

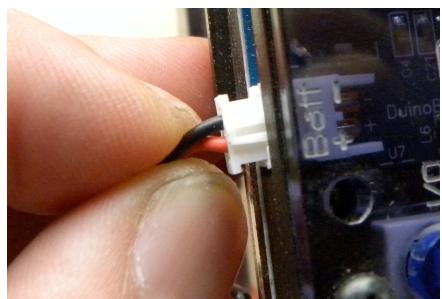
## TUTORIAL 5: FOLLOW THE LIGHT

**Description:** We humans have two legs, and we can move in any direction we want. Robots can be set up with two wheels and we can instruct them which direction to go. How fast, where to stop, how to turn, it's up to you.

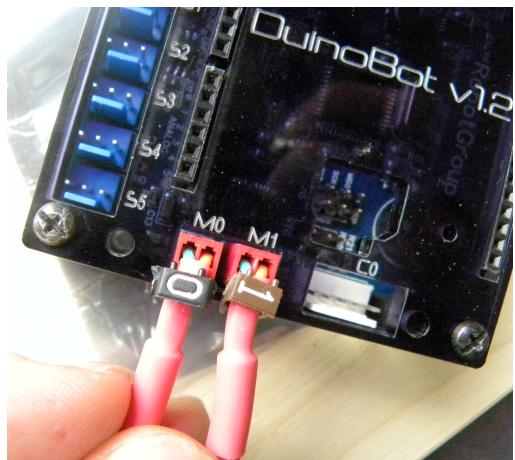
In this tutorial we will see how to make the robot follow a light. The principle is very simple: the robot will move its wheels faster according to which side detects brighter light.

### Materials needed:

- USB Cable
- Duinobot v1.1 or higher (or any board, just check what kind of batteries and motor it needs)
- Computer with miniBloq (v0.81 or higher)
- 3 x AA batteries (rechargeable recommended, protect the environment!)
- 2 x Motor 12VDC Multiplo compatible
- 2 x Cable (red) Multiplo compatible
- 2 x Cable (blue) Multiplo compatible
- 2 x Light sensors (LDR)



**STEP 1:** Connect the batteries because the motor needs more power than the provided by your USB. Remember to use 3xAA alkaline or rechargeable Ni-MH batteries. Switch it ON after connecting the batteries.



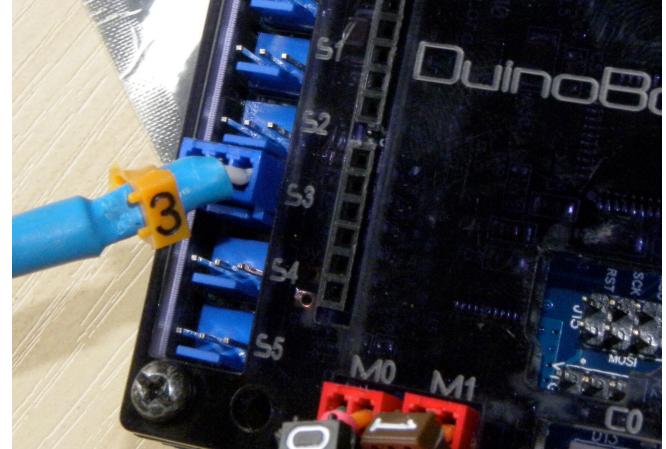
**STEP 2:** Connect the red cable into the motor output. Use the M0 input for the motor at the left and M1 for the motor at the right. If you mess up the connections, the robot will go backwards. So don't worry and learn by doing.



Connect the other side of the cables to the motors.

**STEP 3:** You will now connect a Light Sensor to the Brain of the robot. You can use the blue cables and note that you can connect to the SENSORS' inputs.

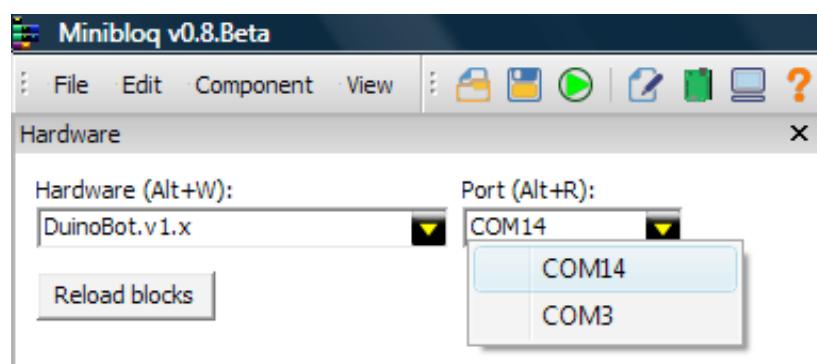
On the DuinoBot board, sensors start with S0 and end with S5, but there are expansion shields compatible with Arduino that can allow you to connect many more sensors, in case that your robot needs them.



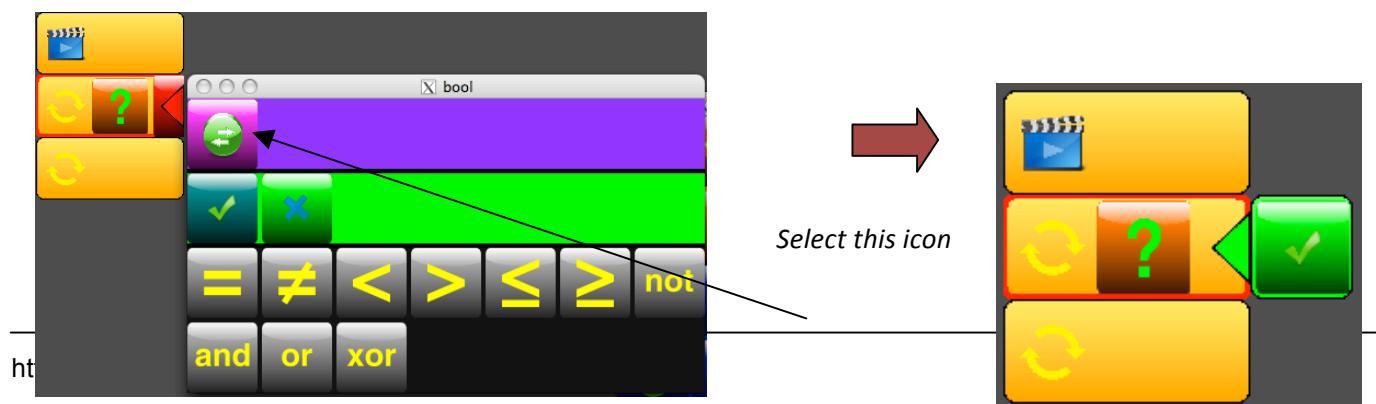
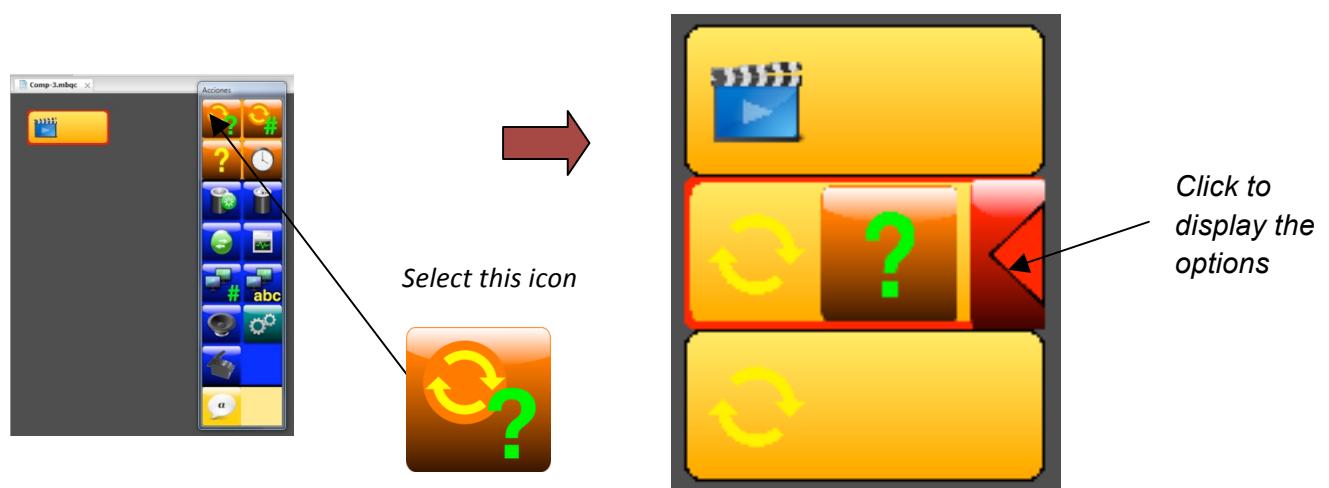
*Light Sensors internally have what is called a “photo-resistor” and they change when they see/detect a bright light. A perfectly rational explanation for these electrical parameters is that it is a kind of eye. The robot will see the light with these eyes. They are, of course, much simpler than human eyes, but still they can provide useful information to where to go.*



**STEP 4:** After connecting the board with the mini-USB cable, switch it ON. Make sure that the Hardware has your correct model of board. You should select the port with which it communicates and the type of board in the “hardware” miniBloq section (top left side of the screen).



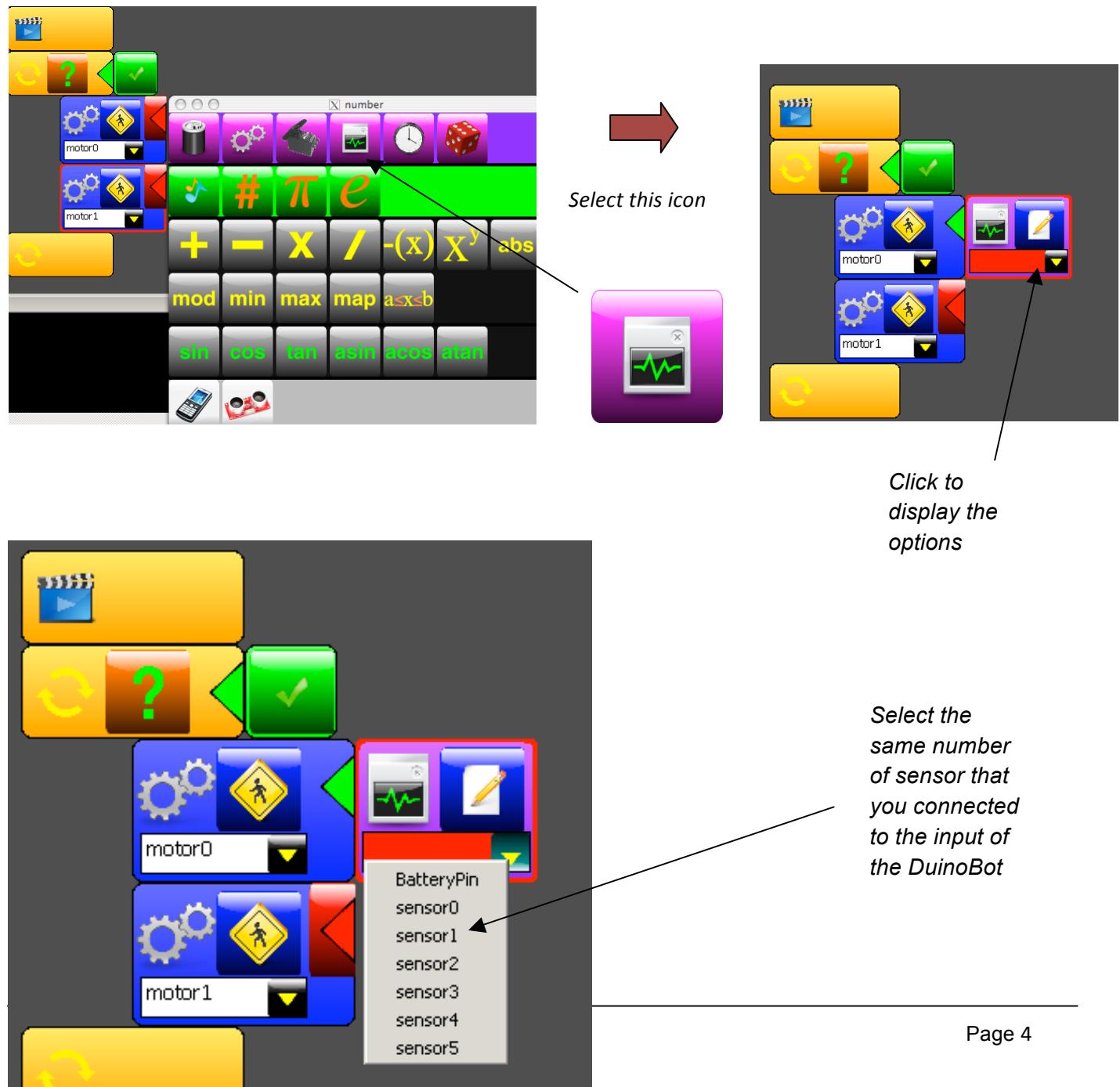
**STEP 4:** Once the board is connected and miniBloq is properly configured, create a new project, selecting from the “File” menu, the option “Create”.  
On your empty and new sketch, select the WHILE icon and set it up to run forever (with a TRUE condition, the green tick symbol).

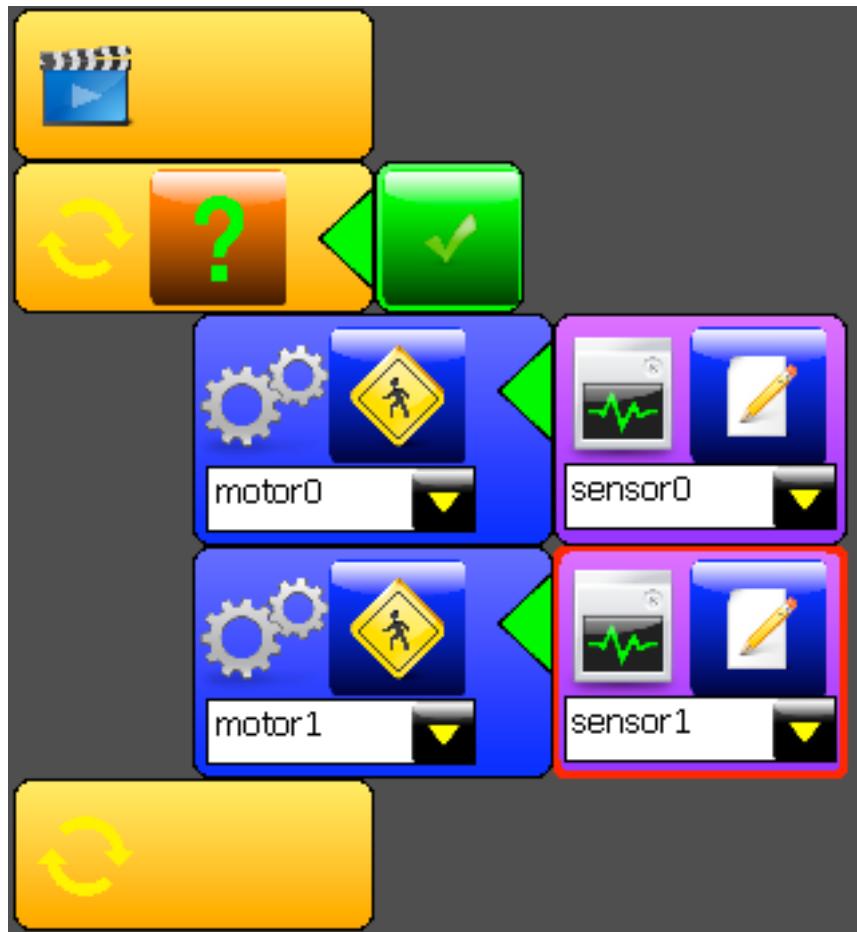




Then click on the gears icon, which symbolizes setting the motor status. With that we are going to be saying “Repeat this order endlessly”. Something like “Forever, slave, do this”. [Well, you can omit the part of slave.] In previous tutorials we have been assigning a constant value, a number, to the speed. This time it will be different.

**STEP 5:** When we open menus to set parameters, the second row (in green color) indicates constant numbers that will set up a fixed value. The first row (in purple) will set up dynamic values, which will be changing through the time.





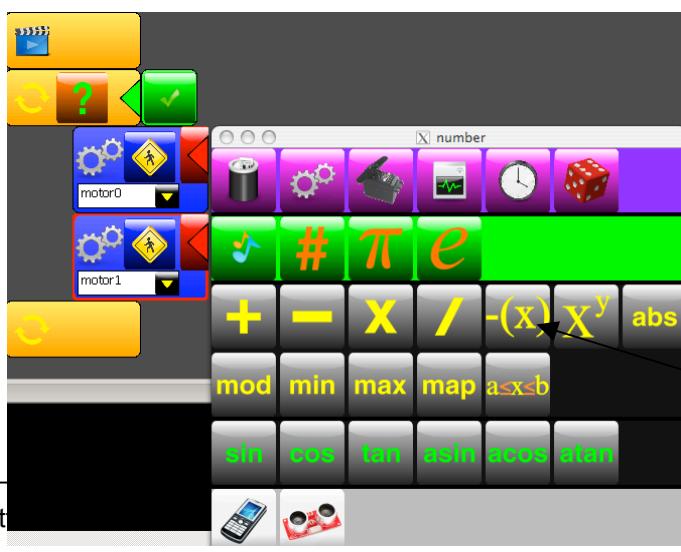
**STEP 6:** Set up the state of the motors to be updated with the state of the sensors, like shown in the picture.

Once that you program it by pressing the button “RUN” , you can test the result by getting a bright light next to each of the sensors and see how the wheels spin.

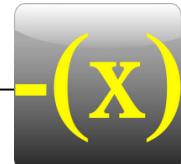
Any LED flashlight (from your cell phone or your bike) will work. You can also see the effect of exposing it to direct sunlight.

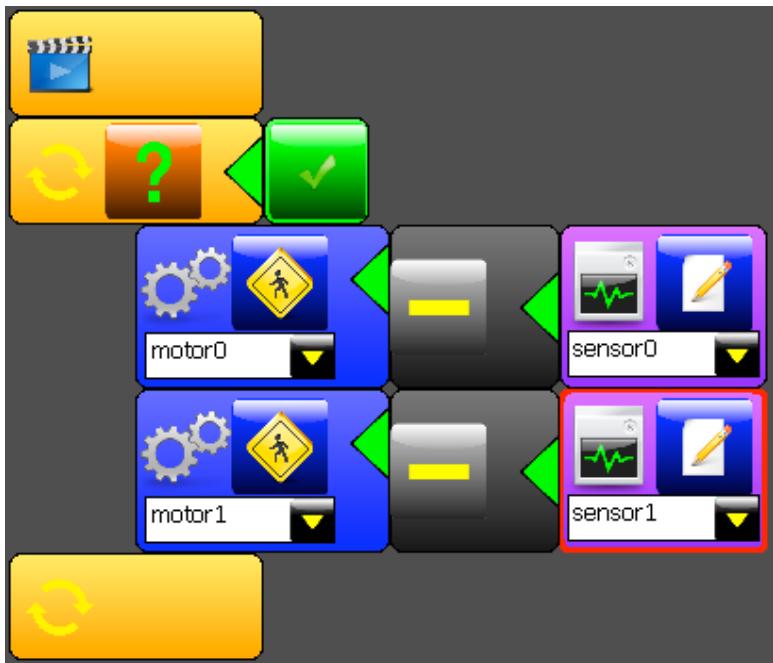
Try out to set up that Motor0 moves as fast as Sensor1 detects light. And Motor1 as fast as Sensor0.

With both sensors mounted on the front of the robot, you might get it moving ahead when there is a light in front of it. And actually turning left and right.



**STEP 7:** Once that you have mastered the technique of following a light, you might want to get the robot to get away from a light. For this we will use a mathematical operation to modify the speed of the robot. We already used this function previously in order to make the motor move backwards. Yes, the negative function!





*While the sensor has “some output”, the motor state will be updated to that value. If you are not in complete darkness, the eyes of the robot will sense some light. That means that nevertheless that the photo-resistor inside of the light sensor is not pointed directly by your flashlight, they will get some value.*

*You might see this effect by the robot moving without any bright light going directly into its eyes. We will solve this problem in future tutorials adding some intelligence to our robot.*