Move Steering – Part 3

– The Steering Differential –

Considerations for Robotics Task

Learning Goal

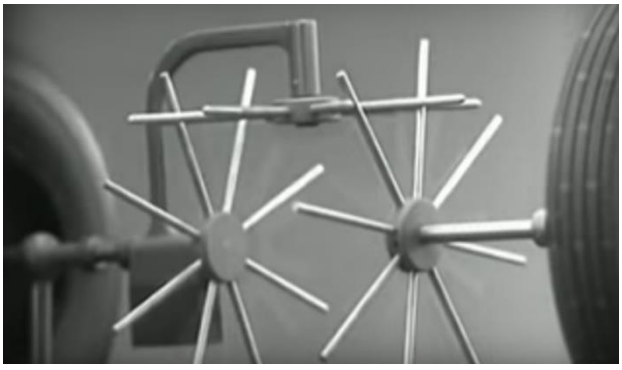
Students understand that a **steering differential** is determined by the number entered in the <Move> steering programming block.

Mathematical Engagement

The **steering differential describes the different power that is delivered to each wheel**. When the differential is zero, each wheel gets the same power and they go in the same direction, whereas at its maximum the wheels are going in different directions at their maximum power. For example, when -100 is entered in the <Move> steering programming block, the left wheel moves backwards and the right wheel moves equally forward. Students learned in Part 2 that at -100 steering setting the robot turns around a circle of radius $6\ cm$.
For Part 3, we adapted the convention of **expressing the steering differential as a percentage** ranging from -100% to 100%, or as a fraction between -1 and 1.

Teaching Suggestions

A partner teacher has used the video *Around the Corner – How Steering Differential Works* to illustrate the steering differential to their students.



We also found that it may be helpful to refer back to the vertical and horizontal number line representation of Part 2 to further scaffold spatial understanding of number.

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Materials Needed

- EV 3 **robot**
- **Recording Sheet** for Part 3, available at http://stem-education.ca/files/SteeringRecordingsheet_2020Part3.pdf

Instructions, Steps and Programming for Part *3*

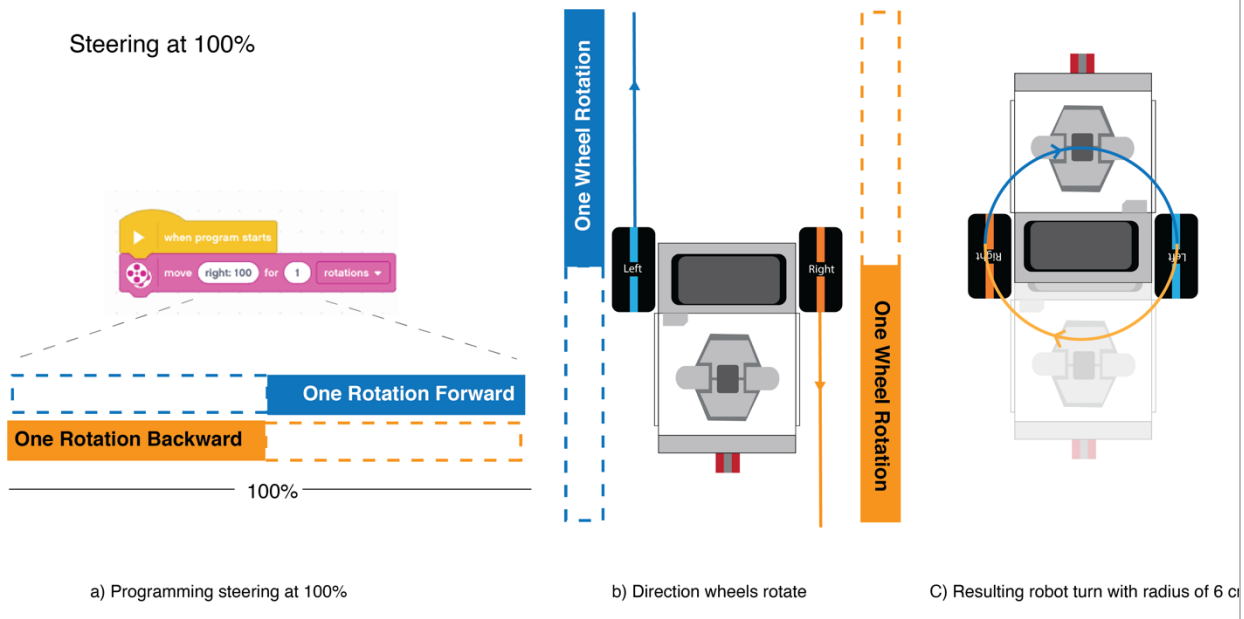
Please find a printable version of the Recording Sheet for Part 3 at http://stem-education.ca/files/SteeringRecordingsheet_2020Part3.pdf

The following excerpt includes a visual for the steering differential:

The **power differential** is the different power that is delivered to each wheel. When the power differential is at its maximum, each wheel is going in different directions. When the slider is set to 100 the power is going to both wheels for a maximum or tight turn.

In the image below

a) shows how the steering is programmed – the steering on the <Move> Programming Block set to 100 means 100%,
b) shows how the direction the wheels rotate, and
c) shows the movement of the robot.



a) Programming steering at 100% b) Direction wheels rotate C) Resulting robot turn with radius of 6 c

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Assessment of Student Understanding

Indicators of Student Understanding

The illustrations of the steering differential on the Recording Sheet are useful for spatially representing proportional relationships (Grades 4-6), and spatially scaffolding algebraic ideas about opposite quantities with distance from a center in Grade 7.
When engaging with Part 3, students measure wheel rotations (geometric measurement of circles), record positive and negative numbers to indicate direction (spatial understanding of number), order fractions and whole numbers (fraction equivalence and ordering), represent data, and determine patterns and structures.

Assessment of Student Understanding

Students can **articulate/explain how the percentage of the steering differential relates to** the number and direction of **left and right wheel rotations**.
The fourth column of our summary table includes an overview of steering settings and the steering differential represented as a fraction.

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