Meter Stick Drop

Materials
(per group)
- ❑ data sheet
- ❑ meter stick

Purpose

To compare reaction times when using sight and sound.

Process Skills

Observe, measure, collect data, communicate, interpret data, identify and control variables, draw conclusions

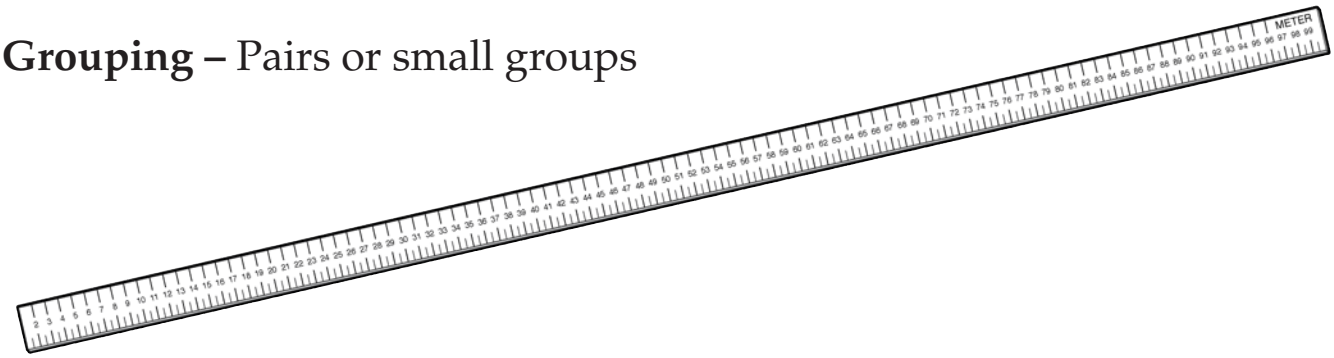
Background

The **nervous system** within your body helps send and receive signals that travel between your **brain** and every other part of your body. When you experience something with your senses, messages travel through **nerves** very quickly to your brain. Your brain figures out how to **react** to the new information. Then it sends signals to the proper part of the body to tell it how to react.

In this experiment, a partner will drop a meter stick and you will see how quickly you can catch it. You will use either your sense of sight or sound to notice when the meter stick begins to fall. Then your brain will signal your hand to close around it. You will measure the distance the stick traveled before you caught it. This will give you an idea of how fast your **reaction time** was.

Time – 30–45 minutes

Grouping – Pairs or small groups



Procedure

Hypothesis: Read the procedures in Parts 1 and 2. As a group, discuss whether you think you will be able to catch the meter stick more quickly when using sight or sound. Explain why you think this will be so. Record your hypothesis on the data sheet.

Part 1: Measuring Reactions with Sight

1. Choose one partner to be the first one to catch the meter stick. This student should sit in a chair. Choose another partner to drop the meter stick. This student should stand and face the seated partner.
2. Have the seated partner extend one arm straight out, with the thumb and fingers about 5 cm (2 in.) apart (see Figure 1).
3. The standing partner should hold the meter stick near its top, and let it hang so that when it is released, it will drop between the other partner's thumb and fingers. The end of the meter stick with the lowest numbers should be even with the top of the seated partner's hand (see Figure 1).

Figure 1

4. The partner holding the meter stick should tell the seated partner to get ready to catch the meter stick. The seated partner must watch the very bottom of the meter stick. Sometime soon, without warning, the standing partner should release the meter stick, and the seated partner should catch it as quickly as possible.

5. Look at the meter stick and find the first centimeter mark above the thumb of the partner who caught the stick (see Figure 2). The distance between the bottom of the stick and this mark is the distance the stick traveled before the student caught it. Record this distance as Trial 1 for that student, on Part 1 of the data sheet.

6. Set the meter stick back to its starting position, and try the test four more times, with the same student catching the stick. Record the results of each trial on Part 1 of the data sheet. Then calculate and record the average distance for that student. To find the average, add the distances of all five trials, and then divide the sum by five. You may round the average to the nearest centimeter.

Figure 2

7. Now repeat the experiment so that each partner can test and record his or her reaction distance with sight five times. Then calculate and record the average reaction distance for each student.

Figure 3

Part 2: Measuring Reactions with Sound

1. Try the experiment again, but this time, the seated student must have his or her eyes closed. The partner holding the meter stick should tell the seated partner to get ready to catch the meter stick. Sometime soon, without warning, the student dropping the stick must say "Now" at exactly the moment when the stick is released (see Figure 3).
2. The seated student should try to catch the stick as quickly as possible once he or she hears the word "Now." Again, find the first centimeter mark above the thumb of the partner who caught the stick. Record the distance for that student as Trial 1 on Part 2 of the data sheet.
3. Repeat the test with the first student four more times. Record the results of each trial on Part 2 of the data sheet. Then calculate and record the average distance for that student. Again, you may round the average to the nearest centimeter.
4. Now repeat the experiment so that each partner can test and record his or her reaction distance with sound five times. Then calculate and record the average reaction distance for each student.

Name_____ Date_____

Hypothesis: Will you be able to catch a meter stick more quickly when using sight or sound? Why do you think this will be so?

Collect Data

Part 1: Measuring Reaction Distance with Sight

Name	Reaction Distance (in cm)					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Average

Part 2: Measuring Reaction Distance with Sound

Name	Reaction Distance (in cm)					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Average

Name_____ Date_____

Analyze Data

1. During Part 1, did your reaction time improve from Trial 1 to Trial 5, or were the results about the same? Explain why you think this was so.

2. Were your average results for the sight and sound tests very different, or were they very similar? Explain why you think this was so.

3. Was your hypothesis proved or disproved?

4. Explain at least three things that happened in your body that allowed you to catch the meter stick in Part 2 of this experiment.

Draw Conclusions

1. Do you have a faster reaction time when using sight or sound? Why do you think this is so?

2. If you were sitting under a tree, and a large branch started falling toward you, would you rather be able to see it or hear it? Why?

Meter Stick Drop

TEACHING TIPS

Humans have important body systems that help us stay alive and healthy. Each system plays an important role, and is made up of several key organs and components. These parts must work together to keep us alive and healthy. An understanding of how our bodies work can raise our awareness of our own health, leading us toward safe and healthy practices. In this way, we can protect our most important asset—our body.

SET-UP AND PROCEDURES

- Before all groups begin, ask student volunteers to help you model the procedures from Parts 1 and 2.
- Encourage students to share their hypotheses with the class before beginning the experiment, and to reflect on the results afterward.
- In some cases, you may need the seated student to be higher off the ground, so that the meter stick does not hit the floor. You can have him or her stand while the dropper stands on a stepstool.
- It is unlikely that the entire meter stick will pass a student's hand before he or she can catch it. But if it does, instruct the student to write "100 cm" on the data sheet.

SPECIAL NOTE: In this experiment, students will not measure the actual amount of time between the drop and the catch. But knowing the distance will help them compare their reaction times from the sight tests with those from the sound tests.

SAFETY

- Be sure the meter stick will not give students splinters.
- Students should be instructed only to drop the stick, not throw it or wave it in the air.

MATERIALS

- You can substitute a yardstick for the meter stick if teaching English units.
- Meter sticks are inexpensive and can be found at hardware stores. They are sometimes even given away as free promotional items. Alternatively, you may want to ask ahead of time for volunteers to bring one in.

EXTENSIONS AND VARIATIONS

- *Variation:* Let students explore trying to catch objects shorter than a meter stick. They may find that there is a point at which an object is too short to be caught.
- *Variation:* Let students use stopwatches to measure actual reaction times. See the Process Science tab on **Science a-z.com** for resources to help students understand how to measure time with a stopwatch.

- *Math:* Have students research the actual amount of time it takes for an object to fall short distances. Then have students use this information and the results from Tables 1 and 2 to calculate their actual average reaction times.
- *Inquiry Science:* Collect the data from the whole class, and encourage students to draw conclusions about reaction times for certain populations. They might compare girls vs. boys, younger vs. older students, etc.
- *Inquiry Science:* Have group members try various means of distraction for the student trying to catch the stick. For example, they might tap on the student's arm, wave their arms, or sing a song while the other partner is trying to concentrate. Or have the student who is catching the stick recite the alphabet backwards or turn his or her head to one side while trying to catch the stick. Compare how each type of distraction affects reaction time.
- *Guest:* Invite a police officer to explain to students the importance of reaction time when they are riding a bicycle or when adults are driving a car. Encourage students to discuss how distractions may create risk by reducing reaction time.
- *Home Connection:* Have students list video games or other games and activities in their homes that require quick reactions.
- *Research:* See Using the Internet in the *Unit Guide* for suggested websites to extend the learning.

ANSWER KEY

Hypotheses will vary, but should be supported by logical reasoning or a plausible theory. Hypotheses may vary from student to student.

Data on the tables will vary. The average distance on each row should be an accurate average of Trials 1–5.

EXPERIMENT The Human Body—Meter Stick Drop Data Sheet

Name_____ Date_____

Hypothesis: Will you be able to catch a meter stick more quickly when using sight or sound? Why do you think this will be so?

Collect Data

Part 1: Measuring Reaction Distance with Sight

Name	Reaction Distance (in cm)					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Average

Part 2: Measuring Reaction Distance with Sound

Name	Reaction Distance (in cm)					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Average

ANSWER KEY AND EXPLANATIONS

Analyze Data

1. During Part 1, did your reaction time improve from Trial 1 to Trial 5, or were the results about the same? Explain why you think this was so.

Results will vary. Students should analyze their row on Table 1 to see whether the distance stayed roughly constant, or whether there was a pattern. The results are likely to be similar across all trials, because the task is easy to learn. Performance will probably not improve much with practice. If there is a lot of variation, it may be due to slight changes in the methods used.

2. Were your average results for the sight and sound tests very different, or were they very similar? Explain why you think this was so.

Results will vary. Students should compare just the averages from Tables 1 and 2, and make an accurate observation. The results are likely to be similar because both senses work very quickly.

3. Was your hypothesis proved or disproved?

Students should compare their hypothesis with the data from Tables 1 and 2. The answer may be different for different members of the group.

4. Explain at least three things that happened in your body that allowed you to catch the meter stick in Part 2 of this experiment.

First, the student's ears heard their partner say "Now." Then nerves sent signals via nerves from the ears to the brain, telling it that the key word has been spoken. The brain knew that the next instruction was to close the hand, so it sent a signal to the hand to close around the meter stick. Finally, the hand closed and caught the meter stick.

Draw Conclusions

1. Do you have a faster reaction time when using sight or sound? Why do you think this is so?

Results will vary. Students should base their conclusion on comparing their own data from Tables 1 and 2. If there is a distinct difference, it may be due to the student having developed one sense more than the other through his or her daily activities. Some students may have a vision or hearing impairment that affects reaction time with that sense.

2. If you were sitting under a tree, and a large branch started falling toward you, would you rather be able to see it or hear it? Why?

Answers will vary. Whichever sense the student cited in conclusion #1 should be cited here, because that sense would give him or her the most time to be able to move out of the path of the falling branch.