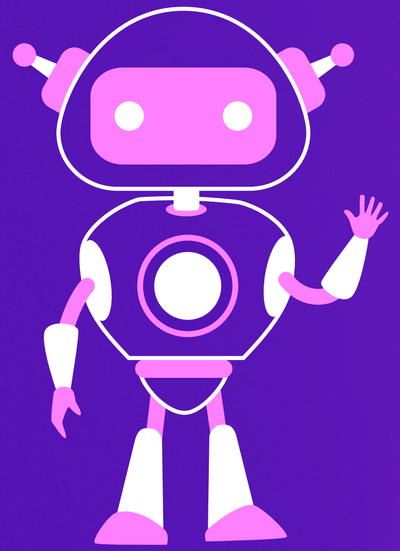
STEM in action - Robotics

Robotics That Are Changing The World



Often people worry about robots, as they think they're going to steal their jobs or even take over the world. But that isn't true. Most uses of robotics are designed in order to help humans so they can do things more easily, or do different things that only humans are good at. Have a think about which robots you know of that already exist?

Throughout the week we've looked into STEM (Science, Technology, Engineering & Maths); but today is all about STEM in Action, and that's because robotics requires a mix of all of those areas. Robots are essentially bits of technology based on computer science that work using complex maths and are engineered in a way to make them function. Combine the fact that computing power is constantly getting better, with the fact that lots of talented people are moving into the field of robotics and you'll realise that it's an exciting area moving at a very fast pace. It also requires lots of people with very different skills.

The robots themselves are getting more advanced, and are also being used in more and more industries. From food production to telecommunications and even in your own home with autonomous hoovers or lawn mowers! Robots that work in a manufacturing setting are known as 'industrial robots'. They can perform tasks such as painting, packaging or labelling. Apart from being precise and consistent, robots are flexible and can work in any surrounding. They can prevent humans doing dangerous jobs because they are capable of working in hazardous environments, and can also handle lifting heavy loads, toxic substances and perform repetitive tasks without getting bored.

There are three activities coming up starting with building your own robotic arm! You'll then use that robot arm in an activity to create instructions, and finally have the chance to kick off your own research project all about robotics.

Have a Go

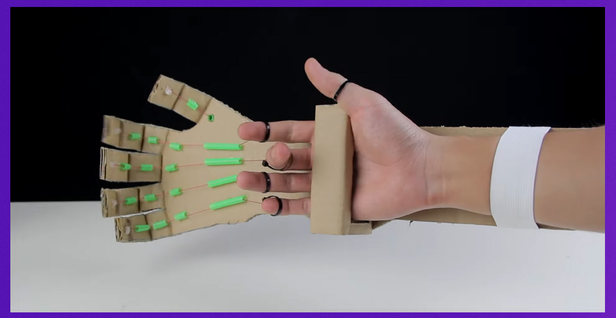
- Rise of the robots
  https://atadastral.co.uk/go/bswrh1
- Will robots take over the world?
  https://atadastral.co.uk/go/bswrh2
- Build a robot buggy
  https://atadastral.co.uk/go/bswrh3
- Milk Carton Robot
  https://atadastral.co.uk/go/bswrh4

Teacher Links

- Jam Sandwich Algorithm
  https://atadastral.co.uk/go/bswrt1
- Bee-Bots Basics Activity
  https://atadastral.co.uk/go/bswrt2
- Bee-Bot Route Decomposition Activity
  https://atadastral.co.uk/go/bswrt3

Activity 1
Build your own robot arm

For this first activity, you're going to create your own robotic arm which should look something like this:



Now have a go at making your own!

1 Make a template of your hand:

- Place the back of your hand on a piece of cardboard. Spread out your fingers and draw a pencil line around each finger, your thumb and the first few centimetres of your wrist
- With a pair of scissors, carefully cut out the cardboard template of your hand.

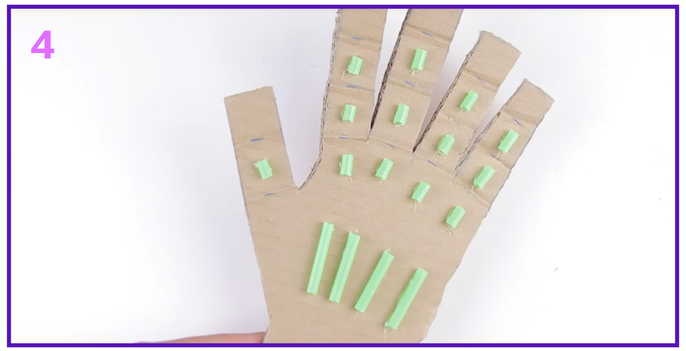
2 Take a look at the palm of your own hand and now look at your fingers. Notice that on each of your fingers you have some creases in the skin where each joint in your finger is? We need to replicate this on your robot hand so that it can move and flex:

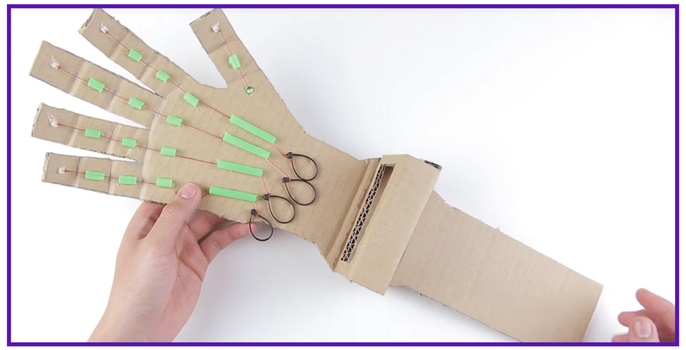
- On each finger of the cardboard hand, draw three separate horizontal lines where the creases would be on your own fingers
- Carefully bend the cardboard fingers along each crease.

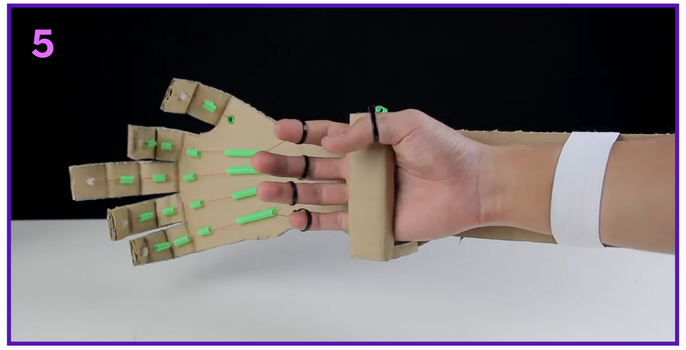
3 Make the handle which is where you will slide your hand in to control the robot arm:

- Measure the width of your hand with a ruler
- Now cut another piece of cardboard. It needs to be the width of your hand +6cm in length and roughly 3cm wide
- Fold this piece of cardboard 3cm from each end so you end up with a long, thin 'U' shape
- Tape or glue each end of this cardboard handle to the bottom of the cardboard hand, on the wrist section.

Activity 1
Build your own robot arm







Images provided by Hack Room Youtube channel

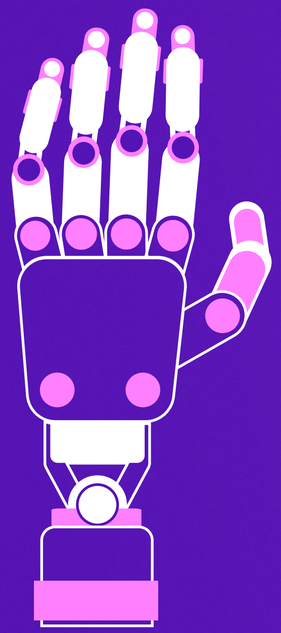
4 **Time to add some “bones” to your robot hand:**

- Cut up some straws. You will need 12 small sections (1-2cm) and 4 slightly larger sections (3-4cm)
- Tape or glue 3 of the small straw sections to the palm side of each finger - you can leave the thumb alone, as for the purpose of this task you won’t need to control the thumb
- Tape or glue one longer straw section onto the palm of the hand under each finger
- Now cut 4 pieces of string that are all 15cm long
- For each finger, feed a piece of string through each section of straw (including the piece of straw on the palm of the hand under each finger)
- Leave the end of string near the handle loose
- Tie a large knot in the fingertip end of the string. Alternatively, you could tie one end of each piece of string around something small and stick that to the end of each finger to stop it letting the string pass through the straw.

5 **Using your robot hand:**

- Slide your own hand into the handle section and wrap each piece of string around your corresponding finger
- Now as you move your own fingers, it should pull on the string and make the cardboard robot finger move
- What light objects can you pick up with it?
- You will also need this robot arm for the next activity.

Activity 2
Using your robot arm



This next activity is all about creating an algorithm for the robot arm you've built. Remember that an algorithm is just a precise set of rules or instructions that are followed in a sequence to complete a task.

You're going to create an algorithm for your robot arm which will tell it where to move objects in order to make certain patterns.

Your objects can be anything small and lightweight that your robot arm will be able to pick up. For example some toy bricks or blocks (or anything that you can stack).

Print out the template playing area on page 16 to continue with this activity.

You'll start off with your objects all laid out in the starting position and your challenge is to move them into the correct final positions in order to make the pattern you're given (see the next page for an example).

However, the only instructions that you will be able to use in your algorithm are the following:

- **Move 1 space LEFT**
- **Move 1 space RIGHT**
- **Move 1 space UP**
- **Move 1 space DOWN**
- **OPEN Hand**
- **Open Hand**

You can write down your set of instructions or you can print out and cut up the instruction cards on pages 10-15, to help lay out your algorithm for the robot arm.

You can swap your algorithm with your partner or in your team and test each other's out. If it doesn't work then you'll need to debug it to see what was wrong.

Here are some things to think about... how few instructions do you

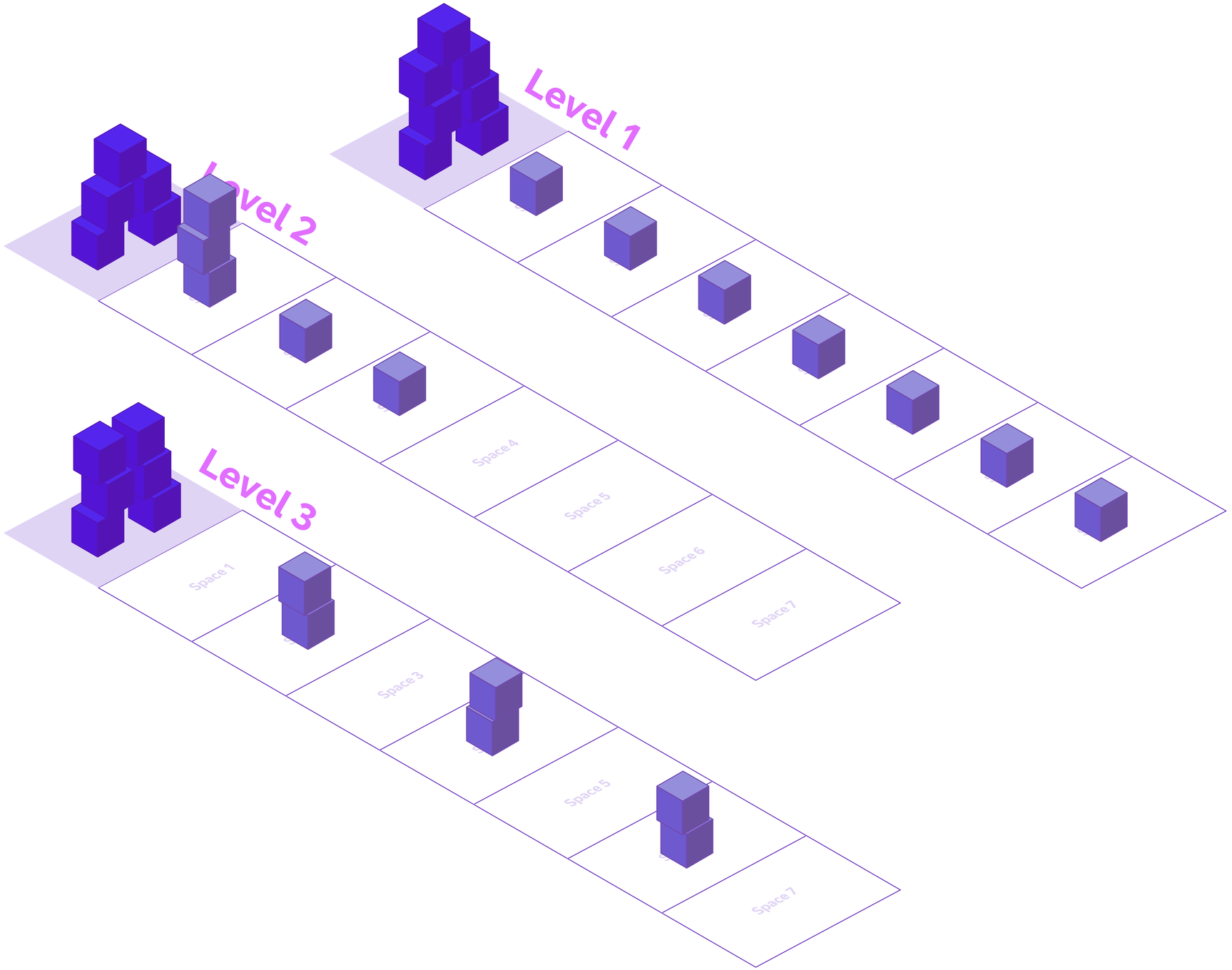
Activity 2

Using your robot arm

Key

Starting position:

Desired final position:

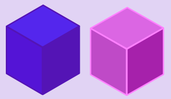


Activity 2

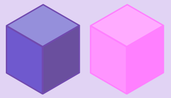
Using your robot arm

Key

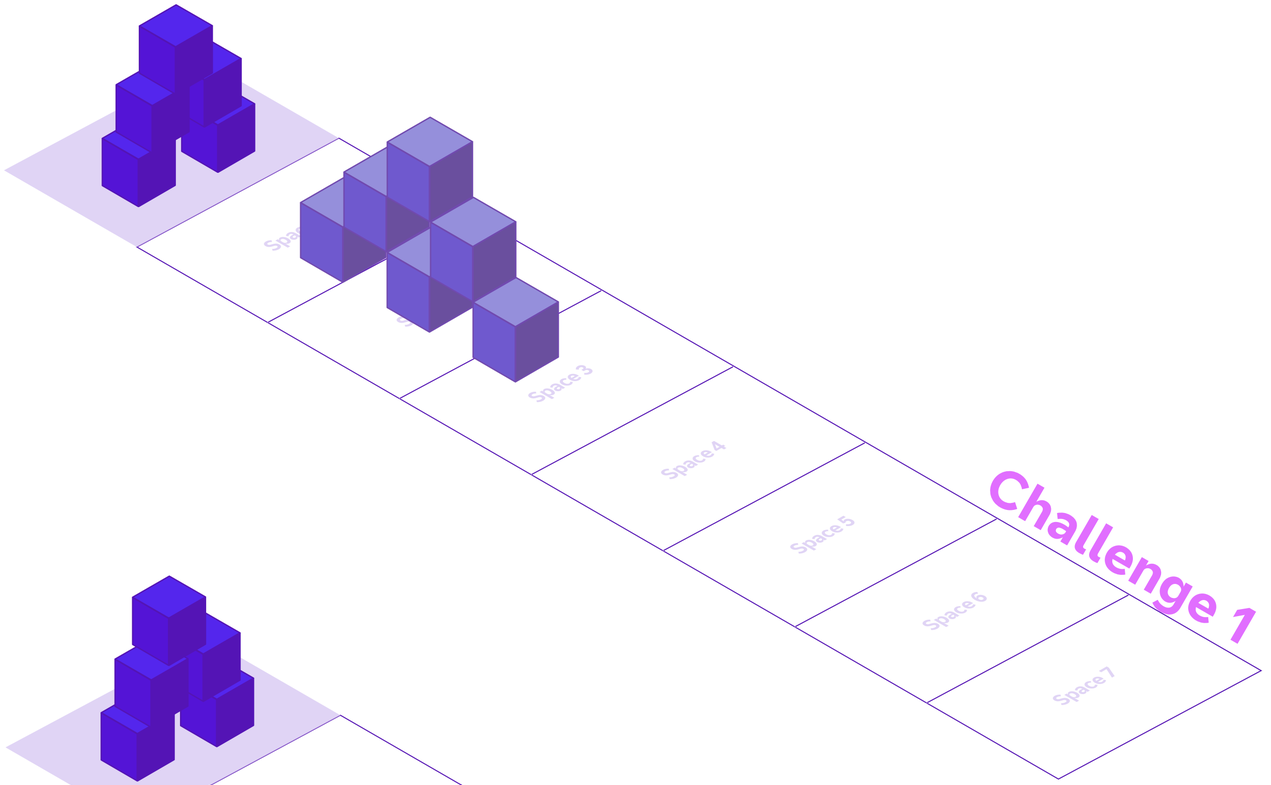
Starting position:



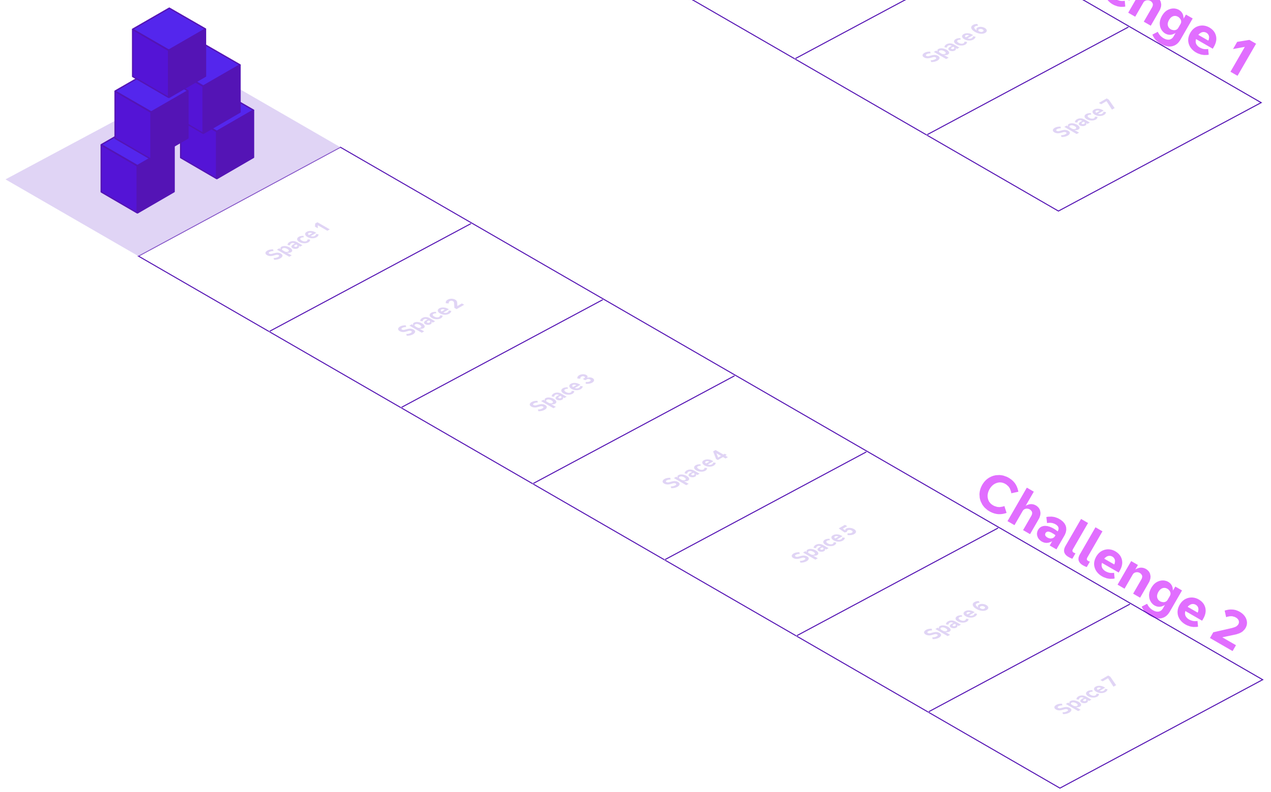
Desired final position:



Challenge 1 - Create a new instruction card that allows the robot arm to move half a step. Can you then create this pattern on the right?



Challenge 2 - Create your own final pattern and challenge your partner to see if they can create an algorithm to make it.



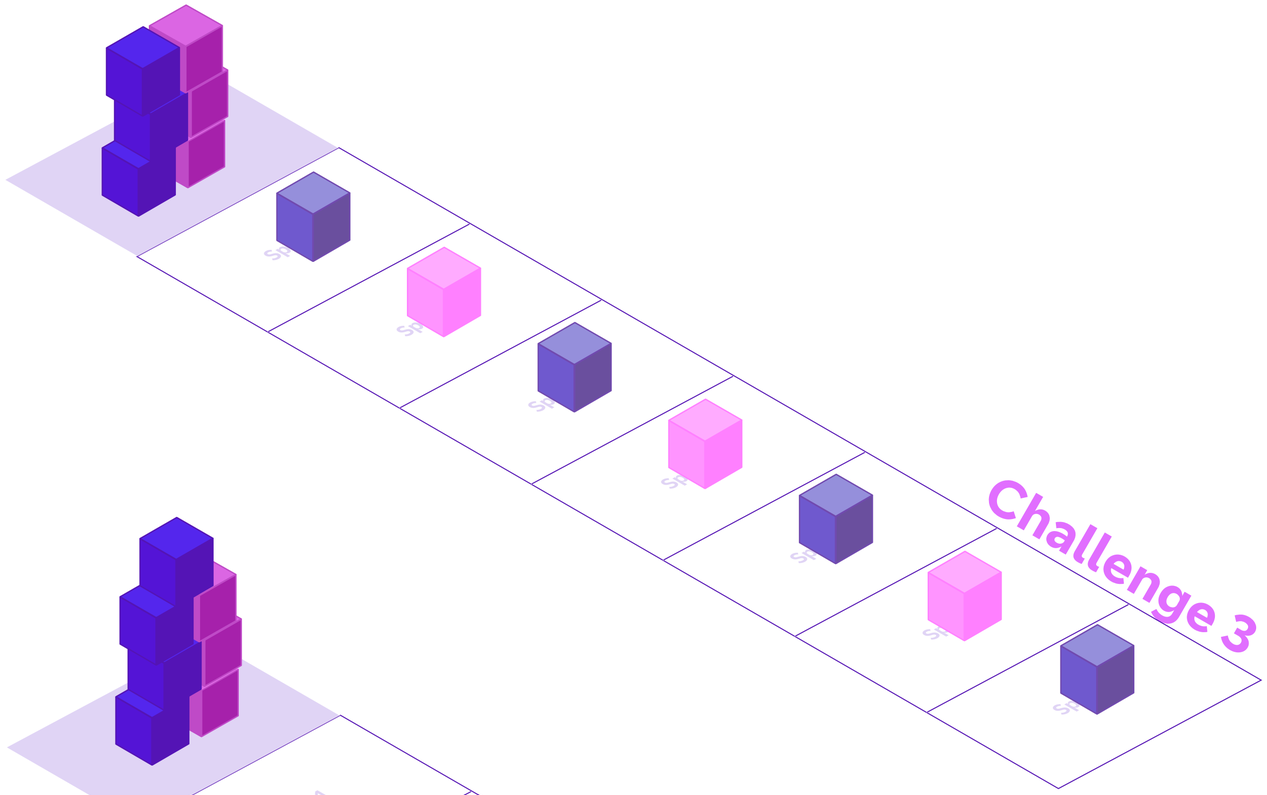
Activity 2

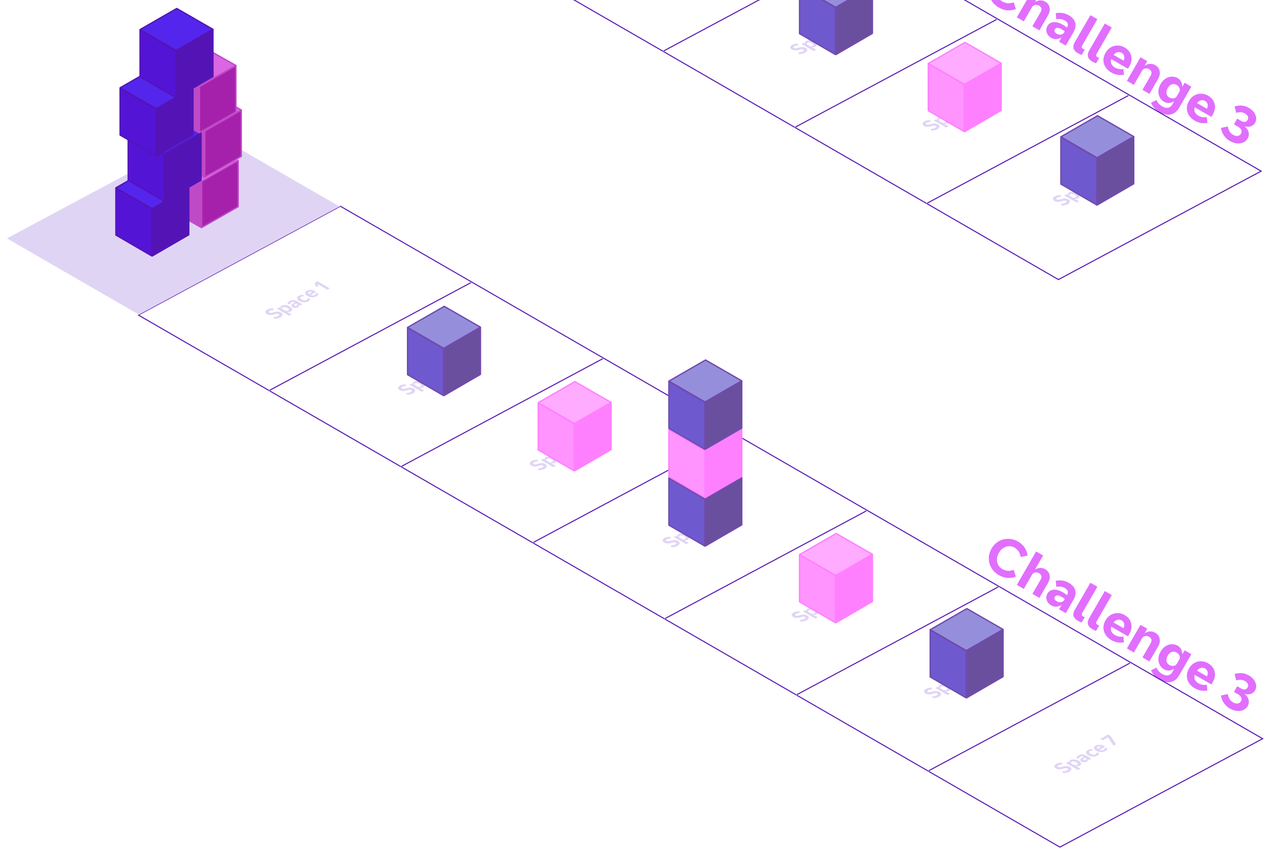
Using your robot arm

Key

Starting position:

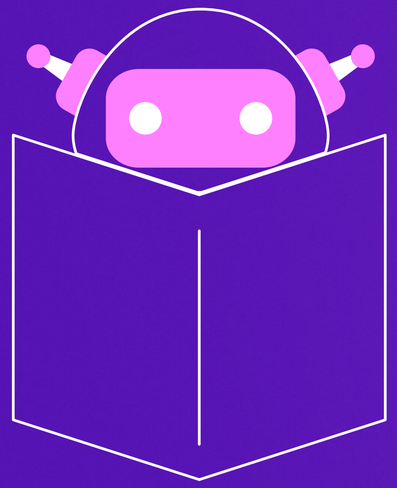
Desired final position:





Challenge 3 - There are now two different colours of object. Create any new instruction cards that you may need and have a go at these:

Activity 3
Robot research project



As the final activity for British Science Week 2022, why not kick-off a research project into robotics. I think you'll agree that robots are pretty cool, so researching them is a great way to end the week and find out more!

Here are some potential robot topics that you could investigate further:

Which robots currently exist and what role are they performing?

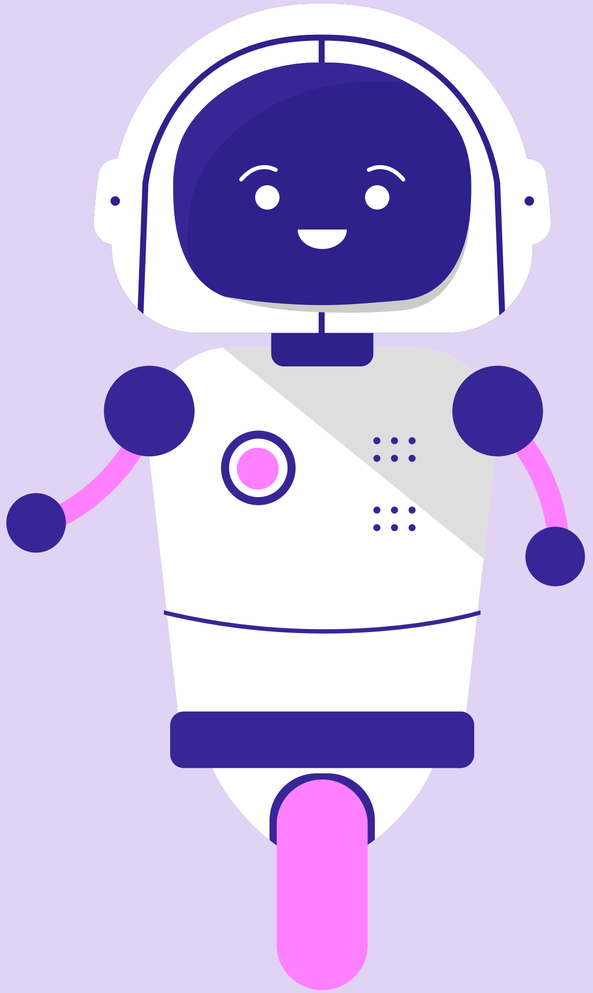
Take a couple of the robots you have found out about today and do a little more investigation:

- What do they look like?
- What are they made of?
- What environment are they in?
- Why is this robot being used?

Now think of a role where a robot could be useful in your school and have a go at designing your robot:

- What would the robot's role be?
- How would it work?
- What would it be made of?
- Does it need any special features or sensors?
- What safety features may it need?
- Would it work alone, with other robots or alongside humans?

Make sure to share your findings with your teacher and also find out what your other classmates learned about robots in their research projects. Good luck!



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Move Left Card

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Move Up Card

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Move Down Card

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Open Hand Card

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Close Hand Card

Please cut out

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STEM in Action

Starting Point	Starting Point
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Space 2	Space 2
Space 3	Space 3
Space 4	Space 4
Space 5	Space 5
Space 6	Space 6
Space 7	Space 7

Please cut out