Benefits of Digital Noise Reduction to Children with Hearing Loss

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Which hearing aid to use?

Hearing Aid 1

Hearing Aid 2

Hearing Aid 3

Hearing Aid 4
Stimuli

• Presented in the sound field
  – 0 degrees azimuth
  – 50 dB SPL
  – Broadband noise at 0 dB SNR

• Noise Reduction On
  – Average level -4 dB
  – Average SNR +2 dB
Participant Characteristics

- 8-12 year-old children
  - 50 children with normal hearing
  - 30 children with hearing loss
    - Mild to moderately-severe
    - Degree of loss appropriate for amplification
1. Managing Complex Environments

Is a hearing-impaired child’s ability to manage complex listening environments improved with digital noise reduction?
Auditory Task

• Word Categorization
  – Words common to children
  – Children indicated the category to which each word belonged
Visual Task

- Dot-to-dot games
  - Dots numbered in increments of 3
- Performance was scored in dots/min

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Procedure

• Multitasking Conditions
  – Auditory only
  – Auditory + visual
  – Auditory + visual + noise
  – Auditory + visual + noise + DNR
Results - Auditory Task
Conclusion

• Children with hearing loss are at a significant disadvantage in complex listening environments
  – Performance decreased with the addition of each competitor

• Digital noise reduction allowed the children to maintain their performance in noise
Is a hearing-impaired child’s ability to learn new words improved with digital noise reduction?
Data Reduction

![Graph showing performance (%) versus bins]
Data Reduction

\[ P_c = 1 - 0.8e^{-n/c} \]
Results
Normal-Hearing Children

8-9 YEAR OLDS

11-12 YEAR OLDS

PERFORMANCE (%)

TRIAL

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Results
Hearing-Impaired Children

8-9 YEAR OLDS

11-12 YEAR OLDS

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Conclusion

• Word learning by children with hearing loss is significantly delayed in noise.

• Digital noise reduction:
  – allowed the younger children to maintain their learning rate in noise.
  – allowed the older children to improve their learning rate in noise.
Summary

• Noise significantly degrades the auditory performance of children during cognitively demanding tasks

• Digital noise reduction is one feature that has the potential to help children maintain or improve their performance