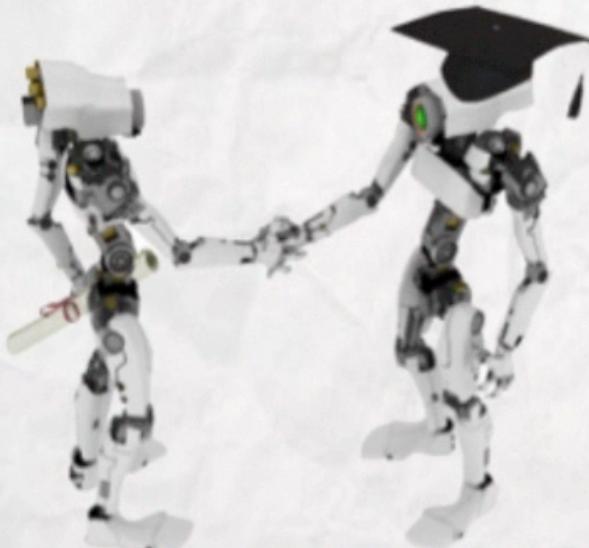


ROBOTICS IN EDUCATION

How to use robotics in the learning-by-doing approach



Davide Valeriani
PhD Student
University of Essex



STUDENT'S OUTLINE



MY OUTLINE



- ✓ Why robotics?
- ✓ Robotics in different levels of Ed.
- ✓ A view to the future
- ✓ Conclusions

LEARNING'S CHALLENGE



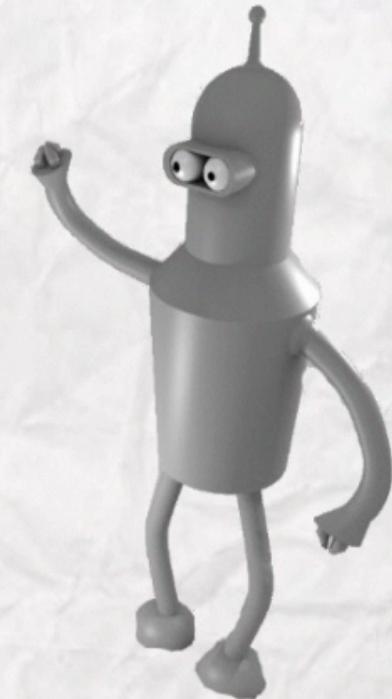
Example isn't another way to teach, it is the only way to teach.

Albert Einstein

WHY ROBOTICS?

Robotics is **multidisciplinar**

- Computer science
- Electronics
- Mechanical Engineering
- Control



LEVELS OF EDUCATION



University



High School



Primary and Middle School

LET'S START...



...BUT NOT TOO EARLY!



PRIMARY AND MIDDLE

- Built a Star Wars city as a backdrop
- Wrote stories about robot and human
- Developed the story using instructions (i.e. move forward)
- Program the robot with teacher



Valiant Roamer
(280 \$)

OR... LEGO WEDO!



BEST APPROACH?



KIT-BASED

CURRICULAR



OLD AND YOUNG

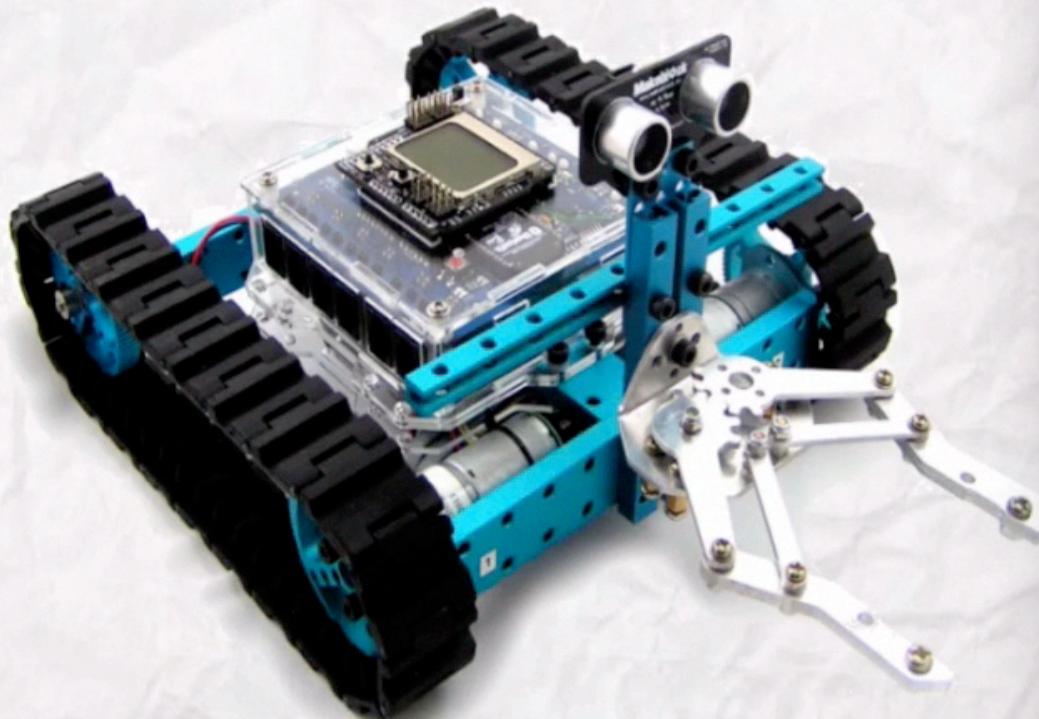
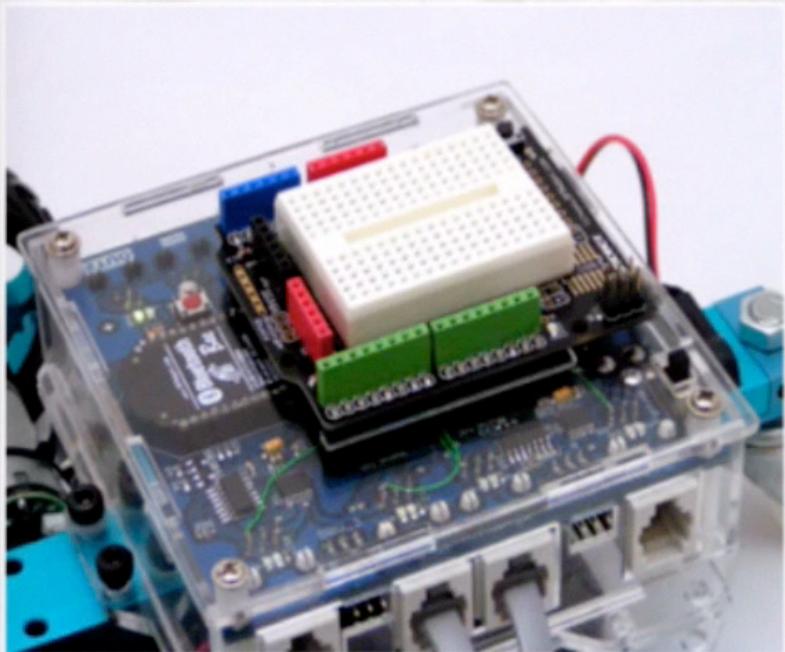
Cross-generational project to introduce pupils and senior citizens to science and technology.



HIGH SCHOOL

- Humanistic competencies higher than technical ones
- Introduce Mechatronics to gymnasium
- Ad-hoc kit with professional components
- Several programming languages available (C++, Prophio, Scratch)

RESULTS

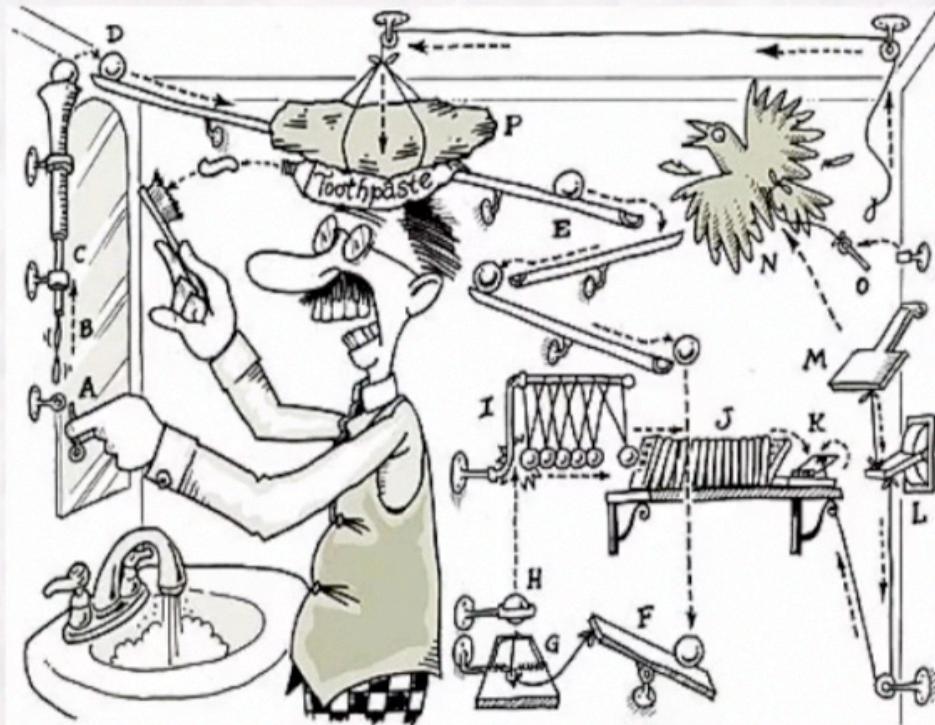


RUBE GOLDBERG MACHINE

→ Simple task



Complex way



DIFFERENT SKILLS

- Time management
- Team work
- Prototyping
- Robotics





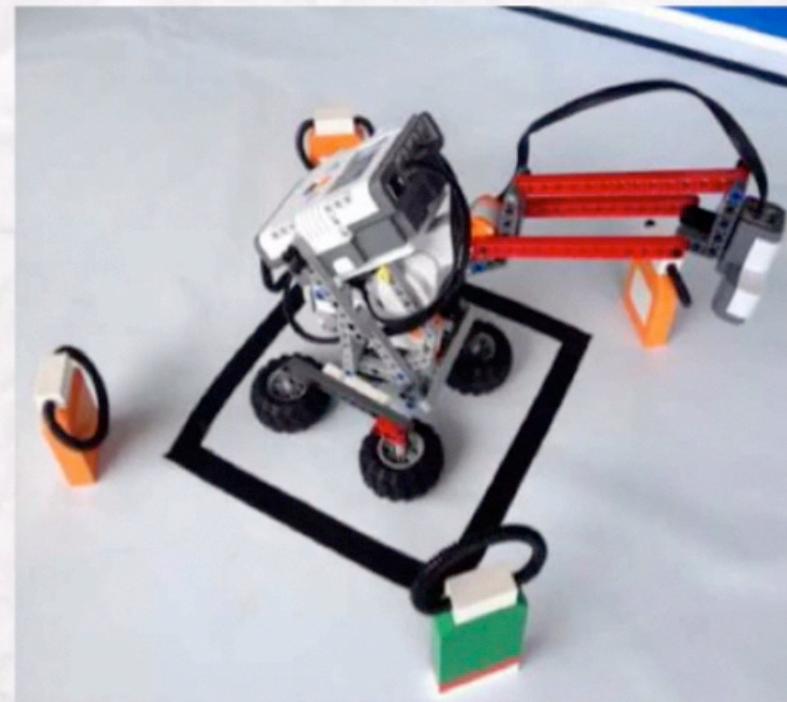
ENTREPRENEURSHIP

- Security alarm for a steam generator
- Mobile traffic light for public works
- Control of a pumping station
- Piano 3.0 simulation



ROBOTICS PROJECT

Automated line for
filling, packing and
palletizing bottles
of wine



CVARC SIMULATOR

System for online competitions on virtual
robots' control

WWW.AIR-LABS.RU

```
<World>
<Box X="100" Y="100" Z="25"
Width="50" Height="50" Lengh="50">
  <Box.Left>
    <ColoredSurface Color="Red"/>
  </Box.Left>
</Box>
</World>
```

UNIVERSITY

Robotics + Design class @ PoliMI

- ✓ Facilitate students to speak easy
- ✓ Competition with beautiful robots
- ✓ Learning by doing useful also in design

PROJECT MANAGEMENT

Modified Extreme Programming and Scrum
(Agile) methodology applied to robotics:

- ✓ Pair programming
- ✓ Work packages
- ✓ Regular meetings
- ✓ Ticket system

OVERVIEW OF TECHNOLOGIES

Building robots: project-based learning

- ✓ Complete robotics kits
- ✓ Build from scratch

COMPLETE ROBOTICS KITS

- ✓ Simple: good entry point
- ✗ Expensive
- ✗ Hard use with other components

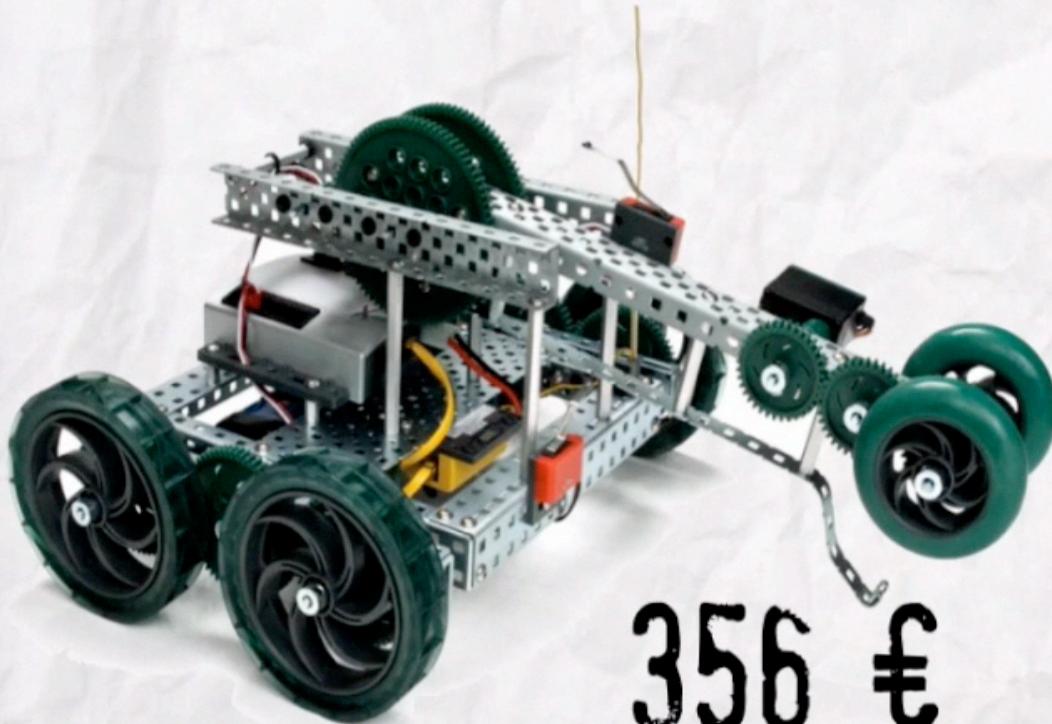
LEGO MINDSTORMS



330 €



VEX



356 €

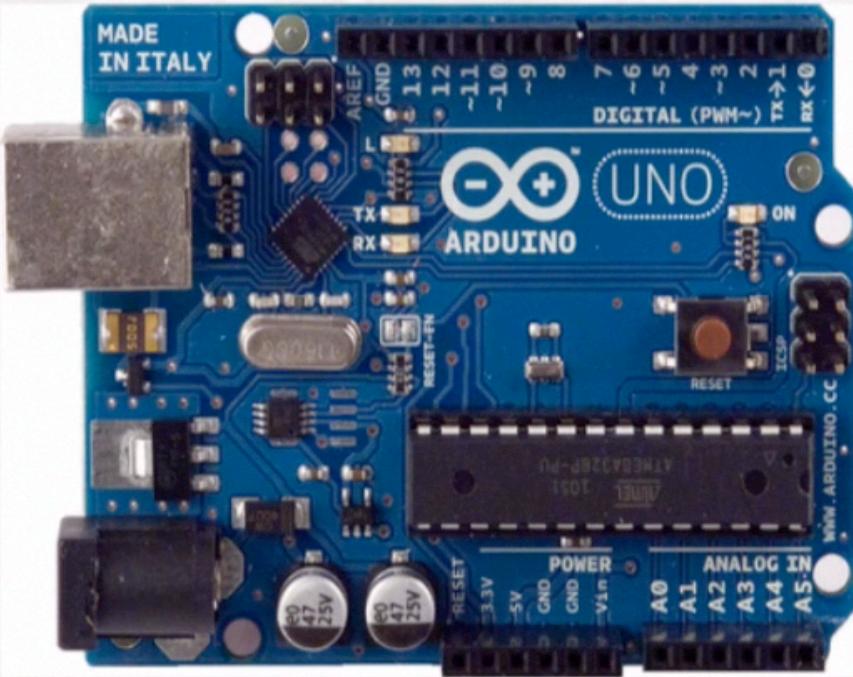
Professional
PIC or Cortex
Written code

ARDUINO

Big community

Require skills

Low cost 18 €



DWENGO

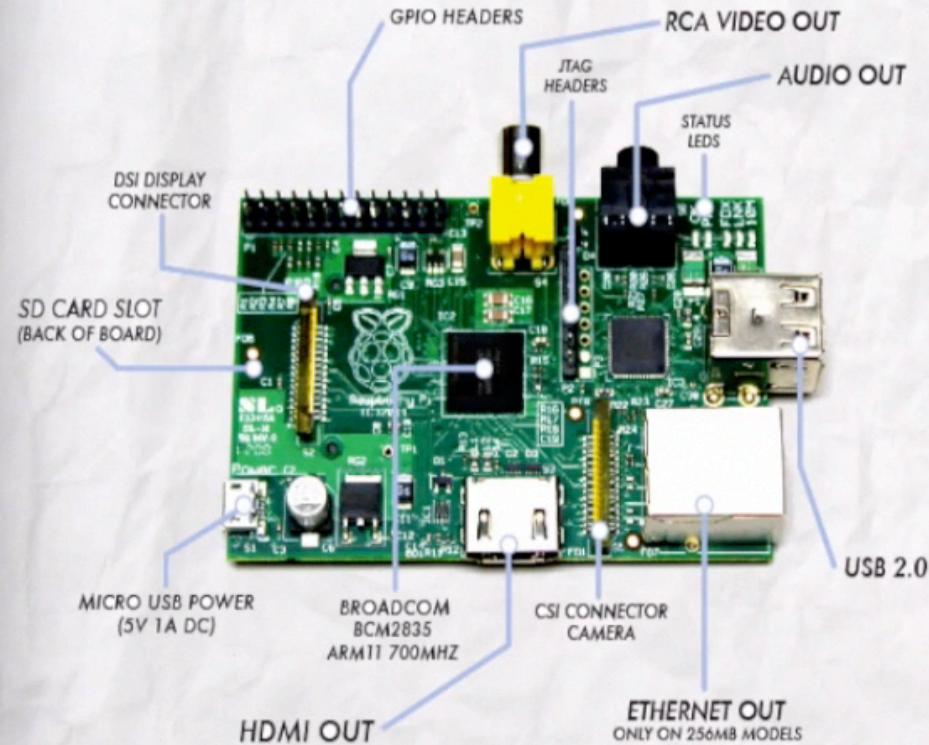


PIC chip

Robotics-oriented

65 €

RASPBERRY PI



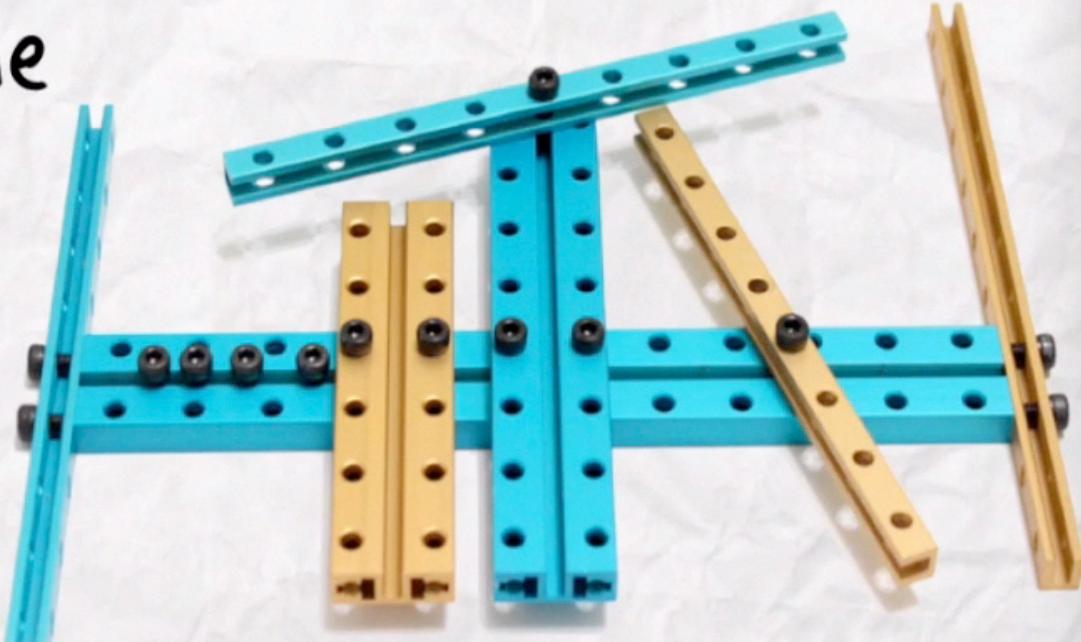
Small computer
OS overhead
25 \$ Powerful

MAKEBLOCK

Lego compatible

Aluminium

Expensive

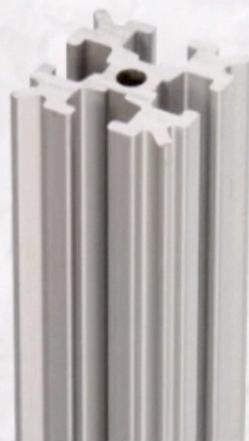


OPENBEAM

Third-part components compatible

Standard M3 nuts and bolts

Open hardware



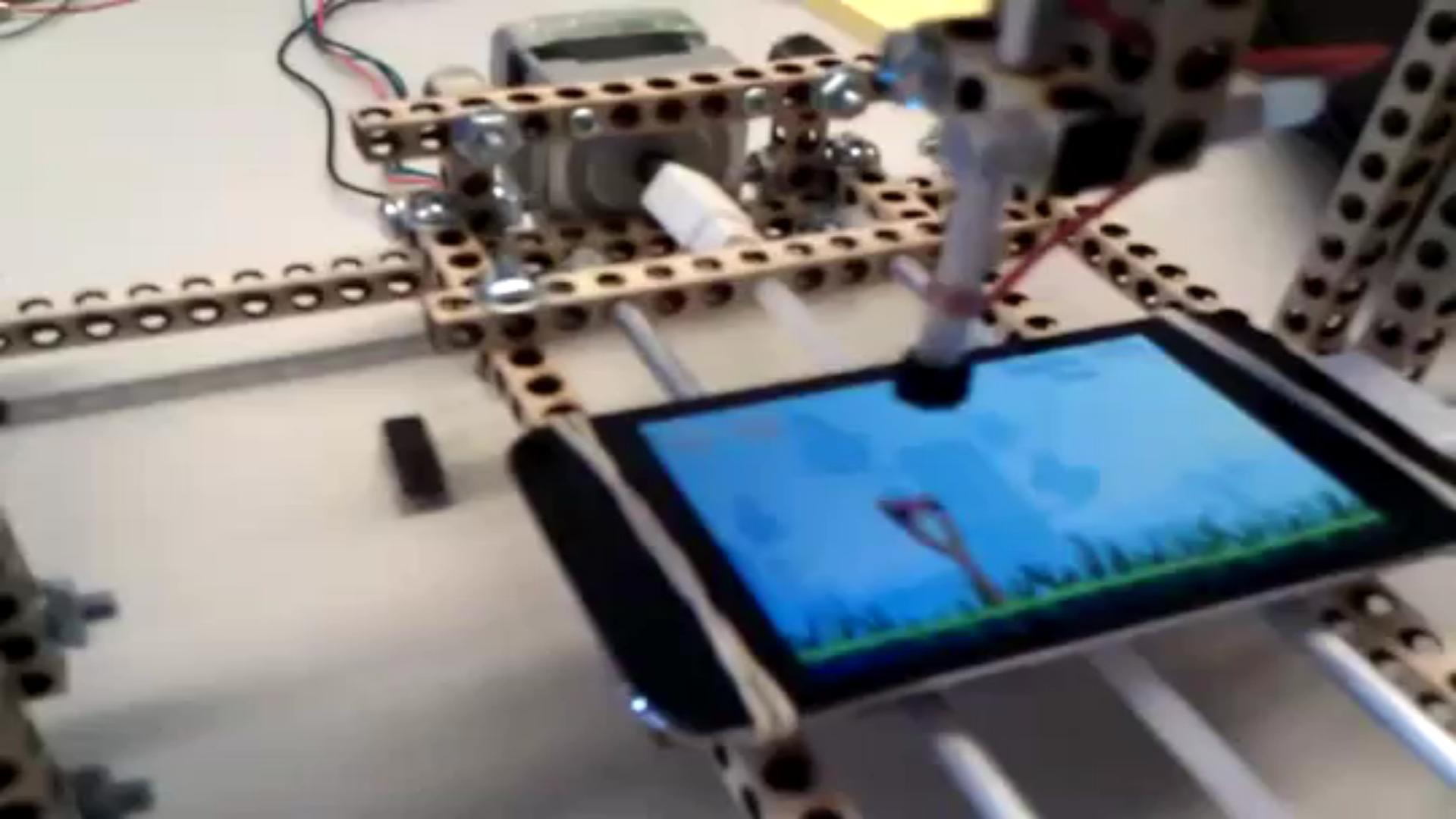
BITBEAM

Lego compatible

Cheap

3D printable





PROGRAMMING LANGUAGES

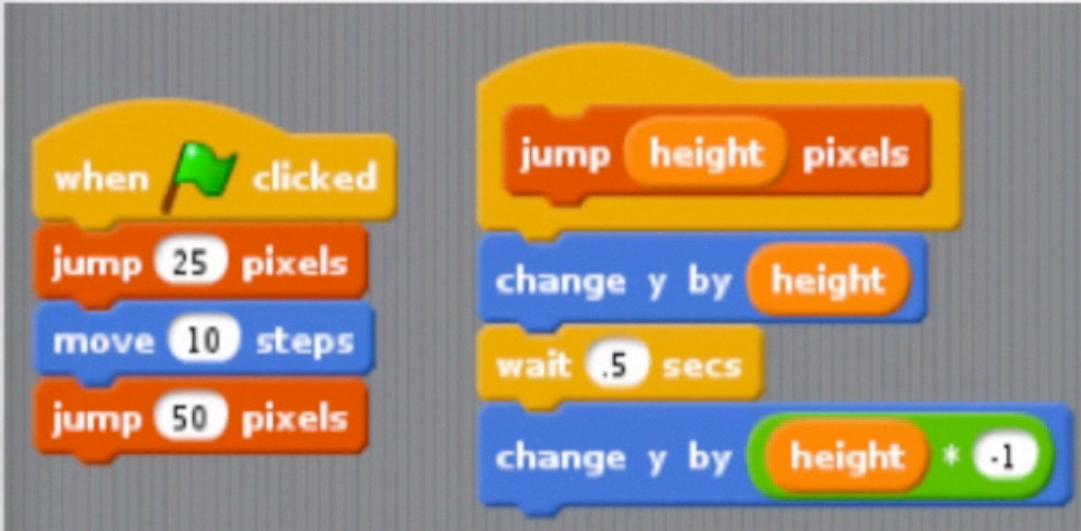


Low level



Graphical

SCRATCH



Puzzle-like GUI
Used to learn
programming

GOOGLE BLOCKLY

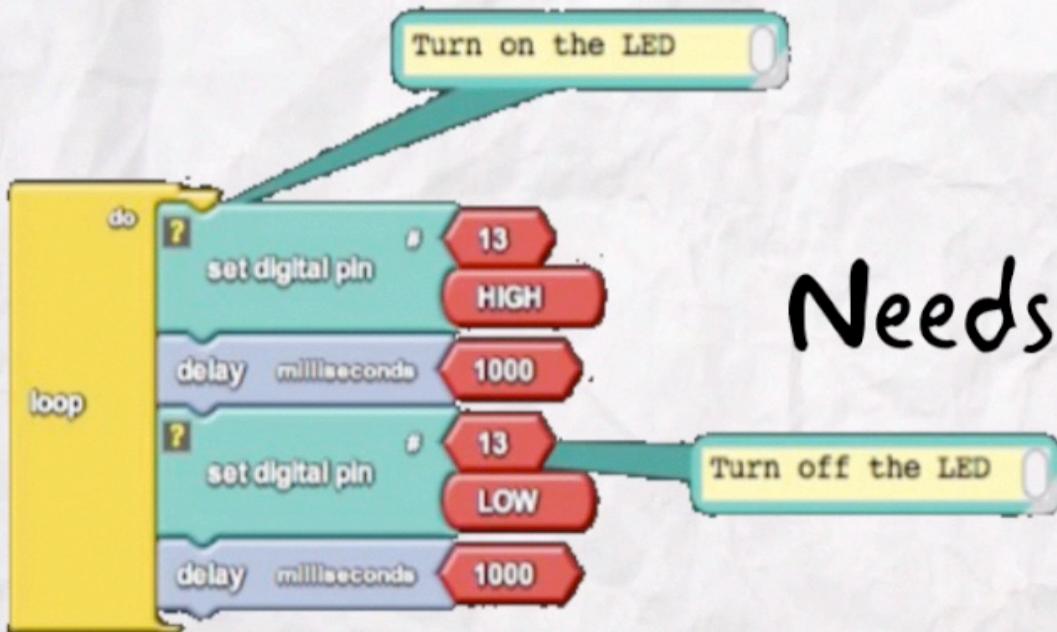


Language GUI

Used for design

JavaScript and Python converter

ARDUBLOCK



Arduino GUI

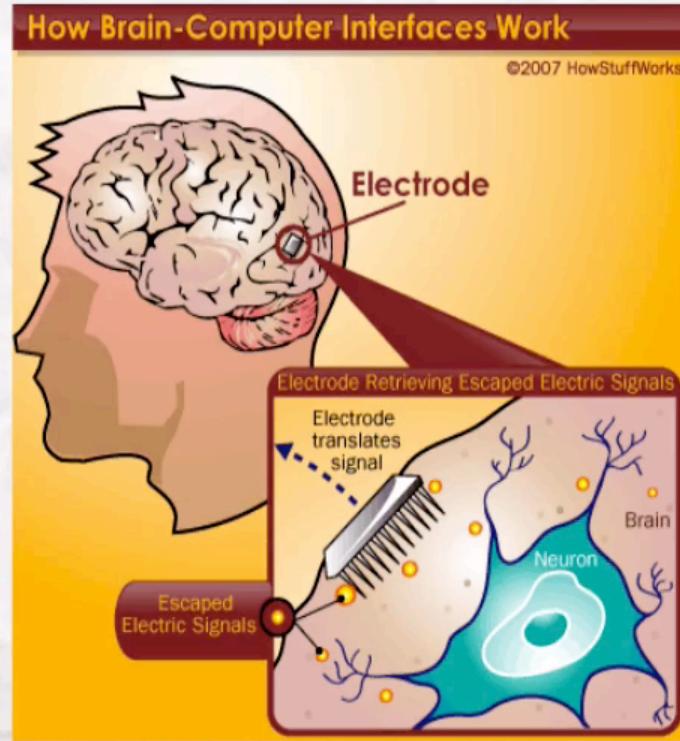
Needs improvement

Educative

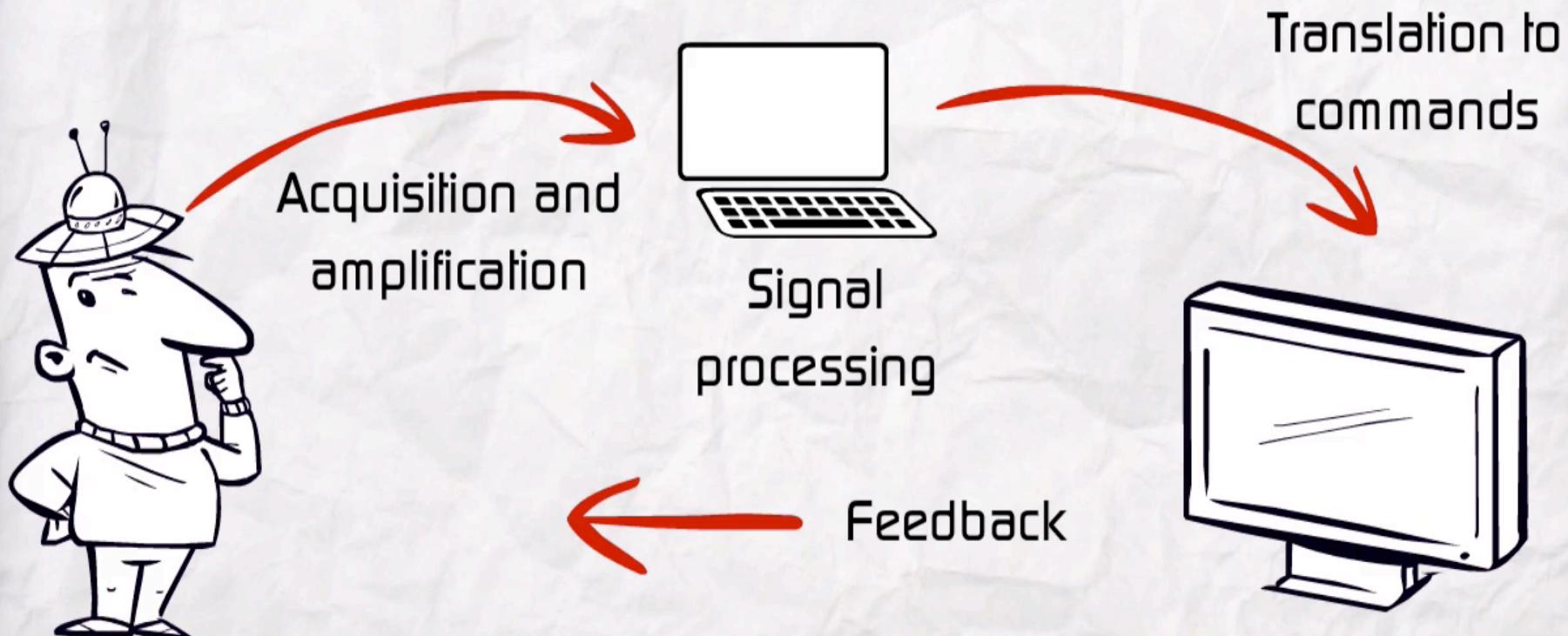
A VIEW TO THE FUTURE



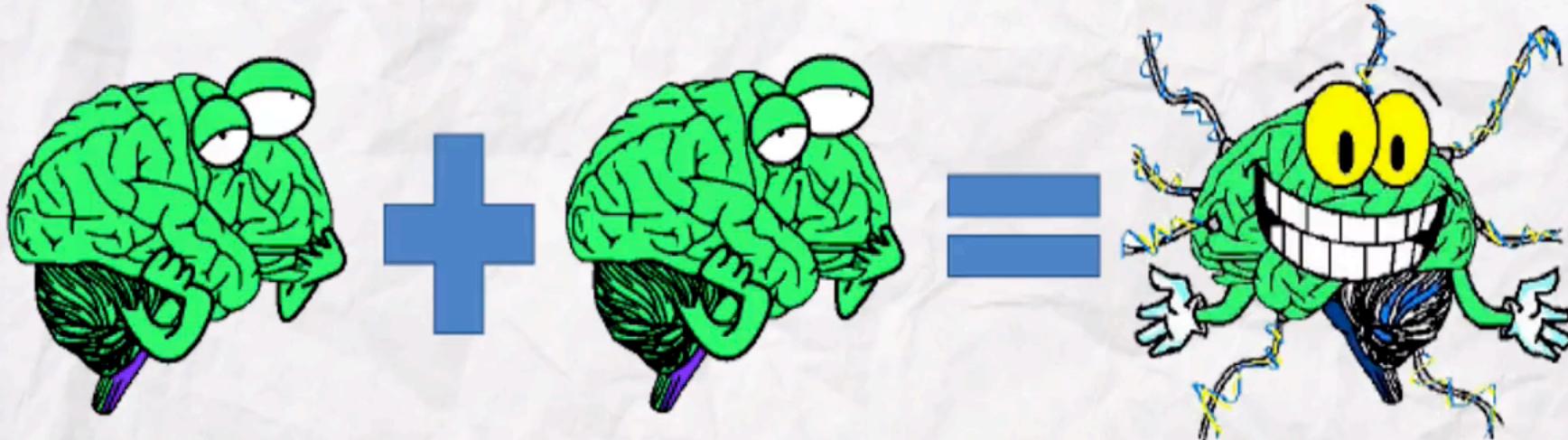
BRAIN COMPUTER INTERFACE



BRAIN COMPUTER INTERFACE



COLLABORATIVE BCI





CONCLUSIONS

OPEN YOUR MIND



