Bilateral maps can improve bilateral cochlear implant patients’ spectral resolution

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Disclosures

• None
Limitations of current clinical fitting

• Many cochlear implant (CI) users perform well in quiet environments but struggle in noisy ones

• Bilateral CIs improve speech understanding in noise compared to unilateral CIs but users are still struggling

• Bilateral CI patients typically are programmed with two unilateral maps
Bilaterally paired electrodes

- Clinically, electrodes in the left and right ear are typically paired based on electrode number.
Bilaterally paired electrodes

- But clinically paired electrodes ≠ perceptually paired
  -> perceptual misalignment
The effect of perceptual misalignment

- Perceptual misalignment can lead to
  - Poor lateralization (Kan et al. 2013)
  - Poor interaural time difference perception (e.g., Poon et al., 2009; Long et al., 2003)
  - Poor interaural level difference perception (Francart & Wouters, 2007)
  - Poor binaural fusion (Aronoff et al. 2015; Kan et al., 2013)
Creating matched maps

- In order to create perceptually aligned maps we use a pitch matching task to determine how the two ears should be aligned.
Creating bilateral maps

- Seven bilateral CI users were tested with electrodes paired
  - based on electrode number only
  - based on 30 pitch matches
Task

- Participants completed a spectral resolution test (Spectral-temporally Modulated Ripple Test; SMRT; Aronoff & Landsberger, 2013)

Spectral Resolution

**Task:** Determine which of the three sounds is different

Density of the ripples is adaptively changed
• All participants had better spectral resolution with the pitch-matched maps.
Clinical pitch matching method

• Creating pitch matched maps can improve performance

• How do we implement this clinically?

• Can we acquire sufficient pitch matching data in a clinically feasible amount of time?
Clinical pitch matching method

• Retrospective analysis of pitch matching data from ten subjects

• Minimal change in pitch matching results beyond ten samples

• Requires approximately six minutes of testing

• Will using the abbreviated pitch matching protocol still yield an improvement in spectral resolution?
Creating bilateral maps

- Five bilateral CI users were tested with electrodes paired based on electrode number or based on pitch matching

- Similar process was used to create pitch-matched maps but based on only ten pitch matches
Clinical pitch matching method

- Using the clinical version of pitch matching task also yields an improvement.

![Graph showing difference in ripples per octave between pitch-matched and numerically-matched methods.](image-url)
Conclusions

• Bilateral maps can improve spectral resolution

• Improvements are seen even when using a rapid process for creating the maps
Thank You!

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