ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era: development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800

TITLE: Programing robots - moving

LEARNING SCENARIO		
School:	***Duration (minutes):***	90
Teacher:	***Students' age:***	13-14

Essential Question:	How to program a robot to move

Topics:

- Programing robot to move

Aims:

- To learn how to program a robot to move

Outcomes:

- Knowing how to write a program for robot to move

Work forms:

- work in pairs, group work

Methods:

- presentation, talk, discussion, interactive exercise

ARTICULATION
Course of action (duration in minutes)
INTRODUCTION **Defining the goal of the lesson:** To program our ARTIEbot for the first time and to see how to move it. Let's face it, robots are cool. In this class we provide a step-by-step, easy-to-follow tutorial (with code samples) that walks you through the process of programing a basic autonomous mobile robot to move.

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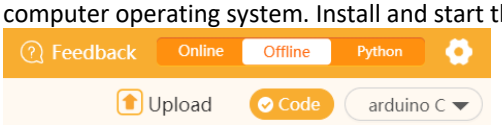
MAIN PART

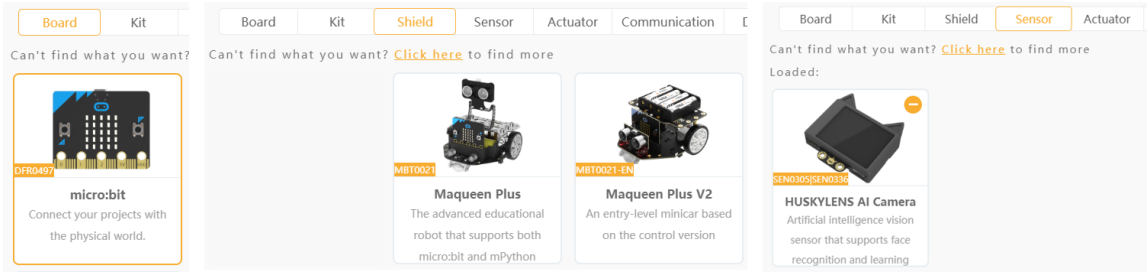
A teacher assissts a student in writing the code for the robot that we have assembled and make it able to move.

Step 1 (both options): Go to: http://mindplus.cc/download-en.html and download version for your computer operating system. Install and start the Mind+. After starting, switch to Offline mode.



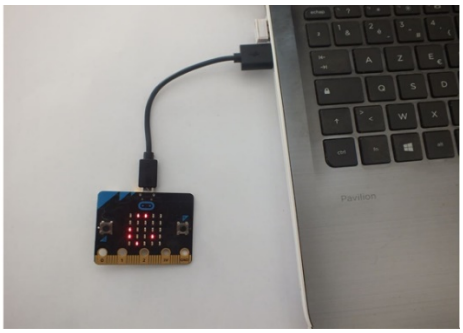
If you are working with Arduino skip directly to step 2. ->

Maqueen Plus:



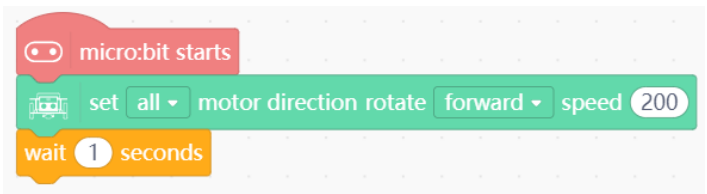
Click on Extensions and from **Board** tab select **micro:bit**, from **Shield** tab select **Maqueen Plus** or **Maqueen Plus V2** and from **Sensor** tab select **HUSKYLENS AI camera**. Click on Back and your software is ready to use selected modules.

Connect micro:bit to your computer via USB micro cable and power indicator will turn on



Click on Connect Device and select micro:bit. Install the device drivers if necessary.

Test the uploading sequence with this code:



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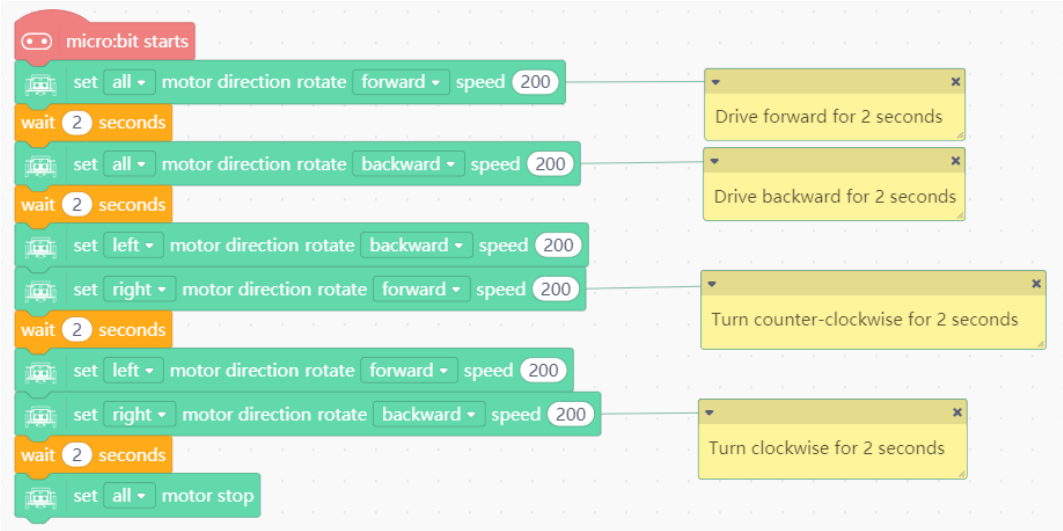
Click on upload.
Robot should move forward for one second and stop.

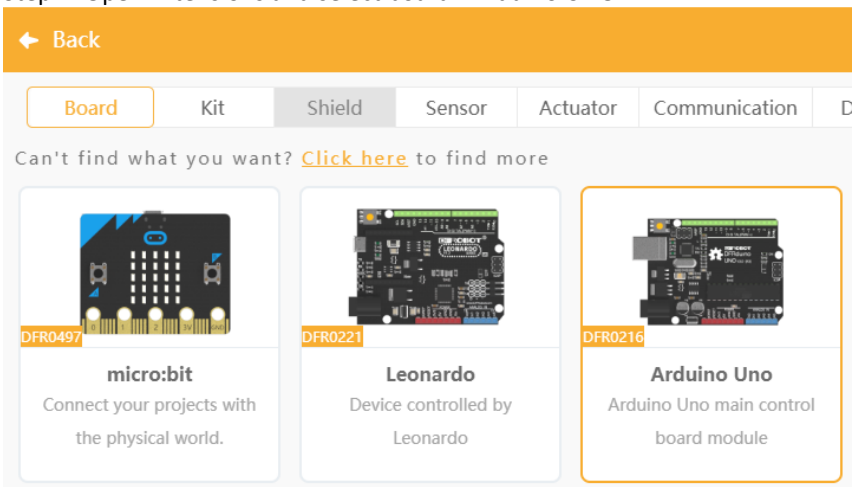
Try this sequence - robot should move as described in comments.



Click on upload.
Robot should move as described in comments (yellow blocks).

Try various speeds to make your robot go faster or slower.

Step 2: Open Extensions and select board - Arduino UNO



Step 3: Switch to sensor tab and select sensor - HUSKYLENS AI Camera

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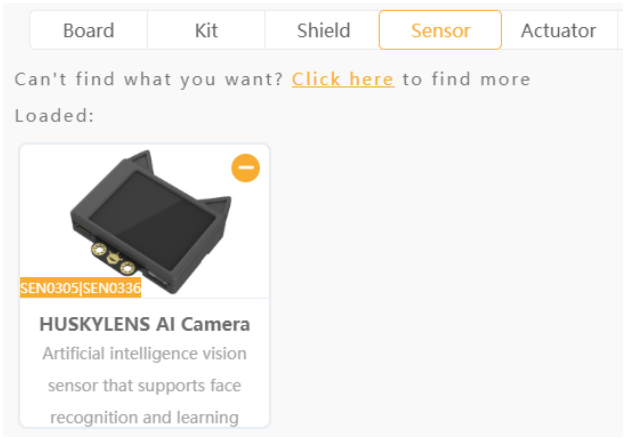
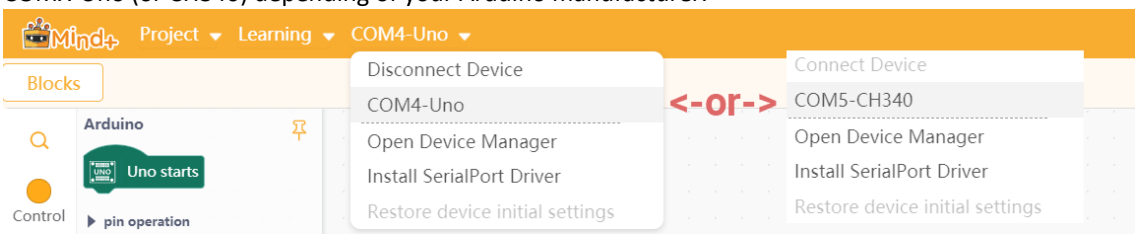


Step 4: After selecting, click on <- Back and you are ready to use Arduino and Sensor blocks. Let's test it to see if it works. Before that you need to connect device. Plug in your Arduino UNO via USB cable and select COMX-Uno (or CH340) depending of your Arduino manufacturer.



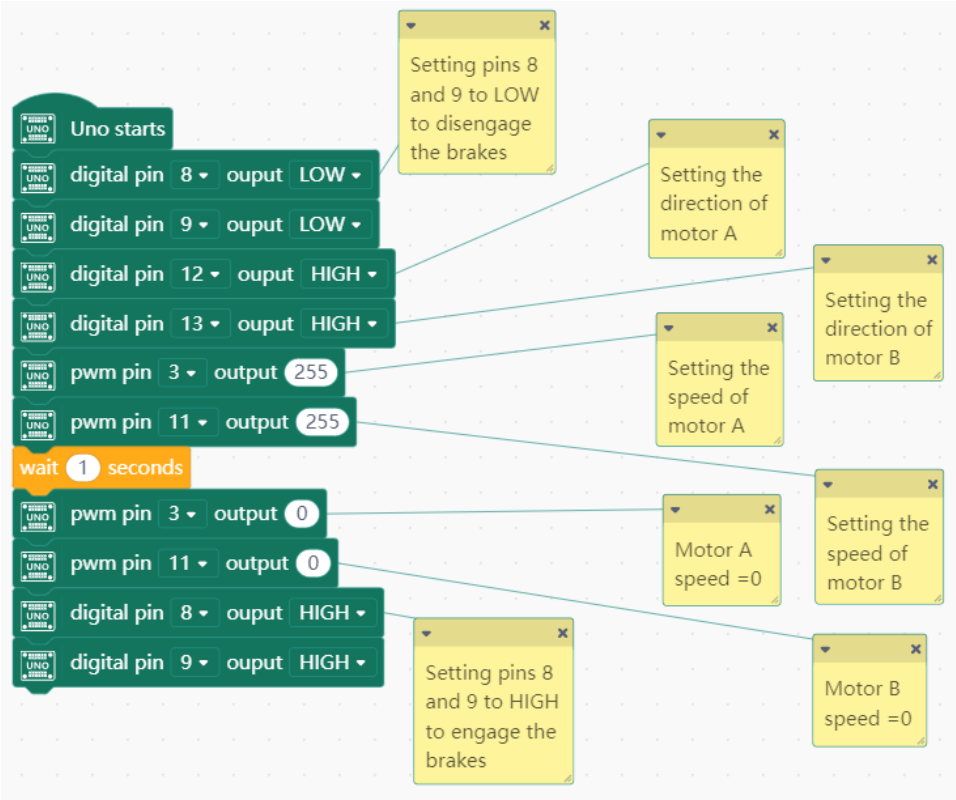
Basic movement

Remember this table from hardware introduction scenario?

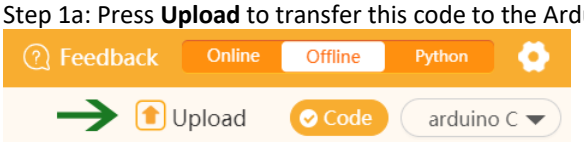
Function	Motor A	Motor B
Direction	Digital 12	Digital 13
Speed (PWM)	Digital 3	Digital 11
Brake	Digital 9	Digital 8
Current Sensing	Analog 0	Analog 1

Two motors (A and B) are left and right motors. Digital pins 12 and 13 are used to change directions (HIGH - one direction or LOW - opposite direction) and PWM pins 3 and 11 are used for setting the speed (0-255). Pins 9 and 8 engage/disengage the brakes (HIGH - brakes on, LOW - brakes off).

Below you can see the example of code with comments on the right side to help you understand how it works.



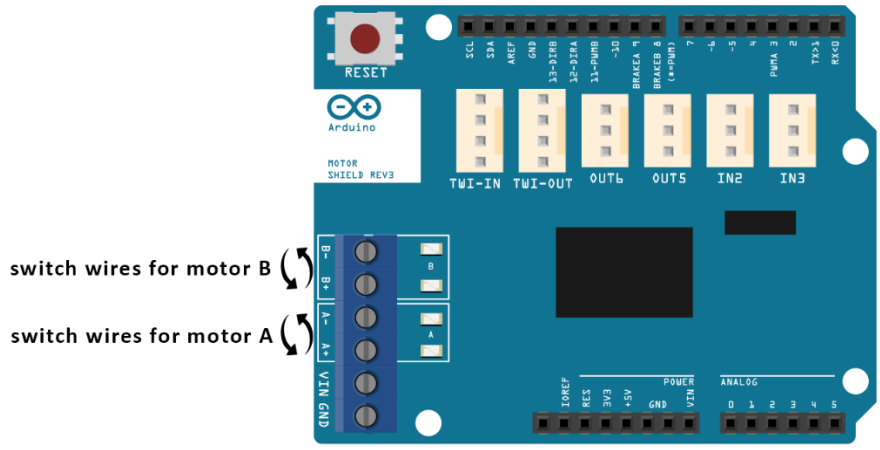
Step 1a: Press **Upload** to transfer this code to the Arduino UNO.



Step 2a: Be careful, robot will start to move immediately after uploading is done! Robot should move forward for one second and stop.

Troubleshooting - if the robot:

- drives backward - switch red and black wires in terminals for both motors.
- rotates clockwise- switch red and black wires in B motor terminals.
- rotates counter-clockwise - switch red and black wires in A motor terminal.



Now you should have your robot driving forward with HIGH state on pins 12 and 13.

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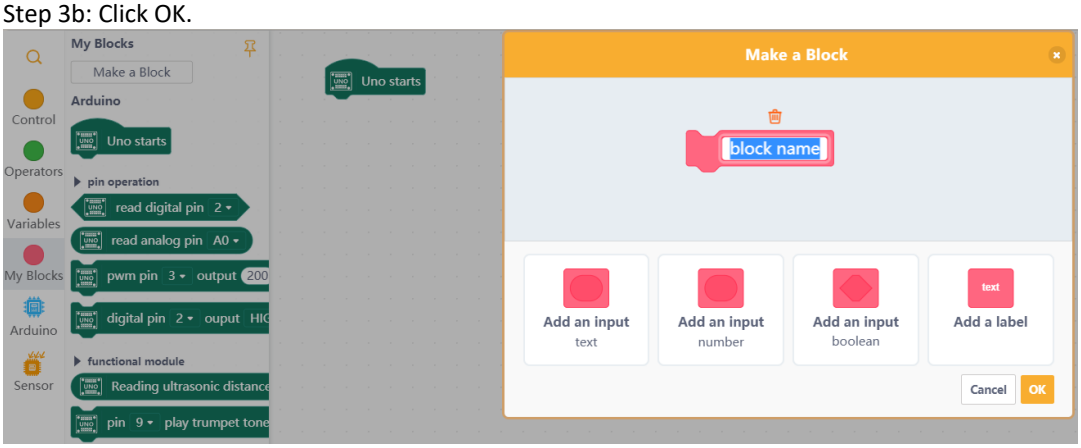
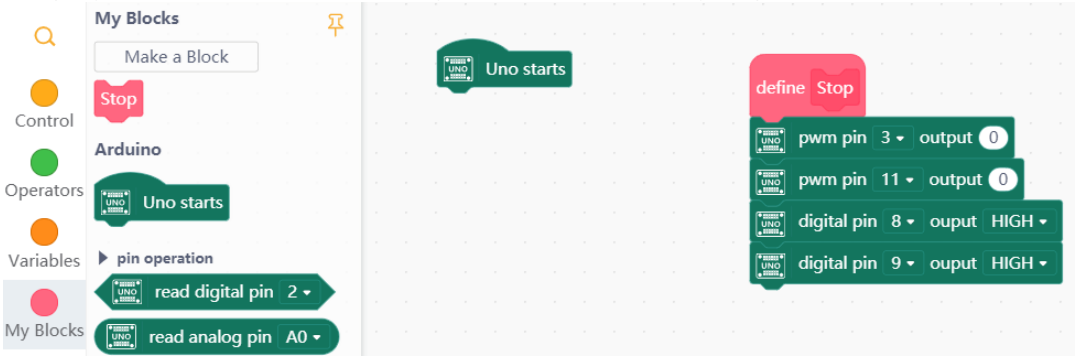
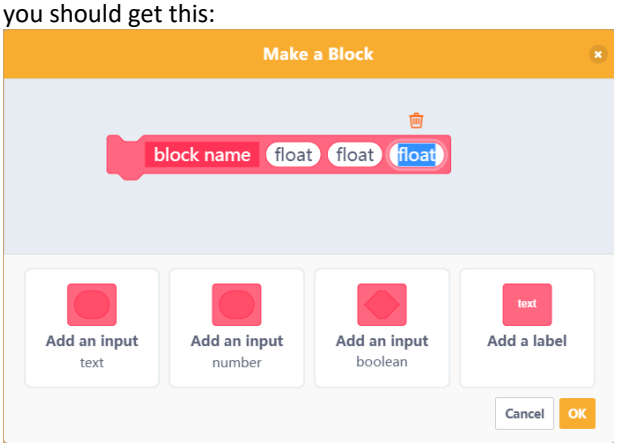
There is also an easier way to program movement – we will use our custom-made blocks instead of repeating whole bunch of pin setting blocks.
Step 1b: Click on My Blocks group (red).
Step 2b: Click on Make a Block button and change the "block name" to "Stop".
Step 3b: Click OK.



You got your first block, but it's currently not associated with anything, so we have to define it first.



Stop block contains 4 blocks. First two blocks are setting the speed of both motors to 0 and last two are "brakes on" blocks. If you want to use coasting just set the state of digital pins 8 and 9 to LOW.
Now it's time to make an input block with 3 numeric parameters which will keep the speed of both motors and duration. Click again on Make a Block button and then click on Add an input - number - 3 times and you should get this:



Change block name to Drive, first float to SpeedA, second float to SpeedB and third float to Time and click OK.

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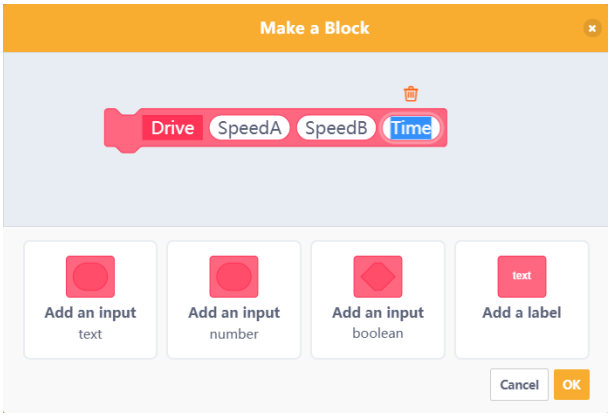
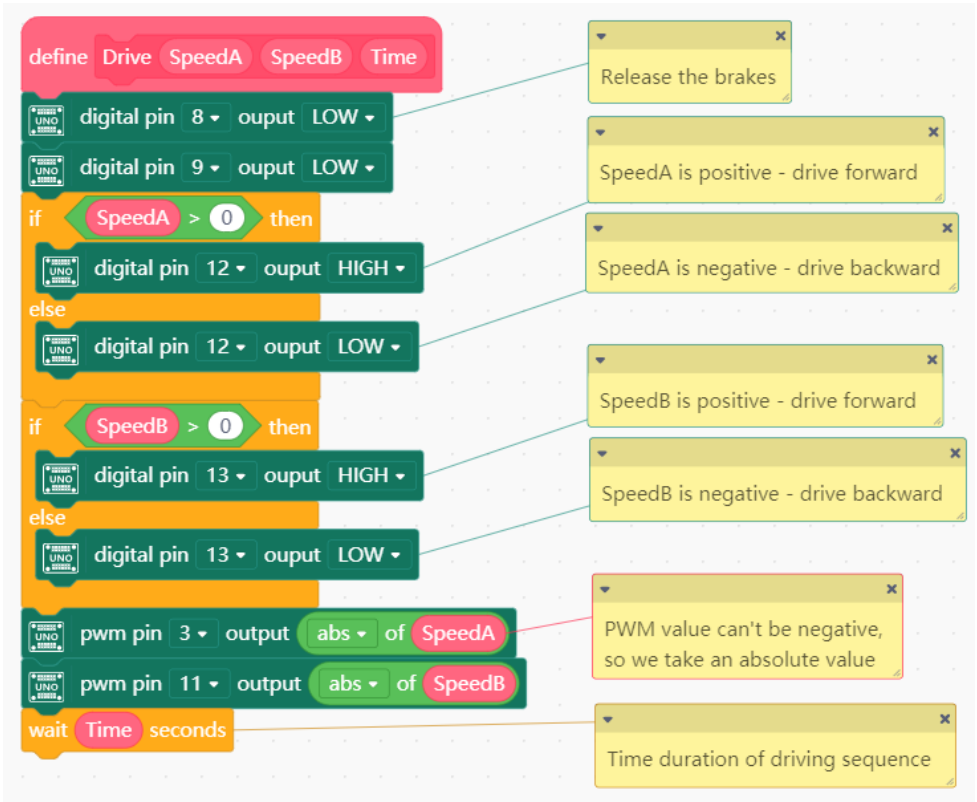


Basic idea is to get SpeedA and SpeedB values (acceptable range: -255 to 255), check if any of it is negative (or both) and if it is - reverse the direction by setting the correspondent direction pin. But to drive the motor you have to use the absolute value on PWM pin..



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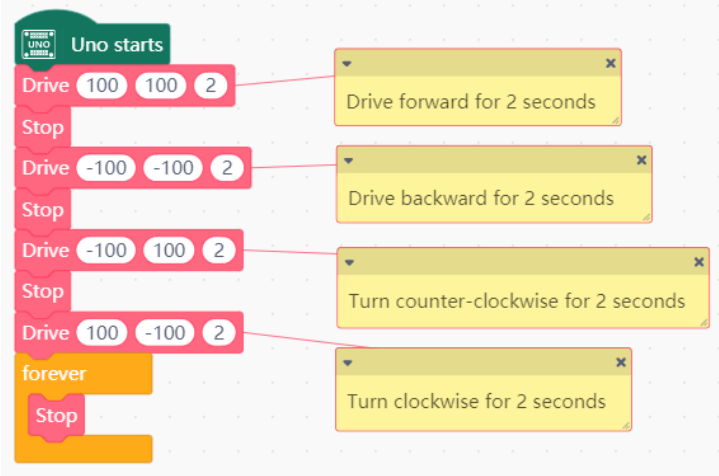
So, let's try to move the robot with our blocks.



Last Stop is in forever loop to end the movement.

Change the values in Drive block, upload your program to Arduino UNO and analyse how fast your robot moves.

You are now ready to use your ARTIEbot in more complex projects including HuskyLens camera.

CONCLUSION

Let's face it, robots are cool. They're also going to run the world some day, and hopefully, at that time they will take pity on their poor soft fleshy creators (a.k.a. robot developers) and help us build a heaven in space . It is a joke of course, but only sort of.

Do the K.W.L. (**K**now, **W**ant, **L**earned) chart with your students.

What I **K**now	What I **W**ant to Know	What I **L**earned

Methods	***Work forms***
presentation *interactive exercise / simulation on the computer*	*work in pairs* *group work*

Material:

- http://mindplus.cc/download-en.html

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Literature

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PERSONAL OBSERVATIONS, COMMENTS AND NOTES