TOOL – ROBOTICS: AN OVERVIEW

PROBLEM SOLVING > 5.3 CREATIVELY USING DIGITAL TECHNOLOGIES

TARGET GROUP	AGE GROUP	PROFICIENCY LEVEL	FORMAT	COPYRIGHT	LANGUAGE
Facilitators	N/A	Level 2	Preparatory guide	Creative Commons (BY-SA)	English, French

This document contains background information for facilitators before they run the workshop with participants. It enumerates different online resources to help understand the basic concept behind robots and offers guidance on how to use the accompanying online tools.

General Objective	Skillset building
Preparation time for facilitator	less than 1 hour
Competence area	5 - Problem solving
Name of author	Gabrielle Taylor
Resource originally created in	French

WORKSHOP DIRECTIONS

1 Definitions

Robot: is a mechatronic machine (mechanic, electronic and digital) designed to execute complex tasks automatically. (Wikipedia)

Program: a series of instructions fed to a computer in order to execute a task or series of tasks. This is the digital component of the mechatronic machine known as the robot.

Robotics: is the collection of the techniques and research leading to the conception, design and operation of automatic machines, or robots. Contemporary robots are used in many domains: industrial, domestic, medical, military, transport, etc. (Source)

The **three laws of robotics** were introduced in 1942 by science fiction writers Isaac Asimov and John W. Campbell. Presented fully for the first time in Asimov's novel *Runaround* (1942), but appearing sporadically in prior works, the laws are:

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

(Source)

2 Some history

Automata were the predecessors to robots. Some of the oldest significant iterations were invented by Israil al-Jazari during the 13th century. An advanced automat was developed by Jacques de Vaucanson in 1738. It took the form of a man playing a pipe. The same inventor also created a duck automat that could flap its wings, crane its neck, and swallow food. (Source) The first digital and programmable robot – Utimate – was created in 1954 and sold to General Motors in 1961 where it was used to perform tasks on the assembly line that were dangerous and difficult for humans. In 1970, the lunar robot Lunokhod 1, deployed by the Soviet Union, travelled 10 km on the lunar surface and sent over 20,000 images back to

earth. (Source) Sophia was unveiled in 2016, and was conferred with Saudi Arabian nationality in 2017. This drew much criticism, as it was not clear whether this meant that Sophia could vote or marry, or for example whether a deliberate shutting down of her system would equate to murder.

3 Some fun ways to introduce participants to robotics

Today, many interesting and free tools exist online to introduce students to robotics. Bringing together fundamentals in programming and engineering, learners can program a robot at home or during an organised workshop. Here are some examples of platforms we recommend:

Arduino

Arduino is a project created by a team of developers comprised Massimo Banzi, David Cuartielles, Tom Igoe, Gianluca Martino, David Mellis and Nicholas Zambetti. This tool allows beginners, amateurs or professionals to create simple to complex electronic systems. The system links computer science and electronics. The advantage of electronic programming is that it greatly simplifies electronic design, thereby reducing the cost and workload required for the production of circuit boards and microcontrollers.

1. Head to Arduino's site.
2. See here for an introduction and further resources.
3. Introductory video: https://bit.ly/3fpVyWW
4. Full four hour+ tutorial video: https://bit.ly/3evQNtL

mBot

mBot is a modular robot using mBlock software based on Scratch. Its construction includes a robust aluminium chassis equipped with two geared motors and a control module. It can detect obstacles, follow a line, emit sounds and light signals, receive orders from a remote control and communicate with other robots using infrared.

1. See these tutorial videos:
    - Part 1

    - Part 2
    - Part 3
    - Part 4
    - Part 5
    - Part 6
    - Part 7
    - Part 8
    - Part 9
    - Part 10
    - Part 11

1. Here is a user manual
2. More documentation and FAQ

Thymio

Thymio was developed at the École polytechnique fédérale de Lausanne. It is easy to pick up and use due to its small size (110 x 110 x 50 mm) and light weight. The Thymio II has various sensors (microphone, infrared, temperature, proximity, accelerometer, floor sensor), actuator (motors, speakers, LEDs) and connectors (USB, memory card).

1. Go to Thymio
2. See here for tips to get started (***youtube video in French language but English subtitles available in settings***) : http://wiki.thymio.org/en:thymiostarting
3. See these four tutorial videos, which are in French but subtitled in English:

    - Part 1
    - Part 2
    - Part 3
    - Part 4

4 Going further

- High quality educational video on robots from a computer science perspective (it is not necessary to have followed the other parts of the series to understand the content here)
- 'What Is A Robot?' from WIRED.com