

Robotics

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HS CS Curricula and Robotics

AP CSP: Does not mention robots specifically as a learning objective, but as a tool to achieve the learning objectives

ECS: Examines applications of robots, ethical considerations, interplay of hardware and software

Robots for Education

Enables interactive feedback

Allows students to test ideas in a familiar environment

Inherently interdisciplinary

including many social science/humanities elements too!

Unique Challenges

Interacting in a noisy environment

Utilizing information from many sensors

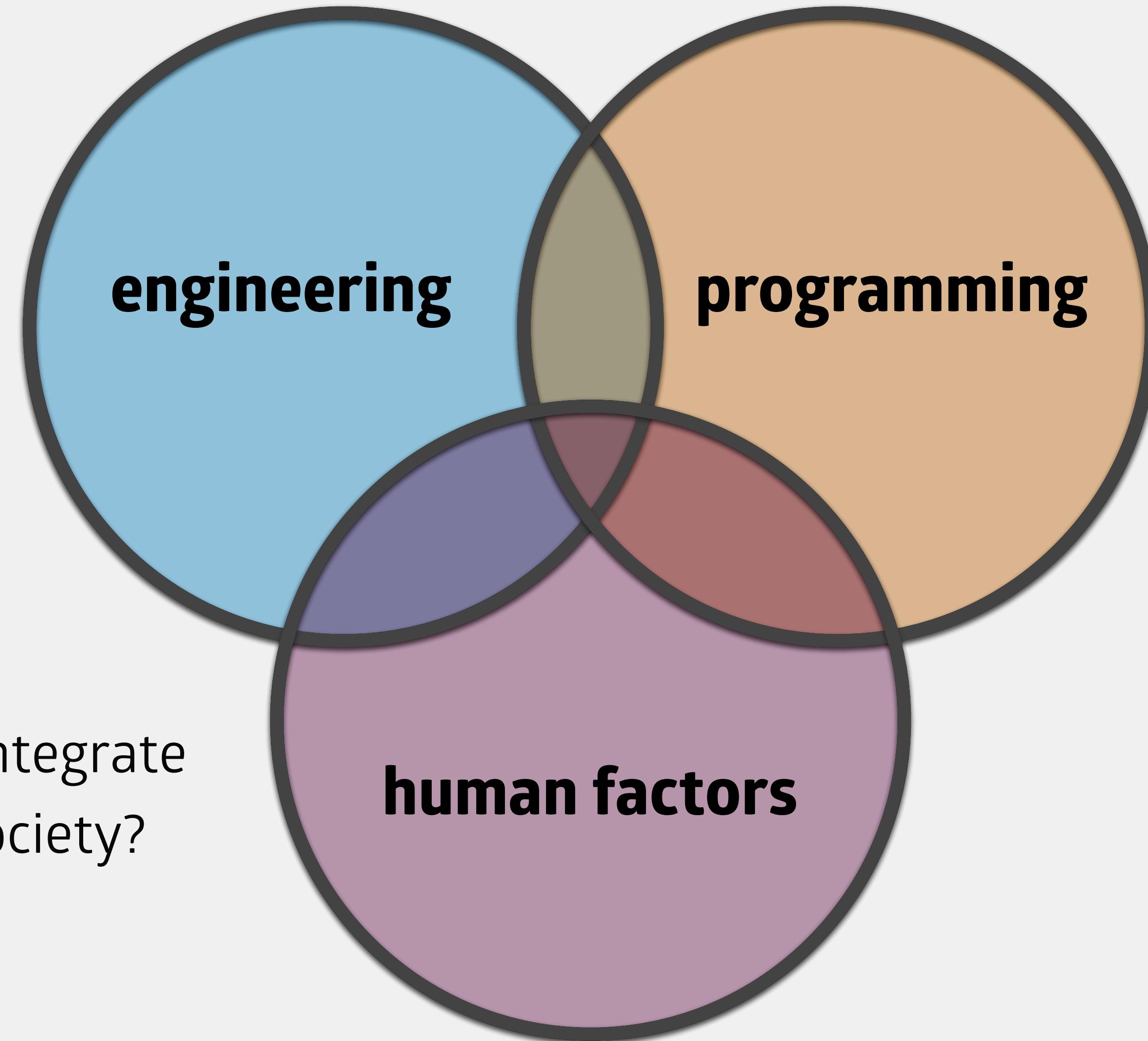
Understanding the world using math

Event-driven architecture

“move forward until...”

Interdisciplinary Use

How do we build
robots?



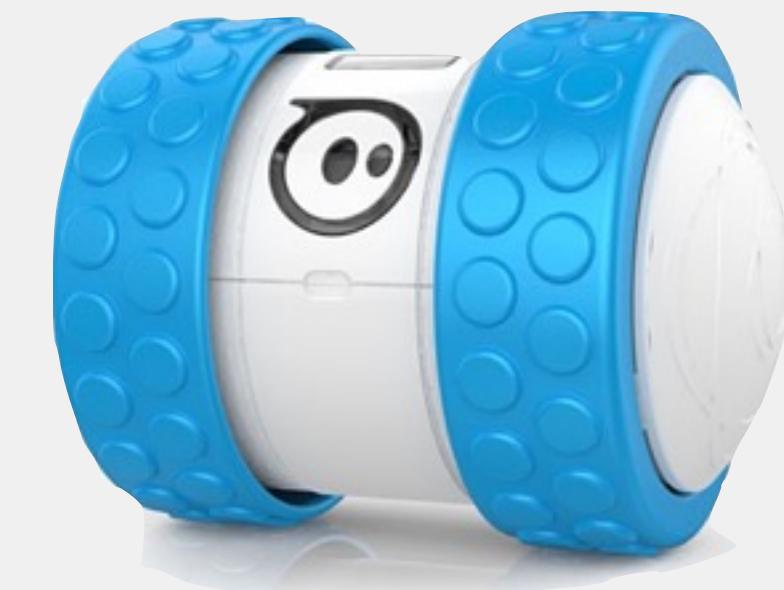
How do we program
robots?

How do we integrate
robots in society?

Platforms



Lego Mindstorms (\$350)



Sphero (\$100)



Dash and Dot (\$200)



Edison (\$50)



Sphero (\$119)



Finch (\$99)

Platforms

CESA 4 has 40 EV3 Mindstorms

Finch has a loan program¹

Many offer educational or bulk discounts

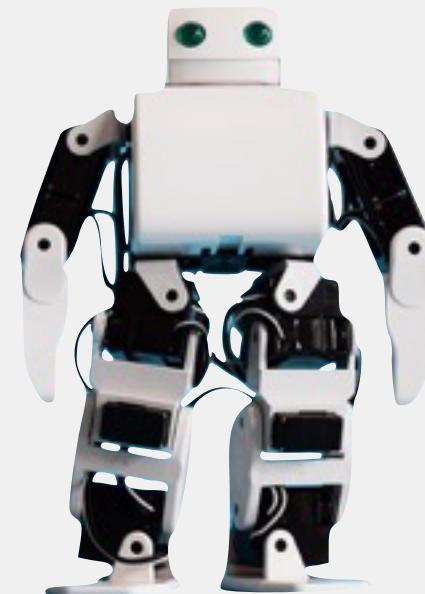
including Edison & Finch

1: <http://www.finchorobot.com/finch-robot-loan-program>

Platforms: DIY/3D Printed



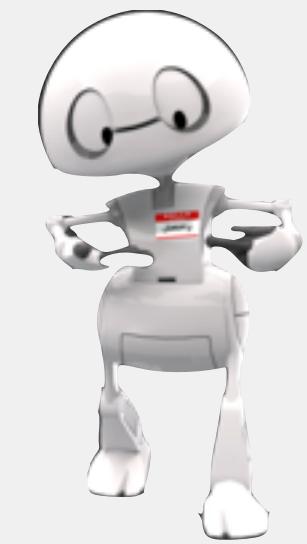
BQ Zowi¹



PLEN2²



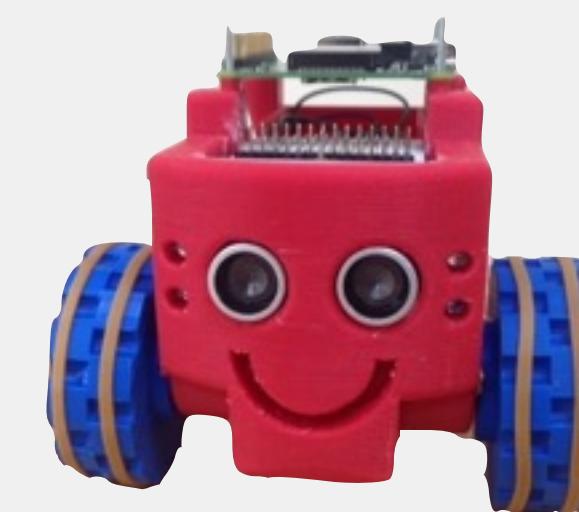
Bob the Biped³



The 21st Century Robot⁴



Maki⁵



Apogee⁶

1: <https://github.com/bq/zowi>

2: <https://github.com/plenprojectcompany/PLEN2>

3: <http://www.instructables.com/id/BoB-the-BiPed/>

4: <http://www.21stcenturyrobot.com/>

5: <https://www.hello-robo.com/maki>

6: <http://www.thingiverse.com/thing:648394>

Robotics Competitions

Numerous competitions¹

BotBall

FRC/FLL

RoboCup

Large teams with multiple talents

7 Rivers Robotics Coalition (7RRC)²

1: https://en.wikipedia.org/wiki/Robot_competition

2: <https://www.7rrc.org/>

Programming Robots

Programming Robots

Similar to what you've seen thus far

Few key differences

- need to work in our (somewhat unstructured) human environment

- many more inputs

Activity: Maze

Groups of 3+

Will collectively execute instructions to navigate a robot through a maze

Execution will require precision and detail

Activity: Maze

One person is an obstacle sensor/engine

One person is a color sensor

One or more people are the robot

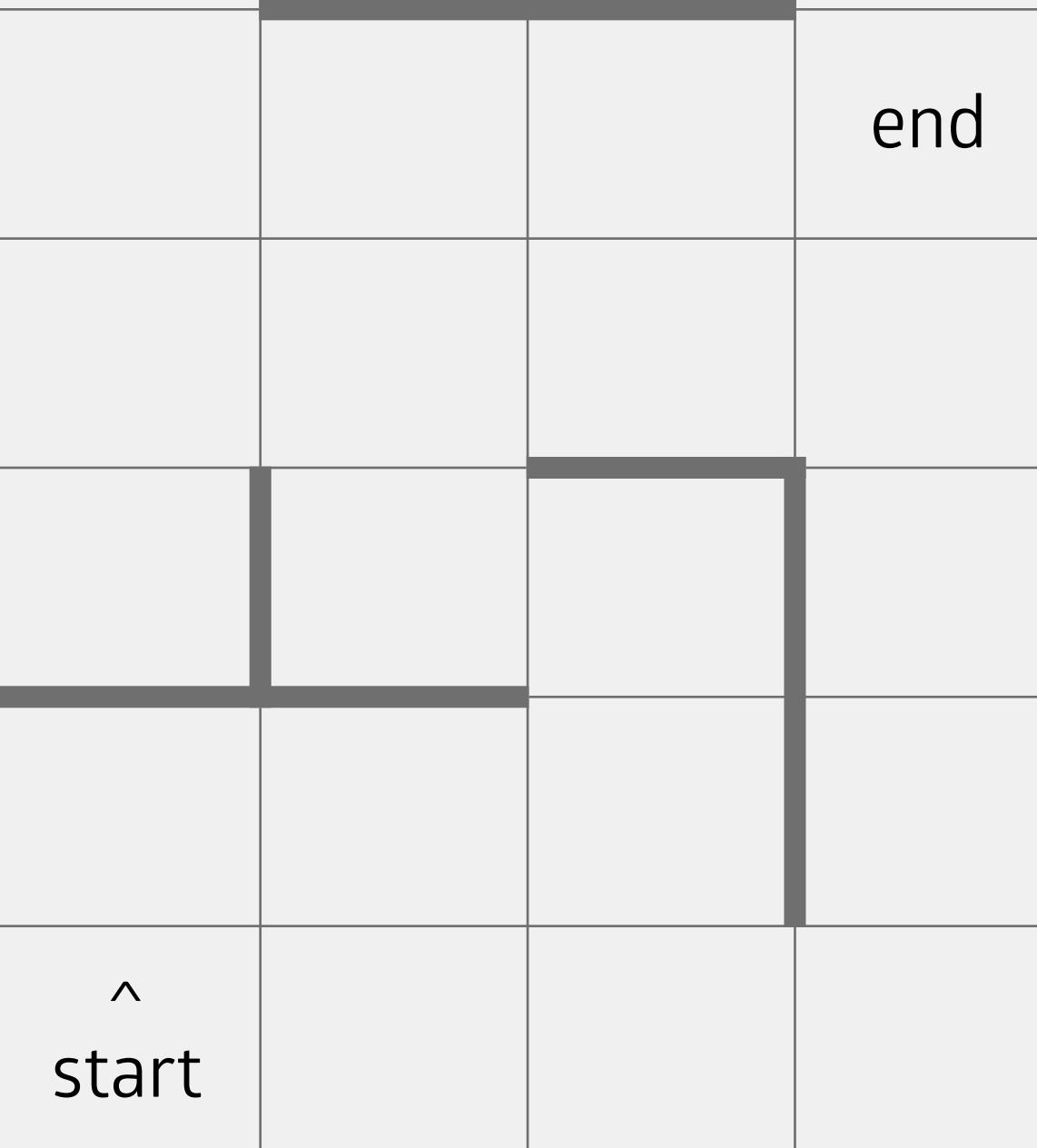
asks questions, makes decisions based on responses

Activity: Maze

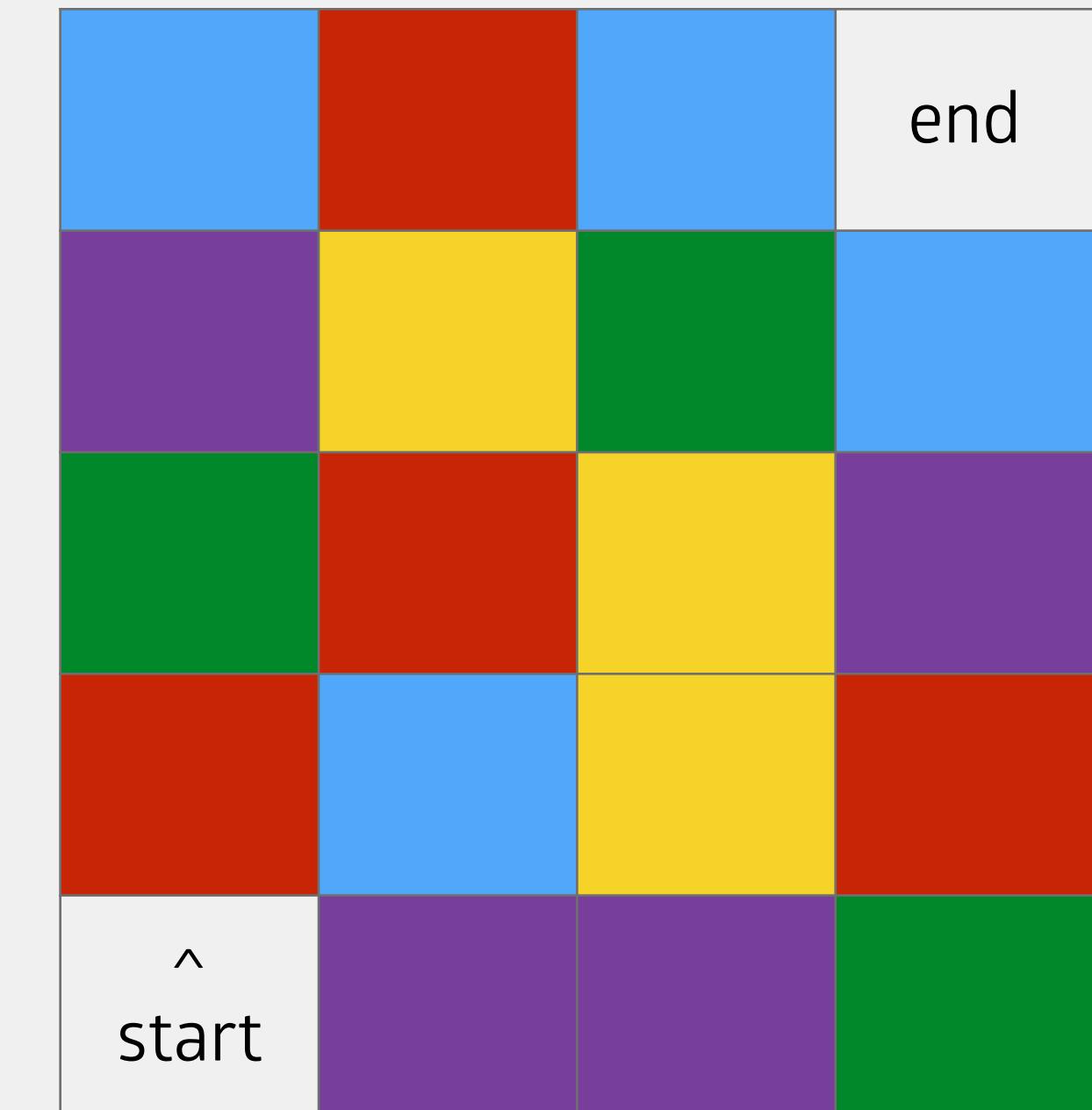
robot



obstacle sensor/engine



color sensor

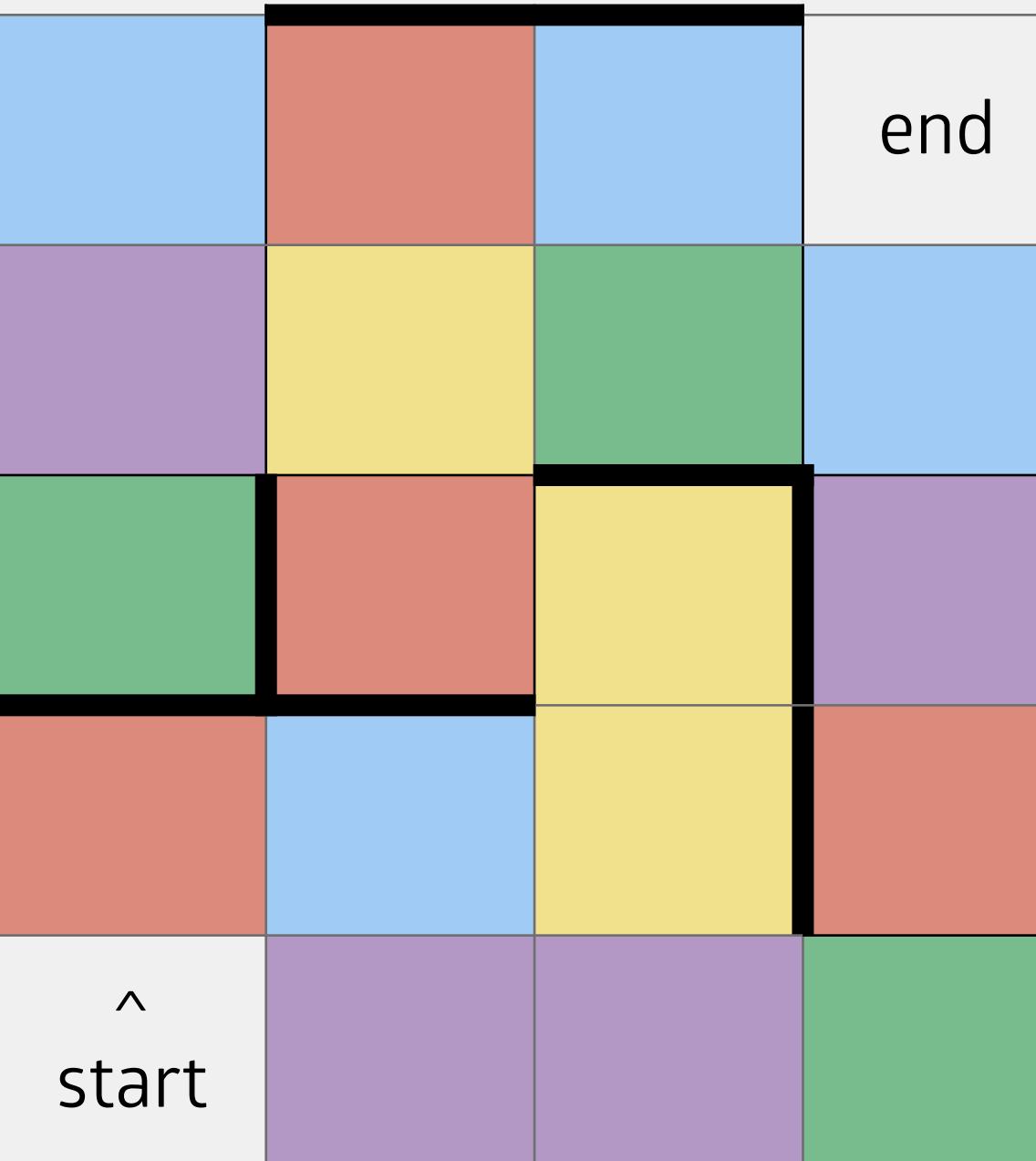


red: turn right

yellow: turn left

Activity: Maze

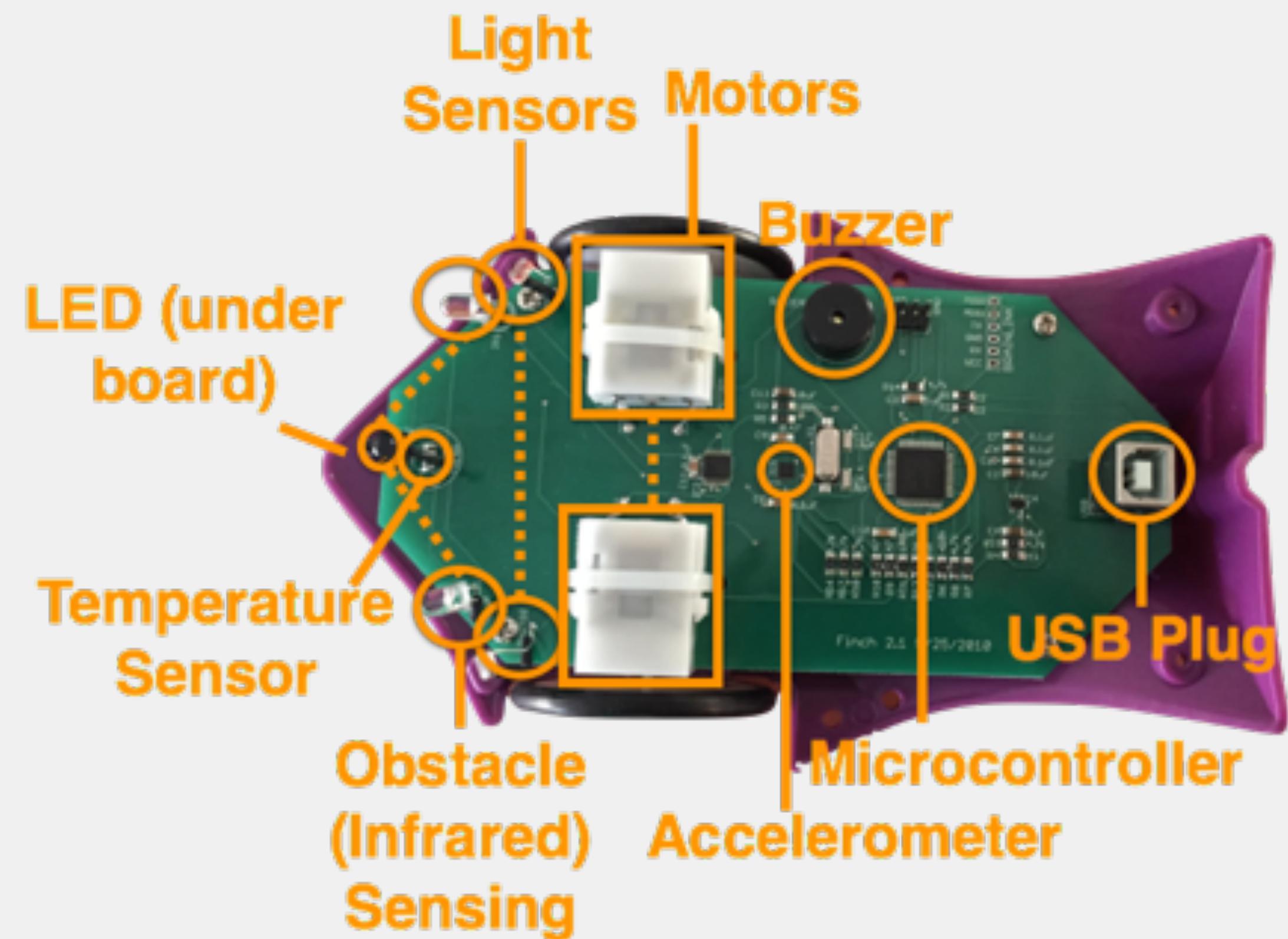
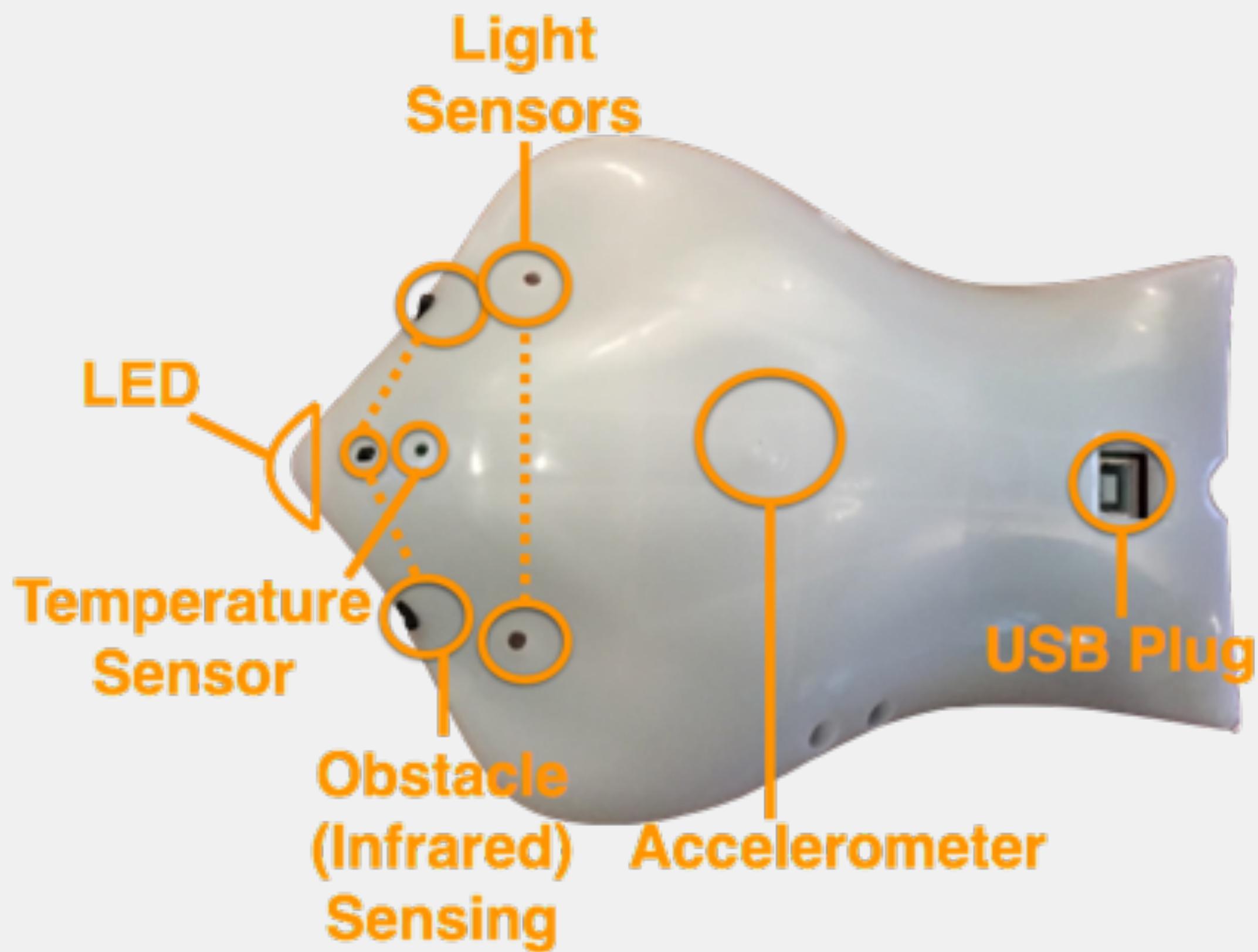
combined map



Finch



Finch Anatomy



Programming Finch

Two main options

Snap/Scratch interface

programming language

Python, Processing, Greenfoot, Java, C++, Scala...

Different recommendations for different grades

<https://www.finchorobot.com/software-overview>

Finch Activities

Demo programs

both GUI and programming languages

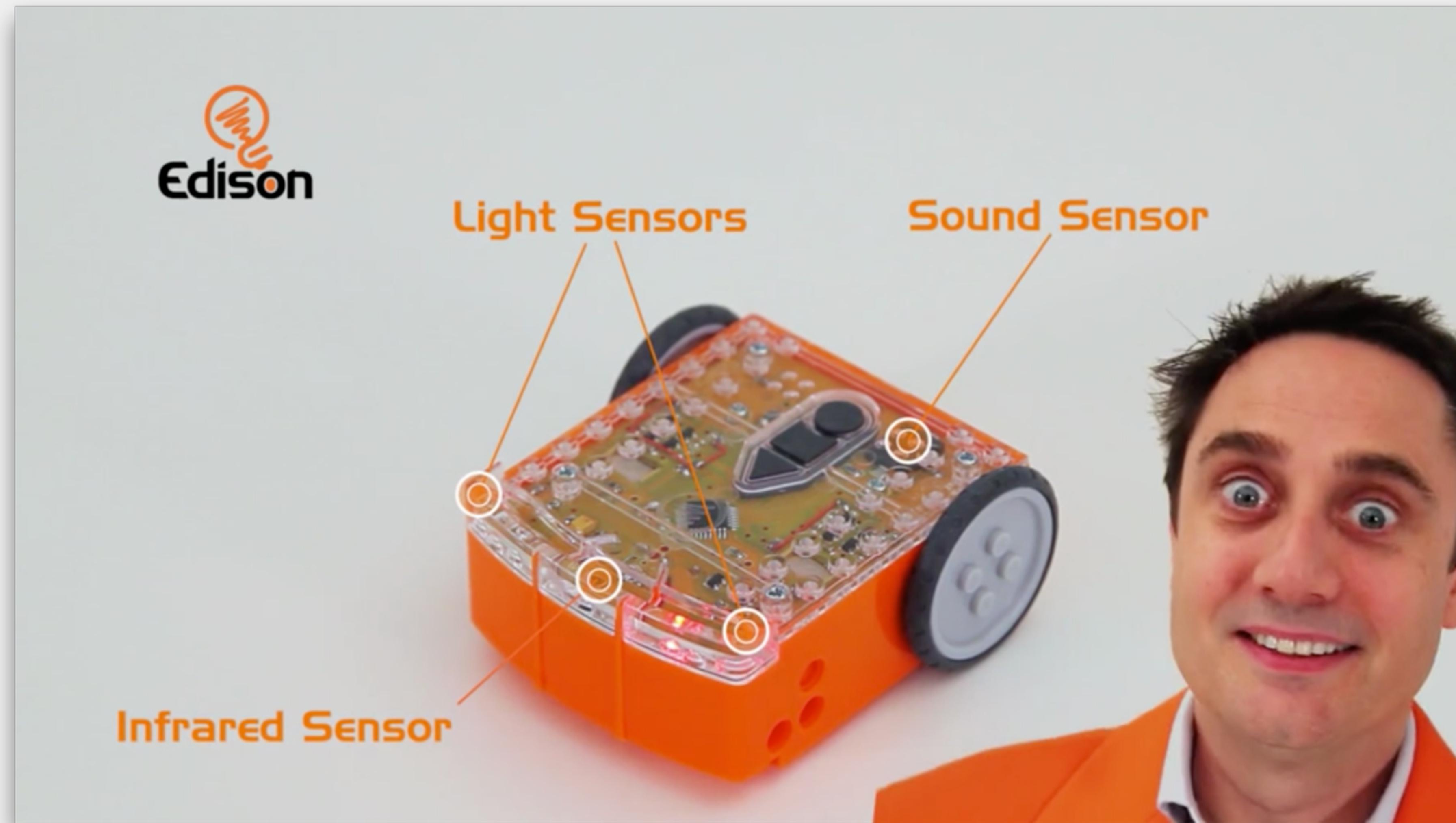
Curricula

all grades, including AP CS A

Edison (v 2.0)



Edison Anatomy: Input



Edison Anatomy: Output

Driving

Left/right LED

Music notes (very basic)

Programming Edison

Three options

barcode controller

Scratch-like interface (EdWare)

Python (EdPy)

All options are available online

barcode mats to download and print

web-based interfaces for both EdWare and EdPy

can also download + install

Barcode Programming

Edison has a number of programs already stored in memory

Activated via barcodes

available in Edison activity books

Allows students to observe how the robot works without programming

EdWare

Works very similarly to Scratch

EdPy

It's not actually Python

compiled, instead of interpreted, so it can download/run on Edison

But, it's been designed to be close in terms of syntax

Functions + documentation contained in EdPy interface

Significant limitations!

cannot import additional modules

cannot use logical operators

Edison Activities

You're a controller

focus on using programs already on the robot via barcode control

serves as a basic introduction to robotics

You're a programmer

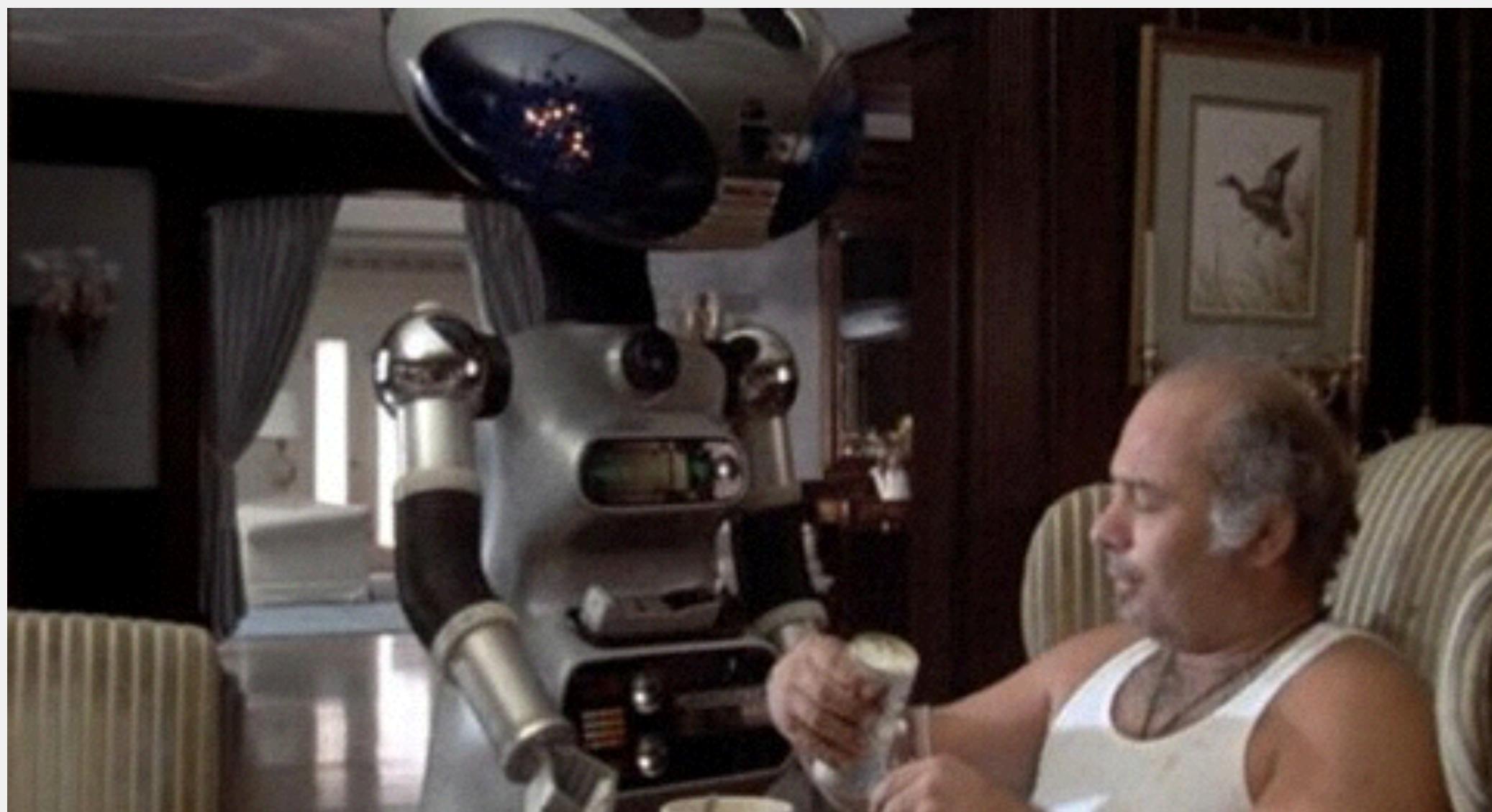
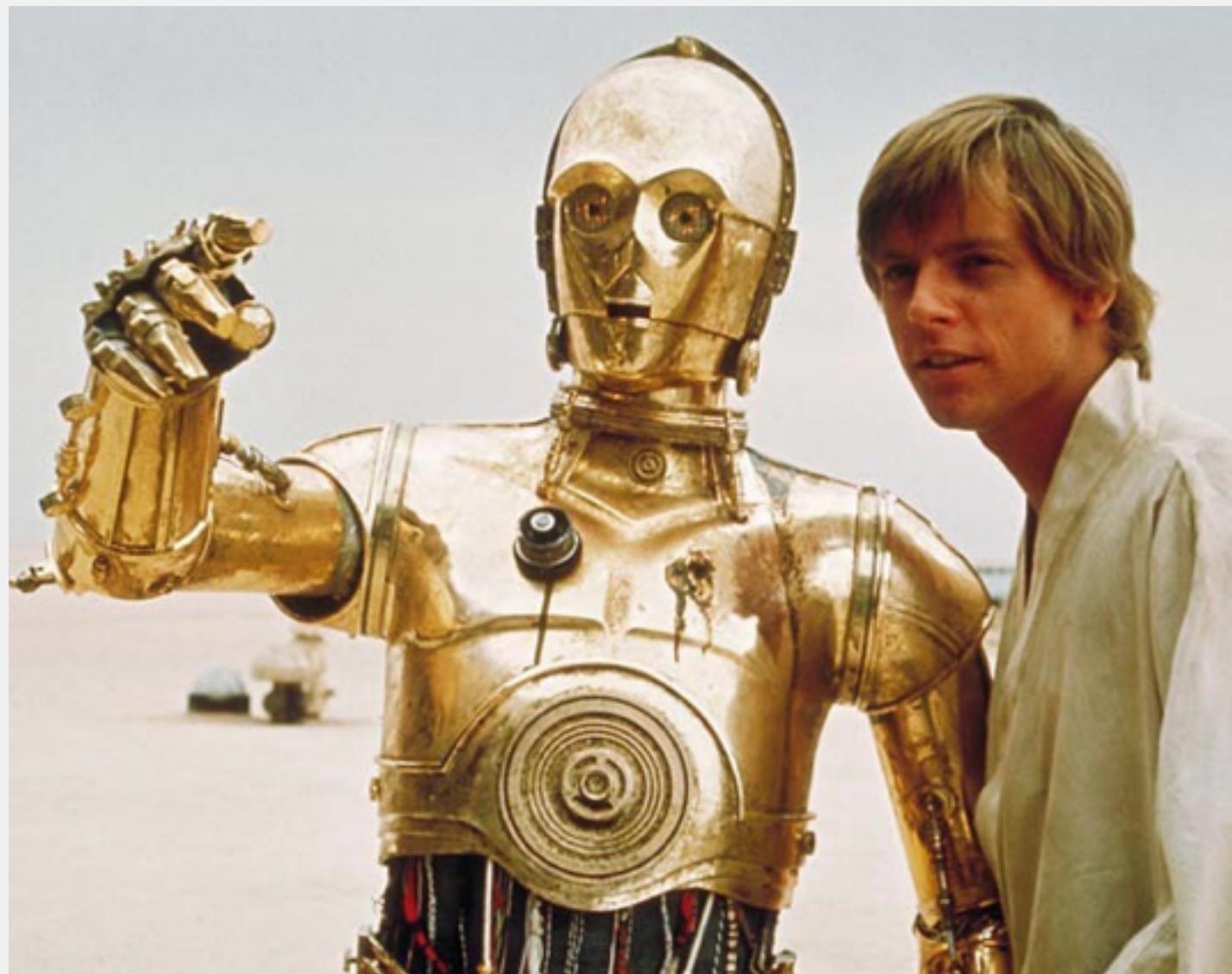
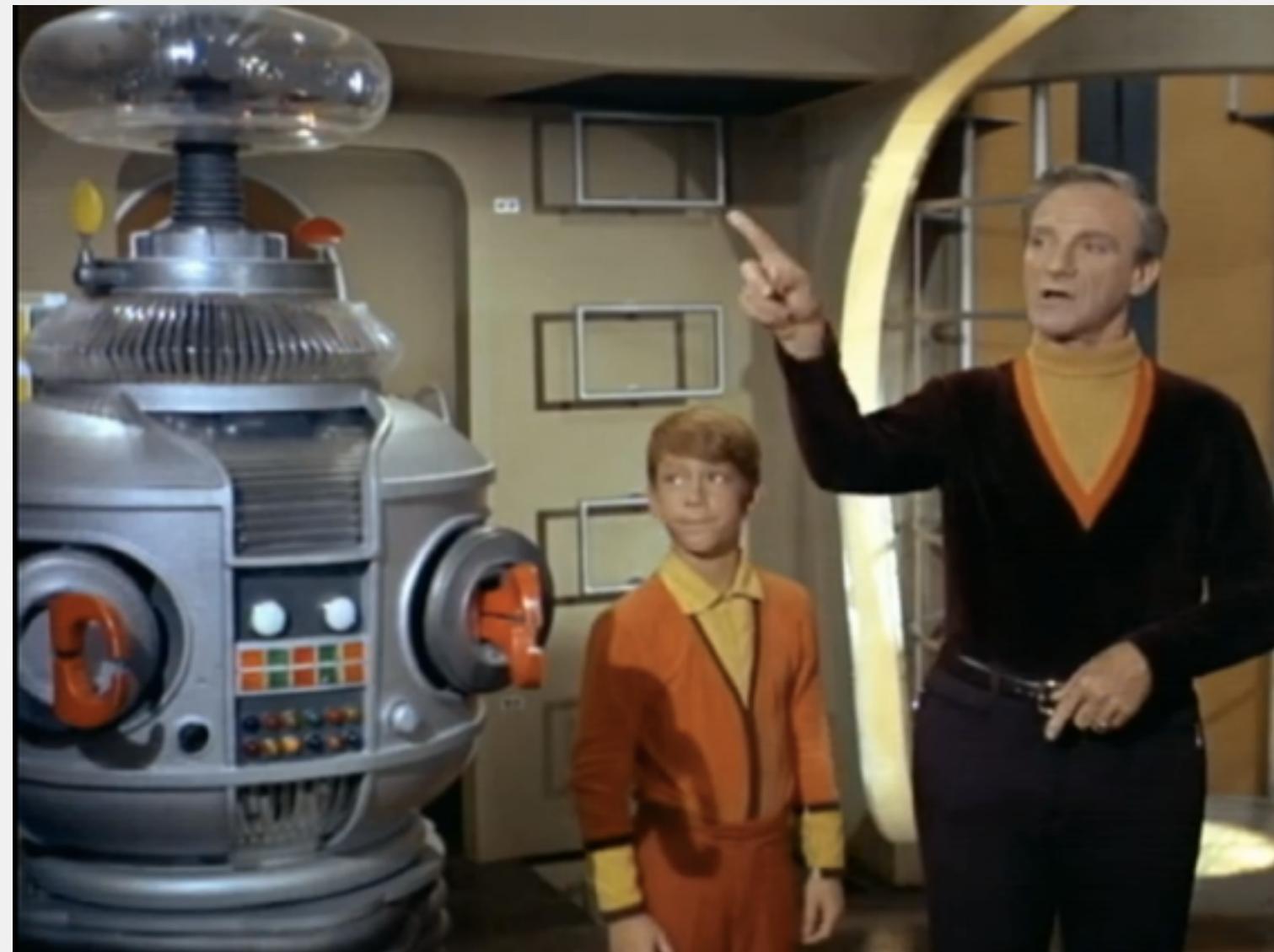
focus on learning how to write programs with Scratch-like interface

You're a builder

focus on engineering and programming new robots

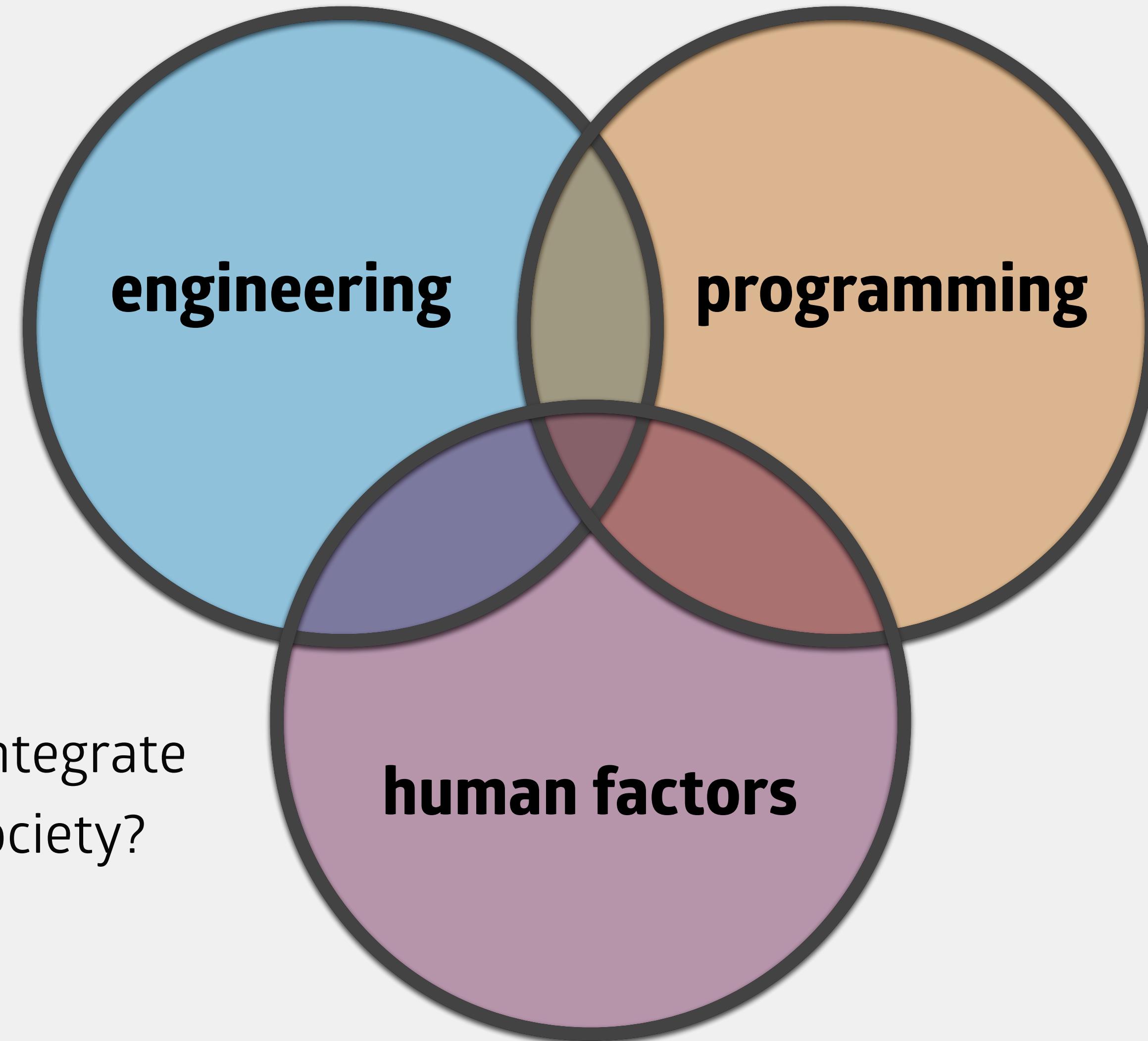
Python-based activities yet to be released

What Else?



Interdisciplinary Use

How do we build
robots?



How do we program
robots?

How do we integrate
robots in society?

Other Topics

Design/use

Construction

Ethics

Social impact