century and the reasons behind it. With the first and second question, students will discover that the international military situation, with two world wars and the Cold War, led to increased interest and especially funding of science by governments in order to get ahead of their enemies. Therefore, the drive for grants to study fields that could be of use to the war effort increased during this period.

In the third question, you will find an introduction to what we know as modern physics, which began with Quantum Theory and the Theory of Relativity. Quantum Theory is, in very general terms, the idea that particles are waves and vice versa, and the Theory of Relativity, formulated by Albert Einstein. Both theories revolutionised the conception of physics, making possible discoveries where classical physics could not arrive.

Then, at the Laboratoire Central des Services Chimiques de l'Etat, in Paris 1947, under the leadership of Jacques Méring, she became familiar with the technique of **X-ray diffraction**, of which she became an expert. This led her to return to England as a renowned crystallographer. With the help of a new grant, in 1951 she joined the Biophysics Laboratory at King's College London, where she made **one of the great discoveries of her career**.

As the director of the project redirected her studies into the field of the then-unknown structure of DNA, Franklin was able to use her knowledge of crystallography to try to deepen her understanding of it.

After carefully improving, adapting and fine-tuning the precarious equipment at her disposal, together with her PhD student Raymond Gosling, she succeeded in 1952 in obtaining **some of the sharpest images of the complete structure of DNA ever made**.

Rosalind made a fundamental discovery by identifying two distinct crystalline forms of DNA. After separating them, Rosalind was able to capture high-quality images of both structures. With these data, she concluded that DNA was composed of a backbone of sugars and phosphates made up of two strands, not three as previously assumed, and that this structure had a helical shape.

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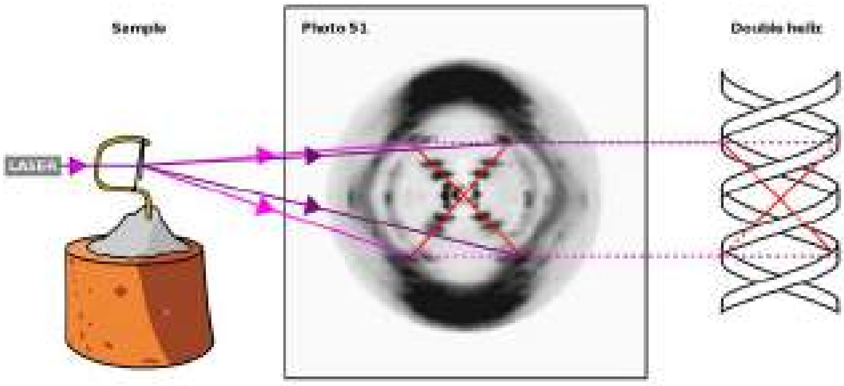
Unfortunately, Franklin's great contribution was never acknowledged. At that time Rosalind had not yet determined how the two strands were joined. This aspect was finally completed by Watson and Crick, who, after unauthorised access to the famous photograph number 51 and the exhaustive analysis that Rosalind had submitted to the Medical Research Council, managed to establish the final connection between the strands, which would **win them the Nobel Prize in 1962**.

Thanks to this revelation, Rosalind was able to describe the density of DNA in more detail and found that its molecules were arranged in a helical pattern.



MagentaGreen, CC BY-SA 2.0 <https://creativecommons.org/licenses/by-sa/2.0>, via Wikimedia Commons

However, Rosalind did not get to live through this event as shortly after some of her work was stolen, she left King's College to work with John Bernal at Birkbeck College. Shortly after this she was diagnosed with ovarian cancer, possibly due to the doses of X-rays she received during the long hours she spent recording diffractograms without sufficient protection, and died in April 1958, just before her 38th birthday.

Classroom Activity 💡

What is cancer? We recommend watching the following video which introduces briefly how this disease develops in different situations:

[Your Body Killed Cancer 5 Minutes Ago]

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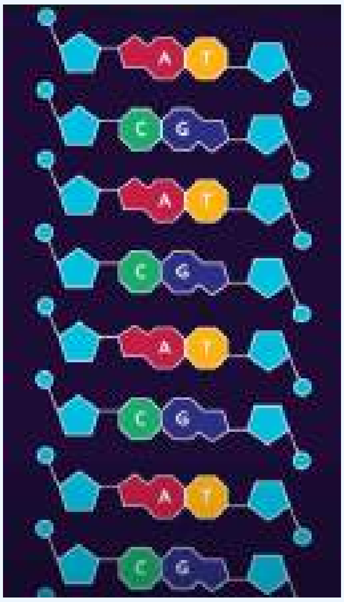
Available subtitles.

Do research on this disease with your classmates and write a report explaining how it comes about and what can be done to try to prevent it as far as possible. Make the difference between a malignant and a benign tumour, etc.

Classroom Activity 💡

The video talks about **mutations**, which is a very interesting topic. Do you know what this is about? Research on the different types of mutations that exist.

TIP: First find out how the different nitrogenous bases combine with each other (mentioned in the second video) and from there, what happens when something unexpected takes place in the process of combination. Remember that according to what we studied, the bases should always be paired in the same way: adenine-thymine and cytosine-guanine. What happens if there is a mistake and these are combined in the wrong way?



Note For The Teacher 📝

The video talks about **mutations**. It would be interesting to propose to the students to delve deeper into this topic and ask them if they believe that all mutations are bad, for which we propose the following questions:

Do they believe that all mutations are bad?
What types of mutations exist?
According to these definitions... Would they be mutants, can they drink milk, can they do shapes with their tongues?

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*On the other hand, on **cancer** research and its origins: (Freeman, S., Quillin, K., & Allison, L. (2013). Fundamentals of biology (5th ed.). Pearson Education):*

Cancer is a general term for a disease caused by cells that divide in an uncontrolled manner, invade nearby tissues and spread to other parts of the body. Cancer cells cause disease because they consume nutrients and space needed by normal cells and interfere with the function of normal tissues.

Although cancers vary in time of onset, growth rate, severity and cause, they all have one characteristic in common: cancers arise from cells in which the checkpoints of the cell cycle have failed.
Cancer cells have two defects regarding their division that cause these problems:

1) Defects that cause proteins necessary for cell growth to be activated when they should not be.

2) Defects that cause tumour suppressor genes to stop the cell cycle.

Cancer involves a loss of cell cycle control. Cells can become cancerous when they begin to divide in the absence of a growth factor signal.
Cells become malignant and cancerous if they acquire the ability to break away from the original tumour and invade other tissues. This process is called **metastasis**.

Activity

We will start the activity by practising some basic shapes in the Blockscad platform (https://www.blockscad3d.com/editor/). BlocksCAD is free software with which we can **create 3D figures**, and not just in any way, but by **programming** the different shapes we want to make.

INTRODUCTORY EXERCISE: Trying out basic shapes in BlocksCAD and getting familiar with the program

We begin by practising the basic shapes (see teacher's note):

Note For The Teacher 📝

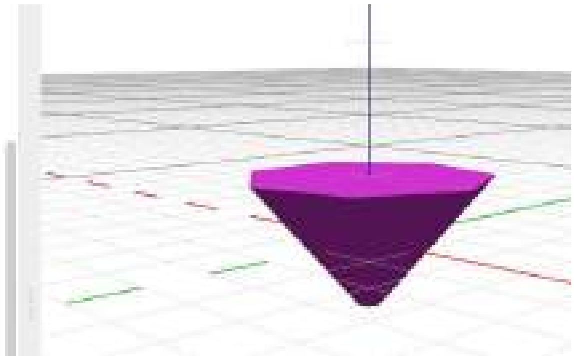
The shapes we make will depend on the level of the group and what the teacher considers appropriate for each level. The list of videos below can be used as a reference.

BlocksCAD: The Four Basic Shapes

Once we have made the first basic shapes and understood the software environment, we will do other simpler exercises before arriving at our final DNA structure:

EXERCISE 1: DNA Model without differentiating nitrogenous bases

We start by programming one of the DNA strands. For this we can choose to start with an inverted cone as a base figure (we can give it any colour we want to distinguish one strand from the other):



We use a J variable and start a counter, which will increment by 1. The displacement on the Z-axis will be given by the J variable. You can try changing the magnitudes by which the counter is amplified in the X-axis rotation to see how that affects how steep the generated 'wave' is. Also, you should use the convex envelope option so that every time an inverted cone is drawn, it is joined with the next one. What happens if you don't select this option?

We now program the other strand which will be the same, but with an additional 180° turn so that both strands do not overlap. The turn must be programmed on the Z axis.

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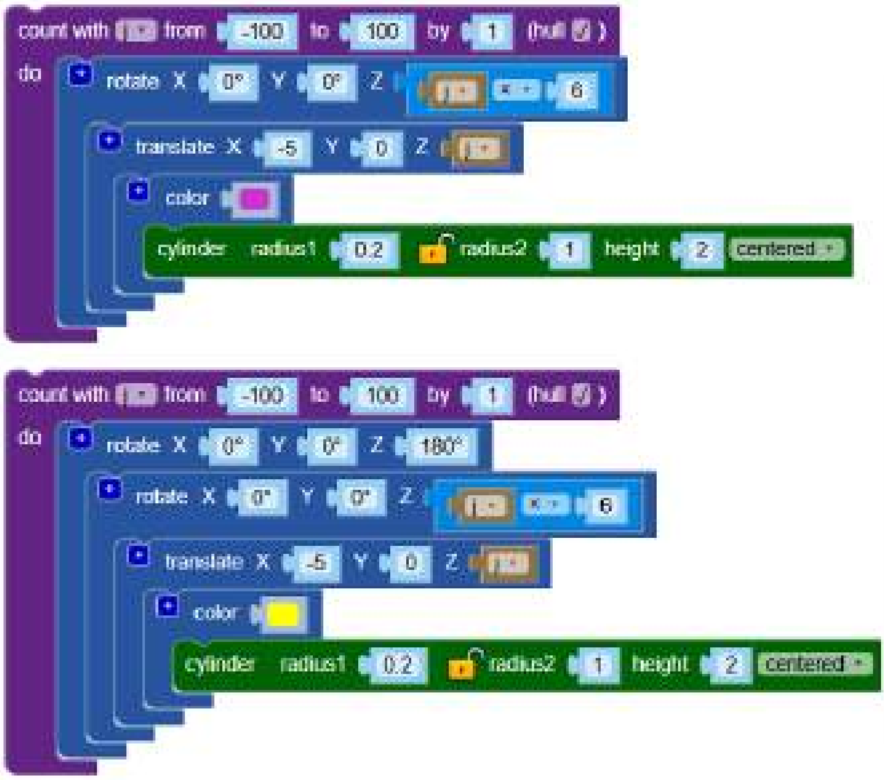

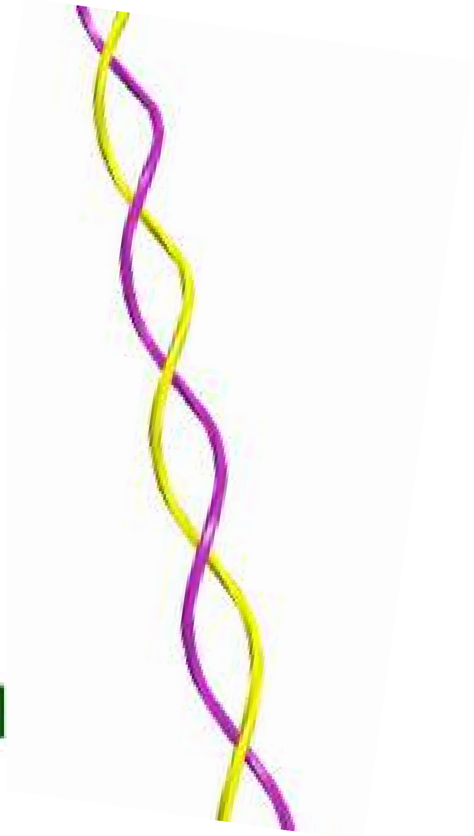

To create the nitrogenous bases, we will do it on a first try without differentiating the bases; that is to say, joining the two strands created with bars that represent these bases. To do this, we start from the same blocks of the first image, but without using the convex envelope, for the cone that you were using we will turn it into a cylinder to look like 'bars'. We will do this by matching the radius 1 and radius 2 of it (this is up to each person; in the example, we have set it at 0.5 but it can be different). Furthermore, we must modify the height of it because if it is too short, the two strands will not be joined. In the example provided, it works well with a height of 9, but what would happen if we lowered it? You can try it. Finally, we must make them overlap in rotation with the original strands. To do this, we will make them rotate on the X-axis instead of the Z-axis. On the other hand, in this case, our counter will not go up one by one, but the bars will be very close together; we selected for the example to go 3 by 3, but this can be modified to your liking.

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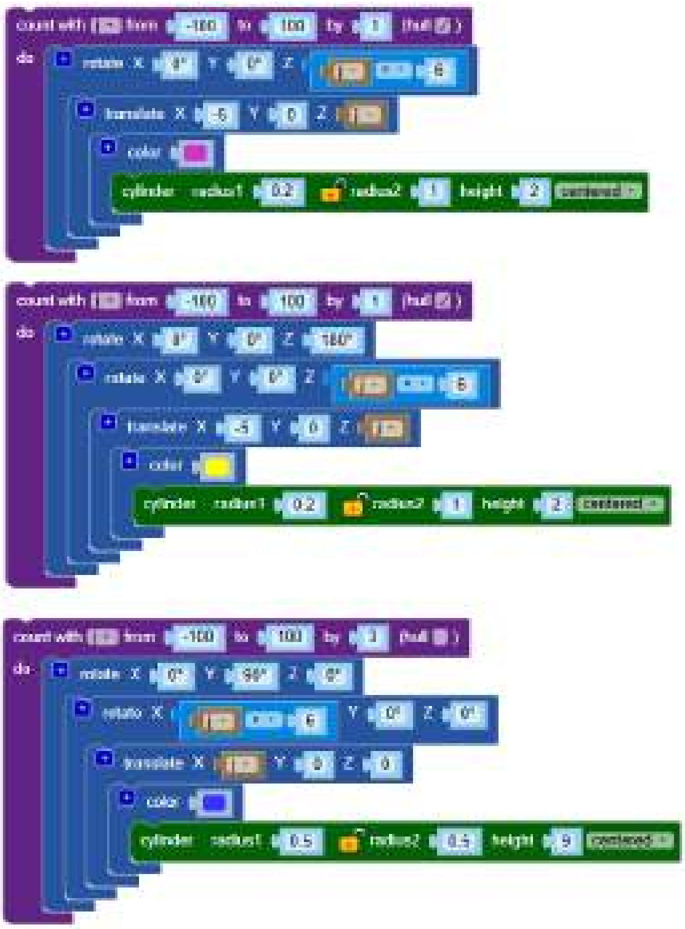

EXERCISE 2: DNA Model differentiating nitrogenous bases

DNA is composed of four nitrogenous bases: adenine (A), thymine (T), cytosine (C) and guanine (G). The stability of its double helix structure is due to the hydrogen bonds that form between complementary bases in each strand. In this specific pairing, adenine always bonds with thymine, while guanine bonds with cytosine. In the second part of this exercise, you will use what you learned in the first part to create a piece of DNA, differentiating each base with a particular colour and ensuring that all the bases are correctly paired.

For reference, it should look something like the image below. Can you think of a code to generate it?

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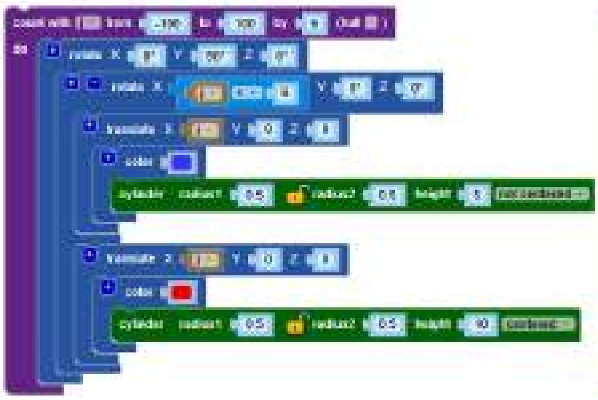
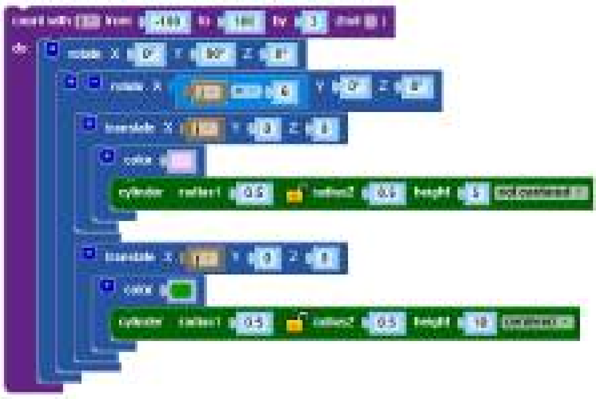
ONE POSSIBLE solution is provided below, although there are many different ways of doing this:





Conclusion and sharing

- What have you learned?
- How did you learn it?
- What did you find easier/difficult?
- Did you already know Rosalind Franklin?
- Can you think of another application for the tools you have learned?

We invite you to share your results on social media by mentioning the STEAMbrace project:

LinkedIn: https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name

Instagram: https://www.instagram.com/steambrace_eu/

X: https://x.com/steambrace_eu

Project Evaluation

Activity Objectives	Key competences (EU)	Evaluation Criteria
Explain what DNA is and how it determines physical characteristics.		Be able to recognise the general structure of DNA and its function.
Relate DNA to how certain physical traits are passed on genetically.	Numerical, scientific and engineering skills	Identify how genetic traits are passed between generations.
Understand the origin of mutations and certain diseases.		Understand where base pairing can go wrong and lead to different types of mutations.

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Develop skills in a 3D design environment to apply the knowledge acquired.	digital and technology-based competences	Become familiar with the platform provided and understand how to indicate turns, enlarge shapes, translate them on the different axes, etc.
Learn about very important figures in the history of DNA.	cultural awareness and expression	Become familiar with the history of Rosalind Franklin and her contribution.

Bibliography

- https://historia.nationalgeographic.com.es/a/rosalind-franklin-y-estructura-adn_16614
- Article about Rosalind Franklin published on edition 7 of Redes Magazine: https://mentazar.ddns.net/hypatia/images/pdf/Redes/adela_redes_7_rosalind.pdf
- *Freeman, S., Quillin, K., & Allison, L. (2013). Fundamentos de biología (5ª ed.). Pearson Educación.*

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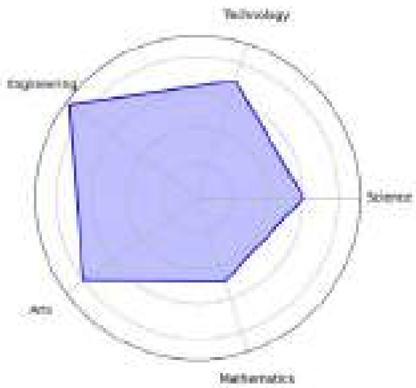
OVERCOMING OBSTACLES



Duration	Age Range	Difficulty
1 hr	15-16	Low
#SCIENCE #IA #RESEARCH		

Description

In this activity, students will carry out a detailed analysis of their environment to identify the architectural barriers that limit accessibility for people with disabilities or reduced mobility. The aim is to make them aware of the difficulties that many people face in their daily lives and to propose practical technological solutions.

This activity not only encourages the use of technology but also empathy and commitment to improving shared environments.

Activity Objectives

- Foster social awareness and empathy
- Develop observation and analytical skills
- Encourage creativity and innovation
- Develop 3D modelling skills
- Application of technology in solving real problems

Key Competences (EU)

- Numerical, scientific, and engineering skills
- Digital and technology-based competencies
- Interpersonal skills, and the ability to adopt new competencies
- Active citizenship
- Cultural awareness and expression

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Materials

Provided by the teacher/institution:
- Computers with internet connection
- Merge Cube template
- Glue
- Scissors
- Tissues for blindfolds
- Measuring tools

Downloadable Elements:
- Merge cube printable

Previous Preparation

- Organisation of students in teams
- Printing the AR cube for the students
- If you are working with Tinkercad and Merge EDU for the first time, it may be necessary to create users.

Contextualization and adaptation

Exercise 1 - What is Augmented Reality?

Watch video 📽 - "Augmented Reality (AR) and Virtual Reality (VR) Explained".
Augmented Reality (AR) and Virtual Reality (VR) Explained |

Classroom Activity 💡 In this activity, you will learn what Augmented Reality is, and the difference between AR and VR or Virtual Reality.
Augmented reality is an interactive experience that enhances the real world with computer-generated information. Using software, applications and hardware such as AR viewers, augmented reality overlays digital content on real-life environments and objects.

Note for the teacher 📝Ask students where they use Augmented Reality, or where they think Augmented Reality could be interesting to use in their daily lives, or in what fields AR can be applied.

Exercise 2 - Walking Blind

Classroom Activity 💡 In this activity, you are going to move as if you were a person with reduced mobility, visually impaired… You will cover your eyes in turns, and try to move around the space, with the help of your companions, and thus feel how a visually impaired person feels.

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Note for the teacher 📝This activity is designed for students to see the difficulties that people with reduced mobility, or visual impairment, have in moving around certain environments. If a wheelchair is available, that would be great, but it is more difficult to get hold of.

Exercise 3 - Architectural Barriers

Classroom Activity 💡Architectural barriers are obstacles that prevent certain users from accessing or moving around a space. This means that people with disabilities, the elderly or people with reduced mobility, or even families with pushchairs, cannot move around easily.
The aim of this activity is to encourage research and the students' ability to observe architectural barriers in their environment, and to promote social awareness by sharing their discoveries with their classmates.

Note for the teacher 📝Students will develop observation, research and presentation skills, while gaining awareness of the importance of accessibility. They will learn to identify architectural barriers and think of practical solutions to remove them, promoting a more inclusive environment.

Activity

Step 1 - Route through your school

Classroom Activity 💡Take a short tour of the school and assess whether it is accessible or not. List all the architectural barriers you find and make a list of everything that could be improved. Also, think about how these changes could be made to improve accessibility in the school.

Note for the teacher 📝If the school is already fully accessible, the pupils are asked to think about how to further improve access to the school. For example, they could suggest automatic doors that open and close on approach, rather than doors with knobs, to make it easier for people with mobility difficulties to enter. You could also consider improving other elements, such as water fountains that are at a more accessible height. Be encouraged to think about anything that can make the environment more comfortable and accessible for everyone.

Step 2 - Measure the architectural barrier

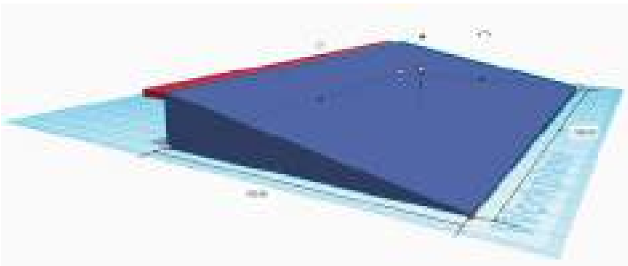
Once you have decided which architectural barrier you are going to 'save', you will need to take measurements to be able to make the design later in Tinkercad. An example could be the following:

Step 3 - Design in Tinkercad

If you need to remember how Tinkercad works, you can access the tutorial in the following link:

Watch video 📽 - "Tinkercad Tutorial - Complete Guide".
https://youtube.com/playlist?list=PL90LC6zq_Lzf9tHyFPzX_9OA35BFTfEBs&si=wtUG7xlaglZ5t9CX

In the example, you are going to design a ramp to facilitate access to the centre. Remember that you must always make the designs to scale, so it is important that you take the measurements of the architectural barrier you want to solve.



Join all the objects you have included in your design so that they become a single piece (don't forget to select all the components and press the **Group button**).

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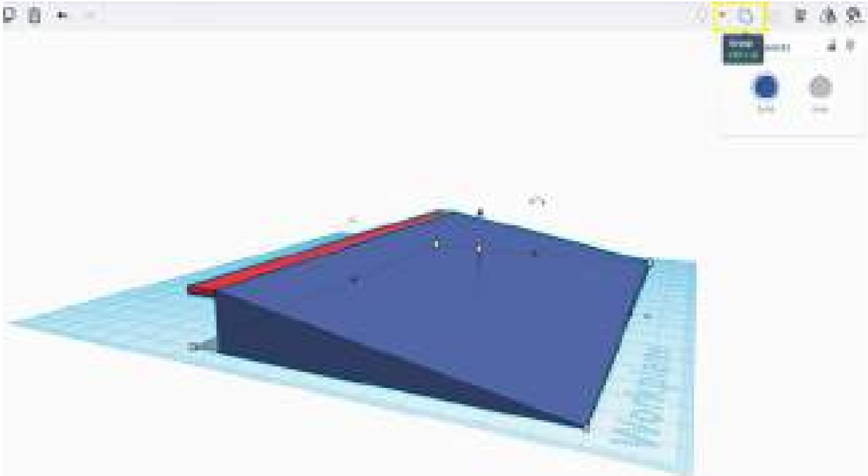
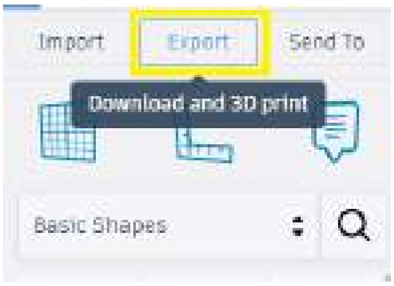
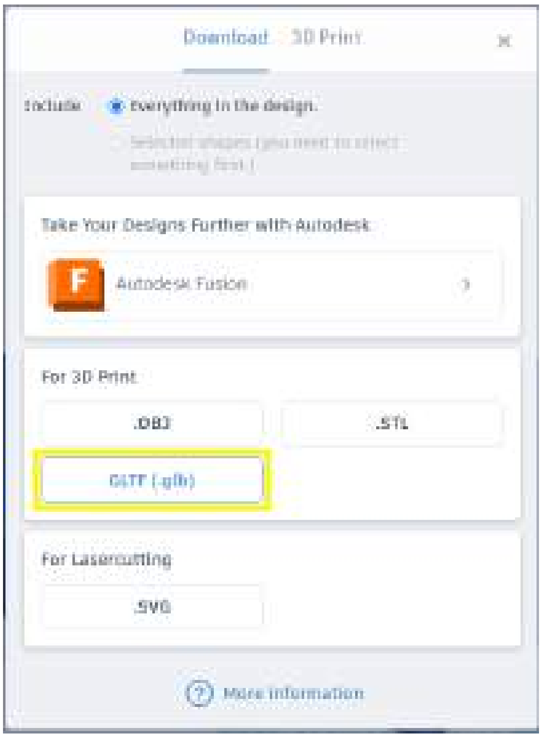


Step 4 - Export the object

In order to continue, you must export and download your design in GLTF (.glb) format.





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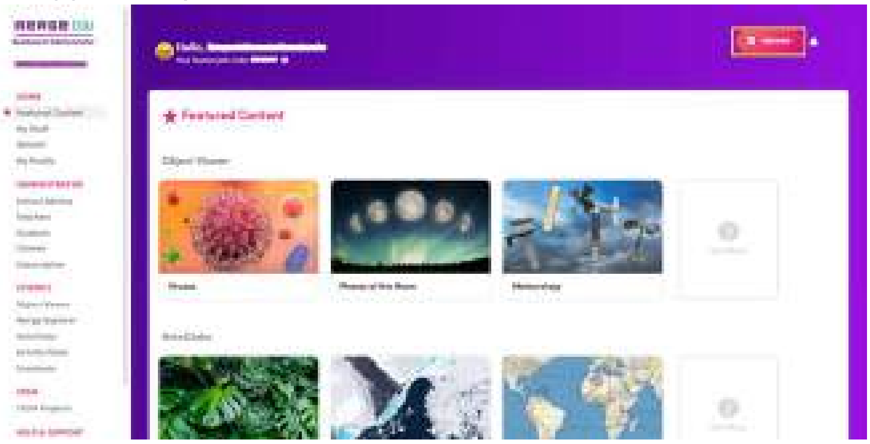
Step 5 - Include the design in Merge Cube

Next, add your design to the **Merge Cube** platform to see how your architectural solution would look like thanks to Augmented Reality.

Go to the website: https://mergeedu.com.

> **Note for the teacher** 📝 You can create a test account with any email address and, for 15 days, perform all the necessary tests and upload up to 50 designs with a single registration.

Once you have logged into your user account, click on **Upload.**



Select the file you want to upload and follow the steps indicated by the programme.

Once you have named the design and added the names of the designers, click on **Done** and you are ready to go.

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Step 6 - Building the cube

Now it's time to build the cube that you will use to view your design in Augmented Reality.

The result will be a cube similar to this one:

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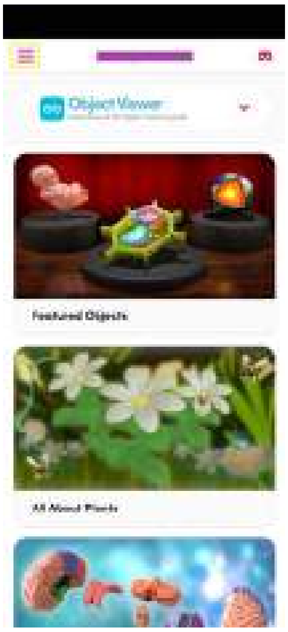
Step 7 - Connecting to Object Viewer

On your mobile device, install the **Object Viewer** application and link it with the same account you used to log in to **Merge Cube**.

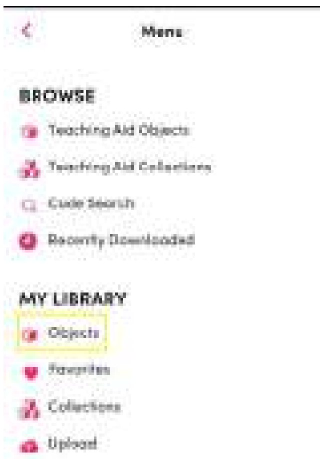
MERGE Object Viewer

Step 8 - Import project

Once the application is installed, and you are logged in, you will see the following screen:



Enter the menu and select **Objects**, where you will find all the designs you have uploaded from the **Merge Cube** platform.



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Once you are ready, just select your design:

A screen will open where you have to select **CUBE** to scan the cube.

This way, you will be able to see how your 3D design would look like in real life. This is the magic of Augmented Reality.

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Step 9 - Put it to the test
With the model loaded, you can go to the places where the architectural barriers were and visualise your solution.

Finally, if you want to remove the cube display and just see the design, you can click on **Stamp.** The design will remain visible, and you can continue interacting with it.

Conclusion and sharing

Classroom Activity 💡

Each group presents their 3D model (they should do this in the place where they have found something to improve. Is better this way because they will be able to show the model represented in that space via the app), explaining:

- The problem they identified.
- Their proposed solution and why they chose it.
- The benefits their solution would bring to people with reduced mobility.

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Debate 🗣️

What was the most surprising thing you discovered?

How has this activity changed your perception of accessibility and inclusivity?

What would you change in your community to make it more accessible?

Note for the teacher 📝 You may conduct a peer-review session where students give constructive feedback on each other's solutions. They could take turns when showing their design so that other classmates could comment on it.

We invite you to share your results on social media by mentioning the STEAMbrace project:

LinkedIn:
https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name

Instagram: https://www.instagram.com/steambrace_eu/

X: https://x.com/steambrace_eu

Project evaluation

Activity Objectives	Key competences (EU)	Evaluation Criteria
Application of technology in solving real problems	Digital and technology-based competencies	Utilises Merge Cube and AR tools proficiently to demonstrate the practical application of their solutions in real-life settings.
Develop 3D modelling skills	Numerical, scientific, and engineering skills	Demonstrates the ability to merge and manipulate design elements effectively to create cohesive structures. Shows proficiency in using Tinkercad to create scaled, accurate 3D models of proposed solutions.
Develop observation and analytical skills		Effectively identifies and documents architectural barriers within the school or community.

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Foster social awareness and empathy	Interpersonal skills, and the ability to adopt new competencies Active citizenship	Shows commitment to proposing realistic, empathy-driven solutions for identified barriers. Demonstrates an understanding of the challenges faced by individuals with reduced mobility through group discussions and personal reflections.
Encourage creativity and innovation	Cultural awareness and expression	Develops 3D models that reflect thoughtful and imaginative approaches to improving accessibility.

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MACHINE VS HUMAN

Duration	Age	Difficulty
1 hr	15-16	Medium
#PROGRAMMING #AI #EXPERIMENTATION		

Description

In this activity, you will explore concepts of Artificial Intelligence in a practical and interactive way using the Machine Learning for Kids tool. You will learn to train an AI to recognise "Rock, Paper, Scissors" gestures, and then, using Scratch, you will programme this classic game. This activity will help you develop your digital and technological skills while understanding how a machine can learn and detect patterns. Additionally, you will research traditional games from your country and delve into the analysis of the differences between professional men's and women's sports. Through this activity, you will gain a more comprehensive understanding of programming, the application of machine learning, and the importance of gender equality in the sports field.

Objectives of the Activity

- Depelop programming skills
- Foster an appreciation of cultural traditions
- Promote teamwork
- Raise students' awareness of the differences that still exist in many fields, such as sports, between men and women and their career opportunities.

Key competences (EU)

- Numerical, scientific and engineering skills
- Digital and technology-based competences
- Cultural awareness and expression
- Interpersonal skills, and the ability to adopt new competences

Materials

Provided by the teacher/institution:
- Computers with webcams

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Downloadable Items:

- Training templates
- Base project

Previous preparation

- Create work groups
- Prepare computers with internet connection

Contextualization and adaptation

Exploring Traditional Games

Classroom Activity 💡 In this activity you will discover and investigate about the traditional games of your country.
In groups you must choose one of the traditional games that are proposed to you, and make a brief description of it by completing the following information:

- Name of the game
- Origin and brief history
- Materials needed to play
- Rules of the game
- Brief description of how to play

Note for teachers 📝 In this activity, students will research and learn about traditional games from their country.
They can make a list of the traditional games they can think of or find quickly on the Internet, and then, in groups, they must gather the information detailed above.
It is convenient and enriching that not all teams choose the same game, but that they share out the different games, so that they all learn about the cultural richness of the traditional games of their country.
The aim is to encourage appreciation of cultural traditions and promote teamwork.

Professional sport: Comparison between men and women.

Classroom Activity 💡 You are going to choose a male and a female athlete from the same discipline, who play in your country. (For example, two basketball stars, who play in the same category, but one male player, and one female player).
Gather information:

- Name and brief biography of the athletes.
- Sporting achievements and merits.
- Recognitions and awards obtained.
- Media coverage received (programs, interviews, social networks).
- Differences in salary, sponsorships and professional opportunities.

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Note for teachers 📝 The aim of this activity is for students to see the differences between men's and women's professional sport and to make a brief comparison and analysis of the data they have obtained.
After having pooled all the data obtained, they will be asked the following questions for a short reflection.

- What differences did you notice between the experiences of male and female athletes?
- Why do you think these differences exist?
- How do you think this situation could change in the future to further promote equality in sport?
- What impact do you think these differences have on the public's perception of sport?

It is important to make them see that until salaries, sponsorships and job opportunities are equal in these disciplines, there will continue to be discrimination between men and women in the sporting environment.

Milestone in History - Machine versus man

Note for teachers 📝 On May 11, 1997, in New York, a supercomputer defeated a chess champion, the Russian Garry Kasparov, for the first time. A historic milestone that, however, was only the beginning of a long road for Artificial Intelligence. Kasparov, 34 years old, faced DeepBlue, a computer created by IBM, with a final result of 3.5 to 2.5 points.
Until then, and since 1985, Kasparov had been the absolute chess champion, but on this occasion, he got up from the table suddenly, in the decisive game.
A year earlier, the then champion had faced DeepBlue and on this occasion, he was the winner, with a result of 4 to 2.
But as has already been said, this was only the first step for AI to continue advancing.
Now show the following video:

Watch Video 📽️: - **"GameGAN: PAC-MAN Re-created with AI by NVIDIA".**
[GameGAN: PAC-MAN Re-created with AI by NVIDIA]

Note for teachers 📝 Nowadays, Artificial Intelligence is so advanced that it is capable of creating an AI system that, by simply playing 50,000 games of Pac-Man, has recreated the game from scratch, all by itself, respecting the game's mechanics and rules.
Supporting news:
https://blogs.nvidia.com/blog/gamegan-research-pacman-anniversary/?ncid=so-yout-74102#cid=_so-yout_en-us

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Activity

Step 1. Access Machine Learning for Kids

To carry out this activity you must use the Machine Learning for Kids platform.

https://machinelearningforkids.co.uk/

Access it and click on the get started button to continue.

Note for teachers 📝When accessing the tool, you can ask students to register. However, the activity can be carried out without having to log in. We recommend this option to avoid wasting time.

Step 2. Creating a new project

The first step when accessing the platform is to create a new project.

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Once created, give the project a name and create 3 fields named as shown in the following image.

Once the necessary fields have been generated, you can now access the project.

Step 3. Creating labels

The first thing you need to do is train your AI by providing it with a source of images that will help it identify the movements you will make later in your video game.

To do this, create labels that will help you differentiate the meaning of the different hand positions. You will need four categories: rock, paper, scissors, and an additional one for when there are no hands in the playing space.

Step 4. Creating a database.

Once the categories have been created, point your computer's webcam at a solid-colored background to minimize its impact on AI training. This will help the model focus on recognizing hand gestures. Although you could use images from the internet or draw them directly, in this case we will use the webcam option to capture the images.

You'll need 15 images in each category, including the "empty" one, so that all categories have the same baseline for comparison and the AI doesn't show a preference for a gesture just because it has a larger number of examples of it.

It is very important that the images represent a wide variety of angles and ways of making the gesture. The more variety and cases you provide, the better the AI will be able to identify your gestures later on.

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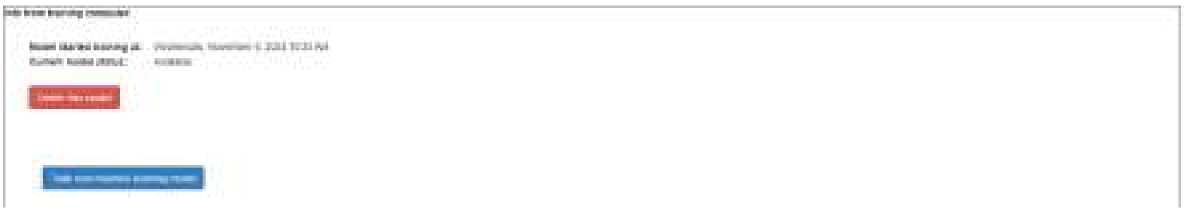
Step 5. Training the AI

Once you have completed the database, go back to the project and go to the learning and testing section.

Once in this section, click on the corresponding option to start training the AI with the images you have created previously. This process will take approximately one minute.

At this point, you can start interacting with our AI and test how it works. Use your webcam to see how well it recognises your hands. You will see a factor called "confidence", which indicates how confident the AI is in giving you an answer. To be reliable, this number should be greater than 50%.

If the AI gives you a high number, but the result is incorrect in relation to the gesture you make, you will need to expand the image database with more examples to increase the accuracy and confidence in the recognition.



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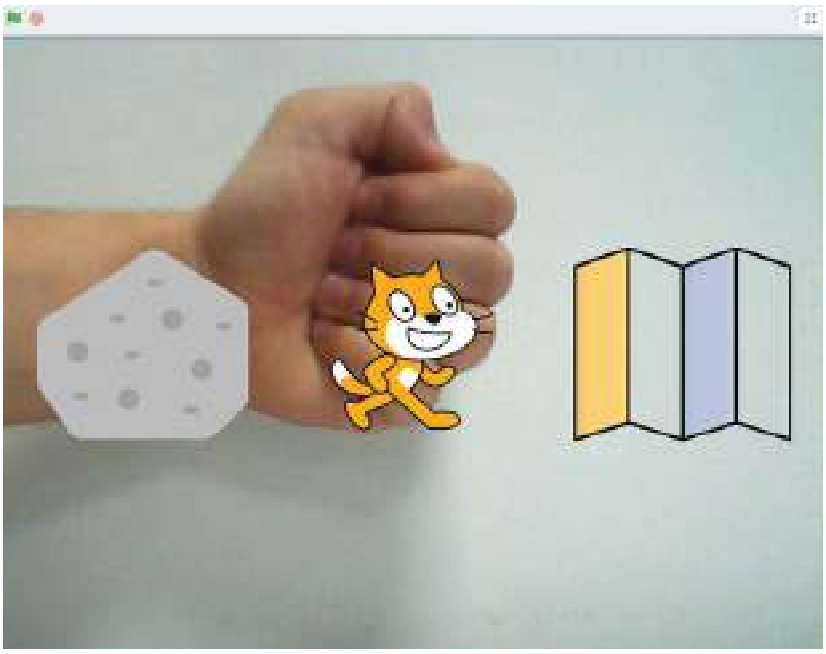
Step 6. Programming in Scratch

Once your AI is well trained, it is time to put it to work in our game. To do this, we will return to our project and use the create button.

You will select Scratch 3 as the tool we will use for this phase of your project.



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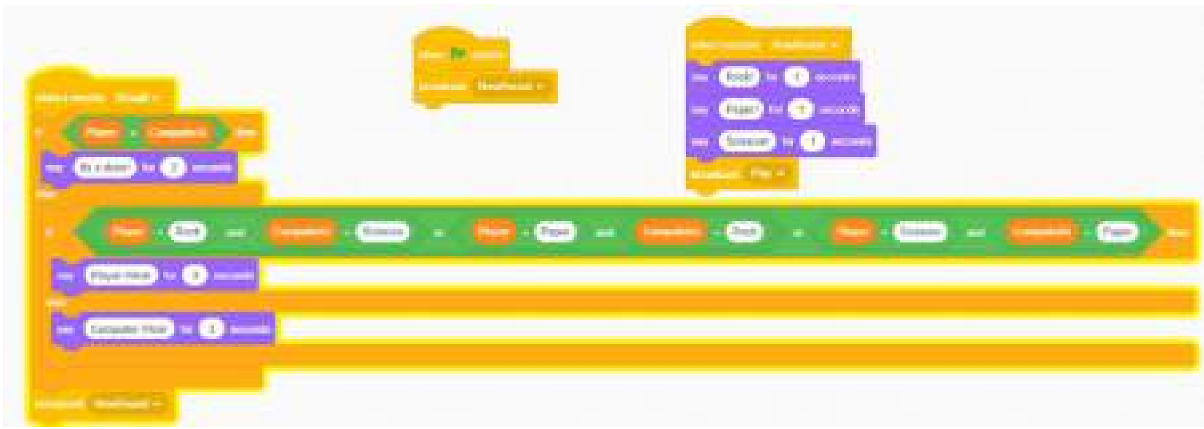
Note for the teacher 📝 Once here, depending on the level and time of the workshop, attendees can be provided with a template with the base code of the game so that they only have to add the machine learning blocks or program it from scratch.

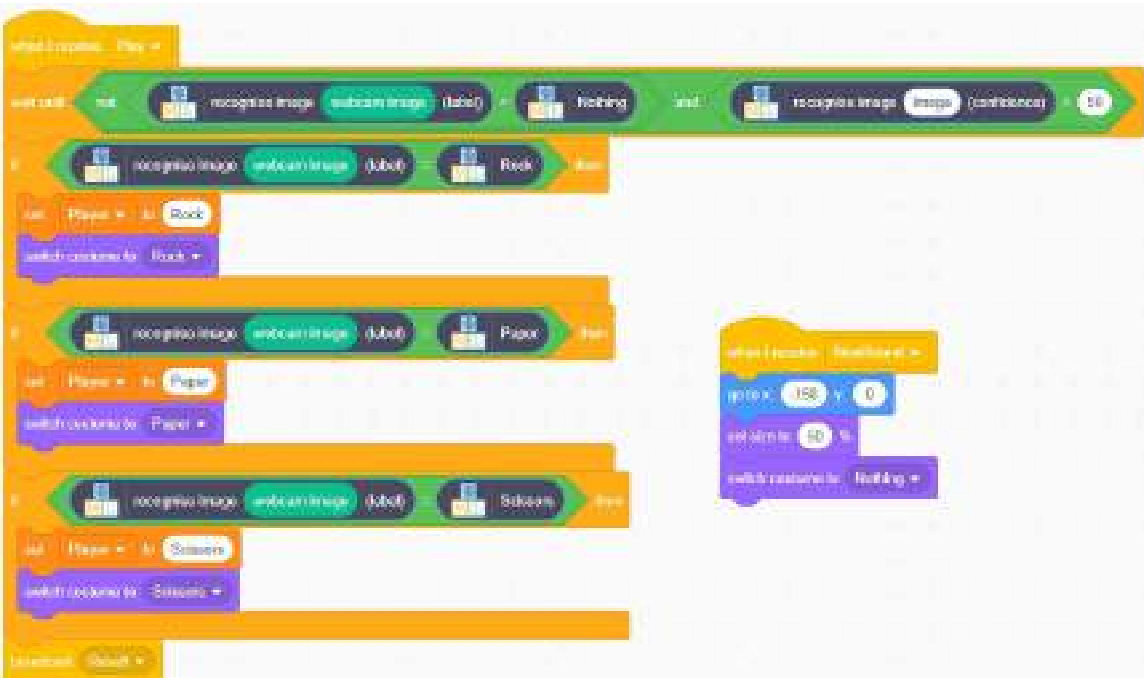
Step 7. Programming the referee (cat)

The cat character has a unique costume and is responsible for showing the symbol chosen by both the computer and the player to decide who wins.



Step 8. Player programming

The player character has the mission of detecting, through the camera, the figure created by the hand and storing it in a variable. In addition, he has three costumes that represent the three possible options (rock, paper and scissors), and that change to show the element chosen by the user.



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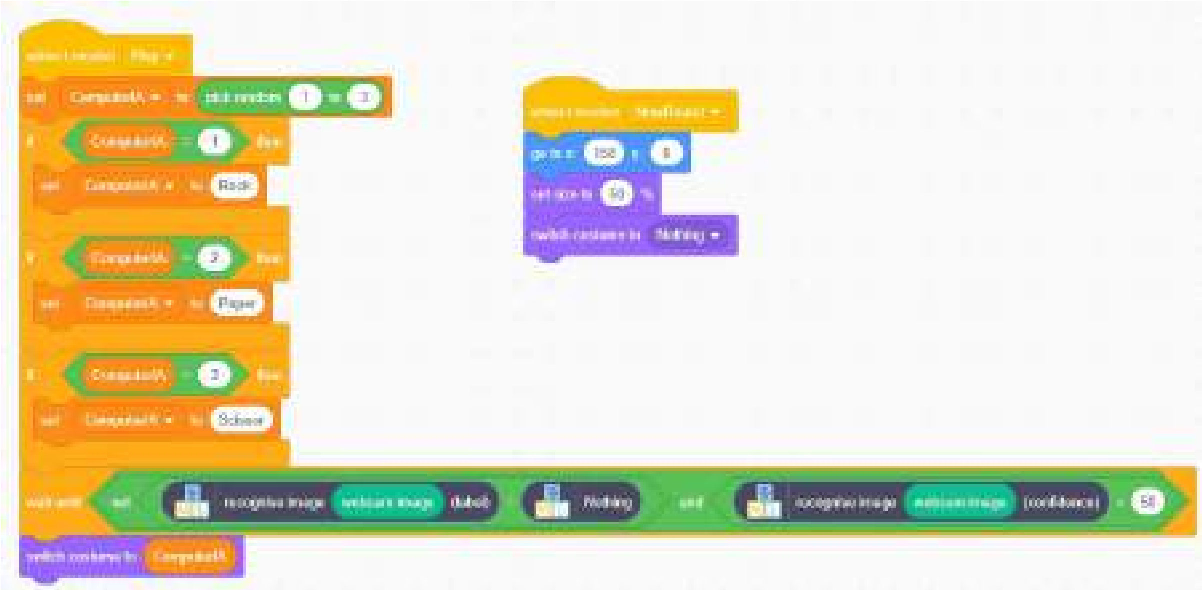
Step 9. Computer programming

The computer chooses a figure at random using the random number instruction. Once it has selected the figure, it waits until the player's figure is recognized, ensuring that the player does not have any advantage.



Conclusion and sharing

Classroom Activity 💡 Let's have a tournament/competition testing the programs of all the teams.

Note for the teacher📝 We can then end up the activity presenting some questions to the students: What new skills did you gain during this project? What are your thoughts on the differences you discovered between men's and women's sports? Do you think what you have learnt today may be applied into other areas?

Show us your results via social media!

- LinkedIn: https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name
- Instagram: https://www.instagram.com/steambrace_eu/
- X: https://x.com/steambrace_eu

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Project Evaluation

Activity Objectives	Key competences (EU)	Evaluation Criteria
Foster an appreciation of cultural traditions	Interpersonal skills, and the ability to adopt new competences Cultural awareness and expression	The group presents well-researched information on a traditional game with clear historical and cultural context
Promote teamwork		Demonstrates effective collaboration within the group, with clear communication and shared responsibilities. Each team member has a defined role and contributes to the project, ensuring balanced participation.
Raise students' awareness of the differences that still exist in many fields, such as sports, between men and women and their career opportunities.		The student provides a well-detailed analysis of both male and female athletes, including achievements, media presence, and sponsorships.
Depelop programming skills	Numerical, scientific and engineering skills Digital and technology-based competences	The student effectively trains an AI model with balanced and varied datasets. The code in Scratch is functional without major errors and follows logical programming practices. The student correctly integrates machine learning blocks in Scratch.

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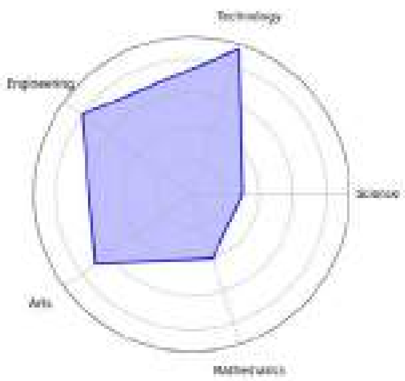
SAFETY ACCESS CONTROL



Duration	Age Range	Difficulty
2 hs	15-16	High
#ROBOTICS #AI #SECURITY		

Description

In this workshop we will become hospital security programmers using mBlock. Together, we will create a system that detects whether a person is wearing a mask and protective glasses to allow them access to the hospital. Using sensor programming and simple logic, we will set up a "virtual guard" that decides who can enter based on security measures.

We will simulate different scenarios to see how our program responds, gaining a closer understanding of how control systems work in real life. In the end, we will have designed an innovative security system, combining programming and technology to take care of everyone!

Objectives of the Activity

- Learn the basics of programming and conditional logic
- Develop skills in using virtual sensors
- Understand the importance of security systems
- Foster creativity and design in programming
- Stimulate critical thinking and problem solving

Key competences (EU)

- Numerical, scientific and engineering skills
- Digital and technology-based competences
- Active citizenship

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Materials

Activity kit:

- Two-color LED
- Connection cables
- Microcontroller
- Servomotor

Provided by the teacher/institution:

- Computers
- Masks
- Cardboard
- Scissors
- Tape
- Optional: paints and elements to decorate

Prrevious preparation

- Creation of work groups (2-3 participants)
- Preparation of materials
- Installation of hello,blocks! drivers, if you have not previously worked with the cirkids microcontroller.
- Configuration of equipment/devices

Contextualization and adaptation

1. Watch video 📽️ - "Smart Construction Safety Guard".

Smart Construction Safety Guard | A.I. Solution from MICology Limited

Subtitles available in:

- Spanish
- English
- Croatian: Automatic translation option must be selected
- Portuguese: Automatic translation option must be selected

2. Watch video 📽️ - "How to improve workplace safety with AI Monitoring".
How to improve workplace safety with AI Monitoring

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What is PPE?

Classroom Activity 💡

PPE refers to equipment intended to be worn by workers to protect them from one or more risks that may threaten their safety or health, as well as all accessories designed for the same purpose.

There are different types of PPE equipment, adapted and designed to protect specific parts of the human body.

Look for information on safety equipment and list the 7 main categories into which it is classified.

Note for the teacher 📝

Partial safety elements can be classified into the following categories:

- Head protectors: helmet
- Ear protectors: earplugs, earmuffs
- Eye and ear protectors: glasses, screens
- Respiratory tract protectors: masks
- Arm and hand protectors: gloves
- Foot and leg protectors: boots
- Trunk and abdominal protectors: belts and aprons.

Inventors who took risks

Classroom Activity 💡Inventors who took risks

Personal protective equipment was created to protect users from known risks. However, in the history of inventions, many times they have arisen by chance or have been created without fully knowing the risks they involved. A notable example is that of Franz Reichelt, an Austrian tailor who pioneered the integrated parachute. This brave inventor called the press and jumped from the Eiffel Tower in Paris on October 4, 1912 to demonstrate how his invention worked. However, the parachute did not work as expected, and Reichelt died instantly, becoming the first death on film in history.

However, Franz Reichelt was not alone. Many inventors have suffered the consequences of their discoveries. Research female inventors who died from their own inventions and describe what improvements could have prevented their deaths.

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Note for the teacher 📝

Below are some examples of female inventors who died due to the risks of their discoveries or by working in dangerous areas without adequate protection:

Marie Curie (1867-1934)
The famous Polish scientist pioneered the study of radioactivity, discovering the elements radium and polonium. At the time, the harmful effects of radiation were not known, so Curie worked without protection. She handled radioactive substances on a daily basis and often carried radium tubes in the pockets of her lab coat. Years of radiation exposure caused her to develop aplastic anemia, which eventually claimed her life.

Improvements to prevent her death: Had she had personal protective equipment, such as gloves, lead aprons, and a properly shielded work environment, she likely would have been able to minimize her radiation exposure.

Elizabeth Fleischman-Aschheim (1867-1905)
Elizabeth Fleischman was one of the first radiologists and dedicated herself to applying X-rays in medicine, often using these devices to diagnose patients. Like Marie Curie, she worked without protection, as the effects of radiation were not well known. After several years of exposure, she developed serious health problems, which led to her death.

Improvements to prevent her death: The use of radiation protection and the creation of safety protocols for handling X-rays would have reduced her exposure.

Clara Immerwahr (1870-1915)
Although not directly killed by an invention, Clara Immerwahr, a German chemist, died in protest against the use of her knowledge in the development of chemical weapons during World War I. She was opposed to the use of chemistry in the creation of deadly weapons, which brought her into conflict with her husband, chemist Fritz Haber, who promoted the use of chlorine gas in warfare. Clara committed suicide in 1915 in protest of this application.
Improvement to prevent her death: Her case highlights the importance of ethics in science and respect for the rights of researchers in their work. Having safe spaces for ethical discussion and the freedom to oppose practices contrary to scientific ethics could have prevented her tragic outcome.

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Equal opportunities?

Classroom Activity 💡

Workplace accidents are those that occur during working hours and are recorded annually to implement continuous improvements in work environments, with the aim of reducing the risk of accidents.

When analysing the sectors of activity, the construction sector presented the highest incidence rate, more than double the average of the sectoral indices.

Look for information about the number of workplace accidents based on the gender of the worker, as well as the sector to which it is assigned.

Once the data has been collected, formulate a hypothesis that justifies the results.

Note for the teacher 📝

In Spain, during 2023, the National Institute for Health and Safety recorded 647,495 work accidents with sick leave. As for gender distribution, men suffered 395,670 accidents during working hours, while women recorded 163,266 accidents. This indicates that men experienced more than twice as many work accidents as women.

The higher incidence of work-related accidents among men could be related to the male predominance in high-risk sectors, such as construction and industry, where tasks usually involve greater exposure to physical dangers. On the other hand, women are more present in the service sector, which has a lower than average accident incidence rate.

However, although women do not suffer from workplace accidents as frequently, they often suffer from other conditions resulting from their work situation, such as stress, which can also have a significant impact on their health.

Activity

Part 1: Designing the interface

Step 1 - Creating the operating room:

Using the Mblock platform, you will create an access control system with artificial vision capable of recognizing whether doctors are ready to enter the operating room. The computer will display the instructions at the same time as a model will simulate the access door that will open when users meet the requirements and carry the necessary PPE.

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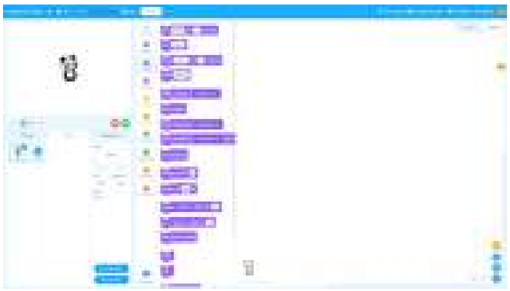

Step 2 - Creating the operating room:

First, you must customize the background and add the necessary characters.

The first character will be controlled by AI and will be in charge of giving instructions to users who wish to access. On the other hand, a doctor has been included who will represent the protective elements that the user wears.

Step 4 - Customizing costumes:

Once you have added the visual elements, you must create the necessary costumes for the character that represents the user. During this first part of the activity, you will focus on configuring all the necessary elements of this character. Make sure that you have selected the correct character before you start programming.

In this case, you must create five different costumes for all the states, as shown below:

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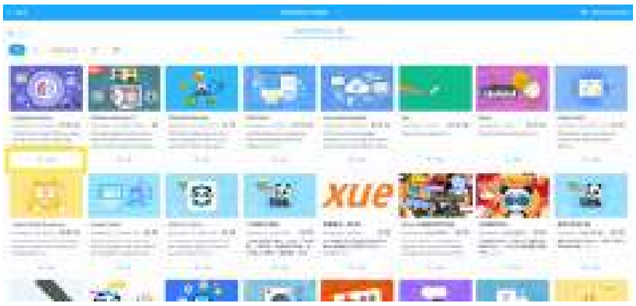
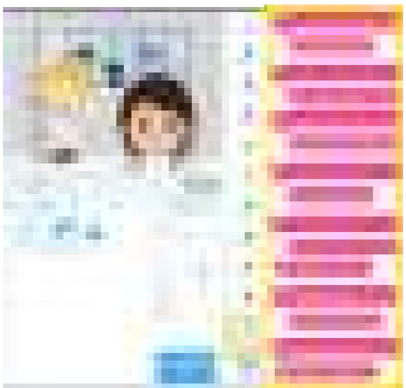
Step 5 - AI Extension:

Now that all the basic elements are included within the program, you must add the necessary AI extension so that you can incorporate computer vision into your program.

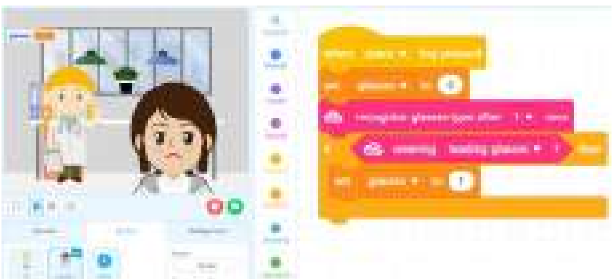




Step 6 - Programming with AI:

Once the extension is included, there are now many blocks that can be used to recognize voice, text, emotions, objects, etc. For your program, you need to use the "recognize glasses type" and "recognize facial blocking" functions. These are two different functions, but their mode of operation is the same.

Below you can find an example of how to recognize if users are wearing glasses. Copy the program and check how it works. Once it is working, add the necessary blocks to detect if the user is wearing a mask using the "recognize facial blocking" function.



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Note for the teacher 📝Below is a possible solution, where two variables have been created for the two states and the necessary blocks have been incorporated to detect the use of a mask.

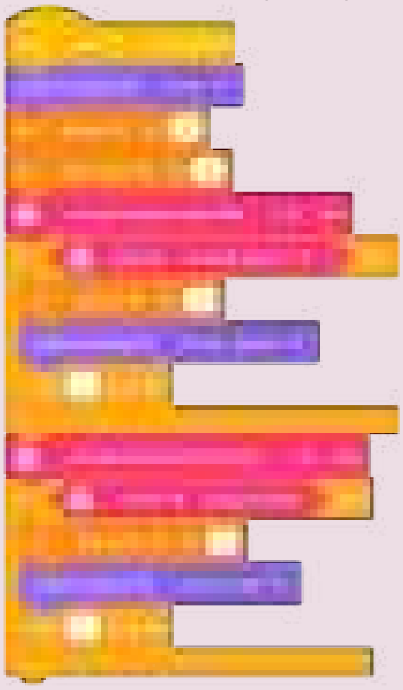
Once the code has been created, students are asked to experiment with the program. It may be necessary to remind them that in the "wearing" block of the glasses, they must select "reading glasses". On the other hand, in the "beign blocked" block they must select "mouth". Sometimes the AI may have difficulty detecting the mask, for this reason students can be asked to cut out small rectangles of paper to cover their mouths.

Step 7 - Costume Changes:

With the image recognition blocks working, add the blocks needed to change the costume of the avatar representing the user. If the user is wearing glasses, the avatar will display them. Once working, modify the program so that it can also represent the mask.

Once you have executed your code, you can see that the default avatar does not appear again, without glasses or mask. To return to the initial state, add the costume change block at the beginning of the code.

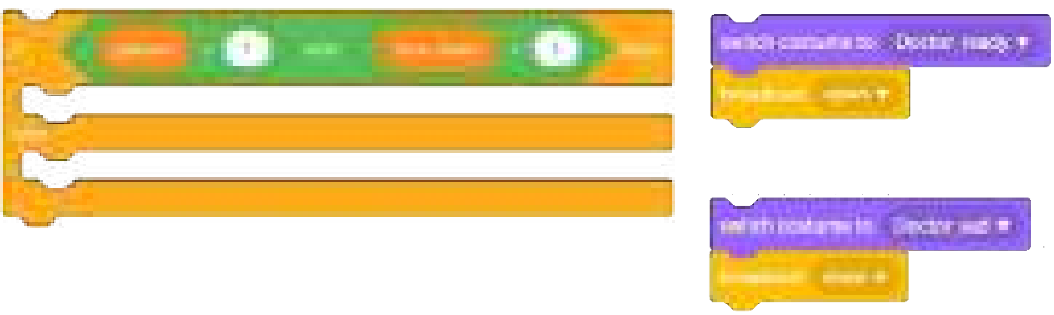
Note for the teacher 📝 Below is a possible solution, where the costume change has been incorporated into both situations (glasses and mask). The costume block has also been incorporated at the beginning of the code so that the image is restored at the beginning.



Step 8 - Making a decision:

Once we have the basic structure of the program that detects the glasses and masks and updates the value of the variables, you must incorporate a conditional that opens the access door when the two conditions are met.

This conditional structure will be responsible for updating the doctor's avatar to "ready" or "sad" if he is not wearing any of the security elements. In addition to these elements that have been used so far, create two global messages "open" and "close". These will be necessary to control the door connected to Cirkids later on.



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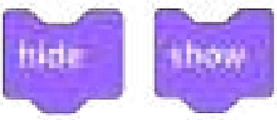
Note for the teacher 📝Below is a general summary of how the program looks so far with all the blocks necessary for its operation.

Step 9 - Hiding elements:

Now all the functions of the avatar representing the user are programmed. To finish, you just need to add the “show” and “hide” blocks. This way, the avatar will only be shown when the scan is activated by pressing the “space” key. Once the user has been scanned and the corresponding costumes have been shown, the avatar will be hidden again.



Note for the teacher 📝 By incorporating the “show” and “hide” blocks, students can observe that the avatar quickly disappears without giving them time to see the “Doctor_ready” or “Doctor_sad” costumes.

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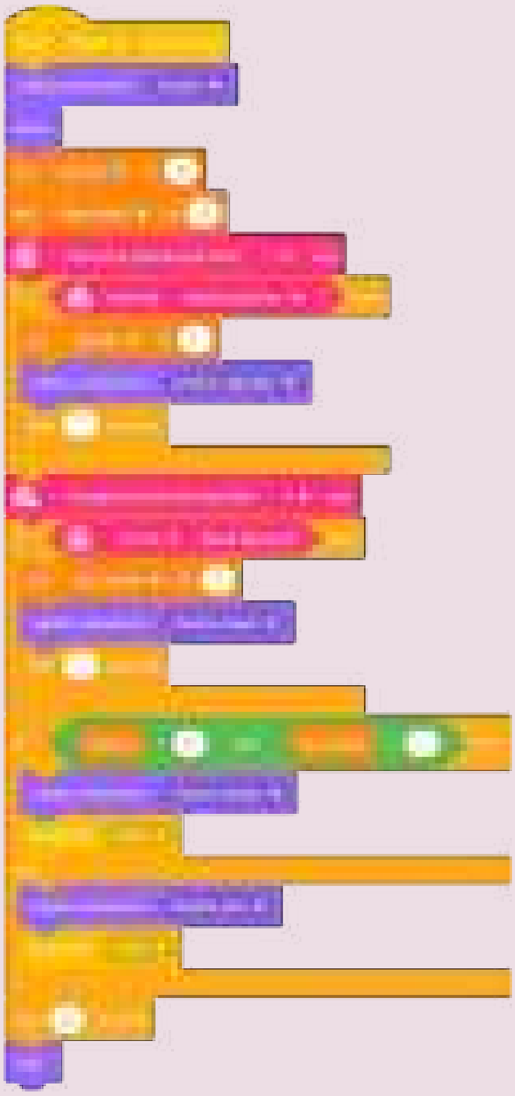
To allow students to see the costume change before hiding, you can place a time block before the “hide” instruction. Here is a possible solution:



Step 10 – Programming the AI avatar:

Once the editing of the “Doctor” character is finished, it is time to start the “AI” character. The programming of this character is very simple, the avatar has to give four messages that accompany the user during its operation.

Message 1: You must tell the user to stand in front of the camera and press the “space” key. This message will be displayed when starting the program with the green flag.

Message 2: Activated when you press the “space” key, this avatar will indicate that the scanning process has begun.

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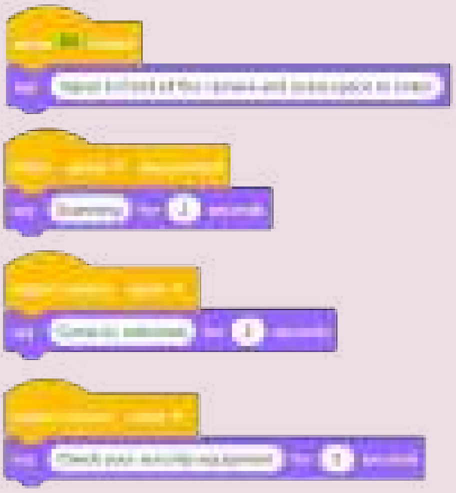
Message 3: This message is executed when the user complies with all security elements and the door is opened.

Message 4: This message is displayed when the user does not comply with some of the points and the door does not open.

Note for the teacher 📝 Below is a possible way to solve this activity:

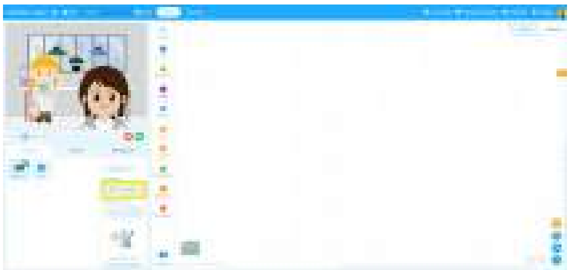


Part 2: Programming the electronics

Step 1 - Add device:

Once the program interface is finished, it is time to connect it to the model that will simulate access to the work area. First, add the device to the MBlock platform so that you can program the necessary instructions.

The connection to the device will be made through the serial port and in “live” mode. You may need to update the firmware of the device to connect correctly. Below you will find the steps necessary to do so.



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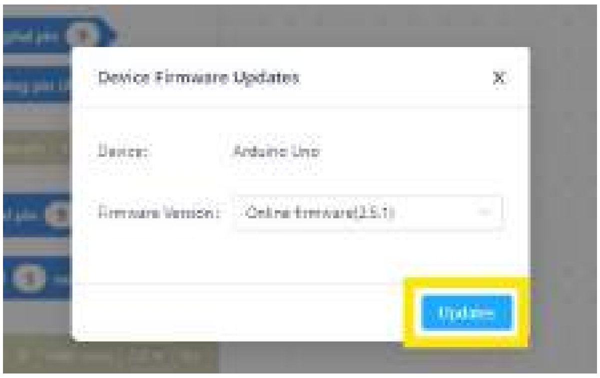


Note for the teacher 📝 This process may seem a little complicated at first, but it is necessary to connect the device to the program created by the students.

Although the device we will use in this session is Cirkids, on the platform you can select Arduino UNO, since it is fully compatible and you will find all the blocks necessary to program it.

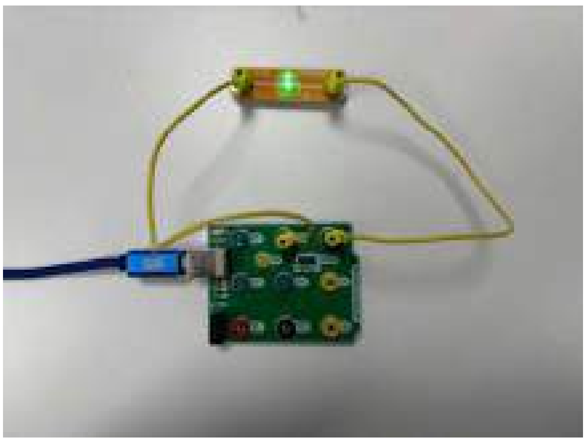
Step 2 - Programming traffic light

To create the traffic light, use the bicolor LED module. This component has the particularity of containing two LEDs in one, which allows it to shine in red or green depending on how it is configured:

Red color: connect "RED" pin to 5V and "Green" to GND.

Green color: connect "Green" pin to 5V and "Red" to GND.

Once the LED is connected to the digital pins as shown in the illustration, configure the pins in the program to control the traffic light correctly.



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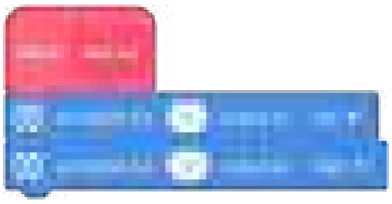
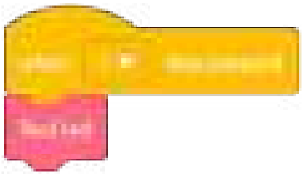
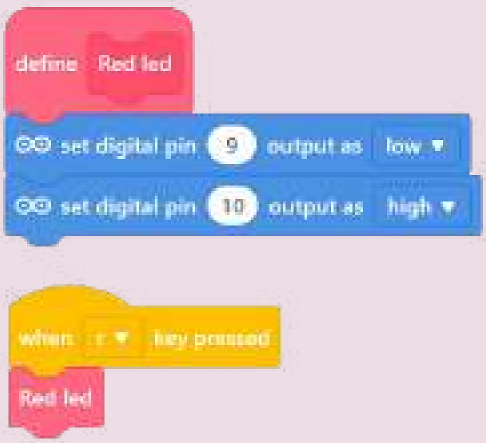
Since each color needs the definition of two digital pins, create a function for each color. To do this, go to the "My Blocks" section and create a new block, giving it a name that allows you to easily identify the color.

Below you can see an example of how the block for the color red was created. Create a similar block for the color green, and then test its operation by assigning a key to each color: “r” for red and “g” for green.



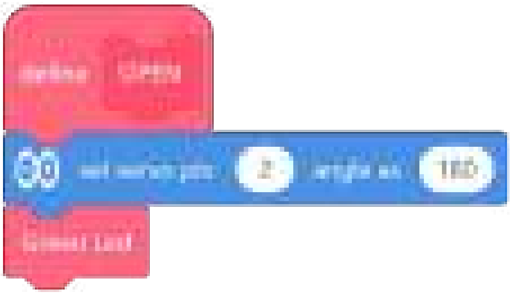


Note for the teacher 📝 Below is a possible way to solve this activity. The “R” and “G” events will be used only to check the correct operation of the bicolor LED, confirming that the blocks are assigned correctly and that the LED lights up with the color corresponding to each function. Once its operation has been verified, you can delete both events.

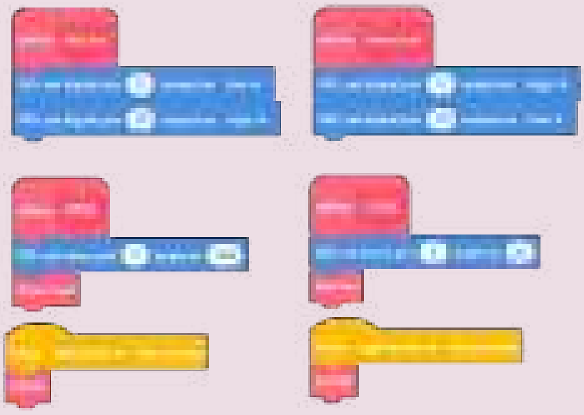


Step 3 - Door Control:

To open the door of your model, use the servo motor connected to digital pin D2. Create two new global functions called “OPEN” and “CLOSE”. Once created, as you did before, add two events to activate these functions and check their operation.



Note for the teacher 📝Below is a possible way to solve this activity:



The servo settings are not final, since they will not be able to finish adjusting them until they build the model with the elements.

Step 4 - Creating the model

Using recycled materials, create a model that simulates a wall or a building in which you must integrate the traffic light and the servomotor. In this case, we will build a model of a hospital, where the challenge will be to open the door automatically with a servomotor and turn on a light using a two-color LED.

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Note for the teacher 📝 In this exercise, students must use all their creativity to come up with the best possible solution for creating the model. The door opening mechanism can be as complex as they wish, or as simple as using a piece of tape as a hinge and allowing the motor arm to push the door.

Step 5 - Creating the mockup

On the cardboard, you must stick a printed sheet or the design you have created to personalize your project.

Step 6 - Adding details

Glue the drawing if you have painted it on a separate piece of paper and then cut out the silhouette of the building. A good idea is to place some supports as buttresses so that it can stand upright without falling over. Don't forget to cut out the door frame so that it can move.



Step 7 - Installing the servo motor

The servo motor will be the component in charge of moving the door of your model. Place it as shown in the image and secure it with a little tape to make sure it is secure.

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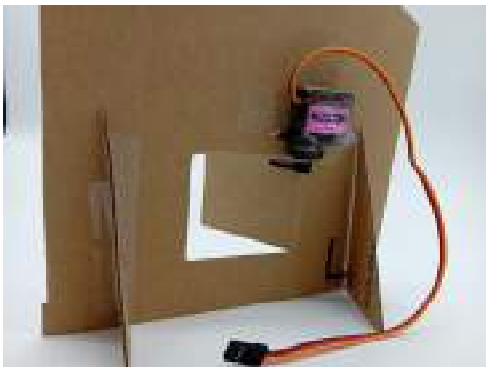
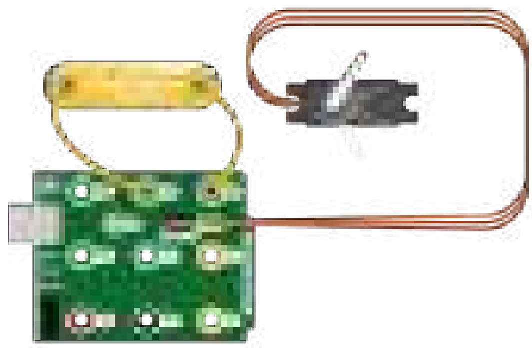


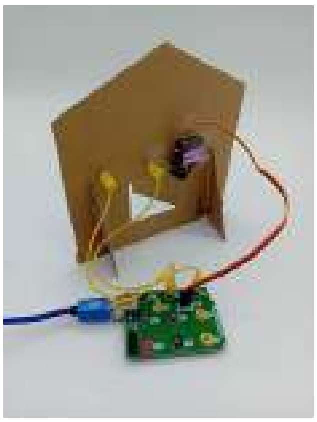
Step 8 - Indicator light

To install the bicolor LED, take the corresponding module and place it on the front of the model. You can secure it by pressing it so that the terminals are firmly attached to the cardboard. The electrical connections will be made through the holes created in the cardboard. This way, you will achieve a clean installation without visible cables.

Step 9 - Indicator light

The last step to assemble our model is to wire the bicolor LED and the servomotor to the microcontroller on the back as shown in the image.





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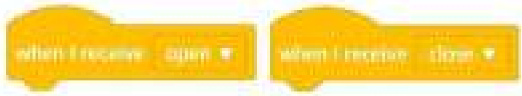
Step 10 - Device Integration

Once the model is built and set up, it is time to link the Arduino code with the programming of the interface in MBlock. To do this, replace the key events you have used so far with the internal message calls you created in the first part of the program: “broadcast open” and “broadcast close”.

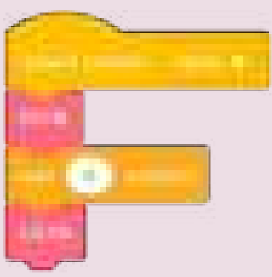


Note for the teacher 📝 Below is a possible solution where the “open” and “close” message events are responsible for controlling the actions of the mockup.

Step 11 - Operation check.

Once the programming is finished, test your access control system. Don't forget to wear glasses and a mask. If you don't have a mask, you can cut a small square of white paper to cover your mouth.

Once your system is up and running, you may need to make some adjustments before you call it finished.



Note for the teacher 📝

When testing the device, students can see that the door does not close automatically after being opened. One possible way to correct this is to set a timeout of 3 seconds and close the door after that time.

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Conclusion and sharing

Classroom Activity 💡

Let's test out models and the other groups as well. Does yours work properly? Which modifications do you think will make the design better? You should also present to the rest of the class your model taking into account:

- How does your system works (AI recognition, sensor integration, etc.)
- What challenges did you face and how did you solve them?
- How could you improve the system further?

Note for the teacher 📝
Once the students finish testing their models, they should end the sessions being asked the following questions and they may also debate about this together:

- Why is it important to have effective security systems in places like hospitals or workplaces?
- How does technology, like AI and programming, help improve safety?
- What precautions or safeguards do you think should be taken when designing AI systems that control access to sensitive areas?
- Do you think that the tools you have learnt today could be used in other areas?

Project Evaluation

Activity Objectives	Key competences (EU)	Evaluation Criteria
Foster creativity and design in programming	Numerical, scientific and engineering skills	Creativity in designing the hospital access control model and incorporating virtual sensors. Use of customized characters, backgrounds, and costumes to make the system visually engaging.
Stimulate critical thinking and problem solving		Demonstrates critical thinking in overcoming challenges like sensor malfunctions, incorrect character responses, or integrating hardware. Willingness to test and modify code to improve sensor accuracy or adapt to real-world scenarios.

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Understand the importance of security systems	Active citizenship	Demonstrates an understanding of the role of security systems in real-life scenarios like hospitals and workplaces. Ability to explain how the activity simulates real-world security access control and its importance in ensuring safety.
Learn the basics of programming and conditional logic	Digital and technology-based competences	Students successfully implement conditional statements to control the flow of the program based on input from the virtual sensors. The logic behind the "open" and "close" actions based on the conditions (mask and glasses detection) is functioning properly.
Develop skills in using virtual sensors		Ability to program and configure the virtual sensors (facial blocking, glasses recognition) to detect the user's PPE.

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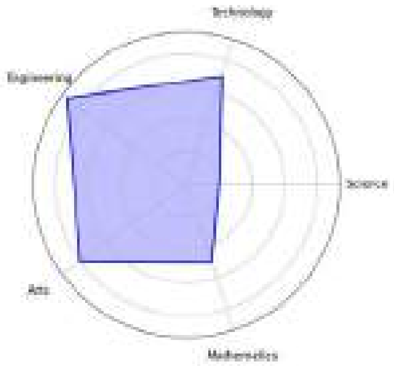
PACKAGING OF THE FUTURE



Duration	Recommended Age	Difficulty
2 hrs	15-16	Low
#ENGINEERING #RESEARCH		

Description

From the marmalade jar to smart packaging with AI. In this session, students will discover the reasons behind the shape, materials and characteristics of packaging. They will learn how new technologies are revolutionising the packaging industry, enabling the creation of adaptive solutions that fit the specific needs of each product and consumer. At the end, students will apply what they have learned to propose and design their own adaptive packaging.

Activity Objectives

- Exploring innovative technologies
- Encouraging creativity and design
- Acquisition of 3D design skills
- Encouraging sustainability in design

Key Competences (EU)

- Numerical, scientific, and engineering skills
- Digital and technology-based competencies
- Interpersonal skills and ability to acquire new skills
- Active citizenship competence

Materials

Provided by the teacher/institution:
- Plastic bottle (Exercise 1)
- Measuring tools
- Computer equipment
- Examples of packaging (extra)

Downloadable elements:
- Packaging example

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Previous Preparation

- Creation of working groups (2-3 participants)
- Preparation of materials
- Setting up accounts in teams to work with Tinkercad
- Configuration of equipment/devices
- Downloading of packaging examples if applicable
- As an extra, it might be useful to have examples of packaging in class.

Contextualization and adaptation

Exercise 1 - Adaptive design

Watch video 📽 - "Impack Automated Packaging Solution".
CVP Impack Automated Packaging Solution | Sparck Technologies

Classroom Activity 💡 Nowadays, the majority of sales are made online. This has led to a significant increase in the number of shipments. It is expected that approximately **100 million packages** are shipped every day worldwide. For this reason, many companies have been looking for solutions to make parcel delivery more efficient. You have probably noticed that many parcels have large dimensions, but do not correspond to the dimensions of the object they contain. The latest technologies have made it possible to implement artificial intelligence in processing chains. In this way, machines have been created that are capable of manufacturing packaging that is exactly adapted to each object, thus avoiding unnecessary waste of material.

AI has made it possible to improve the process, but for many years packaging has been created that has made it possible to make the transport of these goods more efficient.

Look for efficient packaging and other solutions that could have been adopted.

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Note for the teacher 📝 For decades, different types of packaging have been used to maximise efficiency and product preservation, as well as to minimise environmental impact. Classic examples of efficient packaging include:

1. **Soft drink cans:** Made of aluminium, a 100% recyclable material, cans are lightweight and easy to transport. Their cylindrical design optimises storage and distribution space, allowing them to be easily stacked in boxes and on pallets. The aluminium also protects the contents well from light and air, maintaining the freshness of the beverage.
2. **Milk and juice tetra bricks:** This type of multilayer packaging combines carton, aluminium and plastic. Each layer has a specific function: the carton provides rigidity, the aluminium acts as a barrier against light and oxygen, and the plastic seals the package. Tetra bricks are lightweight and take up less space when stacked, helping to reduce transport costs and carbon footprint.
3. **Plastic and glass bottles:** PET plastic bottles are popular for their low weight and strength, making them ideal for transporting large volumes of liquids without adding considerable weight. Glass bottles, although heavier, are 100% recyclable and reusable, making them a more sustainable option in certain contexts, especially where recycling is efficient. The bottles are designed to optimise space and are manufactured in shapes that allow for compact storage and stacking.

Exercise 2 - Great designs of history

Classroom Activity 💡 Find information about a great and unknown woman, Margaret Eloise Knight, by answering the following questions:

- What was her greatest invention?
- In what context was this breakthrough achieved?
- What problems did she encounter after making her invention?

Note for the teacher 📝 Possible answers would be:

- What was your greatest invention? The flat-bottomed paper bag. In 1867, Margaret Knight began working in a factory that manufactured paper bags. She noticed that the bags they produced were inefficient because they had an envelope design and were impractical for carrying items. This inspired Knight to design a machine that could produce bags with a flat bottom, more stable and better able to transport products.
- Knight spent months developing a prototype machine that automatically cut, folded and glued flat-bottomed paper bags. This design revolutionised the packaging industry, as the resulting bags were much more functional and useful for consumers and retailers.
- In what context was this breakthrough achieved? In the second half of the 19th century, industry was booming in the United States, and the need for efficient and practical packaging methods was becoming increasingly apparent. Up to that time, paper bags had been impractical and could not stand upright, which limited their use.

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- What problems did he encounter after making his invention? In 1870, when Knight was about to patent his invention, Charles Annan, a man who had seen his machine in operation, tried to steal the idea and patent it in his name. Knight took Annan to court, and in a highly publicised trial, presented not only his drawings and sketches, but also testimony from people who had seen it working in his workshop.
- The court ruled in Margaret Knight's favour in 1871, recognising her as the rightful inventor of the paper bag machine. This was a remarkable achievement, as few women of the time were able to patent their inventions due to gender bias.

Activity

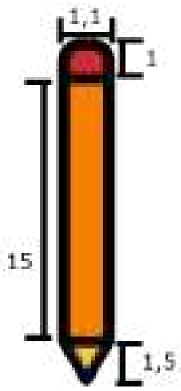
Step 1 - Decide which object you want to package

You will probably find many objects in your classroom that can be efficiently packaged. Decide which of these objects you want to package; in the example, the packaging of a pencil has been designed. It is a simple object that can be packed in a 'simple' way.

Step 2 - Take measurements of the object

Once you have chosen the object, use tools such as calipers or rulers to record its measurements. Many packages have standardised dimensions, so you can also find standard measurements for many items on the internet.

In the case of the example, these would be the measurements:



Step 3 - Model creation

Once the measurements have been taken, it is time to create a 3D replica. To do this, you must create a new 3D design in the Tinkercad platform (https://www.tinkercad.com/dashboard). Use the basic geometry blocks that you will find in the corresponding menu to create the replica.

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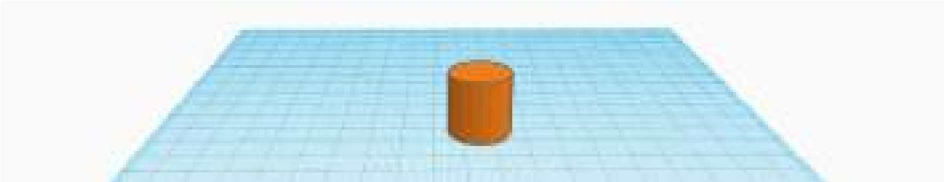
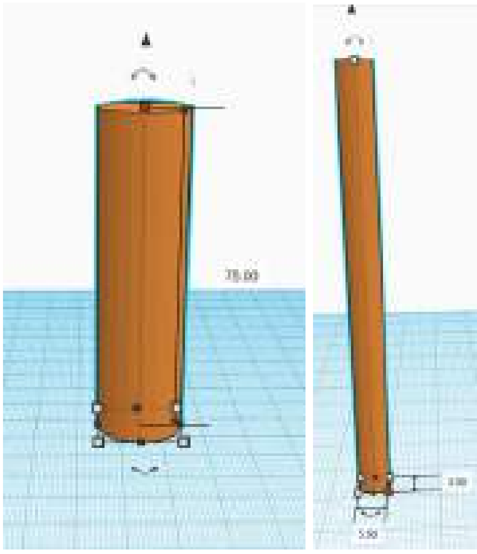
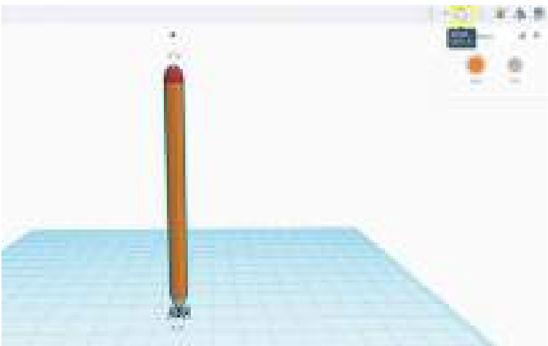


In the example, a pencil has been used as a reference. If your object is large, you can apply a scale to all its dimensions to maintain proportion and facilitate its design on the work table. For example, if you were working on packaging for a 100 x 50 cm painting, you could apply a scale of ⅕, transforming the design to 20 x 10 cm.



Step 4 - Design personalisation

Continue with the whole design and, when you have finished creating your object, you should join all the parts together so that it looks like a single piece. To do this, select all the parts at the same time and press the Group button.



You may notice that, when you put the pieces together, the object becomes one colour. To avoid this and keep the colours you have chosen, you should select **Solid** → **Multicolour**. This will not turn your object into a rainbow, but each shape will keep the colour you have selected.

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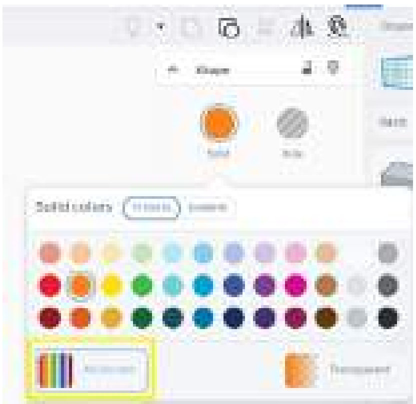
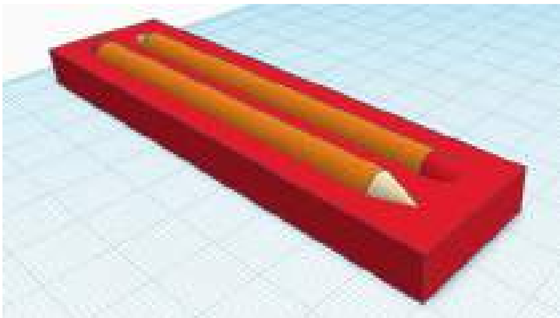


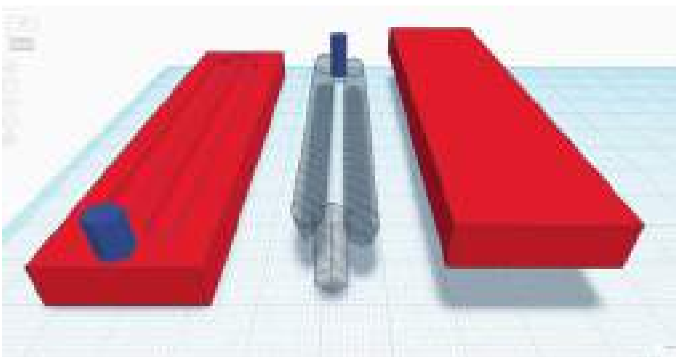
Step 5 - Creating packaging

Once you have your object ready, start thinking about the best way to design a packaging that will keep it perfectly fitted and can be closed securely. We recommend using a basic geometry as the basis for the packaging and applying the necessary subtractions to create the right space to accommodate the object. Once you have done this, you can customise the packaging and make any changes you consider necessary.



Step 6 - Volume subtraction

You can turn your object into a **'Hole'** to create its negative and design the space on the packaging where it will fit. It is also important to make sure that everything fits perfectly when you finish your design. Think carefully about how to make the lids and how to make the packaging stay securely closed.



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the European Union

On this occasion, some hexagons have been added as a guide to join both sides of the packaging and also to close it securely.

Share the designs and ideas you have had with your colleagues.

Conclusion and sharing

Note for the teacher 📝

Once the designs are finished students may present to each other what they have donde with their packagings and why.

After this it could be useful to held a debate about two topics regarding this theme:

- **"What Should Be Prioritised in Future Packaging: Sustainability or Cost-Effectiveness?"**
- **"What Are the Pros and Cons of Using Biodegradable Materials in Packaging?"**

This could be either a written job that they have to handle in or a more "informal" spoken between them.

Debate 🗣️

"What Should Be Prioritised in Future Packaging: Sustainability or Cost-Effectiveness?"

- Should companies focus more on sustainable, eco-friendly solutions even if they are more expensive to produce?
- What are the possible consequences of prioritising one over the other?

"What Are the Pros and Cons of Using Biodegradable Materials in Packaging?"

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Note for the teacher 📝

Finally we can ask each student to complete a small questionnaire about their experience about the activity:

- Did you know any of the designing tools shared today?
- Do you think this may be useful to other areas in your life?
- Has this activity changed in any sense the way that you perceive your surroundings and how it may affect other people?
- Which was for you the most difficult part of this activity?

We invite you to share your results on social media by mentioning the STEAMbrace project:

LinkedIn:
https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name

Instagram: https://www.instagram.com/steambrace_eu/

X: https://x.com/steambrace_eu

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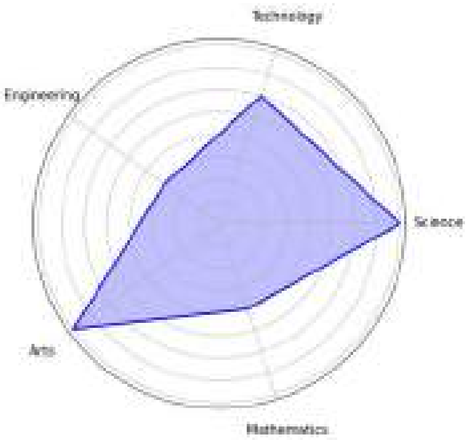
COLOURING THE UNIVERSE



Duration	Recommended Age	Difficulty
1 hr	17-18	Medium
#SCIENCE #AUDIOVISUAL		

Description

In this activity, we will explore how astronomers process images of space, assigning colours to different types of radiation to visualise them in an understandable way. Using colour techniques and tools such as GIMP, you will simulate how colour combinations affect our perceptions and how we can replicate the process of 'colouring' images, as is done with pictures of galaxies. In addition, we will look at how people with colour deficiencies, such as colour blindness, perceive these combinations.

Activity Objectives

- Understand the combination of colours that produce white light
- Become familiar with software in order to better study the composition and colour of objects
- Generate awareness of certain visual conditions
- Introduce certain references in the study of space

Key competences (EU)

- Numerical, scientific, and engineering skills
- Digital and technology-based competencies
- Active citizenship

Materials

Provided by the teacher/institution:
- Computers with Internet access
- Cellophane paper: red-green-blue
- Camera (can be a mobile phone)

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Previous Preparation

- Charge mobiles/cameras
- Software

Contextualization and adaptation

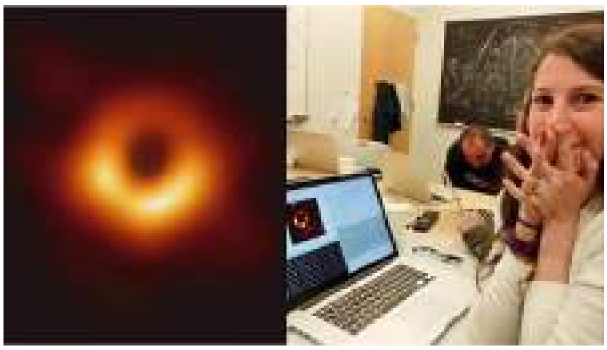
Photo by Alexander Andrews in Unsplash

Contemplating the sky and space has captured the human imagination for centuries. What seem to the human eye to be mere points of light in the sky are actually galaxies of amazing colours and shapes, stars glowing at different temperatures, and nebulae with varying chemical compositions. When observed in detail, they reveal stunning colours and structures: galaxies of reddish, bluish and golden hues, nebulae that glow with green and purple shades, and stars that vary from radiant white to deep red.

Our eyes, through the cones that perceive the colours red, green and blue, allow us to see a part of the visible spectrum. However, to uncover the secrets of the universe and the colours that lie beyond our natural vision, scientists use advanced tools and techniques that reveal the true cosmic colour palette.

The history of astronomy is full of pioneering figures such as **Caroline Herschel**, who, together with her well-known brother William Herschel, made a significant contribution to the study of the stars in the 18th century, furthering our knowledge of galaxies and star clusters.

Today, technology has taken these explorations to another level. One example is the achievement of **Katie Bouman**, who led the development of an algorithm that made it possible to capture the first image of a black hole in 2019.



Katie Bouman with the 'first processed image of a black hole'.

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These advances show that, although the human eye is limited, the combination of careful observation and technological innovation allows us to understand and see the cosmos in ways previously unthinkable.

In today's session we will explore **how to study photographs in a simplified way, simulating the work of astronomers.**

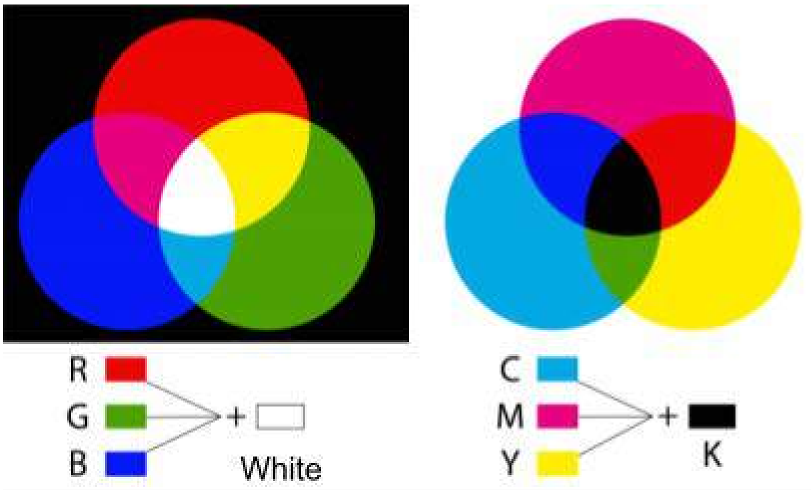
Modern telescopes capture different types of electromagnetic radiation which, being invisible to the human eye, require special processing to convert them into understandable images. The colours we see in images of galaxies and other celestial objects are mostly artificially introduced.

You can explore different images of galaxies here:
https://chandra.harvard.edu./photo/category/stars.html

In addition, the radiations obtained are indicated in each one of them.

This process involves assigning specific colours to each type of radiation detected, which allows us to visualise and analyse spatial phenomena more clearly.

But for all this we need to know how colours are combined (physical optics).For this, let's first look at the difference between primary light colours and pigment colours. Today we will use the primary light colours to our advantage:



The retina of the eye is covered by tiny light-sensitive receptors, a series of photosensitive cells called rods and cones. The rods are sensitive to light, but not to colour. We use the **rods** to see in low light; in fact, in the dark we see everything as black and white.

Cones are less sensitive to light, but can perceive colours. There are three types of cones, each of which is particularly sensitive to a specific part of the visible spectrum: to red, green and blue colours respectively. This arrangement makes it possible to perceive all the colours of the visible spectrum.

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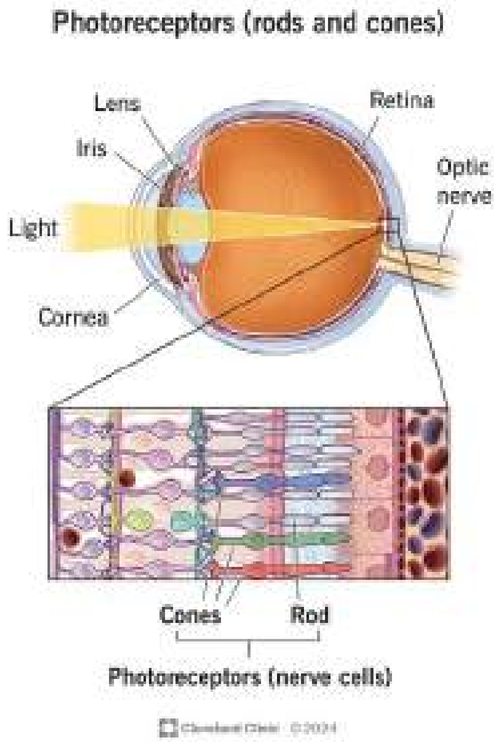

Picture: Cleveland Clinic. (s.f.). *Photoreceptors (Rods & Cones): Anatomy & Function.*

We will also study in this session what happens when one of our cones malfunctions and this leads to vision disorders such as colour blindness.

Watch video 📽 - "How scientist colorize photos of space".

How scientists colorize photos of space

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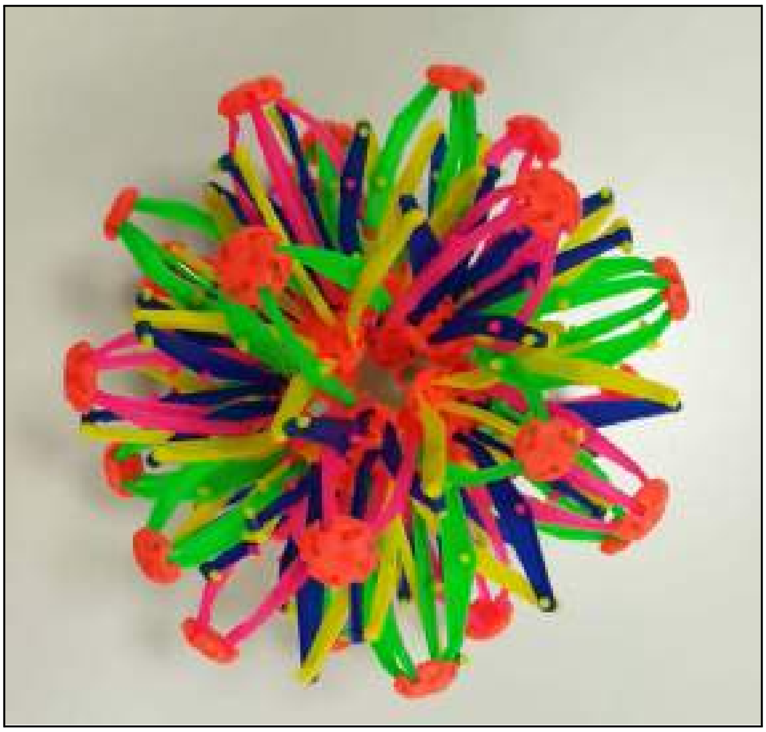
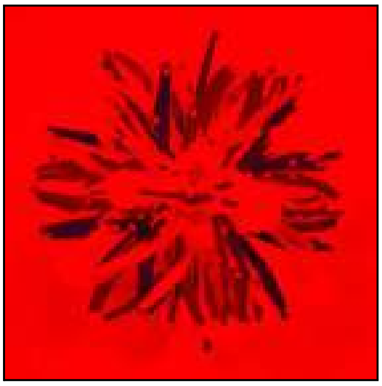
Activity

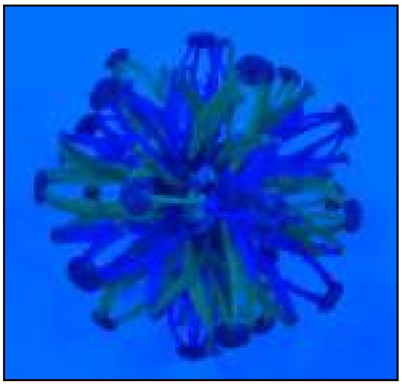
Exercise 1: Colouring Our Surroundings

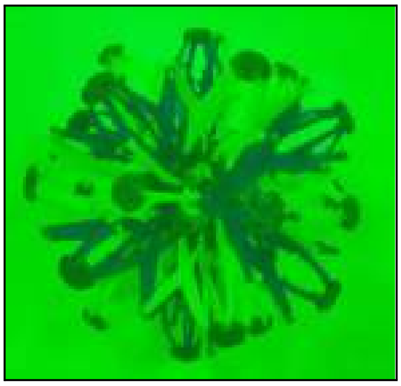
First, we take a photo of something with vibrant colours (as much as possible) - we can get very creative! For this example we will use the photo of the Hoberman sphere below, but it can be a landscape, flowers, clothes, etc.



Then, **without moving the camera** so that we can always take the same photo, we will put a red, blue and green cellophane paper in front of the camera and we will take a photo with each one of them. It is important that the photos are as similar as possible. Below are some examples (you can fold the cellophane if it is very transparent so that it makes for a better filter):







Open the 'GIMP' application (which must be previously installed on the computer you are going to work with).

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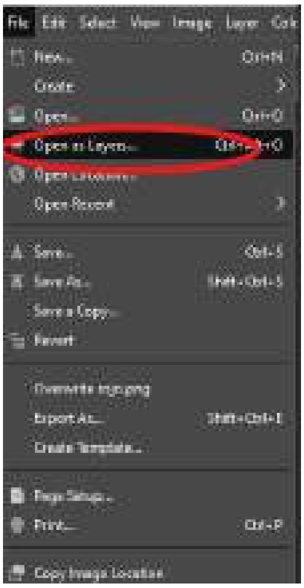
Select the option 'open as layers' and open the three images that we must have previously saved in the computer to upload them as layers (it is recommended to rename each one of them to the corresponding colour to work more comfortably):



📌**NOTE:** The images must be perfectly overlapped one on top of the other. To do this, you may need to lower the opacity of the images and adjust their size in case the photos are not exactly identical. Here's a tutorial that you can follow in case you need to do this:

GIMP: How To Resize An Image Using Gimp

How to Rotate Image in GIMP

You can lower the opacity of the layers in the following way to be able to 'see through' the topmost one and be able to fit it well with the ones below:

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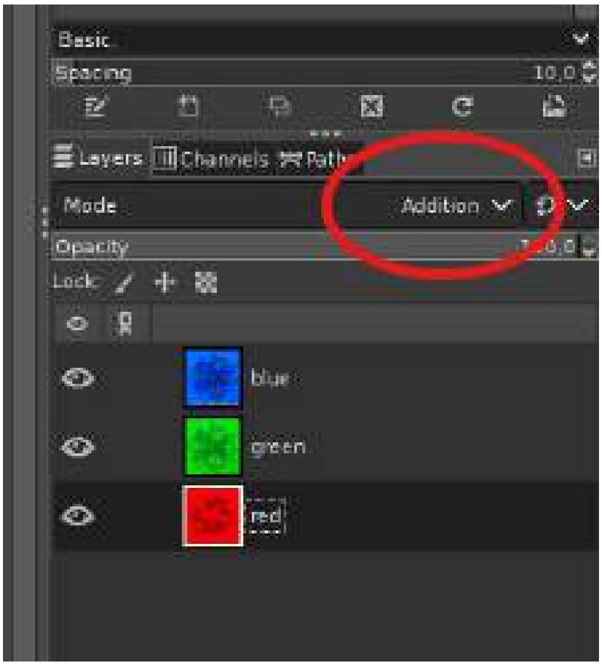
Once we have the images well placed, we must tinker with their opacities in order to obtain our white light and to be able to see colours that are close to reality. For this we select the 'addition' mode in all the layers:



And we will get an image similar to this:

To finish, we can play with the opacities of the layers so that the colours are as accurate to reality as possible. In this particular case it was enough to set an opacity of 80 in the blue layer and increase the contrast of the final image a little:

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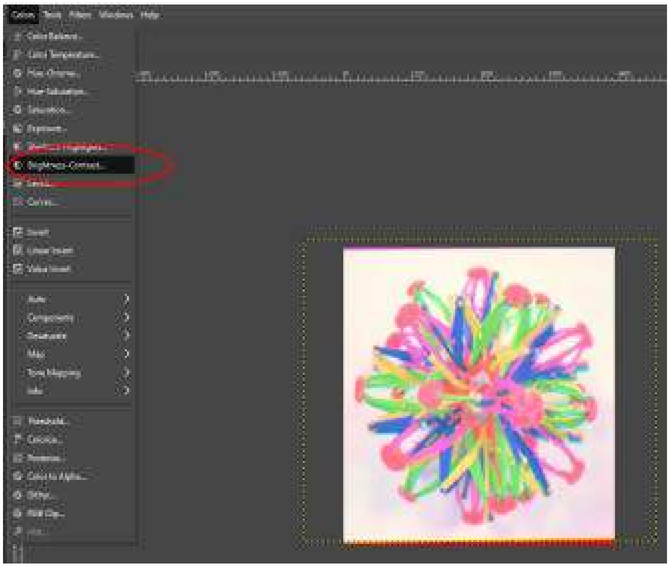
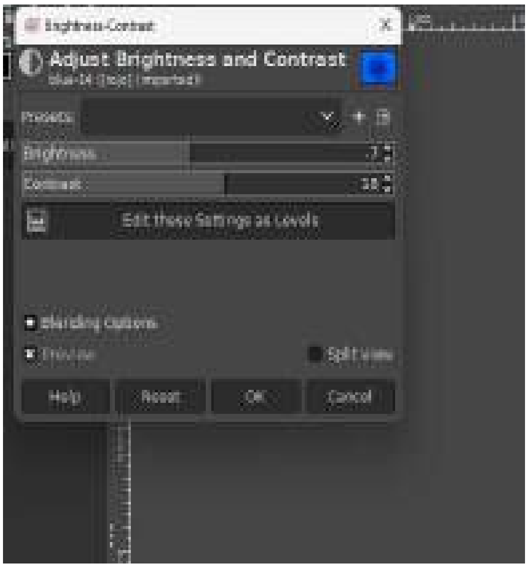
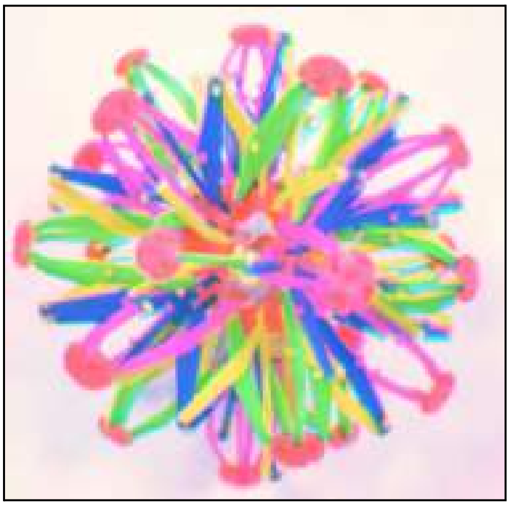
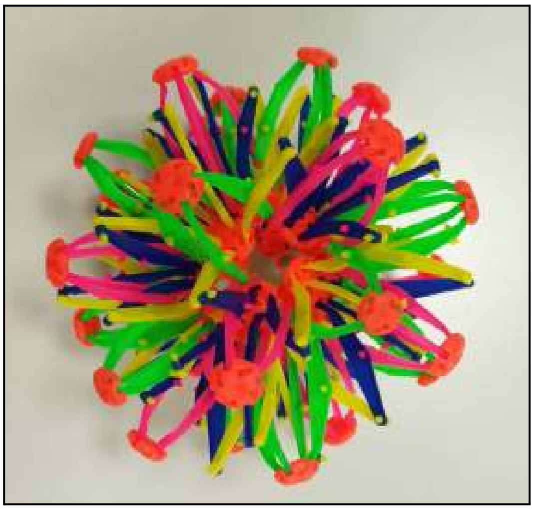




Now we compare the final result with the original:





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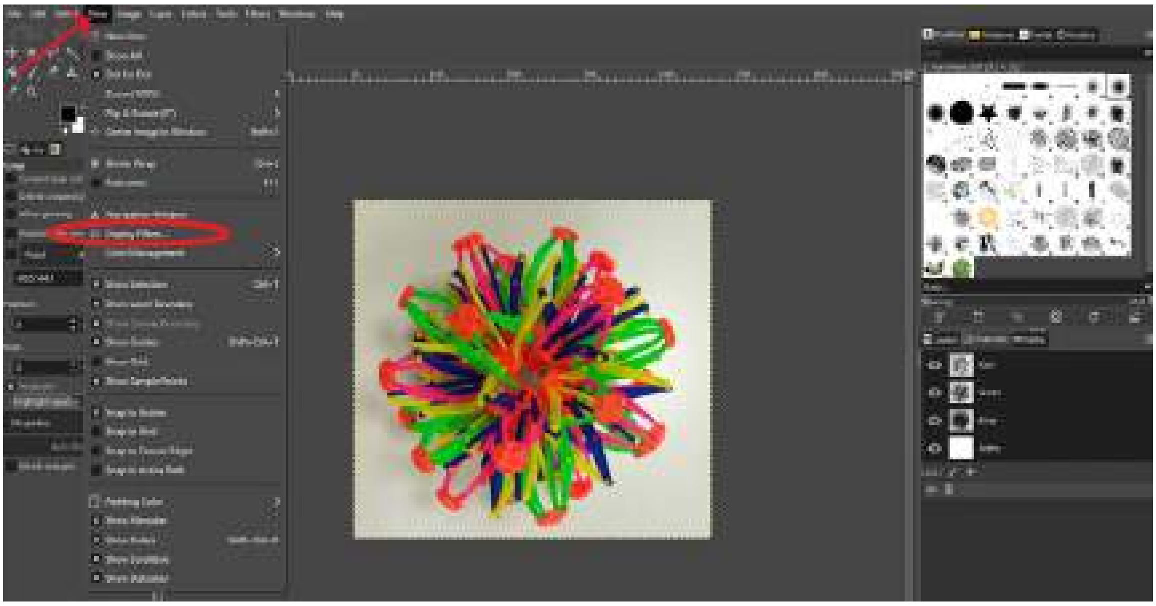
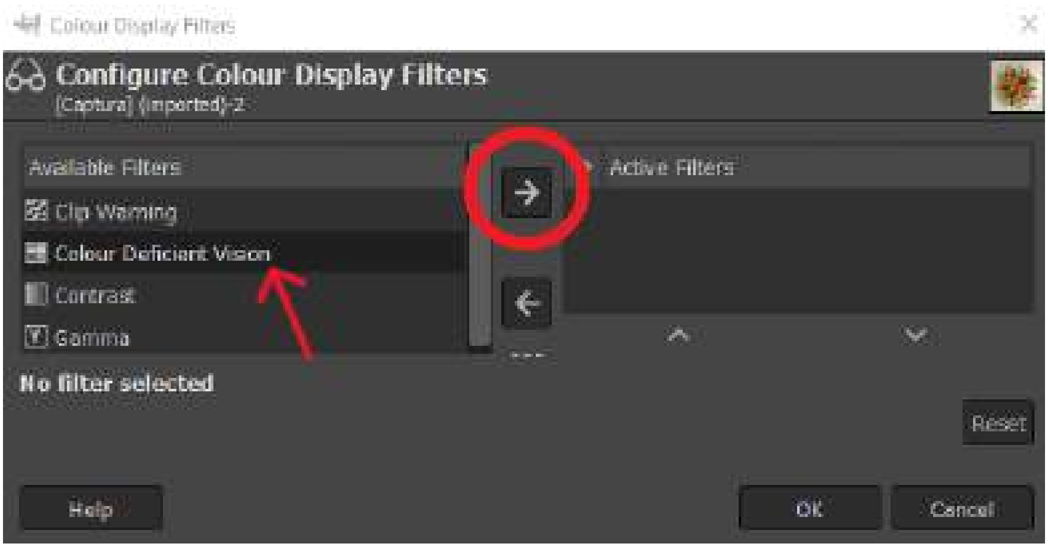
Exercise 2: The World Through Different Eyes

We have mentioned before that there are people who have no sensitivity to some colours. This visual condition is called colour blindness, and in such cases the colours will not be combined as we have studied them before, because some of those receptors in the cones, whether they are blue, green or red, are 'damaged'. So how would we see the combination of radiation that gives rise to the colours in these cases?

GIMP allows us to study this by going to **'View'** and then to **'Display filters'**.



Then click on 'Colour vision deficiency view' and press the arrow pointing to the right, and select the type of colour vision deficiency we are interested in seeing.



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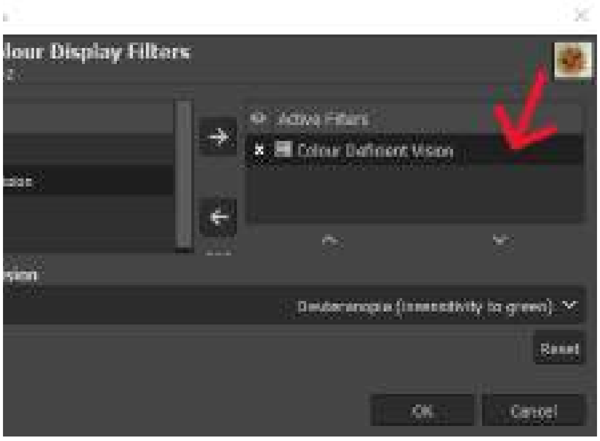

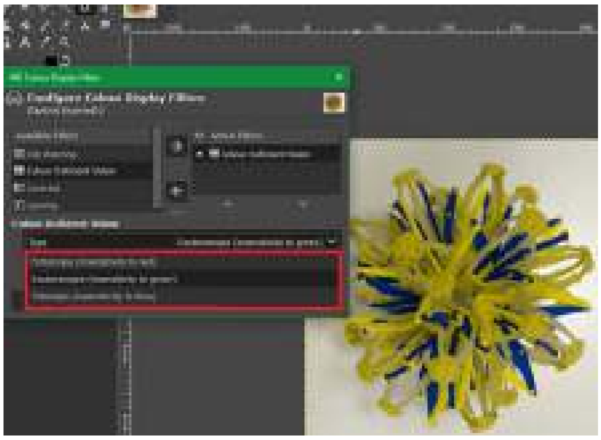

Tritanopia

Protanopía

Deuteranopia

All colours

What can this be useful for? Many times we don't consider it, but when doing academic or work presentations, advertisements, video filters, warning signs, etc., an eye with this condition will not be able to see certain information quickly.

Let's try it with something we all know: traffic lights. Let's use this same software with the following image and follow the same process as before:

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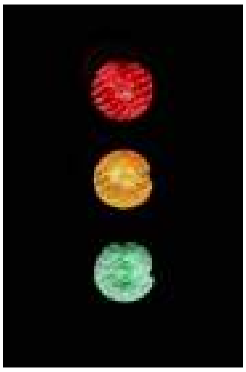

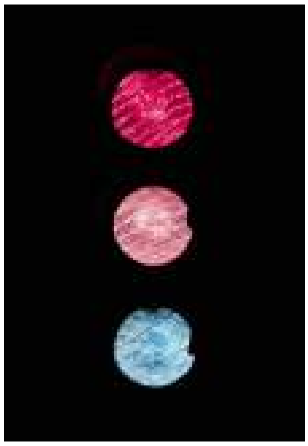

Conclusion and sharing

Today we explored how astronomers interpret and 'colour' images of space to reveal the secrets of the universe, using GIMP to simulate this process. We learned that the colours we see in images of galaxies, stars and other celestial bodies are not exactly as is just because it's a 'picture', but that those colours are added to represent different types of radiation. In addition, we have understood how colour perception can vary depending on the condition of the human eye, as in the case of colour blindness, and how this knowledge can be useful in creating content that is accessible to all.

Discuss 🗣️

How do you think people with colour blindness might experience everyday life, and why is it important to take this into account when designing visual displays or signs? Have you ever thought before about the colours that you use in a presentation for example?

What other examples of how technology improves our ability to 'see' something we cannot perceive naturally can you think of? There is one pretty common in medicine (answer: x-rays)

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In which everyday situations do you think you could apply what you learned today about colour perception?

Show us your images by tagging us on social media!:

- LinkedIn: https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name
- Instagram: https://www.instagram.com/steambrace_eu/
- X: https://x.com/steambrace_eu

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PROGRAMMING MUSIC

Duration	Age range	Difficulty
2 hr	17-18	High
#ROBOTICS #PROGRAMMING		

Description

In this exciting activity, participants will discover how a buzzer works by connecting it to a microcontroller, exploring the principles behind sound generation.

They will then apply this knowledge to create their own homemade speaker, using simple materials such as copper wire and magnets. Along the way, they will learn about electromagnetism, how vibrations produce sound, and the way electric current interacts with magnetic fields. A hands-on experience that unites theory and practice, awakening curiosity and fostering creativity in the world of electronics.

Objectives of the Activity

- Understand the operation of a buzzer with a microcontroller.
- Apply principles of electromagnetism in a practical project.
- Develop skills in building and manipulating electronic components.
- Encourage creativity in the creation of electronic devices.
- Introduce concepts of acoustics and sound generation.

Key competences (EU)

- Numerical, scientific and engineering skills
- Digital and technology-based competences
- Interpersonal skills, and the ability to adopt new competences

Materials

Activity kit:

- Copper coil
- Permanent magnets
- Cirkids microcontroller
- Buzzer module
- Banana-crocodile cables

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Provided by the teacher/institution:

- Paper or plastic cups
- Sandpaper
- Scissors
- Ruler
- Hanger (Optional)
- String (Optional)

Previous Preparation

- Creation of work groups (2-3 participants)
- Preparation of materials
- Installation of hello,blocks! drivers, if you have not previously worked with the cirkids microcontroller.
- Configuration of equipment/devices

Watch Video 📽 - Cirkids Tutorials + Hello Blocks Platform - (subtitles available)

1- **Cirkids, creando circuitos**

2- **Tu primer invento con: Cirkids**

3- **Circuitos electrónicos con Cirkids**

4- **Cirkids y las conexiones eléctricas**

5- **Saca todo el potencial con Cirkids**

6- **¡Hola Microcontrolador!... con Cirkids**

You can access the tutorial playlist directly at:

Your first invention with CirKids

Hello blocks page: https://www.hello-blocks.com/editor/

Contextualization and Adaptation

Watch video 📽 - "Can you tell the difference between music and noise?".
Test yourself: Can you tell the difference between music and noise? - Hanako Sawad

Classroom Activity 💡 Discuss which sounds are considered music and which are considered noise.

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Note for the teacher 📝 After watching the introductory video, students are divided into groups and discuss what they consider to be music and what to consider to be noise. They must argue their ideas and present examples of sounds that fall into each category.

Watch video 📽️ - "What does a Star Wars battle actually sound like?".
What does a Star Wars battle actually sound like?

Classroom Activity 💡 As you can see, sound needs a medium to travel. This is because it is made up of sound waves that generate pressure variations in the air around us. In other words, it is as if every time we speak, we were clapping our hands in the air.

Sound behaves differently depending on the medium it travels through. So can sound travel through a solid?

Note for the teacher 📝 An open question can be asked to the students: why can they hear the teacher inside the classroom and also the noises from the adjacent classroom through the wall?

The answer is yes, since sound needs an elastic medium to travel, and solids, such as walls, can fulfill this function.

Optional: *Below you will find a simple experiment that can be carried out in the classroom with common materials to put this phenomenon into practice.*

Musical coat hangers - At home science - ExpeRimental #8

Classroom Activity 💡 How fine-tuned is your hearing?

There is a skill known as **absolute pitch**, which allows one to recognize musical notes without the need for an external auditory reference. This skill is often related to auditory memory, a brain function that allows one to encode, store and retrieve sound information.

As you know, each musical note corresponds to a specific frequency. This frequency, measured in hertz (Hz), indicates how many times a pressure is applied to the medium in one second.

C4 (Do4): 261.63 Hz
D4 (Re4): 293.66 Hz
E4 (Mi4): 329.63 Hz
F4 (Fa4): 349.23 Hz
G4 (Sol4): 392.00 Hz
A4 (La4): 440.00 Hz
B4 (Si4): 493.88 Hz

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All instruments produce the same frequency when playing the same notes, but just like people, each instrument "sounds" differently. Why do you think this is?

Note for the teacher 📝 At the beginning of the activity, play the following video where a musical note recognition exercise is performed. Ask the students to write on a piece of paper what they think the notes they are hearing are.

G 391.995 Hz

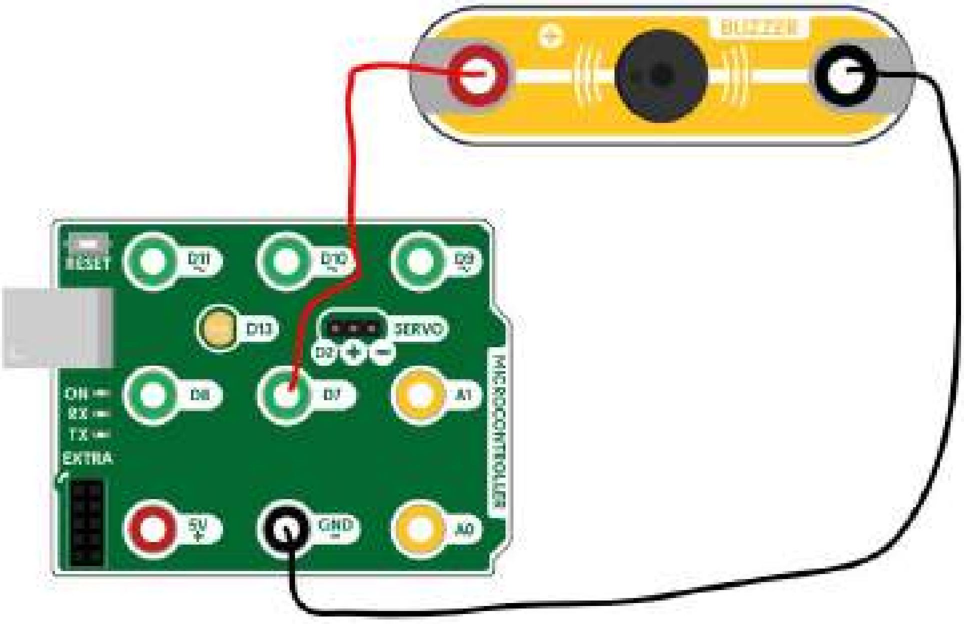
Musical instruments sound differently because of their timbre, which is a specific characteristic that distinguishes them. The timbre is what allows us to differentiate the sound of a piano from that of a guitar, even though both play the same note. This quality is due to the way in which each instrument generates its sound waves.

Activity

Step 1 - Play the music, maestro!:

The Cirkids microcontroller has the ability to play sounds and melodies through the buzzer module, allowing students to explore audio generation and creating interactive sound projects.

This module has an active buzzer that emits high-pitched sounds, similar to the ringtones of old telephones.



Step 2 - Creating melody:

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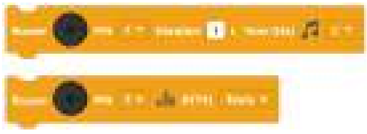
With the circuit assembled according to the diagram above, you can test its operation using the control blocks. In Hello,blocks! you will find two different blocks that can interact with the melody.



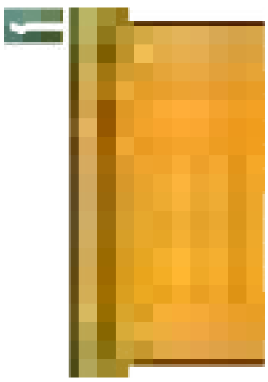
Tone block: This instruction plays the selected note for the specified duration.

RTTTL block: The name of this block comes from the abbreviation for *Ring Tone Text Transfer Language*. In the drop-down menu, you will find different built-in melodies that you can use directly.

Find the staff of a simple melody, such as the one shown below as an example, and create the code necessary to transform each note into the corresponding Tone block.

Note for the teacher 📝 Below is an example of code to play the melody of "Twinkle, Twinkle, Little Star". A good practice would be to reduce the time of each note by half to speed up playback.

The blocks have been programmed within the "setup" function so that the melodies are only played once at the start of the program.



Step 3 - How a speaker works:

The basic principle of a loudspeaker's operation is based on the movement of its membrane, caused by the interaction of the coil (electromagnet) with the permanent magnet. These

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vibrations are amplified through the loudspeaker's membrane, which generates pressure changes in the air and translates into sound.

Watch video 📽 - "How Speakers Make Sound".
How Speakers Make Sound

Step 4 - Creating a speaker:

The elements to build a basic speaker are very simple: a coil that acts as an electromagnet, a permanent magnet and a container that functions at the same time as a membrane and resonance box.

Step 5 - Winding of the electromagnet

Using the enamelled copper wire, make a ring with approximately 70 turns and a diameter of 20 mm. You can find an object of similar dimensions to help you wind the wire, such as the casing of a Cirkids motor. To prevent the coil from coming undone, secure it with a piece of tape once it is created.

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Once you have created the coil, make sure to leave at least 3 cm of copper at the ends so that you can connect the wires to the microcontroller. To make the electrical connection, you will need to remove the enamel (insulation) from the copper coil. You can use scissors, sandpaper or even a lighter to do this.

Note for the teacher 📝 At this point, one of the most challenging steps in the creation of the speaker is carried out: preparing the copper coil for electrical connection. It is essential that the students remove the enamel film covering the copper wire, otherwise the speaker will not work. This enamel acts as an "invisible insulator", preventing electrical conduction.

Step 6 - Coil and membrane

Once you have created your coil, attach it to the bottom of a glass. The glass should be made of a flexible material, such as paper or thin plastic. Use tape to secure the coil so that it stays put and doesn't move around.

Note for the teacher 📝 Paper cups have a small step at the bottom. To ensure that the coil is held in place, students can carefully cut out the perimeter of this step so that the tape can secure the coil to the bottom of the cup.

Step 8 - Checking operation

Once the coil is built and attached to the membrane of your speaker, connect the coil terminals to the microcontroller as shown in the following image.

Once the components are connected, load the following code which will play a note constantly on the selected pin. This will allow you to calibrate the speaker in the next step.

Note for the teacher 📝 With the code loaded and the coil connected, you are ready to move on to the next step. Students may be confused if they expect to hear some sort of sound at this point, but this is not possible yet as the permanent magnet needs to be added. This step will be done next.

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Step 9 - Calibrating the system

With the system fully powered, it's time to add the permanent magnet and test its operation. Take the magnet in one hand and bring it close to the speaker coil. You should start to hear a beeping sound at this point. Note that the closer you bring the magnet to the coil, the louder the sound will be. The same thing happens if you move the magnet along the center of the coil.

Place the magnet in the optimal position for its operation and hold it with a piece of tape, similarly to how you did with the coil.

Note for the teacher 📝 The best results are obtained by placing the magnet centered on the coil and as close to it as possible. Once all the components are attached, you can see how the system begins to work optimally.

Step 10 - Melody playback

Replace the calibration code with a more lively one. Using the RTTTL playback block, you will find different melody options to choose from.

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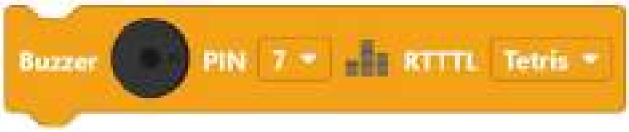

Note for the teacher 📝 We recommend, once again, to include the melody playback block within the "setup" function to avoid it playing continuously throughout the entire execution of the program.

Conclusion and sharing

Debate 🗣️

Get yourselves into small groups and answer and discuss the following questions:

- What did you find most interesting about how sound is produced with a microcontroller and buzzer?
- How did building your own speaker help you understand how sound works in real life?
- What was the most challenging part of the activity, and how did you overcome it?
- What improvements or changes would you suggest for the design or sound quality?
- What part of the project did you enjoy the most, and why?
- What new skills or knowledge do you feel you gained from today's session?

Show us your work reproducing your melodies via social media!

- LinkedIn: https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name
- Instagram: https://www.instagram.com/steambrace_eu/
- X: https://x.com/steambrace_eu

Project Evaluation

Activity Objectives	Key competences (EU)	Evaluation Criteria
Understand the operation of a buzzer with a microcontroller.	Numerical, scientific and engineering skills Digital and technology-based competences	Students demonstrate an understanding of how a buzzer works when connected to the microcontroller Students successfully connect

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	Interpersonal skills, and the ability to adopt new competences	the buzzer to the microcontroller and generate sound using the programming blocks in Hello,blocks
Apply principles of electromagnetism in a practical project.		Students effectively build the electromagnet and apply it to the speaker project, ensuring that the coil and magnet were correctly placed and functional
Develop skills in building and manipulating electronic components.		The students successfully built the circuit, connected the buzzer to the microcontroller, and assembled the speaker using the provided materials (coil, magnets, paper cups, etc.).
Encourage creativity in the creation of electronic devices.		The students show creativity in their project, such as modifying the basic design to create something unique (e.g., using alternative materials or customizing the code for different melodies)
Introduce concepts of acoustics and sound generation		Understanding how sound is produced (vibrations from the coil and permanent magnet) and how these vibrations are amplified through the speaker's membrane

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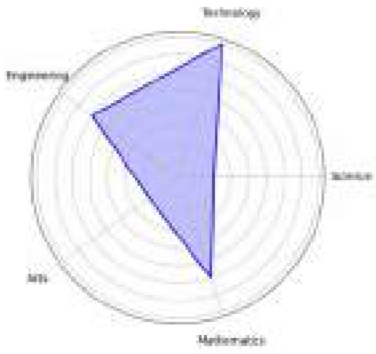
YOUR POCKET ASSISTANT



Duration	Age Range	Difficulty
2 hrs	17-18	High
#IA #PROGRAMMING		

Description

Have you ever imagined what it would be like to have a virtual assistant of your own? In this workshop, we will get hands-on to develop our own AI chatbot using App Inventor. Together we will learn step by step how to design the look and feel and program the responses of our assistant so that it is unique and responds in a natural way. Don't worry if you've never done anything like this before; we'll explore together the logic and creativity needed to bring your chatbot to life. Ready to give your ideas a digital voice? It's time to dive into the world of app programming and discover what you're capable of!

Activity objectives

- Encourage logical thinking and creating algorithms.
- Develop programming and interface design skills.
- Boost creativity in problem solving.
- Improve communication and understanding of computer interaction.
- Develop autonomy and independent learning.

Key competences (EU)

- Numerical, scientific, and engineering skills
- Digital and technology-based competencies
- Interpersonal skills, and the ability to adopt new competencies

Materials

Provided by the teacher/institution:
- Computer equipment
- Android mobile devices will be needed to simulate the App.

Downloadable Elements:
- Complete program

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Previous Preparation

- Create working groups (2-3 participants)
- Set up the equipment/devices with the MIT App Inventor Platform
- Platform access accounts

Contextualization and Adaptation

Watch video 📽️ - "What are AI chatbot"

[What are AI Chatbots?]

Artificial intelligence (AI) has revolutionised the way we interact with technology. A chatbot is a clear example of how a machine can simulate a human conversation, understanding and answering questions in an almost natural way. These programmes use algorithms and databases to process language, generating responses based on what the user needs.

The use of chatbots ranges from assistance in customer service applications to education and entertainment. They are able to understand basic commands and perform simple tasks, making interaction with technology more intuitive and user-friendly. This process relies on AI's ability to analyse patterns and learn from how people use it.

But how do you create a chatbot? In this session, we will learn how to program our own virtual assistant using App Inventor, a platform that allows you to create applications in a simple and fun way. We will understand the logic behind the automatic responses and how we can customise the experience to make our chatbot unique and useful.

The world of AI is fascinating, and this workshop is the perfect opportunity to take our first steps as developers and better understand the technology around us. Are you up for the challenge?

Classroom activity 💡

After this introduction, reflect on the fields in which AI could be applied in the workplace and which jobs you think are at risk of disappearing with the development of new technologies.

Note for the teacher 📝

An interesting example to contextualise the relationship between technological progress and changes in society is the case of the first electronic calculators. When they first appeared, mathematicians and professionals of the time were concerned, arguing that

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these machines threatened to render basic mathematical skills obsolete and radically change the way numerical problems were solved.

This example is a clear parallel of how technology has always raised concerns about the relevance of certain skills and the possible disappearance of certain roles. However, over time, society adopted calculators as indispensable tools that allowed people to concentrate on more complex and advanced tasks. Today, it is unthinkable to do certain jobs without the aid of a calculator, and the original fear has been overcome, giving way to an era in which human work has been empowered by technology.

Activity

Part 1: Interface Design

Step 1 - Project Creation

You will need to sign in with a Gmail account at appinventor.mit.edu

To create a project, click on **'New Project'** and name it **Chatbot.**

Step 2 - Interface Configuration

The graphical interface will contain several elements. To add them to the interface, drag them to the area of the screen where you want to place them.

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You will start with **Screen1**, changing the **AboutScreen** text to 'Chatbot App' and modifying the screen title. In the example, the title is 'I am your Chatbot', but you can customise it with the name you want to give to your Chatbot.

To start creating your interface, look for the elements on the left side of the editor, in the 'palette'...

- Everything to do with the user interface is in the '**User Interface**' section.
- Everything to do with the layout of the screen is in the **'Layout'** section.
- To add elements such as speech recognition, cameras, etc., use the **'Media'** tab.
- You will also use the **'Experimental'** tab to include the **ChatBot**.

Step 3 - Element Customization

You must now add the elements shown in the following image, in the order indicated.

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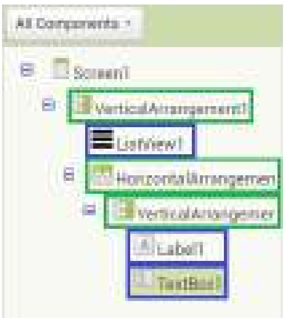

Pay attention to the properties of each of your interface elements to ensure that everything looks correct in the application once installed on your devices.

Step 4 - Interactive Elements

Continue to add the interface elements shown below.

Add another **HorizontalArrangement**, which will be the second one in your interface.

Inside this one, you will place three buttons and rename them by pressing **Rename**. The names will be as follows:

- **ButtonSend**
- **ButtonMicro**
- **ButtonClear**

To design these buttons, upload an image of a microphone using the **Upload File** button...

Below, you will find the configuration of these buttons.

Continue adding the interface elements shown below, and upload the image of the bot you want to use in the app.

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Finally, you should add the **Media** and **Experimental** elements to the screen, without having to place them in a specific position.

Part 2: App programming

Step 1 - First steps to understanding programming

At the beginning of any application, you should indicate what information it should store when it starts and the screen opens, even if it is not directly displayed on the screen. In this case, think about the name of the Bot and the name you want to display yourself with.

You are going to create the following code in App Inventor by clicking on the **Blocks** option.

Step 2 - First Programming Steps

At first, you have to initialise the variables shown below.

The blocks needed for programming can be found in the **Variables** and **Text** tabs. Note that these parts are in the **Built-in** section, as they do not refer to any of the elements added in the design.

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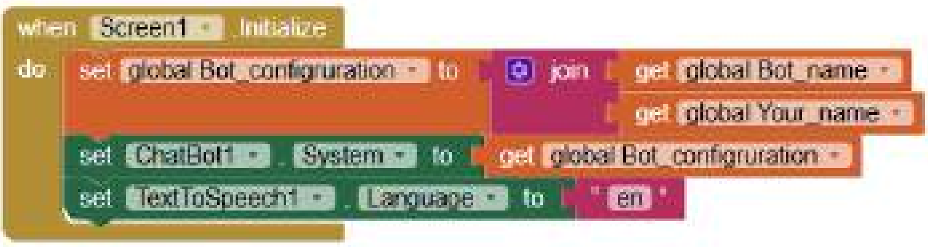
However, when you need to find the **When Screen1.Initialize** block, you will have to look for it in the **Screen1** tab.

Now, tell the application that the main configuration will include the name of the Bot and the name of the programmer (your name), and this will be stored in the system.

You will set the Bot language to English as the default language, and you will see that the **TextToSpeech1.Language** block should have the value ‘en’. If you want the main language to be Spanish, you should set it to ‘es’, and if it is French, ‘fr’.

The final code should look like this:



If you want to test this code in App Inventor to see how your app is coming out, follow these steps: click on the **Build → Android App (.apk)** tool. Once the corresponding QR code appears, scan it with your Android devices.

Note for the teacher 📝

Although the application, when installed, may request permissions and be analysed by the system, there is no problem for students to install it as it will not harm the device.

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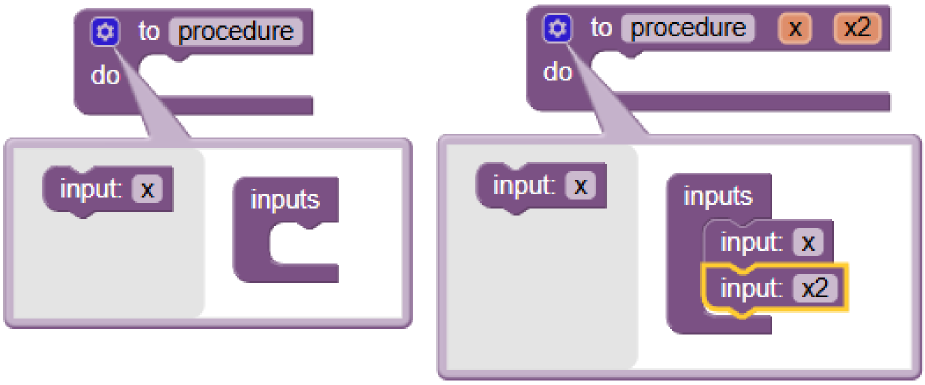
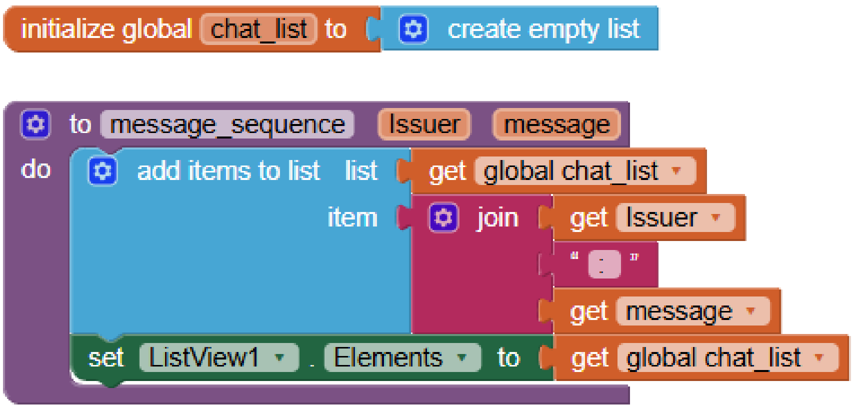
Step 3 - Next Steps

You are going to create a **chat list** that will be empty at the beginning and will be used to store the queries and the answers.

Create a **Procedure** called **message_sequence** with two arguments: **Issuer** and **message**. To add the two arguments, follow these steps:



Each time you call the procedure, the query or response will be added to the list you have created. The **List_View** will be updated to display the message on the screen, indicating the **'sender' + ': ' + 'message'**.



Now we will program the button to send the information that we will pass to the Bot.

When we click the **Send** button, we will call the **message_sequence** procedure with the arguments of '**Sender** " (your name) and **"message'**, which corresponds to the text entered in **TextBox1**.

The chatbot will process the query found in **TextBox1** and, finally, we will clear **TextBox1** so that we can type or talk through the textbox again.

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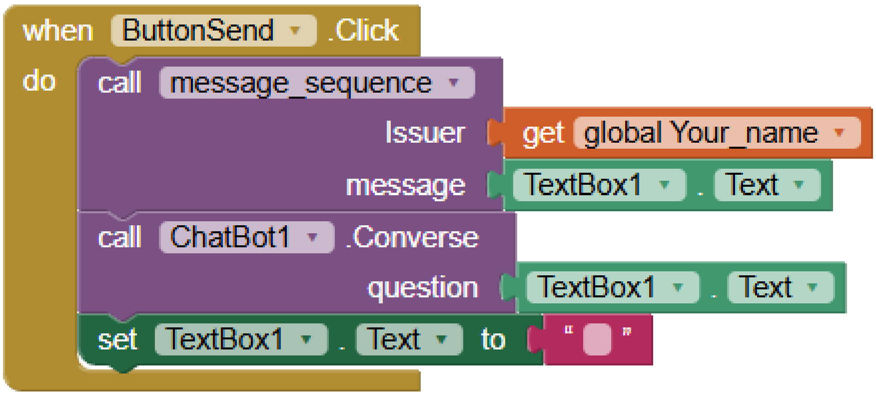

Now you will program the **Microphone Button** so that, when you press it, the device's microphone is activated and the bot can recognise your voice and capture the message you leave.

When you press **ButtonMicro**, speech recognition with **SpeechRecognizer** will be activated.

Once the speech recognition system has converted what you have said into text, it will send an event indicating that it is ready with the result.

You will call the **message_sequence** procedure and send it your name and the result as a message.

The query will be sent to the chatbot with the recognised text as the result.

Now you will program the last button, the **Clear** button. This button will reset the conversation with the chatbot. When you press it, the **chat_list** conversation list will be emptied and all the contents of **ListView1** will be deleted.

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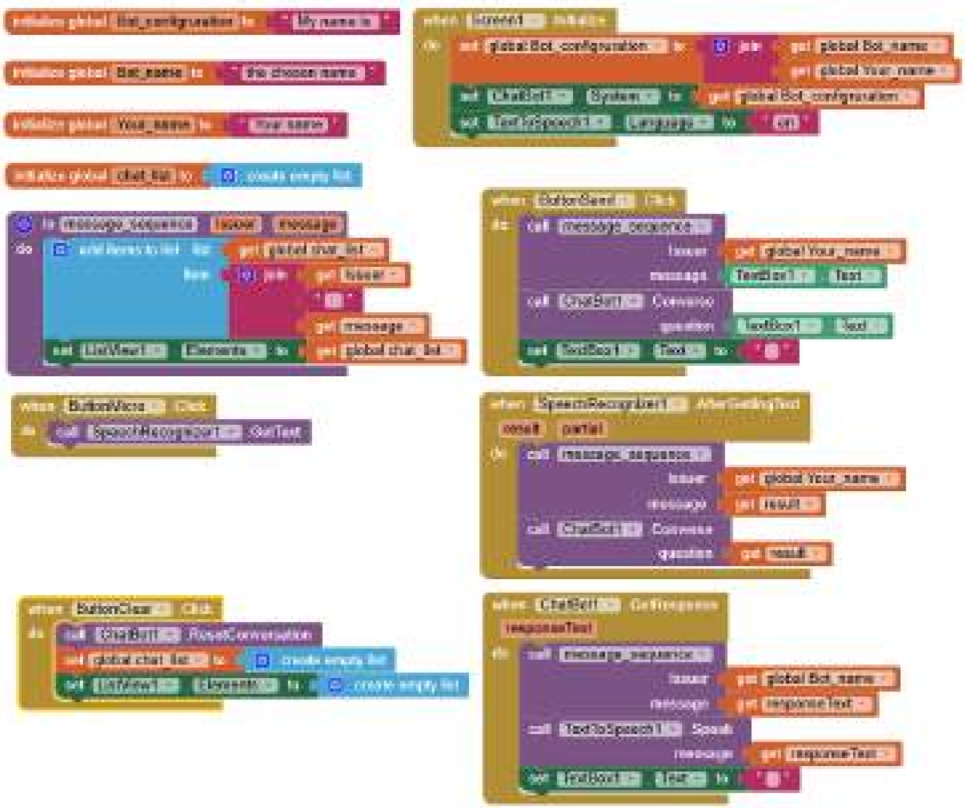
Step 4 - Last Step

All you need to do now is to get the answer to the requested query. This is an event produced by artificial intelligence itself; when the bot has the answer, it notifies the device to indicate that it is ready.

At that moment, the following sequence is executed:

- The **message_sequence** procedure is called and the name of the bot is passed along with the response it has provided, **responseText**.
- The response is read aloud.
- The text box is cleared, as we did before.

Below is the full code in case you need to see it all at once.



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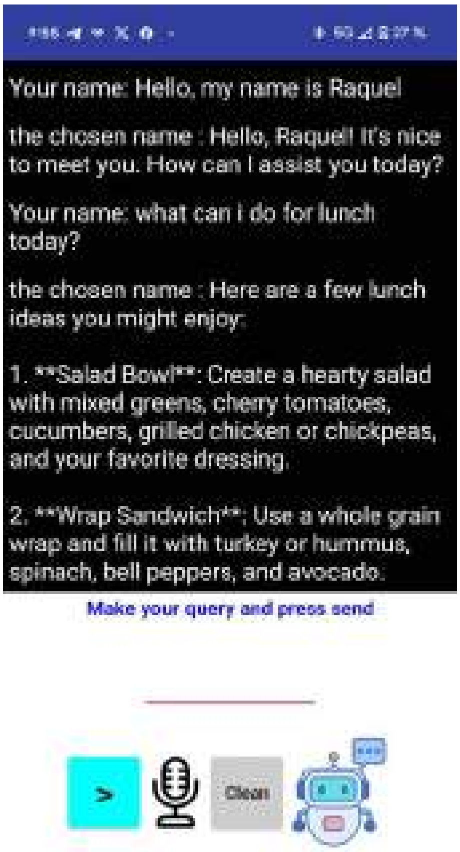
Step 5 - Installation and Testing

Once everything is programmed, reinstall the application on your mobile devices and try interacting with your chatbots.



Conclusion and sharing

Classroom activity 💡

Each group will present their chatbot, explaining:

- its unique features
- challenges faced during development
- and how they overcame those challenges

Also, in groups, you will test each other's chatbots and provide constructive feedback on the functionality and design.

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Note for the teacher 📝

The activity will end with students debating and talking about the answers of this questions:

- How did you ensure that your chatbot interacted with users in a natural way?
- How do you think chatbots can be used in real-world scenarios outside of this classroom?
- What enhancements could you add to your chatbot to make it more intelligent or useful?
- What skills did you develop during this project that you think will be useful in other areas of programming or technology?

Show us your work via social media!

- LinkedIn: https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name
- Instagram: https://www.instagram.com/steambrace_eu/
- X: https://x.com/steambrace_eu

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REAL ASSISTANT

Duration	Age range	Difficulty
2 hs	17-18	High
#PROGRAMMING #AI #ROBOTICS		

Description

Have you ever imagined what it would be like to have your own virtual assistant in the form of a robot?

In this activity, we are going to build and program an AI assistant that will not only answer your questions, but will also have a physical body made by you.

We'll use simple programming tools to bring our assistant to life, teaching it to listen and speak, while learning how AI assistants like the ones we use every day work. Step by step, we'll assemble our robot, decorate it to make it unique, and give it a presence with our programming.

Objectives of the Activity

- Develop programming and robotics skills.
- Encourage creativity and custom project design.
- Understand the basic functioning of AI assistants.
- Enhance problem-solving and logical thinking skills.
- Promote teamwork and collaboration in project development.

Key competences (EU)

- Numerical, scientific and engineering skills
- Digital and technology-based competences
- Interpersonal skills, and the ability to adopt new competences
- Cultural awareness and expression

Materials

Activity kit:
- Cirkids microcontroller
- 10k resistor
- Push button

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- Red LED
- Multicolor LED
- Cables

Provided by the teacher/institution:
- Materials to create the structure (cups, disposable plates)
- Scissors
- Tape

Downloadable Elements:
- [Complete program]

Previous preparation

- Creating work groups (2-3 participants)
- Preparing materials
- Installing hello,blocks! drivers, if you have not previously worked with the cirkids microcontroller.
- Configuring equipment/devices
- Printing time template
- Downloading the program template for mBlock

Watch Video 📽 - Cirkids Tutorials + Hello Blocks Platform - (subtitles available)

1- **Cirkids, creando circuitos**

2- **Tu primer invento con: Cirkids**

3- **Circuitos electrónicos con Cirkids**

4- **Cirkids y las conexiones eléctricas**

5- **Saca todo el potencial con Cirkids**

6- **¡Hola Microcontrolador!... con Cirkids**

You can access the tutorial playlist directly at:

Your first invention with CirKids

Hello blocks page: https://www.hello-blocks.com/editor/

Contextualization and Adaptation

Watch video 📽 - "How AIs, like ChatGPT, Learn".
How AIs, like ChatGPT, Learn

Classroom Activity 💡
A chatbot is a program designed to simulate a conversation and respond in a human-like manner. It uses artificial intelligence algorithms, such as natural language processing (NLP) and machine learning (ML), to help it “understand” users’ questions and requests. These algorithms allow the artificial intelligence to learn and improve over time, making its responses increasingly accurate.

You have probably already used a chatbot. Based on your experience, we invite you to reflect and discuss:

- In what situations has it been useful to you?
- What weaknesses or limitations have you noticed?

Note for the teacher 📝 This activity aims to gather and activate students' prior knowledge about the use of AI in information searches, based on their experiences.

Each team will upload their answers to the questions posed to the platform and then there will be an oral group dynamic to share prior knowledge. It is important that the teacher connects and adjusts the information shared by the students with the new terms and concepts that will be presented in the following activities, as well as with the learning that the students will develop throughout the project.

Watch video 📽️ - “The Turing test: Can a computer pass for a human”.
[The Turing test: Can a computer pass for a human? - Alex Gendler]

Classroom Activity 💡

Nowadays, AI-based voice assistants are widely used in services such as customer service. Repetitive tasks, such as analyzing information and presenting solutions, can be easily performed by these chatbots, which have access to a “manual” with all the necessary data to help customers.

Programmers are working to make these chatbots simulate conversations that are very similar to human conversations, so that users don't feel like they're talking to a machine. Thanks to technological advances, these chatbots not only work in text chats, but can also simulate telephone conversations and add voice effects, such as breathing and background sounds from an office, to make the experience even more realistic.

Have you ever doubted whether you are talking to a real person or an AI assistant?

What jobs do you think could be replaced by artificial intelligence? Why do you think this could happen?

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Note for the teacher 📝 The impact of AI on the labor market is a complex topic, and it is difficult to predict with certainty which jobs will be replaced in the future. However, understanding which jobs could be replaced by AI can help organizations and workers improve their skills and stay up-to-date to be better prepared.

AI not only poses challenges, but also offers new opportunities in the labour market. Jobs related to machine learning, data science and robotics require specialised knowledge and skills, thus creating new jobs. Just like in the industrial revolution, AI is here to help us with mechanical and repetitive tasks, allowing workers to focus on those activities where they can contribute their creativity and their more human side.

Some examples of jobs that could be replaced by AI include:

- Salespeople
- Assembly line operators
- Telemarketing
- Accountants

Classroom Activity 💡

Artificial intelligence has advanced so much that today it can simulate conversations, process large amounts of data, and perform complex tasks. But one question that often comes up is: Will AI one day be able to feel emotions like humans? In this activity, students will explore the hypothesis of whether AI will be able to feel and reflect on what implications that would have for humanity.

Note for the teacher 📝 This activity is designed to stimulate critical thinking and discussion about the limits and possibilities of artificial intelligence. It is important to guide students to recognize the difference between the simulation of emotions and the concept of consciousness. This reflection can lead to broader discussions about ethics, technology, and the future of the relationship between humans and machines.

Activity

Part 1: Assembling your assistant

Using Cirkids components and common materials, shape your AI assistant. This is a big step, as AI assistants usually only exist virtually, without a physical presence. However, giving it an entity and physical presence can be very interesting, especially in real environments, as it makes the interaction closer and more engaging.

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Note for the teacher 📝 In the downloadable elements folder you will find a basic template with the necessary elements for students to start developing their own version. They can also create their own version by customizing the project.

Step 1. The face

You can use a glass or other type of element to hold your character's face, which must be attached to the servo motor so that it can turn sideways to interact with users. Below are the steps followed to build our example.

Placing the servo motor arm on the base.

Face union and placement of the red LED. This LED will light up when the robot is talking.

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Step 2. The base

The servomotor that will support the head and act as a neck, allowing the assistant's head to turn, should be placed on the base. In this case, a paper plate was used.

On the front, place the button with the red LED. The button will be in charge of starting the activity. When it is pressed, the robot will begin to analyze our command. The red LED indicates when the robot is listening.

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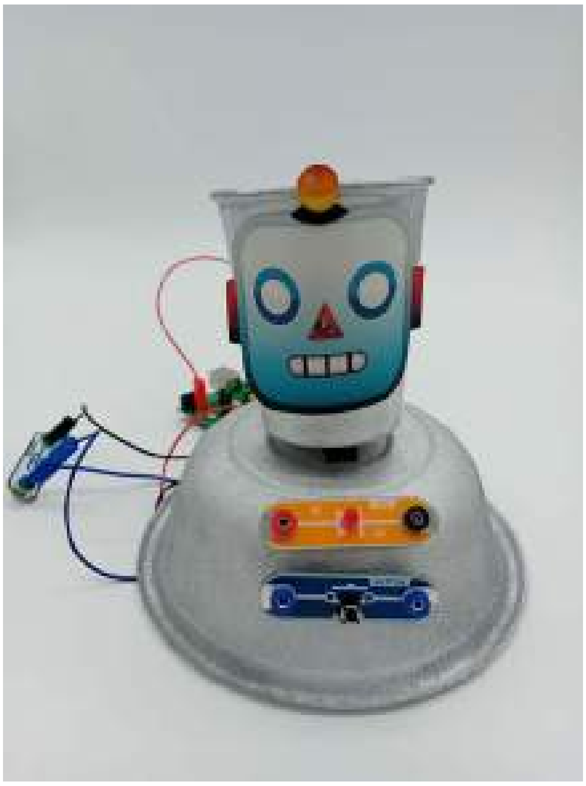
Step 3. Assembling components

Once you have completed the assembly and created the corresponding circuit, it is time to start programming.



Part 2: AI Programming

Students will be provided with a template containing several working examples of interaction with the virtual assistant, which they can use as a basis for expanding and improving their own projects. To do so, they must first understand how it works.

> **Note for the teacher** 📝 In the downloadable items folder you will find the **assistant_ia_sketch_commented_v0.mblock** file. Give this template to the students so they have a starting point and can focus on developing the program by adding new commands.

Step 1. Arduino Interface

Programming begins with direct interaction with the Arduino. A script is used that, when a button is pressed, sends an event so that the AI begins to process the command.

Depending on the status of the command, if the assistant is “listening,” a red LED will light up and the flash will turn off. When the assistant “speaks,” the red LED will turn off and the flash will turn on, while the assistant’s head moves from side to side.

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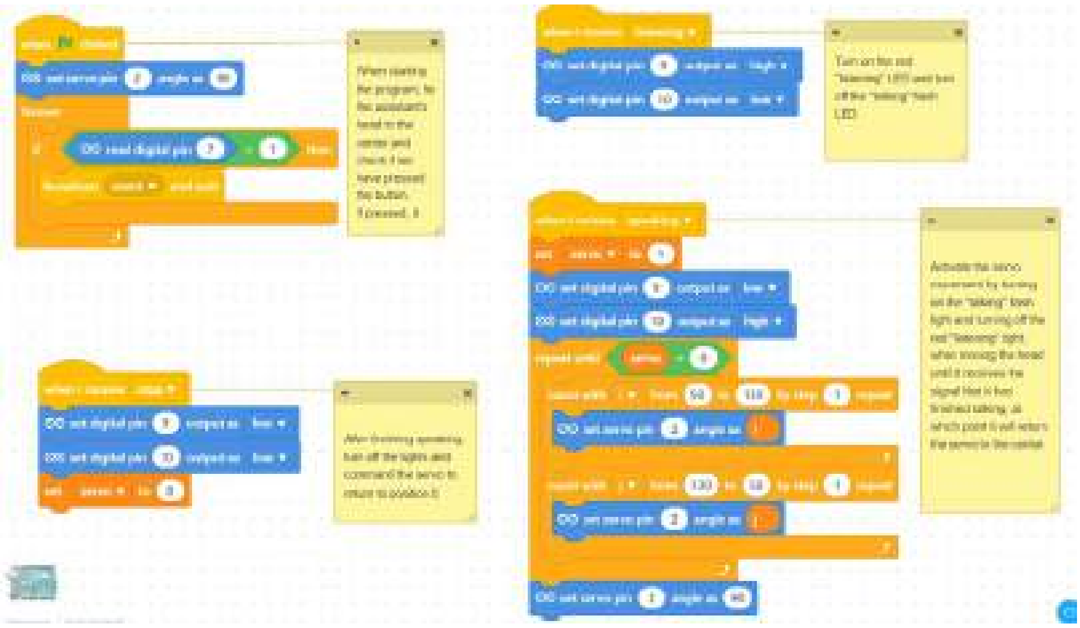
When the stop command is received, both LEDs will turn off and the servo will return to position 0.



Step 2. Initializing the program

When you start the program, the operating language is set. Make sure to set the language to suit your needs.

The template is an example of a teleoperator assistant that can memorize the user's name and phone number. To achieve this, 3 global variables have been created:

- **Level:** Stores the level of the conversation, allowing preset voice commands to be executed.
- **Name:** When the **Level** variable starts at zero, the assistant asks the user for their name and stores it in this variable, allowing for more personalized interaction.
- **Number:** Since it is a telephone assistant, this variable has been created to save the user's telephone number.

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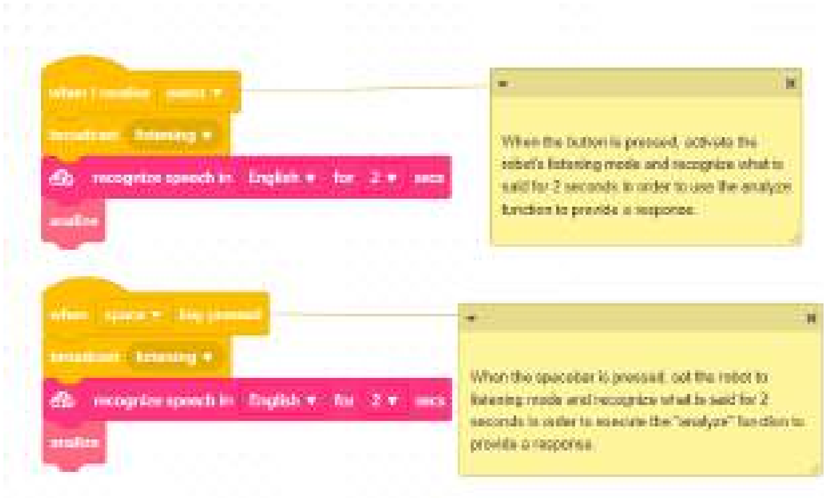
Step 3. Project Setup

Once the program has started, it remains waiting until one of two events is activated: clicking on the assistant or the **space key**.

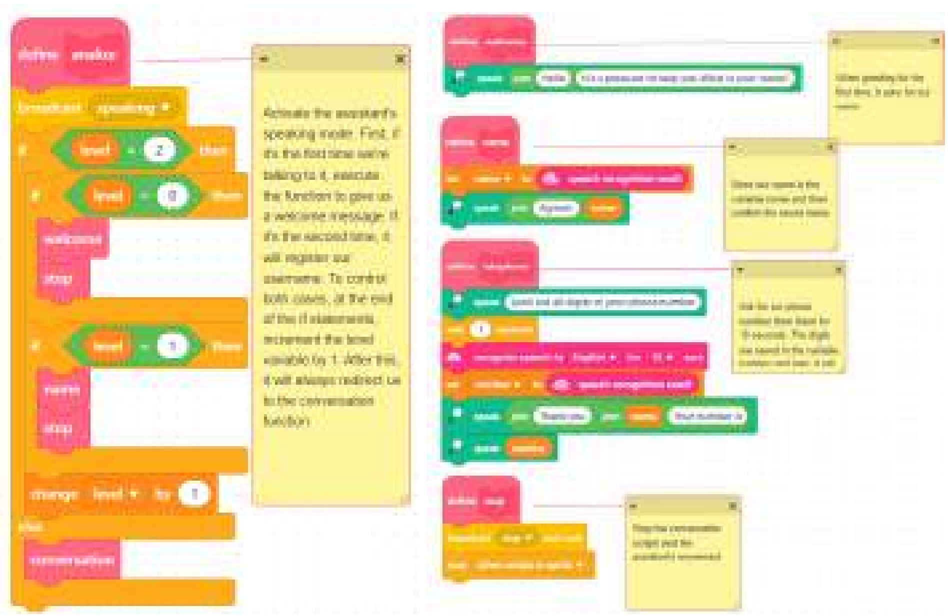
When this happens, the corresponding LED lights up to indicate that the assistant is listening and then analyzes what instruction it received.



Step 4. Analysis of the instruction

After this, when calling the analyze function, and depending on the number of the conversation we had, the assistant will first greet us and ask for our username. It will then save our name and respond to us using it.

After these steps, all subsequent conversations will be evaluated in the **conversation** function.



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Step 5. Pre-recorded instructions

Once the two basic levels of **conversation** have been overcome, the conversation function contains all the possible responses to the different voice commands that the assistant may receive. There are two special cases:

- **Goodbye**: This command triggers an instruction to say goodbye to the user and then resets the global variable **level** to 0. This resets the program and requests the information again on the next interaction.
- The **problem** command runs an external function called **telephone**, which starts a process to prompt the user for their phone number and store it.

Step 6. Expand and program your assistant.

Following the pre-established structure of the assistant, think of a usage situation and add as many functionalities as you consider, adapting its behavior to the situation you want to solve.

What else can you think of that your assistant could do? It could sing a song, solve a mathematical operation, activate an alarm if you enter the wrong password...

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Note for the teacher 📝 Once the assistant's mission has been defined, students should take notes and record all the issues that the device should resolve. After analyzing all the cases, they should enter this information into the program. Once they have finished programming, they can share their work with their classmates and check that everything works correctly.

Conclusion and sharing

Classroom activity 💡

Answer to this questions with the other participants:

- What was the most challenging part of programming your AI assistant, and how did you resolve it?
- How does your AI assistant compare to real-world virtual assistants like Siri or Alexa in terms of capabilities and limitations?
- What new skills did you learn from this project that could be applied to future AI or robotics projects?
- What would you do differently if you had to work on a similar project in the future?

Show us your work via social media!

- LinkedIn: https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name
- Instagram: https://www.instagram.com/steambrace_eu/
- X: https://x.com/steambrace_eu

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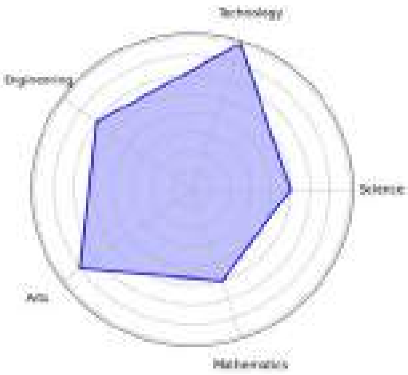
WEATHER PANEL



Duration	Target age	Difficulty
2 hours	17-18	Average
#SCIENCE #AI #EXPERIMENTATION #CRAFTS		

Description

Have you ever wondered what it would be like to have a custom weather panel that can display real-time data for any city in the world? In this workshop, students will have the opportunity to create their own interactive weather panel. They will learn how to program and assemble a circuit that will connect to the Internet to get weather information immediately from the cloud.

During the activity, we will explore how APIs and programming work to access real-time data, and build a circuit with electronic components that display temperature, weather conditions and more. Students will discover how technology and programming combine to make a project come to life, developing hands-on skills in electronics, programming logic and design.

Activity objectives

- Encourage teamwork.
- Understand the use of basic electronic components
- Programming and integration with AI
- Develop problem solving skills

Key competences (EU)

- Numerical, scientific, and engineering skills
- Digital and technology-based competencies
- Interpersonal skills, and the ability to adopt new competencies

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Materials

Activity kit:
- Microcontroller
- Servomotor
- Red led
- Bicolor led
- Connection wires

Provided by the teacher/institution:
- Cardboard
- Scissors
- Glue
- Tape

Downloadable Elements:
- Complete program
- Program structure
- Weather template

Previous Preparation

- Creation of working groups (2-3 participants)
- Preparation of materials
- Installation of hello,blocks! drivers, if you have not previously worked with the cirkids microcontroller.
- Configuration of the equipment/devices.
- Print weather template
- Downloading the mblock template to students' computers.

Watch Video 📽️ - Cirkids Tutorials + Hello Blocks Platform - (subtitles available)

1- **Cirkids, creando circuitos**

2- **Tu primer invento con: Cirkids**

3- **Circuitos electrónicos con Cirkids**

4- **Cirkids y las conexiones eléctricas**

5- **Saca todo el potencial con Cirkids**

6- **¡Hola Microcontrolador!... con Cirkids**

You can access the tutorial playlist directly at:

Your first invention with CirKids

Hello blocks page: https://www.hello-blocks.com/editor/

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Contextualization and adaptation

Investigating Weather Variations.
With this activity, students will acquire skills of investigation and deduction through scientific data. They will be able to observe how geographical factors influence the climate of an area or region.

Note for the teacher 📝

The objective of this activity is to analyse the climatic differences between three cities and understand the factors that influence in these variations.

Classroom activity 💡

- Divide into groups and think of 3 different cities, (they can be the ones you use later in your computer program). Ideally you should choose 3 cities in your country, with different characteristics, a coastal city, a mountain city and a city in an arid area or similar.
- Each group, look up information on the average temperature, annual precipitation and seasonal weather patterns for each of the cities.
- Prepare a short comparative presentation explaining the climatic differences and the factors that influence them, such as altitude, proximity to the sea or a large lake.

Climate change How do we combat it?
I am sure you all know what climate change is, but you are all going to start from the same place.

Watch video 📽️ **- "What is Climate Change".**

[What is Climate Change?]

Classroom activity 💡

In the video, the greenhouse effect appears. This greenhouse effect is essential for life on Planet Earth, because without it, the Earth's temperature would be too low at night and life could not exist on the planet, but the excess greenhouse effect is pushing the planet to its limit.

If you were the most powerful politician on Earth, what would you implement urgent measures to combat climate change?

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Note to the teacher 📝

It would be interesting for students to reflect on the measures they propose, analyzing the pros and cons of such measures in the short and medium term.

For example, one of the measures to be taken would be to make the transition to renewable energies, promoting the use of clean energy sources such as solar, wind, hydroelectric and geothermal, but we should try to minimize the environmental impact of the creation of a wind farm, which means that in a large area of land, wind turbines must be placed with the visual and auditory pollution that this entails, death of birds, soil erosion and deforestation....

In other words, it would be necessary to find the middle ground between slowing down climate change, which is a priority, and the sustainability of ecosystems, production and implementation costs...

Great figures of history and climatology

Classroom activity 💡

Gather information about some outstanding figure who has contributed significantly to the study of climate, climate change or the development of tools or concepts related to climatology.

Share all the information you have found, explaining why you thought it was interesting to highlight this person in particular compared to others you have found.

Note to the teacher 📝

The idea of the activity is that students discover the number of people who throughout history have worked to understand and interpret the climate, and of course, at present, try to help to curb climate change, which has most of the planet so worried.

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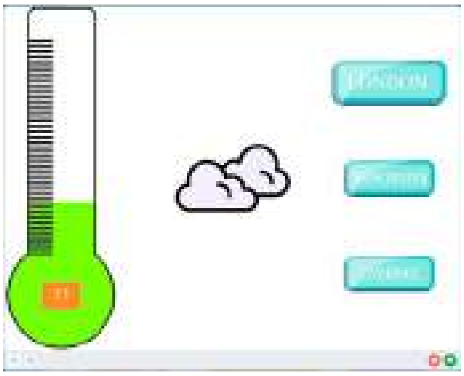
Activity

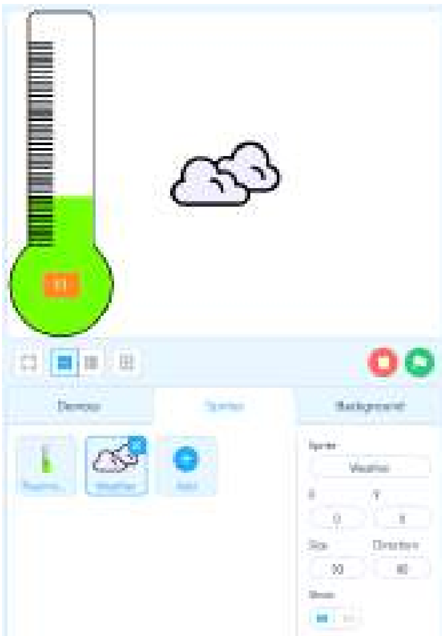
Part 1: Designing the interface:

Step 1 - Creating the environment

Using the mBlock platform and the Cirkids Kit you are going to build a climate machine, which will tell you the climate and temperature in real-time of the three cities that you choose.



You are going to start by opening the weather_code_sketch_v0.mblock document provided to you. Inside the document, you have already imported the two objects, Thermometer and Weather so that you can start working.



Note for the teacher 📝

In the downloadable elements folder, you will find a basic template with the necessary elements for the students to start developing their own version.

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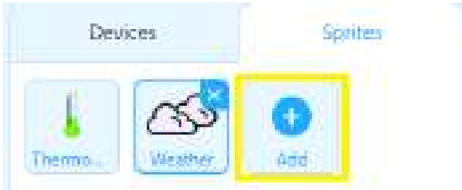
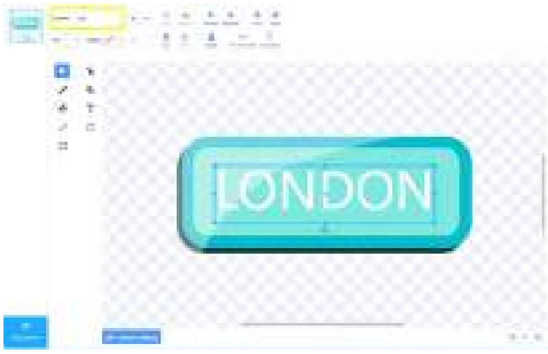
Step 2 - Adding new Sprites

To choose the three cities where you want to know the weather, you must add an object, which looks like a button, by clicking Add to choose the Sprite you want.



Once you have selected the object you want, you must name it with the name of the city it will refer to.

By clicking on "Costumes", you can customize the button by changing the text that appears and put the name of the corresponding city. Also, change the name of "Costume" to "City".



Right-click on the button and select "Duplicate" twice to create two more buttons. Change the Sprite name and appearance of each duplicate button.

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In the template provided, you will see that the extensions "Climate Data", which will provide all the information related to the weather of the selected city, and "Text to Speech", which converts the text written in mBlock to speech, have been added.

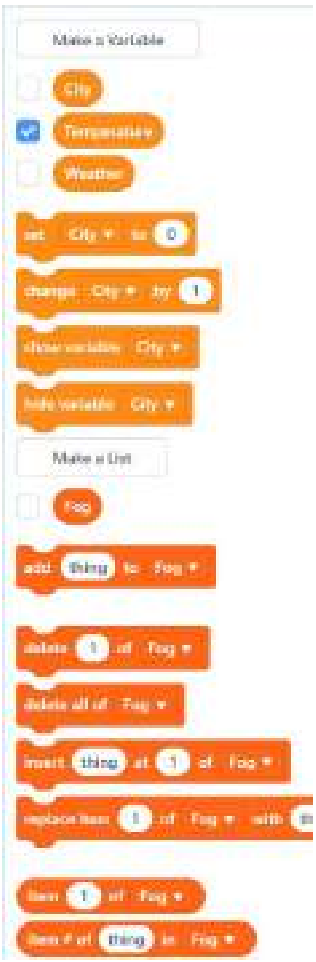
Part 2: Programming the application

Step 1- Variables and lists

In order for you to make the program, you will need the following variables that are already created:

- **City:** to select the city and be able to change it every time you press a different button.
- **Temperature:** to control the temperature of each of the locations indicated.
- **Weather:** to know the specific weather of each city and use it in each of the sprites.

There is also a list created where you can add the different ways to call the fog. If, when using the application, new types of weather appear related, for example, to rain, you can always create your own list for rain and add the different types of rain, programming them in the same way as you will do with fog.



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Step 2 – Programming of the thermometer

When you click on the green flag, you will default to the first city of your choice. In the example, this is done with London, Manchester and Liverpool, but you can choose the cities you want. In the case of the example, London has been selected.

We will assign the variable **City** to "London", **Temperature** to the maximum for London, and **Weather** to the corresponding weather for that city.

Place this on the left of the screen and create a large loop using the "forever" piece. Send two messages: "Refresh" and "Blink".

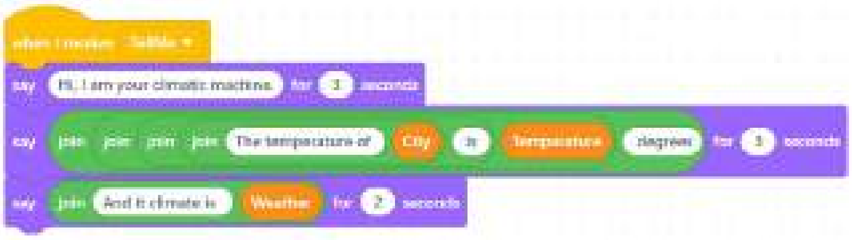
Refresh will refresh the information for the selected city, while **Blink** will make the LED blink to visually show that the information is being updated. Do this every 60 seconds, in case there are any changes in that time interval.

The thermometer itself, when it receives the **Refresh** message, sets the temperature to the **Temperature** variable that will already be set. Whenever the temperature is between 0° and 44°, the corresponding disguise will be displayed, as different disguises have been created for the thermometer to represent the temperature degrees of each assigned city.

The thermometer will also have the ability to talk, so it will receive the **TellMe** message when you press the space key on the keyboard (you will program this later). The thermometer will greet you in written form, and you can customize the message to your liking, including giving your weather machine a name.

To construct the message, you will need 4 connecting pieces inside a "say" block to form the following sentence: "The temperature of "City" is "Temperature" degrees".

In a second "say" block, you will only need one linking piece to build: "And its climate is "Weather".



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Step 3 - Programming the Weather object

The programming of **Weather** is similar to that of **Thermometer**, but it has a special feature: you are going to use the mBlock lists. First, place **Weather** in its place and adjust its size to 50% so that it is not too big.

When this object receives the **Refresh** message sent by the thermometer, it should set the **Weather** variable to the one that corresponds at that moment and check the possible weather options:

- If the weather is cloudy, it will display the Cloudy disguise.
- If the Fog list contains the corresponding Weather variable, it will display the Mist disguise.
- If the weather is clear and sunny, it will display the Sun disguise.
- If it is snowing, it will display the Snow disguise.
- If it is raining, it will show the Rain disguise.
- If it is windy, it will display the Windy disguise.

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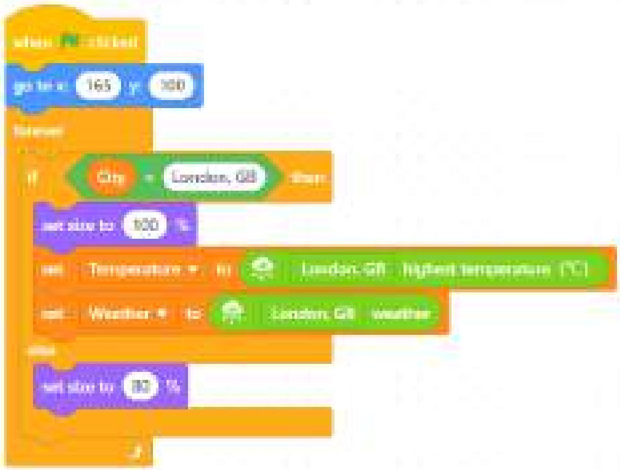
Step 4 - Programming the "London" object

Now it is time to program the first city button, in the case of the example, the London object.

On startup, the button will be placed in place and will continuously check whether the selected city is London or not.

- If the city is London, the button will be displayed at 100% of its size and will constantly update the temperature and weather for that city.
- If the selected city is not London, the button should be reduced to 80% of its size.



Since it is a button, you can press it at any time. When you do so, the button should update the variables with the information corresponding to the city and send the **Refresh** message so that both the thermometer and the **Weather** object know that they need to be updated and change their disguises.

Step 5 - Programming the "Manchester" object

The programming of the **Manchester** object is similar to that of the **London** object, but adjusting its position and the information specific to that city.

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Step 6 - Programming the "Liverpool" object

The programming of the **Manchester** object is similar to that of the **London** object, but adjusting its position and the information related to that city.

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Paso 7 – Programming the Background

Your stage will have a fundamental role in the application you are developing, since it will be in charge of adding the elements to the **Fog** list (previously eliminating any existing content) and of making your program "speak" with its own voice.

Pressing the green flag should clear the data from the **Fog** list.

> **Note to the teacher** 📝
>
> Remember, if at any time you notice that there is a type of weather that has not been previously contemplated, you can create a list and work in the same way as you are doing so far.
>
> To be able to see the weather on the screen, you must activate the "Weather" variable check and thus be able to see at the time of programming, what options it gives.

Add the elements of the list. In the example, **Fog**, **Mist** and **Haze** have been added.

By pressing the space key, you will make your program speak both in written form, as you have already programmed, and in spoken form. You will send the **TellMe** message to make the thermometer start "talking" by selecting the language in **English** and typing the messages as shown in the picture below.

Mainly, you should build the same structure that you created in the thermometer, so that both the stage and the thermometer say the same thing.

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Step 8 - Arduino programming

In order to make the following panel work:

Note to the teacher 📝

As a resource, a downloadable document with all the weather icons as they are in the mBlock program is provided: **weather_template_v0.pdf.**

If you prefer, students can also draw the icons directly on the board.

You must program the Arduino from the Devices option.

You will start with the servo programming. At startup, although it is not visible, the servo will be positioned at angle 0°. It should then continuously adjust to the corresponding angle according to the weather, as shown in the image.

- If the weather is Windy, it should go to degree 15.
- If the weather is Rainy, it should go to degree 45.
- If the weather is Snow, it should go to grade 75.
- If the weather is Clouds, it should go to grade 105.
- If the Weather element is within the Fog list, it should go to grade 135.
- If the weather is Clear, it should go to grade 165.

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Now, from the **My Block** option, you must create two new blocks: **Green** and **Red**. These blocks will be used to control the bicolor LED and turn it on green or red, depending on the current temperature.

You should constantly check if the temperature is above 30°. If it is, the LED should light red; otherwise, it will light green.

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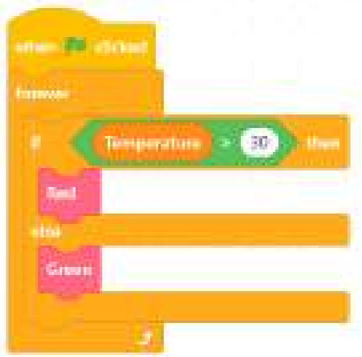
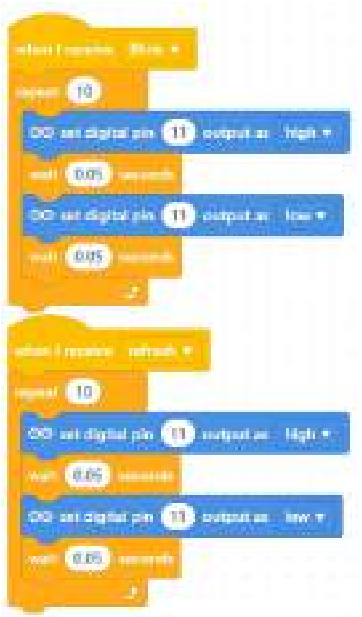


You will also use the red LED as an indicator to show when the weather information is updated.

When you receive the **Blink** and **Refresh** messages, the red LED will flash briefly 10 times.



When you receive the **Blink** and **Refresh** messages, the red LED will flash briefly 10 times. It will be 30 times.

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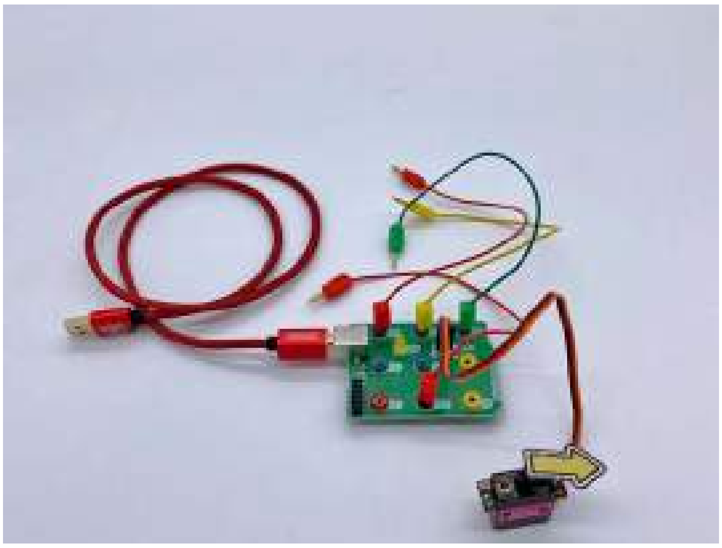
Step 9 – Building the weather panel

Now it's time to work on the manual and electronic parts. From the Cirkids kit, you will need the following components:

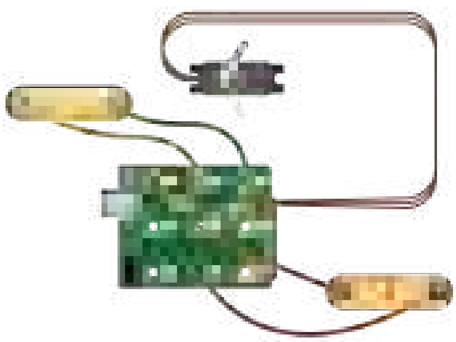
- Controller board
- Servo
- LED
- Two-colour LED
- Connection cables

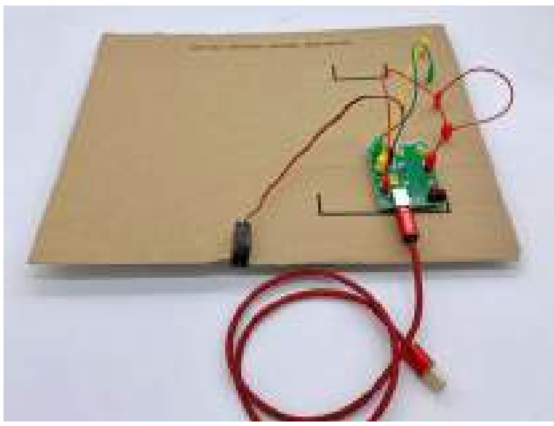
Below, you can see the connections of the circuit before mounting it on the panel.



Now it is time to mount the panel, as you have seen before.

The back of your panel should look something like this:





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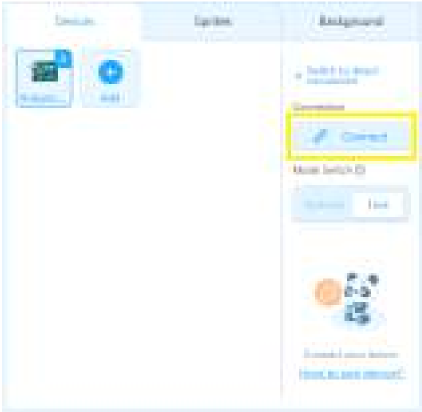
Step 9 - Connect the Arduino and check that everything works correctly.

Now you are going to follow the necessary steps to connect the Arduino to the computer. You ar going to click to the icon connect.



And the list of devices to which you can connect will appear.

Note for the teacher 📝

If you work with mBlock online, you must have mLink open to be able to connect everything to the Arduino. Simply start mLink and you can continue working normally. On the other hand, if you work from the browser, you can activate the "online" option to connect to the device without downloading software.

You may need to update the Arduino's firmware for everything to work properly, but this is a simple step to perform.

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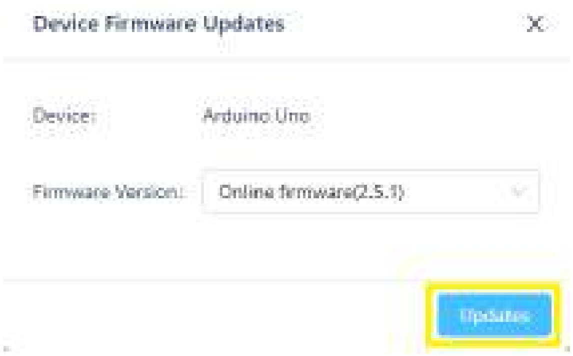
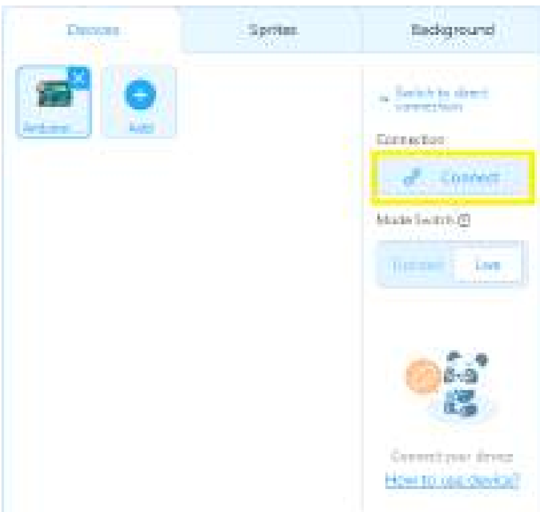
When you click on Update Firmware, the following dialogue box appears



Then reconnect the Arduino, as it is likely to have been disconnected during the process.



And now you just need to press the green flag and check that everything is working correctly.

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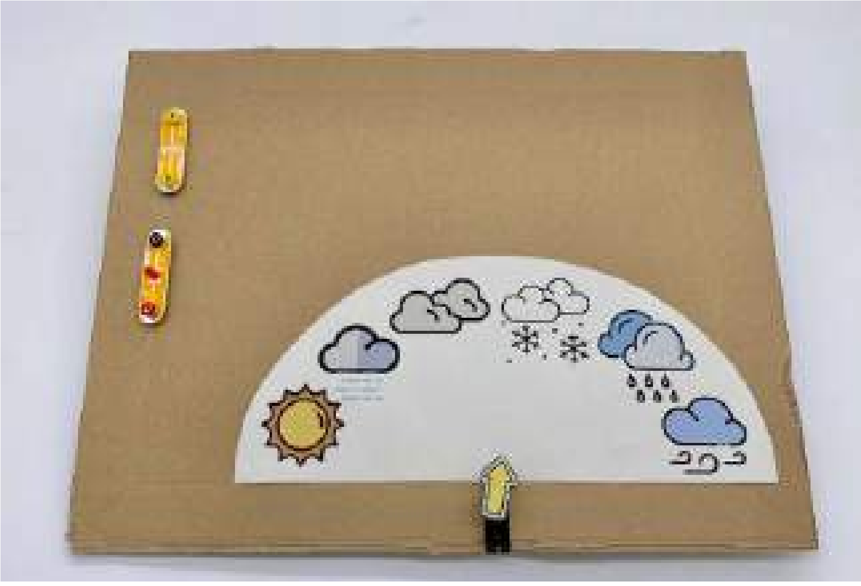

Conclusion and sharing

Classroom activity 💡

Now that our weather panels are out and working we are going to exchange them among the groups so that everyone can see each other projects and analyse what they did differently.

Then, we answer the following questions and we will discuss them with everyone or deliver them in writing (depending on what the teacher considers best):

- Do you think that what you have learnt today, if transferred to a big scale, could in any way help the population in the areas that you have researched about climatology? Do any of these cities have recurrent problems regarding the weather?
- What was the thing that you encountered most problems with while developing the activity?
- Has doing this research contributed to your knowledge about the climate of these cities? Was there data that called your attention?

Show us your working weather panel via social media!

- LinkedIn: https://www.linkedin.com/company/steambrace-project?trk=public_post_feed-actor-name
- Instagram: https://www.instagram.com/steambrace_eu/
- X: https://x.com/steambrace_eu

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Project evaluation

Activity Objectives	Key competences (EU)	Evaluation Criteria
Encourage teamwork	Interpersonal skills, and the ability to adopt new competencies	Active participation by all group members is observed throughout the project. Effective collaboration in researching city data, brainstorming solutions, and assembling the weather panel. Ability to share roles and responsibilities within the group and adapt when needed.
Understand the use of basic electronic components	Digital and technology-based competencies	Proper identification and connection of electronic components (e.g., microcontroller, servomotor, LEDs). Correct wiring and integration of components as outlined in the circuit diagram. Demonstrates an understanding of how components work individually and together to display real-time weather data.
Programming and integration with AI		Correct implementation of programming tasks, including coding the logic for the weather display and AI components. Integration of APIs for real-time weather data retrieval. Customization and functional programming of buttons, weather displays, and the speech function.
Develop problem-solving skills	Numerical, scientific, and engineering skills	Ability to identify and solve issues that arise during the project (e.g., incorrect code outputs, misconnected components). Application of logic and critical thinking in the development and testing phases.

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