INTRODUCTION

This study was developed to test whether the selection of independent channels in each ear and synchronization of time-clocks across ears contribute to the perception of moving versus stationary sounds. For this purpose, we developed a Binaural ACE processing strategy.

RESULTS I: How did Binaural ACE impact auditory motion discrimination?

- Standard ACE: the N highest peaks in each time frame are chosen for stimulation. Each ear picks peaks independently from the other.
- Binaural ACE (bACE): all 2N peaks from both ears are pooled and highest peaks are selected from this pool. Once peaks are picked, the same electrodes are stimulated on both sides.

Auditory motion sensitivity and bias:

- Auditory motion sensitivity (d’) and bias (c) calculated using proportion of stationary stimuli correctly identified and proportion of moving stimuli incorrectly identified.
- Average sensitivity increased with ACE and bACE as compared to Clinical, with a further marginal increase with bACE when compared to ACE.
- Overall, sensitivity was larger than previously reported for CI listeners, with mean d’ scores near 1 instead of 0.2.
- With ACE and bACE, listeners were more biased to report moving sounds as stationary than with the clinical processors.
- One-way ANOVA determined no statistical difference between signal processing conditions.

RESULTS II: How did Binaural ACE impact localization accuracy?

- Root mean square (RMS) error was calculated for trials that were correctly identified as stationary.
- On average, there was no improvement in RMS error across signal processing conditions for stationary stimuli.
- Average RMS error was 24.4° for the clinical processors, lower than previously reported.
- One-way ANOVA determined there was no statistical difference between conditions.

SUMMARY

- Effect of signal processing on motion perception:
  - Binaural ACE gives similar auditory motion discrimination performance as clinical processors, and may give some listeners a slight improvement.
  - Listeners responded with smaller trajectories for the 20° stimuli than the 40° stimuli.
  - One listener (ICM) never reported hearing a sound moving more than 10°.
- One-way ANOVA determined there was no statistical difference between conditions.

METHODS

- Five bilateral Cochlear listeners were presented both moving and stationary sounds via a loudspeaker array (37 speakers spanning 180° at 5° intervals) attached to a 1.4 m radius matrix.
- Participants responded using a laser pointer; OptiTrack motion-capture system recorded responses. Listeners indicated a stationary sound by pressing a button on the laser pointer once and indicated a moving sound by tracing the perceived trajectory of the sound.
- 1000 ms white-noise tokens moved at angular ranges either 0°, 20°, or 40° per second, with a balanced number of stationary and moving trials, presented in a pseudo-random block design across three signal processing conditions (see Table 1).
- Delivered with Tucker Davis Technologies RP2 units.
- Equipment: CCI-Mobile Research Platform
  - The CCI-Mobile is a portable research platform developed at UT-Dallas. One central processor controls both implants, effectively synchronizing the delivery of stimulation across ears.
  - bACE is only possible with a device like the CCI-Mobile, as the design and testing of real-time binaural signal processing strategies is not possible with current research processors that directly stimulate the electrode array.

Signal Processing Conditions

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Device(s)</th>
<th>Time Synchronized?</th>
<th>Binaurally Coordinated?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical (Clin.)</td>
<td>Cochlear NS</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>ACE</td>
<td>CCi-Mobile</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>bACE</td>
<td>CCi-Mobile</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 1: Processing strategies compared in this study.

REFERENCES


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