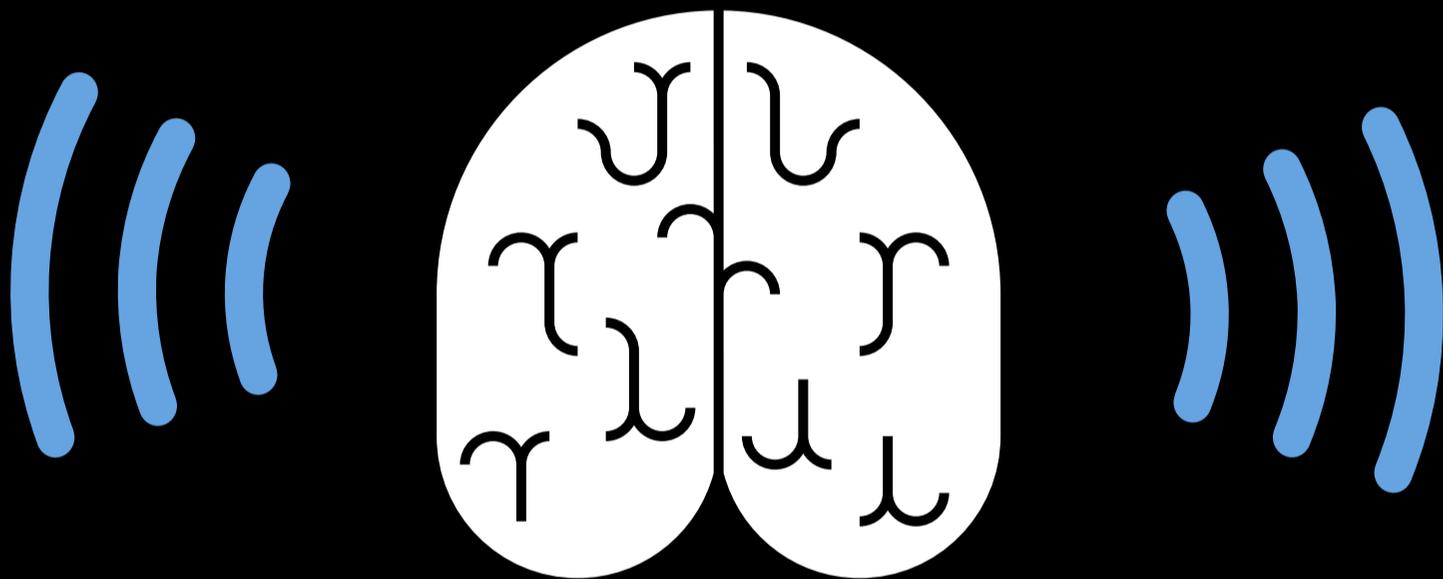


Auditory Processing:

From the Ear to the Brain



A PUBLICATION OF:



NeuroNet
LEARNING

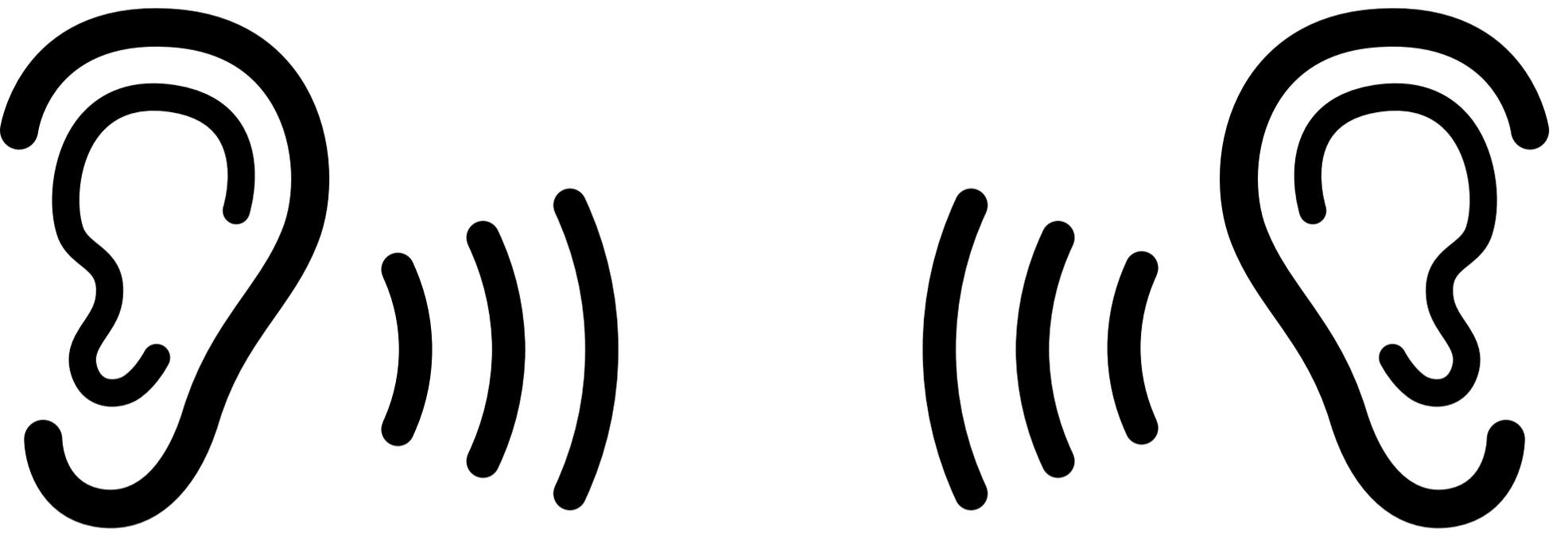
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CHAPTER 1



Introduction



Hear THE WORDS.

Hear THE MEANING.

Hear THE IMPLICATION.

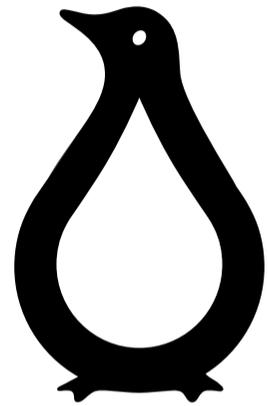


EXCUSE ME!

Take that animal
directly to the zoo!



Im sorry officer!
I will do that
right away



EXCUSE ME!

I TOLD YOU TO TAKE THAT
ANIMAL DIRECTLY TO
THE ZOO!



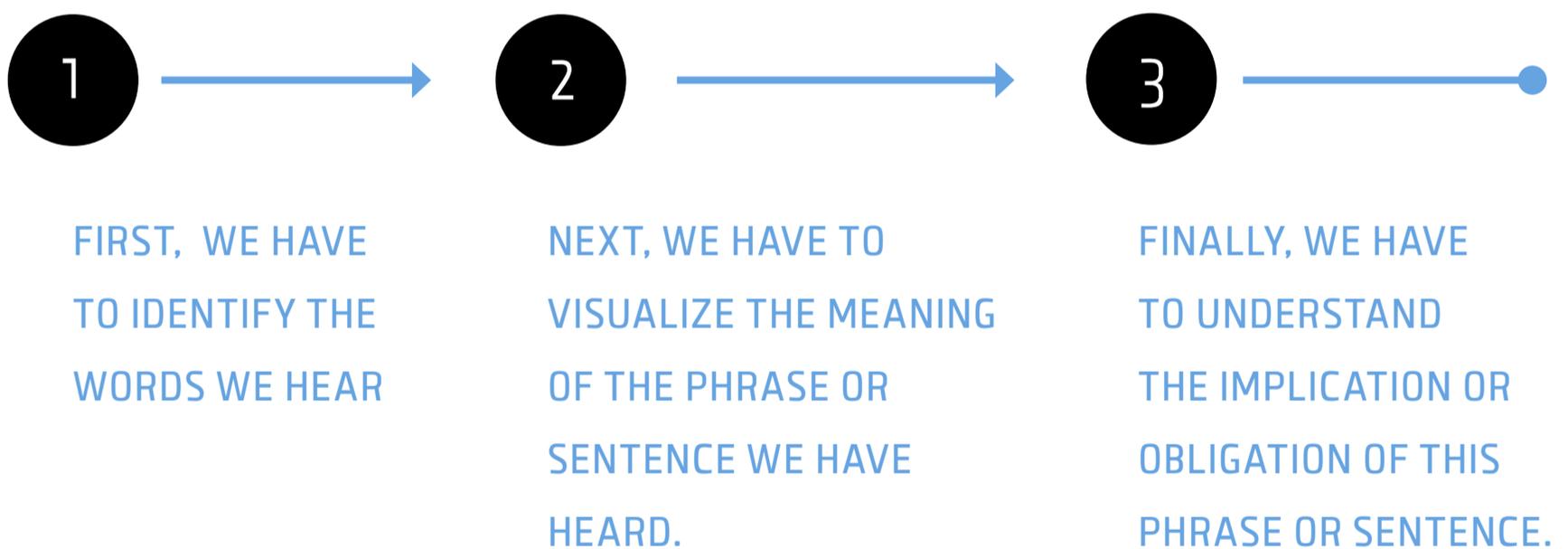
That was
yesterday
officer!

Today were going to
the beach!



The 3 Levels of Auditory Processing

All conversational listening (auditory processing) requires us to “hear” three levels of information:



Even though we hear the exact words and visualize the literal meaning of the sentence, our processing is not complete until we understand and act on the implication of what we have just heard.

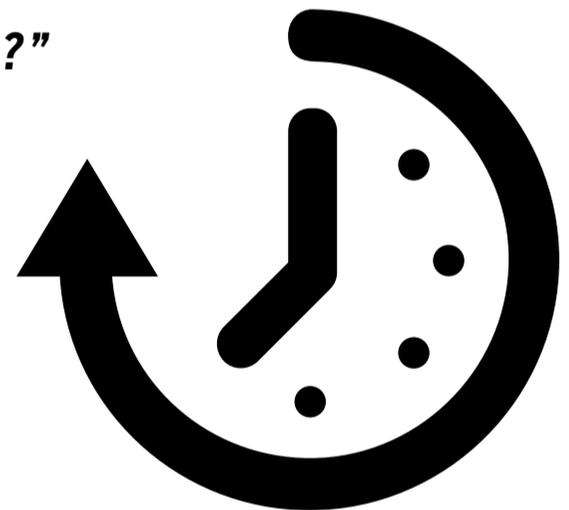
THE SPEED OF AUDITORY PROCESSING

The average conversational speed of spoken English is 3-6 syllables per second (Levelt 2001), with 200 milliseconds between conversational turn-taking (Stivers et al. 2009) depending on the response needed.

When the teacher says,

“COULD YOU PLEASE CLOSE THE DOOR?”

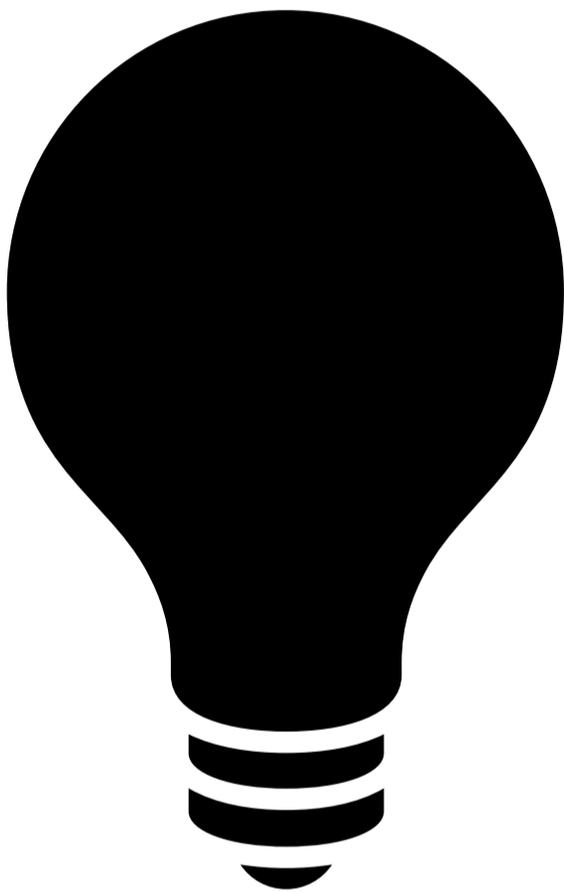
The student has approximately 3-4 seconds to hear the words “Could you please close the door,” then visualize the action of closing the door. The student then must understand that request to get up and shut the door promptly.



ANYONE WHO HAS AN AUDITORY PROCESSING PROBLEM WILL NEED TO SPEND EXTRA TIME IDENTIFYING THE WORDS THEY HEAR.

Consequently, they will have less time to understand the meaning of phrases and sentences, and even less time for understanding the implication or obligation of the tone of voice. A misperception or misinterpretation at any level of auditory processing may result in a misunderstanding or breakdown of communication.

THESE 3 LEVELS OF LISTENING TAKE PLACE SO QUICKLY THAT WE DON'T NOTICE THE INDIVIDUAL LEVELS OF AUDITORY PROCESSING.



WHEN WE STRUGGLE TO HEAR THE WORDS WE HAVE LESS TIME LEFT OVER FOR FIGURING OUT THE MEANING; THEREFORE, EVEN LESS TIME FOR FIGURING OUT THE IMPLICATION OF TONE OF VOICE, OR WHAT ACTION WE ARE REQUIRED TO TAKE. AS A RESULT, COMMUNICATION BREAKS DOWN.



WHAT HAPPENS WHEN COMMUNICATION BREAKS DOWN?

Typical **TEACHER** — **STUDENT** Conversation

It's time to put away your math books and then take your reading worksheet out of your blue folder.

You don't need your book. Put it away and get out your reading worksheet.

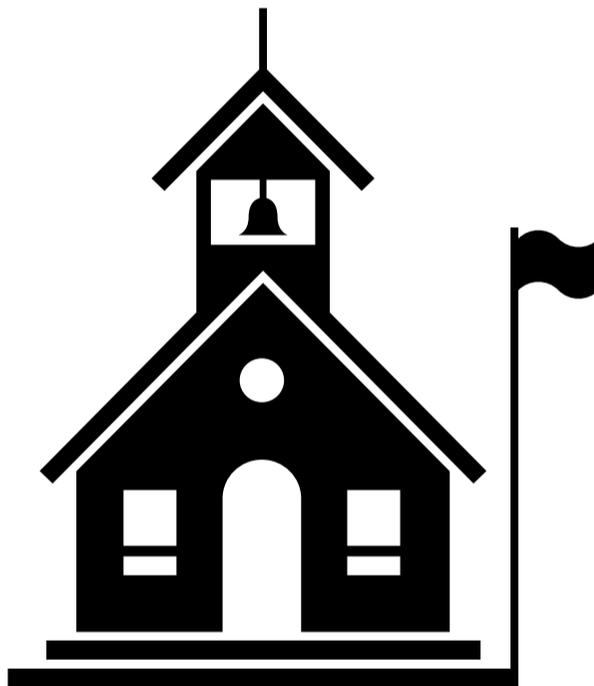
It's in your blue folder!

What book do I need?

Where's my reading worksheet?

TEACHER

STUDENT



WHAT CAUSES AN AUDITORY PROBLEM?



WHEN COMMUNICATION BREAKS DOWN A CHILD MAY GET **DISTRACTED OR GIVE UP**. This may hinder their problem-solving skills or they may act out with inappropriate behavior. A parent or teacher may think that a child is not interested, has an attention problem, and/or has a behavioral problem.



THIS FRUSTRATION CAN LEAD TO HIGHER LEVELS OF **STRESS AND ANXIETY FOR THE CHILD**. The child may feel unintelligent compared to their peers and feel as though they cannot do anything correctly. Teachers may also be left feeling confused and stressed as to why the student doesn't seem to be comprehending their requests.

1



One common cause of mild hearing loss is ear infections & negative middle ear pressure.

2



A second, less common cause, but typically more severe hearing loss is caused by nerve deafness.

3



A third type of hearing loss can occur when the auditory pathways of the brain are not coordinated or integrated, and the child has an interhemispheric integration problem.



AN AUDITORY PROCESSING PROBLEM IS CAUSED BY A HEARING LOSS AT SOME LEVEL OF THE AUDITORY SYSTEM FROM THE EAR TO THE BRAIN. The middle ear, the inner ear, and the auditory pathways of the brain are all required for accurate and on-time auditory processing. Having a hearing loss means not getting enough auditory information to hear the words, hear the meaning, and hear the implication of spoken language in real-time. When children struggle with interhemispheric integration we often see measureable differences in:

AUDITORY DISCRIMINATION

Problems with reading decoding, auditory memory problems with language and reading comprehension, temporal processing deficits problems with rhythm, organization, and planning.

AUDITORY MEMORY

Problems with language and reading comprehension, temporal processing deficits problems with rhythm, organization, and planning.

TEMPORAL PROCESSING DEFICITS

Problems with rhythm, organization, and planning.

CHAPTER 2



**A Struggling Listener
is a Struggling Learner**

Nothing succeeds like PREDICTING success!

AS A CHILD STRUGGLES WITH LISTENING AND AUDITORY PROCESSING,
THIS MAY CAUSE THEM TO DEVELOP POOR LISTENING HABITS AND SKILLS.

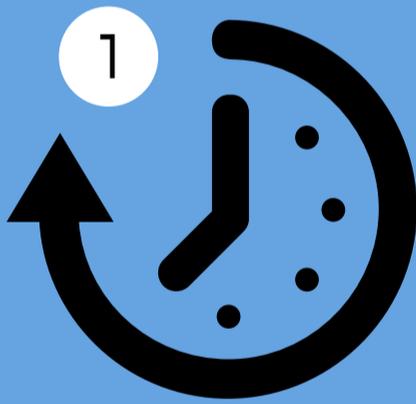
The child may not expect to hear, understand and retain words, language patterns and sentences. A child who doesn't predict they will be successful often doesn't pay attention during group activities or to general directions.

In addition to missing out on valuable and useful language information, the child misses out on the satisfaction of successful listening. If children don't predict they will be successful, they aren't motivated to listen.

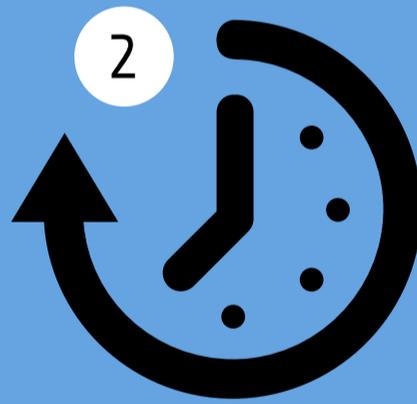
A child can develop good listening skills through practice with successful listening experiences. Through successful listening, a child learns to EXPECT to hear, understand, and remember information. This expectation of real-time successful listening leads to growth in communication.

Successful listening develops thinking and problem-solving skills via conversations, questions, and directions. It lays the foundation for reading decoding by helping children hear the differences between similar words. This also helps to lay the foundation for children's reading comprehension, understanding phrases and sentences, and enables them to visualize the meaning of phrases and sentences.

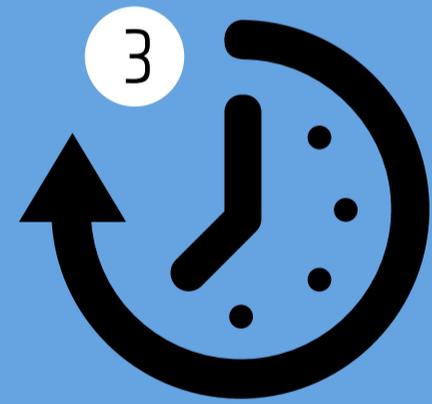
**CHILDREN WHO HAVE PROBLEMS WITH
AUDITORY PROCESSING WILL NEED EXTRA
TIME AND EXTRA PRACTICE TO DEVELOP
ALL 3 LEVELS OF LISTENING SKILLS:**



HEAR
THE WORD



HEAR
THE MEANING



HEAR
THE IMPLICATION

Successful Auditory Processing

WHEN CHILDREN ARE SUCCESSFUL WITH AUDITORY PROCESSING THEY WILL INTERNALIZE A MODEL OF THEMSELVES AS SUCCESSFUL LISTENERS.



HEAR
THE WORD



HEAR
THE MEANING



HEAR
THE IMPLICATION

Children will then bring an attitude of “active listening” to conversations. This positive attitude will enable them to use productive trial-and-error problem-solving skills to resolve auditory confusions.

“ A LISTENING PROBLEM BECOMES
A LEARNING PROBLEM, AND THEN
AN ATTENTION PROBLEM. ”

A CHILD WHO MISHEARS OFTEN NEEDS EXTRA TIME TO FIGURE OUT
THE MEANING OF THE WORDS.

In a one-on-one conversation, where the talker waits for the listener to respond, the problem may go unnoticed. The listener may also have to clarify or repeat words when the listener doesn't understand.

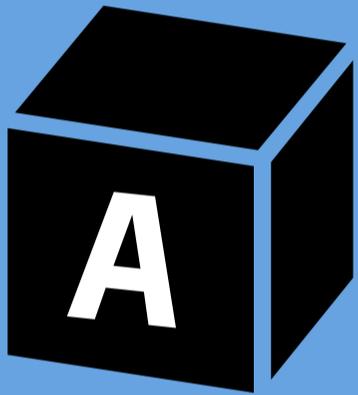
However, in a classroom setting, instruction is given and proceeds at a pace congruent with the entire group. A child that is struggling with the first sentence in a set of directions will have to pause their train of thought to attempt to understand those first words. This will most likely cause them to miss the second and third set of directions. If a teacher is unaware that a child is struggling with hearing, the child may get in trouble for not paying attention.

CHILDREN WHO DO NOT EXPECT TO HEAR MEANING IN SPOKEN
LANGUAGE WILL OFTEN STRUGGLE WITH COMMUNICATION, LEARNING,
READING, AND ATTENTION.

CHAPTER 3



The Three Levels of Auditory Processing



HEAR

THE WORDS

Hear the Words





CHAIR



BEAR

MINIMAL DIFFERENCES BETWEEN WORDS (WINDY/WEDNESDAY; THURSDAY/THIRSTY) MAY COMPLETELY CHANGE THE MEANING OF A SENTENCE.

The ability to hear the differences between the sounds of our language and on-time listening are critical for fluent auditory processing. Phoneme recognition (set of sounds) must be automatic for on-time auditory processing.

USING PAIRS OF SIMILAR-SOUNDING WORDS CAN HELP CHILDREN DEVELOP THE NEURAL NETWORKS REPRESENTING THE SET OF SOUNDS (PHONEMES) USED IN THE ENGLISH LANGUAGE. NeuroNet uses rhyming word pairs (e.g., bear, chair), ending sound differences (e.g., bow, boat, bone, bowl), and middle sound contrasts (e.g., bit, bet, beet) to help children “hear” the important differences between similar words.

“ Practice makes permanent. ”

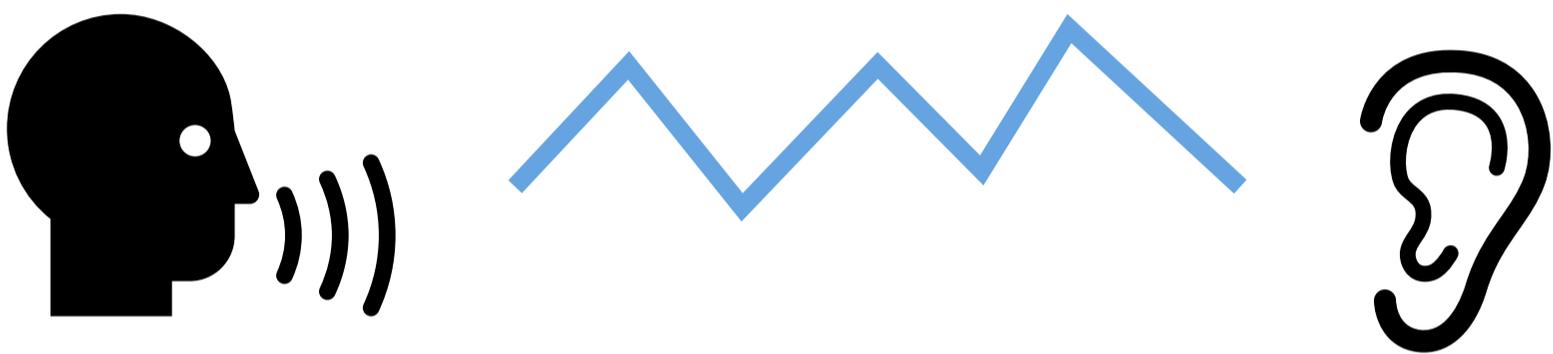
NEURONET INTEGRATED RHYTHMS EXERCISES CAN BE USED TO ENSURE THAT CHILDREN CAN MAKE THE NETWORK:

Hear the words, understand the meaning, and interpret the implication at a rate of 3-6 syllables per second. Rhythmic listening develops on-time auditory processing.

THROUGH THE PRACTICE OF HEARING SIGNIFICANT DIFFERENCES BETWEEN THE SOUNDS IN WORDS, A CHILD COMES TO EXPECT TO HEAR THE SOUND SEQUENCES IN WORDS.

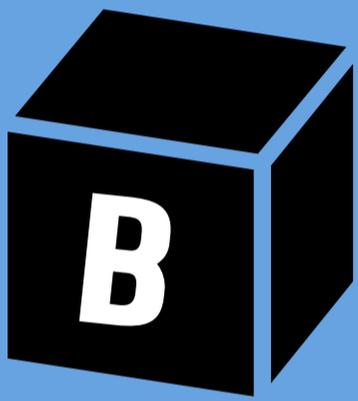
This expectation of real-time auditory processing leads to growth in communication skills (repeating new or unfamiliar language to ensure understanding). It develops thinking and problem-solving skills through conversations, questions, and directions. It also lays the foundation for reading DECODING by setting up sound sequences which can be matched to letter sequences.

STRATEGIES



HEAR THE WORDS

- 1 Practice rhythmic decoding for beginning sound difference, ending sound difference, and vowel differences.
- 2 Practice rhythmic speech, such as poetry, songs, and raps to a musical beat.



HEAR
THE MEANING

CHILDREN OFTEN SAY “YES” TO CONTINUE A CONVERSATION OR TO GET IT OVER WITH, EVEN THOUGH THEY DON’T UNDERSTAND WHAT THEY HAVE HEARD. In a therapist’s office, action words are often used to “show” the meaning of what a child hears.



YES

HEAR THE MEANING OF THE WORDS

Do you understand how to use the word?

Yes.

What's the first word?

(Freezes. Guesses or acts out, but is unable to SHOW what they have to do.)

KNOWING WHAT WE DON'T KNOW

Often a child with an auditory processing problem doesn't know what they don't understand. When we ask them to do something, or ask if they understand what they have to do, they often say "yes." However, if we ask them to SHOW what they have to do, SHOW how to organize their information on the paper, or SHOW which pencil they have to use, we see that they really didn't process or fully understand what they heard.

Have a child SHOW:

WHAT THEY HAVE TO DO

HOW THEY HAVE TO GET ORGANIZED

WHAT TOOLS THEY NEED TO USE

This helps them to build auditory memory for words and language, thus enabling them to express themselves using words.

Using the SHOW strategy in a conversation.....

MOM: Andrew, please make your bed and clean up your room and pick up your laundry before you call your friend.

ANDREW: Sure, mom (but has the phone in his hand).

MOM: Andrew, what do you have to do before you call your friend?

ANDREW: I don't know.

MOM: Let's go look at your room.

ANDREW: Nevermind. I know what I have to do.

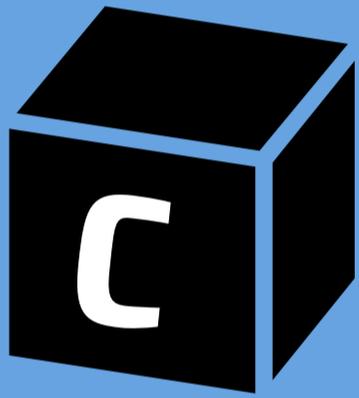
MOM: SHOW me.

ANDREW: (Shows one finger for each item as he names it) Make my bed and pickup my laundry.

MOM: (Shows her hand with three fingers instead of two).

ANDREW: (Showing one more finger): Bed, toys, and laundry.

MOM: (Smiling). You remembered everything! Your auditory memory is getting stronger!

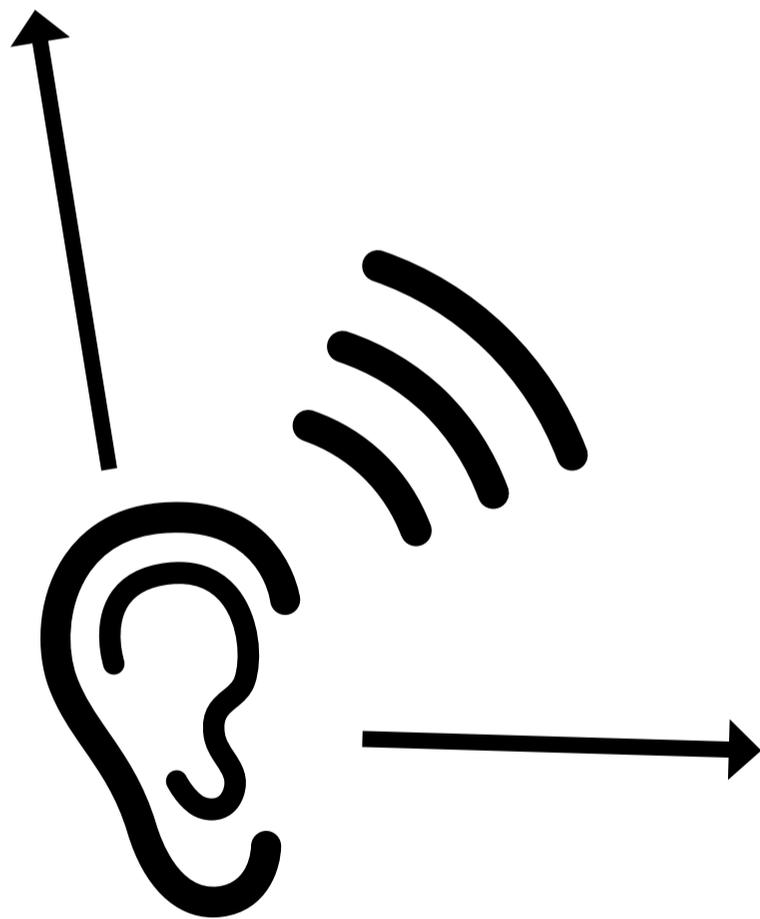


HEAR

THE IMPLICATION

The Network of Hidden Meanings

EVERY DIRECTION HAS A NETWORK OF HIDDEN MEANINGS, INCLUDING WHAT TO DO AND WHEN TO DO IT. THIS TIME WINDOW IS OFTEN EXPRESSED IN THE TONE OF VOICE OR INTONATION PATTERN OF THE SPEAKER.



When a child doesn't respond quickly and appropriately to spoken language, the speaker tends to change their tone of voice before they change any other auditory information. Consequently, the child misses the learning opportunity they need; i.e., a chance to hear the words, hear the meaning, and hear the implication of conversational speech in a conversational tone of voice. The child learns that they don't have to listen until the speaker gets louder.

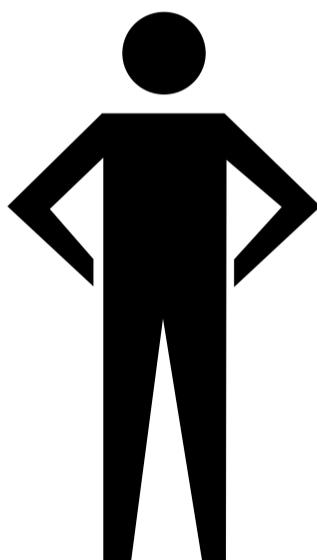


CHILDREN WHO STRUGGLE WITH HEARING THE WORDS AND UNDERSTANDING THE LITERAL MEANING OF WORD SEQUENCES MAY GET LITTLE PRACTICE HEARING THE MEANING EXPRESSED IN A SPEAKER'S TONE OF VOICE.

Consequently, their brains have very few opportunities to experience success with auditory processing. The consequences of poor auditory processing can be significant for anyone engaging in a conversation. Particularly in a large group setting (e.g., a classroom) where the presenter does not have time to stop and individually re-explain new concepts, nor to repeat questions and directions.

Hear the implication

STRATEGY



SMILE

STAND

WALK

Smile as you say the words the first time. Stand up as you repeat the words (in the same tone of voice).

Walk toward the child as you repeat the words for the 3rd time (in the same tone of voice.)

Using the “smile, stand, and walk” sequence enables a child to have more time – more time to hear the words, hear the meaning, and hear the implication; therefore, allowing the child to respond accurately. As a child experiences successful auditory processing they come to expect success in auditory processing, which builds their confidence and motivation for new learning.



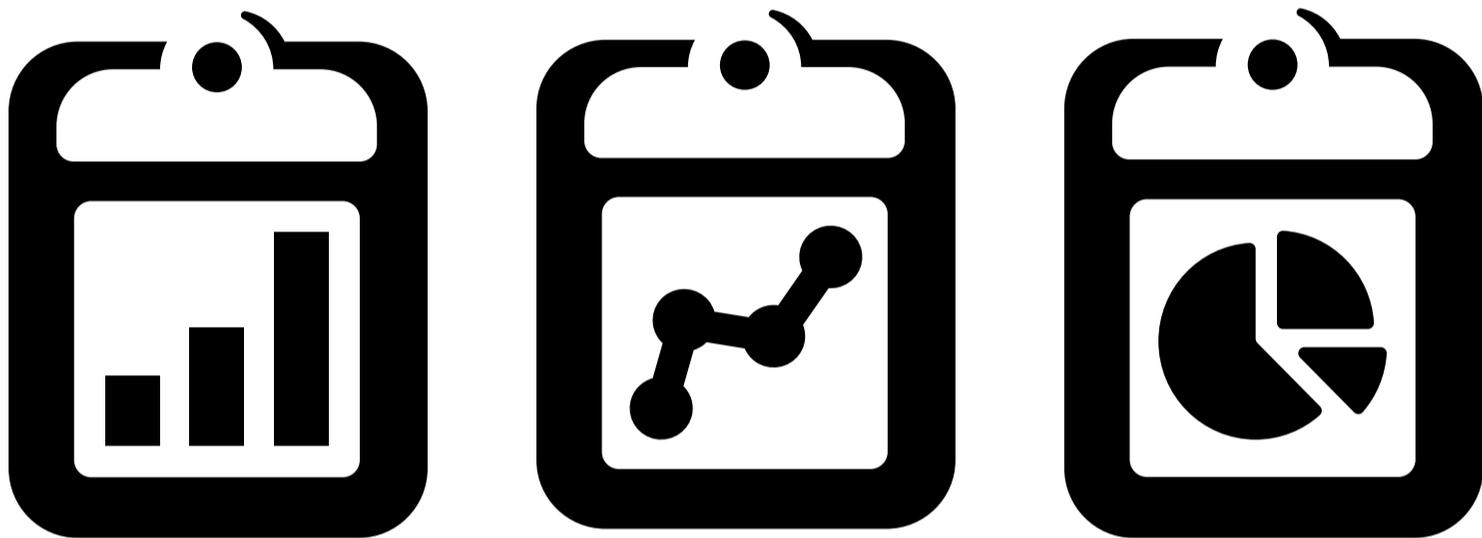
WHEN WE WORK WITH A CHILD TO DEVELOP THEIR AUDITORY PROCESSING, WE ALSO CONVEY THE HIDDEN MESSAGE THAT THE CHILD IS DOING THE BEST THEY CAN AND THAT WE APPRECIATE THEIR EFFORTS TO BE A GOOD LISTENER.

Over 4-6 weeks of consistent, positive repetition (e.g. smile, stand, and walk) for questions and directions, we expect to see that the child needs fewer repetitions in order to respond quickly and accurately.

CHAPTER 4

**Additional
Information & Review**

Auditory Processing: The Good News!



RESEARCH SHOWS THAT BOTH AUDITORY TRAINING AND AUDITORY TECHNOLOGY CAN MAKE A SIGNIFICANT DIFFERENCE IN A CHILD'S LISTENING AND LEARNING (MUSIEK ET AL. 2010; SONG ET AL. 2011).

Testing and measuring auditory processing, training auditory skills, and using technology solutions will help children make the speed-and-accuracy network for on-time and accurate listening. Good listeners are good learners!

Testing for Auditory Processing



An audiologist is a person who specializes in testing hearing and balance. The audiologist uses special equipment and tests to measure a child's hearing and listening for sounds, sound patterns, and words. These tests reveal if information is being transmitted accurately through the middle ear, the inner ear, and the auditory pathways of the brain. The tests also look at auditory perception, auditory discrimination, and auditory memory. The test results are then analyzed and compared normal hearing and listening. However, only an audiologist can diagnose an auditory processing problem.

Training Auditory Skills

PRACTICE WITH AUDITORY SKILLS CAN MAKE A MEASUREABLE DIFFERENCE IN AUDITORY PROCESSING:



AUDITORY
DISCRIMINATION

AUDITORY
WORD MEMORY

AUDITORY
LANGUAGE
MEMORY

AUDITORY SKILLS MUST BE MASTERED FOR BOTH ACCURACY AND SPEED.

Making the speed-and-accuracy network for auditory processing is an essential skill for listening in a group setting.

In addition to individual practice with listening activities, classroom amplification systems can help children improve with listening and learning (Hornickel et al. 2012; Larsen and Blair 2008; Musiek et al. 2010). When the teacher wears a microphone, and their voice is amplified, children hear more auditory detail in speech. Research shows that a school's reading scores increase when classroom amplification systems are implemented to enhance hearing and improve listening (Boswell 2006; Gertel, McCarty, and Schoff 2004).

Review

1

WHAT ARE THE THREE LEVELS OF AUDITORY PROCESSING?

Hear the words
Hear the meaning
Hear the implication

2

WHAT STRATEGIES CAN BE USED TO IMPROVE EACH OF THESE LEVELS OF AUDITORY PROCESSING?

A. HEAR THE WORDS:

Use rhyme and other listening exercises to clarify the differences between phonemes. Use rhythmic speech to make the speed-and-accuracy network for on-time auditory processing.

B. HEAR THE MEANING:

Have the child SHOW you what they are going to do.

C. HEAR THE IMPLICATION:

SMILE, STAND, and WALK. Give the child a chance to successfully process conversational speech in a conversational tone of voice.



“Get your brain to practice what you want your brain to learn.”

WWW.NEURONETLEARNING.COM

The goal of NeuroNet is to help your child become an independent learner. Children who complete NeuroNet programs demonstrate improvements in reading decoding, language skills, and handwriting.

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