Assessing Audiovisual Speech Perception in Adults with Hearing Loss: Effects of SNR

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DISCLOSURE: Test materials described in this presentation are licensed to G.N. Otometrics through The University of Iowa

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Introduction

Listeners must extract linguistic message from highly variable acoustic speech signal

Variability introduced by:

- Talker characteristics - gender, age, dialect and speech rate
- Environment – noise, reverberation

Speech perception in noise is difficult for CI users

- Particularly challenging for CI users
- Addition of visual cues provides substantial gain in speech recognition

Few centers routinely test in both A and AV conditions
Multimodal Lexical Sentence Test (MLST-A™)

30 lists of 12 sentences
- 10 talkers
- 3 key words per sentence
- Key words in each sentence drawn from the same lexical category

Strong Psychometric principles
- Lists are reliable and equivalent within each format: V, A, AV
Purposes

To examine speech recognition performance in adults CI users as a function of:

- Presentation Format
  - Signal-to-Noise Ratio
  - Group
    - CI only
    - CI + HA

To evaluate AV enhancement as a function of SNR
## Participants

<table>
<thead>
<tr>
<th></th>
<th>CI Users (n=10)</th>
<th>CI+HA Users (n=9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Age at Test</td>
<td>50.2 years old</td>
<td>45.8 years old</td>
</tr>
<tr>
<td>CI Configuration</td>
<td>Unilateral – 4</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Bilateral - 6</td>
<td></td>
</tr>
<tr>
<td>Mean Length of Use of Sensory Device</td>
<td>8.44 years</td>
<td>4.55 years</td>
</tr>
<tr>
<td>Gender</td>
<td>Males - 4</td>
<td>Males - 4</td>
</tr>
<tr>
<td></td>
<td>Females - 6</td>
<td>Females – 5</td>
</tr>
</tbody>
</table>
Procedures

Speech administered at 60 dBA SPL

Each participant tested in A and AV formats
- Quiet
- SNRs: -5, 0, +5, +10
- 2 lists per condition (2 formats X 4 SNRS = 8 lists)

Verbal responses scored as % key words correct

Logistic regression computed to estimate Speech Recognition Threshold
Results: Presentation Format

Presentation Format

Percent Correct

Format

A

AV
Results: Signal-to-Noise Ratio (SNR)
Results: Group by SNR by Format

CI Group

CI + HA Group

Percent Correct

SNR

-5 0 5 10 Q

Percent Correct

SNR

-5 0 5 10 Q

A only  A + V

A only  A + V
Results: SRT Performance Intensity Graphs

<table>
<thead>
<tr>
<th></th>
<th>CI</th>
<th>CI + HA</th>
</tr>
</thead>
<tbody>
<tr>
<td>A only</td>
<td>7.8 dB</td>
<td>12.0 dB</td>
</tr>
<tr>
<td>A + V</td>
<td>1.0 dB</td>
<td>.7 dB</td>
</tr>
</tbody>
</table>
Audiovisual Gain

\[ R_{a} = \frac{(AV-A)}{(100-A)} \]

Relative gain in accuracy in AV condition relative to A only

Used by Lachs et al. (2001) to examine AV speech perception in children with CIs
Ra by SNR

Ra by Signal-to-Noise Ratio (SNR)
Conclusions

The MLST-A™
- Incorporates “real-world” stimulus variability
  - Multiple talkers
  - Different presentation formats

The addition of visual cues enhances spoken word recognition
- AV enhancement varies by SNR
  - Enhancement was greatest when CI users under more favorable SNRs

AV testing may better predict communication skills in difficult listening environments