



FLL Workshop – Day 2  
Beginning FLL Programming

Patrick R. Michaud  
[pmichaud@pobox.com](mailto:pmichaud@pobox.com)

University of Texas at Dallas  
June 2017

# Goals

Learn basics of Mindstorms programming

Be able to accomplish some missions

Provide tips that have helped our team

Point out traps that cause frustration

# Topics

EV3 programming environment

Programming basics

Motor blocks – moving forward and backward

Detecting lines, borders, colors

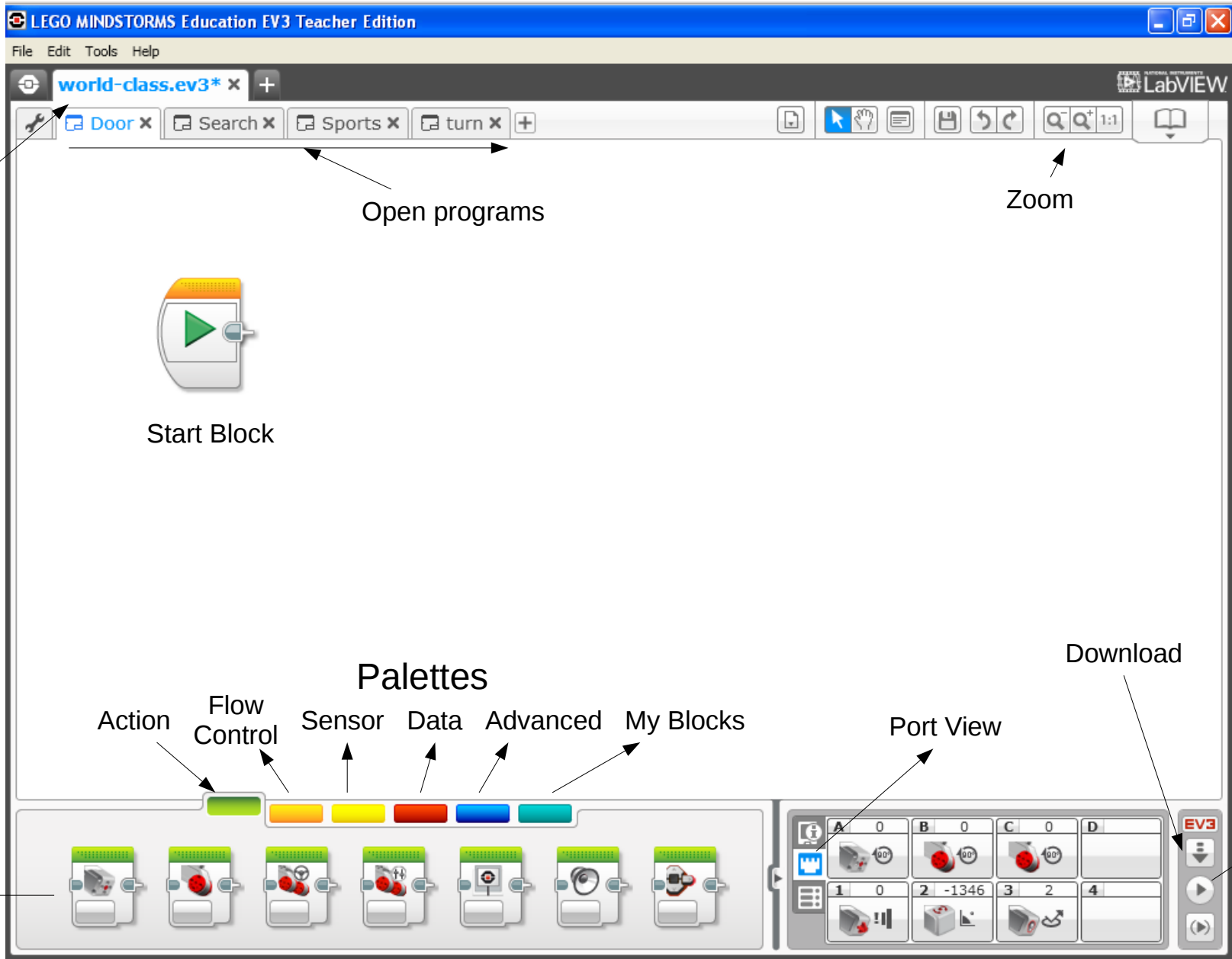
Port view and view mode

Turning basics

Turns using gyro sensor

Simple My Blocks

# EV3 Programming Environment



Project

Open programs

Zoom

Start Block

Palettes

Action

Flow Control

Sensor

Data

Advanced

My Blocks

Download

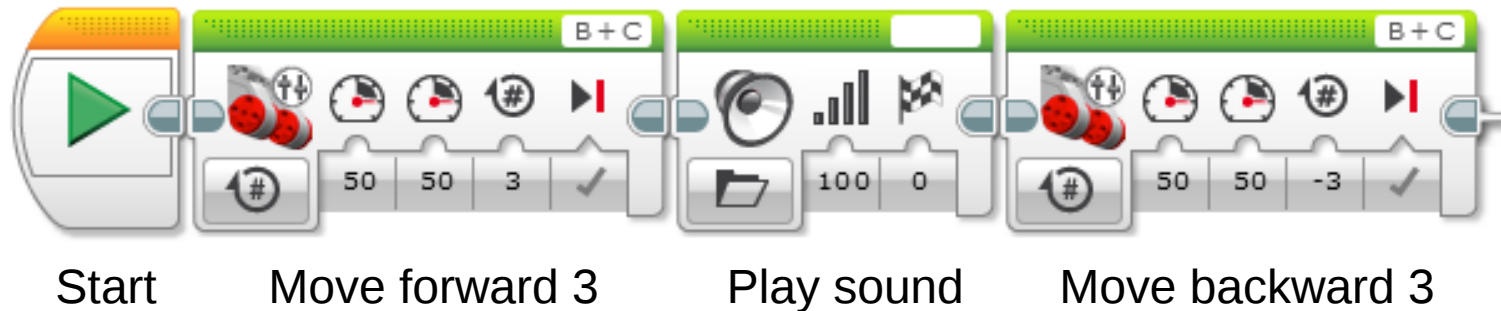
Port View

Download and run

Program Blocks

# Programming basics

A program is a sequence of actions to perform



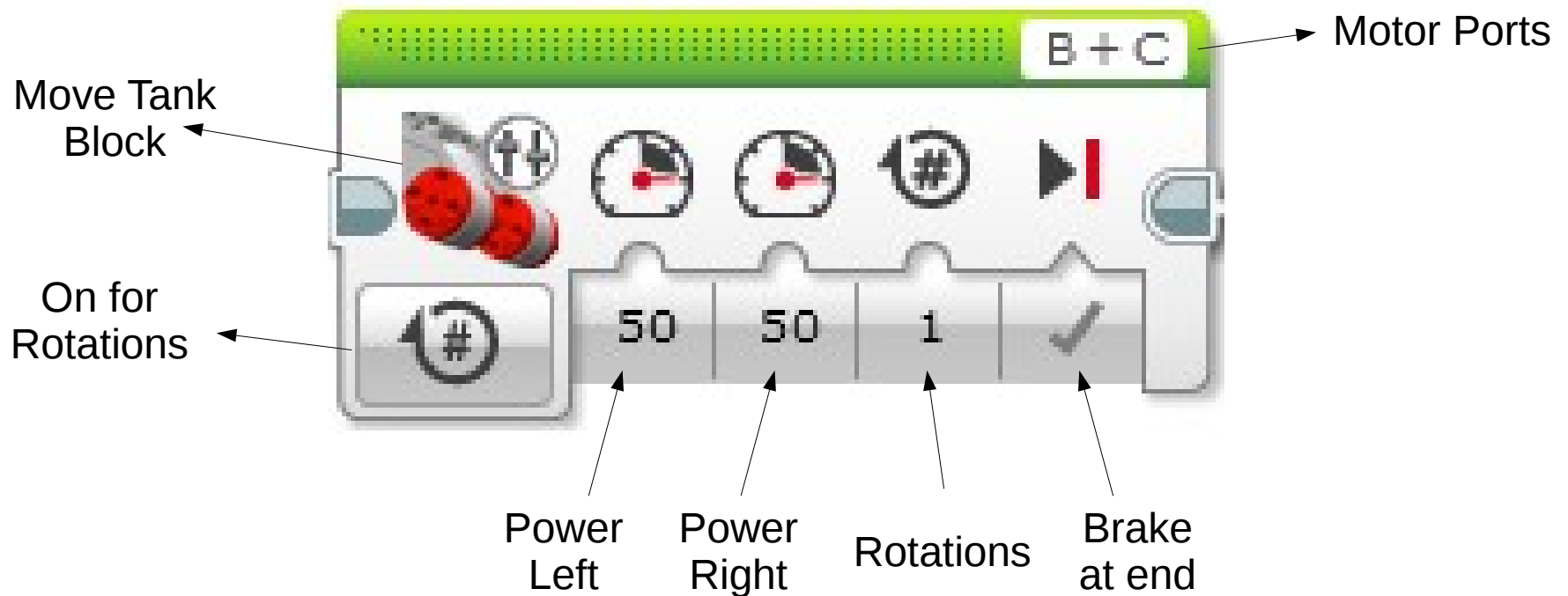
Each action is represented by a “block”

Icons indicate the type and values of block

Robot does *exactly* what you tell it to do  
and *only* what you tell it to do

Programmer determines what actions to perform

# Motor blocks – moving the robot



Motor ports: which motors to turn

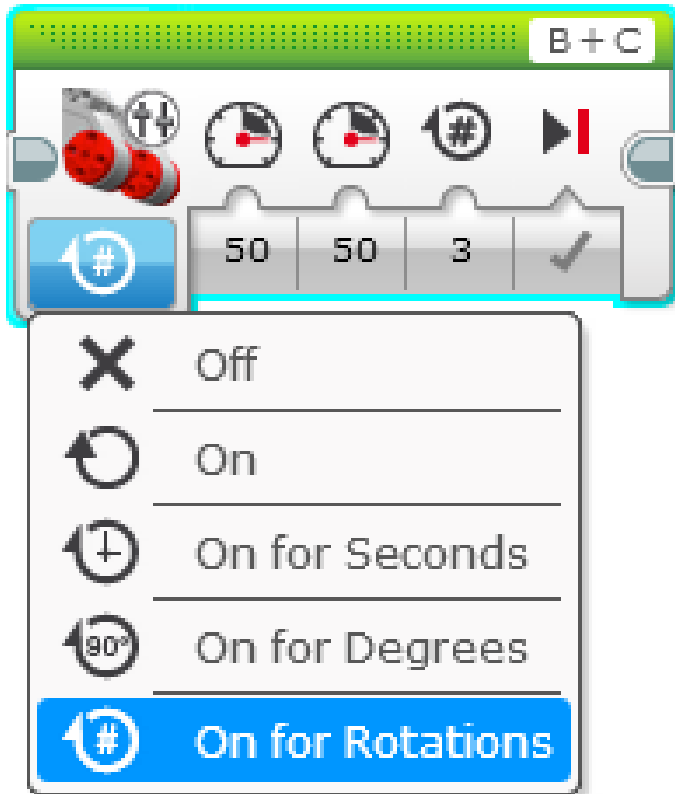
Power left/right: how fast to turn each motor

Rotations: how far to turn each motor

Brake at end: whether to apply brakes when done

# Motor blocks

## Motor commands



## Types of moves

### Move tank



left/right motor speeds

### Move steering



turn direction / sharpness

### Large motor (one)



motor speed



# Programming Tasks



# Fundamentals of turns

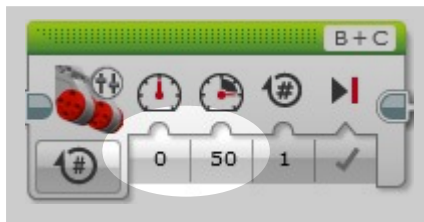
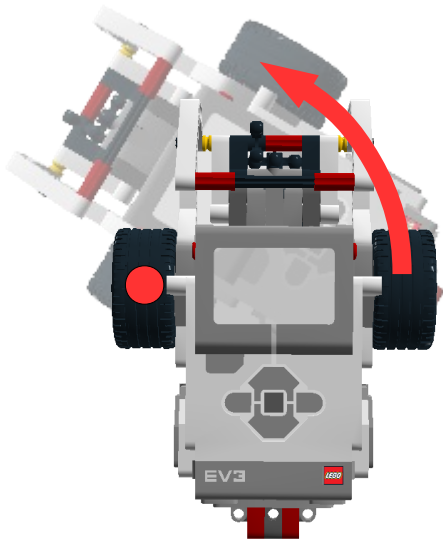
The robot turns when driving wheels move at different speeds

The robot turns towards the *slower* wheel

The greater the difference in speeds, the tighter the turn

# Turning basics – types of turns

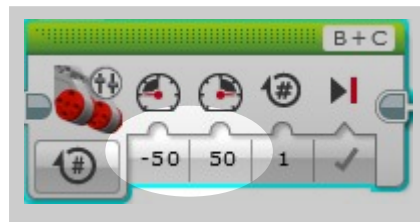
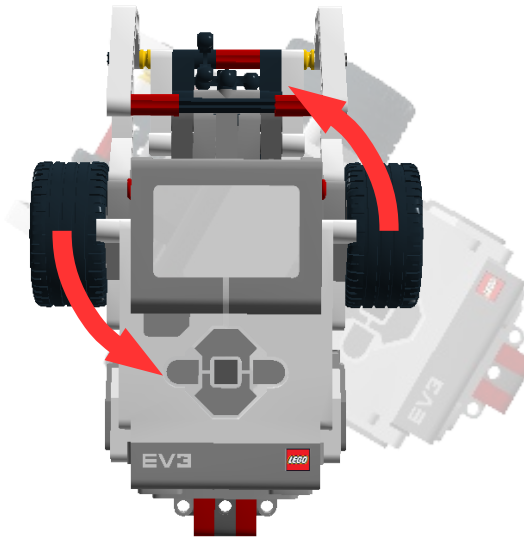
## Pivot turn



One wheel moves,  
other wheel brakes

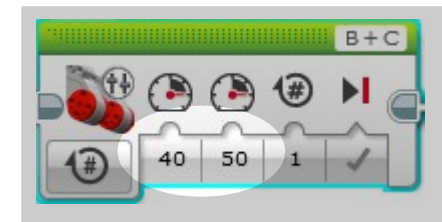
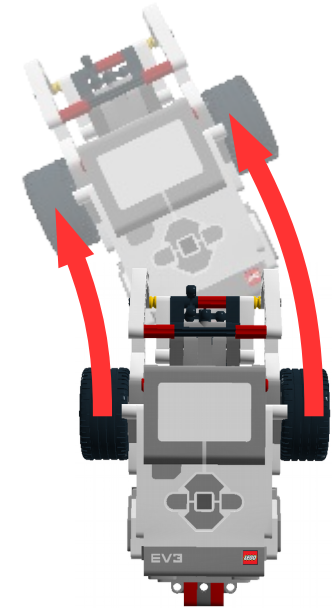
we use this,  
most consistent

## Point turn



Wheels move in  
opposite directions

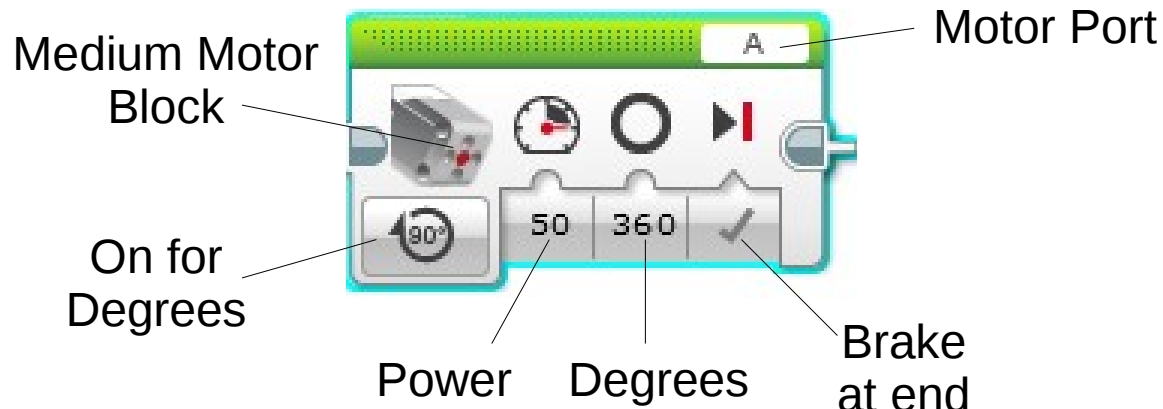
## Wide turn



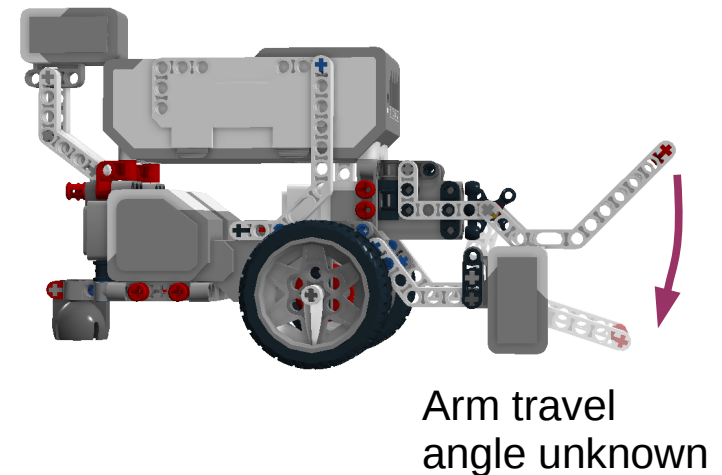
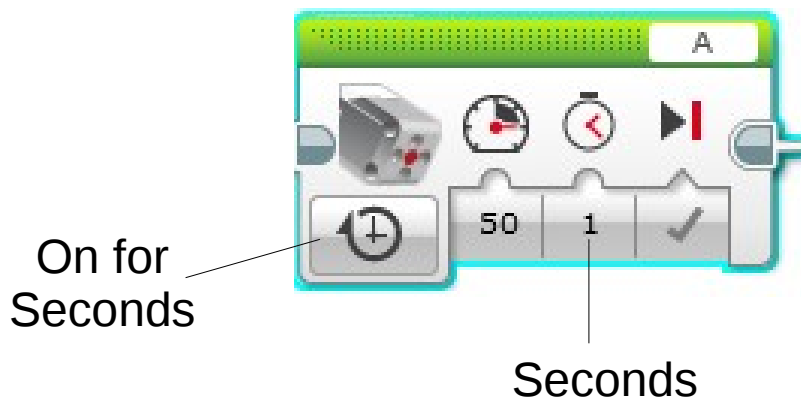
One wheel moves  
slower than other

# Using the medium motor

The medium motor has a different block



Use “On for Seconds” when you want to go to a limit (avoid stalls)



# Wait blocks

Program executes blocks in sequence

Wait blocks makes program wait for something to happen before continuing to next block

- Wait for seconds

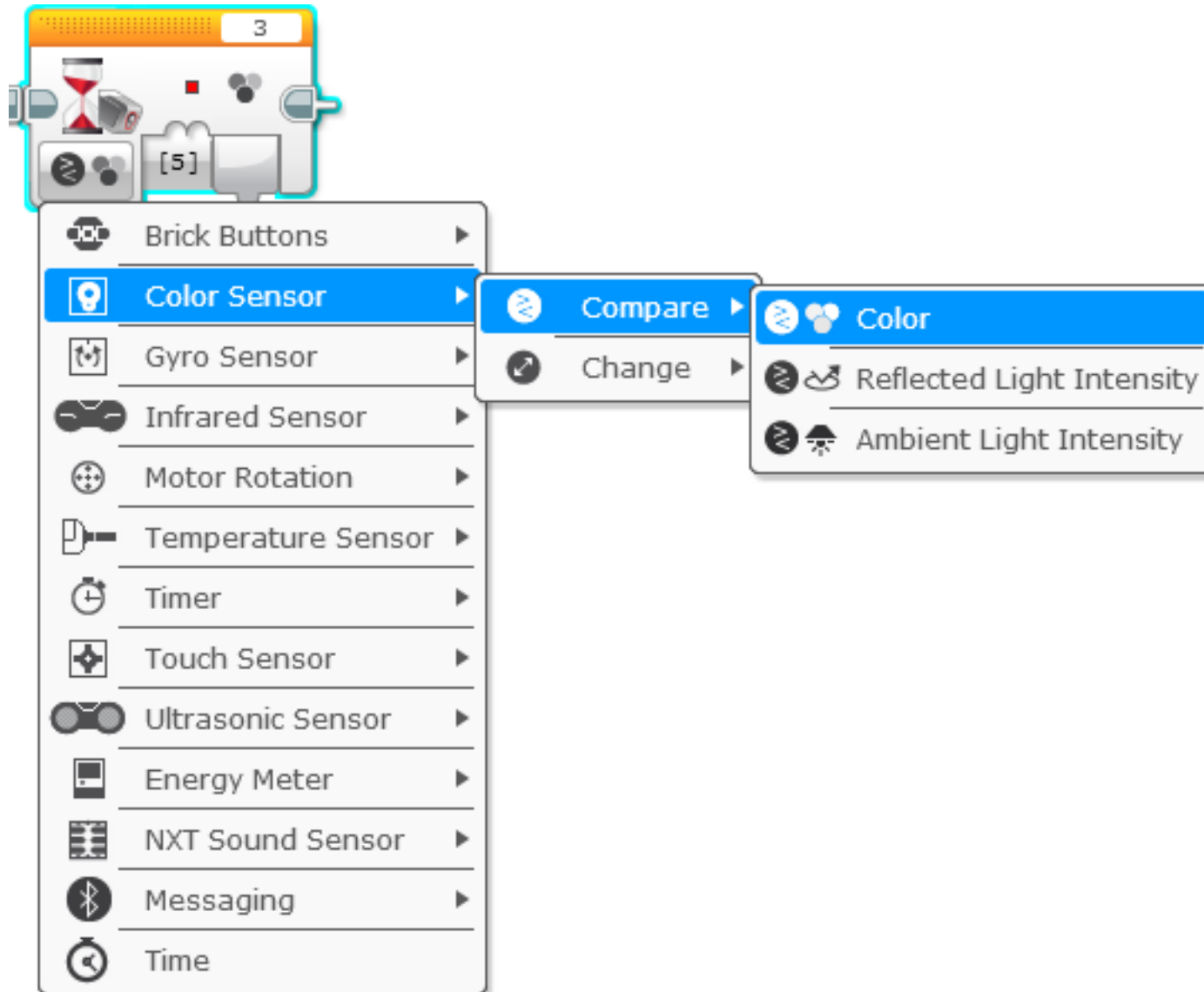
- Wait for sensor to read a certain value

- Wait for sensor to change

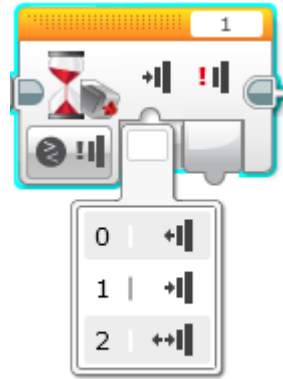
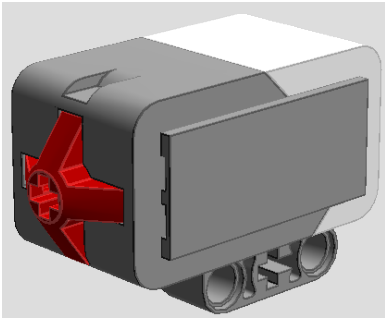
Example:



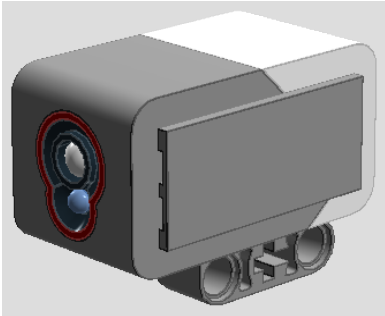
# Wait block options



# Touch and color sensors



Touch sensor detects pressure

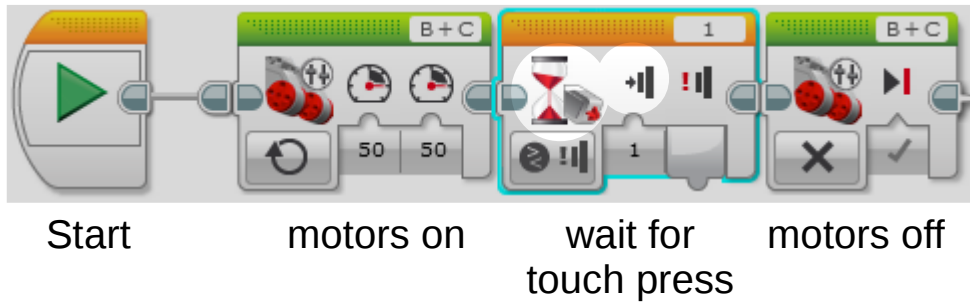


Color sensor can detect selected colors

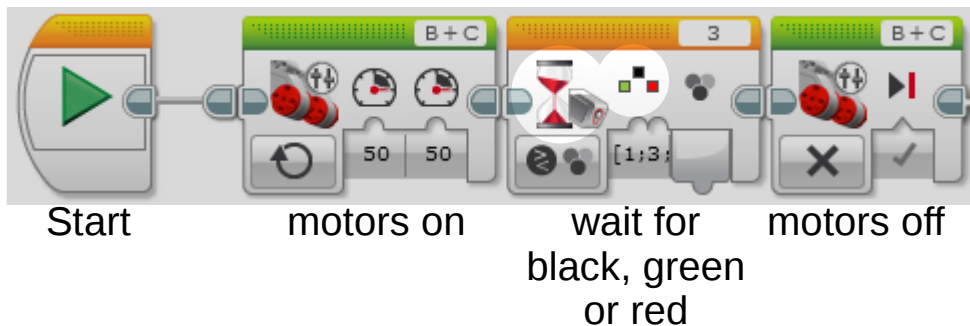
Sensor should be 0.5 to 2.0 cm from color to be detected

# Moving to a border, line, or color

## Move until touch sensor pressed



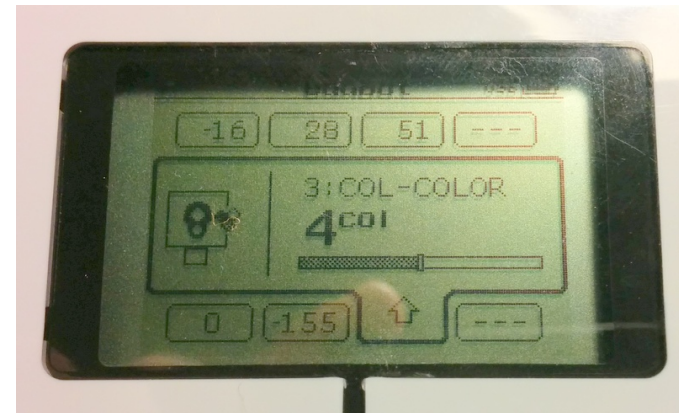
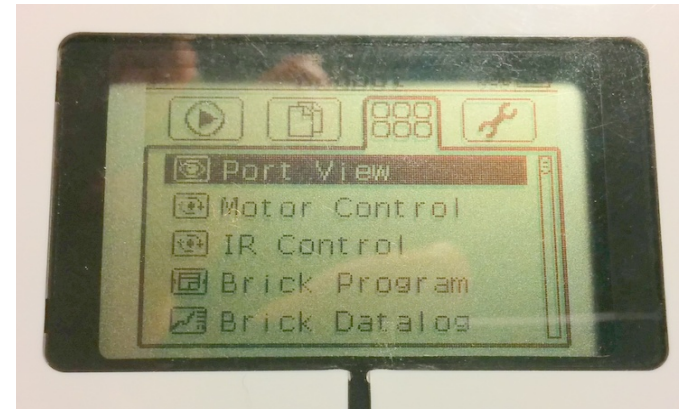
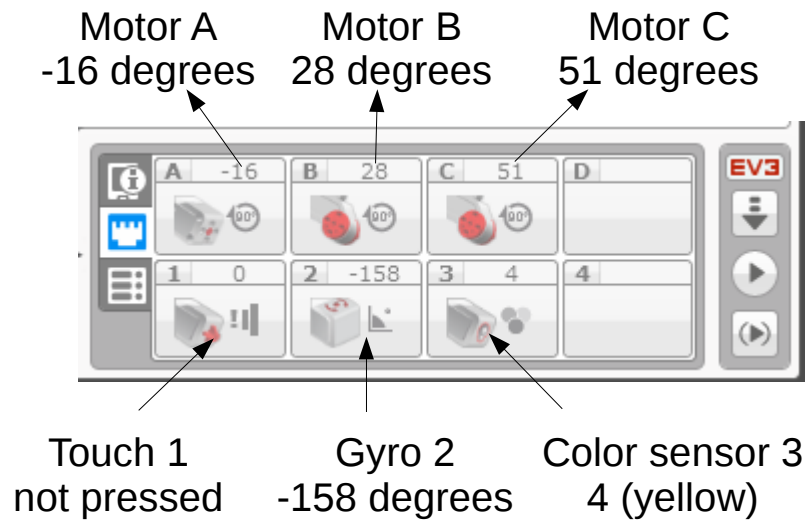
## Move until black, green, or red detected



# Use “port view” to see sensor changes

Software view:

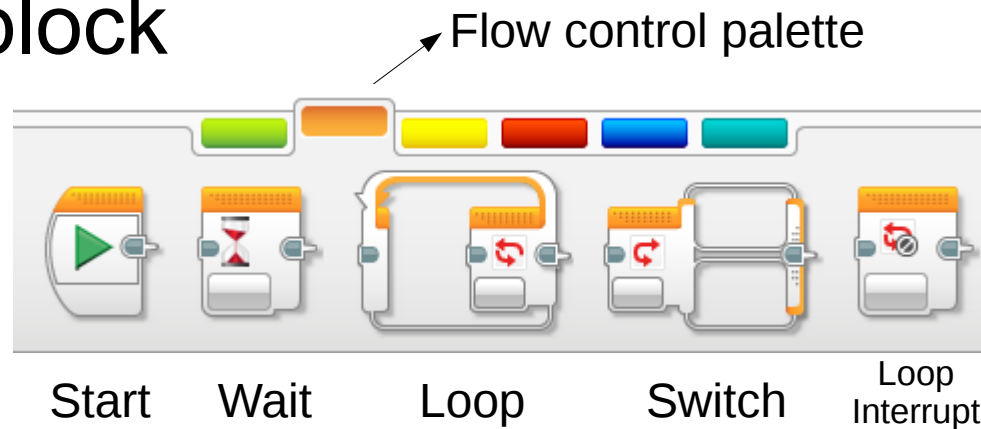
EV3 view:



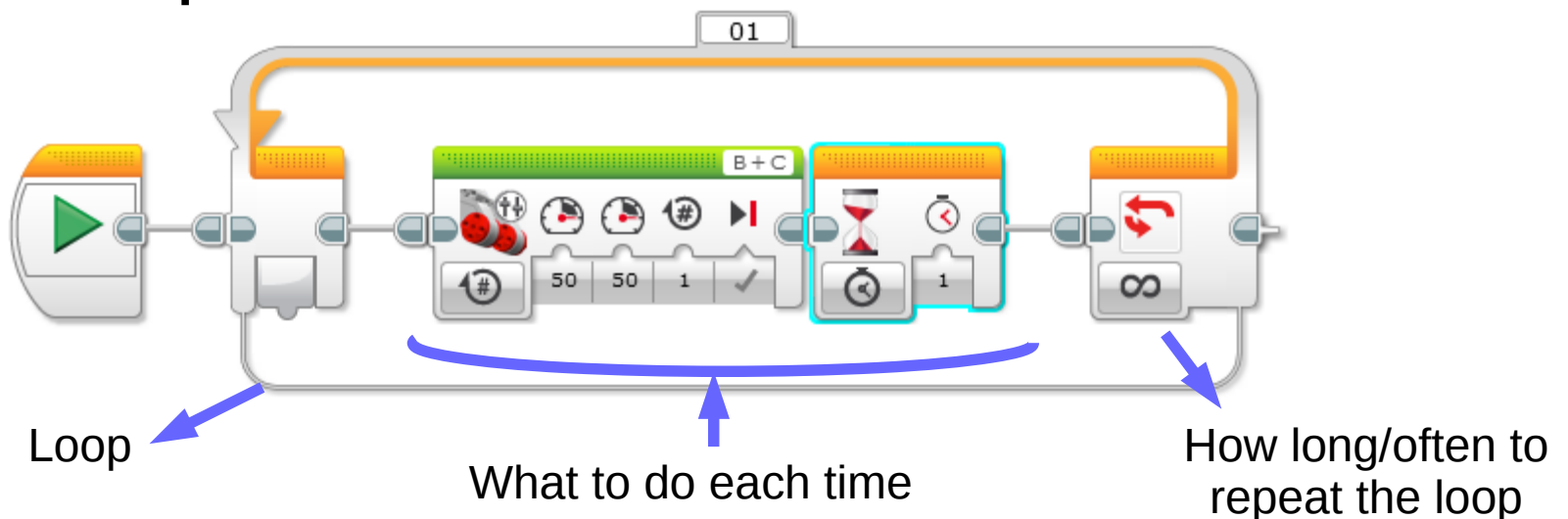


# Loops

To do something repeatedly (like steering), use a “loop” block



A basic loop block





# Programming Tasks

## More about turning

Quiz: If a wheel turns 90 degrees, does the robot turn 90 degrees?

Answer: No

There *is* a formula to convert wheel turn angles to robot turn angles (advanced programming)

But many teams just use trial and error

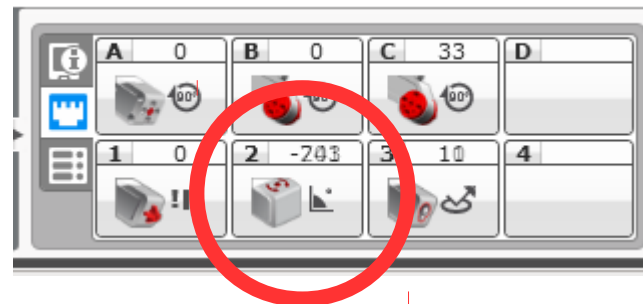
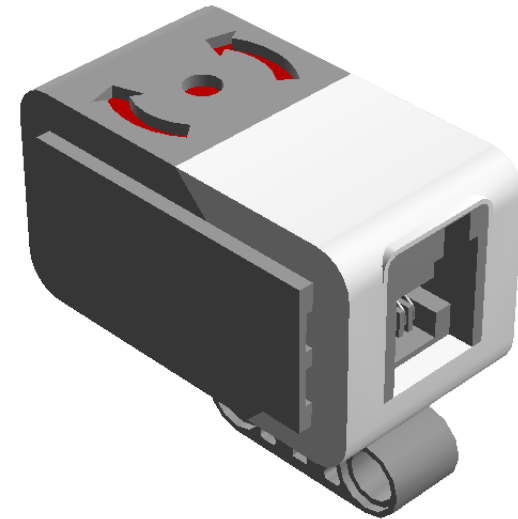
Or, use a gyro sensor

# Gyro sensor

Gyro sensor detects rotation about an axis

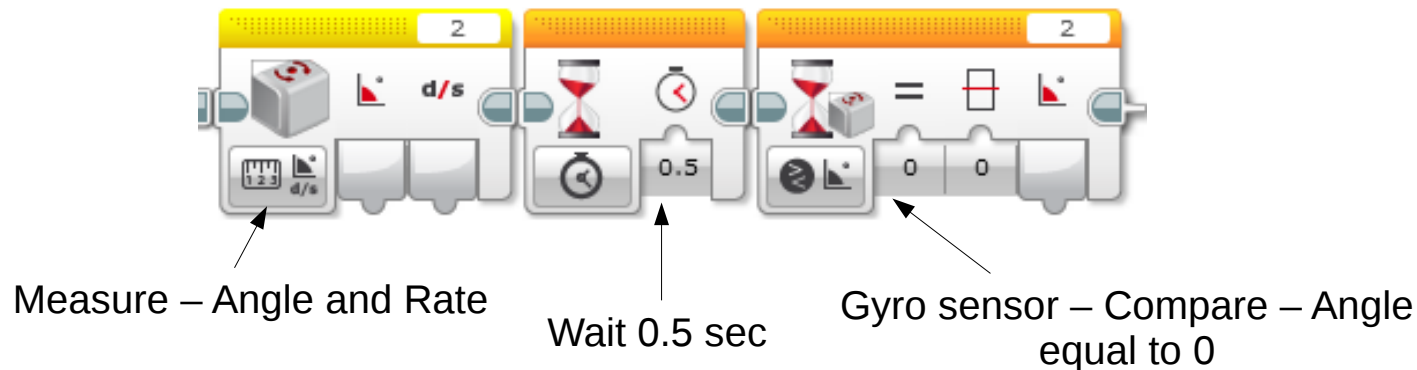
Can measure rotation rate or rotation angle

Sensor has *bias* and *drift*  
sometimes shows movement even when still



# Reducing gyro drift

The following block sequence recalibrates the gyro sensor to eliminate drift:

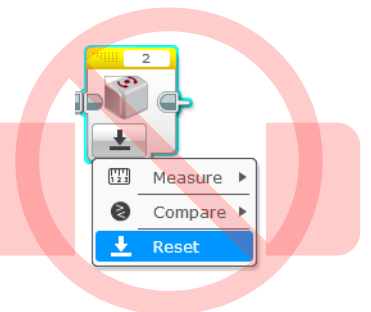


Perform this once at beginning of program

Requires 2-3 seconds to complete

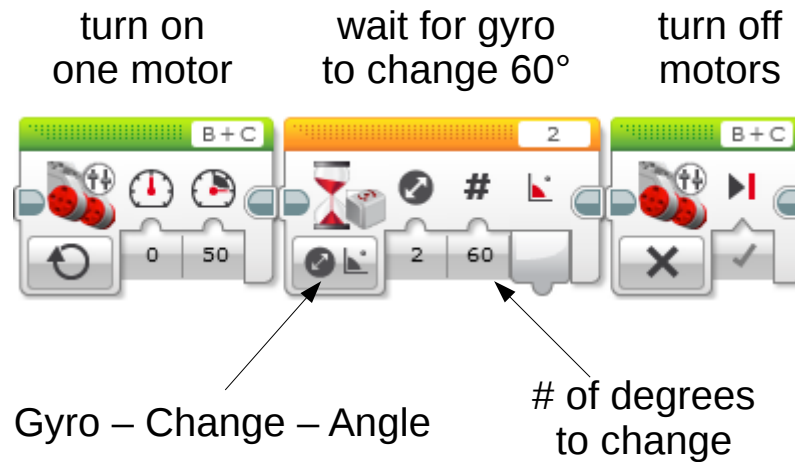
Gyro must be stationary while calibrating

Trap: “Gyro reset” block doesn't recalibrate gyro!



# Turns using gyro sensor

Once gyro reads correctly, turning an angle is:



Gyro sensor is *not* precise

Robot may turn slightly more or less than 60°

**Thank you!**

Questions?

Patrick R. Michaud  
pmichaud@pobox.com

Join the NorthTexasFLL group!