An Experiment on Calculating Speed

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Introduction

If you walk 6 miles in 2 hours, then your average speed is 3 mi/hr. If you drive 165 miles in 3 hours, then your average speed is 55 mi/hr. All you need to do to compute your average speed is divide the distance by the time.

In this lesson you will investigate the speed of the Ozobot Evo robot. This will be accomplished by using an OzoBlockly program that is provided for you. You need not worry about the details of the program—simply load the program into Evo and run the program.

Working with the OzoBlockly Program

Ozobot is placed at the beginning of a line drawn on a piece of adding machine tape approximately 2 meters in length. You can use an Ozobot (or similar) color marker to draw this line. There are two short lines drawn perpendicular to the main line—one at the beginning of the tape, and another at the end of the tape. Figure 1 (left) shows Ozobot Evo at the beginning of the tape. Figure 1 (right) shows Ozobot Evo at the end of the tape. Two meter sticks are placed end-to-end as a way to measure the distance that Evo travels on the long horizontal line on the tape. The distance between the two vertical lines shown in the figure is 1.585 meters. Alternatively, the distance is 158.5 cm or 1585 mm. You can make the distance between the vertical lines anything you wish—suggested to be between 1 and 2 meters.

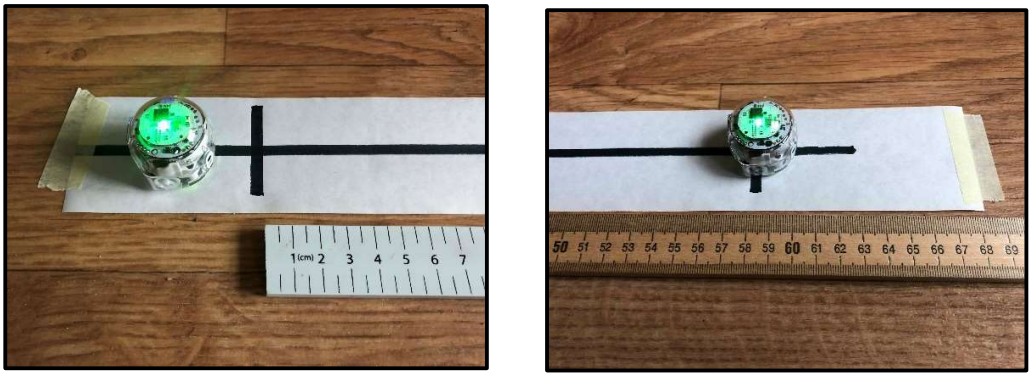

Figure 1

Here are the steps to run the OzoBlockly program, *Determining Speed.ozocode*, that accompanies this lesson:

1. Load the program into Evo.
2. Place Evo at the location shown in the photo on the left in Figure 1.
3. Turn Evo on and start the program. The top light will be red for three seconds and then it will turn green for seven seconds.
4. While the light is green, you need to specify the *nominal speed* that you want Evo to travel along the line. This speed is set by a special block in the OzoBlockly program. To set the speed, click Evo's button the desired number of times during the seven second interval:
    - 2 presses = 20 mm/s
    - 3 presses = 30 mm/s
    - 4 presses = 40 mm/s
    - 5 presses = 50 mm/s
    - 6 presses = 60 mm/s
    - 7 presses = 70 mm/s
    - 8 presses = 80 mm/s

After each press of Evo's button, Evo will quickly flash the top light white. This is to let you know that it has recognized your button press. Don't click the button again until you have seen the white flash.

5. The above are the only allowed speeds. If you press the button zero times, one time, or more than 8 times during the seven-second interval, Evo will ignore your response and turn off. Before Evo starts moving he will speak the speed that you selected, as a double-check for you.
6. Evo has a built-in stop watch timer. The timer will start when Evo crosses the first vertical line on the left and stop when it crosses the vertical line on the far right. Evo will speak the number of seconds required to traverse the distance between the two vertical lines. He will speak this number three times, just in case you missed hearing the first and second times. Then Evo will turn off.

*When Evo speaks the time, it is always **rounded down** to a whole second. For example, if the time is 17.4 seconds or 17.95 seconds, Evo will speak the time as 17 seconds. This is because Evo deals only with integer math. This also explains why it is best to use a 1 to 2 meter (or longer, if you wish) piece of adding machine tape rather than a short line on a standard piece of paper. Evo's rounding down will be less significant if the line is long, especially for the faster speeds.*

View the short accompanying video to see an example run. You're ready to start the experiment! The next page contains a data table for you to fill in as you work, and then some discussion questions as a follow up. Enjoy this learning experience!

Data Table for ***Determining Speed*** Experiment

Nominal Speed (mm/s) (as per Ozobot)	*Distance (mm) (from meter stick)*	*Time (s) (as per Ozobot)*	*Speed (mm/s) (Calculated from speed = d/t)*
20			
30			
40			
50			
60			
70			
80			

Discussion Questions

1. Which speed tends to be higher—Ozobot's nominal speed or your calculated speed? Which of the two speeds do you feel more confident as being closer to the real speed? Why?

2. If you had used a stopwatch instead of relying on Ozobot's time, which of these two times would generally be higher? Why? (As a check on your answer--if you have access to a stopwatch, measure the time for a couple of the nominal speeds with the stopwatch?)

3. If your answer to question 2 was that the stopwatch times would be longer, on average how much longer would each of the times be?

4. Would the amount that the stopwatch times are longer be enough to account for the difference between the nominal and calculated speeds?