Language and Listening for Meaning: A Neurodevelopmental Approach

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Cochlear implants work so well for so many. Yet, sometimes, they don’t…

How to help children to bridge the gap between ability to access sound and making sense of what they hear?
How can professionals use science to inform practice?
Many approaches to promoting language and listening are successful.
How do we understand children for whom “traditional methods” have not worked?

- **IQ**: Cognitive ability – innate & enriched
- **EQ**: Emotional intelligence & motivation
- **X factors**: Caregiver involvement; SES; additional disabilities

Caregiver involvement; SES; additional disabilities
The Need for Discrete Auditory Skills

- Awareness of “needing to listen”
- Detecting presence or absence of sound
- Discrimination of similar-sounding phonemes
- Identification of specific frequencies (Ling sounds)
Is listening \( \rightarrow \) language analogous to crawling \( \rightarrow \) walking?

Challenging the “Listening Hierarchy”

Detection

Discrimination

Identification/Imitation

Comprehension

Estabrooks & Marlow (2000)
Looping Back Around

- Meaningful Exchange
- Communication
- Comprehension
- Language
- Listening
A Model for Aural Habilitation/Communication Therapy for Deaf and Hard of Hearing Infants and Toddlers

Communication

Listening

Comprehension

- Increase ability to express wants and needs
- Increase ability to comment on present events
- Turn-taking
- Increase ability to comment on events removed from the present

Sound exploration

Establish and expand response to sound

Communication

Pretend Play

Visual attention

Looking and pointing

Vocalization

- Increase variety of vowel and consonant sounds in vocal play

Babbling in sign language

Sign and spoken approximations of words

Combining words (spoken or signed)

Build a strong base of language and world knowledge

Begin to link sound and meaning

Aural Habilitation/Communication Therapy for Deaf and Hard of Hearing Infants and Toddlers

Listening

- Turn-taking

Comprehension

- Increase ability to comment on present events
Brain areas involved in Language

- Primary motor cortex
- Broca’s area
- Supramarginal gyrus
- Angular gyrus
- Primary auditory area
- Wernicke’s area
Schema of Meaning

Brains rapidly draw from a wide range of information to understand

– What was stated previously
– Who is the speaker
– Expectations about directions of conversation
– Without context, more difficult to “detect”

(Van Berkum, Current Dir Psych Science, 2009)
Early Life Experiences Shape Brain Architecture

<table>
<thead>
<tr>
<th>Neural Circuitry</th>
<th>Developmental Plasticity</th>
<th>Behavioral Manifestations</th>
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</thead>
<tbody>
<tr>
<td>• Exposure</td>
<td>• Sensitive periods</td>
<td>• Reflects brain → shaped by experience</td>
</tr>
<tr>
<td>• Experience</td>
<td>• Critical periods</td>
<td>• “Alternative pathways” &amp; multi-sensory integration</td>
</tr>
<tr>
<td>• Connections</td>
<td>• Entrenchment</td>
<td></td>
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<tr>
<td></td>
<td>• Enhancement &amp; inactivity</td>
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The Brain Expects Language

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<tr>
<th>Experience-expectant mechanisms</th>
<th>Experience-dependent mechanisms</th>
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<td>Features of the environment expected for humans:</td>
<td>Features of the environment unique to the individual:</td>
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<tr>
<td>- Adequate nutrition</td>
<td>- Access to food</td>
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<tr>
<td>- Access to a caregiver</td>
<td>- Quality of caregiver</td>
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<tr>
<td>- Sensory stimulation</td>
<td>- Variable sensory input</td>
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<tr>
<td>- Language input</td>
<td>- Quality &amp; quantity of access to language</td>
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Reduced Early Language Impacts Neuropsychological Functioning


Graphic from: brighthubeducation.com
Social Neuroscience: The Brain Requires Interaction

Attachment & caring relationship (oxytocin)  
Empathy (arousal, emotion understanding, motivation, top-down regulation)  
Prosocial behaviors (responses to stress)

Cacioppo & Decety, Ann NY Acad Sci (2011)
Functional Neuroanatomy: Auditory Perception to Comprehension

Bottom-Up & Top-Down

Bottom-up, input-driven processes proceeding from the auditory cortex to the anterior superior temporal cortex and from there to the prefrontal cortex, as well as top-down, controlled and predictive processes from the prefrontal cortex back to the temporal cortex are proposed to constitute the cortical language circuit.

(Friederici, *Trends in Cog Neuroscience*, 2012)
Interventions & Supports
Need to Address
How the Brain Works
Considerations for Professionals

Meaningful Communication

The “Languaging Brain”

Top-down & Bottom-up approaches

Critical & Sensitive Periods
Questions?

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References

- Van Berkum (2009). Current Directions in Psychological Science