

Computer Science Unplugged

Summary: Unplugged activities help pupils understand the basic principles of computer science and computational thinking, without even touching a digital device. In the '*Sandwich Robot*' activity, pupils practice their abilities to construct an algorithm with a well thought through sequence. The '*Drawing Pixels*' activity is designed to comprehend how images are displayed on screens through pixels.

Separate your group into two segments and after 20 minutes, let the pupils switch between the two activities.

Timeframe: 60 minutes

Learning outcomes:

- 1.1 Algorithms
- 1.2 Sequences
- 1.4 Events and selection
- 2.4 Abstraction
- 3.1 Working together
- 3.2 Negotiation practices
- 3.3 Describing thought processes
- 3.4 Learning from vicarious experiences
- 5.1 Problem identification
- 5.3 Implementation
- 5.4 Evaluation & reflection
- 5.5 Iteration

Implementation: Sandwich Robot

In this activity, you as an animator are a robot and will be '*programmed*' by your pupils, the programmers. The goal of the programmers is to have the robot successfully making a delicious sandwich with butter and cheese.

Introduction:

Explain to the pupils that you are a robot and want to make a sandwich with butter and cheese. However, you are not programmed to do that. The pupils are the programmers or engineers and have to create an algorithm for you to follow.

Give them a few minutes to discuss and write down what they think is the correct algorithm to have a robot make a sandwich. After that, they get to tell you the code and you, the robot, execute their commands. Warning: a robot takes everything very literally. If the students to command you to pick up bread, pick up the whole loaf. When they tell you to put

down the butter, put it on the floor. Make a lot of 'mistakes' so they will understand how precise programming really is.

Bonus: if you want to make your performance as a robot even better, make classic robot noises and repeat every command in a robot voice while you execute it (wrongly).

If you want, you can look at an example video here for inspiration: <http://bit.ly/CSUrobot>

This activity was translated from Codekinderen.nl

Implementation: Drawing Pixels

Information on Pixels:

Every day, we look at screens and see text, images, video... But how does a computer or a smartphone know how to display a tabby cat? Or a picture of a house?

All digital screens use the same technology to display visual information: with **pixels**. Those are tiny squares on the screen that can take any colour, from white to black and all the shades in between. All the pixels together make up the picture. Traditionally, pixel colours on a display are made by mixing amounts of red, green and blue (RGB). This combination is represented by a code numbers and letters, so the computer knows what to show. For example, the colour "hot pink" has the code `#ff69b4`.

Now, screens have a very high pixel density, so you can't see the little individual squares anymore. But if you look at old video games or so called 'pixel art', it becomes quite obvious to the eye. Even if you take a digital photograph and zoom in as much as you can, you can see all the separate pixels.



Space Invaders (Taito, 1978)



Super Mario Bros (Nintendo, 1985)

Class discussion:

Start the activity with a short class discussion. You can use the following questions, but can of course add your own.

- How are images displayed on a computer display?
- Can you send an image from one computer to another? How do you think that happens?
- How big is a pixel?
 - What kinds of games do you know that have 'pixel art'?

Make your own pixel drawings:

Hand out pencils, erasers and printouts of Worksheet 2 for every pupil.

The students follow the instructions on the worksheet to draw their own pixel drawings, inside the provided grids. Every grid comes with number instructions on the side, which make up the code for the drawing. Be careful: the first number of every row is always white.

Drawing					Code				
					2	3			
					5	1			
					2	4			
					1	1	3	1	
					1	1	3	1	
					2	4			

On the right, you see the number code for each row. The first number is always white, the second number black, then white again, black again ... Rinse and repeat.

For example, on the first row, you have to leave 2 squares white and colour 3 squares black.

On the fourth row, you have more numbers.

The first number is 1 white, then 1 black, three white and lastly 1 white.

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Tips and Tricks:

- Do you and your pupils want to learn more or try some extra activities on how images are displayed on digital devices? Surf to <https://classic.csunplugged.org/image-representation> for more information.
- You can find a lot more cool and fun Computer Science Unplugged activities for free, in a variety of languages at <https://csunplugged.org>

Materials:

For the *Sandwich Robot* activity, you will need:

- A loaf of bread
- A pack of butter
- Several slices of cheese
- A plate
- A knife
- Cleaning supplies, because things will get messy

For the *Drawing Pixels* activity, you will need:

- Worksheet 2
- Pencil and erasers