Basic Bot

Robots & God Workshop

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Robotics Overview

Design
Build
Program
Test
Debug
Fix
Repeat

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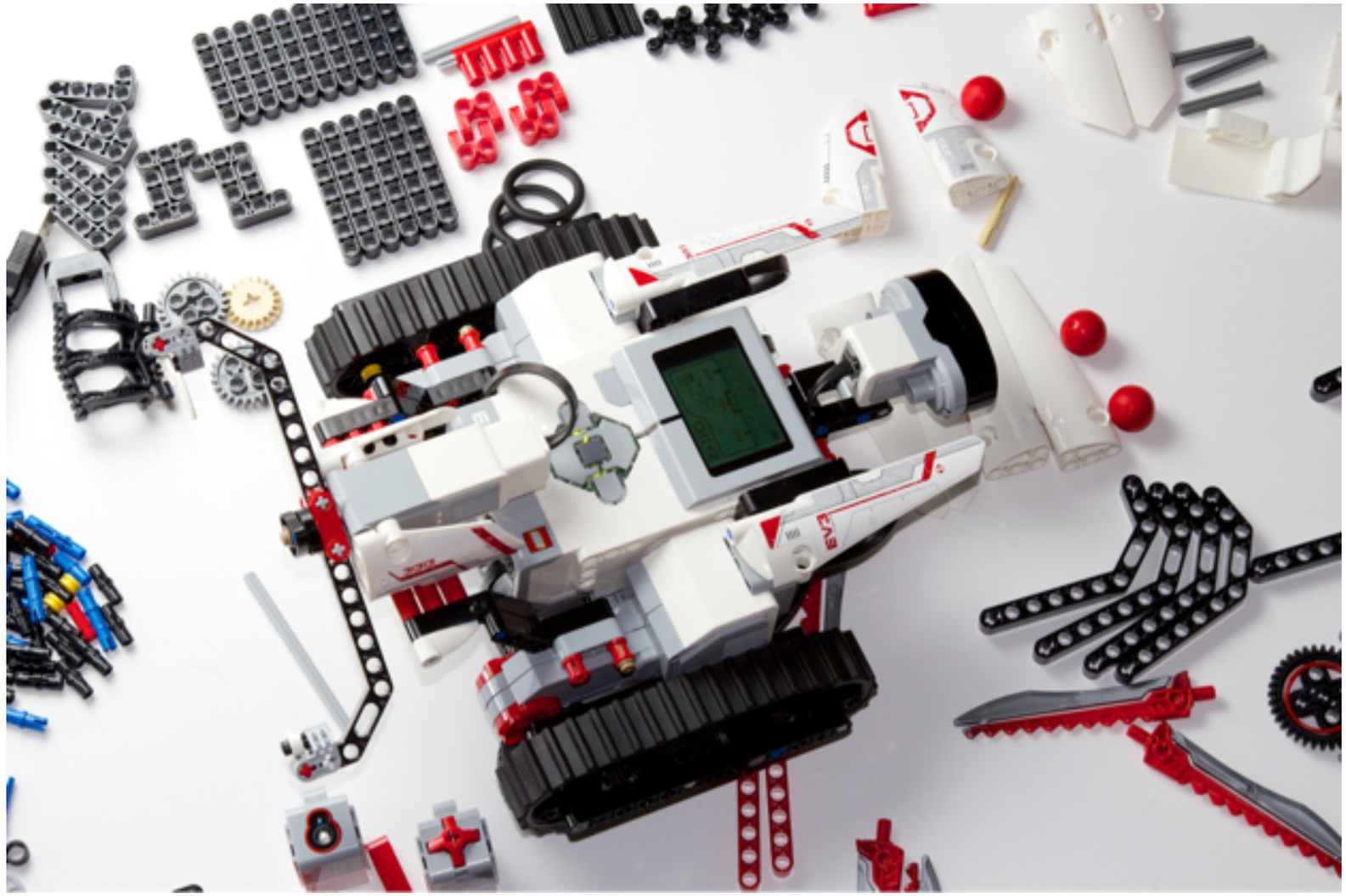
LEGO Mindstorm EV3 Robotics Kit

Computer (brick)
Sensors
Structure
Motors
Gears
Wheels
Power



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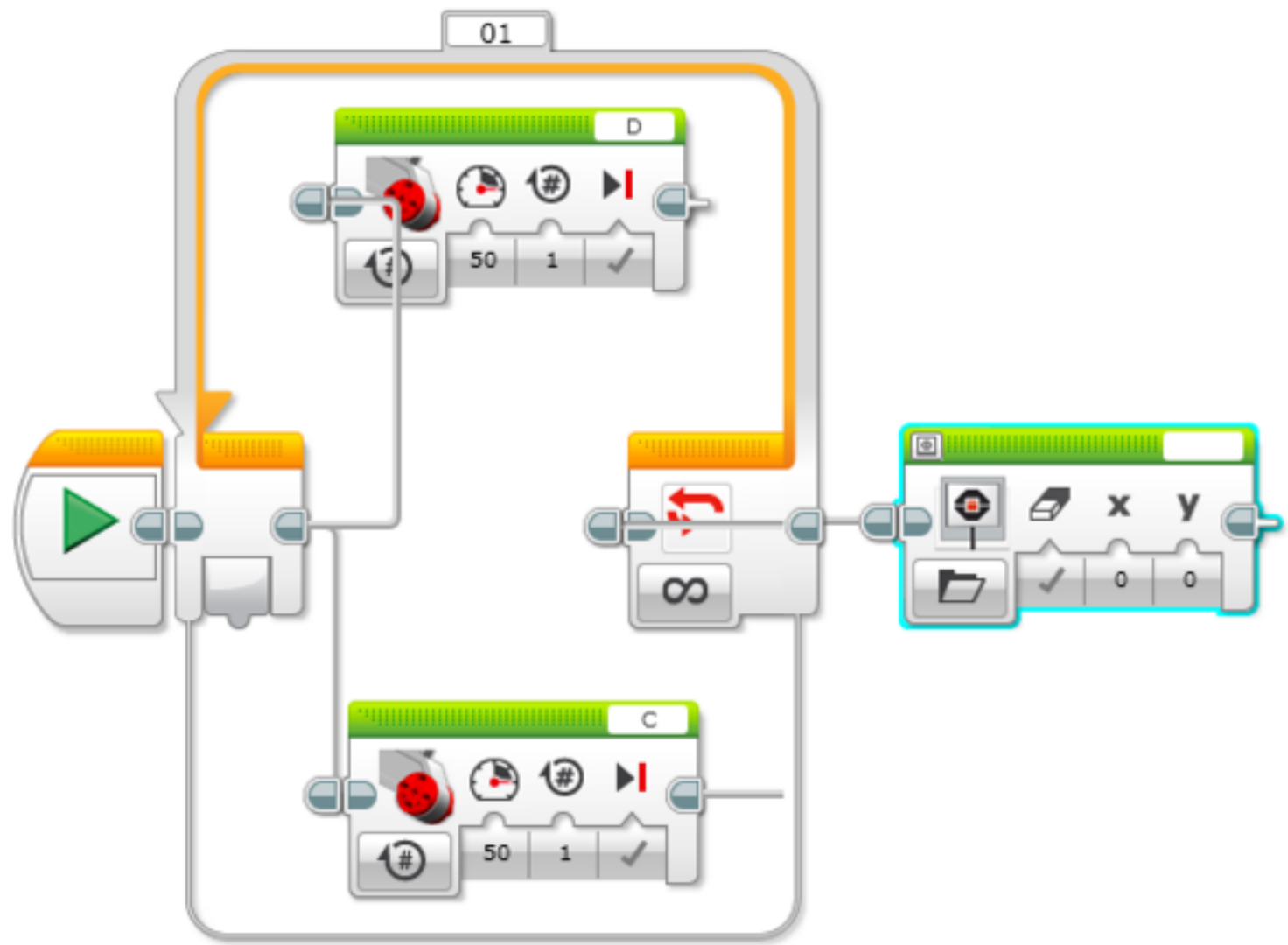
Programming: teaching robot what to do

blocks are commands
types of blocks
motor
sensor
loop
conditional



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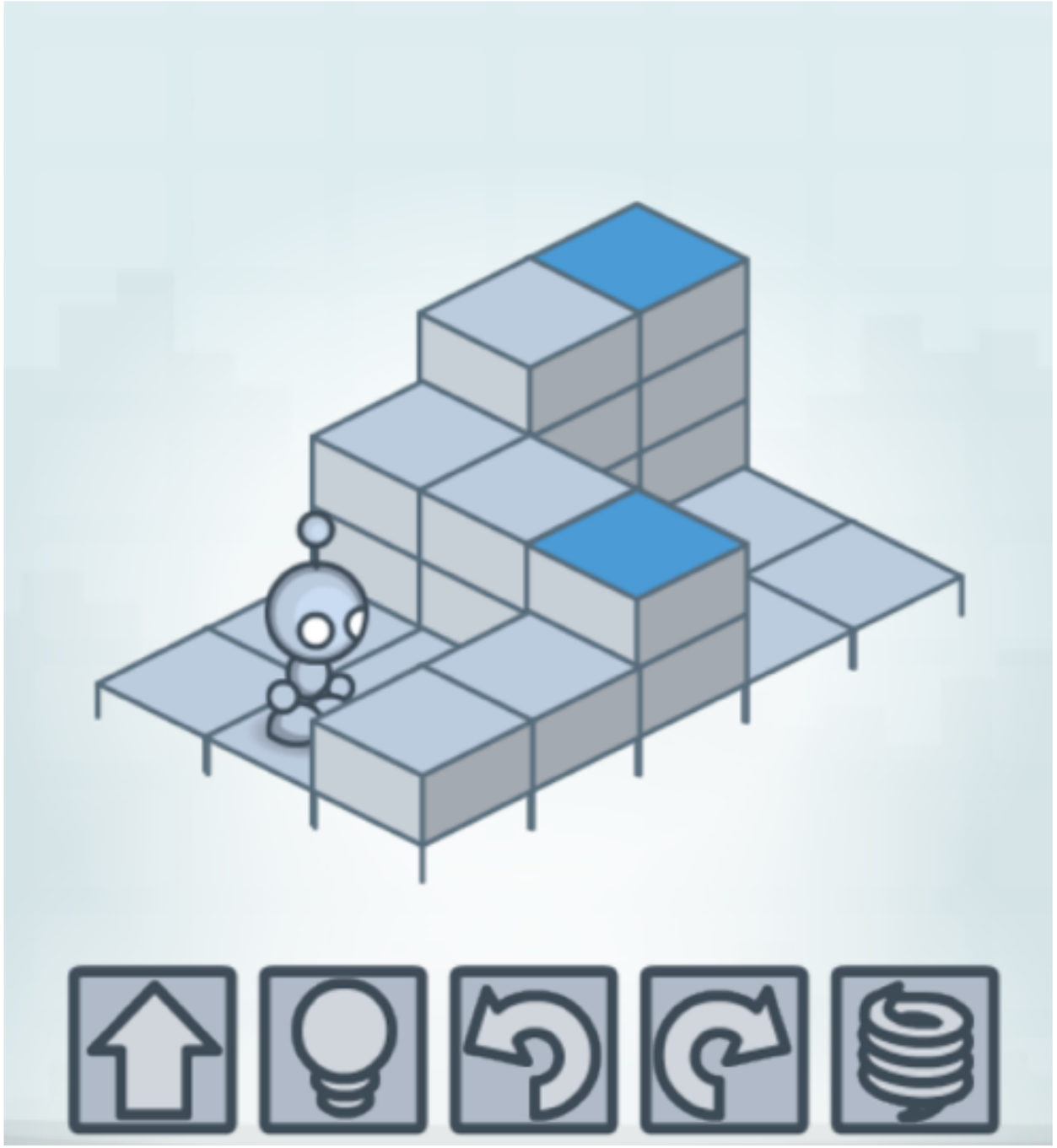
Programming, also known as coding, makes robots come alive!

problem to solve

commands robot knows

sequence commands to solve the problem



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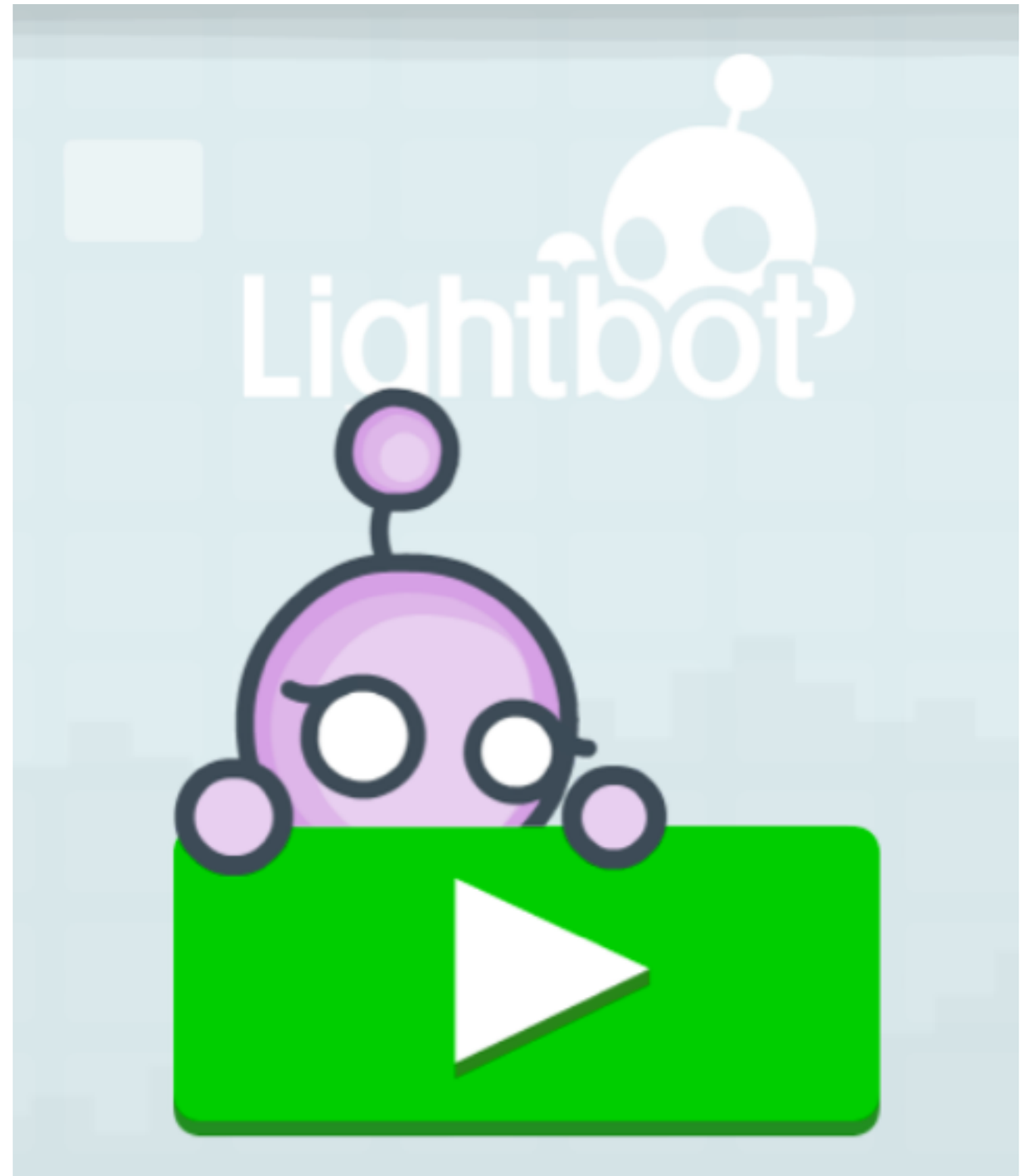
Work thru LightBot to learn basics of programming

see how many levels you can work thru until your teacher tells you to stop

show your teacher how many levels your team did



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Lego EV3 Brick

computer

programmed from
iPad app or display

commands are Lego-like
blocks

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Connecting iPad to Brick

Hey student!

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Bluetooth Dilema

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Lego EV3 Brick: Getting Started

- learn the buttons & display icons
- battery level
- access program files
- view sensor ports
- brick settings (bluetooth)
- rename your brick
- show your teacher

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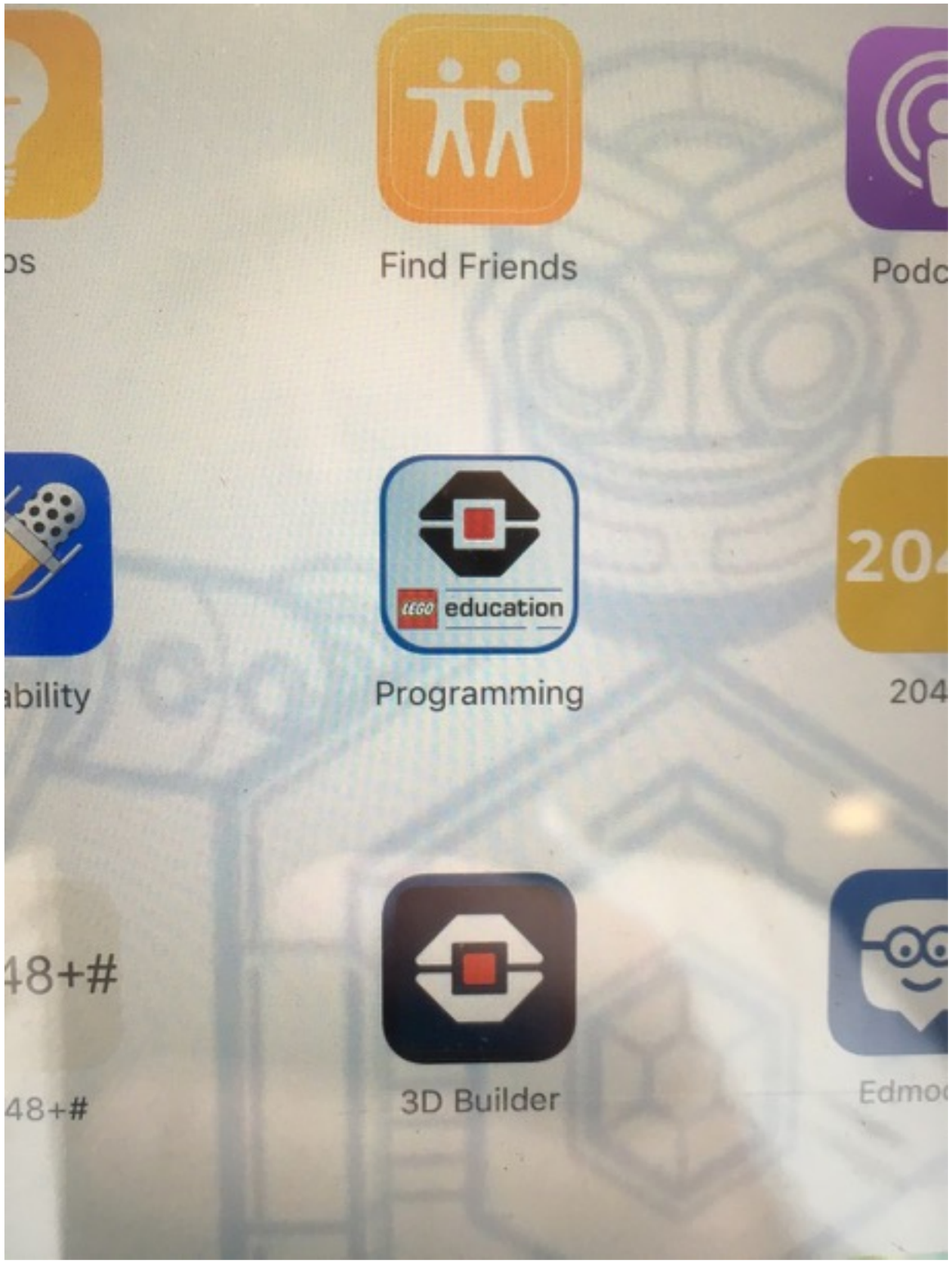
Lego Mindstorm App: Program the Brick

- connect iPad to brick
- rename program
- display your team's name
- say your team's name
- make program stop when user hits any button
- run program from iPad
- run program from brick
- **show your teacher**




dan
My Sound
8
3
2
100
2

Brick Program Challenge Program

- write a program that will do the following using the switch block
  - display each team member's first name when a specific button is pressed on the brick (for example if left is pressed then display Tom, right display Joe, etc)
  - if nothing is pushed display "push a button"
  - repeat this forever (infinity)
  - demo to a teacher
- modify the program to center each the display of the name
- **show your teacher**

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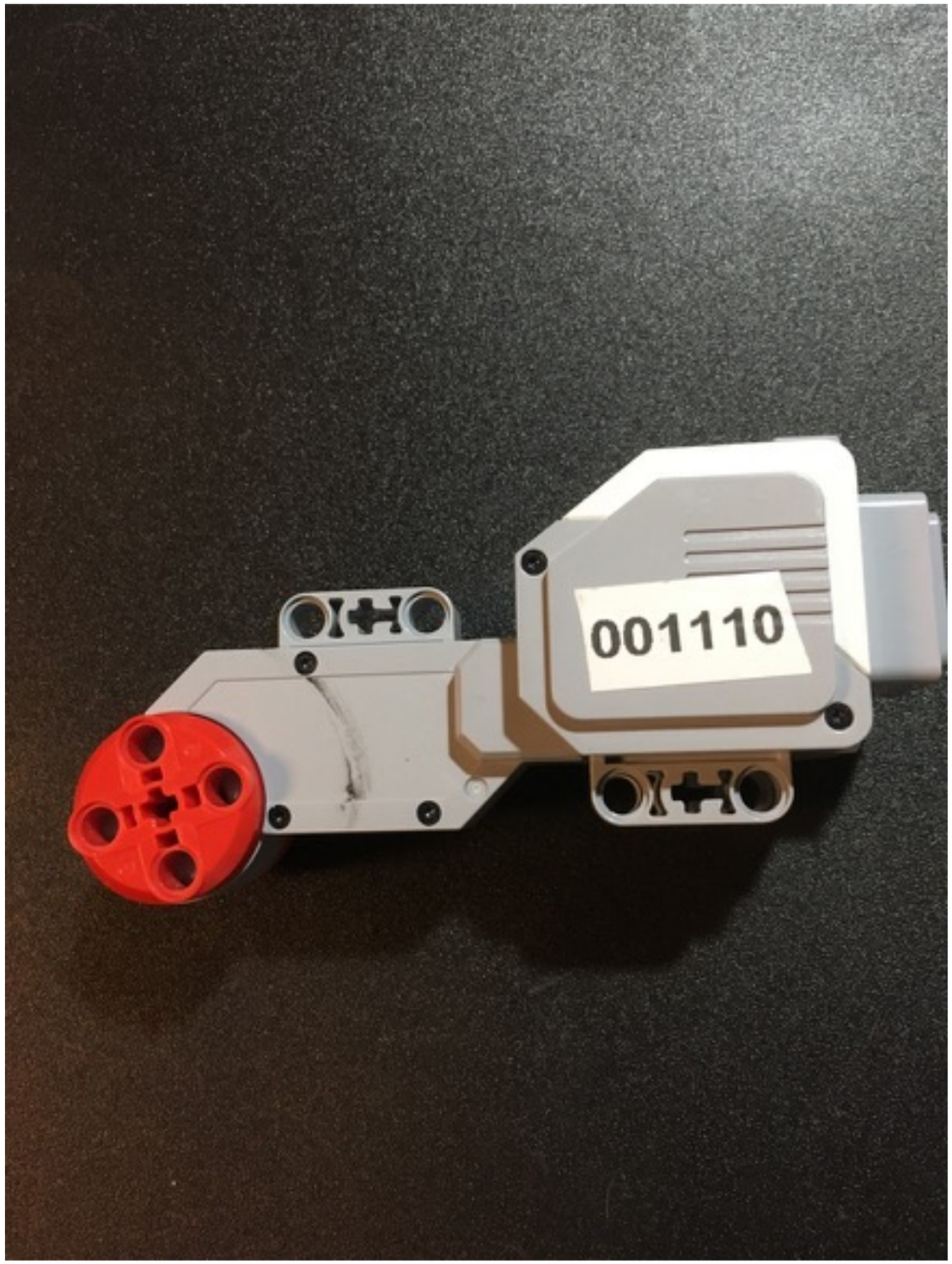
Learn Motors

- 2 large - for moving the bot
- 1 medium - for arm like thing
- movement measured in
  - degrees
  - # rotations
  - time

- configure the following
  - port
  - measure type
  - length
  - power
  - brake or coast



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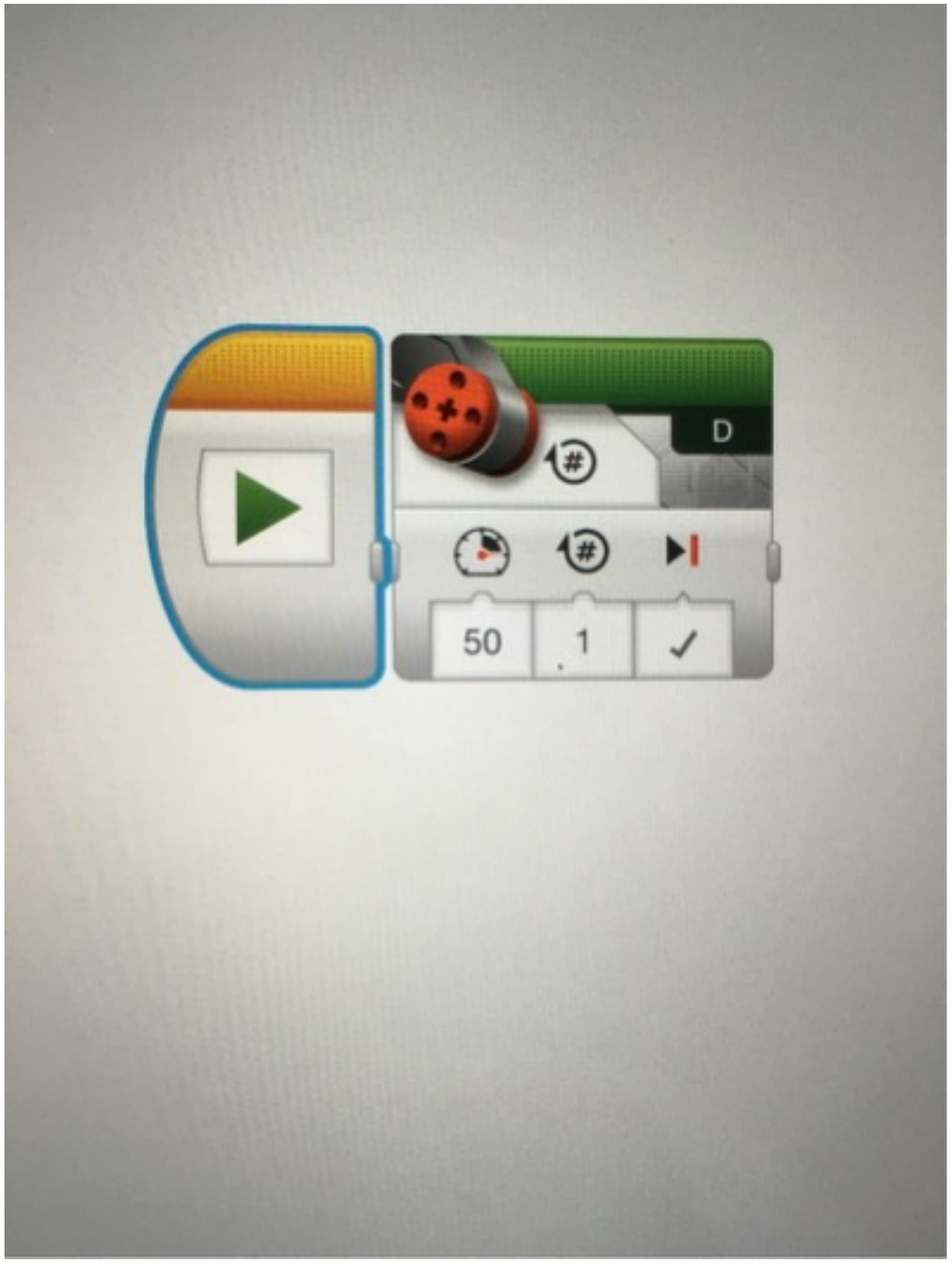
Program: Motors in Sequence

- connect a large motor
- program to do 3 rotations
- experiment with speed & direction
- program motor to turn 30 degrees very slowly
- add 2nd motor & make it turn after the first
  - make first motor turn twice
  - make second motor turn 4 times in reverse
- now make 2nd motor turn twice as fast as the first motor, still in reverse
- **show your teacher**



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Sequence vs Parallel

wash face, then comb hair, then brush teeth

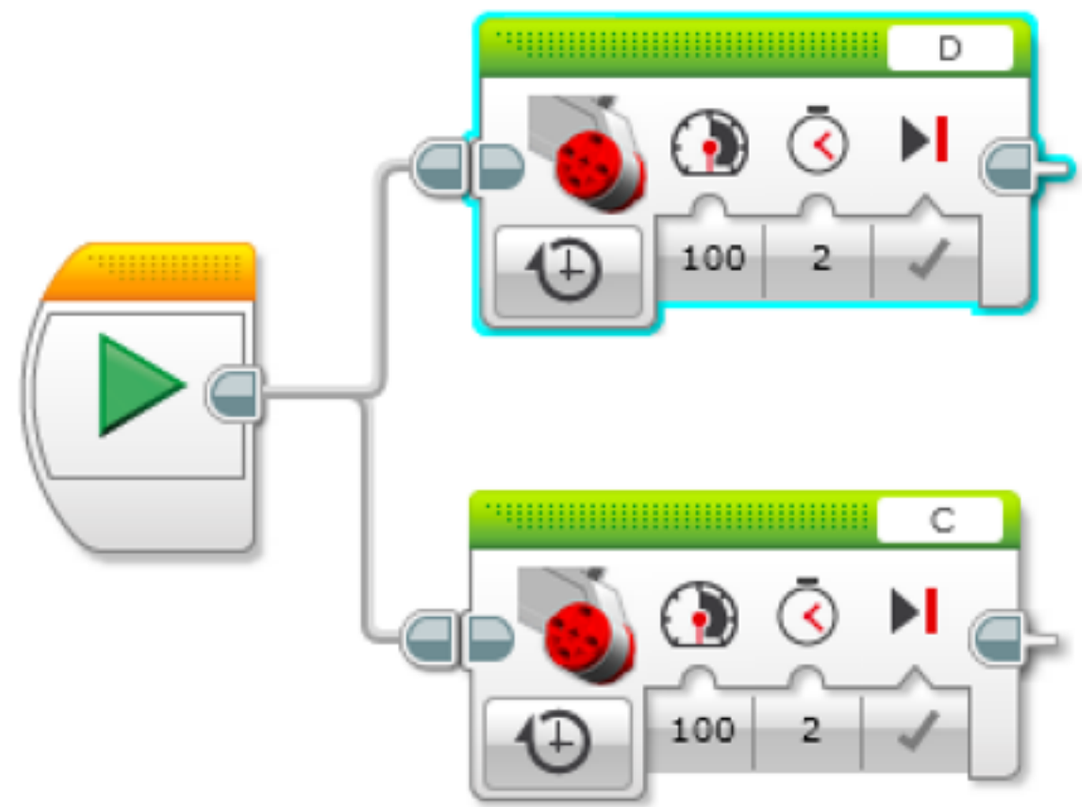
Sequence vs Parallel

+

brushing teeth while listening to music

Program: Motors in Parallel

- make both motors turn at same time in same direction, for 2 seconds at maximum speed
- while the motors are turning, display a message before each motor turns, display a message when motor stops
- **show your teacher**



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which motor
x y AA
0 0 0
motor a
x y AA
0 17 0
D
50 1
done
x y AA
0 111 0
3
motor b
x y AA
0 51 2
A
50 1
done
x y AA
0 111 0
3

Motor: multiple action blocks

- goal: make each motor turn at different speeds and different directions at the same time
  - make one motor turn 2 seconds forward then 3 seconds backward then 180 degrees forward (this will require 3 large motor blocks)
  - at the same time make the other motor do the opposite direction (three more large motor blocks)
- note: faster to use copy/paste of blocks
- **show your teacher**

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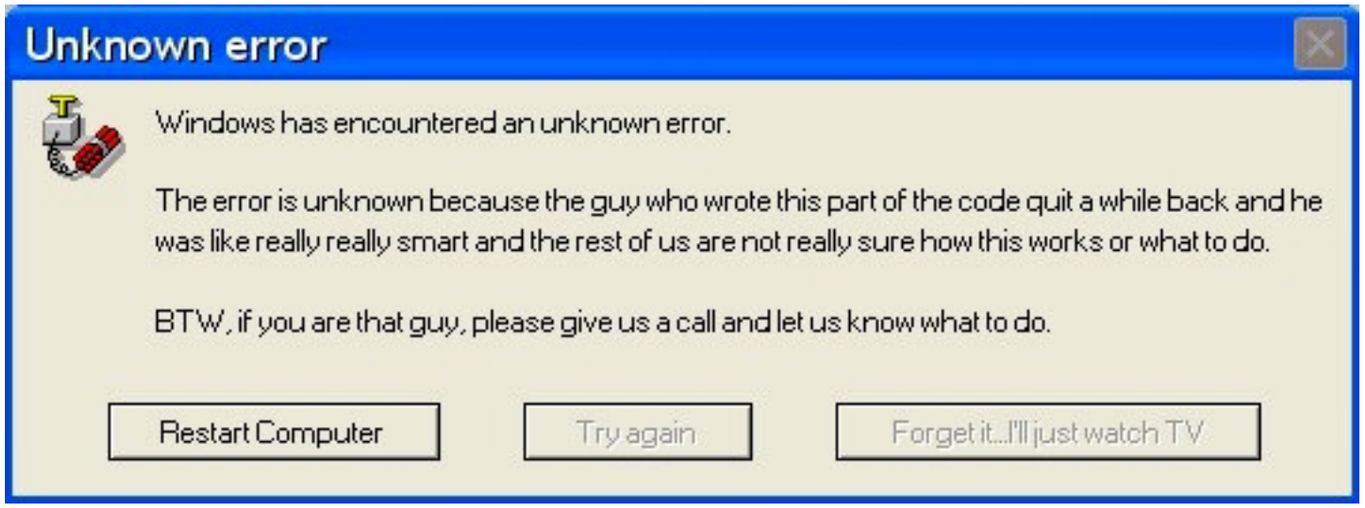
Logic Errors

- as you work with more complex programs, you will run into logic errors
- you will accidentally tell the computer to do something that it cannot do
- or something that doesn't solve the problem right
- these are called logic errors
- learning how to detect and correct logic errors is a HUGE part of becoming a good programmer



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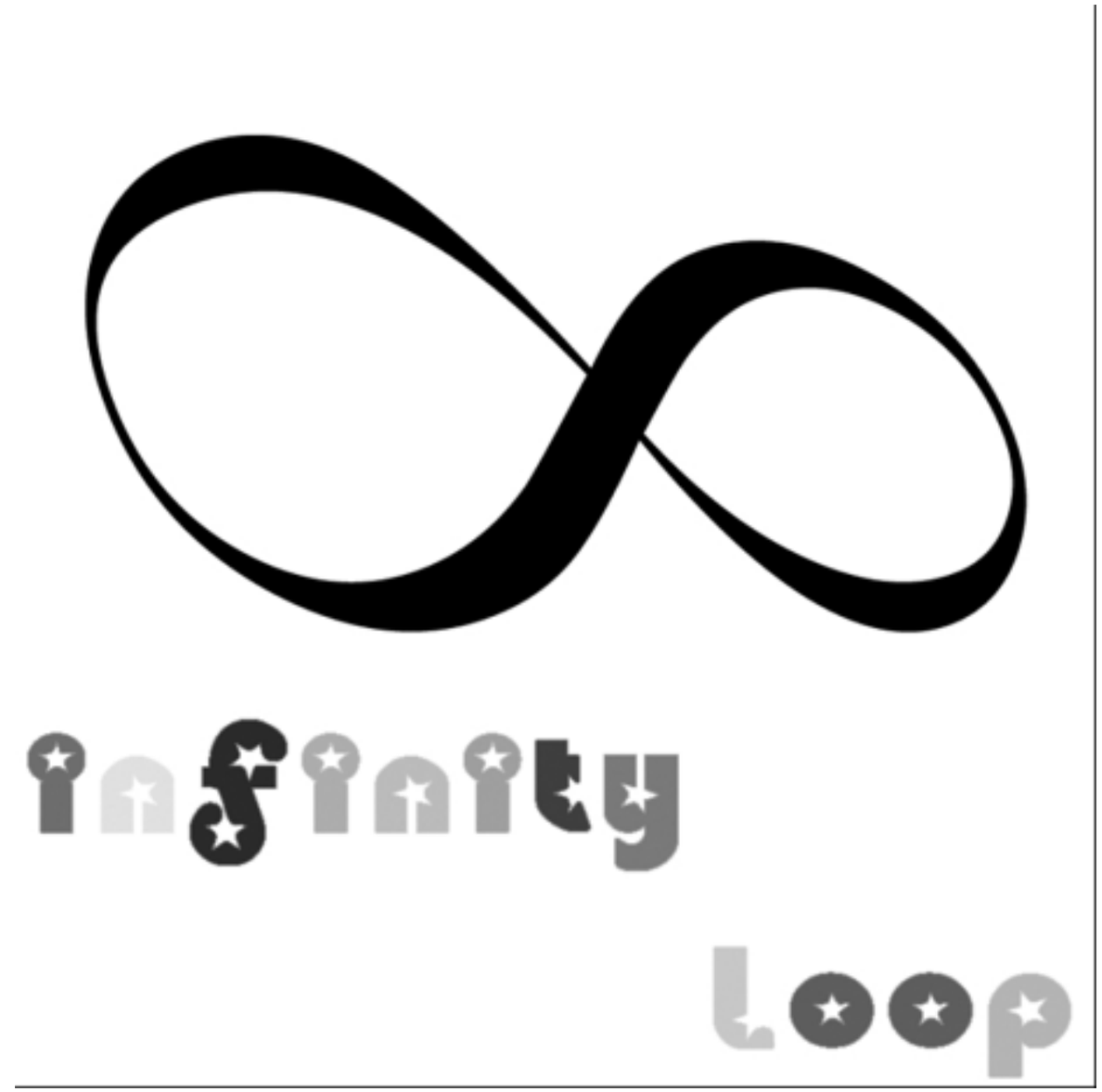
Infinite Loop

- program one motor to go for 1 second with speed 0
  - notice the green flashing lights on top of the brick
  - also notice the action block is flashing
  - this is called an infinite loop
  - you have just told the robot to do something that is not possible
  - we call this a logic error
- **show your teacher**



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Time to build the Basic Bot

Let the building begin!!

Step 1

Prepare brick for mounting bracket to hold motor

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Step 2

Install mounting brackets for motor

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Step 3

repeat for other side of brick

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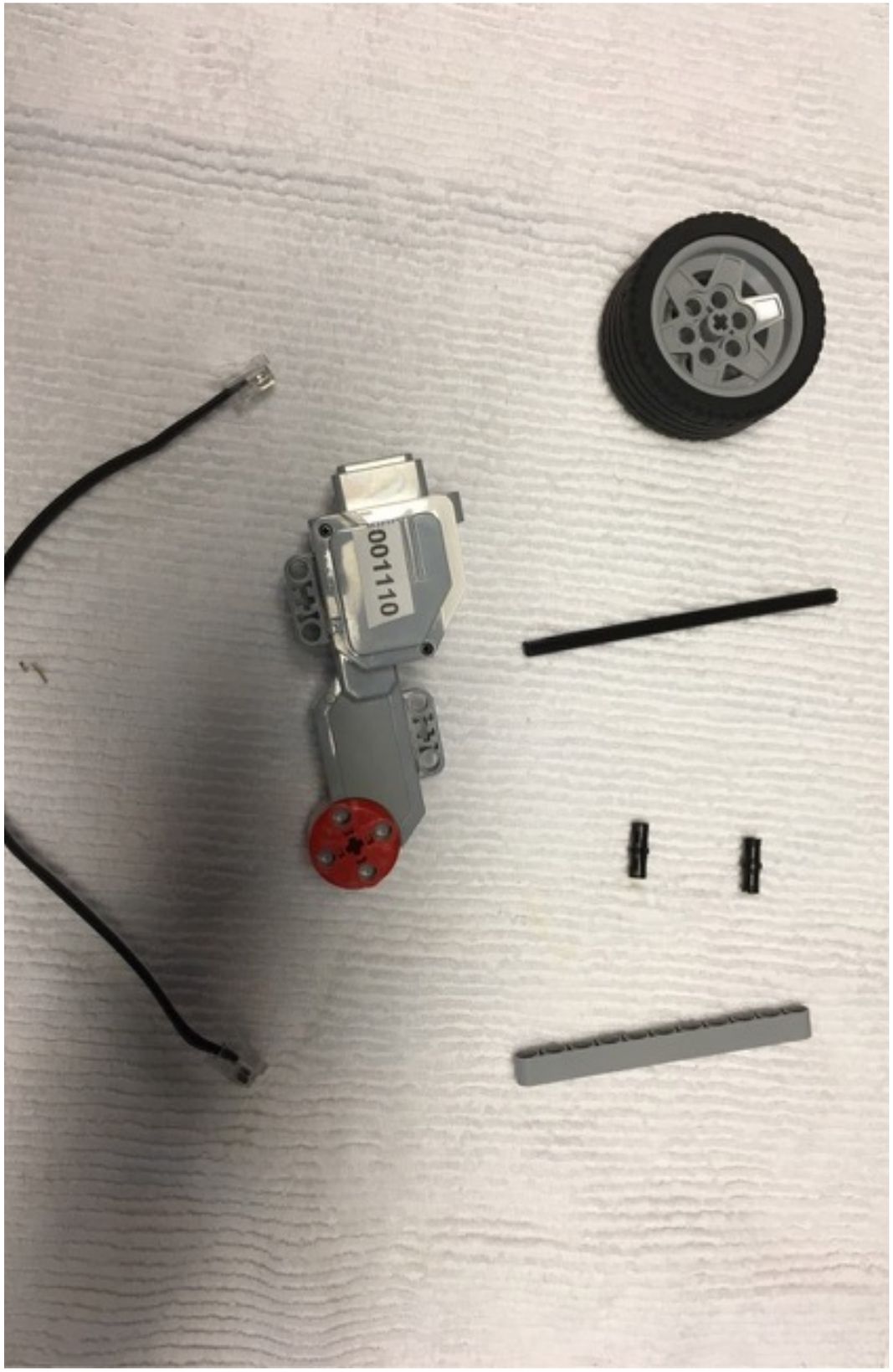
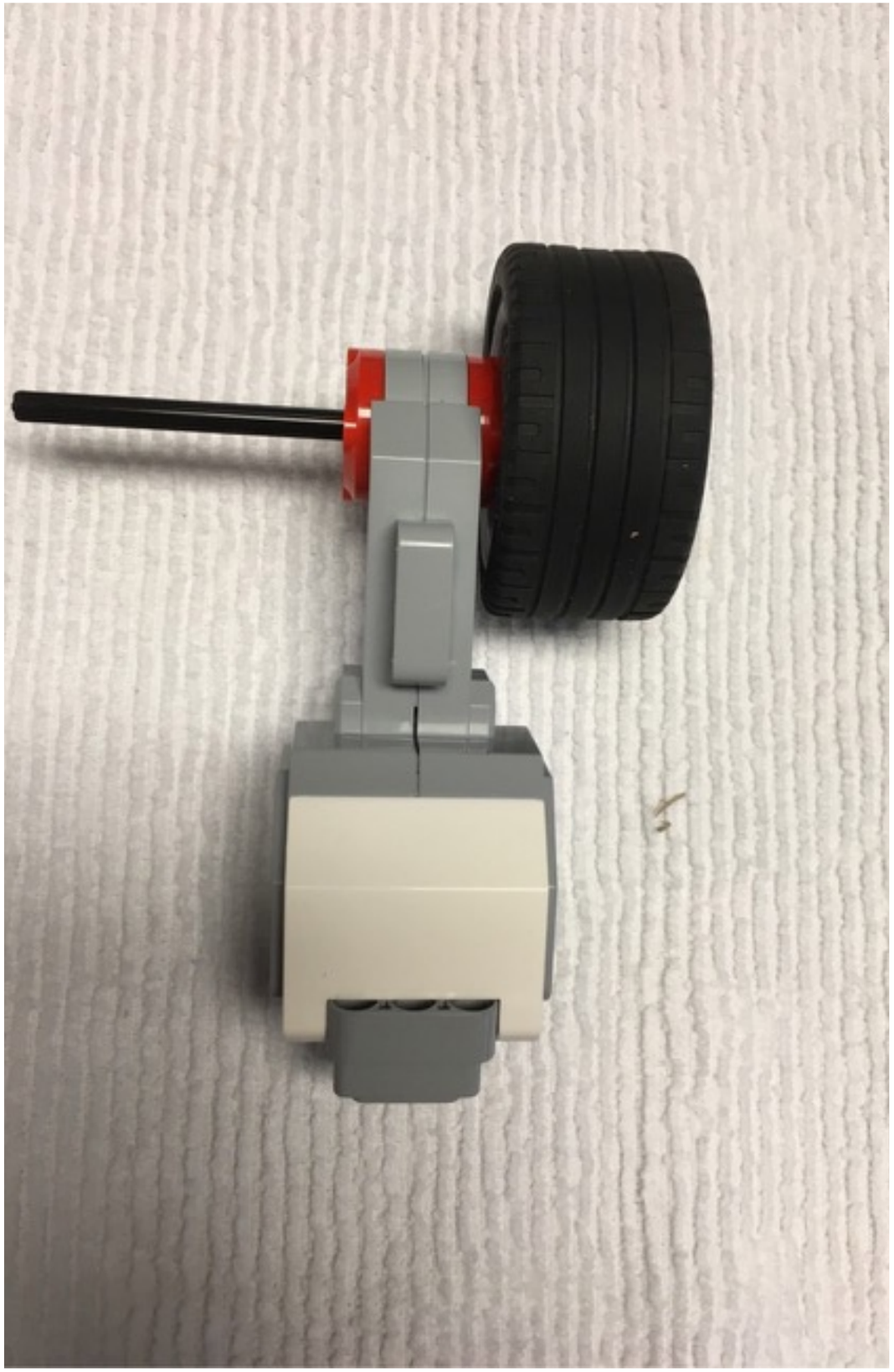
Parts for motor mount

Parts for motor mount



Step 4

Connect wheel to motor



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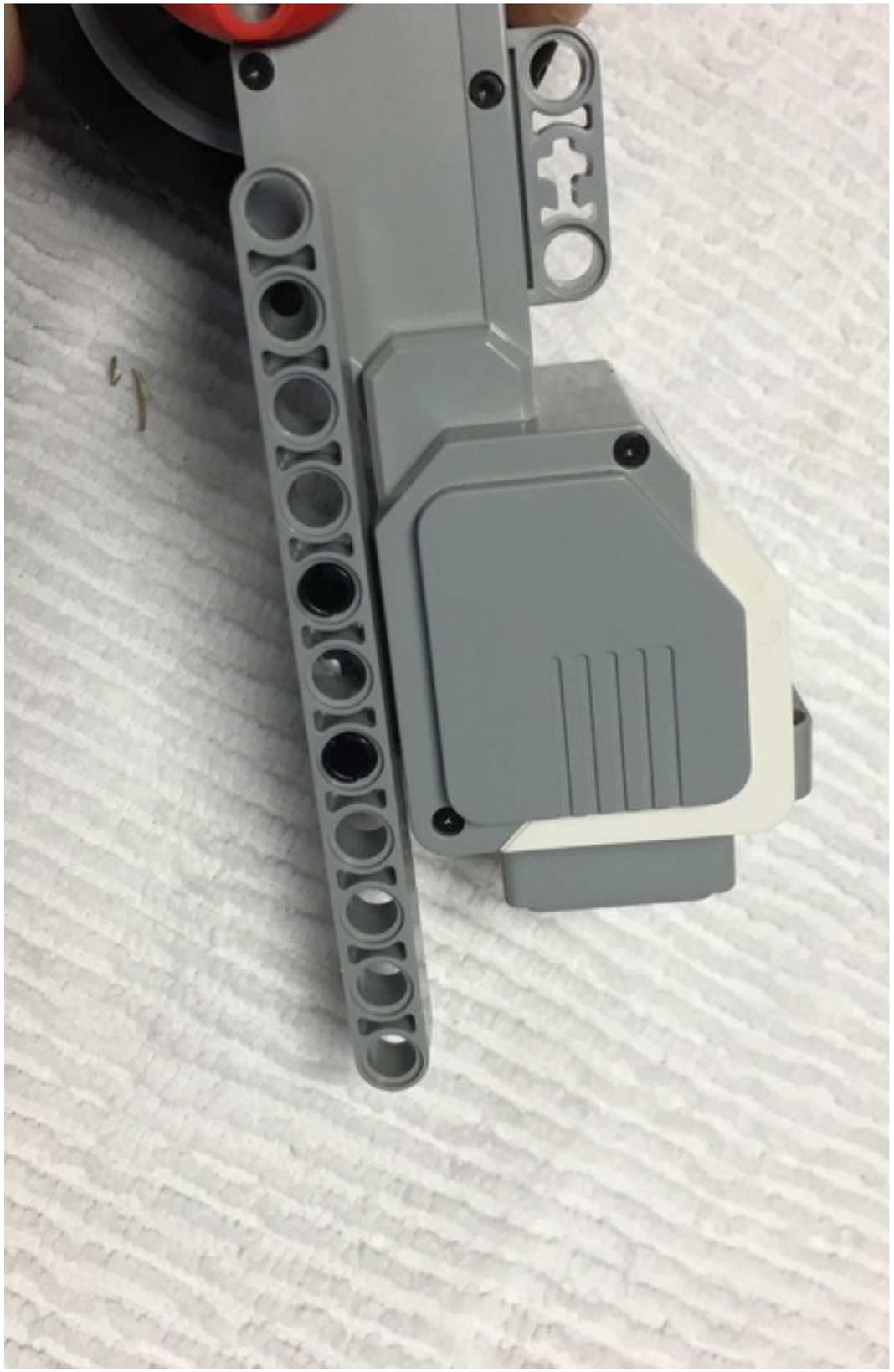
Step 5

Mount bracket to motor



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Step 6

Connect port wire to motor

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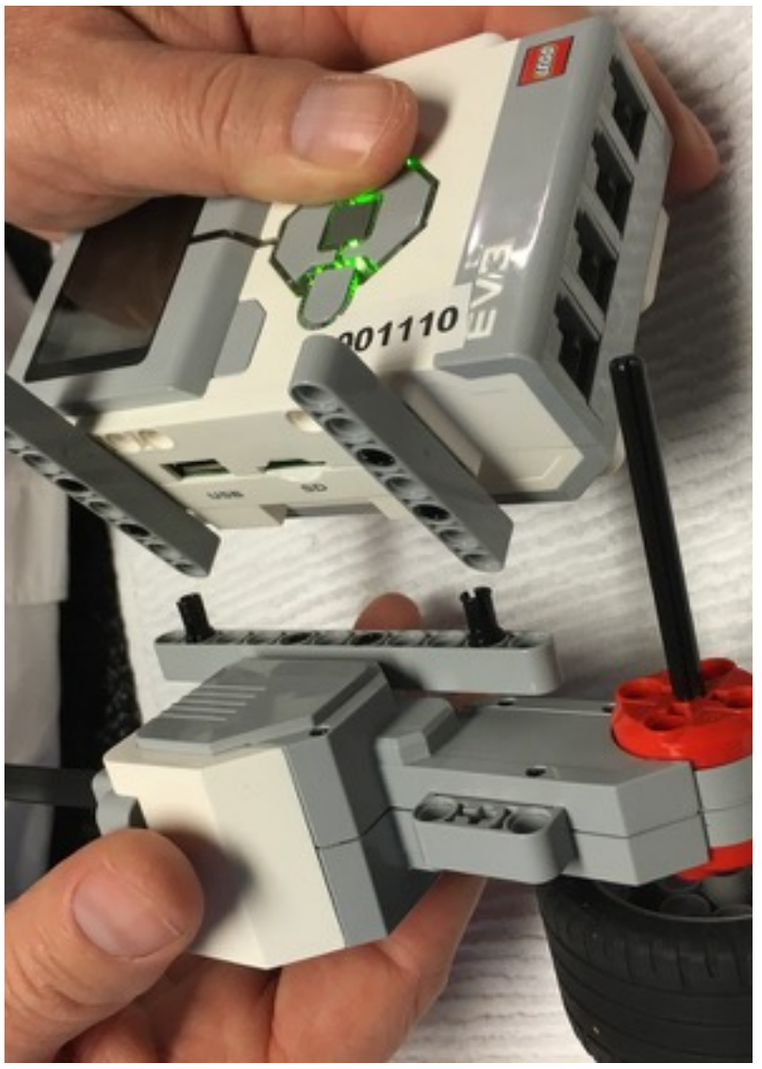
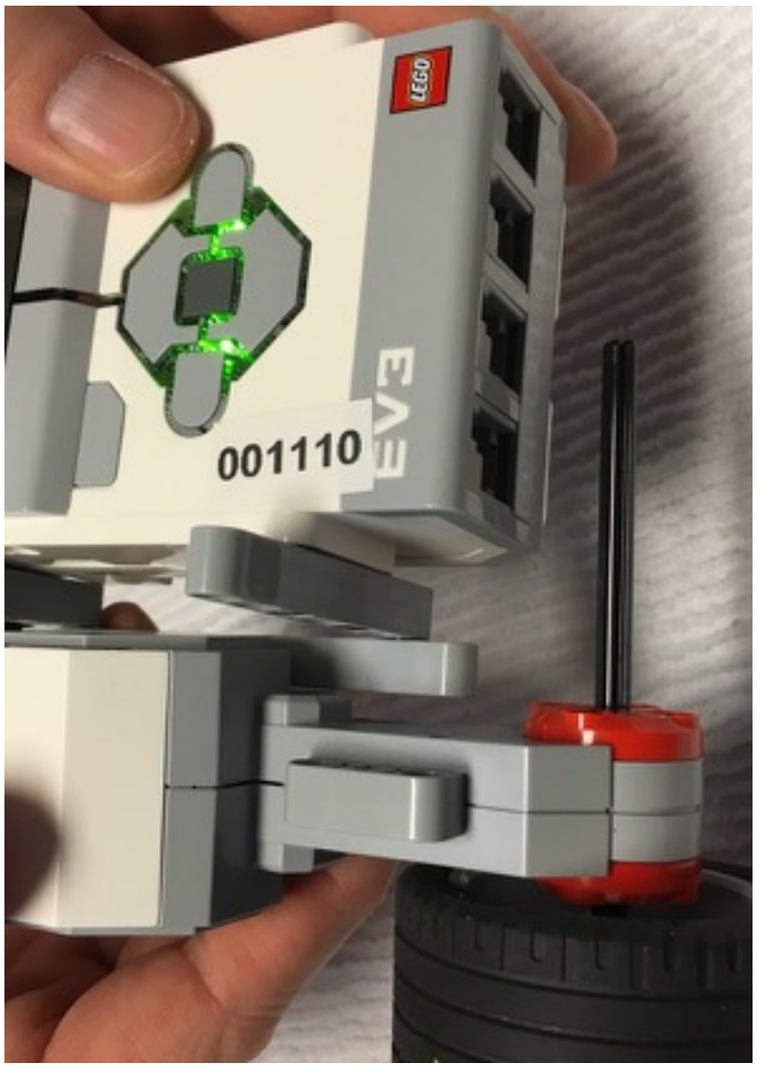
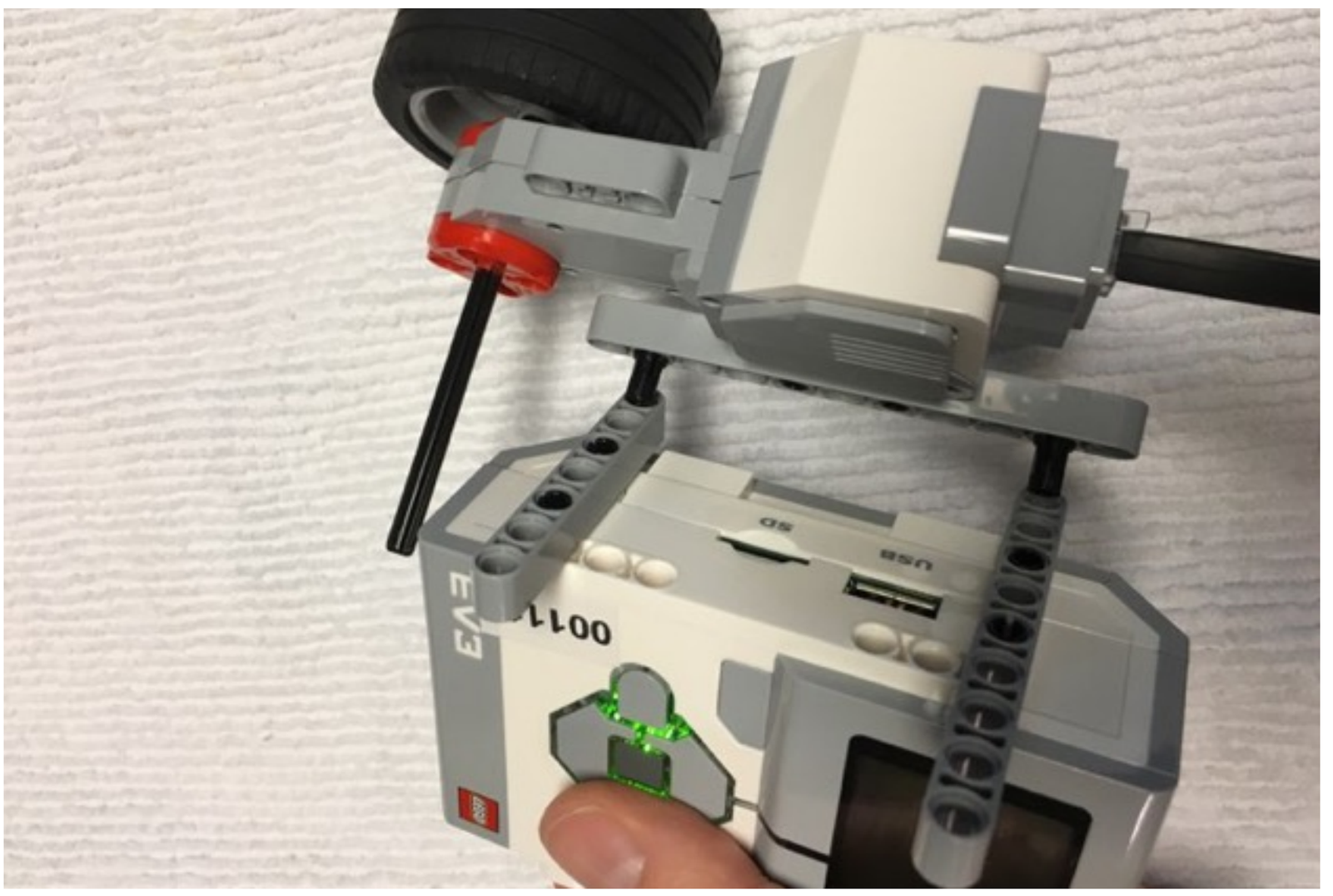
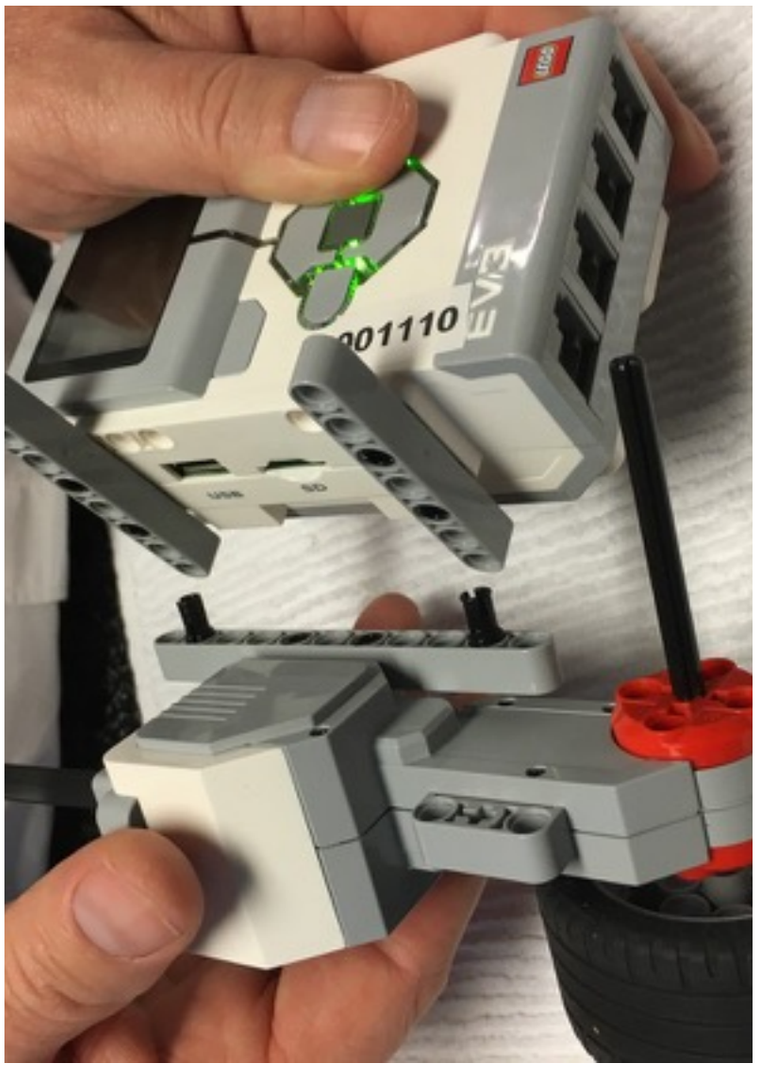
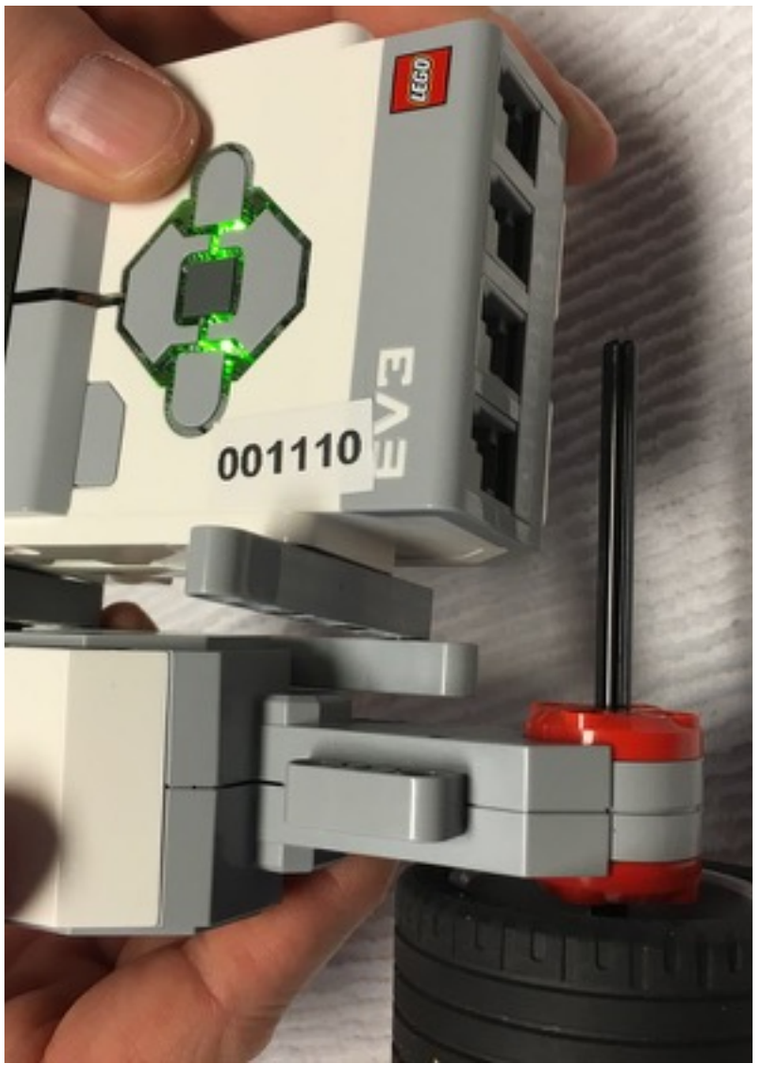

001110
EV3


LEGO
001110
EV3


EV3
USB
SD


001110
EV3


LEGO
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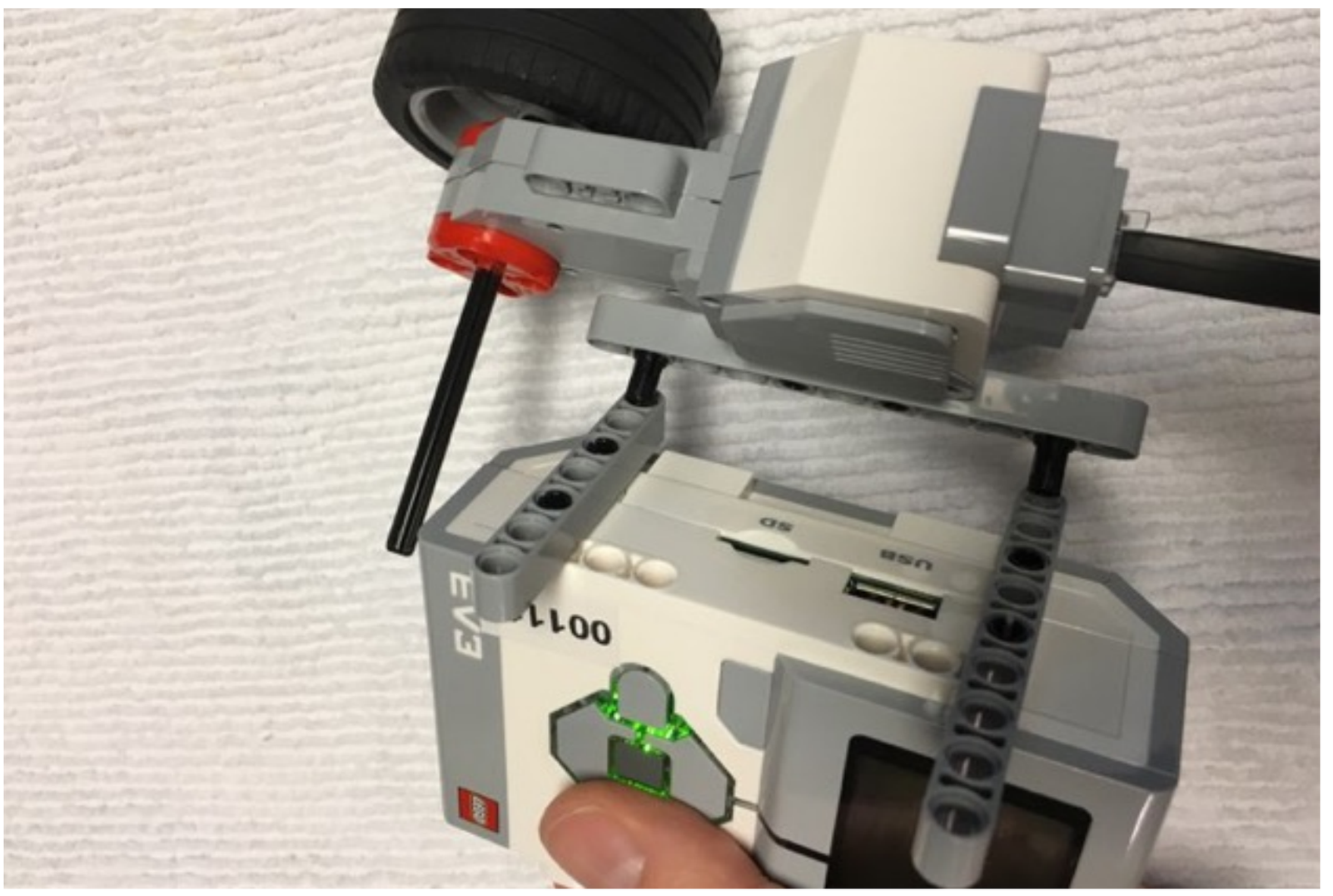
EV3


EV3
USB
SD

Step 8

prepare brick for third wheel

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Step 9

install mounting bracket for third wheel

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Step 10

install connector to third wheel

Step 11

connect third wheel to brick

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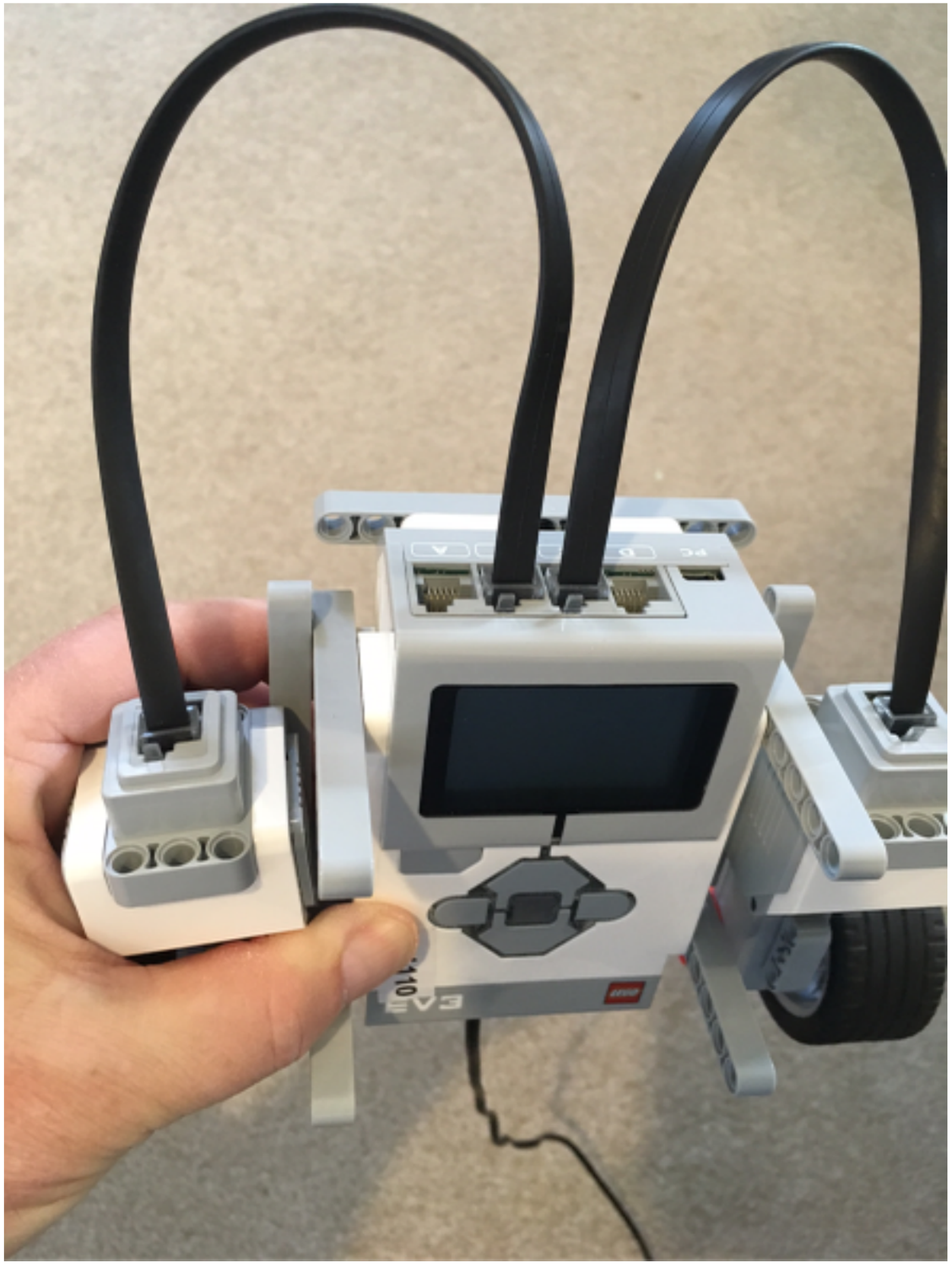
Step 12

connect port wires from motors to brick; take note of which ports (A,B,C,D) that you use; this is needed when you program your bot

SHOW YOUR TEACHER



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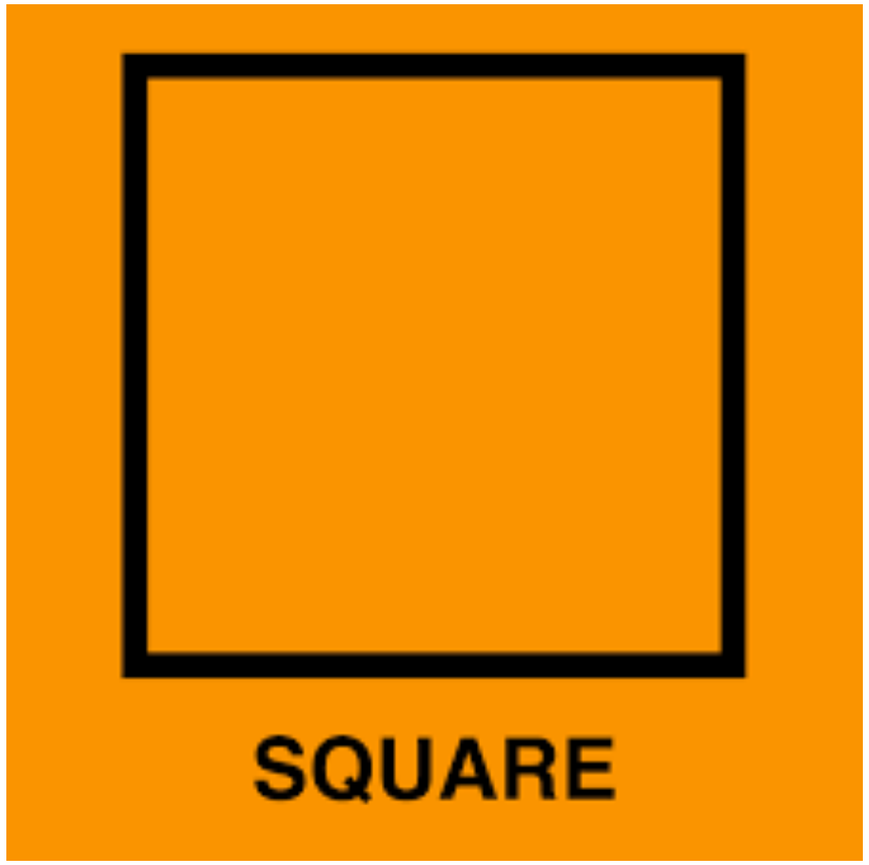
Basic Bot Complete

Let the programming begin!!

Square #1

- goal: make your robot move in a square
  - make robot go in straight line for 4 rotations
  - make robot turn to the left
  - the friction of the floor will impact your rotation factor - experiment till you get a perfect 90% turn
  - now do this sequence 3 more times
- **show your teacher**



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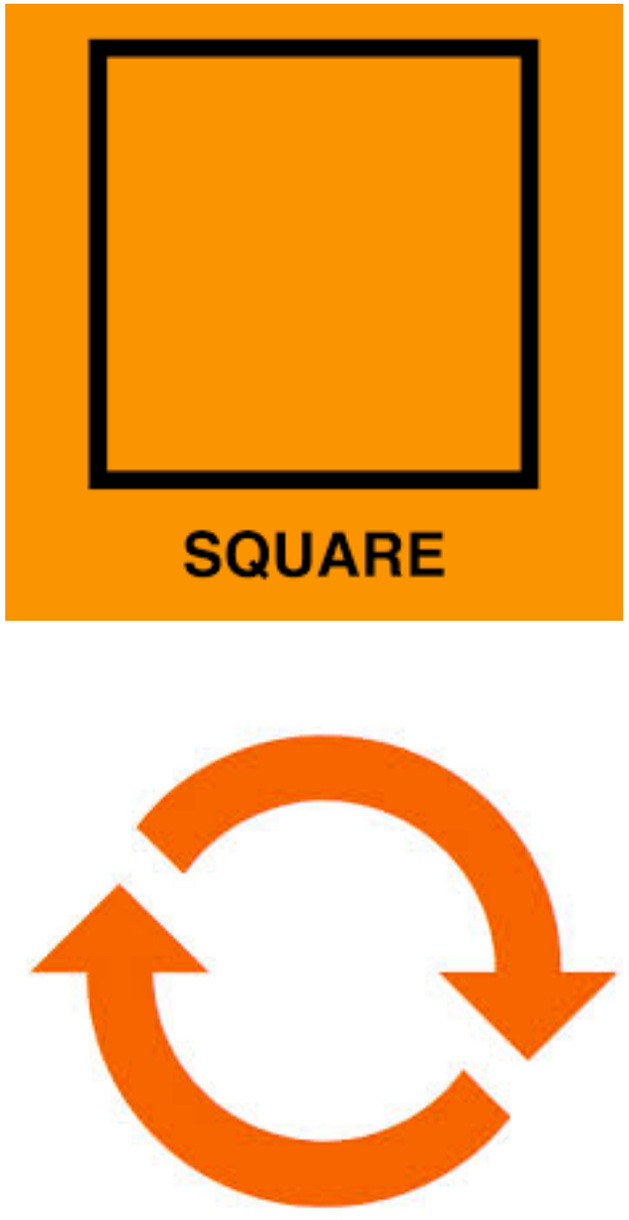
Square #2

- goal: make your robot move in a square using the loop block to reduce the number of commands
- working with loop block
  - using only 4 action blocks, 2 each in parallel, program your robot to do a square using the loop block
- **show your teacher**



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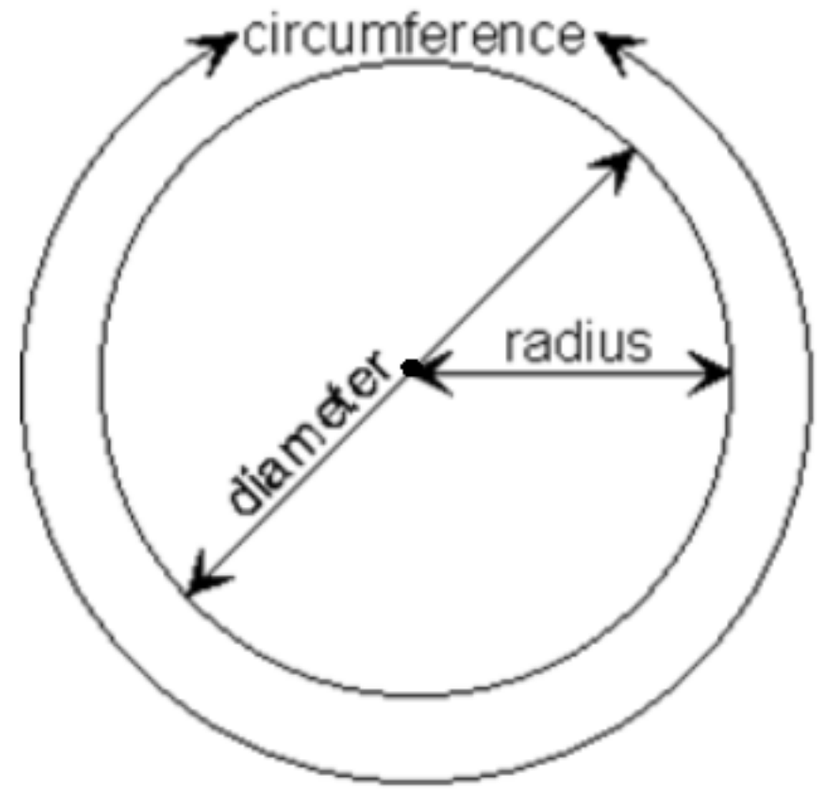
Circle Forever

- goal: make your robot move in a 1-2 foot diameter circle continuously
- you can do this with 2 motor blocks in a loop or experiment with the Move Steering block
- **show your teacher**



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Touch Sensor

- goal: learn how to read & program the touch sensor
- plug in a touch sensor to port 1 on your Brick
- use the port display on the Brick to see how this sensor works
- write a program using the Loop block to make both motors turn until the touch sensor is pushed
- hold your robot up in the air to test
- now make the motors turn smoothly rather than jerky
- **show your teacher**

Connecting Sensors

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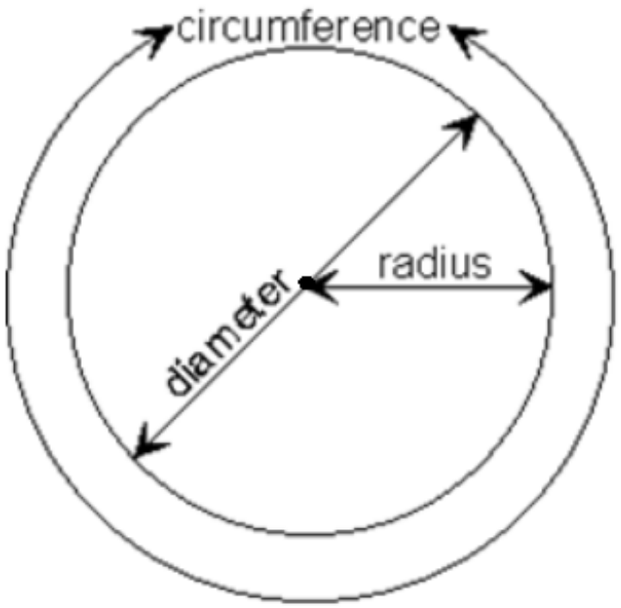
Circle Stop Touch

- goal: make your robot move in a 1-2 foot diameter circle and stop when the touch sensor is pushed
- **show your teacher**



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Ball Hitting Bot Challenge

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