Theory of Mind Development in Children with Hearing Loss: Strategies for Social Emotional Growth

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Topics Covered

- Discussion of the "auditory brain" and pre-literacy development
- Definition of ToM, and relationship to child development and to children with hearing loss
- Neurological implications
- Relationship of ToM to language development, tracking of conversations, and intensity of social/language exposure
- Relationship of ToM to distance hearing and incidental learning
- Ling 6 Sounds and Distance Hearing

Family's Desired Outcome

- The family's desired outcome guides us – ethically and legally.
  - What is your long term goal for 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.*
- This talk is all about the **context** of service delivery and professional collaboration if the family chooses listening and talking for **today's child** who is deaf or hard of hearing.

Intention For This Presentation: Invitation To Listen

- How will the performance of your students improve as a result of what you have learned during today?
- That is, specifically, how will the knowledge you gain impact the outcomes of the children you serve?

Themes

- *Because of technology and brain neuroplasticity*, the audiologist's role has expanded in pediatric sectors.
- *Because of technology and brain neuroplasticity*, the landscape of deafness has changed.
- *Because of technology and brain neuroplasticity* , today's infants represent a new and different generation of children who are deaf.
- There are *limited data* about the social, emotional and cognitive development of today's children who are identified at birth and who have good auditory access.

Main Ideas

- Hearing is a first-order event for the development of spoken communication and literacy skills…**no "earlids".**
- Anytime the word "hearing" is used, think "**auditory brain development**"!!
- Acoustic accessibility of *intelligible* speech at soft levels and at distances is essential for brain growth and for social-emotional development.
- Signal-to-Noise Ratio is the key to hearing intelligible speech – **Use an FM.**

It's All About The Brain

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

Hearing aids, FM systems and cochlear implants are not about ears; they are about the brain!

They are Brain Access Tools!

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 2013

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The World Has Changed For Hearing Loss, too

Spoken Communication: Past And Present

(1) CD of possible "auditory-oral" outcomes before early identification, early intervention, and cochlear implant technology – and (2) DVD of possible listening and spoken language outcomes in this day and age.

What Does "Deaf" Look Like in 2012?

- Does 2012 "Deaf" look like 1970 "Deaf"?
- We have used the same words for decades, but context and opportunities have changed dramatically!

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New Brain Research

Basic neural research now provides data that substantiates the necessity of accessing and stimulating auditory brain centers.

There is a science behind our practice!

Auditory Neural Activity

- Important changes have been shown in the higher auditory centers due to hearing loss/deafness.
- The auditory cortex is directly involved in speech perception and language processing in humans (Tobey, 2010).
- Normal maturation of central auditory pathways is a precondition for the normal development of speech and language skills in children (Sharma & Nash, 2009).

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Brain Wiring

- We are in a brain plasticity revolution -- much interest and attention.
- The brain's availability to neural rewiring changes over the years.
- Critical periods of neural development are not simple or straightforward.

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Critical Periods?

The cortex matures in stages/columns, and the level of maturity depends on the richness of exposure and experience (Merzenich, 2010).

Level one of the cortex probably matures by 12 months. This first stage, the "setup" stage for the cortex, has the brain "always-on."

In this period, all is takes to develop auditory pathways is exposure to sound. The brain's task is to create a model of the culture into which it just happens to have been born. The baby learns how to control the actions required to survive and thrive in that world (Merzenich, 2010).

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More about Critical Periods (Merzenich 2010)

The second stage of cortical development has the brain now controlling its own plasticity as the child masters skill after skill. These are learning-driven changes and they are huge.

The higher levels of the cortex continue to mature to age 17-19 years.

Neural organization is bottom-up maturation. The quality of the lower level maturation, stimulation, and practice influences the quality of the higher level neural maturation.

Adult cortical plasticity is controlled "from the top".

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Neuroplasticity – Some Generalizations

- To change the cortex, one must control attention and working memory.
- ***Experience dependent plasticity:*** Repeated auditory stimulation leads to stronger neural connections (Kilgard, 2006).
- Sensory experience directly shapes the rewiring that makes learning possible....especially guided neural reorganization (Merzenich 2010).
- The skills and abilities that we develop are a product of our culture -- our exposure, experience and practice.
- Attention plays a major role in activation of the auditory cortex (Musiek, 2009)

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Why Early ID And Amplification/Implantation, Before Age 2, Is Critical (Robbins, et. al, 2011)

- Skills mastered as close as possible to the time that a child is biologically intended to do so, results in ***developmental synchrony***.
- Mastery of any developmental skill depends on ***cumulative practice***: the more delayed the age of acquisition of a skill, the farther behind children are in the amount of cumulative practice they have had to perfect that skill. The same concept holds true for cumulative auditory practice.
- Delayed auditory development leads to delayed language skills.
- Developmental practice looks different than remedial practice.
- A cochlear implant can make proficiency in more than one spoken language possible ….provided we do what it takes.

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Early Literacy Development – Janet Werker at UBC, Dev. Psy. 2009

- Infants acquire native languages by listening, and start life prepared to speak.
- At birth, infants prefer their mother's speech, and songs and stories heard before birth, and they can categorize content vs. function words.
- In the first 6 months, babies can discriminate many speech sounds, but by the end of the 1st year, there is a functional reorganization to language specific phonemes; infants become language specific listeners between 6 and 12 months of age.
- This reorganization improves and tunes the phonetic categories required for their language, and attenuates those distinctions not required.

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Early Literacy Development – Janet Werker at UBC, Dev. Psy. 2009

- Fetuses hear mostly the low frequency acoustic features of their mother's speech in utero – so the acoustic focus is on rhythmic elements.
- At birth, infants listen at multiple levels at the same time.
- They learn to distinguish rhythm, phonemes, and phonologic elements all at once.
- Therefore, speak in complete sentences/phrases with a great deal of melody.
- Infant speech perception acuity predicts their vocabulary.

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Early Literacy Development – Janet Werker at UBC, Dev. Psy. 2009

- Infants use their phonetic categories to bootstrap learning new words.
- Phonetic distinctions guide new word learning at approximately 17 months.
- Listening experience in infancy is critical for adequate language, communication, and literacy development.
- Phonetic categories > phonological processes > lexical-semantic use > reading and higher order language use.

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Intervention Models

- In today's context, we all must use a combination of models – balanced for each individual child.
- ***Ecological model*** – Typical social-linguistic models with high expectations.
- ***Instructional intensity*** --- practice, practice, practice.
- Families must be involved if sufficient instructional intensity is to be obtained.

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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 aspects of human social life such as surprises, secrets, tricks, mistakes and lies.
- As children age and gain more social and language skills, a ToM forms the basis for inference, perspective taking, social reasoning, and empathy.
- A ToM is critical for academic development, especially in collaborative educational environments.

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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 that 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 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 that 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 – 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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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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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!!

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 that 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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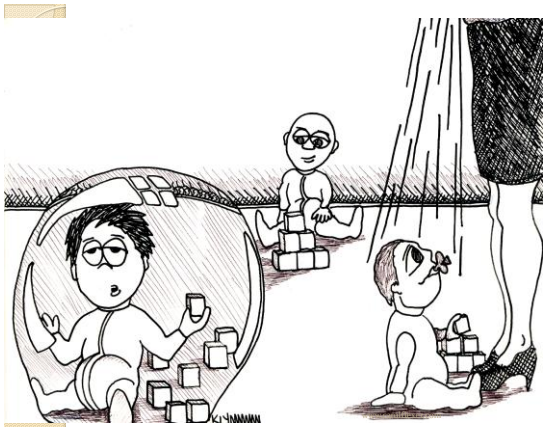

If our children with hearing loss depend mostly on active instruction, they will have an information, knowledge, and social deficit compared to children with typical hearing.
Do not confuse Language with Knowledge!

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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 4-6 feet.
- We must know a child's overhearing potential!

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Pay Attention! (Doidge, 2007) The Brain that Changes Itself

- "When we want to remember something we have heard, we must hear it clearly because memory can be only as clear as its original signal….muddy in, muddy out." p. 68
- Learning new information/tasks/skills requires active attention.
- "While we can learn with divided attention, divided attention does not lead to abiding changes in your brain maps". p. 68

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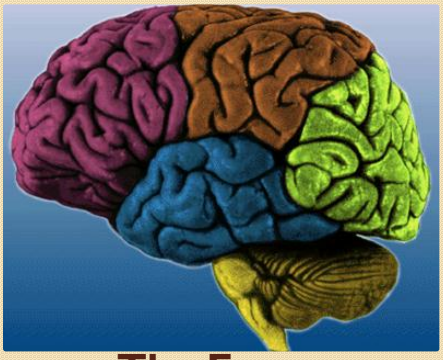
It's All About The Brain

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

Hearing aids, FM systems and cochlear implants are not about ears; they are about the brain!



The Ear

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Critical Keys to a Successful Spoken Language Outcome:

Access the Auditory Centers of the Brain as Early as Possible;

Then, Practice, Practice, Practice Listening and Talking

How Much Practice is Needed to Influence Neural Structure?

- Malcolm Gladwell: 10,000 hours of practice;
- Hart and Risley: 46 million words heard by age 4;
- Dehaene: 20,000 hours of listening as a basis for reading;
- Pittman: Children with hearing loss require three times the exposure to learn new words and concepts due to the reduced acoustic bandwidth caused by the hearing loss.

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Numbers of Spoken English and Sign Language (ASL) Words

- The Second Edition of the 20-volume *Oxford English Dictionary* contains full entries for **171,476 words** in current use.
- Random House Webster's Unabridged Sign Language Dictionary (2008) by Elaine Costello, Ph.D. identifies **5,600 up-to-date signs** with full torso illustrations.

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How To "Grow" Your Baby/Child's Brain for Listening, Speaking, Reading and Social Competence

Information to share with families of children with hearing problems of any type and degree, including ear infections and auditory processing difficulties

Work in Harmony with Our Organic Design

- Human beings are designed to listen and talk….if we do what it takes!

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For Parents: How To Grow Auditory Brain Centers

- Above all, **love, play, and have fun** with your child!
- Once your child receives a hearing aid or cochlear implant, make sure he/she **wears it every waking hour (at least 12 hours/day)**. Auditory brain centers need consistent access to clear, complete sound in order to develop.
- **Check** your child's technology regularly. Equipment malfunctions, often. Without auditory access, talk to the floor.
- Use the FM in all environments.

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How Can We Help Children to 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.
- **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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For Parents: How To Grow Auditory Brain Centers

- **Minimize background noise**. Turn off the T.V.
- **Sing** to your child! Fill their days with all kinds of music and songs.
- **Speak slowly, clearly** and in full sentences with lots of melody. Stay close!
- Focus your child on **listening**. Call attention to sounds around the room. Point to your ear. Use listening words such as "you heard that", and "you were listening".
- **Emphasize sound** before vision for *auditory enrichment.*

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For Parents: How To Grow Auditory Brain Centers

- **Read, Read, Read aloud** every day. Try for 10 books per day.
- Name **objects** in the environment as you encounter them in daily routines.
- Talk about and **describe** how things sound, look, and feel.
- **Compare** how objects or actions are similar and different in size, shape, smell, color, or texture.

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For Parents: How To Grow Auditory Brain Centers

- Talk about where objects are **located.** You will use many prepositions such as in, on, under, behind, beside, next to, between. Prepositions are the bridge between concrete and abstract thinking.
- **Describe sequences**. Talk about the steps involved in activities as you are doing the activity. Sequencing is necessary for organization.

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Brain, Brain, Brain!!!

The purpose of hearing aids, cochlear implants, personal-worn FM, classroom FM and IR systems, and auditory-based intervention is to access, grow and develop auditory brain centers using a cognitive/linguistic paradigm.