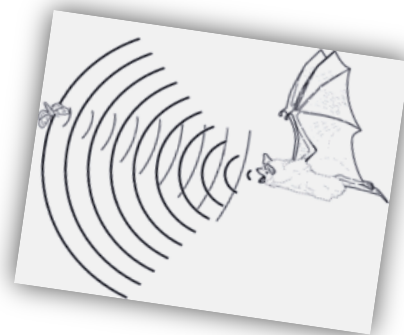


Batty About Echolocation



Materials

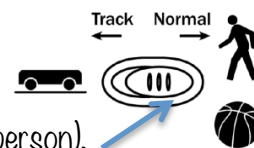
- GoMotion! Motion detector
- Laptop

Objectives

1. Pretend the motion sensor is a bat hanging from a branch and that you are an insect the bat wants to eat.
 - a. You will collect several runs of data to learn what the bat sees when you (the insect) do different things.
 - b. Each time you will carefully copy the graph from the computer screen onto one of the blank graphs.


Set-up

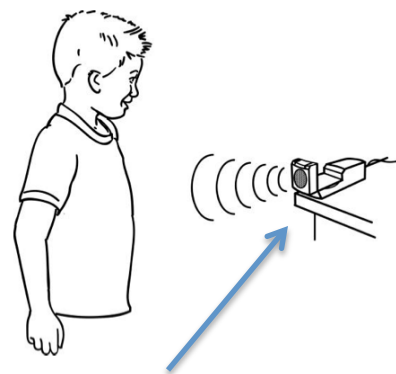
1. Set-up for data collection.
 - a. Connect the motion sensor to your computer.
 - b. Make sure the switch is set on the “normal” setting (basketball and person).



2. Set-up your computer.
 - a. Put a laptop on the station desk.
 - b. Login using “mill3.” (password: 123456)
 - c. Start Logger Lite on your computer.



3. Open the file for this activity by doing the following:
 - a. Click the “Open” button. 
 - b. Open the folder called “Elementary Science.”
 - c. Open the file called “22a Batty About Science.”



4. Set-up your station.
 - a. Lift up the head of the motion sensor and rotate it so it is open at a right angle.
 - b. Set it on the edge your desk, just like the sketch to the right.
 - c. Make sure there is a clear path at least 1 meter wide and 4 meters long in front of the sensor. (Carefully move furniture, if necessary, and make sure everyone stands back.)
 - d. When you are in front of the motion sensor, you should be able to see the gold circle of the sensor and the computer screen at the same time.
5. Set-up all four graphs.
 - a. Label both axes (sides) of the graph.
 - i. Write the title, labels, units, and numbers. Use the graph on Logger Lite to help you.

Part I: You as an Insect





Graph I: Insects Resting

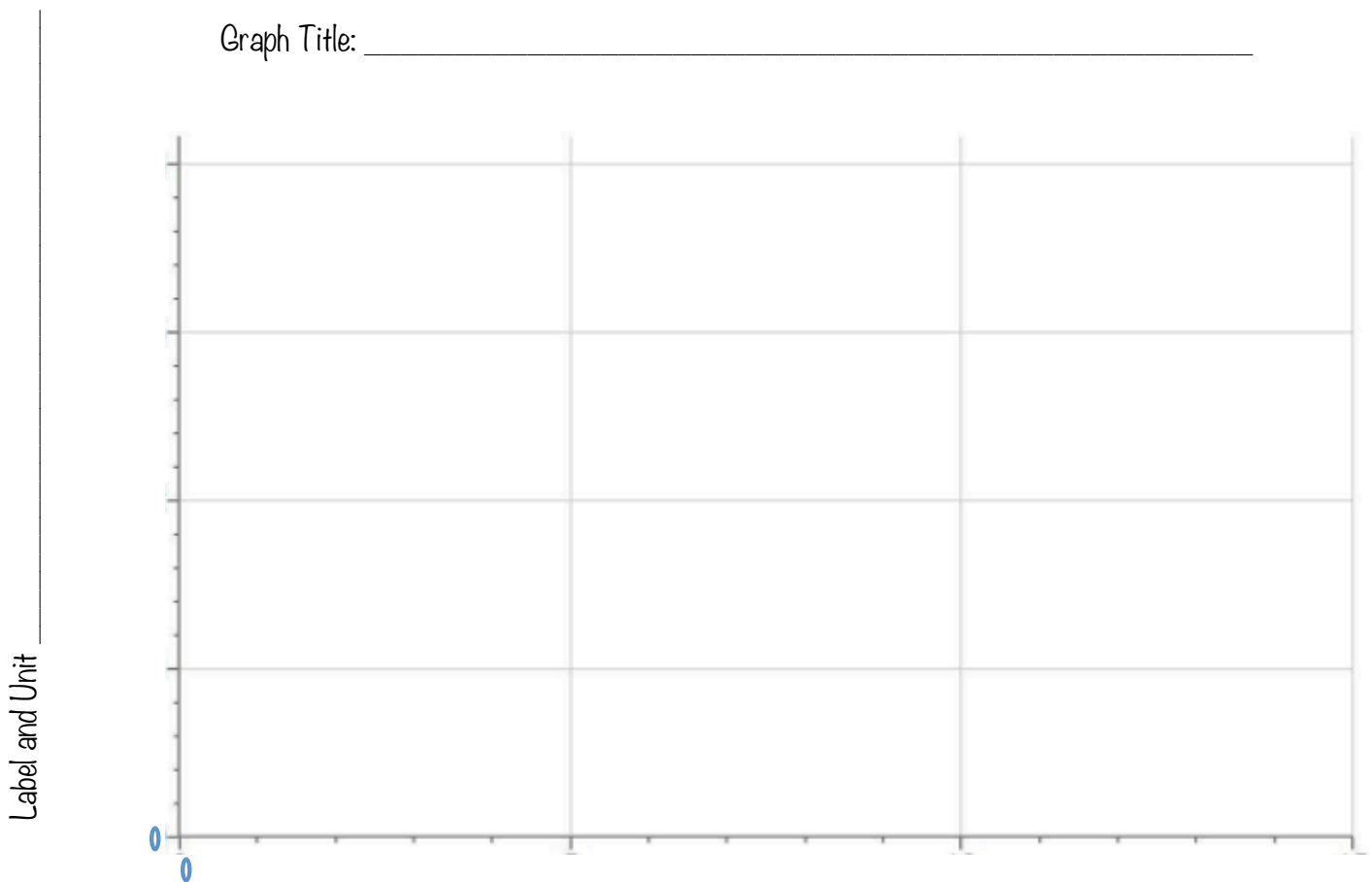
The director reads directions aloud.

Part A:

1. Have the technology operator hit "Collect." 
2. The insect stands .5 meters in front of the motion sensor and does not move until the fast clicking stops.
3. Have the technology operator hit "Store." 
4. The recorder draws the data on the graph below.

Part B

1. Have the technology operator hit "Collect." 
2. The insect stands 2 meters in front of the motion sensor until the fast clicking stops.
3. The recorder draws the data on the graph below.
 - a. This graph will have data from the .5 meter **and** 2 meter runs, so trace with **two different colors**.
4. Once the recorder is finished drawing, the technology operator can hit "New." 





Label and Unit _____

Graph 2: Insects Flying Away at Different Speeds



Part A

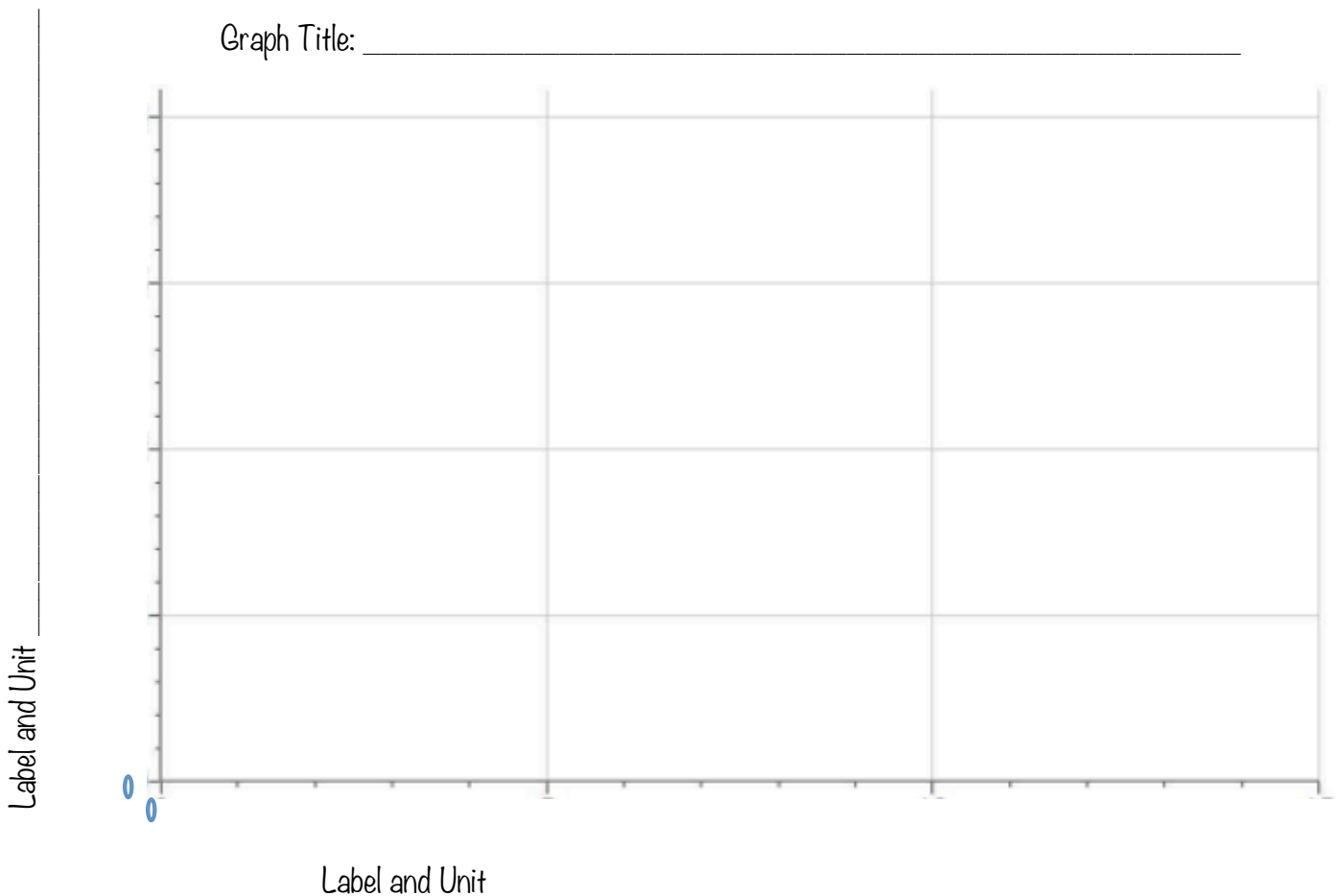
The director reads directions aloud.

1. The insect stands at .5 meters in front of the sensor.
2. Have the technology operator hit "Collect." 
3. The insect slowly walks away from the motion sensor until the fast clicking stops.
4. Have the technology operator hit "Store." 
5. The recorder draws the data on the graph below.



Part B



1. The insect stands .5 meters in front of the sensor.
2. Have the technology operator hit "Collect." 
3. The insect quickly walks away from the sensor until the fast clicking stops.
4. The recorder draws the data on the graph below.
 - a. The graph will have data from when you were walking away slowing **and** walking away quickly, so trace with **two different colors**.
5. Once the recorder is finished drawing, the technology operator can hit "New." 



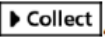

Graph 3: Insects Flying Towards at Different Speeds

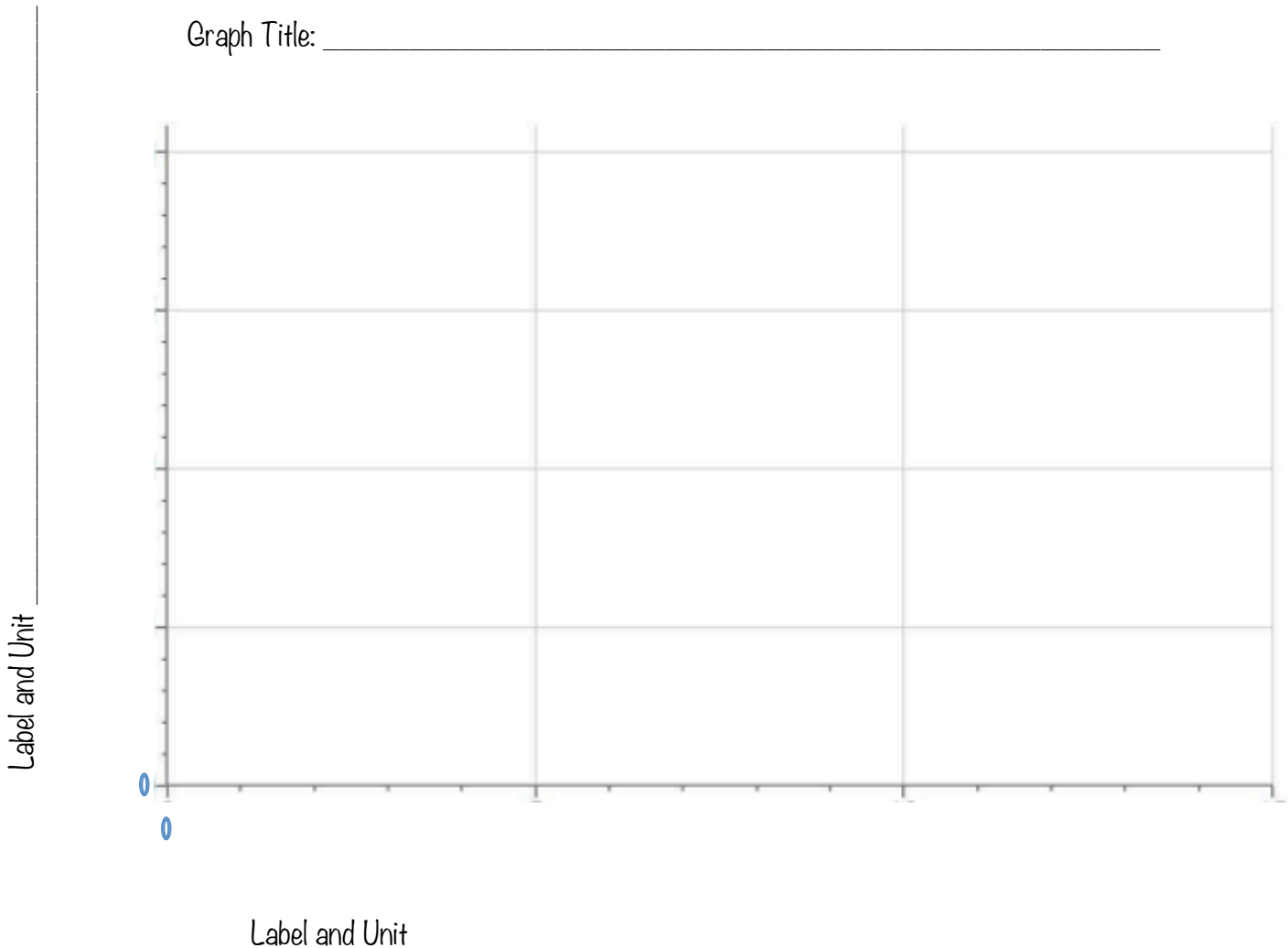
Part A

The director reads directions aloud.

1. The insect stands 3 meters in front of the motion sensor.
2. Have the technology operator hit "Collect." 
3. When you hear fast clicking, the insect slowly walks towards the sensor.
4. Have the technology operator hit "Store." 
5. The recorder draws the data on the graph below.

Part B

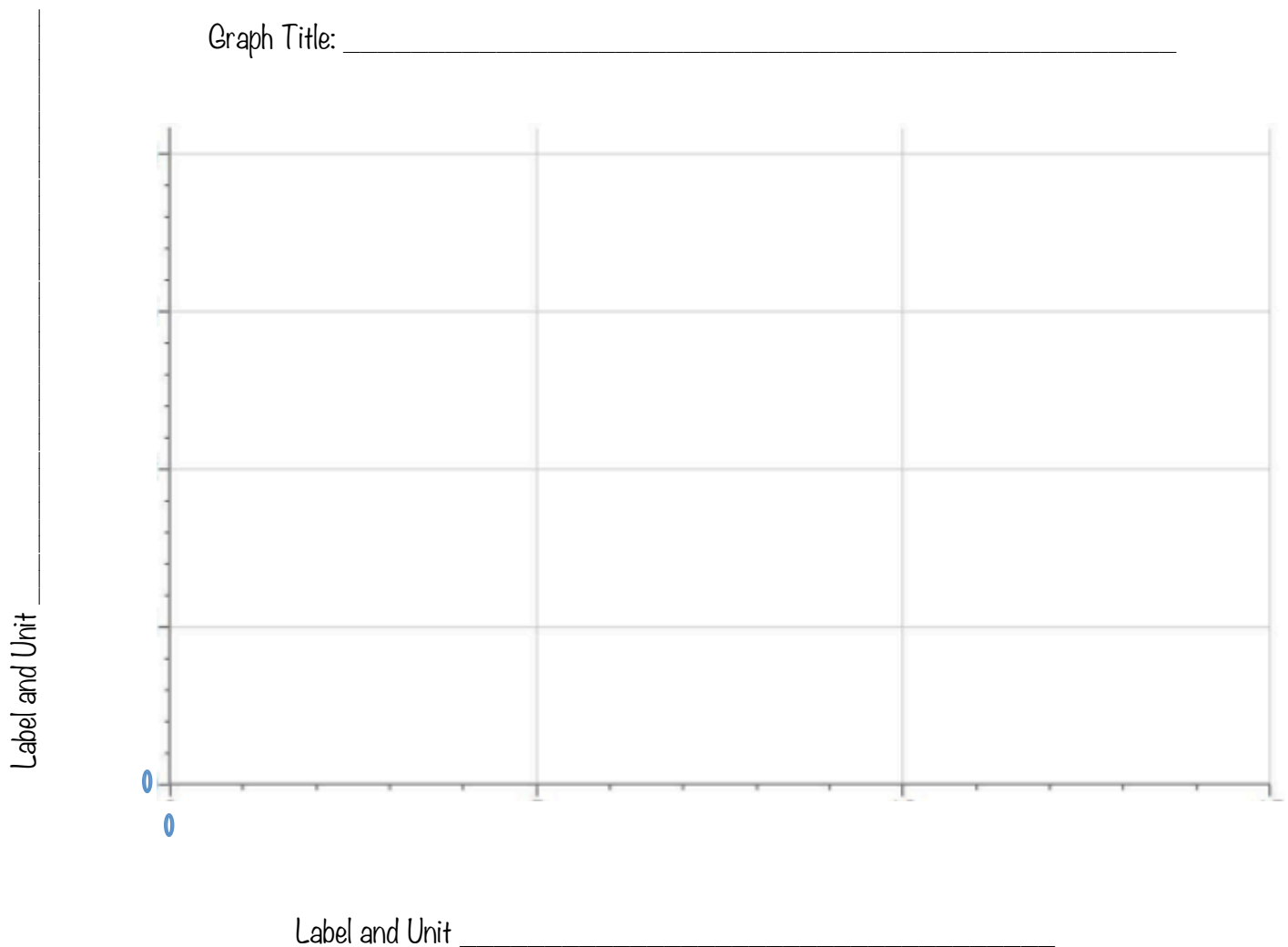
1. The insect stands 3 meters in front of the motion sensor.
2. The technology operator hits "Collect." 
3. When you hear fast clicking, the insect walks quickly towards the sensor.
4. The recorder draws the data on the graph below.
 - a. The graph will now have data from when you were walking toward it slowly and when you were walking toward it quickly, so trace with two different colors.
5. Once the recorder is finished drawing, the technology operator can hit "New." 



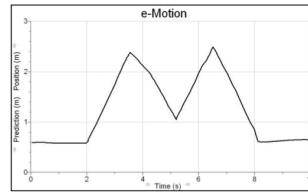
Graph 4: Jumping Insects

The director reads directions aloud.

1. The insect stands 2 meters in front of the motion sensor.
2. The technology operator clicks "Collect."
3. When you hear fast clicking, the insect will jump up and down, trying to land on the 2-meter mark each time he/she jumps until the fast clicking stops.
4. The recorder draws the data on the blank graph below.



Analyze Your Data



Part I: You as an Insect

Directions: Read, discuss, and answer each question **as a group**. All answers should be complete sentences. **Each group member** should take turns reading and writing the responses.

1. What does the graph line look like when you, the insect, do **not** move?

2. When the insect moves **farther away** from the bat (motion sensor), which way does the line on your graph go?

3. When the insect moves **closer to** the bat, which way does the line on your graph go?

4. Describe the slope (type of path) of your graph line when the insect moves **quickly** towards the bat.
 - a. (Is it sloping upwards or downwards? Is it a steep or gentle slope?)

5. Describe the slope (type of path) of your graph when the insect moves very **slowly** from the bat.

6. When you stand in front of the bat in **one place and jump up and down**, what does the graph do?
 - a. Why **doesn't** the **graph line** go up and down like you?

7. If you are finished, you may **experiment with other motions**. What else might insects do? What would the graph look like? Find out!



Part 2: Following the Path of Other Insects

Objectives:


- Observe the path of other insects that flew in front of a bat and were able to escape.
- Create motion to copy the behavior of the insects in order to escape the bat.
- Formulate directions for other students (insects) to follow.



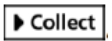
The director reads directions aloud.

1. View the flight path of the **first** insect by having the **technology operator**:
 - a. Click the open button. 
 - b. Open the file called "22B Insect 1".
2. Look at the flight path of "Insect 1" and think about what you did in Part 1 to make similar lines on the graph.
 - a. Discuss your ideas as a group.
3. The **recorder** fills-in the blanks below based on what you think you need to do to match the flight path. The **insect** may need to act out the motion to help the group decide.
 - a. Stand _____ meters in front of the bat (sensor).
 - b. Stand still for _____ seconds.
 - c. Then for _____ seconds, move _____ (towards or away from) the bat _____ (quickly or slowly).
 - d. Then for _____ seconds, move _____ (towards or away from) the bat _____ (quickly or slowly).
 - e. Stand still for _____ seconds _____ meters away from the bat.
4. Now it is time to try to follow the path.
5. The **technology operator** clicks "Collect." 
 - a. When you hear fast clicking, the **insect** follows the directions you wrote above.
6. Reflect: The **director** reads, everyone discusses, and the **recorder** writes the response.
 - a. How well were you able to follow the path of the first insect?
 - b. Would you do the same next time?
 - i. If so, why? If not, what would you change?

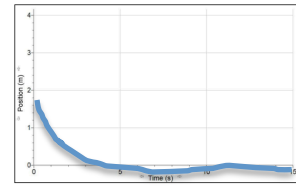
The director reads directions aloud.

1. View the flight path of the second insect by having the **technology operator**:
 - a. Click the open button. 
 - b. Open the file called "22c Insect 2".
2. Look at the flight path of the second insect and think about what you would do to match the flight path.
 - a. Discuss your ideas as a group. The **insect** may need to act out the motion.
3. The **recorder** writes down what you will do to match the flight path on the lines below.
 - a. Use the directions you wrote for the first insect (Step #3) as an example of what to write.

4. Now get ready to try to follow the path.
 - a. The **insect** stands at the location your group picked and have the **technology operator** click "Collect."
 - b. When you hear fast clicking, the **insect** follows the steps you wrote.
5. Reflect: Discuss as a group and the **recorder** writes the response.
 - a. How well were you able to follow the path of the second insect?
 - b. Would you do the same next time?
 - i. If so, why? If not, what would you change?



Analyze Your Data



Part 2: Following the Path of Other Insects

Directions: Read, discuss, and answer each question **as a group**. All answers should be complete sentences.

Each group member should take turns reading and writing responses.

1. Imagine a graph where the path of an insect slopes downward gently for five seconds, then stays flat. Describe what the insect was doing when this graph was made.

2. Imagine a graph where the path of an insect **stays flat for seven seconds**, then slopes **steeply upward**. Describe what the insect was doing when this graph was made.

3. Echolocation helps bats catch prey and also avoid obstacles (things in their way). What would a graph line look like if a tree trunk were a few meters in front of a bat?

4. Based on what you learned today, describe how bats would **like insects to move** so that they are easy to find and catch.

- a. Think about path, distance, and speed.

5. As a group, **construct a poster** showing how bats use echolocation. Include pictures and words.

- a. Consider including information about the action of the bat and motion of the insects.