



HUMAN FACTORS & ERGONOMICS



STUDENT LESSON
PLANS

University of Rhode Island



DIRECTIONAL HEARING



University of Rhode Island

DIRECTIONAL HEARING OVERVIEW

PURPOSE

To understand how the human ear locates the origin of a sound. This interactive activity helps students learn about how the human ear works, its limitations and potential safety risks.

BACKGROUND INFORMATION

The human ear is a complicated organ. For the purpose of this lesson, the external ear will be the primary focus. The anatomy of the external ear or outer ear consists of two main features. These features are the "pinna" or "auricle" which is the outer part of the ear; as well as the "external auditory canal" or "tube" which connects the outer ear to the inside or middle ear.



Soundwaves incoming from different directions bounce off of different areas of a person's ear and into their "tube" or earhole. The human brain accounts for this by using a complex algorithm to understand the origin of the sound. This is where the study of psychoacoustics, frequency and spectral cues come into play.



APPLICATION TO HF&E

Imagine you are at a concert and standing in the front row next to the loudspeakers. How does this affect your hearing? Have you considered the short term and long term effects? Understanding how the outer ear works and its limitations can help allow future engineers to design better hearing protection which has a wide range of applications whether you are rocking out at a concert or working on a construction site.



LESSON PLAN GRADES K - 3



University of Rhode Island

DIRECTIONAL HEARING TEACHER MATERIALS



YOUTUBE LINK

SmarterEveryDay - "Shooting Down a Lost Drone and Why Dogs Tilt Their Heads"

<https://www.youtube.com/watch?v=Oai7HUqncAA>

KEY TAKEAWAYS

- A small drone gets stuck in a tree in a large forest and is lost so a father with his two kids all branch out in different directions to try to triangulate the direction the sound of the drone is coming from
- This leads to the idea of understanding how the ear perceives sound and the direction of the sound

REFLECTION

1. How difficult was it to identify the direction of the sound **without** the Playdoh on your ears?
 - a. What about **with** the Playdoh on your ears?
2. Imagine that you are listening to your headphones really loud, how do you think hearing impacts human safety?
3. Do you think that it is helpful to understand how the human ear works and its limitations? Why or why not?

DIRECTIONAL HEARING TEACHER MATERIALS

LENGTH OF COMPLETION

60 minutes

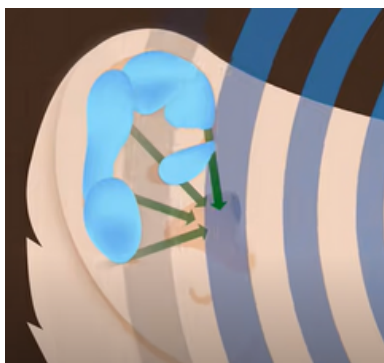
BILL OF MATERIALS

Playdoh (10 pack - \$7.99 on Amazon)

Bandanas or blindfolds (14 pack - \$11 on Amazon)

PROCEDURE

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a. <https://www.youtube.com/watch?v=Oai7HUqncAA>
2. Divide students into pairs (Student A and Student B)
3. Student A will put on a blindfold or bandana while Student B stands four feet away from Student A, in whichever direction Student B chooses
4. Student B will start to clap softly and Student A will attempt to identify the direction of the sound by pointing
5. Once Student A has pointed in the direction that they believe the sound is coming from, Student B will then move to a different position and softly clap again
6. Repeat process five times
7. Student B will then switch places with Student A and repeat Steps 2 - 5
8. Next, Student A will place Playdoh on their ear as seen in the image below (**be careful not to put Playdoh inside the ear canal**)



9. Repeat Steps 2 - 5 and notice the difference in Student A's ability to identify the direction of the sound
10. Student B will switch places with Student A and place Playdoh on their ear and repeat Steps 2 - 5. Notice the difference in Student B's ability to identify the direction of the sound.

DIRECTIONAL HEARING STUDENT HANDOUT

LENGTH OF COMPLETION

60 minutes

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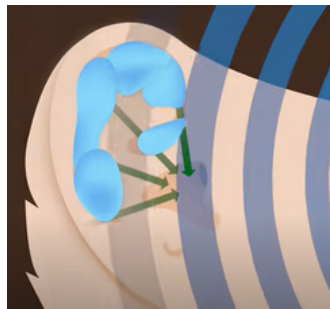
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8. Next, Student A will place Playdoh on their ear as seen in the image below (**be careful not to put Playdoh inside the ear canal**)



9. Repeat Steps 2 - 5 and notice the difference in Student A's ability to identify the direction of the sound
10. Student B will switch places with Student A and place Playdoh on their ear and repeat Steps 2 - 5. Notice the difference in Student B's ability to identify the direction of the sound.

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LESSON PLAN GRADES 4 - 6



University of Rhode Island

DIRECTIONAL HEARING TEACHER MATERIALS



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DIRECTIONAL HEARING TEACHER MATERIALS

LENGTH OF COMPLETION

60 minutes

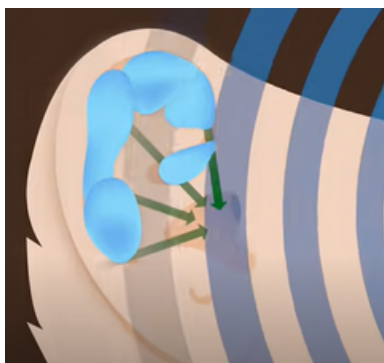
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5. Once Student A has pointed in the direction that they believe the sound is coming from, Student B will then move to a different position and softly clap again
6. Repeat process five times
7. Student B will then switch places with Student A and repeat Steps 2 - 5
8. Next, Student A will place Playdoh on their ear as seen in the image below (**be careful not to put Playdoh inside the ear canal**)



9. Repeat Steps 2 - 5 and notice the difference in Student A's ability to identify the direction of the sound
10. Student B will switch places with Student A and place Playdoh on their ear and repeat Steps 2 - 5. Notice the difference in Student B's ability to identify the direction of the sound.

DIRECTIONAL HEARING STUDENT HANDOUT

LENGTH OF COMPLETION

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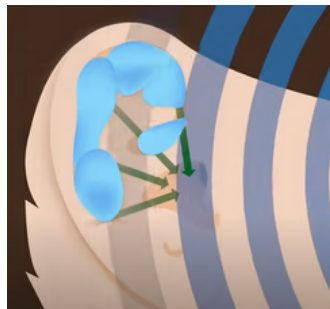
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LESSON PLAN GRADES 7 - 9



University of Rhode Island

DIRECTIONAL HEARING TEACHER MATERIALS



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DIRECTIONAL HEARING TEACHER MATERIALS

LENGTH OF COMPLETION

60 minutes

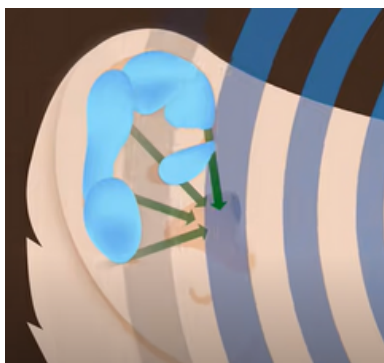
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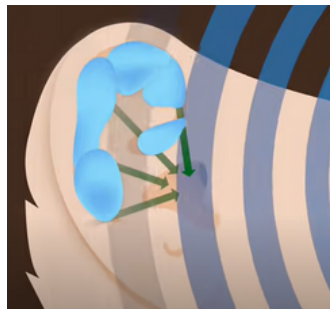
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LESSON PLAN GRADES 10 - 12



University of Rhode Island

DIRECTIONAL HEARING TEACHER MATERIALS



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DIRECTIONAL HEARING TEACHER MATERIALS

LENGTH OF COMPLETION

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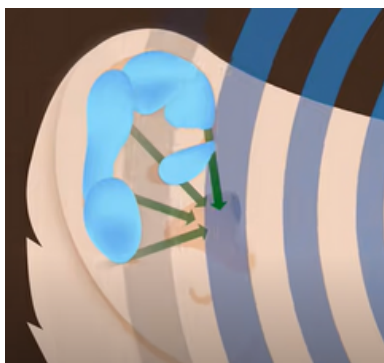
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