

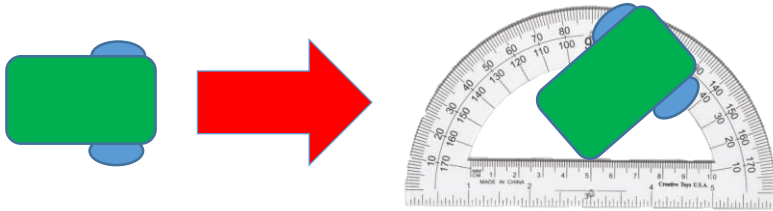
Lecture 2: Educational robotics. Turn_degrees My BLOCK

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Lesson Objectives

1. Create a useful My Block
2. Learn to make a My Block that will take inputs based on measurements with a protractor
3. Make a Turn_Degrees My Block

Rotation vs. Protactor Degrees



45 degree turn by the robot in the real world can be measured with a protractor. **We call this protractor degrees.**



You can use the EV3 to measure how much your wheel turns. **We call this rotation degrees.**

- Just like Move_CM, you can also create a My Block for turns. In Move Centimeters, we had to figure out how much the robot wheels rotate for one CM.
- To make a Turn Degrees My Block, you have to figure out how much your rotation sensor on the motor turns for one degree on a protractor.

Turn Degrees in 3 Easy Steps

STEP 1: How many rotation degrees does the robot turn for every 1 protractor degree?

- STEP 1A: Rotation Sensor Measurement
- STEP 1B: Program the robot to turn 1 protractor degree

STEP 2: Add a Math Block to convert protractor degrees to rotation degrees.

STEP 3: Create a Turn_Degrees My Block with 2 inputs (power and degrees)

Step 1A: Measuring Rotation Sensor

Calculate how many motor degrees are in 1 protractor degree

- Go to Port View and pick the rotation sensor on your motor
- Hold one wheel in place and only turn the other wheel (Pivot Turn). Turn the robot any number of degrees you choose. Make sure the wheels don't slip when you do this.
- Look at the Motor Degree value and divide by the number of protractor degrees you turned.
- This is the number of rotation degrees in 1 protractor degree.

An example using Droid Bot

- Robot was turned 90 protractor degrees
- Using Port View, the motor moved 330 degrees
- $330 \text{ motor degrees} / 90 \text{ protractor degrees} = 3.7$



Step 1B: Turn the Robot 1 degree

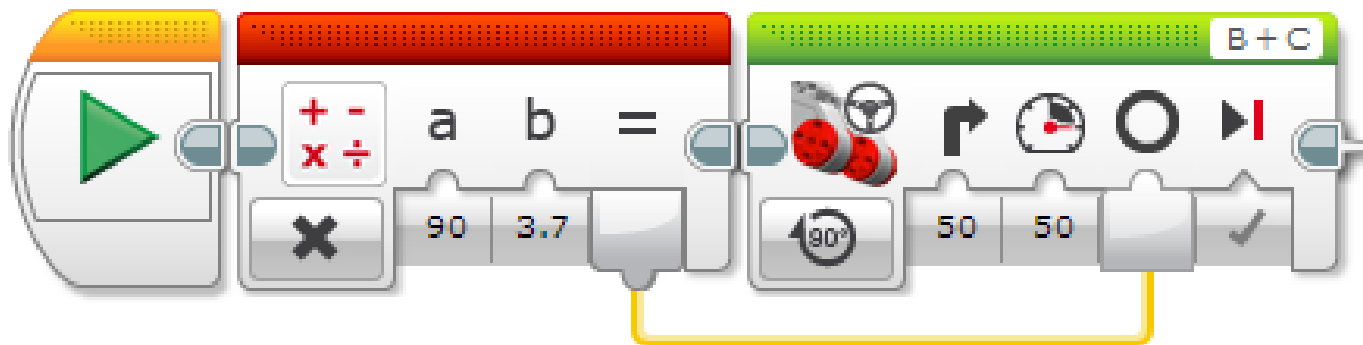
The goal of this program is to turn the robot 1 protractor degree.



3.7 is the number of motor degrees in 1 protractor degree for Droid Bot. You will have to customize this based on your robot using Step 1A in the Powerpoint instructions.

Step 2: Protractor to Motor Degree

The goal of this program is to automate the conversion between protractor degrees and motor degrees.

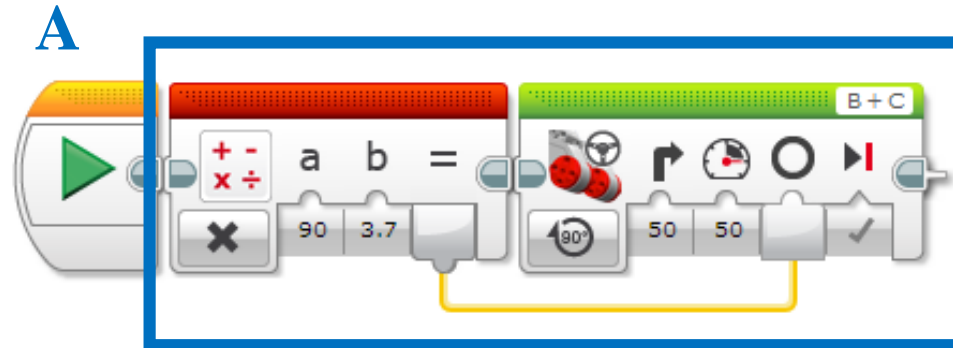


We use a math block to multiply the amount of protractor degrees (input a) by the degrees per motor degree (input b). 3.7 is specific to Droid Bot.

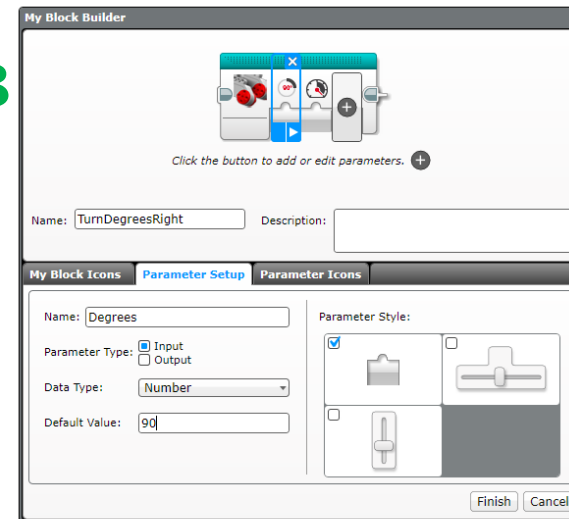
The result of the Math Block is passed into the Move Steering block

Step 3A: Set up My Block

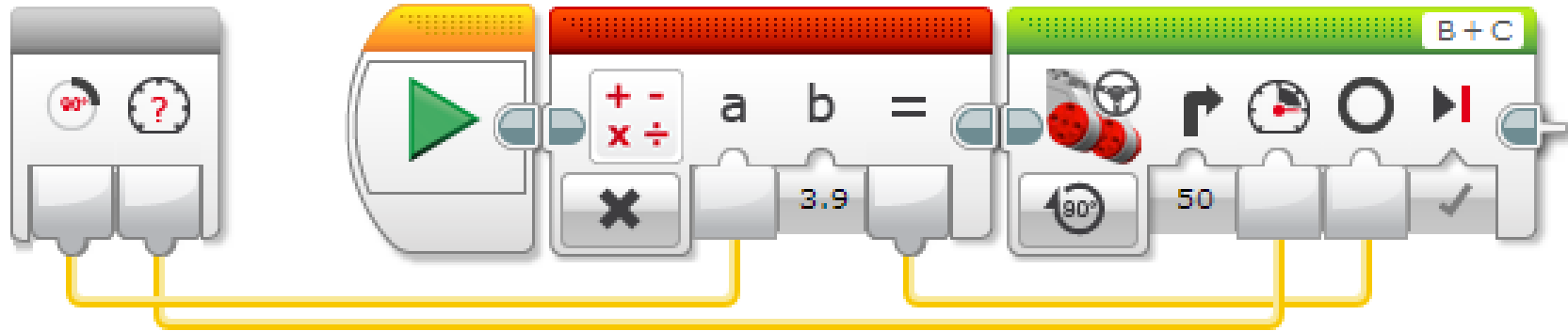
- A. Highlight the two blocks and go to My Block Builder
- B. Create two inputs: one for degrees and one for power. Both inputs should be setup as numeric inputs
- *Refer to the My Blocks with Inputs & Outputs lesson if you need help setting up the My Block*



B



STEP 3A: Wire the Inputs



C. Wire the inputs in the grey block. The degrees input connects to the Math Block. The power goes into the Move Steering Block's power input. The result of the Math Block is wired into the Move Steering Block's degree input.

Step 3B: Turn_Degrees My Block

Repeat the process to make a My Block for Left and Right Turns. You can double click on any my block to look inside and see the contents.

Each My Block has two inputs: degrees and power

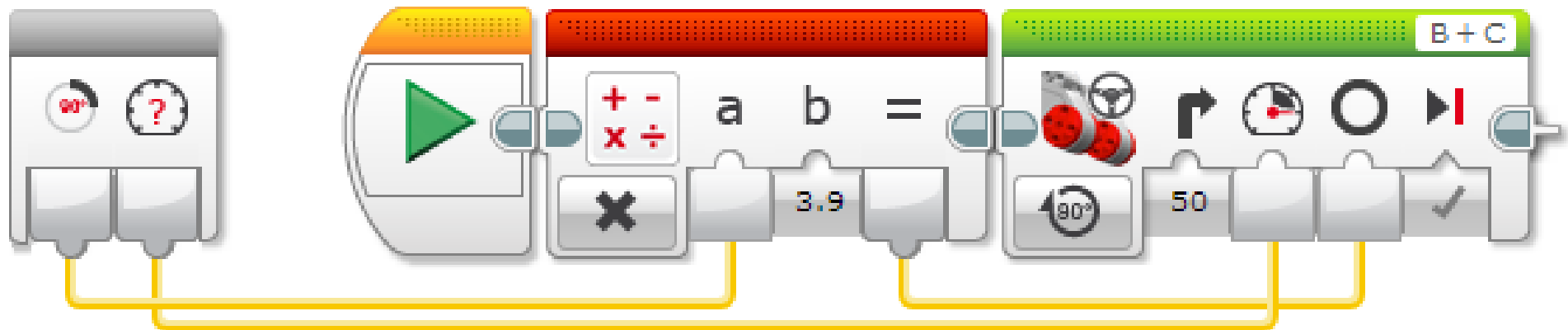


This my block turns the robot right.

This my block turns the robot left.

STEP 3B: Inside Turn_degrees Right

This program is Step 2 converted into a my block with two numeric inputs: degrees and power

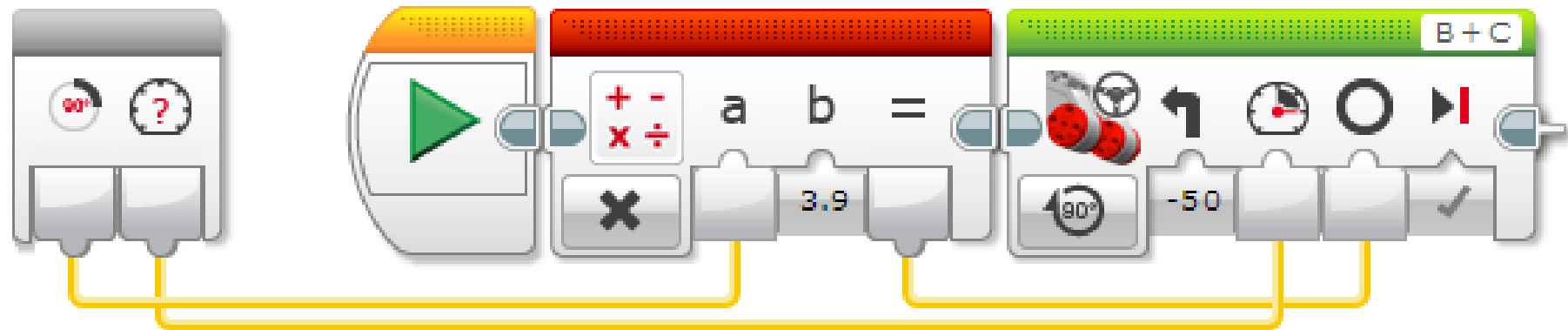


This block converts protractor degrees to motor degrees.

We turn the motor for the amount of degrees that was calculated in the previous block.

STEP 3B: Inside Turn_degrees left

This program is Step 2 converted into a my block with two numeric inputs: degrees and power. This was converted to do a left turn.



This my block converts protractor degrees to motor degrees.

We turn the motor for the amount of degrees that was calculated in the previous block.

Discussion

Why is a Turn_Degree My Block useful?

- You can measure turns using a protractor and input this number into your turn block

Will changing the inputs in one copy of Turn_Degrees impact another copy of it?

- No. That is exactly why a My Block is useful. You can use the same block multiple times, each time using a different number for power and degrees (or any other parameter you set up).

Can you alter a My Block after it is made?

- You can change any of the contents, but not the grey blocks (input and output parameters). If you need to make changes to the parameters, you must remake your My Block.

References

- Benedettelli, D. (2014), *THE LEGO® MINDSTORMS® EV3 LABORATORY build, program, and experiment with wicked cool robots*. William Pollock, USA.
- Griffin, T. (2014), *THE ART OF LEGO® MINDSTORMS® EV3 PROGRAMMING*. No Starch Press, USA.
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- Filipov, S.A. (2013), *Robotics for children and parents*, Fradkova, A.L., St. Petersburg.