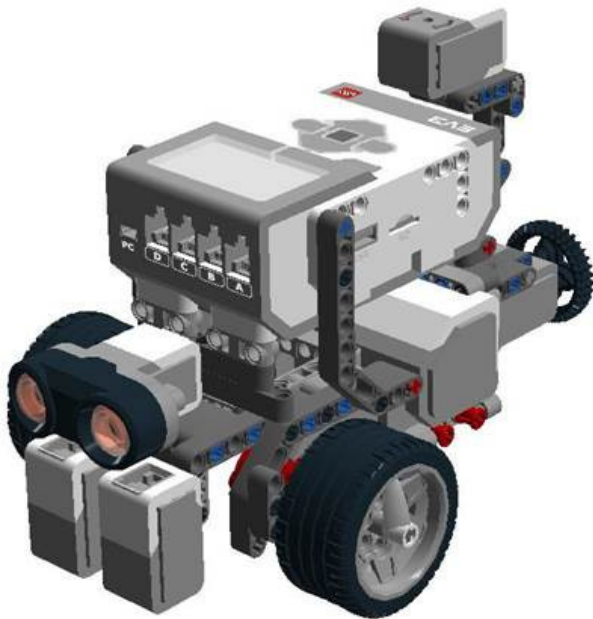# Turning on Green



A POSTERIORI
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# WARNING!!!

- This...

- ...is **NOT Reliable**!

**Color sensor block in compare color mode**

## Problem

- There are many shades of green...

- ...but the EV3 sensor is designed to detect **one** particular shade

### According to my EV3, these are...

**Brown**

**Blue**

**Green!**

# Solution

- **Try many sensors** (...and hope that you'll get lucky)
    - Many people have reported that some sensors are better than others at detecting green and some green are more detectable than others
    - ...luck is for the incompetent. You guys can do better.

- **Treat green as grey**
    - Ignore color and use reflected light readings
    - Difficult to handle dead ends and less reliable

- **Use custom block that reads the RGB value**
    - Slightly more difficult to start with, but overall programing logic will be easier
    - Most reliable

# Mindcub3r Color Sensor RGB Block

- Download from http://aposteriori.com.sg/competitions
  - Modified version that supports US and UK english
  - Official version only support US english
- Provides 3 output values for Red, Green, and Blue
  - From 0 (color not detected)
  - ...to 1023 (color very strongly detected)
  - ...but you'll probably max out at around 200 to 300 as the built in LED is too weak
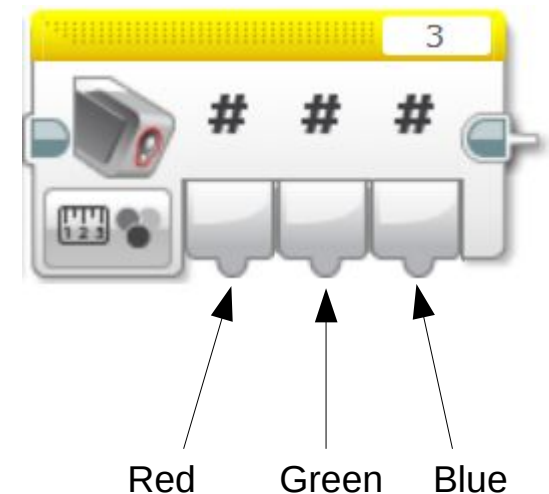


Red    Green    Blue

# What is Green?

- Green reading higher than Red and Blue?

| Red | Green | Blue | Color | Green? |
|-----|-------|------|-------|--------|
| 0 | 255 | 0 | | Definitely |
| 110 | 230 | 150 | | Still Yes |
| 110 | 220 | 200 | | Maybe... |
| 180 | 210 | 200 | | More grey than green? |
| 250 | 255 | 250 | | Almost completely white... |

- It can be difficult to even define what's "Green"

- Better to have a calibration routine, and use that to calibrate for the "Green" that's used in the competition

# Methods of Detecting Green

**1) Compare the Green reading with the average of Red and Blue readings**

- Moderate chance of false positive

- Low chance of false negative


**2) Compare all three color components (Red, Green, Blue) against the calibrated value**

- Low chance of false positive

- Moderate chance of false negative


**3) Convert to Hue, Saturation, Value (HSV) and compare the Hue**

- High chance of false positive when on white or black

- Low chance of false negative

- Can reduce false positive by comparing S and V in addition to H, but will increase chances of false negative

- Complicated to implement

# Methods of Detecting Green

- No best solution

- Depends on the shades of green, white, and black used on the playing field

- Method 3 (HSV) can be very powerful, but is difficult to use

- Method 2 (Compare RGB) may be the simplest and most robust

- Whichever method used, **make sure to have a means of calibrating it during the competition!**
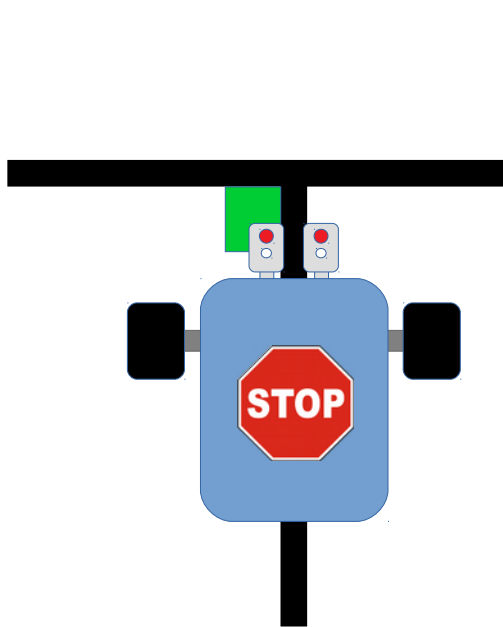
# Testing

- Display the RGB readings on the EV3 screen

- Test out the Green box, the White background, and the Black lines

- Make sure you select a suitable value of K to differentiate between those 3 colors



Read RGB values           Display on EV3 screen
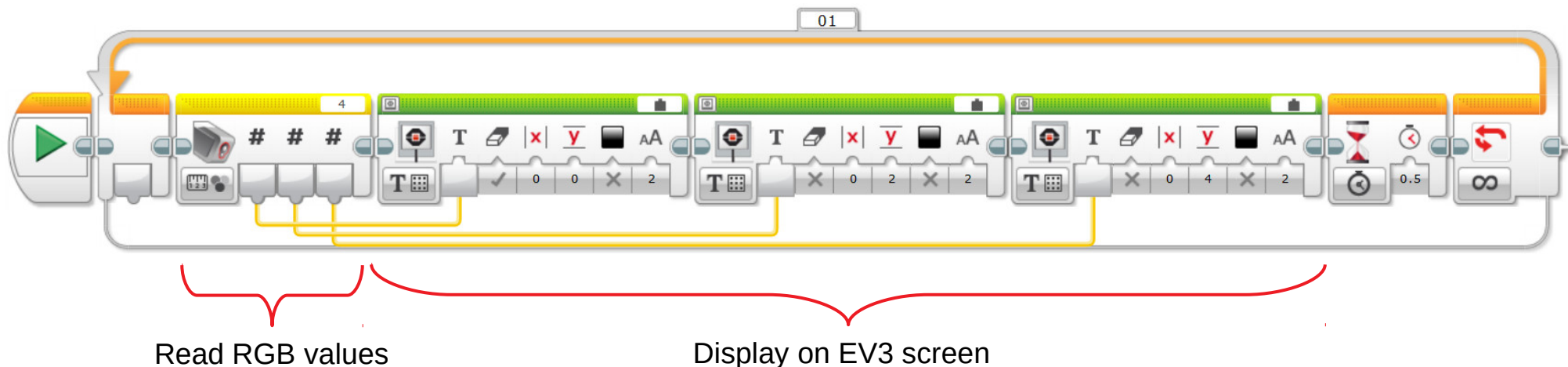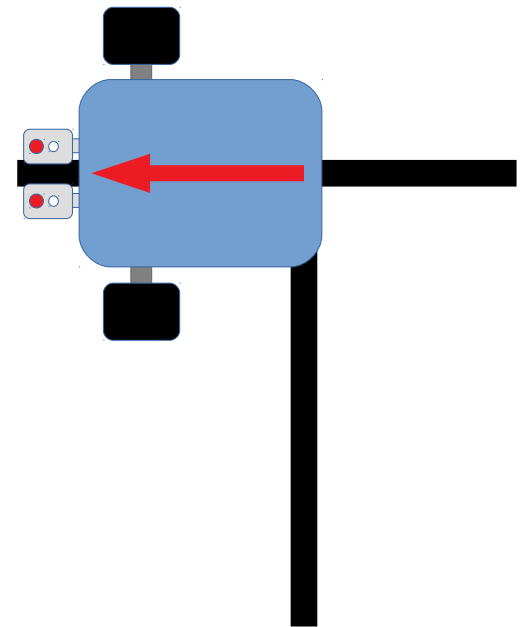
# Turning at the Junction

Method 1

- Stop line following
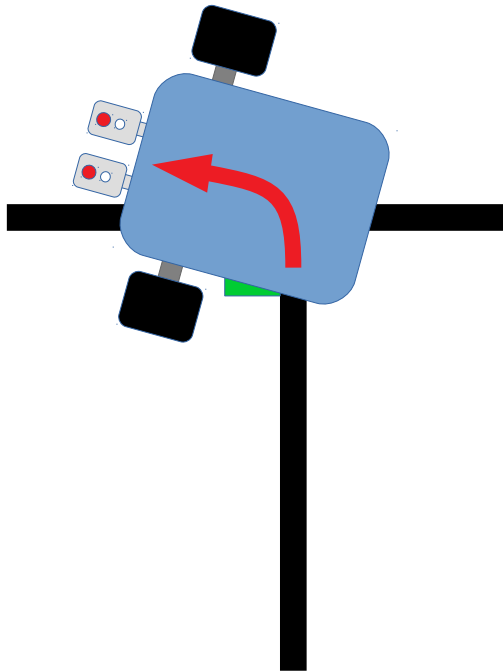- Turn left (Dead reckon)
- Continue line following
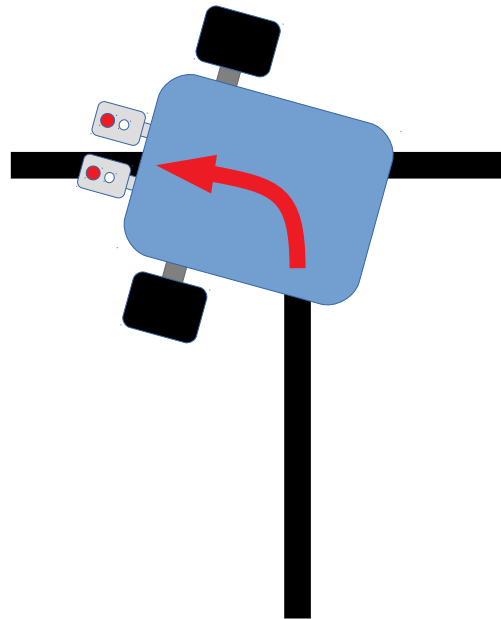


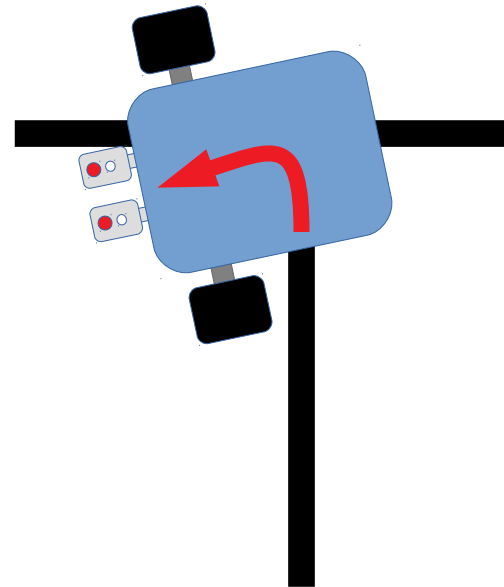**Stop**  **Turn**  **Continue**

# Turning at the Junction

Problem with Method 1

- May overshoot / undershoot the line
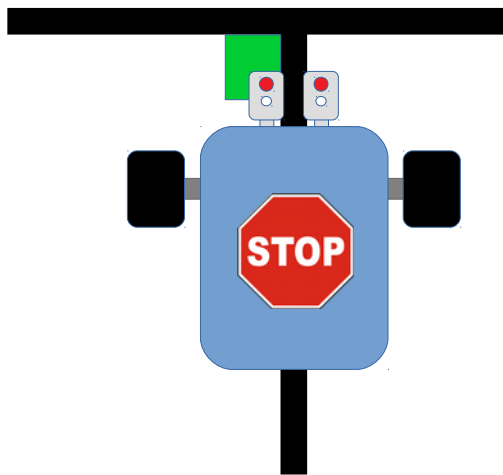
- Unreliable
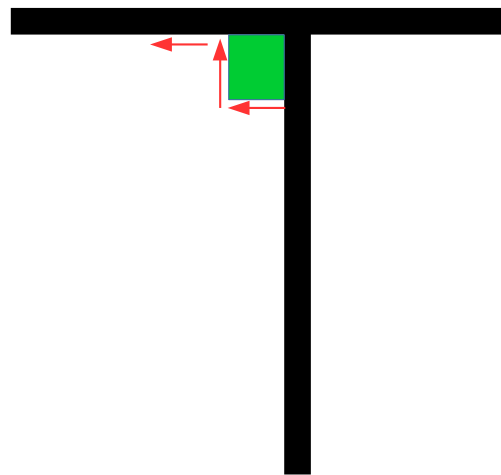


**Overshot Line**          **Undershot Line**
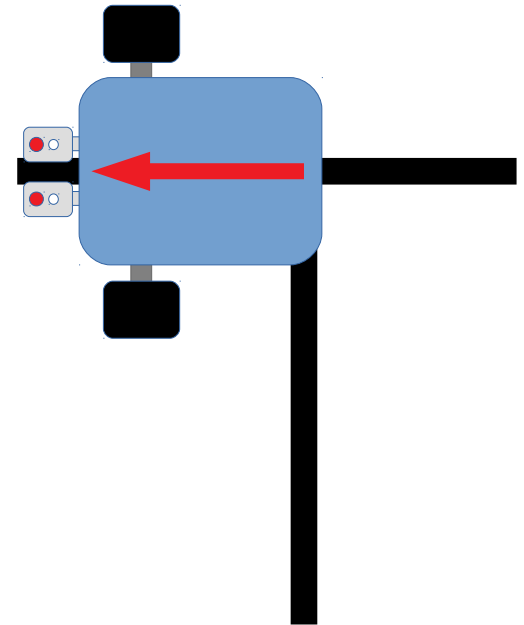
# Turning at the Junction

Method 2

- Stop line following
- Switch to single sensor line following (left sensor)
- Continue two sensors line following



**Stop**

**Single line following**

**Continue**

# Reflected Light for Line Following?

- Sum up the RGB values using an Advanced Math Block to get the total reflected light value

- You can use this value for normal line following

- Note that the value will range from 0 to ~900 (...normal reflected light reading ranges from 0 to 100)

- Divide by 8 or 9 to make the output range approximately 0 to 100 (optional)



"d" not used

Output. Total reflected light
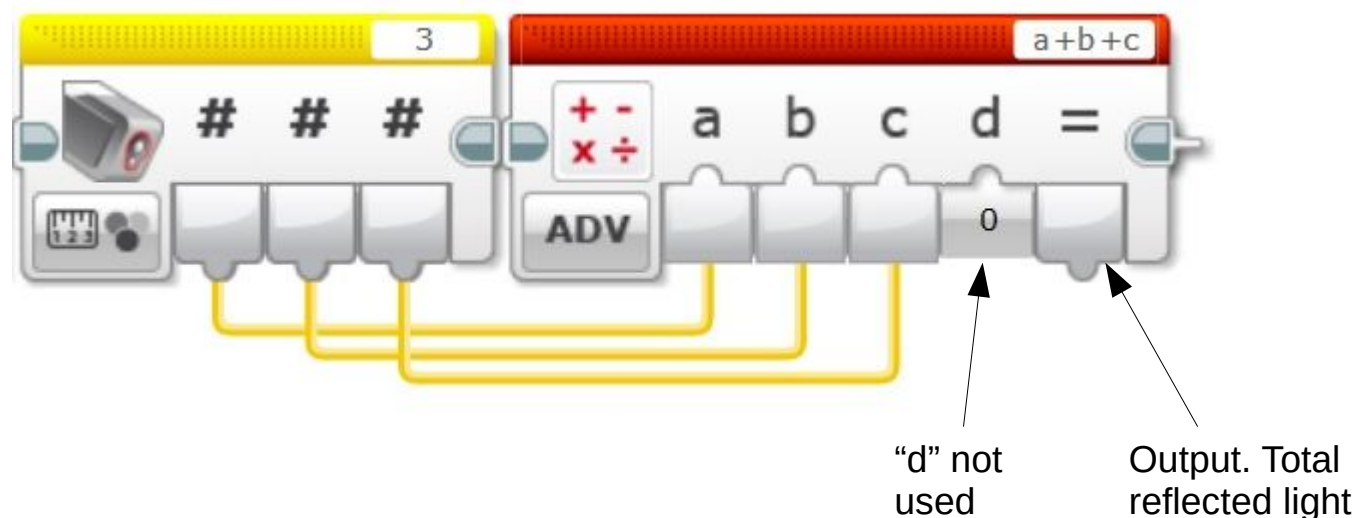
# Tips

- From the light sensors, you only need to know...
    1. Is Left sensor reading Green? (True or False)
    2. Is Right sensor reading Green? (True or False)
    3. Left sensor reflected light value (0 to 100)
    4. Right sensor reflected light value (0 to 100)
- You can put everything into a single My Block that outputs only these four values
- You can also write these values directly into a variable inside your My Block and access it from the rest of your program
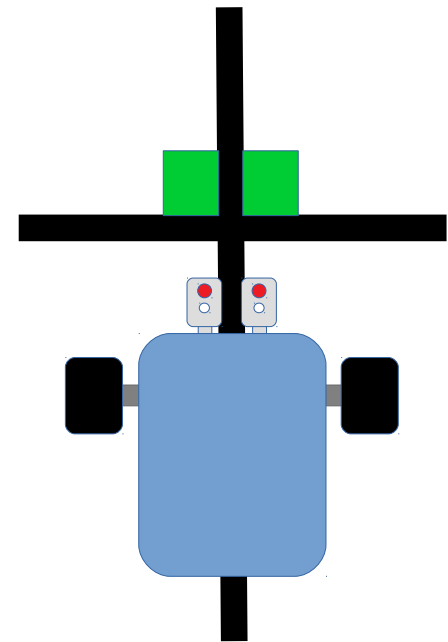
# Challenges

- Write and test your program

- How to handle cases like these?
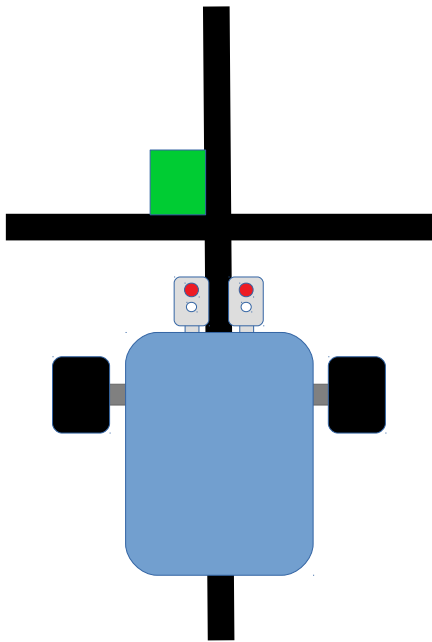


**Robot should
go straight**
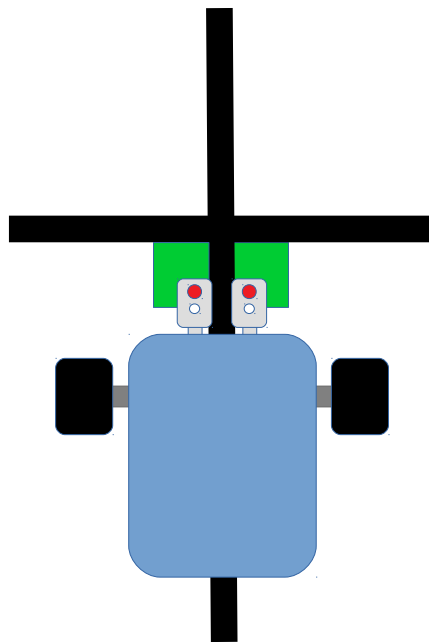
**Robot should
make a U-Turn**

**Robot should
go straight**

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