BLOCKS 3: LIGHTS

OVERALL TIME *1- to 2-hour lesson*

GROUPS *Three to four kids*

PROGRAMMING LEVEL *Advanced Block: Functions, Variables, Complex Controls (If Then), and Comparators*

CONTENT THEME *Technology & Engineering*

OBJECTIVE

- **I can use a gyroscope to calculate rotational velocity.**
- **I can learn what absolute value is.**
- **I can create and execute a Block program.**

OVERVIEW

In this activity, you will build a spinning top program where the gyroscopic spin rate will control the main LEDs, and you will use the concepts of normalization and absolute value. This is a great activity after you complete Blocks 2.

MATERIALS

- **Sphero BOLT**

EXPLORATION: SPINNING TOP

In this activity you will learn a new way to control the Sphero BOLT's lights and use them to build a creative program that replicates a spinning top toy.

- *How do you think the Sphero BOLT can recognize when it's spinning or rolling? Do you know of a sensor that might do this?*
- *What other devices can recognize rotation?*

EXPLORATION: LED

- *What does LED stand for?*
- *Can you think of other devices (besides the Sphero BOLT) that use LEDs?*
- *Why does the Sphero BOLT only need three different color channels?*

To learn more about LEDs, take a look at the video below.

▶ *https://youtu.be/AgSSSOKIJZA*

EXPLORATION: GYROSCOPE

Change the Sphero BOLT's red and green color channels to visualize the gyroscope's sensor values.

- *What is the vertical axis also known as and how is it measured?*
- *What is the horizontal and forward axis known as?*
- *How do you designate whether the Sphero BOLT spins clockwise or counterclockwise? What is your value range?*

SKILLS BUILDING: PROGRAM FRAMEWORK

Setup the framework for the spinning top program.

- *Why should the stabilization feature be turned off to complete this assignment?*

Take a look at the video below to see how to setup the framework for the spinning top program.

▶ *https://youtu.be/MNo6hEfJr2Y*

SKILLS BUILDING: GREEN FOR "IF" (POSITIVE VALUES)

Use the gyroscope sensor data to modulate the green channel on the LEDs, and introduce normalization.

- *Why are we normalizing the gyroscope spin rate with these two numbers?*
- *What happens if you spin the Sphero BOLT clockwise? Why does this happen?*

Learn how to modulate the green channel on the LEDs below.

▶ *https://youtu.be/GNng3GLfaqA*

SKILLS BUILDING: RED FOR "ELSE" (NEGATIVE VALUES)

Use the gyroscope sensor data to modulate the red channel on the LEDs, and introduce "absolute value."

- *What is absolute value?*
- *Why is the absolute value necessary when determining the LED channel scale?*

Learn how to modulate the red channel on the LEDs below.

▶ *https://youtu.be/JB2ecAVRRnE*

CHALLENGE: SENSOR STREAM

Now that you've completed building this program, investigate the gyroscope sensor stream data.

- *What did you notice about the sensor data?*
  - *Pay special attention to the gyroscope pitch and roll.*

Take a look at the video below to check out the Challenge!

▶ *https://youtu.be/TUgb4exCDn8*

REFLECTION

Write or reflect in a group what you learned with the Sphero BOLT:

- *What is a gyroscope?*
- *How does the the Sphero BOLT's acceleration and direction affect the velocity?*