



# NYCI

# STEAM

## In Youth Work

## Activity Pack

The National Youth Council of Ireland

The National Youth Council of Ireland is the representative body for voluntary organisations in Ireland. We use our collective experience to act on issues that impact young people.

Compiled by TechSpace.

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## About STEAM in Youth Work

NYCI's STEAM in Youth Work project is a two-year project that aims to transform the capacity of the youth sector to use STEAM\* to support the achievement of youth work outcomes and to improve the lives of young people.

Through training, residential schools, grants, resources and equipment dissemination, youth workers gain the skills and knowledge needed to facilitate high-quality STEAM learning experiences for young people. Through hands-on follow-up support they are supported to use what they have learned in their practice.

*"The projects shown to us are accessible and success will build confidence and raise enthusiasm for STEAM but more importantly for a young person's problem solving confidence in general."*

-Training participant

STEAM is an effective method for engaging learners in creative, higher-order problem-solving while experiencing STEAM. Young people's engagement in these projects leads to development in their perceptions of STEAM, scientists and the impact of STEAM on their lives.

NYCI's STEAM in Youth Work project is funded by the Science Foundation of Ireland.

**\*STEAM = Science, Technology, Engineering, Art, Maths**

## About This Resource

With our STEAM in Youth Work Activity Pack we want to provide youth workers with a selection of some of our most popular STEAM activities and give them practical guidance on how to use them within their practice. These step-by-step activity guides are designed to help youth workers plan and facilitate innovative STEAM activities with young people and are applicable in both an in-person and remote youth work context. They include equipment lists and recommendations as well as links to other relevant resources for extension projects.

If you have any questions about this Activity Pack, or need any support in implementing any of these activities with young people, contact [katrin@nyci.ie](mailto:katrin@nyci.ie) or [barbara@nyci.ie](mailto:barbara@nyci.ie) or call NYCI at 01 478 4122 and ask to speak to someone from the STEAM in Youth Work team.

This Activity Pack is based on training that was developed as part of NYCI's STEAM in Youth Work project by TechSpace.

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## Activity 1: Paper Circuits

**Level:** Beginner

**Time Required:** 30 minutes

**Aim:**

Create a basic circuit to illuminate your own drawing!  
The aim of this activity is to use simple conductive materials, to create a circuit which can be embedded within an image on paper.

**Young People will:**

- Enhance their creative skills by integrating electronics into their work.
- Learn to build a basic circuit, using some simple materials from home.
- Understand the importance of laying out the components of a circuit accurately, so that electricity can flow from the positive to negative connections.
- Use a Maker mindset to ensure that their Paper Circuit works successfully at the end.

**Materials:**

[LEDs](#) (any colour)

Tinfoil, Wire or [Copper Tape](#)

Paper/Card

[Coin Cell Battery](#) (3V CR2032)

Arts & Crafts Supplies

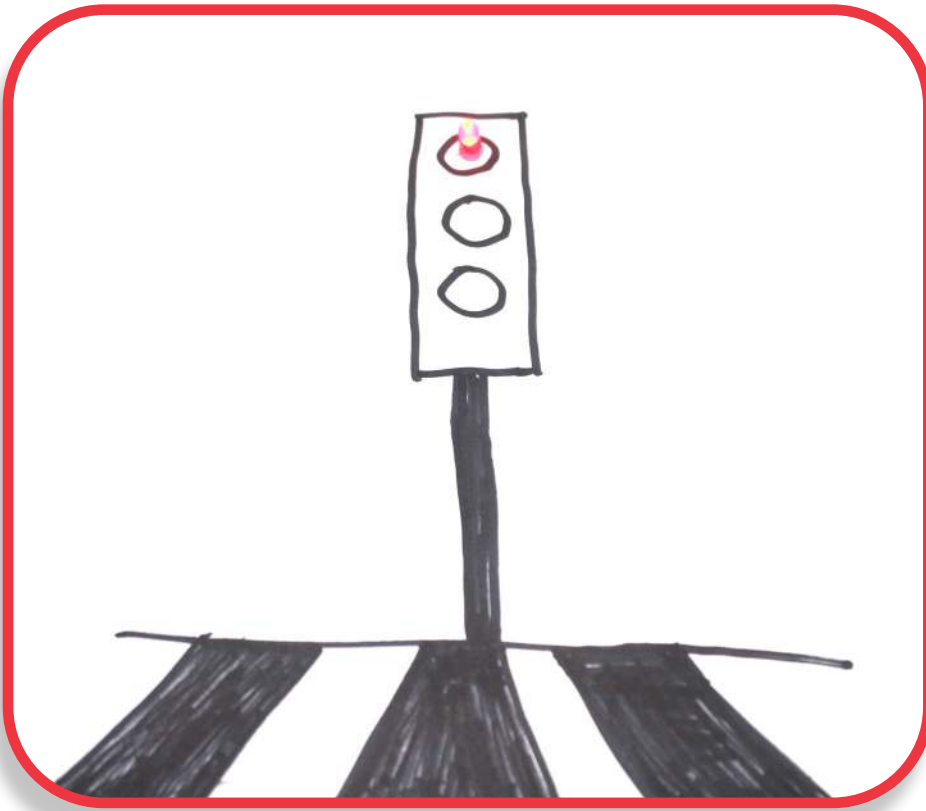


Fig 1. Sample paper circuit from makerspaces.com

**Costs:**

It costs approximately €1.95 per person to create a Paper Circuit, using the materials listed.

STEAM components for this activity can be purchased from [Kitronik](#), [Radionics](#) or even [Wish](#).

## Instructions:

### Step 1. Plan Your Design

We first want to sketch out our project without considering our circuit. We will then plan our circuit once we know the shape of our project and the desired location of the LEDs. Have a look at the following sample image for an idea of how you could create a paper circuit picture.



Fig 2. Sample paper circuit drawing



## Step 2. Create Your Circuit

- A. Take a thin strip of tinfoil, wire or copper tape and replicate the circuit outline in Fig. 3. The strip of tinfoil, wire or copper tape can never cross over itself, and should not be broken into different pieces, other than breaks for the LEDs and battery.
- B. One end of the tinfoil, wire or copper tape strip needs to touch the positive (+) side of the coin cell battery and the other end needs to touch to the negative (-) side.
- C. Pay close attention to the sample circuit pictured to get the positive (+) and negative (-) ends of your circuit in the correct order. You can bend the legs of your LEDs to flatten them down on the paper if you wish – remember that the long leg of the LED is the positive side (+) and the short leg of the LED is the negative (-) side. You'll need to make sure that the positive (+) side of your LED is connected to the positive (+) side of your battery by your circuit's wiring. It's up to you if you want the LED to push through, to the front of your design page, or just to illuminate it from behind.
- D. At this final stage, it's also important to make sure that your circuit doesn't cross over itself, as this will break the circuit and prevent the LEDs from lighting up.

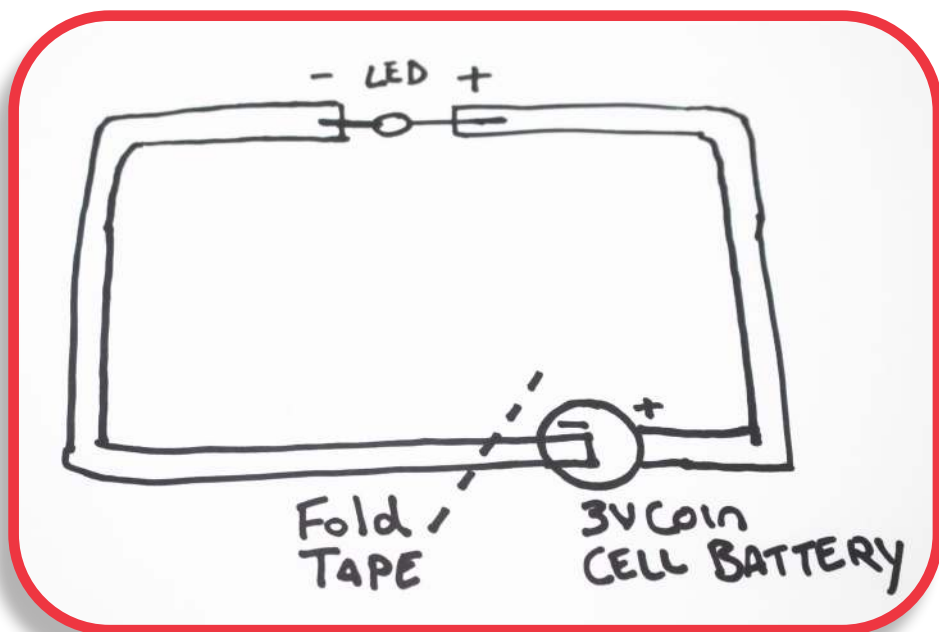


Fig 3. Circuit outline for paper circuit

## Step 3. Complete your Design

Stick down the paper circuit to the back of your design/ picture, as in Fig. 4. Be sure to leave some free space at the bottom of the page/card, so you can fold over its corner and connect the tin foil, wire or copper tape strip with the coin cell battery.

### Question:

Did your young person have any problems with getting their Paper Circuit to work? What did you/they change in the circuit, to get the LED to light up successfully? Try to encourage your young person to talk you through what they did to ensure that their Paper Circuit worked correctly and what they may do to improve the process in future.

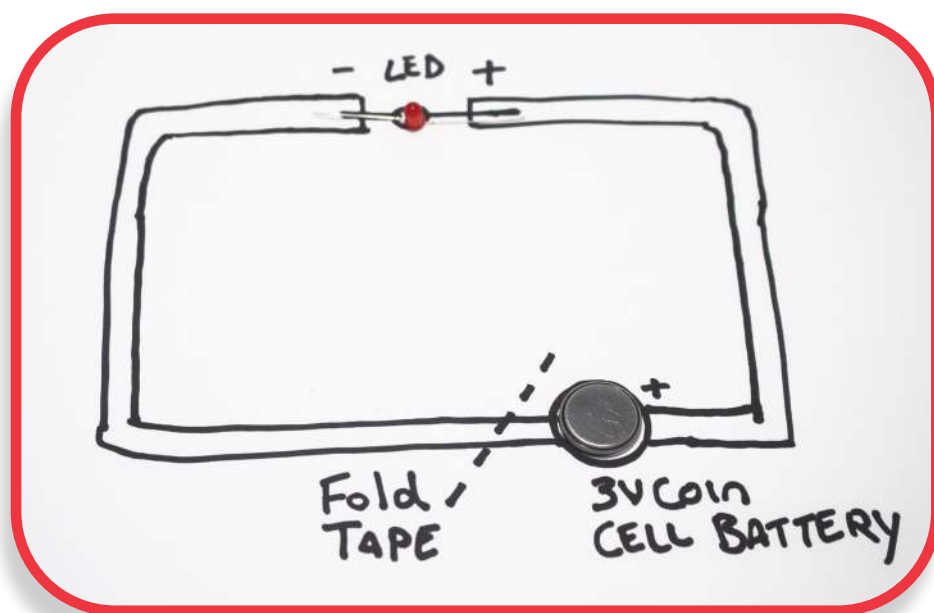


Fig 4. How a paper circuit can be laid out on the back of a picture.



Fig 5. Components needed to create a paper circuit.

# Activity One

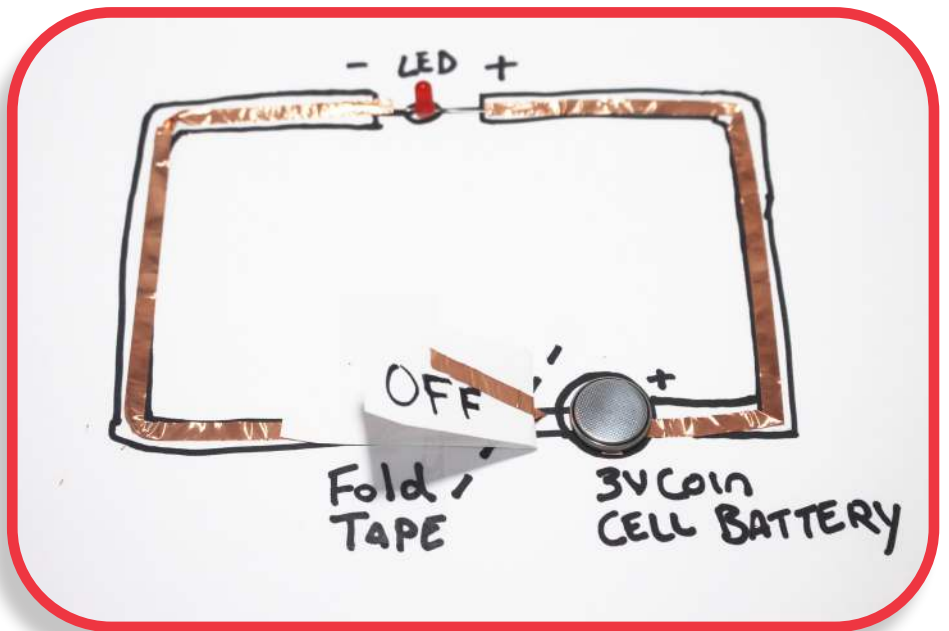


Fig 6. Open circuit with components placed on circuit outline.

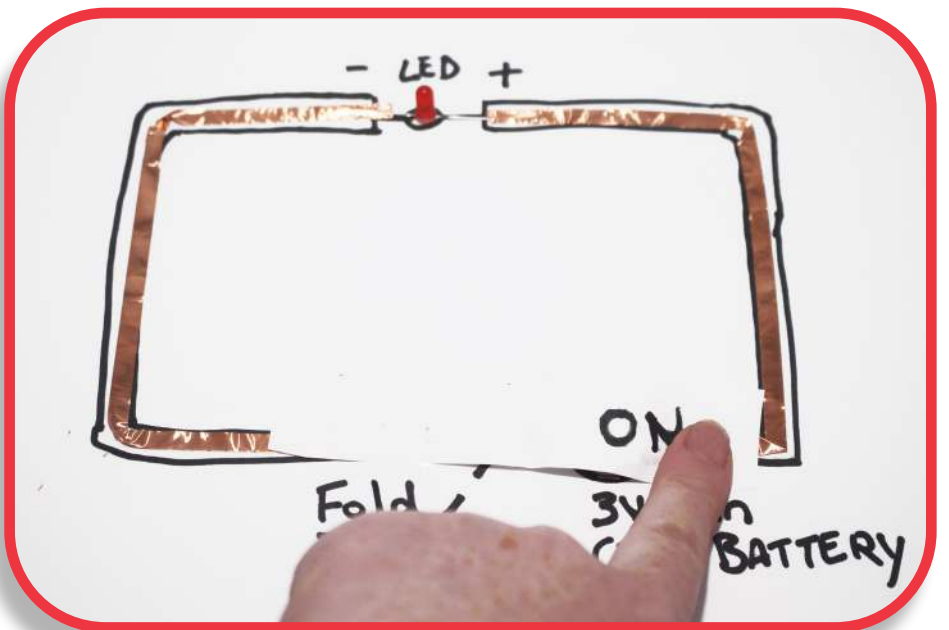


Fig 7. Closed circuit using paper as a switch.

### **How could a Paper Circuit activity be delivered with young people remotely?**

- A separate session could be facilitated just around the creative tasks within this activity. Young people will need time to design a project which they want to illuminate, as well as to plan the structure of the corresponding paper circuit.
- It may not always be feasible for you to deliver STEAM activity materials to your young people. Many of the materials for Paper Circuits can actually be sourced at home or from a local Euroshop. For example, you can use tin foil from home or even purchase some cheap slug barrier tape from the local shop (this is actually the same as copper tape!), for creating the wires of your circuit. LEDs can also be obtained from some Euroshop string lights (usually approx. €1.50) - Just use a pliers to prise open the LED holder and you should be able to use the enclosed LED for your Paper Circuit!

### **Suggested follow-on tasks/experiments:**

You can create lots of different projects using Paper Circuits:

- Paper [Badges](#)
- Light Up Paper Hats
- Light Up [Board Games](#)
- [3D Cards](#)
- [Tracing Paper Lanterns](#)
- Light Up Invitations

## Activity 2: STEAM Racer

**Level:** Beginner

**Time Required:** 45 minutes

**Aim:**

Create a motor-powered racer car using a simple circuit and engineering! The aim of this activity is to become familiar with basic circuitry and learn to use problem-solving to build a STEAM Racer

**Young People will:**

- Learn the basics of circuitry and Making
- Gain experience in building a hands-on electronic device
- Use problem-solving to navigate through difficulties which they encounter during the activity
- Question how things work and what would happen if elements of their STEAM racer were changed

**Materials:**

Plastic Bottle, Cardboard, Tube or something similar

2 Straws

2 Wooden skewers

4 Wheels (Buttons, Bottle Caps, Cardboard, Coins, Watch Batteries)

Blue Tack

Sellotape

[Mini Low Torque DC Motor](#)

2x [AA Batteries](#)

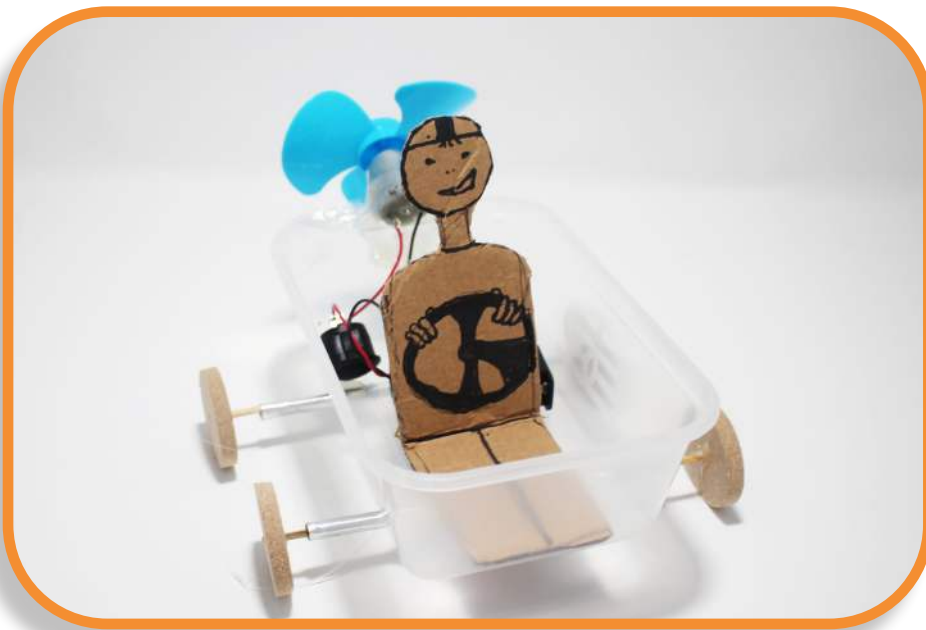
[AA Battery Holder](#)

[Mini Propeller Blade](#)

Ruler

Scissors

Hole Puncher



### Costs:

It costs approximately €3.00 per person to create a STEAM Racer, using the materials listed above. If you also want to provide tools (i.e. hot glue gun, glue sticks) from this list, the activity will cost approximately €17.50 per person.

STEAM components for this activity can be purchased from [Kitronik](#), [Radionics](#) or even [Wish](#).



Fig. 1 - STEAM Racer materials

## Instructions:

### Step 1. Create a STEAM Racer Circuit as per Fig. 1

If you have a switch this is the stage where you can add it in.

1. Once you have built the car you must decide where to put all of the pieces.
2. Weight distribution will have an impact on the STEAM racer's efficiency.

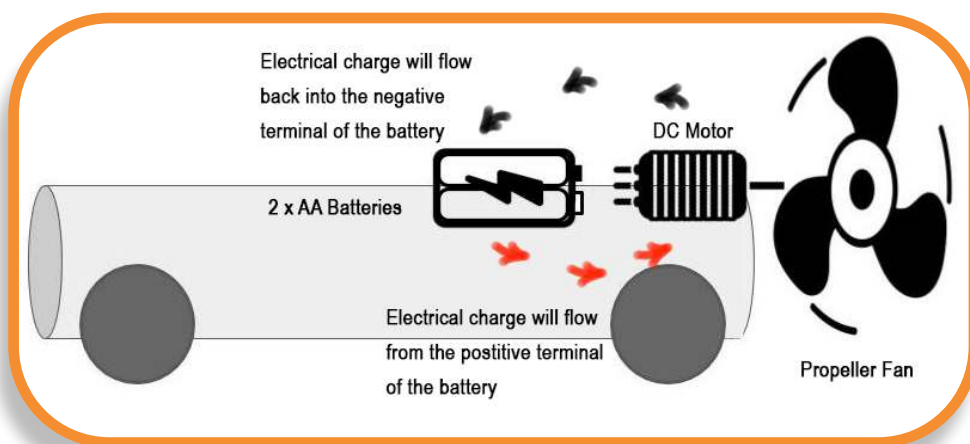


Fig. 2 - STEAM Racer circuit structure

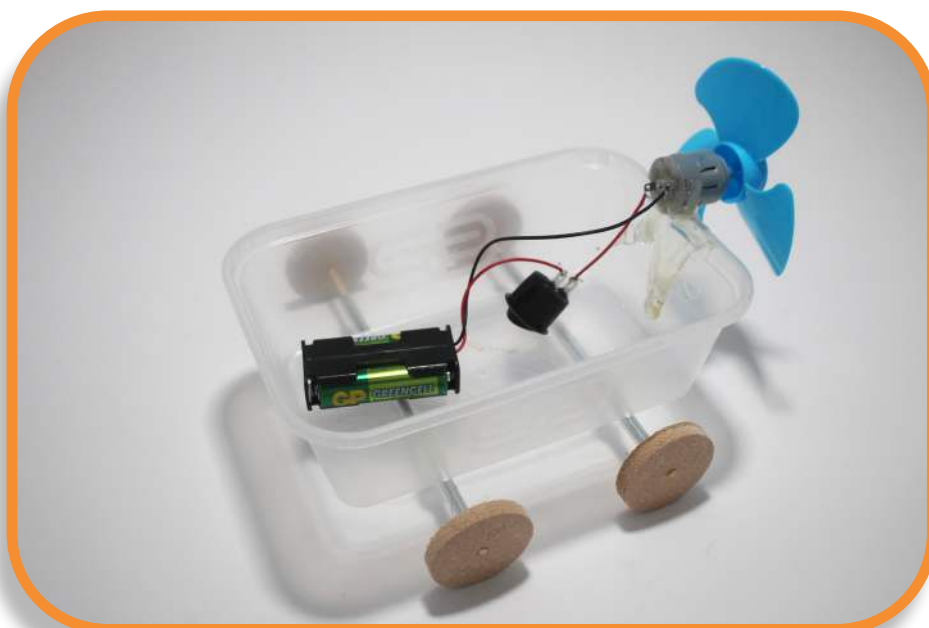


Fig. 3 - STEAM Racer and circuit image



**Optional:** If you have a switch, you can also include it in your circuit, to make it easier to turn on/off. To include a switch, simply cut the black wire in the centre and twist each loose end of the cut wire around the metal loops of the switch. Have a look at Fig. 2 to see how a switch will look in your circuit.

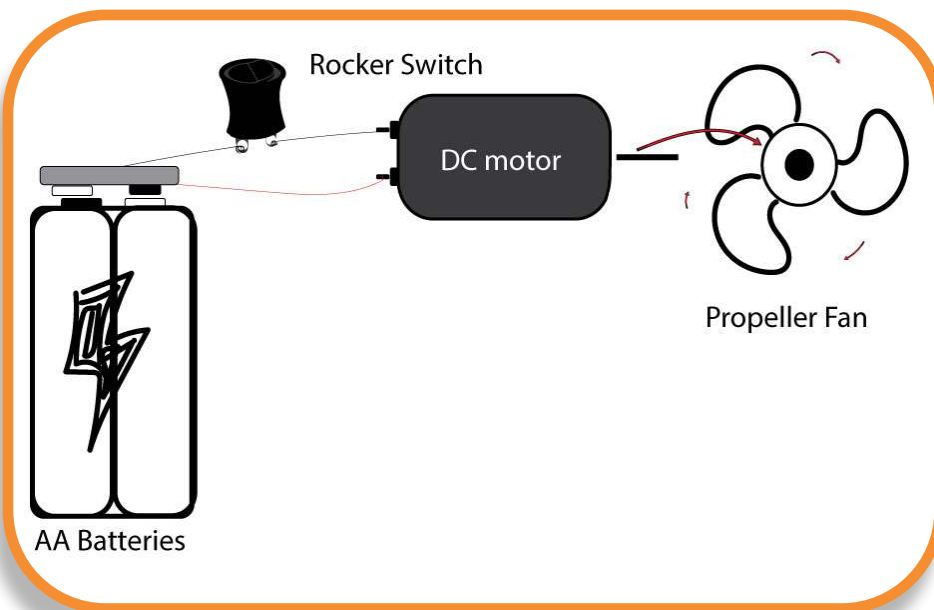


Fig. 4 - STEAM Racer Motor circuit with optional switch

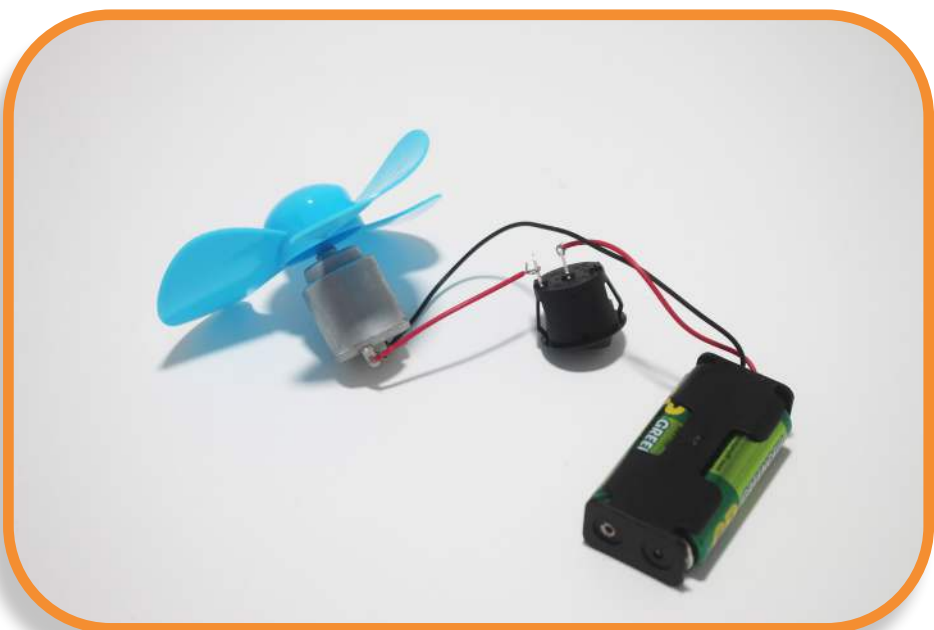


Fig. 5 - STEAM Racer Motor circuit with optional switch

## Step 2. Create the Body of Your Racer

Measure out the body of the STEAM Racer (if you're using cardboard for the body). The piece of card for the body of your racer should measure around 22cm x 4.5 cm. For this example, we are using a plastic container.

## Step 3. Measure and Cut Paper Straws and Skewers

We recommend using paper straws and wooden skewers as they're degradable and more environmentally friendly than plastic materials. Always try to avoid single-use plastics when you're doing STEAM activities!

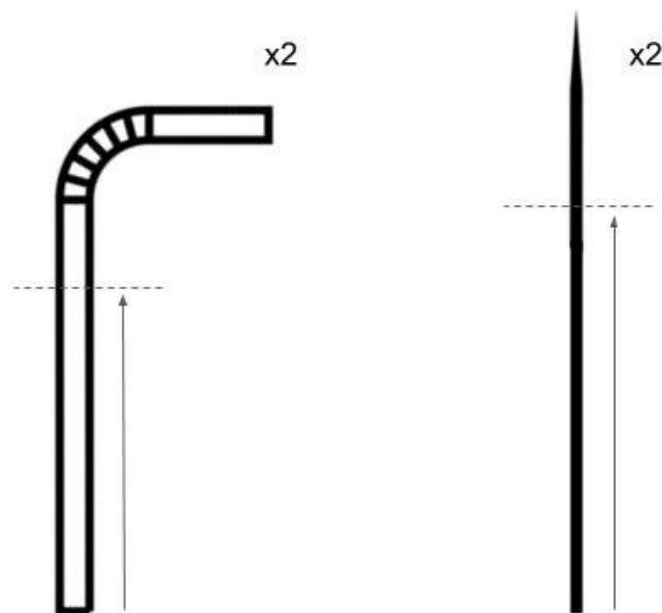


Fig. 6 - Remove the hinges of paper straws and pointed ends of wooden skewers.

The wooden skewers should be at least 2cm-5cm longer than the paper straws. This will have an impact on how well your racer will work at the end, so pay attention to this step.

Be sure to cut the pointed ends off the wooden skewers and any hinged ends off the paper straws. We don't want the wooden skewers/paper straws on our STEAM Racers to be bendy or pointy!



Fig. 7 - Image of a plastic container, forming the STEAM Racer body

## Step 4. Form the Body of Your Racer

Retrieve the piece of card which you previously cut out for the body of your racer. Create a cylinder shape, by rolling up your piece of card lengthways and securely taping the loose ends together.



Fig. 8 - Image of STEAM Racer body, showing where straws and skewers are to be inserted

## Step 5. Create Holes for the Axles of Your STEAM Racer

Cut holes opposite each other at the base of your STEAM Racer's body (see diagram below). You can use a hole punch for this step or even one of the sharp ends which you removed from your wooden skewers. Be sure to cut the holes directly opposite each other and at the same height. If these holes in your STEAM Racer are not balanced, it might not move very well

The paper straw and wooden skewers will form the axles of your STEAM Racer. For each axle, insert a paper straw into a pair of holes on the body of your STEAM Racer. Be sure to glue down the paper straw, once you've put it in place. Then insert the wooden skewer into the paper straw.

**Note:** It's important here to make sure that the wooden skewer ends overlaps each end of the paper straw by about 3cm. As you'll see in a few moments, this will enable the wheels of your STEAM Racer to rotate freely.



Fig. 9 - Image of STEAM Racer body with wheels attached

**Question:**

Why are we using both paper straws and wooden skewers?

If we just used wooden skewers by themselves they would get stuck under the weight of the STEAM Racer and would not rotate. By gluing down a paper straw first, this will act as a support construct for the wooden skewer, thus enabling the wooden skewer to rotate.

## **Step 6. Attach Wheels to the Ends of the Wooden Skewers**

You can use super glue, hot glue or plasticine for this step. Make sure your wheels are big enough so that the body of the STEAM Racer is not touching the ground. Otherwise your Racer will drag and not move very fast. This would be a pity after all of your hard work!

## **Step 7. Attach the circuit you built in Step 1 to the body of your STEAM racer. To do this, you can use tape or glue**

Attach the circuit you built in Step 1 to the body of your STEAM Racer. To do this, you can use tape or glue.

**A couple of things to pay attention to at this stage:**

1. Make sure that the propeller has enough space to spin freely. We recommend attaching the motor to the very end of your Racer, so that the propellor can spin and push your Racer along.
2. While you're fixing it to the body of your Racer, make sure that your circuit remains intact and that you aren't obstructing any part of the wiring with tape or glue. Otherwise this could prevent the electrical charge from travelling through the circuit.

## Step 8. Let's add a driver to our car

Let's add a driver to our car by cutting the shape out of some paper. Why not draw yourself as the driver, with your name and age written on the driver's shirt?

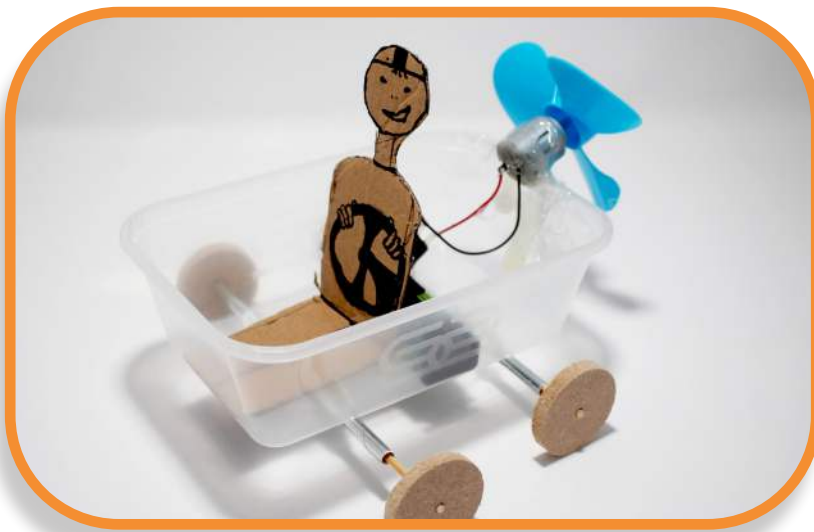


Fig. 10 - Example of a structure for STEAM Racer driver

## Step 9. Customise

Cut a hole or insert a cardboard seat for your driver and customise the STEAM Racer's design. Now you're all done! and customise the STEAM Racer's design.

# Activity Two

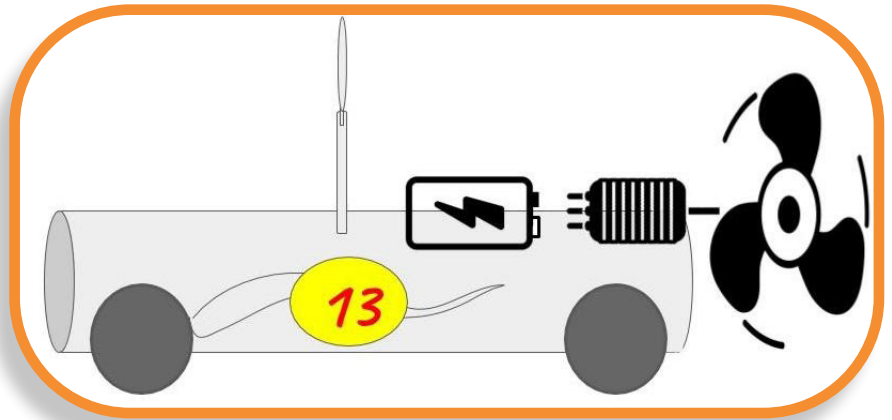


Fig. 11 - Complete STEAM Racer structure and design



Fig. 12 - Complete STEAM Racer



### **How could a STEAM Racer activity be delivered with young people remotely?**

- Young people can use materials from home to create a STEAM Racer - a plastic bottle for the body, sticks from the garden can replace the skewers and bottle lids can be used as wheels. This process of upcycling can also begin a group discussion on environmental awareness or an online research project.
- For more of a focus on the planning and engineering behind a STEAM racer, why not use elastic bands to control your racer? Have a look at this [Instructable](https://www.instructables.com/id/Rubber-Band-Racer-/) for more ideas: <https://www.instructables.com/id/Rubber-Band-Racer-/>

### **Suggested follow-on tasks/experiments:**

- Can you make your STEAM Racer the fastest? Try timing its speed. Then make some structural change and time it again. Is there any difference in its speed and why do you think this is?
- If you're working remotely, but as a group, why not each make an identical race course and see who can get their STEAM Racer to reach the finish line fastest?
- Try out wheels made from different materials or of different sizes - bigger, smaller, heavier, lighter. Investigate how each of these options changes the way your STEAM Racer moves.
- Can you make your car out of something other than paper? Some objects from home like a used plastic bottle or a Pringles® container could work really well!
- Is a heavier or lighter Racer fastest? Change the materials for the body of your racer to find out!
- Can you add some bright LEDs? Why not use some Paper Circuits to illuminate your STEAM Racer?
- What other vehicle shapes could you make?

## Activity 3: Mini Motor Bug

**Level:** Intermediate

**Time Required:** 25 minutes

**Aim:** Build your own motor-powered jumping bug!  
Use your pre-existing STEAM skills to create an intricately designed moving bug

**Young People will:**

- Use this activity to enhance their previous knowledge of circuitry design and creation.
- Learn to plan and structure the shape and weight of their Mini Motor Bug, in order to ensure that it can work properly.
- Gain further insights into the influence of conductive and insulating materials, in the formation of efficient electrical circuits.

**Materials:**

1 clothes peg

3 paper clips

2 [LEDs](#) (any colour)

[Mini Vibrating Motor](#) (3V 2.0mm, Circular)

[Coin Cell Battery](#) (3V CR2032)

[Electrical Wire](#) (red and black are the easiest use when working with circuits)

[Soldering iron](#) and [solder](#)

[Glue gun](#) and [glue sticks](#)

Sellotape

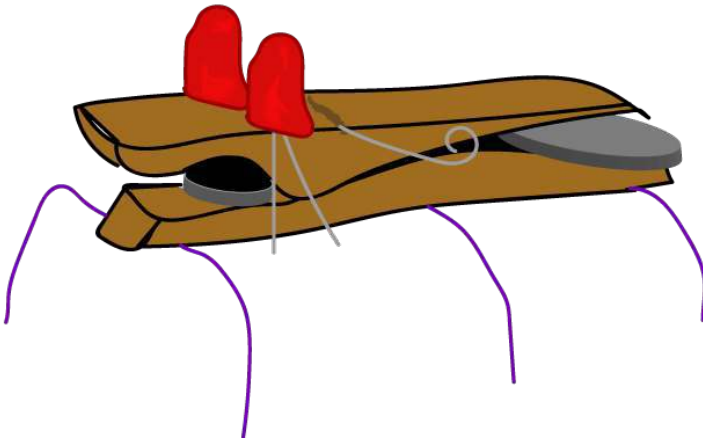


Fig. 1- Drawing of a peg bug model

### **Costs:**

It costs approximately €4.50 per person to create a Mini Motor Bug, using the materials listed above. If you also want to provide tools (i.e. hot glue gun, glue sticks, soldering iron) from this list, the activity will cost approximately €30.50 per person.

STEAM components for this activity can be purchased from [Kitronik](#), [Radionics](#) or even [Wish](#).

## Instructions:

### Step 1. Have a Look at What You're Aiming For

To get a view of the finished project, check out this tutorial video first:

<http://joshbuild.com/how-to-make-a-mini-robot-bug/>

### Step 2. Place Your Motor in the Pinch of the Peg

See Fig. 2 for direction on the positioning of the motor.

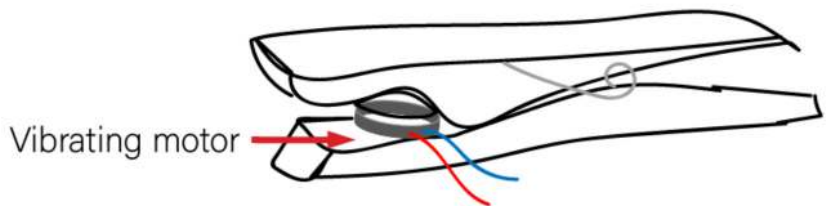


Fig. 2- Motor positioned within the pinch of the peg

### Step 3. Attach LEDs to Mini Bug

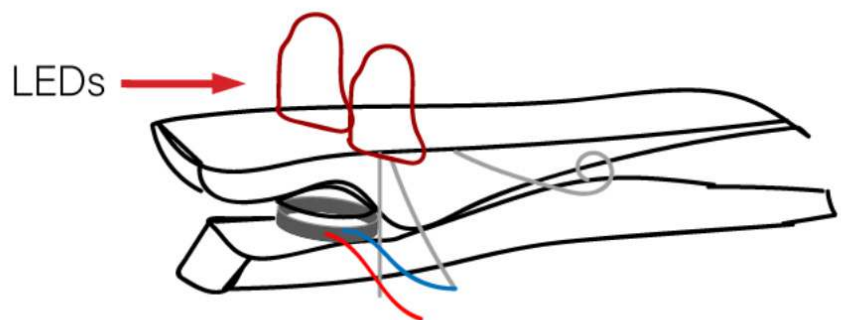


Fig. 3 - LEDs positioned on a Mini Motor Bug

Attach your LEDs to the sides of the peg using your glue gun. Both legs of the LEDs should be matching the direction of the charge; the positive (+) or long LED leg should be connected to the positive (red) wire, while the negative (-) or short LED leg should be connected to the negative (black) wire.

## Step 4. Connect LEDs to Circuit

Use your red wire to connect the long legs of the LEDs, which is the positive (+) side to each other. Use the black wire to connect the negative (-) short legs. The colours of the wiring in this part of your mini motor bug don't have any influence on your circuit working properly - it's just a visual aid to make it easier to keep your circuit's positive (+) and negative (-) side separate.

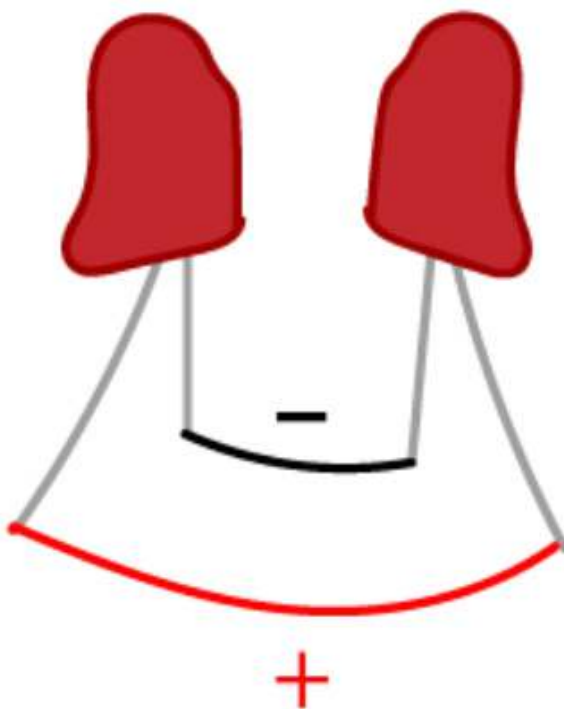


Fig. 4 - Diagram of wires connected to LEDs

# Activity Three

The vibrating motor comes with two wires attached to it - one red and one blue or black. Here, the red wire is positive (+) and the blue/black is negative (-). Connect the motor's red wire to the other red wire which you previously attached to the positive leg of the LED. Attach the motor's blue/black wire to the black wire, connected to the negative leg of the LED.

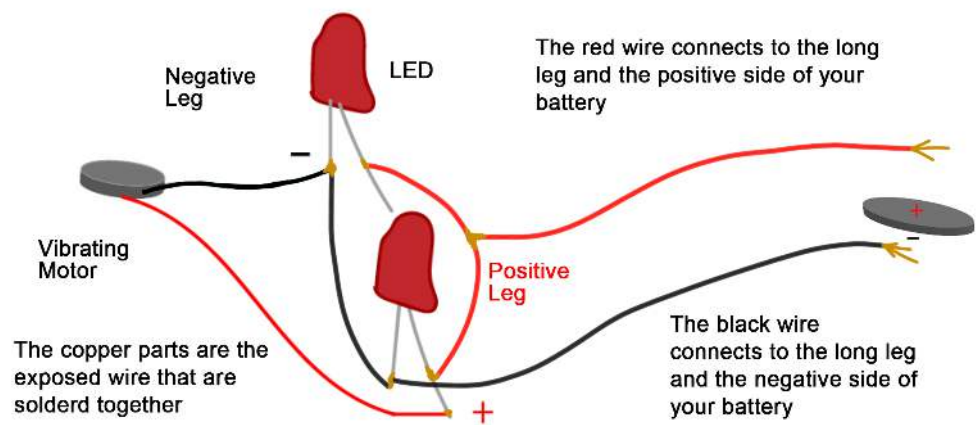


Fig. 5 - Diagram showing motor connected to LEDs

## Together

Once you're sure none of the circuit's wires are accidentally touching each other, you can go ahead and solder. Be careful, as the soldering iron can reach up to 400°C and you may get a nasty burn if you unintentionally touch it!

Here's a handy guide for learning to solder, if you're new to it:  
<https://www.makerspaces.com/how-to-solder/>

If you don't have the means to solder your circuit together, you can simply twist the ends of your circuit wires tightly together. Though this option is less secure than soldering, it can be useful when it's not safe for a young person to solder remotely. You could try coating the twisted wires together with glue, if you like – just be sure to test that your circuit is still working, as you add in each new piece of the circuit.

## Step 7. Create Legs for Your Mini Motor Bug

Unfold the paper clips and glue them on to the bottom of the peg, to hold up your bug. You can alternatively try using pipe cleaners as legs for your mini motor bug, though they'll need to be quite strong to hold up the body of your bug.

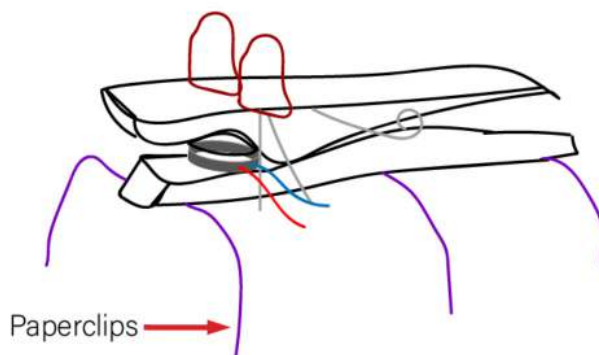


Fig 6. Positioning of legs (paperclips) on your Mini Motor Bug

## Step 8. Connect the Battery to the

## Circuit

Using tape, connect your red wire to the positive side of the coin cell battery, and the black wire to the negative side of the battery. Using tape will allow you to change the battery easily when it runs out.

**How could a Mini Motor Bug activity be delivered with**

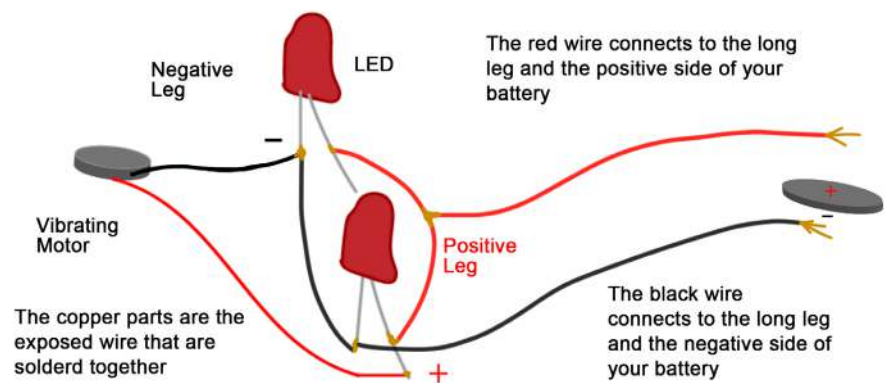


Fig. 7 - Diagram of complete Mini Motor Bug circuit



## **young people remotely?**

- The Mini Motor Bug is a step up from basic circuitry activities and would be great to facilitate with a young person who really likes STEAM.
- If you're facilitating this activity remotely, start by getting your young people to try to identify each component of the project themselves. Encourage them to test their circuit, by checking that their LEDs and motor are all working. To do this, simply connect each component up to a battery, one by one.
- It's also a good idea for your young people to try to build the circuit itself before placing each part of it on the body of the Mini Motor Bug. That way they know the structure of the circuit and how it will need to be positioned on the body of the Bug, to make sure that it will work properly.

## **Suggested follow-on tasks/experiments:**

- This activity could be created using lots of different materials, as a bug body. The important thing to keep in mind is that the body needs to be small enough for the motor, so that your Bug will vibrate and move around. Once you have the basic circuit created, why not try using different bases for the bug, to find a good or unusual version of your own Mini Motor Bug?
- See how many LEDs you can add on to your Mini Motor Bug circuit. Extra LEDs can represent the bug's eyes or just be added as decoration. The coin cell battery will only be able to provide power to a few LEDs and the motor, but it's fun to experiment and see how you can scale up your circuit!

## Activity 4: 3D Design – Make a Keyring

**Level:** Intermediate

**Time Required:** 40 minutes

**Aim:** Design and export a personalised keyring using TINKERCAD. For this activity, you will create a 3D keyring with your name on it, using 3D design software. This is an introductory activity that will get you comfortable with using TINKERCAD (a 3D design studio) for the first time. Design and print a name tag keyring with your young people! 3D printing can sometimes take a long time to complete but the keyring is a nice and quick activity that allows for quick printing with your groups.

**Young People will:**

- Become familiar with TINKERCAD, as a 3D design tool.
- Create a personalised 3D image, which can be printed on a 3D printer.
- Discover how emerging technologies can enhance learning and creativity, as well as strengthen 21st-century skills.
- Develop concepts around sustainability and design thinking for making-with-purpose goals.

**Materials:**

[Tinkercad](#)

Internet Access

Computer



Fig. 1 - Screenshot of TINKERCAD project

**Costs:**

Costs vary for 3D printing. 3D printer prices can start at €200 upwards. Filaments can also range depending on plastic type but roughly cost around €20.00 on Kitronik. To outsource printing, you can print in most local libraries or fab labs for free.

STEAM components for this activity can be purchased from [Kitronik](#), [Radionics](#) or even [Wish](#).

**Note:**

21st-Century Skills: Critical thinking, Creativity, Collaboration, Communication, Information, literacy, Media literacy, Technology literacy, Flexibility, Leadership, Initiative, Productivity, Social skills

## Instructions:

### Step 1. Search for TINKERCAD Online

Type in the following address to your search bar in your browser:

[www.tinkercad.com](http://www.tinkercad.com)

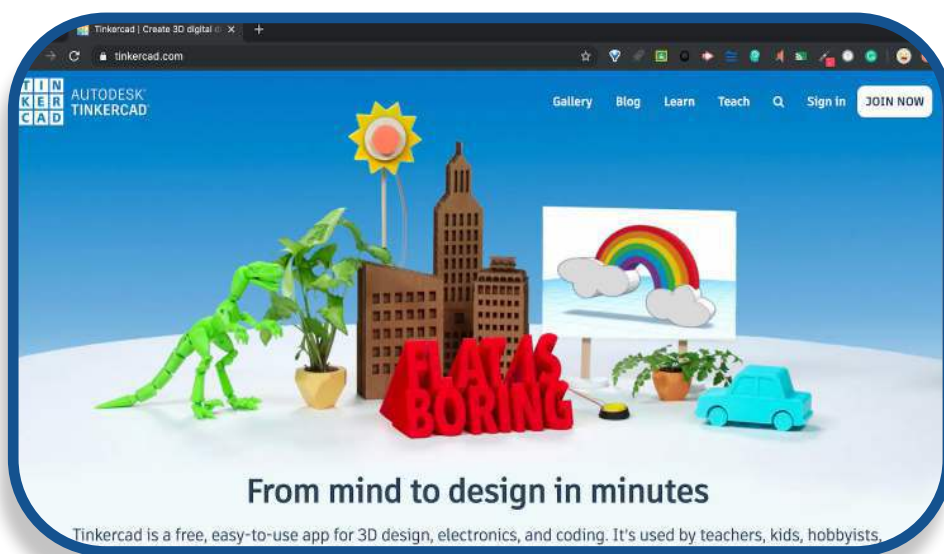


Fig. 2 - Screenshot of TINKERCAD homescreen

You will need to create a free account to use this software.

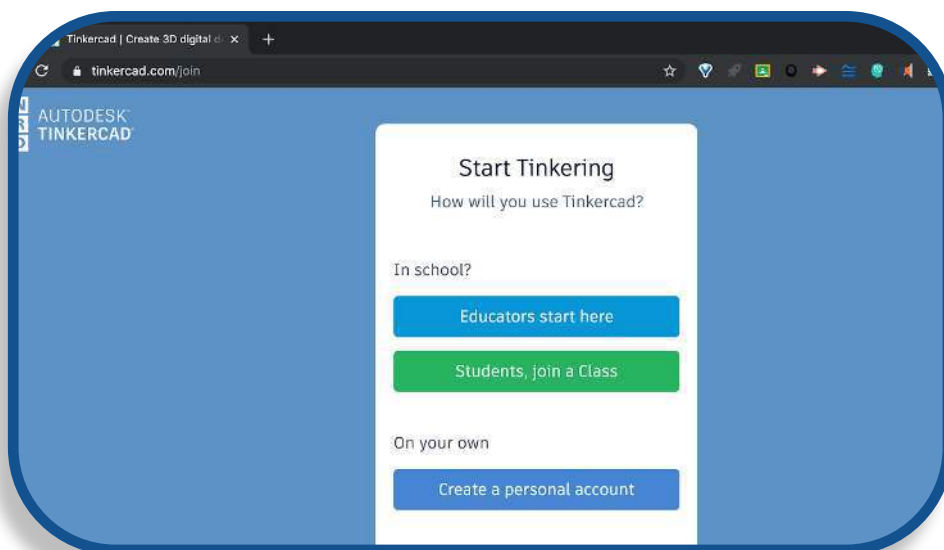


Fig 3. Screenshot of TINKERCAD join page

## Step 2. Create a Project

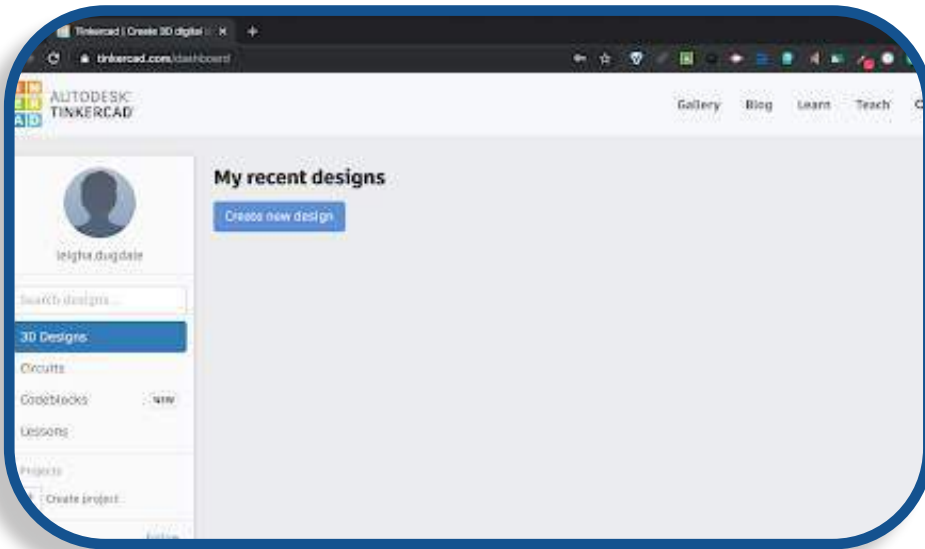


Fig 4. Screenshot of TINKERCAD dashboard

Once you have signed up and signed in to your Autodesk on TINKERCAD you can create a new design.

### Using the Workplane:

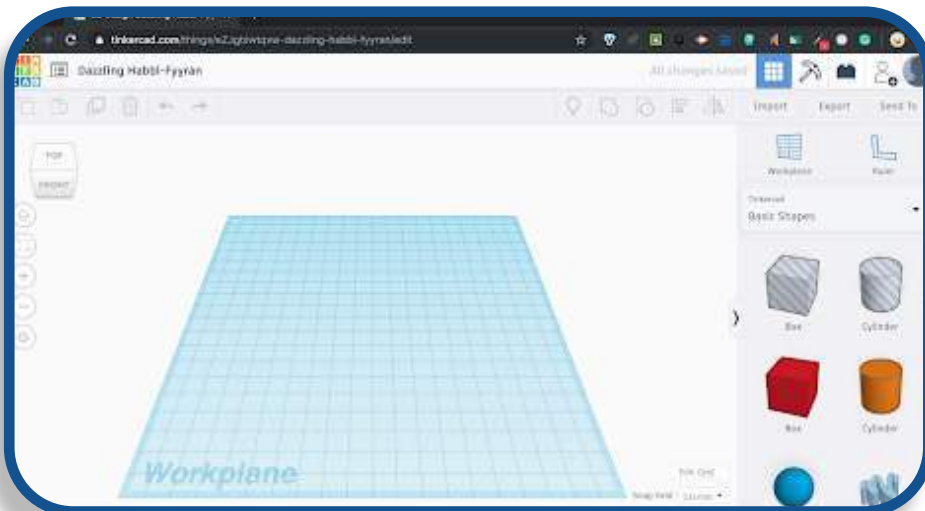


Fig 5. Screenshot of TINKERCAD studio

The right hand panel in your workspace is where you will find shapes to work with.

## Step 3. Create a Shape

Select the red rectangular box and a property menu will appear.

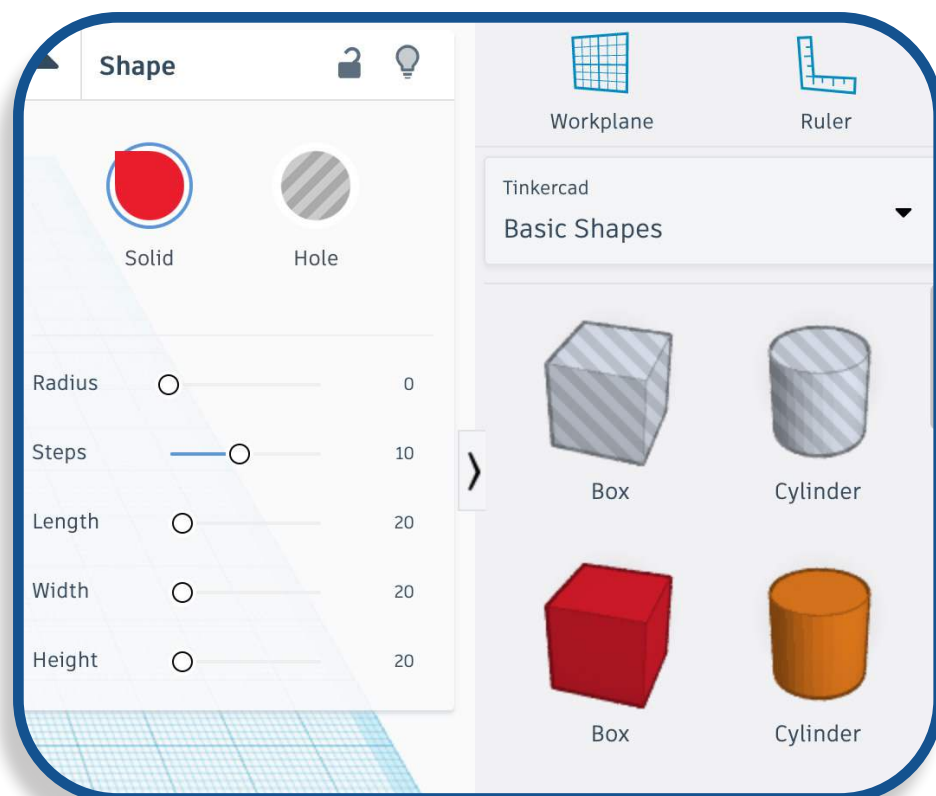


Fig 6. Screenshot of TINKERCAD tools

The solid shading will print solid blocks and the grey and white shading will create hollow blocks, which can be used to create negative space (an indent) in your shape. You will see an example of this in Step 6.

**Please note:** You can adjust the sizes of your shape manually here too if you have specific dimensions which you need to use. You can also resize your shape later on the workplane by dragging the handles that appear when the object is selected.

## Step 4. Add Text to Your Rectangle

Under Basic Shapes, scroll down until you see the text option. The Properties panel will appear and you can add your desired text there. Select the solid color to change the color of your shape. The text can be hollow and etched into your rectangle shape but for this example, we will build your text on top so that it is protruding out of the keyring. You will need to select “solid” for this, as the “hole” option creates a negative space within your shape.

**Note:** The colors in TINKERCAD are only a visual aid. In reality, your shape will print in the color of the 3D printer’s filament.

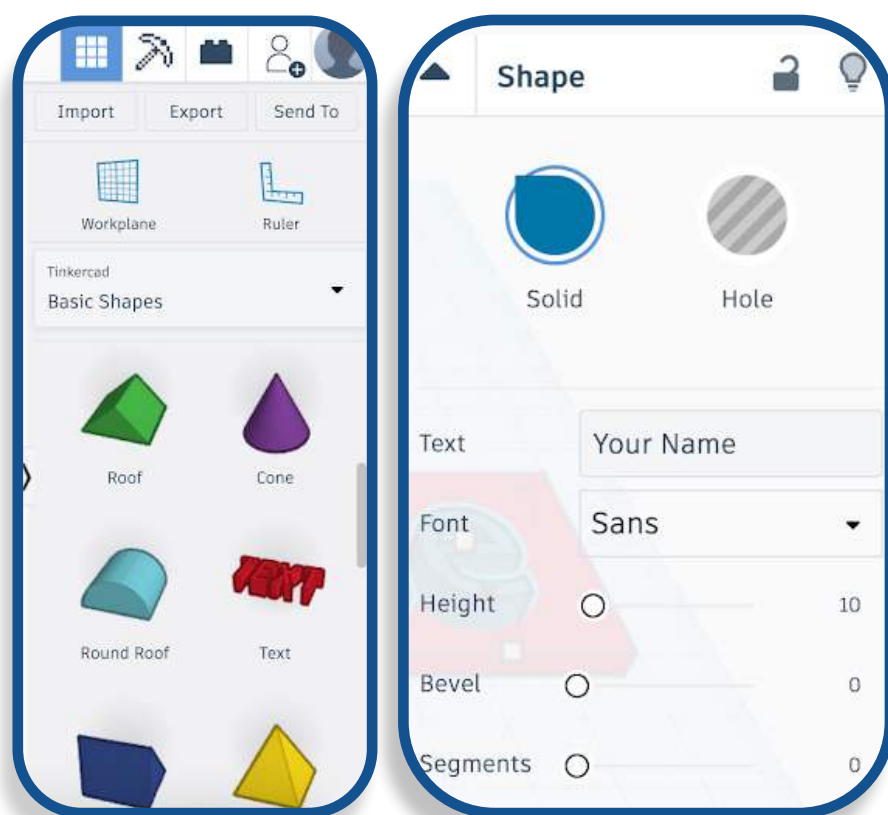


Fig 7. Screenshot of TINKERCAD shapes

## Step 5: Check All Perspectives of Your Workplane



Fig 8. Screenshot of TINKERCAD perspectives cube

You will notice a little cube in the top left corner of your workplane. If you click and move it around it will move your object around so that you can see it from above, below and side-to-side. This is very important to keep checking on, from time to time; as you add new shapes and elements to your object, it may look good from one perspective, but objects may have unintentional gaps which you can't always see from above.

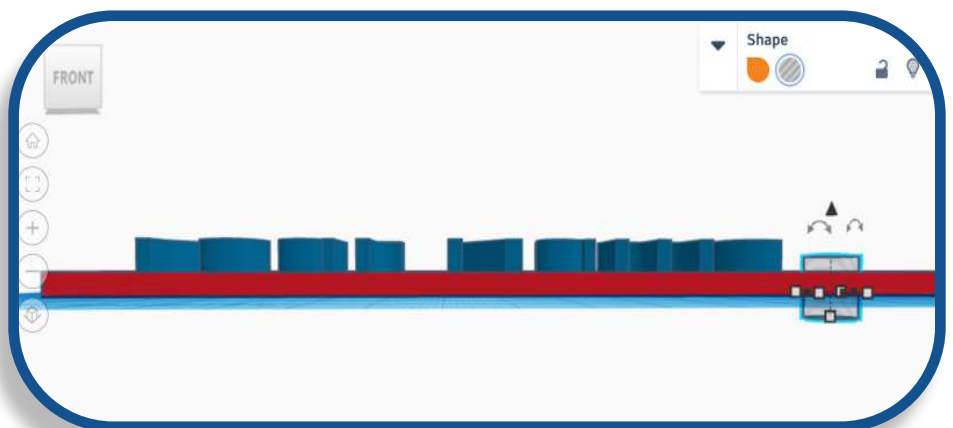


Fig 9. Screenshot of TINKERCAD front view of the object along the x-axis



## Step 6. Create a Hole for Your Keychain

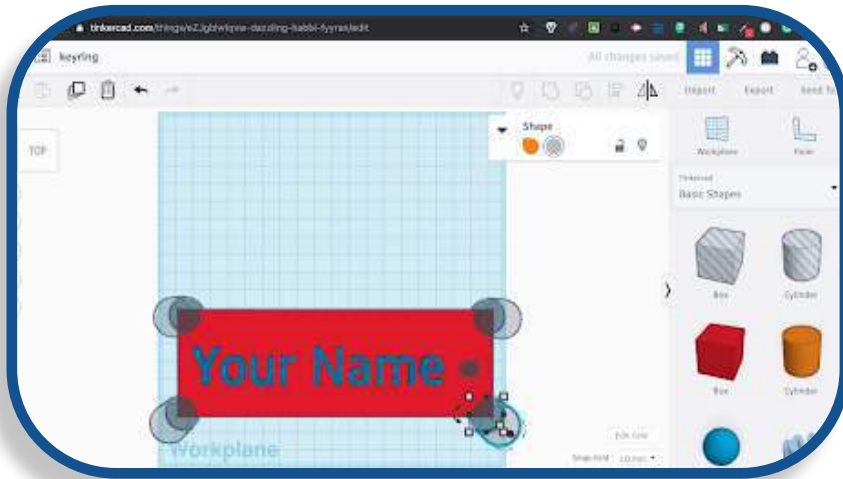


Fig 10. Screenshot of TINKERCAD overview of the object, with one hollow object selected

Adding a hole to the keychain counts as a new shape and that's why you need to group several shapes together for your complete object. You can group and ungroup shapes together as seen in the image below. Once grouped together you can preview your object with the hollow objects cut out and removed.

### Grouping objects

To group all of your objects you can use your mouse to draw a selection box around your objects. Then click the group object button.

**Note** If you only want to group some objects, hold shift and

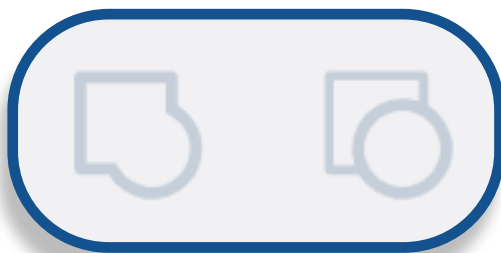


Fig 11. Screenshot of TINKERCAD group and ungroup buttons

# Activity Four

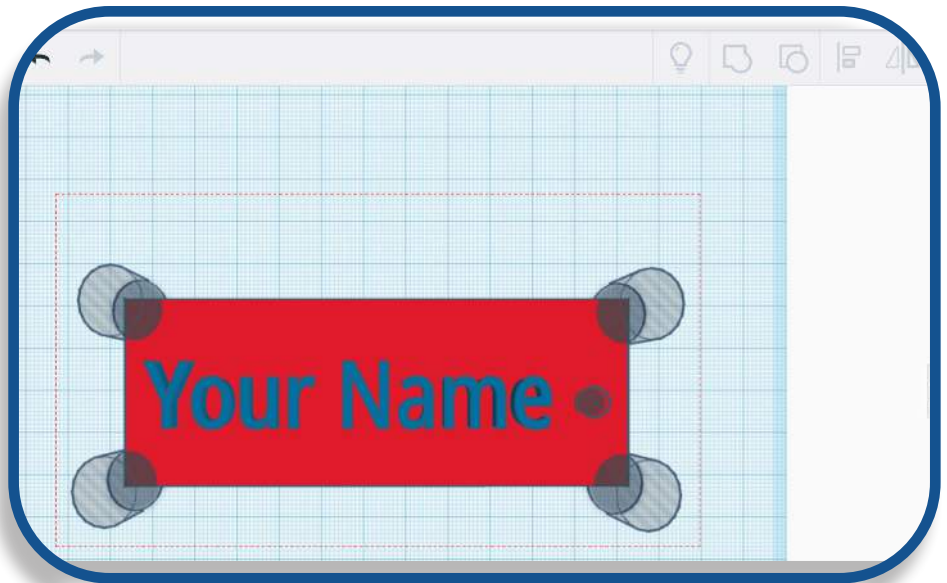


Fig 12. Screenshot of TINKERCAD, an example of a selection box but not yet grouped

An example of a selection box but not yet grouped

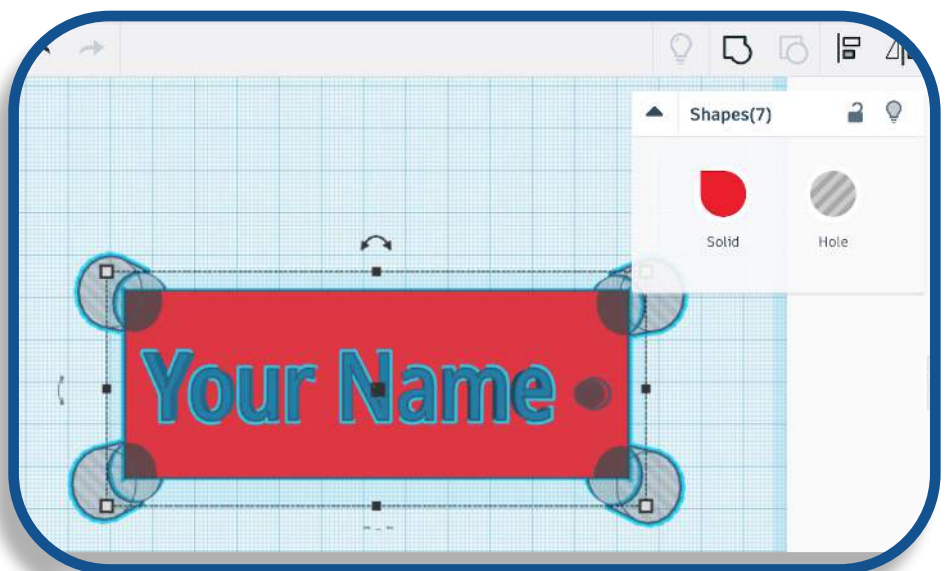


Fig 13. Screenshot of TINKERCAD, an example of all objects selected but not yet grouped

An example of all objects selected but not yet grouped

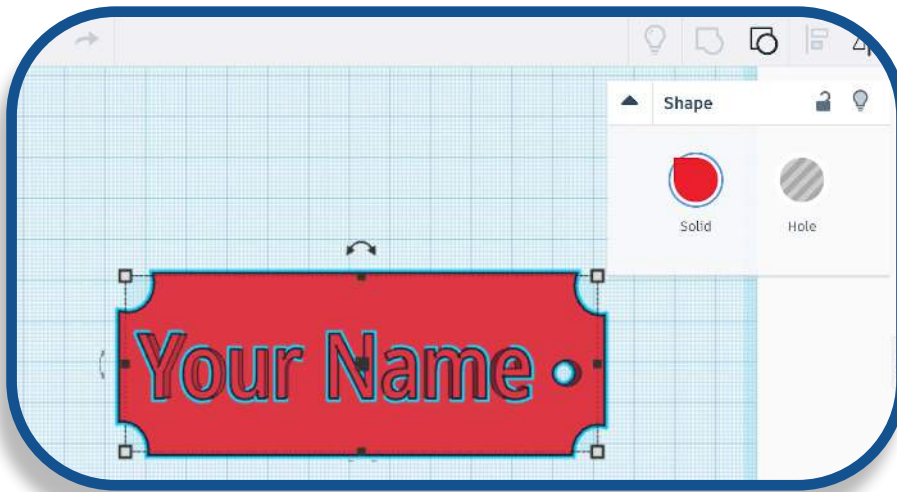


Fig 14. Screenshot of TINKERCAD, an example of a grouped object

An example of a grouped object  
click on those specific objects and click group objects.

## Step 7: Check All Perspectives of Your Workplane

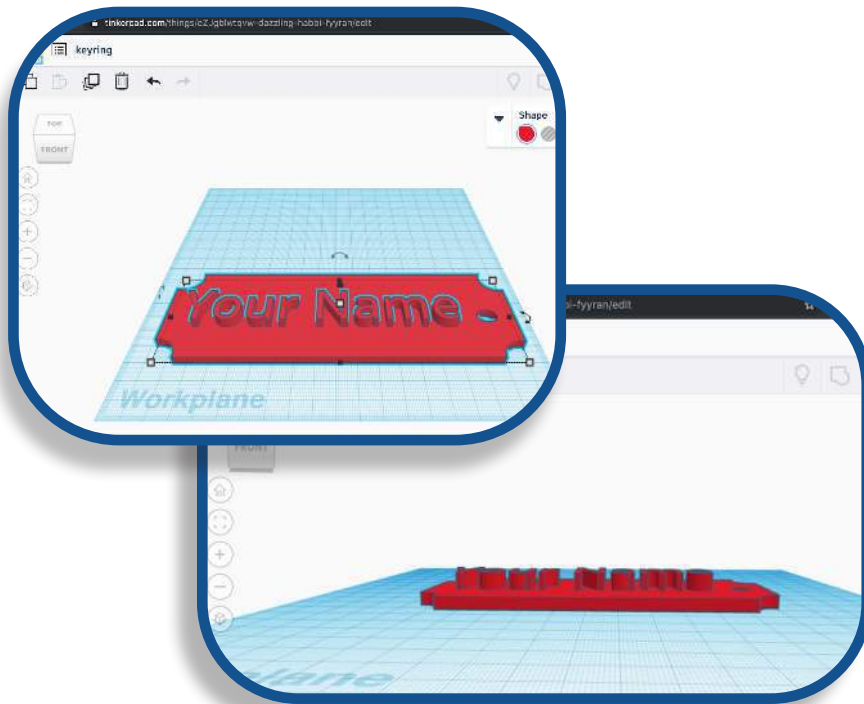


Fig 15. Screenshot of TINKERCAD, an example of a grouped object

Fig 16. Screenshot of TINKERCAD, an example of a grouped object from another perspective

## Step 8. Export for Printing

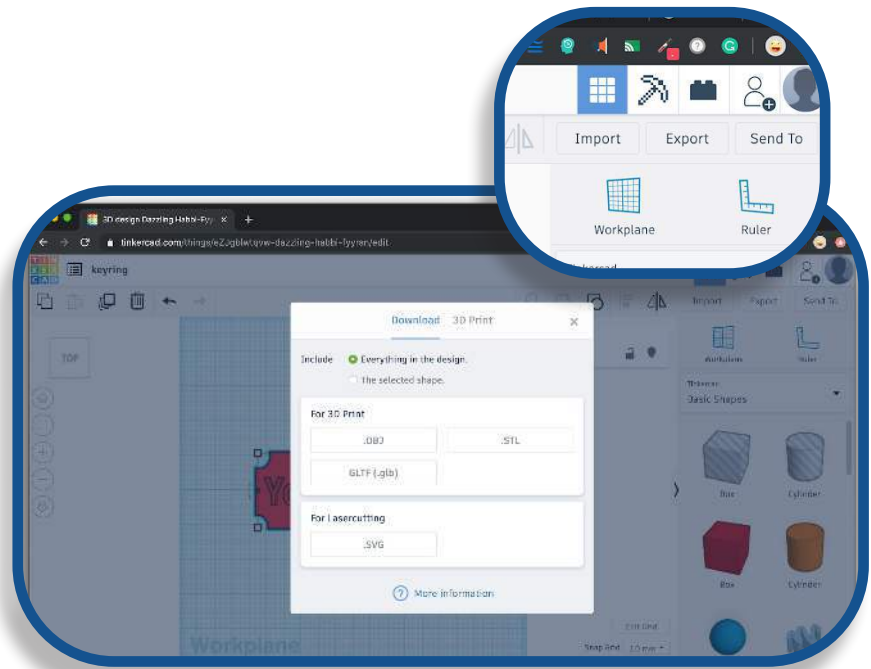


Fig 17. Screenshot of TINKERCAD, import and export buttons  
Fig 18. Screenshot of TINKERCAD, download box

For this project, you should export in .STL.

### File Types

.OBJ  
.STL  
.GLB  
.SVG

OBJ stands for Wavefront Object, this file type supports multi-color printing and is preferred for textured printing too.

STL file format cannot handle high-resolution printing whereas OBJ can.

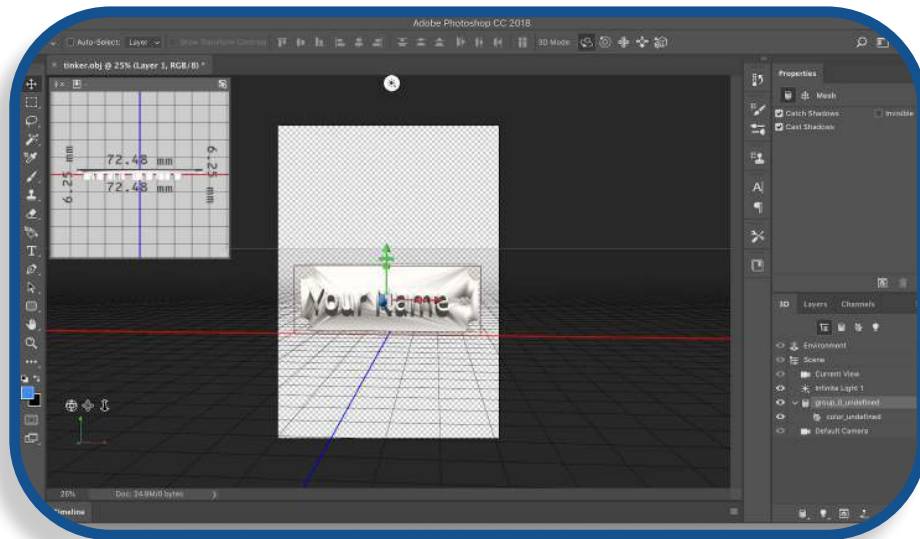


Fig 19. Screenshot of Photoshop

STL or Standard Triangle Language, an STL file is considered the industry standard for 3D printing.

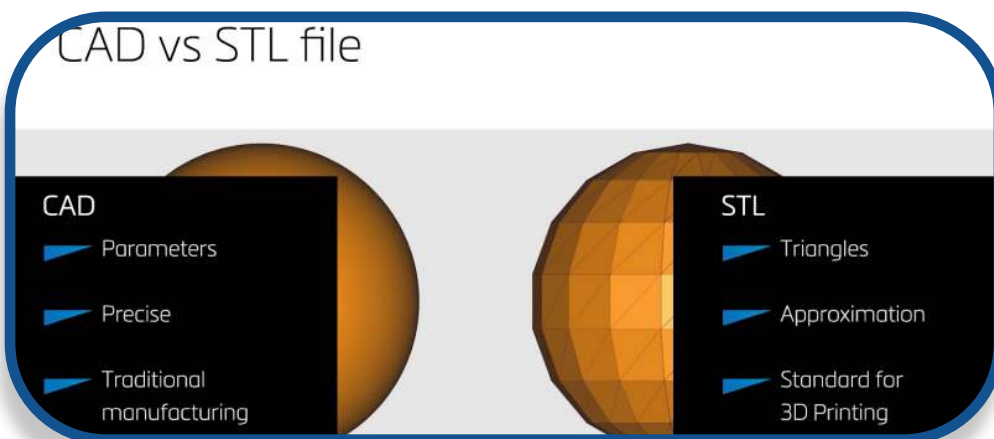


Fig 20. Screenshot of <https://www.youtube.com/watch?v=1IIYZloCPSA>, an example of CAD and STL graphic

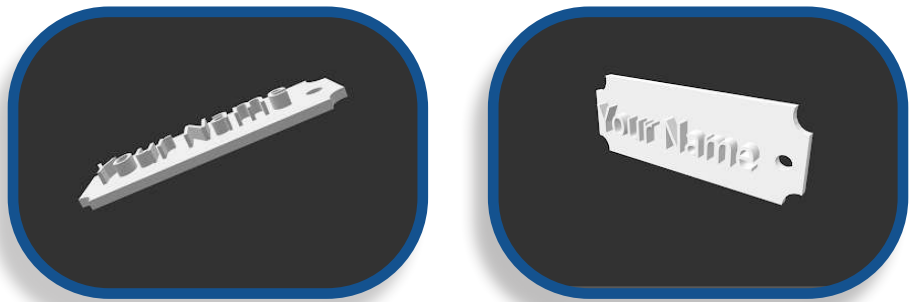


Fig 20. Fig21. an example of STL graphic preview on desktop

GLB GL Transmission Format. It stores 3D scenes.

SVG: Scalable Vector Graphics is a two-dimensional vector graphic and is used for Laser Cutting.

If you would like to print your 3D object you will need a slicer program to convert your file to a machine code that is readable by the printer.

A slicing program converts your .STL file into a G-Code file which is a set series of thin layers and instructions that the printer can read. There are a number of different slicing programs that can be used. Here is a link to a top ten list: <https://www.3dnatives.com/en/top-10-slicer-software-200520194/>

Cura is a popular slicing program, it's easy and free to use.

### Note

3D print design can be used as a design solution tool. From cup holders, phones stands, to wrenches and storage solutions. Check out this link <https://all3dp.com/1/useful-cool-things-3d-print-ideas-3d-printer-projects-stuff/> to see some cool ideas that young people can make and use or even create a mini company from. Printing your objects has become increasingly more accessible, check out your local library, fab lab, youth organizations or Institutions of technology for access. There are also online printing services available in Ireland, just google it!

The best way to get started is to get stuck into TINKERCAD and, while these instructions, may appear at first read, abstract, once you are logged into TINKERCAD and have your account set up, it will all become a lot clearer.



## How could a 3D Design activity be delivered with young people remotely?

- 3D design is a great way to engage young people who like art, in STEAM activities. It's free to use and doesn't need a very fast internet connection. It's also very flexible, so the user gets to play around with it as much as they like, and not worry about making any irreversible mistakes.
- TINKERCAD offers [distance-learning lesson plans](#) for educators too. They cover a range of topics, such as Design, Maths, Engineering and Social Sciences.
- Create objects that are useful or design solutions for young people. The following is a list of ideas: <https://all3dp.com/1/useful-cool-things-3d-print-ideas-3d-printer-projects-stuff/>

## Suggested follow-on tasks/experiments:

- Why not try to create a 3D replica of something at home? Your bedroom, your favourite toy or even yourself!
- If you like playing Minecraft, TINKERCAD also has a [Minecraft mode](#) where you can create worlds and characters from the game.

## Activity 5: Design an Interactive Talking Poster

**Level:** Advanced

**Time Required:** 60 minutes

**Aim:** Design your own interactive poster using coding skills and advanced circuitry design. Code a control pad device, used for gaming, to play sound when pressed. These sounds can enable your poster to tell a story or offer facts about your poster's image.

**Young People will:**

- Create an interactive poster.
- Customise sprites\* for their interactive poster
- Make a connection between Makey Makey\*\* and Scratch\*\*\*.

**Materials:**

Laptop	<a href="#">Hot Glue Gun</a>
Paper or card	<a href="#">Glue Sticks</a>
<a href="#">Makey Makey</a>	1 Wooden Skewer
<a href="#">Electrical Wire</a>	
<a href="#">Wire Stripper</a>	

**Costs:**

It costs a total of approximately €76.17 per person to create their own interactive talking poster. However some of the tools used can be shared between young people (e.g. hot glue gun, glue sticks), which will significantly reduce costs. By itself a Makey Makey costs €50.04 from Kitronik and if you want to provide just circuitry tools to each individual young person, the activity will cost approximately €20.72 per person.

STEAM components for this activity can be purchased from <https://kitronik.co.uk/>



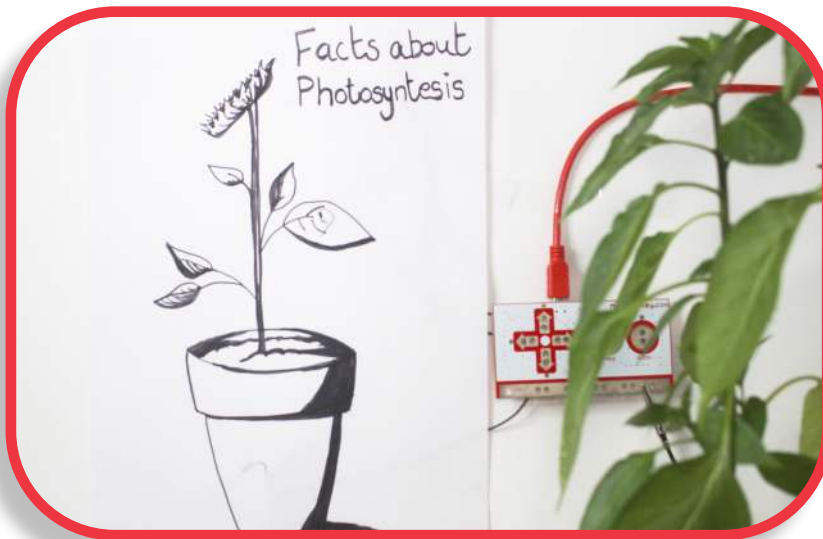


Fig 1. Image of a hand-drawn interactive poster...  
Press parts of the poster to play sounds!

### Note:

\*A sprite is a character or an object that can be coded in Scratch to move, speak, or react to a set of instructions.

\*\*A Makey Makey is a microcontroller - a circuit board that is programmed to work just like a game controller. It is connected and powered through the laptop and works very well with Scratch projects. The buttons on the Makey Makey are conductive. So when conductive material (e.g. play dough, tinfoil, fruit) is connected to those buttons, the material acts as extensions of the buttons.

\*\*\*Scratch is an online block coding platform for young people. Scratch is used to build games and animations. Block code can be compared to a puzzle of blocks that hold specific coding instructions and actions. They are colour coded blocks that must be stacked from top to bottom in the order that is desired for actions to be carried out.

## Instructions:

### Step 1. Design your Poster

Design your poster and decide on the message that you wish to convey. In this guide's example, we will create a Fun Facts about Photosynthesis poster. Make sure to plan the parts of your poster that you want to make interactive. The design below will have three interactive buttons - the flower, the leaf and the pot.



Fig 2. Example of a hand drawn poster design in this case the chosen subject is Photosynthesis

Choose a subject and look up facts to help you create your own talking poster. You could create an environmental awareness poster about recycling or an anti-bullying poster.

## Step 2. Search for Scratch Online

Type in the following address to the search bar in your browser: <https://scratch.mit.edu/> You can create a free account to use Scratch or download your project on to the desktop either. Click Create in the top menu.

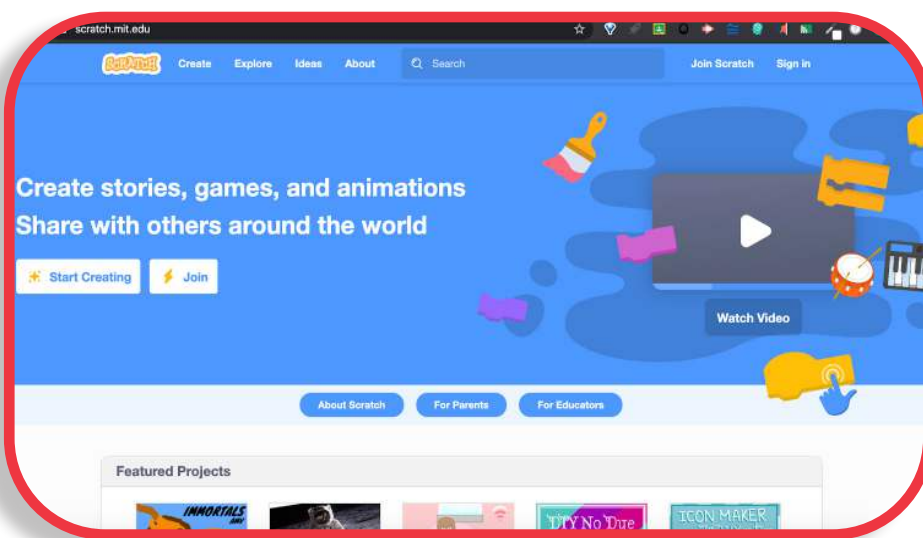


Fig 3. Screenshot of Scratch join page

Scratch allows you to drag the code blocks from the menu on the right to the workspace in the center of the page.

### To select a block:

Click and drag it onto your workspace.

### To delete a block:

Click and drag it away from your workspace.

## Step 3. Code your objects

### Your Scratch Code

Replicate the Scratch code below to create your poster content. You may customize as needed.

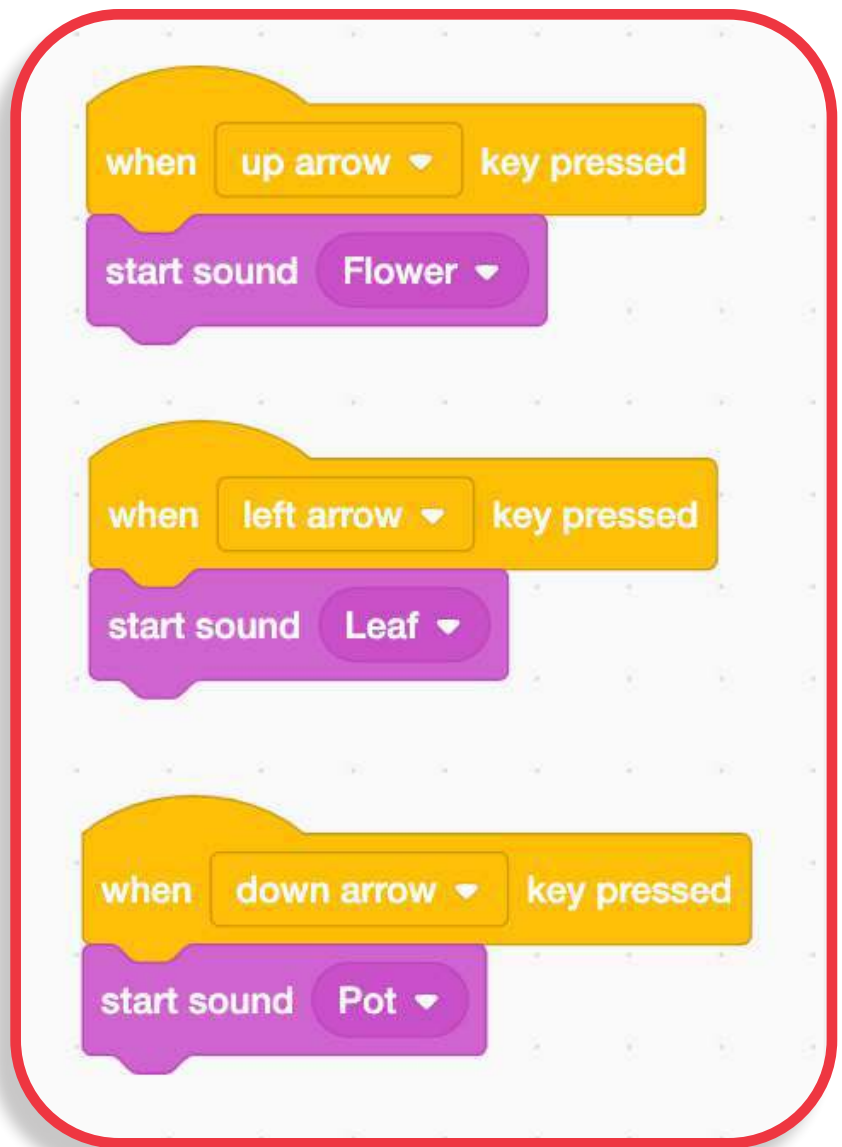


Fig 4. Screenshot of the code used in example

### Scratch Code menu:

While some of the following language may sound abstract, as soon as you start playing with Scratch for yourself, you will see it is actually a very accessible and user-friendly way to start coding!

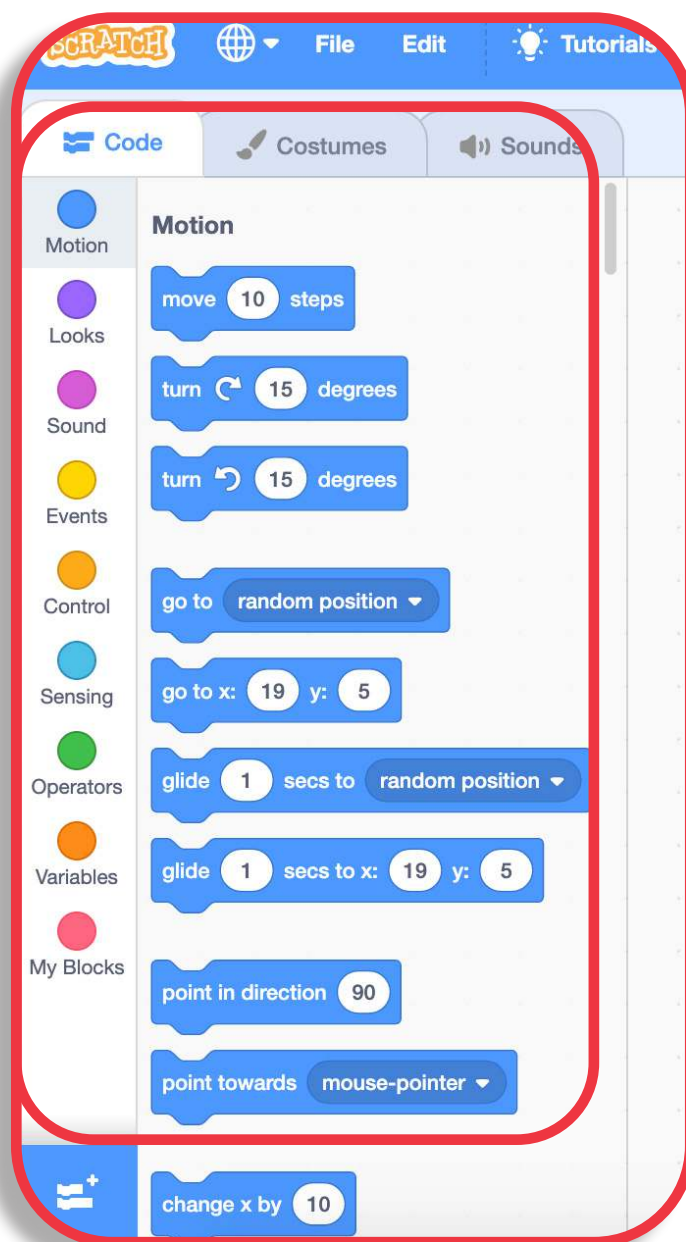


Fig 5. Screenshot of Scratch code menu

### Note:

The pop out menu is highlighted in the example above.

# Activity Five

Some blocks work differently. The following is a breakdown of each block type and what they do:

## **Hat Blocks**

A hat block is your starter block - it is an event block. You will only be able to stack below it.

## **Stack Blocks**

These are the middle blocks - they offer commands for your sprite.

## **C Blocks**

C Blocks are C shaped blocks of code that are used for loops and conditions.

## **Boolean Blocks**

A Boolean block is an elongated hexagonal block that reports boolean values. It is a subset of algebra used for creating true/false statements.

## **Reporter Blocks**

A reporter block is a block that reports a value. These can be anything, from numbers to strings.

## **Cap Blocks**

Cap Blocks are the stop blocks - the bottom blocks of code in a script.

For more about block code check out:

<https://www.youtube.com/watch?v=VhfEcEj0fSc>

## Sound Options

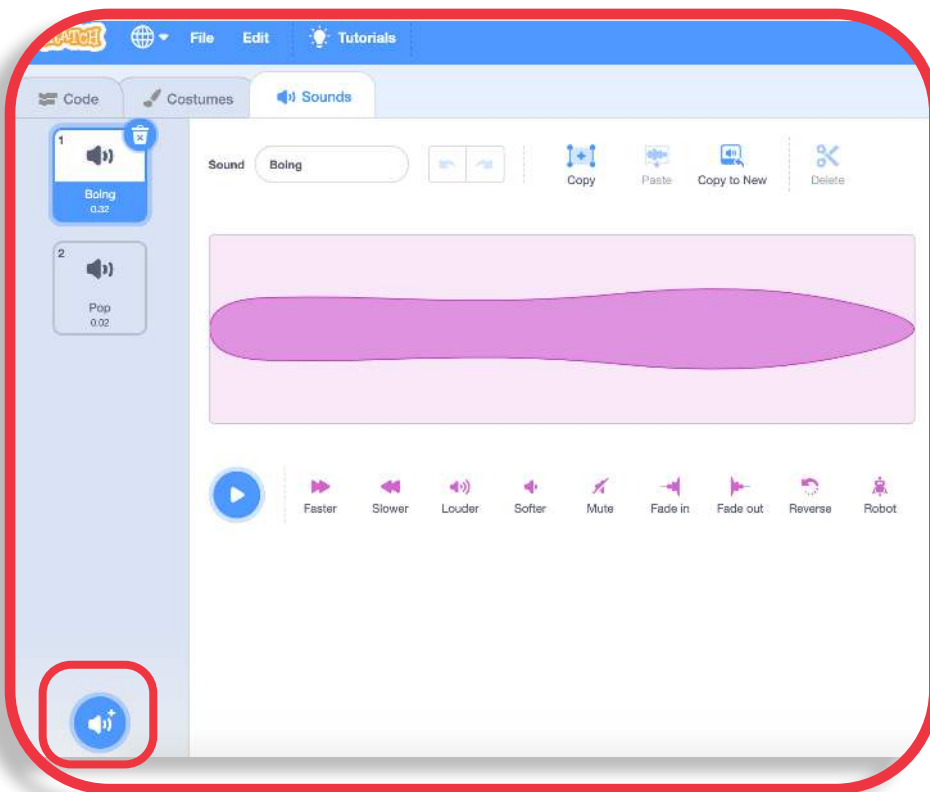


Fig 6. Screenshot of Scratch sound options

The Sounds tab will allow you to use sounds or add your own using the button in the bottom right (highlighted in the above image).

# Activity Five

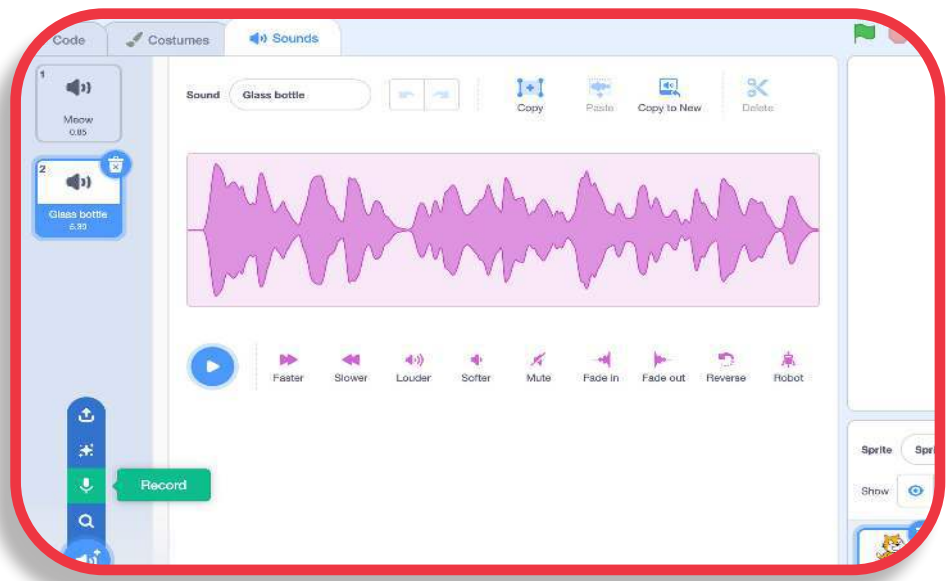


Fig 7. Screenshot of Scratch sound menu

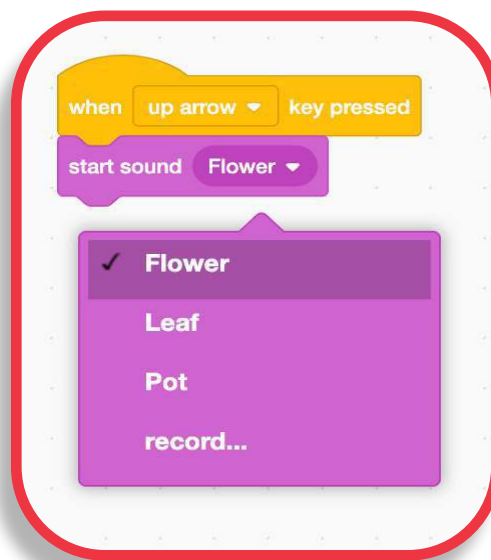


Fig 8. Screenshot of Scratch sound options in the code menu



## Step 4. Connect Wires to Makey Makey

Looking back at the code we used in the Step 3, we coded the Up, Down and Left arrows to make our objects play a recorded sound or message. Now connect the wires to the Makey Makey as shown in Fig. 9 and connect your Makey Makey to the computer via USB. Remember to strip back and expose the conductive element of the wire to allow for the flow of electricity.

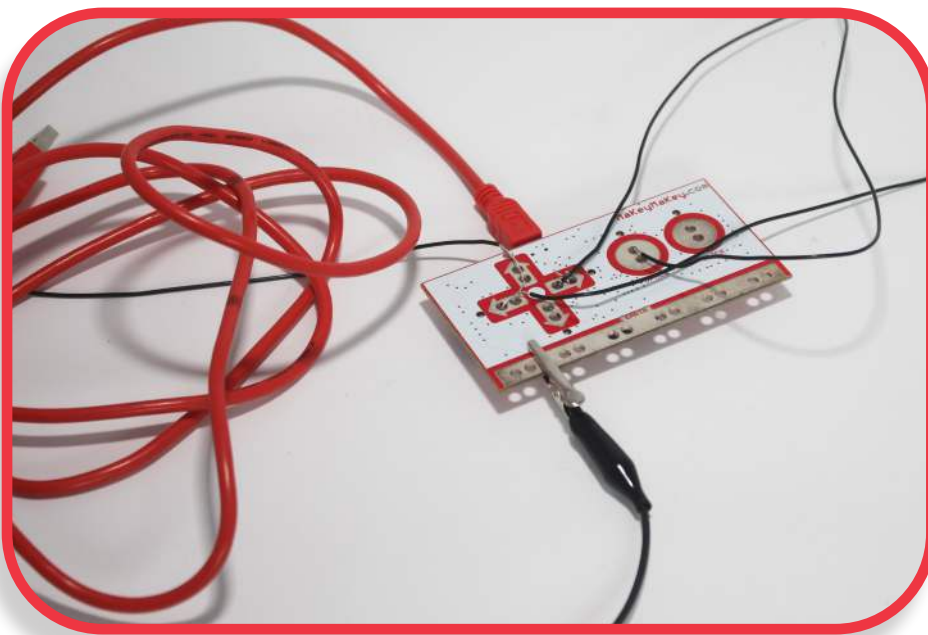


Fig 9. Makey Makey with wires attached

# Activity Five

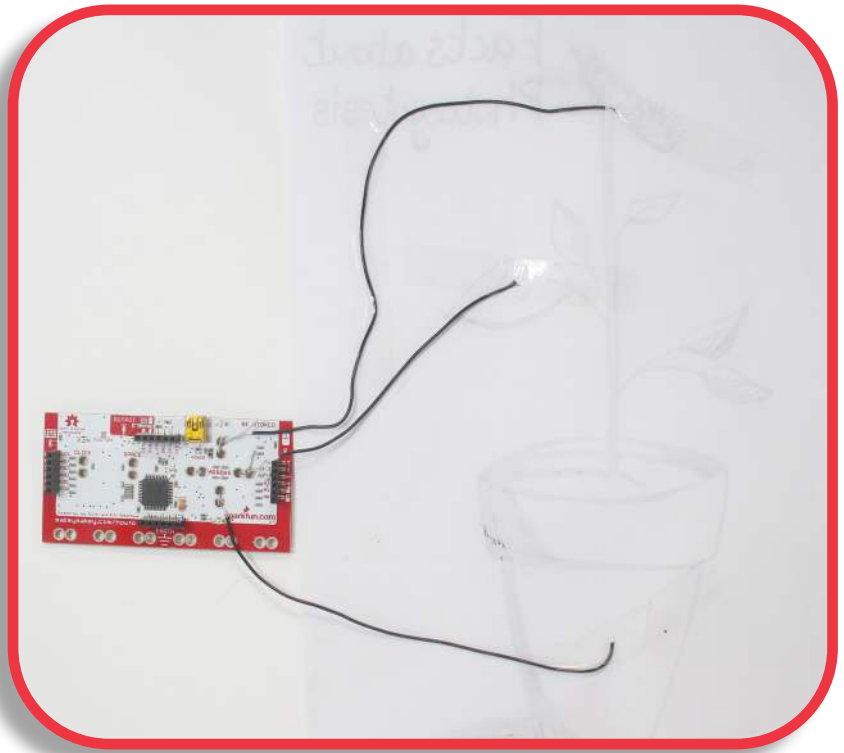


Fig 10. The back of the poster where your wires will be attached

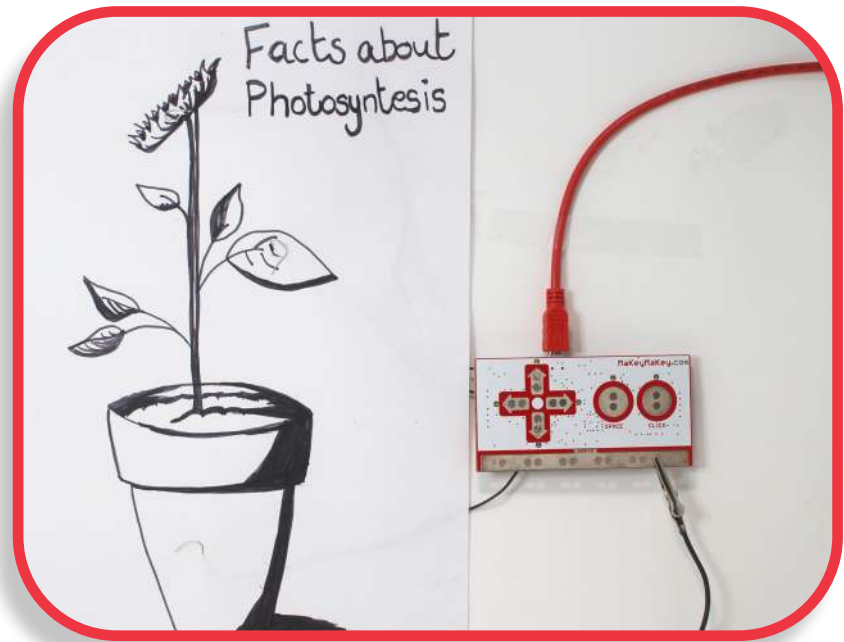


Fig 11. The front of the poster with the Makey Makey mounted

## Step 5. Expose the Conductive Wire and Secure It

Connect the wires to your poster. Spread out the fibers of the cable or loop your exposed wire to create a larger conductive 'button' on the interactive objects drawn on your poster. Use sellotape to secure it at the back of the poster.



Fig 12. The interactive object with exposed wire looped through

## Step 6. Create a Conductive Handle for the Earth Button

The earth panel is the long strip at the bottom front side of the Makey Makey. Earthing or grounding is when you join yourself to the circuit so that the electricity travels through you. Your body essentially becomes part of the circuit! Add a wire to the earth panel on the Makey Makey. You can add a handle on to the opposite end of the wire but it must also be conductive. Tin foil works well for this. You must earth yourself to the Makey Makey to complete the circuit. When you hold the earth button and another button on this microcontroller, you are closing the circuit. You open the circuit when you let go. In this example the plant is our earth control, when you hold the plant and press a button on the poster, it activates the sound.



Fig 13. Makey Makey with alligator clip connected to the leaf of a plant to be used as earthing device. i.e. When you hold the plant and press a button on the poster, it activates the sound.

### How does the plant work in the circuit?

Water is conductive, which means it carries electricity. A plant, like humans, contains a lot of water.

## Step 7. Test Your Product

Touch the centre of the chosen objects on the poster whilst also touching the plant to activate sound.

The exposed wire connects to the arrow commands on the Makey Makey.

You have already coded those commands through Scratch in Step 3. The flower in the image below is connected to the Left arrow and that arrow has been commanded to play a recorded fact about photosynthesis.

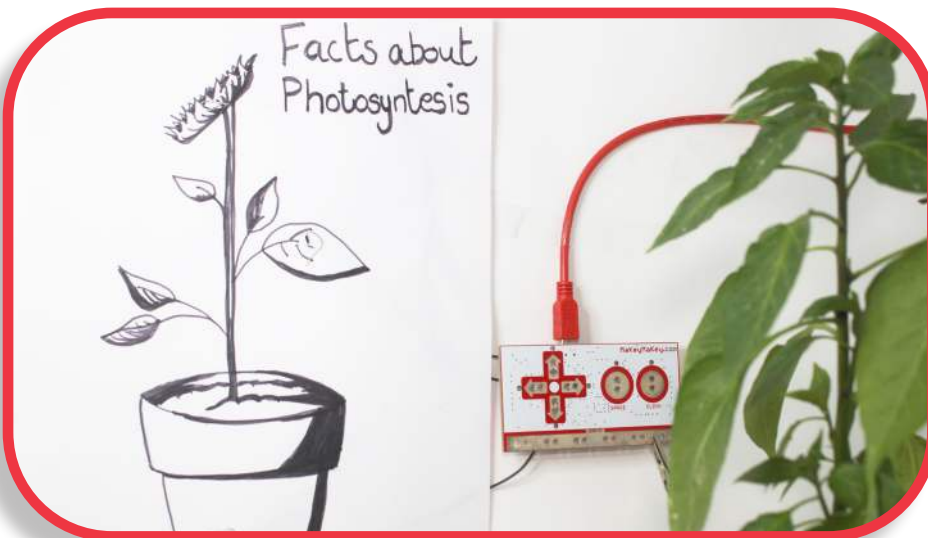


Fig 14. The hand drawn poster is connected to the Makey Makey, earthed to a live plant. The Makey Makey is powered through your laptop via USB. The sound is also played through your laptop.

## Step 8. Remix

You can paint your poster or add shapes using conductive material, such as tin foil, if desired. Play around with the Scratch code - try adding in other objects. Experiment with different sounds or try to upload your own. There's lots of scope for customisation of this fun activity!



Fig 15. Photograph of the alligator clip attached to the leaf, to be used as earthing device

### **How could an Interactive Coding Poster activity be delivered with young people remotely?**

- This would make a great group project, which can be used as a quiz or to create an interactive informative poster. Young people can share and work on project code through Scratch, with the goal of creating a collectively coded project.
- This project can also be useful for young people to create their own interactive artwork or installations. They could use it to make an 'About Me' project or even use it to enhance their own drawings and designs.

### **Suggested follow-on tasks/experiments:**

- With Makey Makey, you can scale up your project to be as big as you like. Can you make an installation using a projector that takes up the whole wall in your room or youth centre?
- Scratch offers a wide range of tutorials (<https://scratch.mit.edu/projects/editor/?tutorial=getStarted>) covering different elements of this block-coding platform. Why not create a free account and experiment with new options within your workspace, to see what you can do with some simple code?







The National Youth Council of Ireland

The National Youth Council of Ireland is the representative body for voluntary organisations in Ireland. We use our collective experience to act on issues that impact young people.

Compiled by TechSpace.

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