Bilateral Speech Perception is Disrupted When One or Two Ears Provide Degraded Speech

Introduction

- Many patients with bilateral cochlear implants (BiCIs) have asymmetric hearing outcomes (1-3).
- Asymmetric hearing outcomes are associated with:
  - Poorer sensitivity to binaural cues (4-5)
  - Poorer sound source localization (6-7)
  - Attentional shifts versus primary focus (8-9)
  - Worse speech understanding (10).
- Thus, asymmetric hearing outcomes provide less sensitivity to segregation cues and poorer overall outcomes (11).
- Proper speech outcomes could be due to failure to allocate attention to the more intelligible ear, maladaptive integration of loudness of sound, or both.

Goal: Investigate the speech perception of words presented across the ears where one ear provides a degraded signal in each condition.

Methods

- Two groups of listeners participated:
  - One normal-hearing (NH) group
  - One bilateral cochlear implant (BiCI) group
- Sixteen channel vocoding (14) was completed with low-noise carrier signal (i.e., interaural asymmetry), or both ears provide degraded signals.
- The task indexed the one above. Listeners chose one- or two-word responses.
- Responses were recorded on a graphical user interface identical to Waisman Center.

Results

- Hypothesis: If one or both ears provide degraded speech understanding, then speech perception will result in: (1) poorer accuracy, and (2) maladaptive integration.
- One listener showed asymmetric speech understanding (Fig. 4A).
- Listeners with symmetric speech understanding were most likely to exhibit bias toward their right ear (Fig. 4B). This was the first-implanted ear for all listeners except IBY.
- Listeners with asymmetric speech understanding showed substantially more frequent interference (Fig. 5A).
- Thus, asymmetric hearing outcomes yield poorer sensitivity to binaural cues (4-5), poorer overall outcomes could be due to failure to allocate attention to the more intelligible ear, maladaptive integration of loudness of sound, or both.

References