Hearing Loss, Executive Functions, and Theory of Mind: Audiologists and Speech-Language Pathologists Collaborate

Afternoon Short Course

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Disclosure

I am receiving an honorarium for this presentation.

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Topics Covered

- As an audiologist, I will discuss these topics from an auditory perspective
- Possible counseling narratives
- Sleep – Foundational for Executive Functions
- Definition and description of Executive Functions
- Definition of ToM, and relationship to child development and to children with hearing loss
- Relationship of ToM to language development, tracking of conversations, and intensity of social/language exposure
- Relationship of ToM to distance hearing, incidental learning and overhearing the "free" information of social exchanges
- Relationship of Music to ToM
- Parallel processing and Executive Function
- Tips for families and practitioners

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Always start conversations with the Critical Question: What is the Family's Desired Outcome?

- The family's desired outcome guides us – ethically and legally, and drives our recommendations.
- What is your long term goal for your child?
- **How do you want to communicate with your child?**
- Where do you want your child to be at age 3, 5, 14, 20? What does it take to get there?
- *95% of children with hearing loss are born to hearing and speaking families.*
- *Many families* use a main language at home other than the school language, so they likely are interested in their child speaking several languages.

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<u>Possible Narrative:</u> The Ear is the "Doorway" to the Brain for Sound -- Spoken Language/Information – Talking – Reading.

We hear with the brain – not with the ears!

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So, what is Hearing Loss? We can think about Hearing Loss as a "Doorway" Problem

- The ear is the "doorway to the brain" for sound.
- Hearing loss of any type and degree obstructs that doorway a little (hard of hearing), a lot (more hard of hearing) or completely (deaf), preventing sound/<u>auditory</u> <u>information</u> from reaching the brain.
- Hearing aids and cochlear implants break through the doorway to allow access, stimulation and development of auditory neural pathways.

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The purpose of technologies (e.g. hearing aids, cochlear implants, RMs, CADS) is to get sound -- auditory language information -- through the doorway to the brain.

There is NO other purpose!

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So, What is Hearing?

- Hearing can be defined as brain perception of auditory information.
- Anytime the word "hearing" is used, think "**auditory brain development**" using 1 billion neurons with a quadrillion connections!
- Acoustic accessibility of *intelligible* spoken language is essential for brain development and growth of knowledge.
- **There are no "earlids" – the brain is available for auditory information 24/7.**
- Signal-to-Noise Ratio (SNR) is the key to hearing intelligible auditory information – speech must be 10 times louder than background sounds.

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Hearing vs Listening

- **Hearing** is acoustic access to the brain – brain perception of auditory information; it includes improving the signal-to-noise ratio by managing the environment and utilizing hearing technology.
- **Listening** is attending to acoustic events with intentionality – activating the pre-frontal cortex.
- **"Hearing" must be made available before "listening" can be taught.**
- **We must know about the "hearing thing" before we can do the "listening thing".**
- **The concept of Extrinsic vs. Intrinsic redundancy.**

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Extrinsic vs Intrinsic Redundancy: A Key Concept (James Jerger)

- Extrinsic redundancy refers to the integrity of information from outside the person….."bottom-up" sensory input.
- Intrinsic redundancy refers to the cognitive capacity -- the internal knowledge and attentional resources of the person….."top-down" processing.
- There is an inverse relationship between these two concepts that must be considered for children.
- Specifically, children do not have the top-down capabilities available to adults.

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Improve Intelligibility of our Spoken Communication to Enhance "Bottom-Up" Sensory Input – Use a Remote Microphone and Speak Slower!

- Most adults speak faster than most children (and many aging persons) can process (often faster than 200 words per minute – way too fast!).
- Use "clear speech"….slow down (aim for 124 words per minute, like Mr. Rogers)….**pause**…use appropriate suprasegmentals to enhance meaning.
- The talker's use of "clear speech" can improve the listener's speech discrimination by up to 40%.
- Use remote microphone wireless technology (RM) to improve the SNR.

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It's All About The Brain

Hearing loss is not about ears; it's about the brain!

Hearing aids, remote microphone systems and cochlear implants are not about ears; they are about getting auditory information to the brain!

They are "brain access tools".

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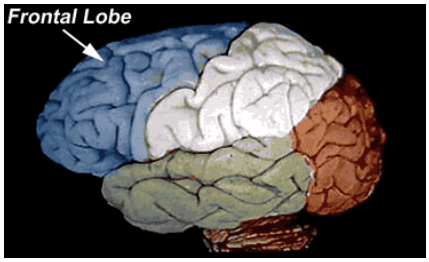
The Real Ear



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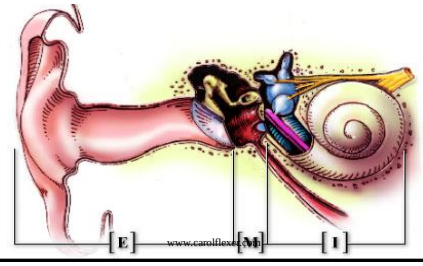
First display a picture of the "Brain Ear", and then the more traditional picture of the "doorway" ear, showing:

Outer (external), Middle and Inner Ear



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The Big Picture: The World Has Changed!

- *Who Moved my Cheese?* by Spencer Johnson, M.D. – a book about change
- We are an Information/Knowledge-based economy that demands high levels of spoken communication and literacy.
- We are educating children to take charge in the world of 2030, 2040, and 2050….not in the world of 1970 or 1990 or even 2022.

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The World Has Changed For Hearing Loss, Too.

Spoken Communication: Past And Present

1. CD of possible "oral" outcomes before early identification, early intervention, and cochlear implant technology
2. DVD of possible "auditory-verbal – Listening and Spoken Language (LSL)" outcomes in this day and age

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What Does "Deaf" Look Like in 2020?

- Does 2020 "Deaf" look like 1990 "Deaf"?
- We have used the same words for decades, but the context and possibilities have changed, dramatically!

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Computer Keyboard Analogy: Another narrative to use when counseling about hearing loss and use of technology

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- Data input precedes data processing
- Hearing loss or poor acoustic environments can be thought of as analogous to having a malfunctioning computer keyboard that interferes with data entry to the brain – the hard drive.

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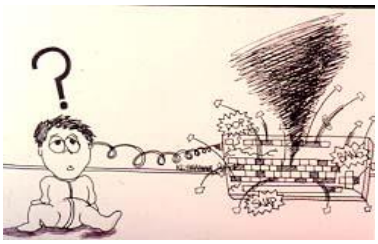

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Amplification technologies (hearing aids, RM systems, cochlear implants) facilitate data entry to the brain by providing a more accessible keyboard. A great keyboard does not "fix" the hard drive.

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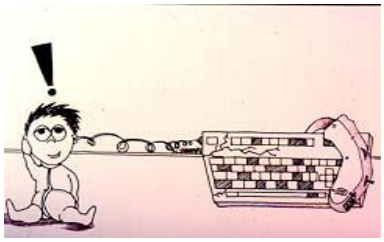

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From a Brain-based perspective --Who are the children in our schools?

Children in our school programs have many unique characteristics and a range of social experiences.

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We have a wide variety of children with cochlear implants and hearing aids in our preschool and school programs. Some of the variables include:

- Those children who were aided/implanted very young -- in their first year of life.
- Those implanted in the toddler years, but their brain DID receive some acoustic exposure (via hearing aids) pre-implant.

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More…..

- Those implanted late (after 18 months of age), and their brain had not received acoustic exposure pre-implant.
- Those who had received the implant in infancy, but the CI was not programmed effectively or was not worn, and/or their early therapy was not auditorily focused.
- Those who are older, but they have had a progressive hearing loss....so their brain was developed initially around acoustic sound.

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Always consider: What is the status of the child's auditory brain?
Where has the brain been?
What does the brain "know"?
What is the Child's "Hearing Age"?
What language and social exposure has the child experienced?

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Sleep: Related to Development of Executive Functions and Learning

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Sleep is critical!

- Lack of sleep deteriorates a wide swathe of brain performance related to executive functions and learning:
  - Working memory function
  - Long-term memory storage
  - Memory retrieval

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The Importance of Sleep

Source: National Sleep Foundation

- Children in households with bedtime rules and children who get adequate sleep, score higher on a range of developmental assessments.
- Results indicate that among sleep habits, having a regular bedtime was the most consistent predictor of positive developmental outcomes at 4 years of age.

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The Importance of Sleep

- Scores for receptive and expressive language, phonological awareness, literacy and early math abilities were higher in children whose parents reported having rules about what time their child goes to bed.
- Having an earlier bedtime also was predictive of higher scores for most developmental measures.
- According to the American Academy of Sleep Medicine, preschool children should get a minimum of 11 hours of sleep each night.

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The Importance of Sleep

- Getting less than this recommended amount of sleep is associated with lower scores on phonological awareness, literacy and early math skills.
- Studies show that many children are not getting the recommended amount of sleep, which may have negative consequences for their development and school achievement.

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The Importance of Sleep

- Across all ages, a late bedtime and having a parent present when the child falls asleep had the strongest negative association with reported sleep patterns.
- A late bedtime was associated with longer sleep onset latency and shorter total sleep time, whereas parental presence was associated with more night wakings.

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The Importance of Sleep

- Those children (ages 3+) without a consistent bedtime routine also were reported to obtain less sleep.
- Furthermore, a television or computer in the bedroom (ages 3+) and regular caffeine consumption (ages 5+) were associated with shorter total sleep time.

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The Importance of Sleep

US-based recommendations for sleep suggest that young children should:

- fall asleep independently;
- go to bed before 9:00 PM and obtain at least 10-13 hours of sleep per night;
- have an established bedtime routine that includes reading as part of their bedtime routine;
- refrain from caffeine;
- and sleep in bedrooms without televisions.

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How much sleep is needed at each age and stage? (National Sleep Foundation)

Age	Recommended	May be appropriate	Not recommended
Newborns 0-3 months	14 to 17 hours	11 to 13 hours 18 to 19 hours	Less than 11 hours More than 19 hours
Infants 4-11 months	12 to 15 hours	10 to 11 hours 16 to 18 hours	Less than 10 hours More than 18 hours
Toddlers 1-2 years	11 to 14 hours	9 to 10 hours 15 to 16 hours	Less than 9 hours More than 16 hours
Preschoolers 3-5 years	10 to 13 hours	8 to 9 hours 14 hours	Less than 8 hours More than 14 hours
School-aged Children 6-13 years	9 to 11 hours	7 to 8 hours 12 hours	Less than 7 hours More than 12 hours
Teenagers 14-17 years	8 to 10 hours	7 hours 11 hours	Less than 7 hours More than 11 hours
Young Adults 18-25 years	7 to 9 hours	6 hours 10 to 11 hours	Less than 6 hours More than 11 hours

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Executive Functions

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What is Executive Function?

- Medina (2018), writes that Executive Function (EF) is the ability to get something done -- and not punch someone in the nose while doing it.
- EF is a set of neurologically-based skills involving mental control and self-regulation.
- Foundational features of EF include:
  - Response inhibition
  - Cognitive flexibility
  - Working memory

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Description of Executive Functions

- Executive Function (EF) is an umbrella concept that includes a collection of interrelated functions that are responsible for purposeful, goal directed, problem-solving behavior.
- Specifically, EFs are a collection of processes that are responsible for guiding, directing, and managing cognitive, emotional and behavioral tasks, especially during novel problem solving.
- EF is the ability to sustain an appropriate problem solving set for accomplishment of a future goal.
- The EFs pertain not only to cognitive control; they also involve regulatory control of emotional response and behavioral action.

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Center on the Developing Child: Harvard University

- **Enhancing and Practicing Executive Function Skills with Children from Infancy to Adolescence – clip about Executive Function**
- http://developingchild.harvard.edu/resources/multimedia/videos/inbrief_series/inbrief_executive_function/

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Neurological Issues for EF

- The developmental route of EFs follows the prolonged course of neurological development, chiefly with respect to the pre-frontal regions of the brain.
- The neurological nature of the frontal lobes is their dense synaptic connectivity with other cortical and subcortical regions of the brain.
- The prefrontal system is highly and reciprocally interconnected through bidirectional connections with the limbic (motivational) system, the reticular activating system (arousal), the posterior association cortex (perceptual/cognitive processes,) and the motor regions (action) of the frontal lobes.

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Neurological Issues for EF

- A disorder within any component of the frontal system network can result in executive dysfunctions.
- There is no such thing as an Executive Function disorder -- there are *disorders in Executive Function*.
- Therefore, disorders in executive function can arise from insults to the primary prefrontal regions as well as from damage to the densely interconnected posterior or subcortical areas.
- So, if the brain is disrupted anywhere, a disorder in Executive Functions could occur.

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Pre-frontal Cortex Electrical Activity

- Slow pre-frontal lobe electrical activity was certified, in 2013 by the FDA (USA Food and Drug Administration), as a biomarker of ADHD (Attention Deficit Hyperactivity Disorder).
- This slow electrical activity in the prefrontal cortex leads to poor executive function because the “rational brain” lacks proper control over the “emotional brain”.

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Developmental Stages of Executive Function

- At birth, babies have inhibitory control, e.g. they have to inhibit inappropriate mouth behaviors in order to nurse….red flag if this was a problem.
- From 3 to 24 months -- the beginning of non-verbal working memory.
- Verbal working memory develops from 2-13 years.
- Emotional modulation goes from 3 years -- ???
- Plan/organize/monitor -- 3 to 32 years.
- Because of their complex, higher order nature, the maturation and development of EF is prolonged.

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More about EF Development

- To summarize, the development of attentional control, future-oriented intentional problem solving, and self-regulation of emotion and behavior begin in infancy and continue into the preschool period.
- However, executive control (EC) at these early ages is variable, fragile and tied to the external stimulus situation; increasing stability is achieved between 18 and 30 months of age.
- Girls have greater EC as preschoolers, and draw upon EC to a greater degree to regulate their behavior.

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Behaviors Observed in Disorders of Executive Function

If a child has difficulty inhibiting ineffective behaviors, the child may:

- Be impulsive
- Have difficulty stopping when being silly
- Have to be supervised, closely
- Not think before acting

If a child has difficulty with emotional control, the child may:

- Overact to small problems
- Have angry outbursts – be explosive
- Tear up easily and have frequent mood changes

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Behaviors Observed in Disorders of Executive Function

If a child has difficulty with working memory, the child may: (remember, "muddy in, muddy out")

- Be absent minded
- Remember only the first or last item when given 3 things to do
- Have trouble with multistep chores

If a child has difficulty self monitoring, the child may:

- Not notice when he causes others to feel bad or become angry until it is too late
- Not understand "why", when people seem upset with her -- and not ask for help when needed

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Overlapping Conditions, Symptoms and Behaviors

The following Executive Function difficulties or symptoms can occur with or because of a language disorder, ADHD, CAPD, learning disability, or hearing loss with limited auditory/linguistic exposure and practice:

- Attention; Language; Verbal Memory
- Following directions; Listening
- Processing speed
- Academics
- Behavior Problems

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Treatment for Problems with EF

Neuropsychologists can assist in designing treatment plans based on the child's EF profile, such as one obtained from the BRIEF-P -- Behavior Rating Inventory of Executive Function -- Preschool Version (Gioia, Espy, & Isquith, 2003). ***Sample of strategies:***

- facilitating inhibitory control by controlling antecedents to the impulsive behaviors;
- allowing meaningful and consistent consequences to happen;
- give "2 minute" warnings when tasks are about to change;
- practice appropriate emotional reactions;
- and reduce exposure to overly stimulating environments.

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Treatment for Problems with EF

Sample of strategies for working memory:

- encourage self-talk (private speech) to assist in regulating emotions and their expression as well as remembering tasks;
- parent/clinician speaks slower to allow the child to rehearse and think about the communication;
- Mostly the parent/clinician/teacher takes on the role of *Executive Function Manger* until the child can learn that role for herself.

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Treatment for Problems with EF

- Noise disrupts Executive Functions and can cause listening fatigue: Be mindful of acoustic accessibility – have a quiet environment.
- Minimize distractions.
- Use RM technologies…personal or sound field.

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Theory Of Mind (ToM)

"The capacity to infer other people's mental states, and to use this information to predict behavior, is a central cognitive ability that emerges early in human development" (Pyers and Senghas, 2009).

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Definition and Description of ToM; An Aspect of Social Cognitive Development – Emotional Understanding

- A "Theory of Mind" (often abbreviated in ToM) is a specific cognitive ability to understand others as intentional agents.
- It also means one must be able to maintain, simultaneously, different representations of the world.
- ToM appears to be an innate cognitive potential in humans, but one requiring social/linguistic and other experience over many years to bring it successfully to adult fruition.
- It has been commonplace in philosophy to see ToM as intrinsically dependent upon our linguistic abilities.
- As each child's ToM matures, he or she is able to gauge others' beliefs, desires, perspectives, and intentions, and perhaps predict their behavior.

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Definition and Description of ToM -- More

- Having a ToM allows children to understand many nuanced and layered aspects of human social life such as surprises, jokes, teasing, secrets, tricks, deceit, manipulation, cheating, negotiation, collaboration, exaggeration, mistakes and lies.
- As children age and gain more social and language skills, a ToM forms the basis for inference, perspective taking, social reasoning, social navigation, and empathy.
- A ToM is critical for academic development, especially in collaborative educational environments.

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What are Mirror Neurons?

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The Science: Mirror Neurons

- A mirror neuron is a neuron that fires when a person acts, and also when the person observes the same action performed by another.
- Mirror neurons are thought to be in the pre-frontal cortex and inferior parietal cortex and are important for language development and for growth of Theory of Mind skills.
- ***Talking activates mirror neurons – texting does not.***

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We can't help copying others, especially if we are emotionally in-tune!

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ToM and Children

- A workable ToM doesn't develop before the age of 4 years; by that age, a child should be able to distinguish between what is so and what people believe is so.
- One of the most important milestones in theory of mind development is gaining the ability to attribute *false belief*: that is, to recognize that others can have beliefs about the world that are wrong.
- A new model of sex differences in the mind suggests females, on average, show a stronger drive to empathize; empathy is broader than 'theory of mind' because it not only involves identifying the mental states of the other person, but also responding to these mental states with an appropriate emotion.

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Theory Of Mind And Children With Hearing Loss

- The language skills in children with hearing loss are directly related to their Theory of Mind skills, however, it isn't general language skills but rather specific vocabulary skills.
- That is, if a child can understand sentences such as, "He *thought* his cake was in the cupboard," he is more likely to understand and predict behavior premised on a false belief.
- One important way that children gain an understanding of other's thoughts is by attending to the back and forth viewpoint exchange of family members; therefore, the child must be able to track multi-talker conversations – a skill that demands the maximum possible auditory brain access to soft speech at a distance – **in the same language as those in the environment.**

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Theory Of Mind And Children With Hearing Loss

- Overhearing "self-talk" (of parents, or others in the environment) such as "where are those car keys," or "I forgot the agent's name", assist the child in understanding others have a state of mind that is different from the child's.
- Siblings in the home promote the development of ToM because there tends to be more discussions of mental states that lead to differences in behaviors – **provided those discussions are acoustically available to the child with hearing loss – and in the same language.**

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Summary Comments: ToM

- Language, not just social experience, is required for development of an understanding of false-belief.
- Nevertheless, social experiences and language likely function together to build a mature ToM.
- The child needs to **use/produce** as well as hear *mental-state verbs* (e.g. think, know), which leads to a meta-awareness of those internal processes that can affect human action.

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Examples of Mental-State Words and Phrases for Desire, Emotion, Modulation of Assertion, Thinking and Knowing

- What if…?
- I wonder…
- What do you think?
- When I was….
- You won't believe…
- Bet you can't guess…
- What do you see?
- Remember….
- This reminds me
- Possibly
- Could be
- If I were..
- One time..
- Would you believe??
- How do you think she feels?
- What could happen next?
- Why did she….?
- Want
- Like
- Disappointed

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Imagine a "Think Bubble" over the child's head to Facilitate Adult-Child ToM.
Think about what the child might be thinking.

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Use Causal Explanatory Talk

- Because…..
- Ask, "How do you know?"
- Seeing is knowing
- Hearing is knowing
- Smelling is knowing

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Summary Comments: ToM

- To compete academically, children need to be able to know and have the confidence to express their feelings in presenting arguments.
- Children require knowledge about the subtle social rules for communication-- and these rules are learned incidentally -- by participating in conversations and by overhearing the conversations of others.
- ***Lack of social competence impedes academic progress.***
- ***Language and speech delays impede social relationships.***

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"What's the difference between a discussion and a debate? A ToM Issue.

- What is the purpose of each?"
- The goal in a debate is to win an argument.
- The goal of a discussion is to understand rather than win, so the tactics are different.
- When you're seeking to understand another person's ideas (ToM), being able to listen actively and question in a way that furthers the conversation is more important than focusing only on expressing your own opinion.

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Incidental Learning And Distance Hearing

Acoustic access at a distance and for soft speech *(in the same language as others in the environment)* is critical for the development of ToM!!

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Incidental Hearing

- Hearing is a distal sense.
- Hearing enables us to monitor what is happening in the environment – to gain "free information"…not direct instruction.
- Hearing enables us to learn casually, incidentally, and passively.
- Hearing enables us to learn about our culture, about social conditions, about human interactions– by "over- hearing" the conversations and transactions of others.

We must extend a baby/child's distance hearing as much as possible, as often as possible, to access "Free Information" and to assist in the social and linguistic access and practice that is necessary for development of ToM.

Children must be able to "overhear" conversations!

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Why extend distance hearing and "overhearing"?

Because the literature in developmental psychology tells us about *90%* of what very young children know about the world, they learn incidentally.

And, it's not just about knowledge, overhearing facilitates social/cognitive development.

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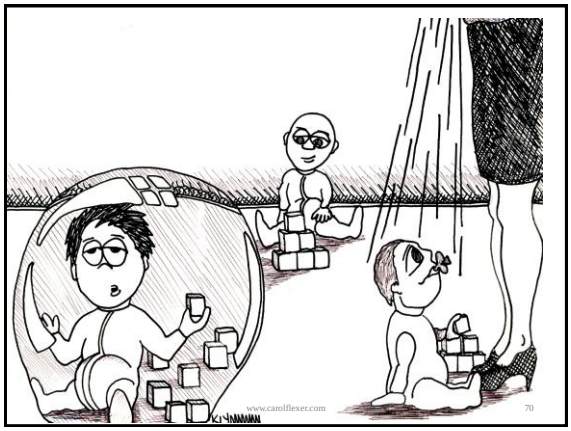

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If our children with hearing loss depend mostly on active instruction, they will have an information, knowledge, and social deficit compared to children with typical hearing. Do not confuse Language with Knowledge!

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The Ling Six Sound Test as a Measure of Distance Hearing

- Rationale for the selection of the sounds.
- How to present the sounds – keeping loudness and duration constant with distance.
- Mark the distances in a quiet hallway.
- Use the test daily at the child's greatest distance and also at 3-6 feet.
- We must know a child's overhearing potential!

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What about Music and ToM?

By music, we mean adult-directed singing out loud with the child throughout the day – an active and interactive conversation.

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The Brain LOVES Music! Professionals, coach families to include music activities, daily. Why?

- Music is a whole brain work-out!
- The brain loves music – the words stimulate the left hemisphere and rhythm stimulates the right hemisphere, and the corpus callosum is "exercised" by cross-over – called interhemispheric transfer.
- Music enhances "paralinguistics"-- emotion.
- Rhythm is foundational for literacy development.

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Music for brain health (Kraus, 2018)

- Music tunes listening skills, sharpens mental acuity and boosts language skills.
- In children, music speeds up brain development.
- Music training also improves children's reading and math skills.

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Summary Ideas about Music and the Developing Brain – Laurel Trainor -- http://trainorlab.mcmaster.ca/

- Infants' brains become specialized for what they are hearing.
- Active participation is better than passive listening.
- By the end of the first year after birth, infants are becoming specialized for the rhythmic and tonal structure of the music they hear.
- Listening to auditory stimuli effects movement; music and movement are intimately connected.
- Across cultures, infants experience concurrent movement and singing in everyday life.
- Synchronizing rhythmically with others is important for social development -- ToM.

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Parallel Processing/Multi-Tasking and Executive Function

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The Myth of Multitasking (Whitman & Kelleher, 2016)

- There is no such thing as multitasking. The brain cannot multitask, instead it rapidly switches from meeting the demands of one task to meeting the demands of another.
- There is a switching cost for doing so.
- Multitasking results in more effort for less efficient performance.
- Those who self report being great at multitasking are no better at doing so than those who say they cannot.

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Difficulty With Parallel Processing

- Children with hearing loss have great difficulty focusing and switching when having to deal with multiple, simultaneous tasks.
- They might not be able to listen, and think about a different or even about a related subject at the same time.
- Apparent off-task behavior may really be an inability to perform parallel processing – to rapidly switch between tasks.

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Specific Strategies for Parents: How To "Grow" Your Child's Brain for Speaking, Listening, Reading, Learning and Making Friends

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Calculating the Time Children Spend at Home vs. at School, From Birth to Age 18

• Assume that a child sleeps 8 hours/day
• 24 hours/day - 8 hours sleeping = 16 waking hours/day
• 365 days/year x 18 years = 6,570 days
• 6,570 days x 16 waking hours/day = 105,120 waking hours by age 18

• Average 6 hours per day at school.
• Average 180 school days/year
• 180 school days/year x 6 hours/school day = 1,080 hours per school year.
• 1,080 hours/school year x 13 school years (1 year kindergarten + 12 years through H.S.) = 14,040 school hours

• 14,040 school hours / 105,120 waking hours = .13356 or …

Just 13.36% of waking hours by age 18 are spent in school!
PARENT ENGAGEMENT MATTERS!!!!

Adapted from "Nine Truths about Parent Engagement" (Wherry, 2014)

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Work in Harmony with Our Organic Design

- Human beings are designed to listen and talk and have social relationships -- if we do what it takes…if we "activate" auditory neural centers with linguistic information!

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Thoughts about Audition and ToM

- Caregivers may need training/coaching to be sensitive to the infant's/toddler's emotional state and emotional communications.
- Psycho-social development is not an isolated domain but is interwoven with language and cognition.
- ToM developed during the preschool years provides a conceptual foundation for metacognitive thinking processes that will be a major focus in the school years.
- We need to be aware of emotional readiness for school.

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How Can We Help Children to Learn Theory of Mind Skills?

- Inferring how others feel is based on underlying skills such as perception of facial expressions, perception of emotion in the vocal expressions of others, knowing the emotion words, and reasoning about emotion.
- Social access to group learning demands auditory brain access!
- Distance hearing, multiple microphones, acoustic accessibility, strong language base and an experience base are necessary to allow auditory cognitive closure.

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How Can We Help Children Learn Theory of Mind Skills?

- Pretend play and role-playing allow children to escape from the reality of objects and roles; to do this, children may need to create separate cognitive representations for what is real and what is imaginary.
- Talking about past events also has been found to be related to Theory of Mind skills in children, probably because children need to discuss decontextualized events.
- Talk about what you are "thinking", not only about what you are "doing".
- **Overhearing capabilities are critical!**

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Children's Literature And ToM

- Children's literature may be especially useful for ToM development in children with hearing loss.
- By reading to children, parents expose children to alternate views of the world.
- In experiencing stories, children can become cognizant of other people's thoughts, perceptions, and motivations.

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Implications for Parents, Teachers, Auditory Therapists and Early Interventionists working with Children with Hearing Loss

- Talk constantly with the child about what the child is ***thinking*** as well as about what the child is doing …….Conversations
- Create experiences and talk about them
- Use complex language, explain it, and link it to the experiences
- Singing can advance emotional expression.
- Read aloud with the child on a daily basis, using books that are at least slightly beyond where the child is linguistically
- **Have the child tell the story back to you**

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General References

- Cole, E., & Flexer, C. (2020). *Children with Hearing Loss: Developing Listening and Talking, Birth to Six, 4th ed.* San Diego: Plural Publishing.
- Madell, J., Flexer, C., Wolfe, J., & Schafer, E.C. (2019). *Pediatric Audiology: Diagnosis, Technology, and Management, 3rd ed.* New York: Thieme Medical Publishers.
- Madell, J., Flexer, C., Wolfe, J., & Schafer, E.C. (2019). *Pediatric Audiology Casebook, 2nd ed.* New York: Thieme Medical Publishers.
- Merzenich, M.M. (2010, April). *Brain plasticity-based therapeutics in an audiology practice*. Learning Lab presented at the American Academy of Audiology National Conference, San Diego.
- Robertson, L. (2014). *Literacy and Deafness: Listening and Spoken Language.* San Diego: Plural Publishing.

88

References for EF and ToM

- Medina, J. (2018). *Attack of the teenage brain!* Alexandria, VA: ASCD Publisher.
- Moeller, M.P. (2007). Current state of knowledge: Psychosocial development in children with hearing impairment. *Ear & Hearing, 28(6)*, 729-739.
- Netten, A.P., Rieffe, C., Soede, W., & et al. (2017). Can you hear what I think? Theory of mind in young children with moderate hearing loss. *Ear & Hearing, 38(5),* 588-597.
- Pichora-Fuller, M.K., & Phillips, N. (2017). Tackling the toll of hearing loss on executive function. *The ASHA Leader, 22(7*), 6-8.
- Rizzolatti, G., & Craighero L. (2004). The mirror-neuron system. *Annual Review of Neuroscience, 27,* 169-92.
- Westby, C. (2017). Keep this theory in mind. *The ASHA Leader, 22(4),* 18-20.
- Whitman, G, & Kelleher, I. (2016). NEUROTEACH: Brain science and the future of education. New York: Rowman & Littlefield.

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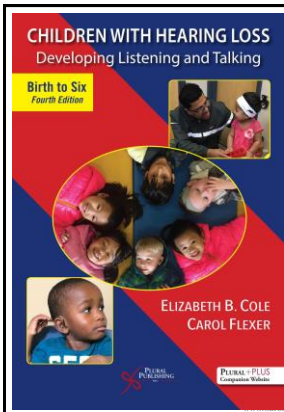

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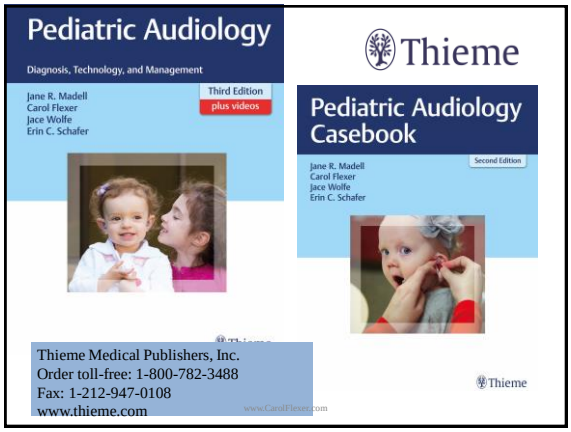
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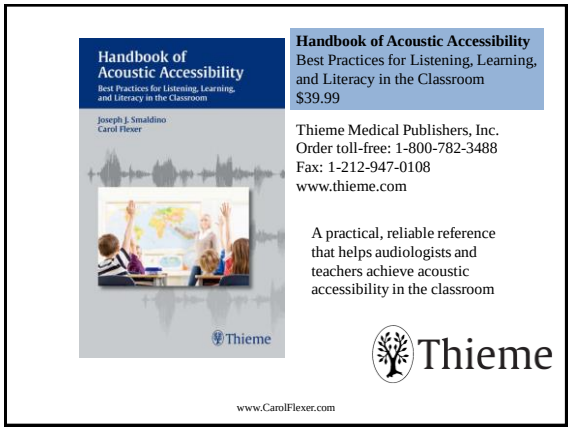
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