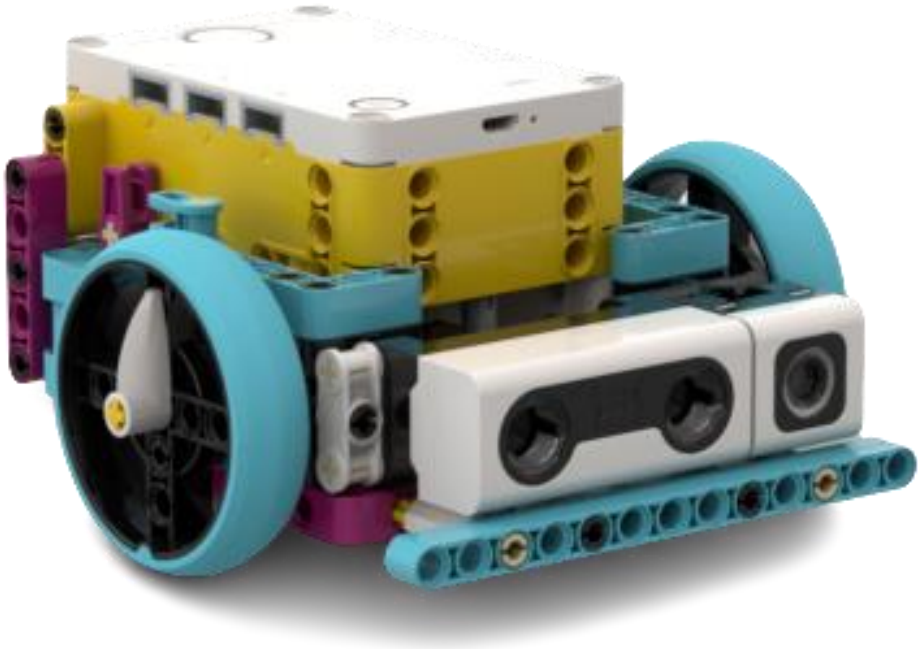
Steering



Steering

Learning Goals

- Build knowledge about coding and robotics by coding a robot to make it move.
- Read, debug, and alter code to make a robot move and turn.
- Have FUN learning!

Steering

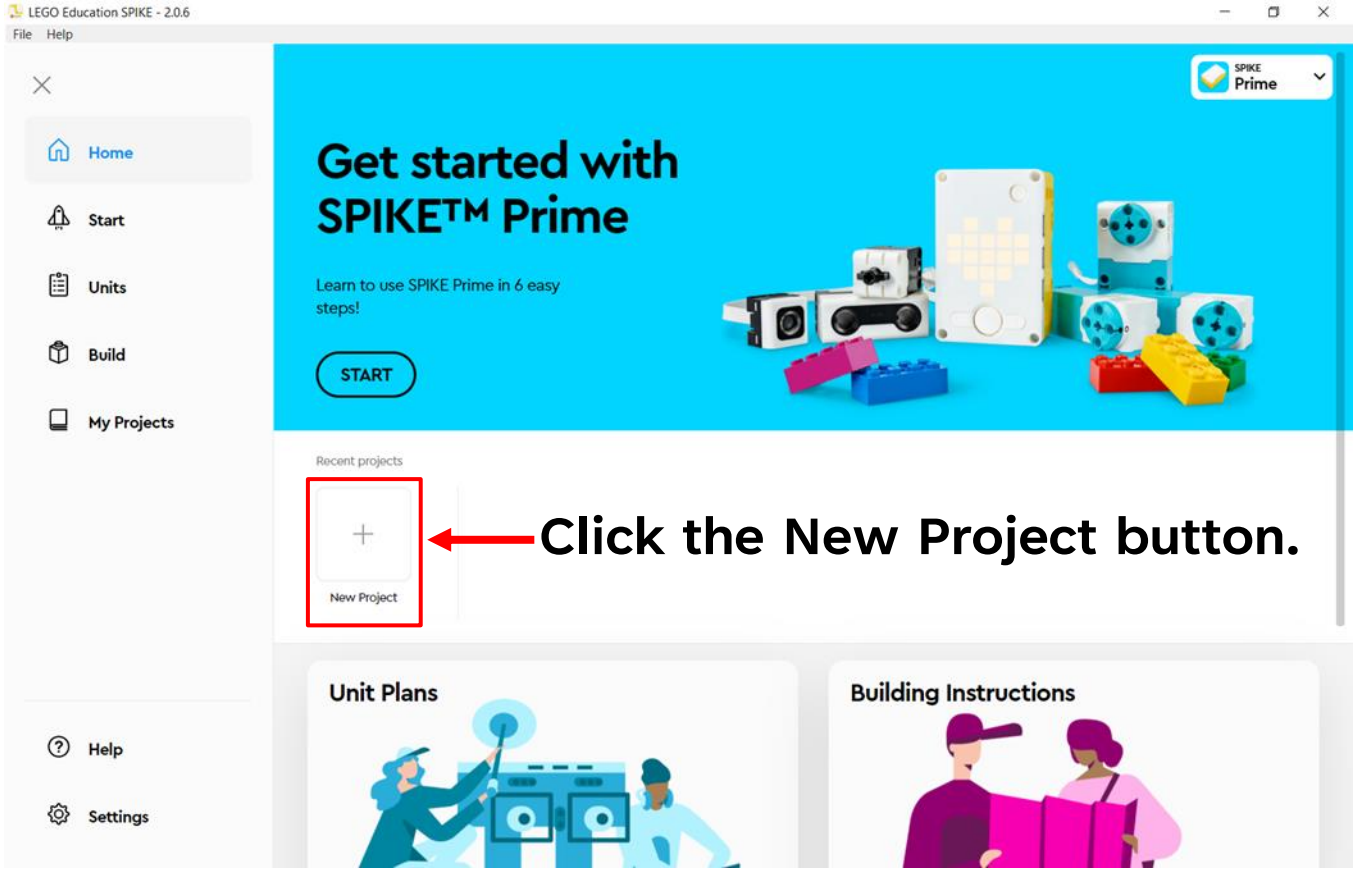
Did you review the Getting Started document?

Do you have the Robocar with Spike attached?
Is Spike turned on?

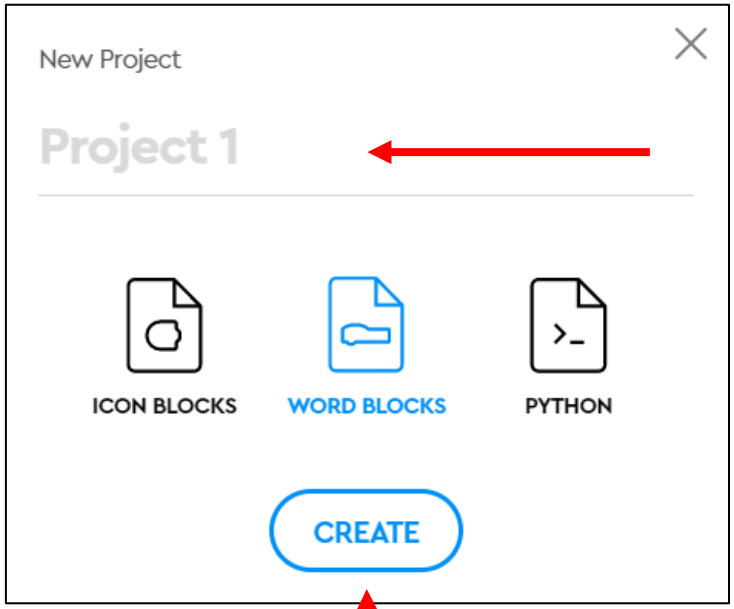
Is the LEGO Spike app open and on screen?
Is Spike connected and ready to use?

Do you know how to download programs to Spike and select programs from Spike?

Steering

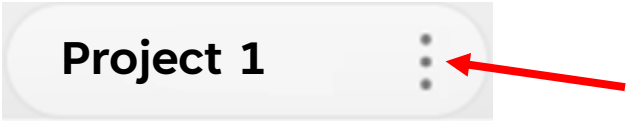

LEGO Education SPIKE - 2.0.6
File Help
Home
Start
Units
Build
My Projects
Help
Settings
SPIKE Prime
Get started with SPIKE™ Prime
Learn to use SPIKE Prime in 6 easy steps!
START
Recent projects
New Project
Click the New Project button.
Unit Plans
Building Instructions

STEERING



Click WORD BLOCKS and then the CREATE button.

OR

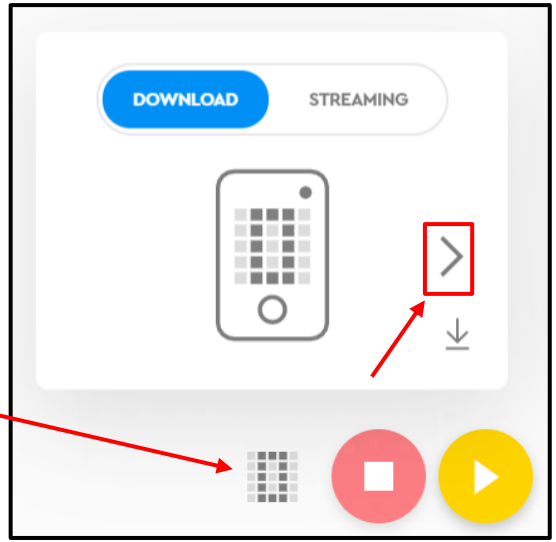


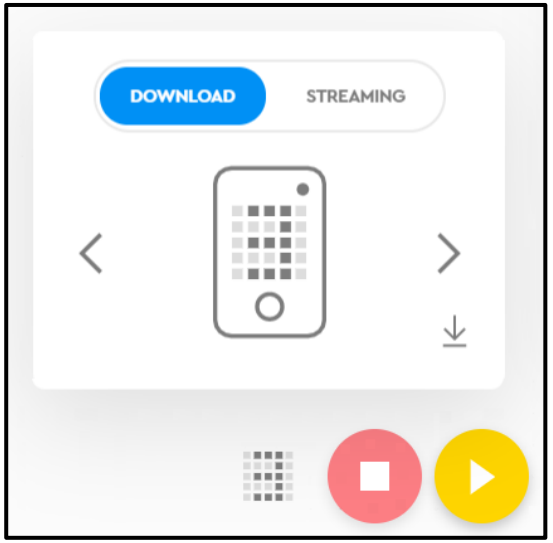
Name your program.

- Click the three dots OR click in the New Project window.
- Name your project: Steer-_____ (your names).

Steering

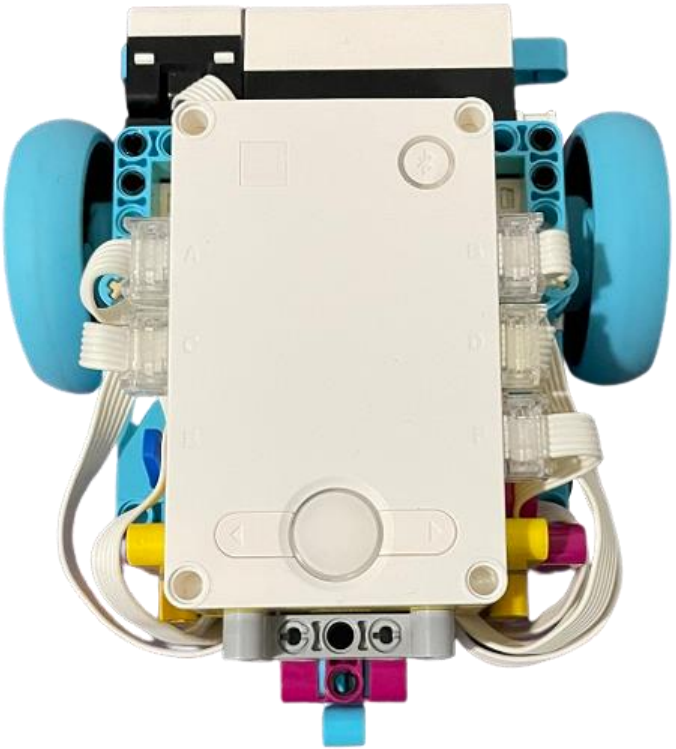
Click the program memory slot button.





Change the program memory slot to three.

Steering



The Robocar motors that make it move are connected to ports A and B.

If for some reason the motors are not connected to ports A and B, please let Mr. Desmond know.

Do not connect the light. For now, it is purposefully disconnected from port C.

Steering

Robot Steering - Introductory Information

The concepts involved in robot steering can get confusing, so it is important to distinguish between how much the robot is turning and how much the wheels attached to the motors are spinning.

How much the robot will turn is dependent on two factors:
1) how gradual or sharp the turn needs to be, and
2) how much turning needs to happen.

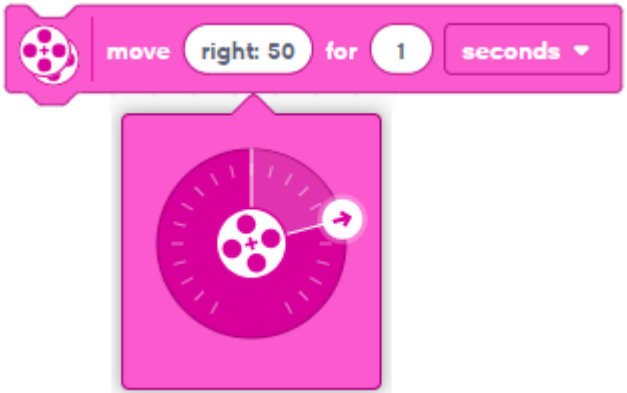
Determining how to make the robot turn is usually only figured out by trial and error.

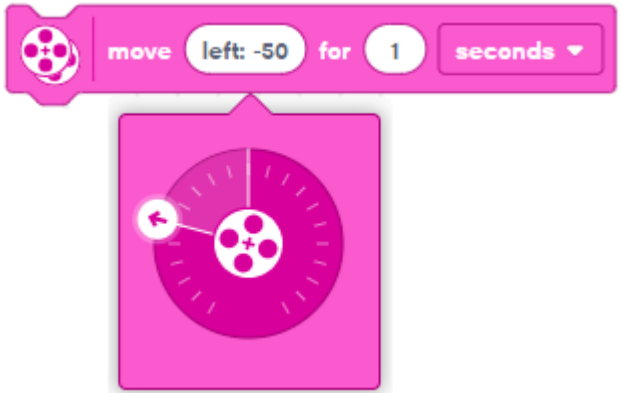
Steering

Robot Steering - Introductory Information

To determine **how gradual or sharp the turn needs to be [Factor 1]**, the Spike app uses a turning dial.

The turn dial uses points on an arc from zero; right turns are positive numbers, and left turns are negative numbers. The turn dial arc range is from -100 to 100.





Steering

Robot Steering - Introductory Information

To determine **how much turning needs to happen [Factor 2]**, the Spike app uses the duration of the movement of the motors. The use of seconds is the preferred duration unit to move the motors, but rotations and degrees could also be used.

Robot Steering - Exploration 1

Activity Goals

1) To explore how to use the turn dial to control whether a turn is gradual or sharp **[Factor 1]**.
2) To investigate and compare the differences in how much a robot will turn as the turn dial arc values are adjusted.
3) To understand the relationship between turn dial arc values and how the robot turns.

Robot Steering - Exploration 1

Activity Steps

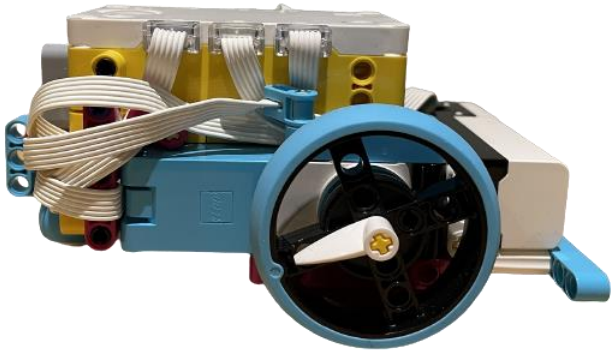
1) Create a chart to record Exploration 1 data. Chart
2) Create a code sequence to move the Robocar. Code
3) Read the testing instructions and complete the testing. Test
4) Add to your Exploration 1 data chart. Chart
5) Create a new code sequence to move the Robocar. Code
6) Read the testing instructions and complete the testing. Test
7) Answer questions and explain your ideas. Explain

Steering

Robot Steering - Exploration 1

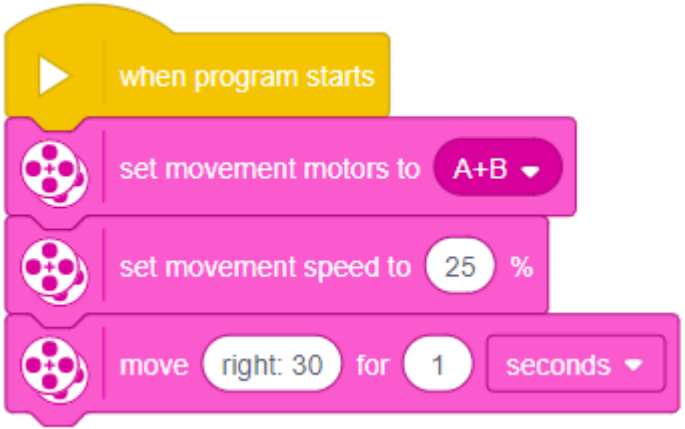
Create this chart to record your finding for how much the Robocar turns when using move right 30 for one second.

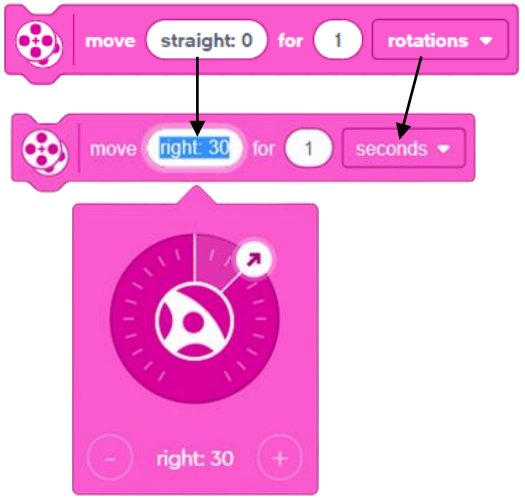
Steering Exploration 1		
Turn Dial Arc Number	Duration Time (seconds)	Robocar Turn (slight / sharp)
30	1 s	



Robot Steering - Exploration 1

Create a code sequence to have the Robocar move right 30 for one second at 25% speed.





Download the program to Spike.

Steering

Robot Steering - Exploration 1

Position the Robocar ready to move.

Run your Steer program.

Visually track how Robocar turns.

Using move right 30 does the Robocar make a slight or a sharp turn?

Repeat. Run your program again.

Record your finding on your chart.

Using move right 30 the Robocar will turn a certain amount in one second.

Steering

Robot Steering - Exploration 1

Change your code to make the Robocar move left -30.

Position the Robocar ready to move.

Run your Steer program.

Visually track how Robocar turns.

Using move left -30 does the Robocar make a slight or a sharp turn?

Repeat if necessary.

Does this confirm what you discovered using move right 30?

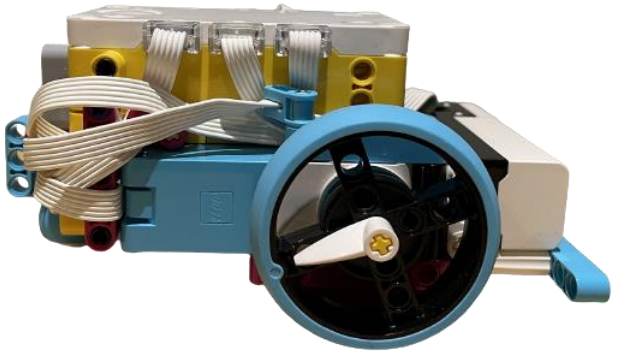
Using move left -30 the Robocar will turn a certain amount in one second.

Steering

Robot Steering - Exploration 1

Add to the chart you created earlier to record your finding for how much the Robocar turns when using move right 90.

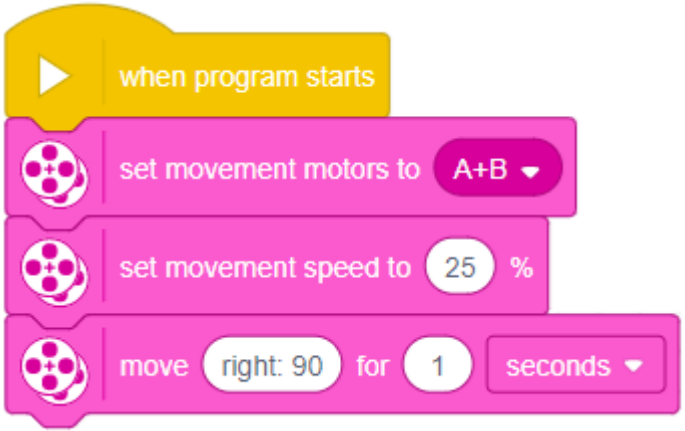
Steering Exploration 1		
Turn Dial Arc Number	Duration Time (seconds)	Robocar Turn (slight / sharp)
30	1 s	
90	1 s	

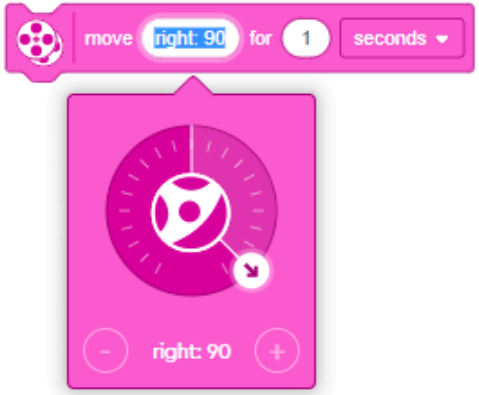


STEERING

Robot Steering - Exploration 1

Create a code sequence to have the Robocar move right 90 for one second at 25% speed.





Download the program to Spike.

Steering

Robot Steering - Exploration 1

Position the Robocar ready to move.

Run your Steer program.

Visually track how Robocar turns.

Using move right 90 does the Robocar make a slight or a sharp turn?

Repeat. Run your program again.

Record your finding on your chart.

Using move right 90 the Robocar will turn a certain amount in one second.

Steering

Robot Steering - Exploration 1

Change your code to make the Robocar move left -90.

Position the Robocar ready to move.

Run your Steer program.

Visually track how Robocar turns.

Using move left -90 does the Robocar make a slight or a sharp turn?

Repeat if necessary.

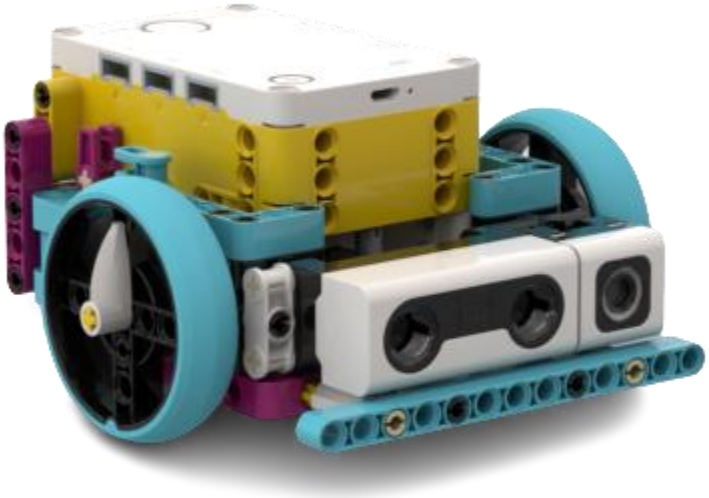
Does this confirm what you discovered using move right 90?

Using move left -90 the Robocar will turn a certain amount in one second.

Steering

Robot Steering - Exploration 1

Check in with Mr. Desmond.
Be prepared to show your chart and how your Robocar turns.



Steering

Robot Steering - Exploration 1

Think about it, discuss your ideas as a group, and then write your answers on your paper below your chart.

1) How does the turn dial arc number affect the Robocar's turns?
2) Explain how the turn dial controls how gradual the Robocar's turns are.
3) What is the function of the turn dial as related to steering the Robocar?

Check in with Mr. Desmond.
Be prepared to show your work and discuss your ideas.

Steering

Robot Steering - Consider This

To determine **how gradual or sharp the turn needs to be [Factor 1]**, the Spike app uses a turning dial.

The turn dial uses points on an arc to determine whether it will be a slight turn, a sharp turn, or something in between.

Robot Steering - Exploration 2

Activity Goals

1) To explore how the duration of the turn controls how much turning will happen **[Factor 2]**.
2) To investigate and compare the differences in how much a robot will turn as the amount of turning time is adjusted.
3) To understand the relationship between the duration of the turn in seconds and how much a robot will turn.

Robot Steering - Exploration 2

Activity Steps

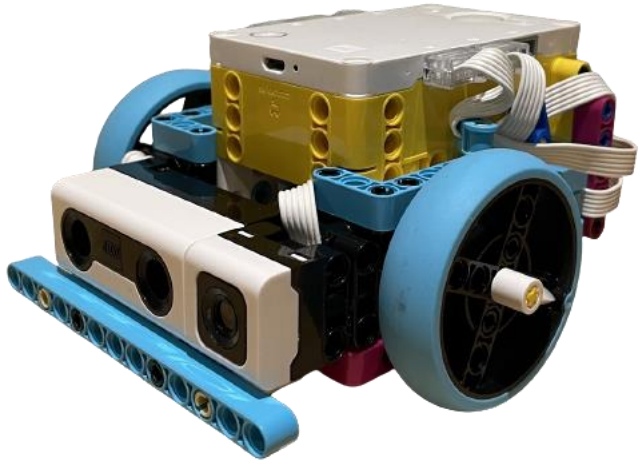
1) Create a chart to record Exploration 2 data. Chart
2) Create a code sequence to move the Robocar. Code
3) Read the testing instructions and complete the testing. Test
4) Answer questions and explain your ideas. Explain

Steering

Robot Steering - Exploration 2

Create this chart to record your findings for how much the Robocar turns.

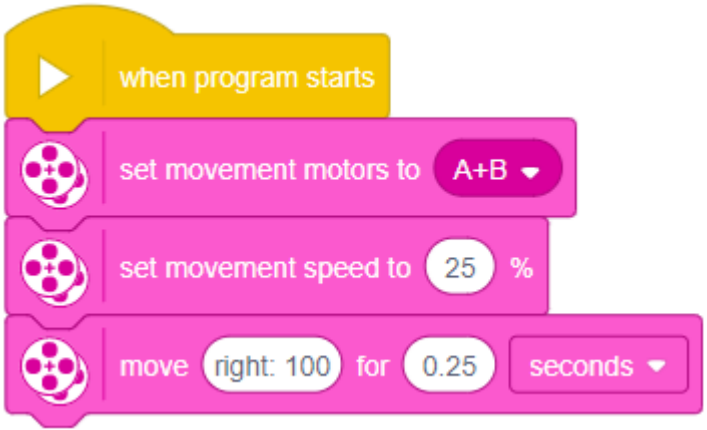
Steering Exploration 2		
Turn Dial Arc Number	Duration Time (seconds)	Robocar Turn (degrees)
100	0.25 s	
100	0.5 s	
100	1 s	

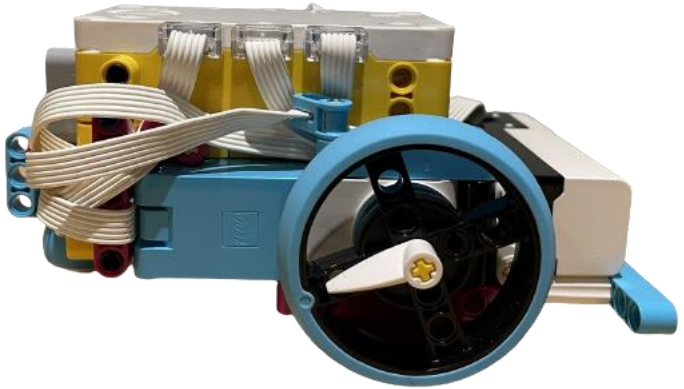


STEERING

Robot Steering - Exploration 2

Create a code sequence to have the Robocar move right 100 for 0.25 seconds at 25% speed.

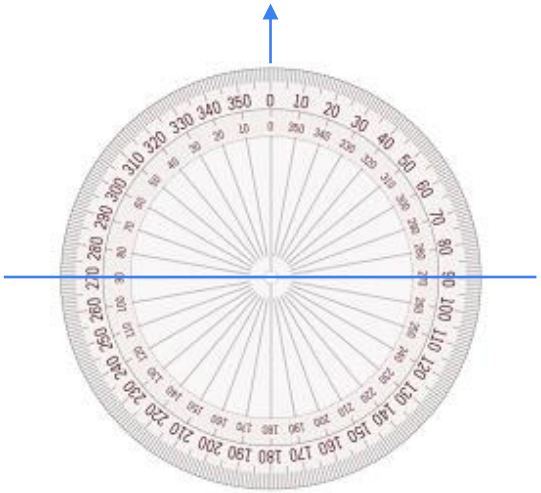




Download the program to Spike.

Steering

Robot Steering - Exploration 2



Collect one of the paper protractor sheets.

Place the wheels of the Robocar along the line that runs through 270º and 90º.
[Zero degrees should face up as if the direction of movement is straight forward.]

Hold the paper still and run your program.

Visually track how the Robocar turns and mark (using your finger) the Robocar's position after the turn.

Determine as best as you can how many degrees the Robocar turned.

Steering

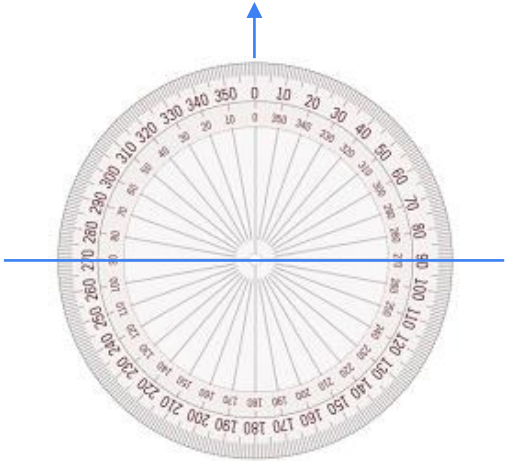
Robot Steering - Exploration 2

Complete all of the following steps.

1) Record your findings for how many degrees the Robocar turned after 0.25 seconds.

2) Change the time in your code to 0.50 seconds. Place the Robocar on the paper protractor sheet. Record how many degrees the Robocar turns after 0.50 seconds in your chart.

3) Change the time in your code to 1 second. Place the Robocar on the paper protractor sheet. Record how many degrees the Robocar turns after 1 second in your chart.

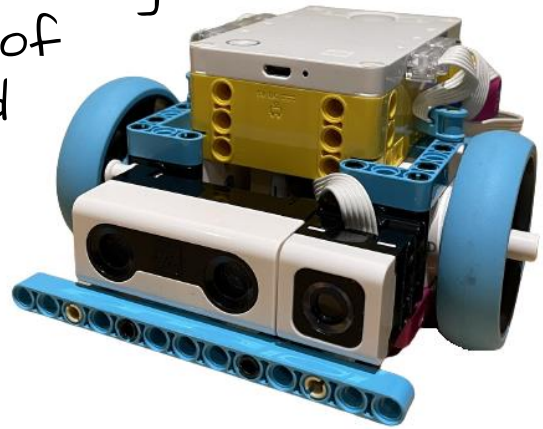


Steering

Robot Steering - Exploration 2

Think about it, discuss your ideas as a group, and then write your answer on your paper below your chart.

1) Using seconds as the duration unit when steering the Robocar connects to the relationship of time, speed, and distance that you explored previously.
   Explain how time, as measured in seconds, affects how much the Robocar turns (distance).



Check in with Mr. Desmond.
Be prepared to show and discuss your answer.

Steering

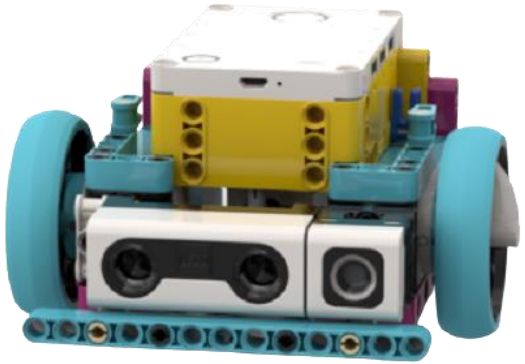
Robot Steering - Consider This

The duration unit is directly related to how much the Robocar's motor spindles spin and the wheels turn. The duration of the turn determines how much turning will happen **[Factor 2]**.

How to make the Robocar turn is determined by figuring out:

(1) how gradual or sharp the turn needs to be, and

(2) how much turning needs to happen based on the duration of the movement of the wheels.



Robot Steering - Exploration 3

Activity Goals

1) To explore ideas related to how the robot turns.
2) To investigate how much a robot will turn when using degrees as the duration value.
3) To understand the difference between how much a robot will turn as measured in degrees or rotations and how degrees and rotations function as a duration unit.

Robot Steering - Exploration 3

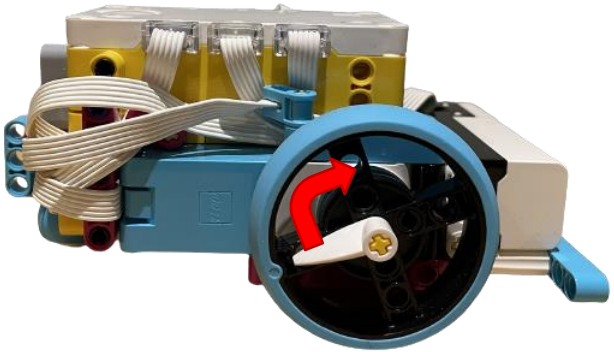
Activity Steps

1) Create a chart to record Exploration 3 data. Chart
2) Create a code sequence to move the Robocar. Code
3) Read the testing instructions and complete the testing. Test
4) Explore more ideas about durations. Explore More
5) Answer questions and explain your ideas. Explain

STEERING

Robot Steering - Exploration 3

Create this chart to record your findings for how much the Robocar turns.



Steering Exploration 3		
Turn Dial Arc Number	Duration Unit (degrees)	Robocar Turn (degrees)
100	90^0	
100	180^0	
100	360^0	

* 90 degrees as the duration unit means that the motor spindle and the wheel attached to it will spin for 90 degrees.

STEERING

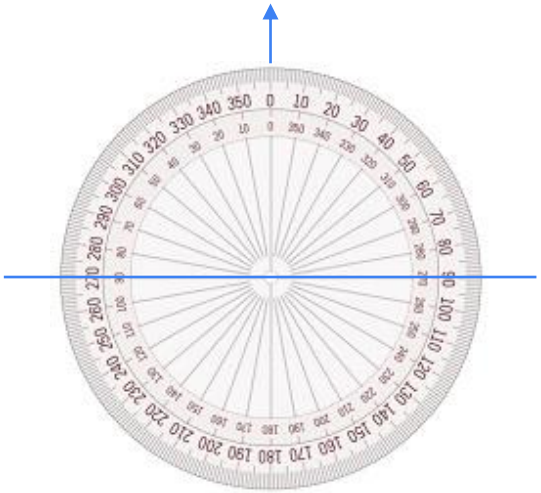
Robot Steering - Exploration 3

Create a code sequence to have the Robocar move right 100 for 90 degrees at 50% speed.

Download the program to Spike.

Steering

Robot Steering - Exploration 3



Collect one of the paper protractor sheets.

Place the wheels of the Robocar along the line that runs through 270º and 90º.
[Zero degrees should face up as if the direction of movement is straight forward.]

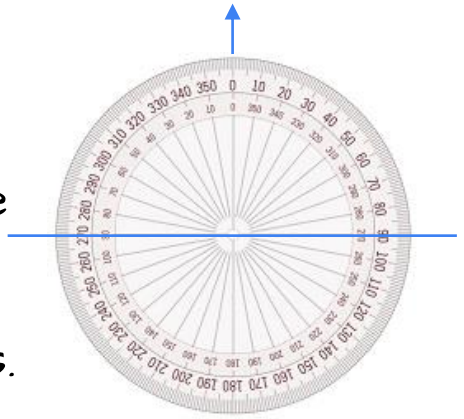
Hold the paper still and run your program.

Visually track how the Robocar turns and mark (using your finger) the Robocar's position after the turn.

Determine as best as you can how many degrees the Robocar turned.

Steering

Robot Steering - Exploration 3



Complete all of the following steps.

1) Record your findings for how many degrees the Robocar turned using 90 degrees as the duration.

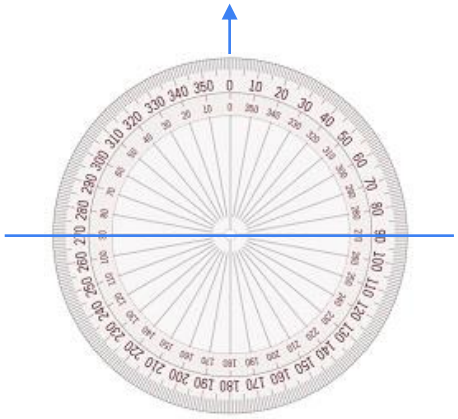
2) Change the duration in your code to 180 degrees. Place the Robocar on the paper protractor sheet. Record how many degrees the Robocar turns using 180 degrees as the duration in your chart.

3) Change the duration in your code to 360 degrees. Place the Robocar on the paper protractor sheet. Record how many degrees the Robocar turns using 360 degrees as the duration in your chart.

Steering

Robot Steering - Exploration 3

More Explorations



Have the Robocar move right 100 for 360 degrees at 50% speed.
Watch the wheel of the Robocar spin.
Did the the wheel spin 360 degrees?
360 degrees of wheel movement is equal to how many rotations of the wheel?

720 degrees of wheel movement is equal to how many rotations of the wheel?
Have the Robocar move right 100 for 720 degrees at 50% speed.

Steering

Robot Steering - Exploration 3

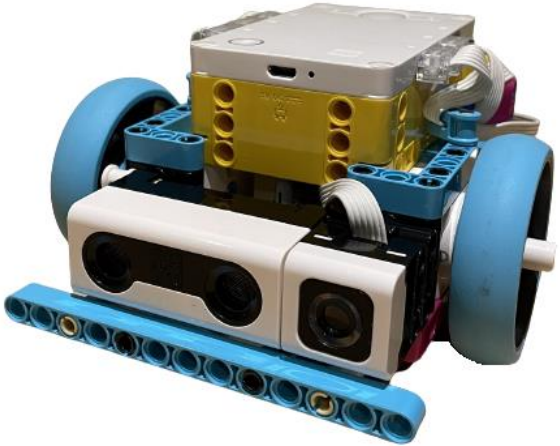
Think about it, discuss your ideas as a group, and then write your answers on your paper below your chart.

1) During steering what Robocar part is actually moving when you use degrees as the duration unit?
2) Did move 100 right for 90 degrees make the Robocar complete a right-angle turn (a 90⁰ turn)?
3) Did move 100 right for 180 degrees make the Robocar complete a half circle (a 180⁰ turn)?
4) Did move 100 right for 360 degrees make the Robocar complete a circle (a 360⁰ turn)?
5) What does it mean to move for "degrees"?

Steering

Robot Steering - Exploration 3

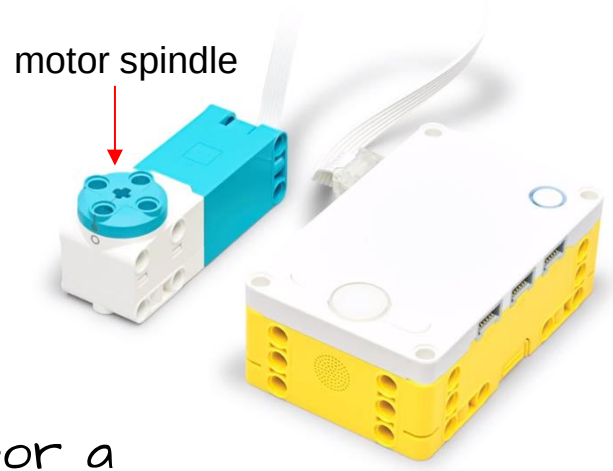
6) What is the relationship between rotations and degrees?
7) How many rotations is 360 degrees?
8) How many rotations is 720 degrees?
9) When steering the Robocar how are degrees as a duration unit different from using seconds as the duration unit?



Check in with Mr. Desmond.
Be prepared to show your answers and discuss your ideas.

Steering

Robot Steering - Consider This



When the motor runs it is the motor spindle that is moving (spinning). The Robocar's wheels are attached to the motor spindle. That means the wheels spin at the same time and at the same rate as the spindle.

When the motor runs the spindle moves for a certain duration as controlled by the coding. For example, if we were to code the Robocar's motors to move for 720 degrees each motor spindle would complete two rotations and spin in a full circle two times.

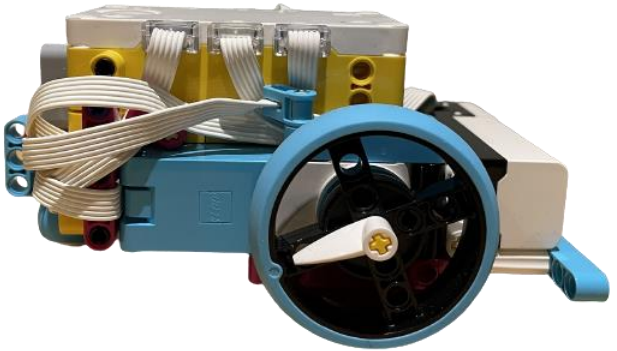
The Robocar would **not** turn in a circle two times.

Steering

Robot Steering - Consider This

Degrees as a duration unit refers to how many degrees the motor spindle and the wheel connected to the motor spins. **Degrees as a duration unit does not refer to how many degrees the robot itself will turn.**

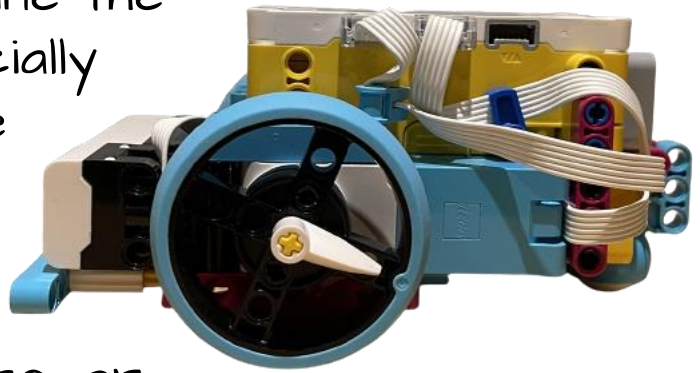
When thinking about robot steering it is important to distinguish between how much the robot is turning and how much the wheels attached to the motors are spinning.



Steering

Robot Steering - Consider This

Time is a very useful way to determine the movement of robotic systems, especially robotic systems that move about like the Robocar.



Degrees and rotations can be very useful when working with fine, precise, or exact movements such as the movement of a robotic arm.

Steering Challenges

Learning Goals

- Build knowledge about coding and robotics by coding a robot to make it move.
- Independently create code to make a robot move and turn.
- Have FUN learning!

Steering Challenges

Challenge 1 - There and Back

Program the Robocar using seconds as the duration unit to move forward 30 cm, complete a U-turn (180⁰), play a sound, and then move forward back to the starting point.

You are expected to demonstrate your success to Mr. Desmond - showing both the robot in action and the code before you begin the next activity.

Steering Challenges

Challenge 2 - The Rectangle

Program the Robocar using movement in seconds to complete the path of a rectangle with the long sides equal to 40 cm and the short sides equal to 25 cm.

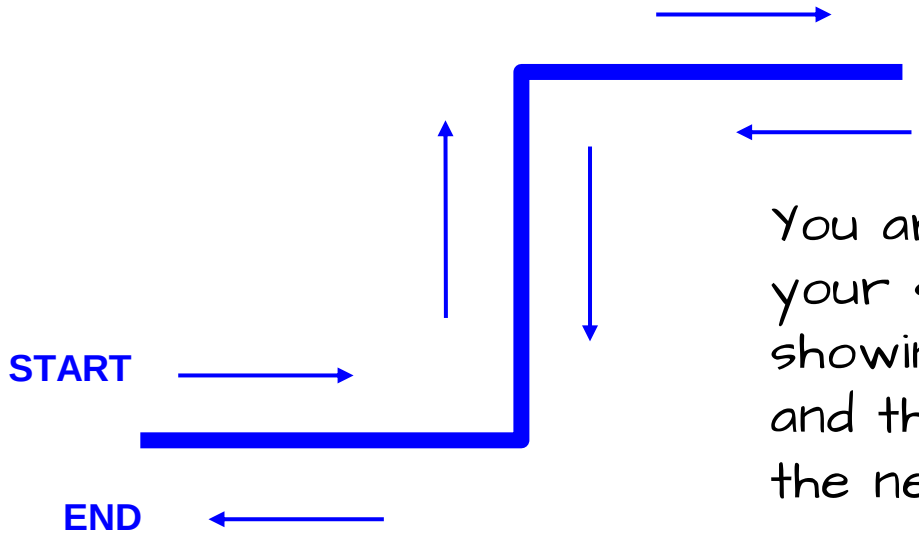
Each corner turn should be as precise as possible.

You are expected to demonstrate your success to Mr. Desmond - showing both the robot in action and the code before you begin the next activity.

Steering Challenges

Challenge 3 - The Corner Challenge

Program the Robocar using seconds as the duration unit to complete movement along the path of the design below. Each move should be about 25 cm.

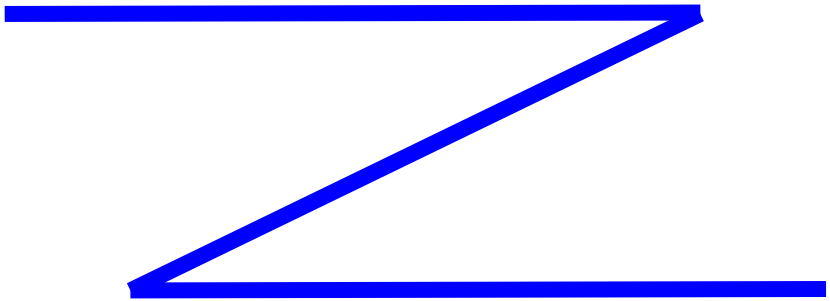


You are expected to demonstrate your success to Mr. Desmond - showing both the robot in action and the code before you begin the next activity.

Steering Challenges

Challenge 4 - The Zig-Zag Challenge

Program the Robocar using seconds as the duration unit to complete movement along the path of a Z design.
Each line should be about 35 cm.



You are expected to demonstrate your success to Mr. Desmond - showing both the robot in action and the code before you begin the next activity.