



EDINBURGH INTERNATIONAL
SCIENCE FESTIVAL

generation
science



The science behind the show

What are robots? The word robot is often applied to any device that works automatically or by remote control, especially a machine that can be programmed to perform tasks normally done by people. Robots come in all shapes and sizes, including small robots made of Lego, and larger wheeled robots that can play football with a full-size ball.

What do we get robots to do? Many robots perform tasks that are too dull, dirty, delicate or dangerous for people. Generally, we also expect robots to be autonomous, meaning that they work using their own sensors and intelligence, without needing to be constantly controlled by a human.

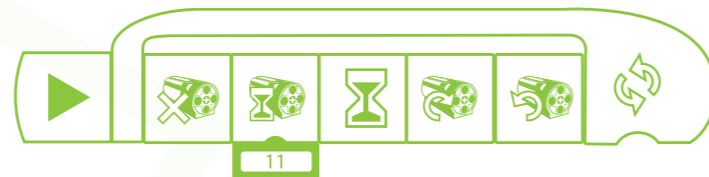
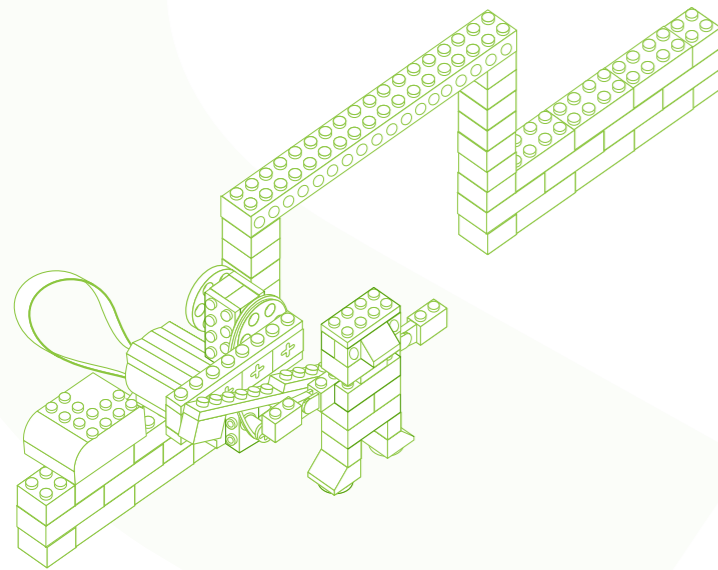
The robots used in this workshop are Lego WeDo robots. They are built from Lego pieces and the system uses special software to program the robots. Pupils place on-screen instruction blocks in order to give the robot instructions. The instructions are communicated to the robot through a USB cable and the robot follows the instructions when the start button is clicked.

What is a program? A program is a sequence of instructions that a robot or computer follows to perform a specific task. Programs can vary hugely in size – they can be as small as two or as big as millions of lines long. Just as humans have several languages to communicate, computer scientists have developed several programming languages that can be used to provide instructions.

What does a computer program do? Today, computer programs are used almost everywhere – in homes, schools, offices, factories, hospitals, shops and by the military. You almost certainly use them every day! Common computer programs include Microsoft Word, Adobe Photoshop, Internet Explorer, Google Chrome, Instagram and WhatsApp. They are used:

- To make graphics and generate special effects in films.
- To perform ultrasounds, MRI scans and x-rays.
- To enable our mobile phones to work.

Can you name any more computer programs and their uses?



BRICKS AND BLOCKS

Welcome to Generation Science!

Brought to you by the Edinburgh International Science Festival, our shows and workshops spark pupils' curiosity and bring science to life.

What we do

Each show or workshop is fully equipped and delivered by trained science communicators. We create fun, interactive environments where everyone gets out of their seats and gets involved. Our inspiring demonstrations and engaging activities are linked to the Curriculum for Excellence, explaining key concepts in a unique and memorable way.

Event Description

Bricks and Blocks is a hands-on, interactive workshop where pupils engage with programming. The class will join our enthusiastic team to discover what robots are, why they are useful and how we tell them what to do.

Following an introduction on the importance of giving instructions in the correct order, pupils will work in pairs to program Lego WeDo goalkeepers to move back and forth in front of a goal. They will build on their programming knowledge by taking on additional challenges and adding new instruction loops.

Curriculum Links

Bricks and Blocks complements the following experiences and outcomes:

TCH 1-01a: By exploring and using technologies in the wider world, I can consider ways in which they help.

TCH 1-03a: As I extend and enhance my knowledge of features of various types of software, including those which help find, organise, manage and access information, I can apply what I learn in different situations.

TCH 1-09a: I am developing problem solving strategies, navigation and co-ordination skills, as I play and learn with electronic games, remote control or programmable toys.

Learning Outcomes

- Describe what robots are and why they are useful.
- Recognise that the order of instructions is very important.
- Identify that a computer program is a set of instructions.
- Create basic computer programs for robots to perform simple tasks.
- Recall that a robot will only do what it is programmed to do.

Some Useful Links

studio.code.org/
bbc.co.uk/schools/0/computing/

FOLLOW-UP CLASSROOM ACTIVITY 1

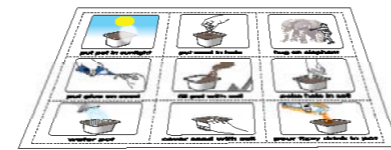
Plant a seed

You will need:

- Containers for planting seed (such as empty yoghurt tubs)
- Potting soil
- Seeds (such as sunflowers)
- Water
- Plant a Seed worksheets
- Scissors
- Glue



 put pot in sunlight	 put seed in hole	 hug an elephant
 put glue on seed	 fill pot with soil	 poke hole in soil
 water pot	 cover seed with soil	 pour fizzy drink in pot



1. Cut out the steps for planting a seed from the worksheet.
2. Work together to choose the six correct steps from the nine options.
3. Glue the six correct steps, in order, onto a separate piece of paper.
4. Trade your finished program with another group.
5. Use the program you've been given to plant your seed.

- What other examples of everyday algorithms, or lists of steps, can you think of?
- In teams think about the steps required to complete a task. Then share your steps with the rest of the class, without letting anyone know what the task was. Can the rest of the class guess what activity your algorithm is for?

Explanation

An algorithm is a list of steps that you can follow to finish a task. We follow algorithms every day when it comes to activities like making the bed, making breakfast, or even getting dressed in the morning. You can use algorithms

to help describe things that people do every day.

To make a computer do anything you have to write a computer program, this program includes algorithms. To write

a computer program, you have to tell the computer, step by step, exactly what you want it to do. The computer then "executes" the program, following each step to accomplish the end goal.








FOLLOW-UP CLASSROOM ACTIVITY 2

Getting Loopy

You will need:

- Dance Instructions
- Space for the class to move

Part 1: The teacher stands at the front of the class and demonstrates the dance moves below:

 1. Clap, clap, clap	 2. Hands behind head, hands on waist,	 3. Clap, clap, clap	 4. Left hand up, right hand up,	 5. Clap, clap, clap
 6. Repeat 3 times	 7. Belly laugh			

Part 2: Dance loops

1. Now show the class slowly, one instruction at a time.
2. Can you find the loop in the instructions?
3. What would the dance be like if we only repeated the main part 2 times? Or more?
4. Is there anything else in the dance we could use a loop for?

- Give the students pictures of actions or dance moves they can do. Have the children arrange the moves and add loops to choreograph their own dance.
- Find some videos of popular dances that repeat themselves. Can you find the loops?

Explanation

In order for computers or robots to do what we want, we have to give them a clear set of instructions. We call these instructions a program, and the computer or robot will only do what the program instructs it to. It is important to keep this set of instructions as simple as possible, otherwise it can become

very long and complicated. One way of keeping the instructions simple is to use a loop.

In programming, a loop is a sequence of instructions that is continually repeated until a certain condition is reached. For example, it might be to

repeat a certain number of times (like clap your hands three times) or repeat until something in particular happens (like keep dancing until the music stops). A loop is one of the most basic pieces of computer programming.