Maine's Earliest Interaction Website: Understand and Analyzing Audiograms Through an Interactive Module

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- ★ Initiated and continuously refine the ELCO process.
- ★ Live in Southern Maine exploring both ocean and mountains with my husband and two young daughters.

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- ★ Educational Audiologist
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- ★ Living the hockey mom dream with my son (11), daughter (7), husband, and pup (1.5)

Disclosures

Amy Spencer is a paid employee of MECDHH/GBSD as their Early Intervention and Family Services Coordinator.

Katherine Duncan is a paid employee of MECDHH/GBSD and Consultant to the Maine EHDI Program.

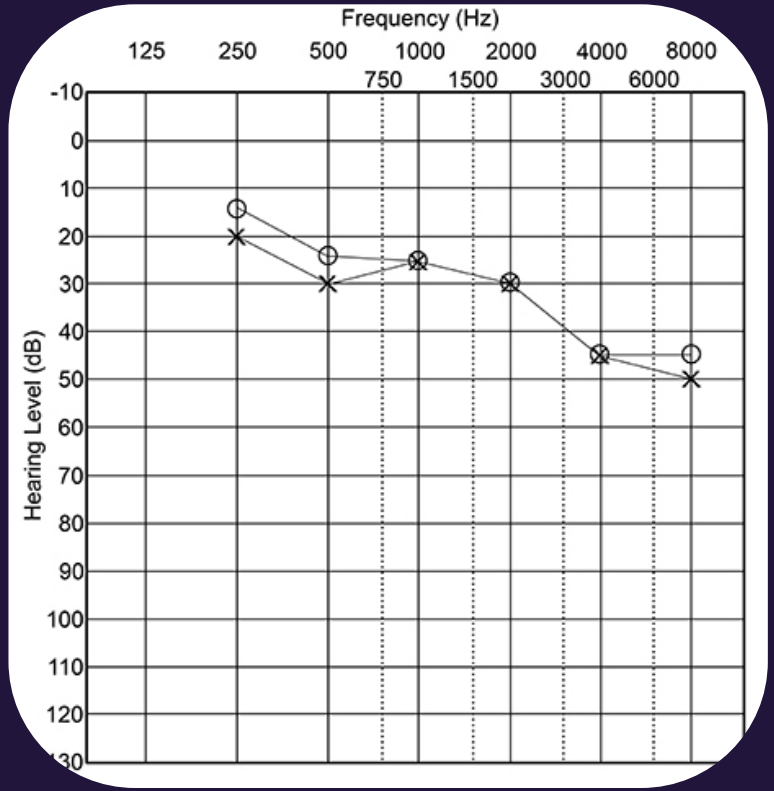
Today's Objectives:

Participants will be able to list two challenges of traditional audiograms.

Participants will be able to describe how an interactive audiogram module benefits families.

Participants will be able to describe how an interactive audiogram module benefits professionals.

The Traditional Audiogram



- Sterile/clinical
- Little meaning to those who are not familiar with audiology/audiograms
- Does not provide information about the impacts of the patient's hearing levels
- Does not do a good job representing spoken language

Interactive Audiogram Module Walkthrough

Your Child's Audiogram

A GUIDED TOUR

Whether your child's audiogram looks simple or complicated, on a basic level it represents **how your child responds to sounds** at different volumes and frequencies at that point in time. Specifically, the audiogram is designed to tell you the **softest sounds** your child can hear at each frequency tested.

However, whether it's your first time looking at an audiogram—or it's been a while since you've looked at one—it may not be clear how to read it. The following pages will help you to learn more about your child's audiogram and what an audiogram can tell you about your child's hearing.

Learn how to read an audiogram

How to Read an Audiogram

At a basic level, **the point of an audiogram is to represent the level or degree of your child's hearing difference**.

Recall that an audiogram is designed to show you the **softest sounds** your child can hear at each frequency tested. Take a look at the example audiogram shown in **Figure A.** and you'll see that the points on the chart form a line. If this were your child's audiogram, the primary thing to understand is that any sounds that fall below the line are sounds your child can hear—while sounds above the line are ones they cannot.

That being said, there is a lot more to know about an audiogram so let's break it down piece by piece.

Ok, tell me more

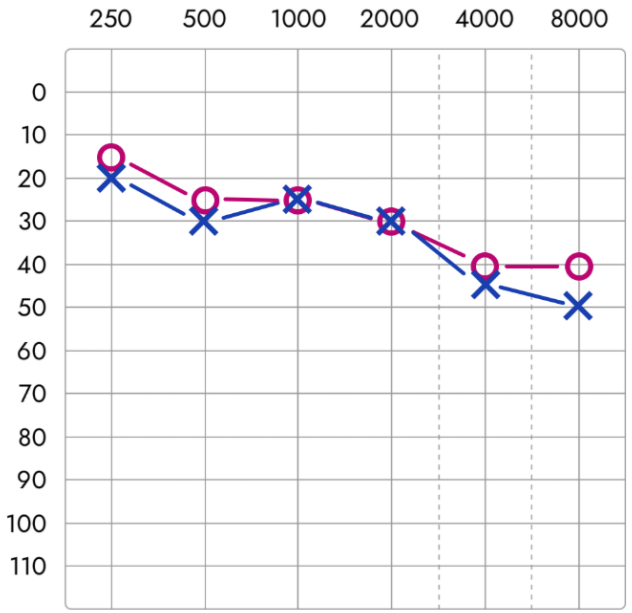


Figure A. an example audiogram

The Y-Axis

The numbers on the side of an audiogram refer to the intensity or **volume of the sound**. The volume is measured in decibels (dB).

Starting at the top, as you go down the graph imagine you are turning up the volume on a radio. **The top of the graph represents quiet sounds**, like whispers or dripping water. **At the bottom you'll find loud sounds** like airplane engines or a dog's bark.

For any given symbol on your child's audiogram, its position on the Y-axis represents the quietest sound your child responded to at that frequency (more about frequency on the next page).

What about the x-axis?

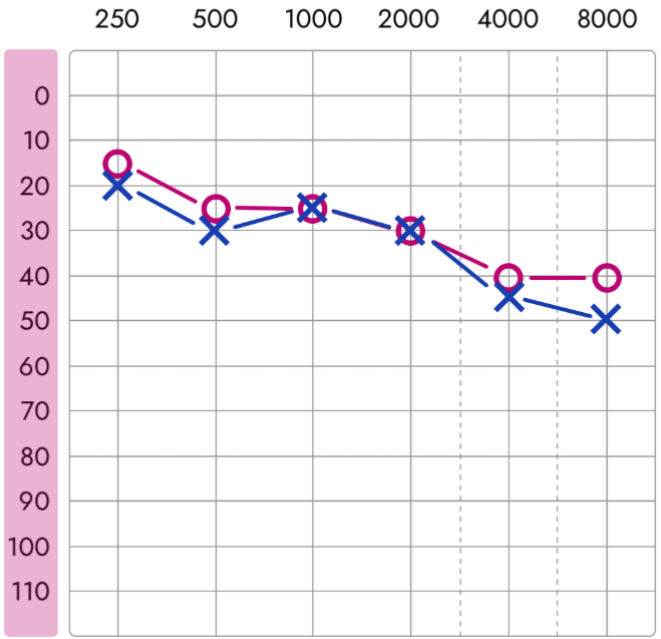


Figure B. example audiogram y-axis

The X-Axis

The numbers across the top of the chart refer to **the frequency or pitch of the sound**, measured in Hertz (Hz).

You can think of the x-axis as an extremely long musical scale, with the **lowest notes on the left**, and the **highest notes on the right**. Note that "low" and "high" don't indicate volume here—that's what the y-axis is for. For low frequencies, think of sounds like distant thunder—while a piercing whistle is a good example of a high frequency sound.

Typically when determining your child's hearing thresholds, an audiologist will test your child's response at all of the frequencies pictured in **Figure C.** However, what symbol they record for each test will mean something specific, which we'll look at next.

Tell me about the symbols

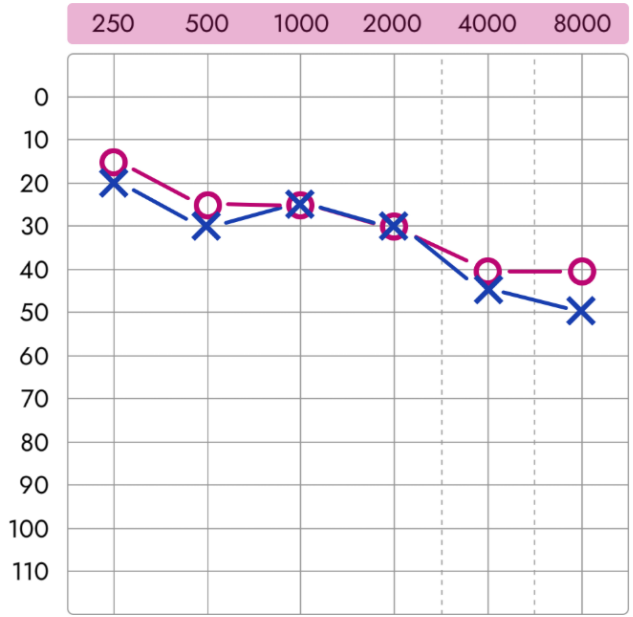


Figure C. example audiogram x-axis

Audiogram Symbols

Your audiogram may contain many different symbols depending on what tests your audiologist conducted. We will go into more detail later, but for now the important thing to know is that these symbols show whether a test was done on the left or right ear, and what kind of test it was.

If you see these symbols, they represent testing done on the **right ear**.

If you see these symbols, they represent testing done on the **left ear**.

Note: as seen above, symbols for the **right ear** are often color-coded as red, while symbols for the **left ear** are often blue. This is not always the case though.

This symbol represents testing done in the **soundfield**, which does not provide ear-specific information. This kind of test is generally performed using speakers, and is often used when a child cannot tolerate wearing headphones.

Next

Audiogram Symbols In Depth

Let's get into detail about the various symbols you can find on an audiogram. **Note**: blue symbols on the left represent tests on the left ear, while red symbols on the right are for right ear tests.

The 'X' and 'O' symbols represent your child's hearing thresholds when measured using headphones or insert earphones. This is also known as air conduction testing.

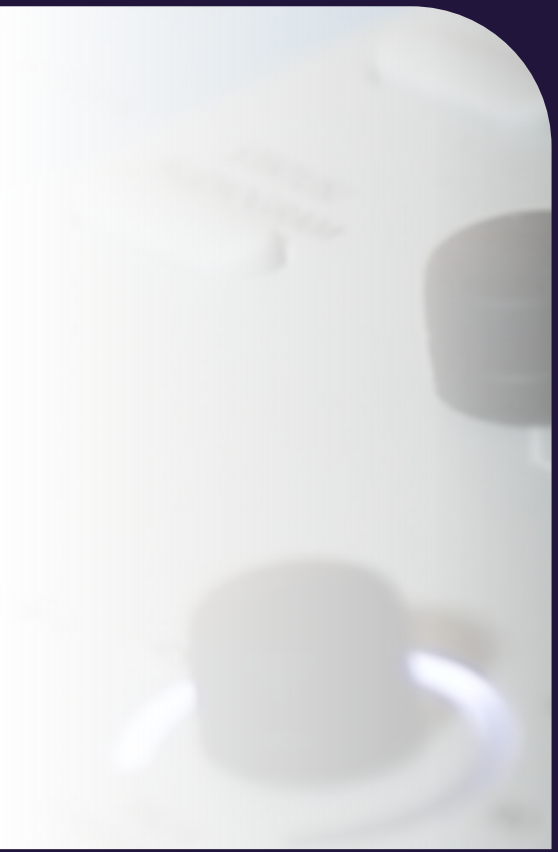
The '□' (square) and '▵' (triangle) symbols also represent your child's hearing thresholds when measured using headphones or insert earphones; however, they indicate your child's audiologist used a technique known as "masking" to ensure the results they obtained truly reflected hearing in each ear. Masking is used when there is significant difference between air conduction thresholds in each ear. When testing the thresholds in the ear with more significant hearing levels, it is possible that the loudness levels used to test that ear are so high that the sound crosses over to the other ear. Masking is used to prevent this crossover.

The '>' and '<' symbols represent your child's hearing thresholds when measured via bone conduction. Bone conduction testing bypasses the outer and middle ear, directly measuring hearing at the level of the inner ear.

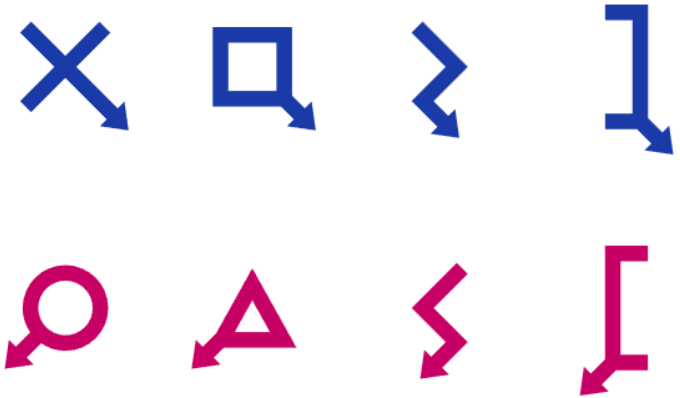
> <

The ']' and '[' symbols represent bone conduction thresholds when masking is used. Masking is used in bone conduction testing to ensure the responses obtained reflect the ear being tested. This is because either ear can potentially hear sounds presented via bone conduction, when masking is not used.

] [



If any symbol has a downward-facing arrow attached to it, it indicates a "no response" result. This means that your child did not respond at the loudest possible volume during testing (usually indicated by where the symbol is marked on the y-axis). This can indicate a significant hearing difference at that particular frequency.



Next

A Note About Privacy

If you haven't already, go grab your child's audiogram. On the next few pages we're going to recreate this audiogram so that we can then analyze it.

Note: privacy is very important to us, so rest assured that none of the information you are about to share will ever be available to us. However, your information will be saved on your end in case you need to come back to this page later. This data is only saved on your computer and we will never see it. However, we suggest you **don't use this tool on a public computer**.

Next

Step 1. The Right Ear

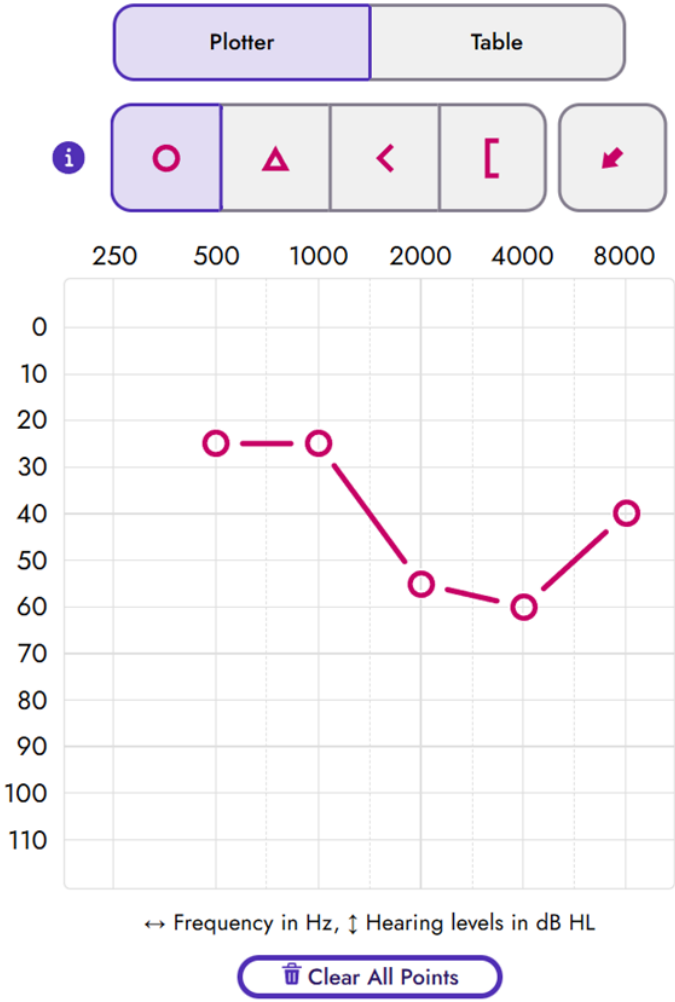
We'll start with symbols corresponding to testing completed for your child's right ear. Choose any of the symbols above the graph that appear on your child's audiogram.

Now click on the graph to the right to add points. If you make a mistake, just **click on any point again to remove it**.

Continue doing this until you've added all of the above symbols that show up on your copy.

If you're having trouble, or you were only given a table of numbers, try switching to **table mode**.

Next



Step 2. The Left Ear

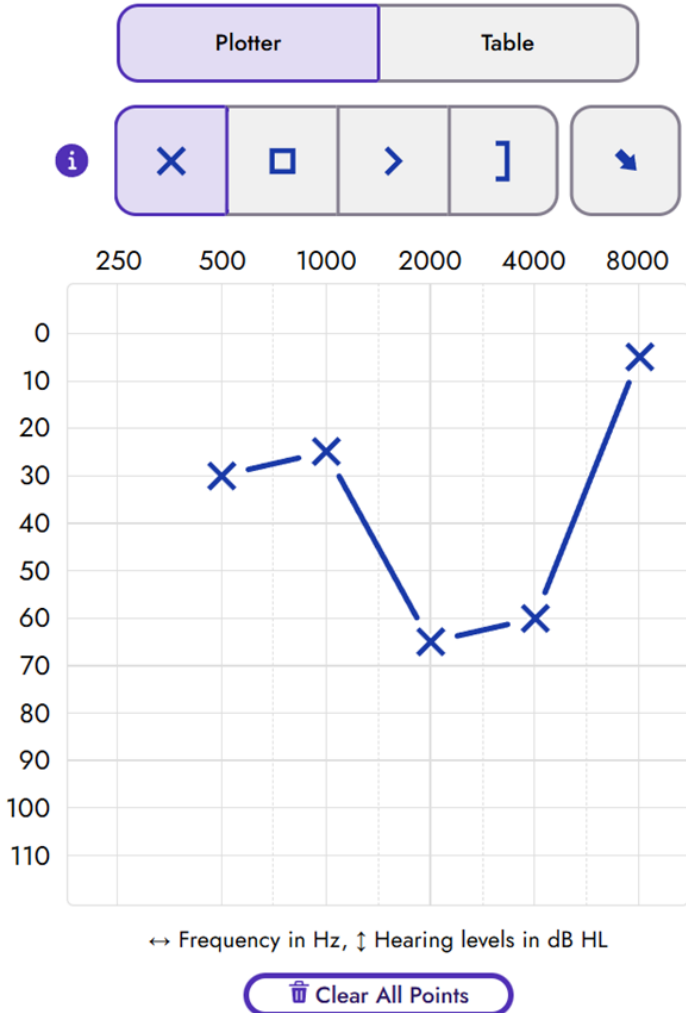
We'll continue with symbols corresponding to testing completed for your child's left ear. Choose any of the symbols above the audiogram that appear on your child's audiogram.

Now click on the graph to add points. If you make a mistake, just **click on any point again to remove it**.

Continue doing this until you've added all of the above symbols that show up on your copy.

If you're having trouble, or you were only given a table of numbers, try switching to **table mode**.

Next

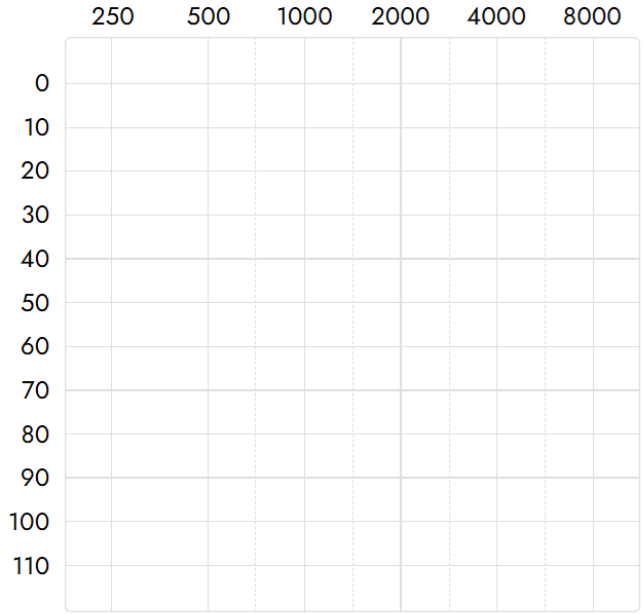


Step 3. Soundfield (Optional)

We'll continue with symbols corresponding to testing in the **soundfield**, which does not provide ear-specific information. This kind of test is generally performed using speakers, and is often used in cases where a child cannot tolerate wearing headphones. **This step is optional** and only necessary if you see any "S" symbols on your child's audiogram.

Now click on the graph to add points. If you make a mistake, just **click on any point again to remove it**.

If you're having trouble, or you were only given a table of numbers, try switching to **table mode**.



↔ Frequency in Hz, ↕ Hearing levels in dB HL

Clear All Points

Next

Plotter | Table

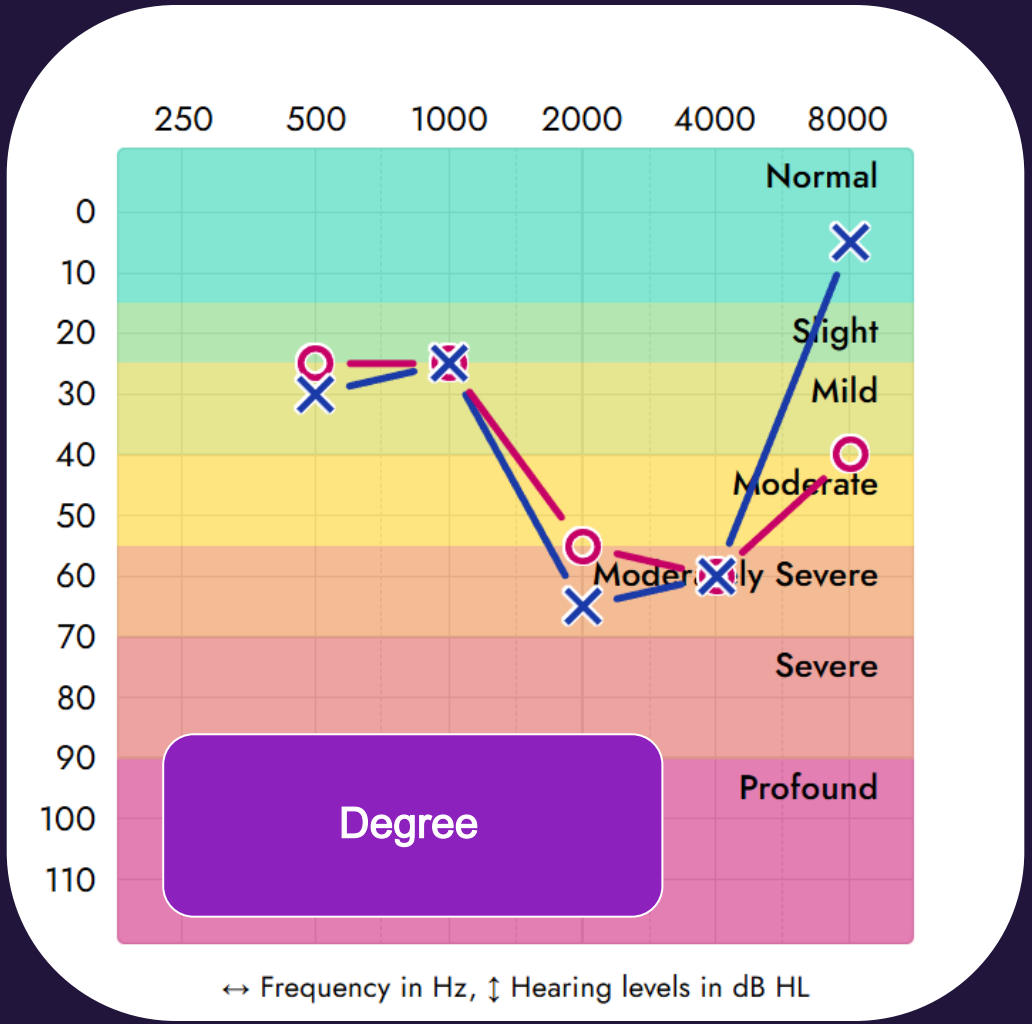
SYM	FREQ (Hz)	VOL (dB HL)	
○	500	25	🗑
○	1000	25	🗑
○	2000	55	🗑
○	4000	60	🗑
○	8000	40	🗑

+Add Point

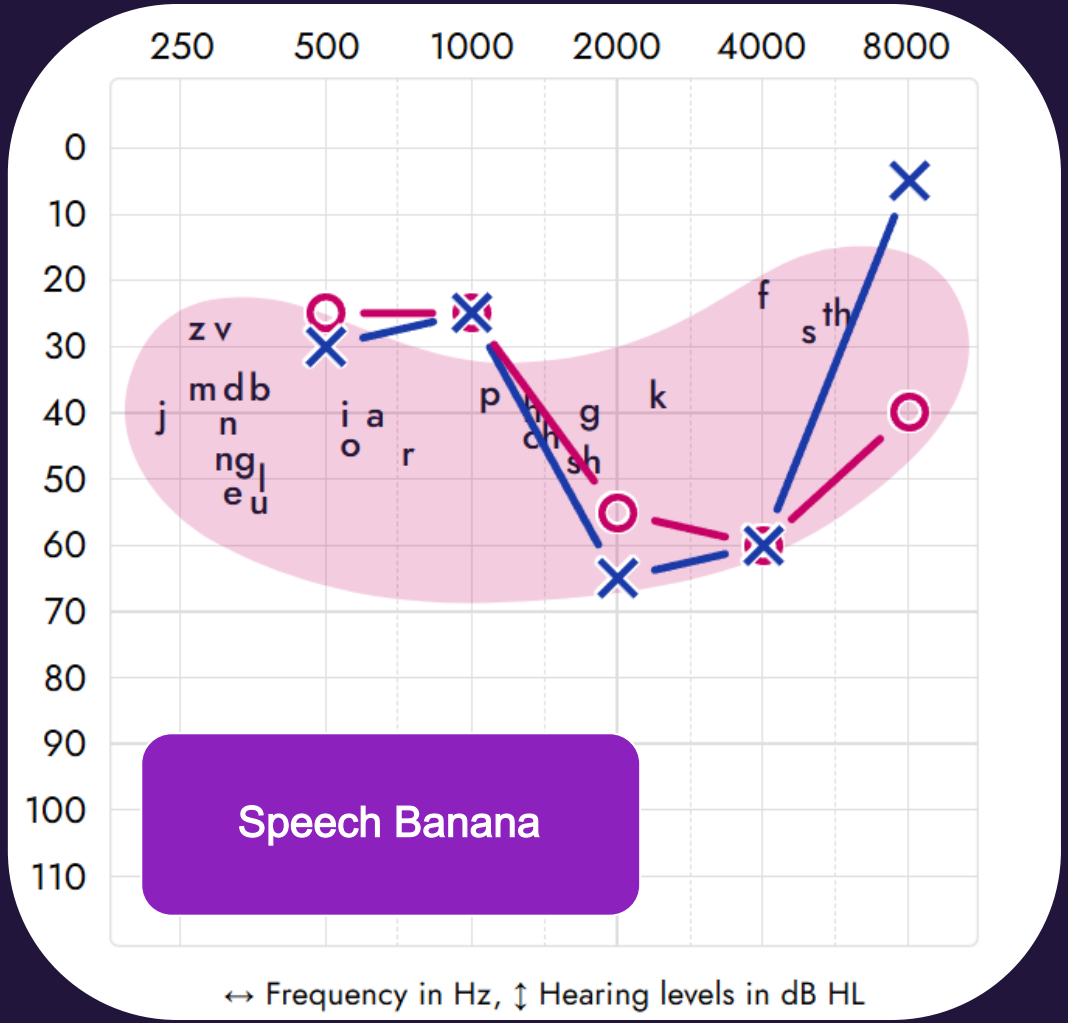
Clear All Points

Combined Audiogram

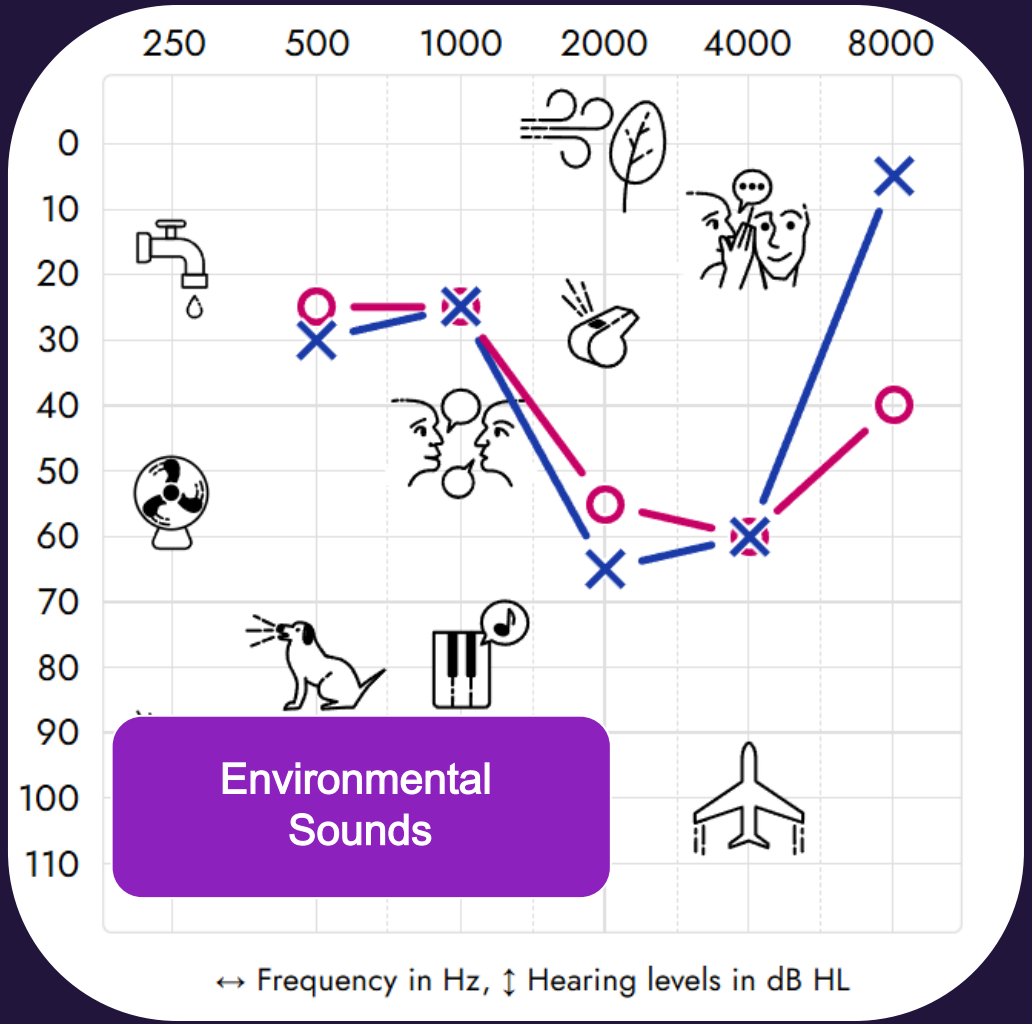
This chart represents your child's *hearing thresholds* for both ears (and/or their soundfield tests). Remember that an audiogram shows you the **softest sounds** your child can hear at each frequency tested.



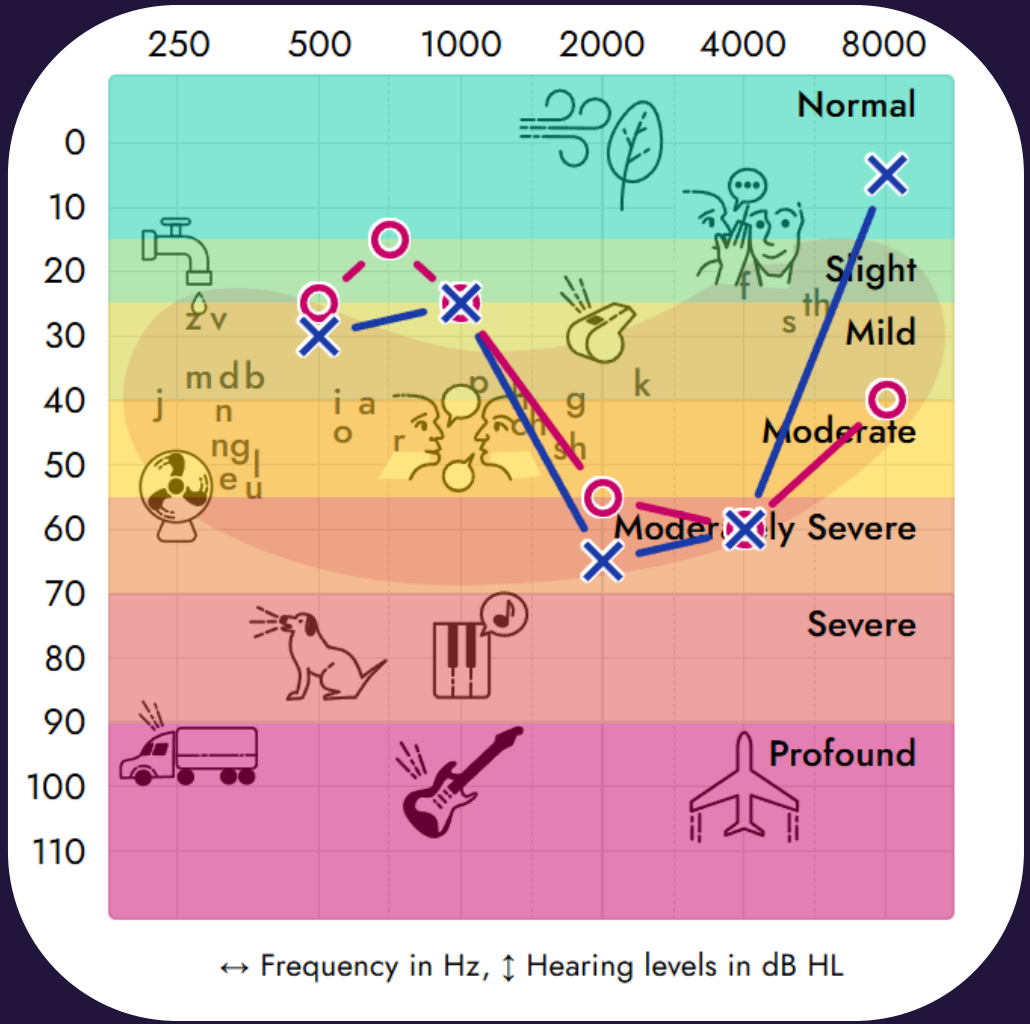
The ”Degree” layer shows where your child's thresholds fall within the categories your audiologist would use to determine how significant your child's hearing levels are. Any sounds above the line created by connecting your child's hearing thresholds are sounds your child is unable to access without hearing technology. Any sounds below the threshold line are sounds they can access.



The "Speech Banana" layer shows where the sounds that make up spoken English generally land in terms of pitch and loudness. These sounds are also called phonemes and are represented by letters like ‘z’ (as in zebra) or ‘th’ (as in three). If any of the phonemes are higher on the chart than your child’s thresholds, then your child may have difficulty hearing those parts of words without hearing technology.



The ”Sound Examples” layer shows a variety of common environmental sounds and their relative loudness/pitch.

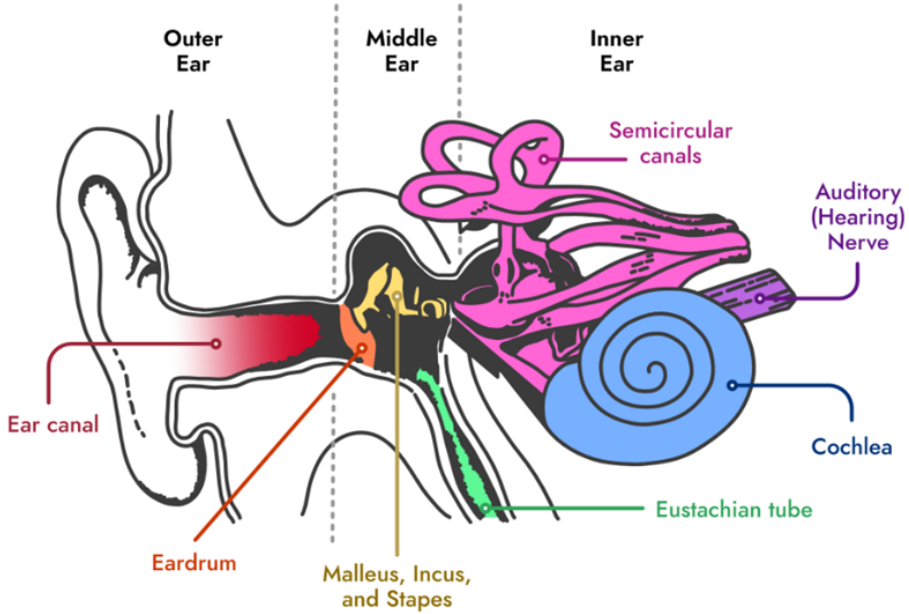


Combined Degree, Sound Examples, and Speech Banana layers

Types of Hearing Differences

As you've seen, an audiogram can represent many different tests of your child's hearing, but *why* were those different tests performed? There are different types of hearing differences, each with their own cause—the different tests an audiologist performs will help them determine what type your child may have.

The "type" of hearing difference refers to where along the auditory system there may be a difference in structure, or blockage, that is impacting how sound is transmitted to the brain. The three types of hearing differences are **sensorineural**, **conductive**, and **mixed**.



An ear diagram showing the different parts of the ear and their functions.

Conductive hearing differences occur when there is something that physically prevents sound from traveling through the outer and/or middle ear. This can occur when the child has an ear infection, or in cases where the outer ear does not fully develop.

More about conductive hearing differences
More about ear infections and temporary conductive hearing loss

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Sensorineural hearing differences are caused by a difference in development of the inner ear that changes the way the inner ear and auditory system interpret sound. A child with a sensorineural hearing difference has difficulty hearing sounds clearly.

Mixed hearing differences describe a combination of sensorineural and conductive hearing differences. An example of a mixed hearing difference is an existing sensorineural hearing difference and an additional temporary conductive component due to an ear infection or fluid in the middle ear.

Additionally, **Auditory Neuropathy Spectrum Disorder (ANSD)** is a type of hearing difference is caused by a miscommunication between the parts of the ear, the auditory nerve, and the listening center in the brain. A child with ANSD may be able to hear that sounds are present, but the sounds are not heard clearly or consistently.

More about ANSD

The type and degree of your child's hearing differences are important for you and your audiologist to know, as these details help you to understand what hearing technology may be appropriate for your child, and how your child's hearing differences might impact their spoken language development, if one of your family's goals is spoken language.

Benefits to Families

Counseling information available at all times - not dependent on EI provider or audiologist to understand their child's results

Able to share with other family members who are not present for audiology visits, to deepen their understanding of the child's hearing

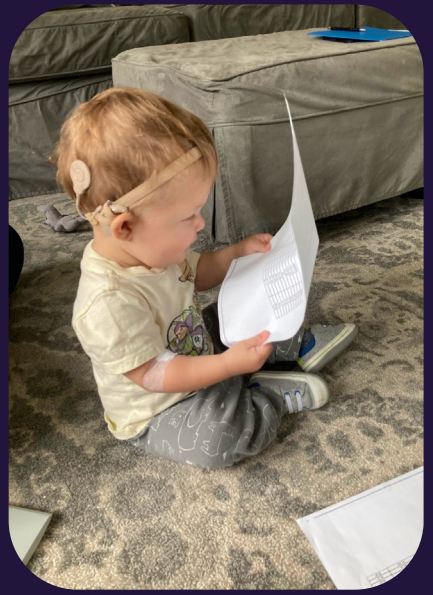
Offers more detailed information about hearing than the average audiogram, in a family-friendly manner

Benefits to Providers

Readily available counseling tool/ continuity of info sharing

Interactive and easily personalized to the child's hearing levels- not a generic resource

Offers the ability to show as much or as little information at once to the family via layers on the audiogram tab



Future Goals

Align content with new Familiar Sounds Audiogram

Add hearing levels simulator to have both

Auditory & Visual representation of sounds/speech

Maine's EHDI Website

How to Contact Us:

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THE MAINE EDUCATIONAL CENTER FOR THE DEAF AND HARD OF HEARING
GOVERNOR BAXTER SCHOOL FOR THE DEAF

Resources

2019 Joint Commission on Infant Hearing Position Statement

FCEHDHH

Hearing First Familiar Sounds Audiogram eBook