

Visual Perception STEM Experiment

Overview:

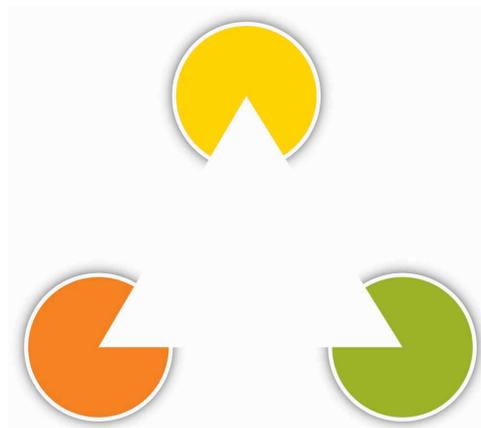
This lesson uses the micro:bit to measure the visual perception of a student by completing a circuit on a board. The student will be measuring his/her ability to visualize a diagonal line formed by blinking LEDs in a number of different environments and conditions. The differences in perception demonstrate how the the brain processes information in different ways as more or less blood/oxygen is delivered to it.

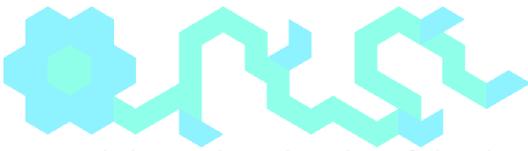
Students will be able to:

- Design and carry out an experiment to test their ability to visualize a diagonal line using the micro:bit.
- Utilize simple block code to produce a device that will measure and read out the time it takes for the students to recognize a diagonal line.
- Construct a data table and graph to observe a trend
- Make a conclusion based on the data
- Construct a model to describe how humans receive different types of information through their senses, process the information in their brain, and respond to the information in different ways. 4-LS1-2

Introduction Exercise

An accurate picture of what visual perception is should be demonstrated by the teacher before performing the experiment. The picture below is a good example, ask students to describe what they see. The teacher should inform the students that even though they see a triangle, there is no triangle.





A thorough explanation of visual perception is needed as well as a discussion about the micro:bit can be used to explore visual perception with the blinking lights function.

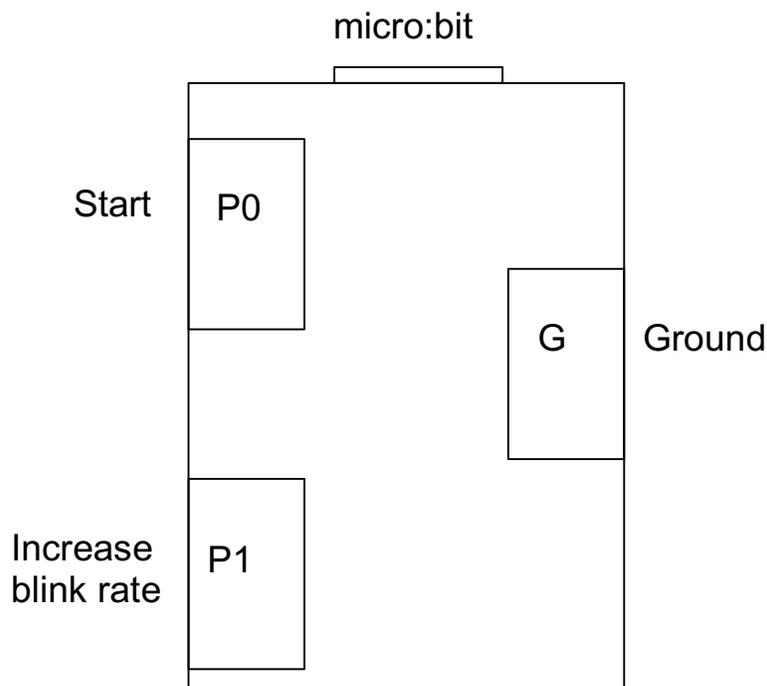
Materials needed:

- 1 micro:bit device with USB cable
- 1 battery pack
- 1 cereal box
- Two 4" by 8" pieces of foil
- masking tape

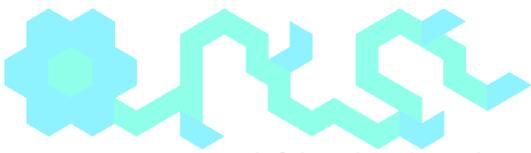
Recommended Procedure:

1. Download the code here onto the micro:bit and connect the battery pack to the micro:bit.
2. Cut a square in the bottom of the cereal box and tape the micro:bit to it so that the LED array can be seen when looking down into the box from the top.
3. Paste the foil on either side of the box and connect with wires and croc clips to P0 (top left-hand side), P1 bottom left-hand side and ground (right hand side) pins.

Top-down view of cereal box



4. While looking into the box press the Start foil (P0) with your left hand while holding the Ground foil (G) with your right hand. After the countdown timer starts, release the box with



your left hand and continue to hold with your right hand on ground.

5. Initially the cursor will blink slowly and move down in a diagonal motion from top left to bottom right. Increase the blink rate by touching the Speed Up P1 foil. Every time this foil is touched the time delay in between blinks will decrease by 20 ms.
6. Continue to push the P1 pin with your left hand and count how many times the foil is pressed. Stop pressing when you see a solid line.
7. Record how many times you pushed the P1 button and translate that into delay time. See sample table below.

# of times the Speed Up foil is pushed	The delay time between blinks (milliseconds)
0	200
1	180
2	160
3	140
4	120

8. Now repeat steps 4-7 after performing various physical activities. See the table below for examples.

Physical activity (performed 5 minutes before experiment)	The delay time between blinks (in which a solid line is perceived)
2 minutes of medication with breathing	
2 minutes of jumping jacks	
2 minutes of running	
2 minutes of a math worksheet	

9. After the table is completed, have the students make a bar graph on a piece of graph paper and then compare with the rest of the class.

Recommended Discussion Questions

- What does it mean to be able to see a diagonal line when in reality
- What happens when to humans' brains as exercise is performed?



- Why would an increase in blood flow increase the ability of cells/organs to function?
- What trends (if any) can be seen in the data?
- It has been said that “when you are tired your mind will play tricks on you.” Support or debate this statement based on your data.

Standard Addressed

Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways. 4-LS1-2

Crosscutting Concept

A system can be described in terms of their components and interactions.

Disciplinary Core Idea

- Different sense receptors are specialized for particular kinds of information, which maybe then processed by the human’s brain. Humans are able to use their perceptions and memories to guide their actions.

Science and Engineering Practices

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.
- Support an argument with evidence, data or a model.

Example: Make Code

See: <https://makecode.microbit.org/projects> and scroll to STEM



```
on start
  set pause to 50

on pin P0 pressed
  while true
    do
      for index from 0 to 4
        do
          plot x index y index
          pause (ms) pause
          unplot x index y index

on pin P1 pressed
  set pause to (pause + 10)
```

Make Code: Hex File

<https://makecode.microbit.org/CdX3KM1v2X7p>