

# e-Motion!

Have you ever wondered how automatic doors at grocery stores know when to open? There is a sensor over the door that works similarly to Motion Detector. Motion Detector sends out sound waves that reflect from objects, such as your body. Based on the amount of time it takes the wave to bounce back, Motion Detector is able to calculate the position of the object.

## OBJECTIVES

In this activity, you will

- Explore the different lines and curves produced by moving in front of the Motion Detector.
- Learn to write detailed steps for creating an M or W shape on the graph.
- Match different letter and designs drawn on the graph.

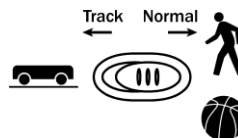
## MATERIALS

LabQuest  
Vernier Motion Detector

## PROCEDURE

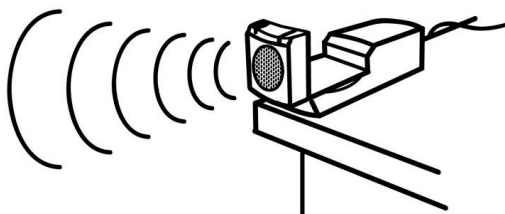
### Part I Creating Straight-Line Graphs Such as M, N, and W

1. Do the following to set up the Motion Detector for data collection:
  - a. Make sure the Motion Detector is connected to LabQuest.
  - b. Set the switch on the Motion Detector to the Normal setting as shown here. You can find the switch by pivoting the head of the Motion Detector.
  - c. Choose New from the File menu.
  - d. On the Meter screen, tap Length. Change the data-collection length to 10 seconds.
  - e. Tap the Graph tab. Choose Show Graph from the Graph menu and select Graph 1. This will display a graph of position vs. time.








**LabQuest 21**

2. Set the Motion Detector on a table so that there is an open path at least 2 meters wide and 3 meters long in front of it. You should face the sensor and must also be able to see the LabQuest screen.



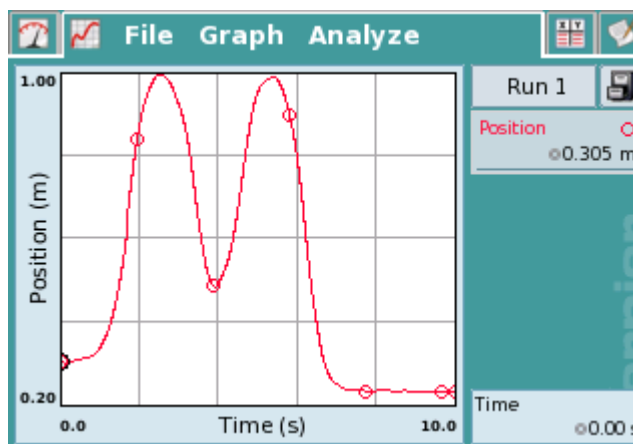
3. Before you begin, review the different segments you can create using the Motion Detector by completing the table below. (The height of each segment cell represents 3 meters and the time is 10 seconds for each cell.)

Segment	Starting position	Direction (forwards or backwards)	Time	Speed (fast or slow)
	m		s	
	m		s	
	m		s	
	m		s	
	m		s	

1 2 3 meters

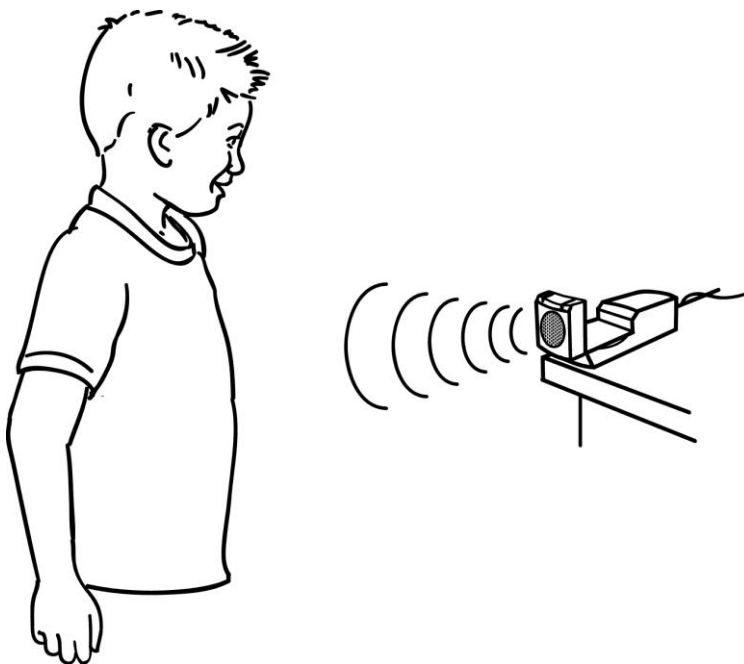
0 2 4 6 8 10 seconds

4. In this part of the activity, you will complete writing the steps necessary to create the letter **M** using a Motion Detector. An example of what this might look like is shown to the right. **Think about how you would make a similar M shape and fill in the blanks below.** You will have a total of 10 seconds.

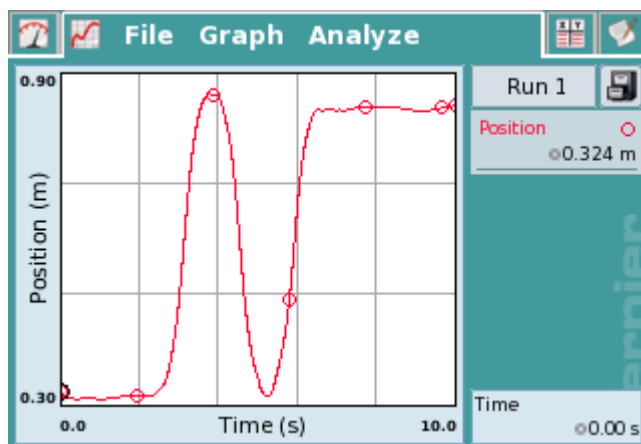


- Start \_\_\_\_\_ meters from the Motion Detector.
- Stand still for \_\_\_\_\_ second(s).
- Move \_\_\_\_\_ (forward or backward) for \_\_\_\_\_ seconds moving \_\_\_\_\_ (fast or slow).
- Move \_\_\_\_\_ (forward or backward) for \_\_\_\_\_ seconds moving \_\_\_\_\_ (fast or slow).

- e. Move \_\_\_\_\_ (forward or backward) for \_\_\_\_\_ seconds moving \_\_\_\_\_ (fast or slow).
  - f. Move \_\_\_\_\_ (forward or backward) for \_\_\_\_\_ seconds moving \_\_\_\_\_ (fast or slow).
  - g. Stand still for the last \_\_\_\_\_ second(s).
5. Estimate the distance from the sensor needed to begin the **M** and then stand in front of the Motion Detector, facing it, at that position.
6. Have one person start data collection, and when you hear fast clicking, follow the directions in Step 4. **Note:** Be sure to keep your hands at your sides and as still as possible.
7. If the graph of the **M** looks like the example, congratulations! If you want to try to make the **M** again, just start data collection, and follow the directions you filled out in Step 4.
8. You will now make the letter **N**. To get started, do the following things:



- a. Choose New from the File menu.
  - b. On the Meter screen, tap Length. Change the data-collection length to 10 seconds.
  - c. Choose Show Graph from the Graph menu and select Graph 1. This will display a graph of position vs. time.
9. On the lines below, write down the steps you would take to match the letter **N**. Use the words in Step 4 as a pattern.



Steps for matching the letter **N**:

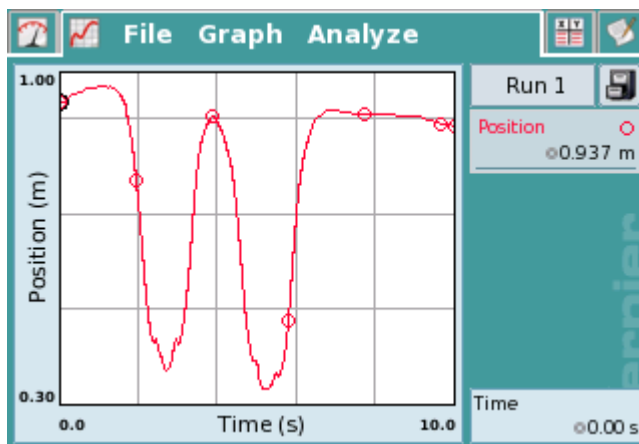
---



---

10. Have one student stand in the right place in front of the Motion Detector, then have another student start data collection. When you hear fast clicking, follow the directions you wrote in Step 9 for making the letter **N**.
11. If the graph of the **N** looks like the example, congratulations! If you want to try to make the **N** again, just start data collection, and follow the directions you wrote in Step 9.

12. You will now make the letter **W**. To get started, do the following things:
  - a. Choose New from the File menu.
  - b. On the Meter screen, tap Length. Change the data-collection length to 10 seconds.
  - c. Tap the Graph tab. Choose Show Graph from the Graph menu and select Graph 1. This will display a graph of position vs. time.



13. On the lines below, write down the steps you would take to match the letter **W**. Use the words in Steps 4 and 9 as a pattern.  
Steps for matching the letter **W**:

---

---

---

---

---

---

---

---

14. Have one person stand in the right place in front of the Motion Detector, then have another student start data collection. When you hear fast clicking, follow the directions you wrote in Step 13 for making the letter **W**.

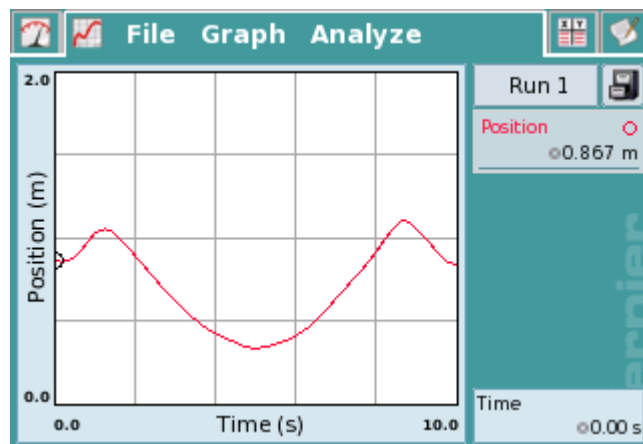
15. If the graph of the **W** looks like the example, congratulations! If you want to try the **W** again, just start data collection, and follow the directions you wrote in Step 13.

## Part II "e-Motion-al" Graphs

You have now made three letters with straight-line segments. Now let's try expressing our "emotions" by making a happy face and a sad face on the graph!

16. You will now make a happy face. To get started, do the following things:

- a. Choose New from the File menu.
- b. On the Meter screen, tap Length. Change the data-collection length to 10 seconds.
- c. Tap the Graph tab. Choose Show Graph from the Graph menu and select Graph 1. This will display a graph of position vs. time.



17. Write the steps you should follow to match the happy face graph shown in the example. Use the directions you wrote above as a guide for what to write.

---



---



---



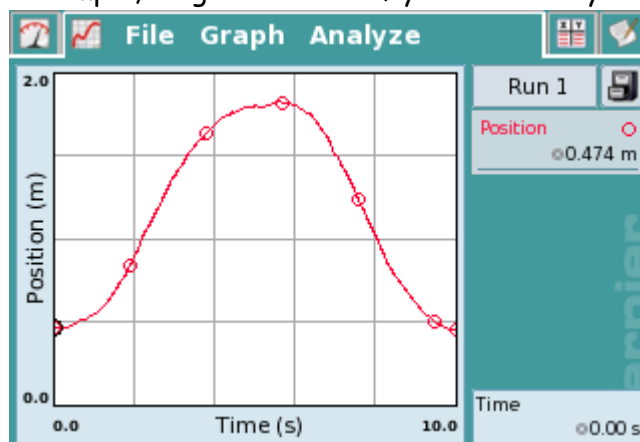
---



---

18. Have one person stand in the right place in front of the Motion Detector, then have another student start data collection. When you hear fast clicking, follow the directions you wrote in Step 17 for making the happy face.

19. If the graph of the happy face matches the example, congratulations! If you want to try to make the happy face again, just start data collection and follow the directions you wrote in Step 17.



20. You will now make a sad face. To get started, do the following things:

*LabQuest 21*

---

- a. Choose New from the File menu.
- b. On the Meter screen, tap Length. Change the data-collection length to 10 seconds.
- c. Tap the Graph tab. Choose Show Graph from the Graph menu and select Graph 1. This will display a graph of position vs. time.

21. Write what you need to do to match the sad face:

---

---

---

---

---

---

---

---

- 22. Have one person stand in the right place in front of the Motion Detector, then have another student start data collection. When you hear fast clicking, follow the directions you wrote in Step 21 for making the sad face.
- 23. If the graph of the sad face matches the sad face example, congratulations! If you want to try to make the sad face again, just start data collection, and follow the directions you wrote in Step 21.

Good job!