Sensation & Perception

Guest Lecturer: Eswen Fava
Infant Music & Language Perception
October 30, 2008

What we’ll be covering today...

• Introduction to infant hearing
  • Overview of infant language perception
  • Introduction to infant music perception
• NIRS methodology in context
  • Example from masters data re: infant music perception
Hearing: Babies are good listeners

- Infants on higher side of freq thresholds (v. adults) - for noise
- Infants discrimination between tones adults
- Adults freq discrimination ~1%
- Why?

Hearing: Beginnings of Language Perception

- Mom’s voice v that of other women?
- Infant Directed Speech (IDS) AKA “Motherese”
**Babbling & Early Sounds**

- Babies actively produce sounds from birth
- Production of sound occurs in 4 stage process
- ~6 mos, cultural differences in pre-speech begin to emerge
- Exposure to speech necessary

![Time line showing stages of babbling and early sounds](image)

**Early Language Comprehension**

- **Categorical speech perception**
  - recognizing consonants
  - infants' discrimination ability (specialized abilities) rapidly improves

- +6 mos loose ability to discriminate non-native language

- Coarticulation (say “zip lip” and “back lip”)

- Different speakers
## Categorical Speech Perception

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td># bahs</td>
<td>60</td>
<td>10</td>
<td>70</td>
</tr>
<tr>
<td># gahs</td>
<td>10</td>
<td>60</td>
<td>0</td>
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<tr>
<td>Perceived change between bah &amp; gah?</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
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</table>

### Segmenting Fluent Speech

- ~6 mos
- Segment fluent speech into separate words
  - Stress patterns in words
  - Pitch
  - Pauses
  - Made up languages
Hearing: Music Perception

- infant preference: consonance / dissonance
- rhythm preferences?
- perception of melodies

Methods for Assessment:
Unlocking the secrets of babies’ sensory capabilities

<table>
<thead>
<tr>
<th>CNS:</th>
<th>Autonomic NS</th>
<th>Behavioral</th>
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<tbody>
<tr>
<td>neurological anatomy</td>
<td>Heart rate</td>
<td>Kicking</td>
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<tr>
<td>single-cell &amp; intercellular</td>
<td>Respiration</td>
<td>Head turning</td>
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<td>physiology</td>
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<td>aggregated cortical electrical</td>
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<td>Sucking patterns</td>
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<td>central function</td>
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<td>Looking (Violation</td>
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<td>of Expectation, Visual</td>
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<td>Preference)</td>
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<td>Habituation Recovery</td>
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Habituation Recovery: a process of learning where individual reacts with less & less intensity to a repeatedly presented stimulus.
CNS (Pros & Cons)

• Neurological anatomy
  • presumption?
  • problem?

• Single-Cell & Intercellular Physiology
  • “trigger feature” (e.g. place cells in vision)
  • limitations (3)?

CNS (Pros & Cons)
Optical Imaging: NIRS (Near-Infrared Spectroscopy)

• presumption?
• measure?
• why useful?
Master’s Experiment Introduction

• Classical music, like speech, uses pitch as a salient feature of its structure

• Infants may process music and language in a similar way because they possess many of similar qualities such as pitch, timbre, rhythm, tempo, and stress

• EEG and ERP research has generally demonstrated right temporal signals when adults (both expert and novice) and children are exposed to music

  • (in comparison with left lateralized signals when both populations are exposed to speech)

Master’s Experiment Methods

• Infants 5-10 months in age (N=17)

• Infants wore a NIRS headband with bilateral probes on the T3 and T4 temporal areas from the 10-20 System

  • 10s baseline
  • 20s music trial
  • 20s speech trial
Master's Experiment: Results (Hemodynamic Functions)

Speech Trials

Left Temporal

Right Temporal

Music Trials

Left Temporal

Right Temporal

Master's Experiment #2: Results (Hemodynamic Functions)

Music Trials

Left Temporal

Right Temporal

Music Trials

Left Temporal

Right Temporal
The End... thanks for coming!

“bye!”