Background Noise Impacts on Speech Perception for Children with Autism Spectrum Disorder

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Research Purpose

How does background noise impact speech perception for typically-developing children versus children with Autism Spectrum Disorder?

It is generally known that children have a more difficult time understanding speech in background noise than do adults (development of average adult performance occurs around the age of ten; i.e. Elliott & Katz, 1980, Elliott et al., 1981, Johnson, 2000). Studies have also shown that adolescents and adults with Autism Spectrum Disorder (ASD) understand speech in quiet as well as a typically-developing (TD) adolescents and adults in noise (Russo et al., 2009, Alcantara et al., 2004). However, there is very little understood in the following areas:

- How children with ASD compare with TD children in their ability to discern speech in the presence of background noise and,
- If older children with ASD develop speech perception skills at a later time than their TD peers— if at all.

This study aims to grasp a better understanding of the development of speech-in-noise task performance in children with and without ASD, to give insight into why these differences occur.

Sample

Experimental Group:
- Children (6-12 years old)
- 20 typically-developing children (Current: n=11)
- 20 children with Autism Spectrum Disorder (Current: n=0)
- Normal hearing (20 dB at 1000, 2000, 4000 Hz)
- Native English speaker (learned English before the age of two)

Control Group:
- 20 Adults (18+ years old) Current: n=16
- Normal hearing (25 dB at 1000, 2000, 4000 Hz)
- Native English speaker

The experimental study takes place over two scheduled clinic visits after a brief phone screener to ensure that the participants qualify (refer to sample).

First Clinic Visit:
- Pure-tone Hearing Screening: must pass at 20 dB at 1000, 2000, 4000 Hz (ASHA, 1997)
- Receptive Language Screening: Token Test for Children-Second Edition (McGee et al., 1997)

The control group is subject to the hearing screening and the components of the second clinic visit.

Methods

Stimuli delivered via loud speaker at 65 dB SPL, and modulated speech shaped noise (0 dB SNR), speech shaped noise (0 dB SNR), and modulated speech shaped noise (0 dB SNR)

Backgrounds:
- Four-talker babble (5 dB SNR; two male and two female talkers), time-reversed four-talker babble (5 dB SNR), speech shaped noise (0 dB SNR), and modulated speech shaped noise (0 dB SNR)
- 30 words in each noise, 24 words in quiet
- Stimuli delivered via loud speaker at 65 dBA

First Clinic Visit:
- Participants are given a pure-tone hearing screening.
- Participants are required to pass at 20 dB at 1000, 2000, 4000 Hz.
- Participants are then given a receptive language screening test.
- Participants are given a cognitive evaluation test.

Second Clinic Visit:
- Participants are given a speech perception test in each background condition (n=11).

Results

The control group is subject to the hearing screening and the components of the second clinic visit.

Discussion

- TD children are performing at a lower level on speech-in-noise tasks than adults, as is expected.
- TD children are not following the average adult pattern of increasing performance (based on percent correct) from SSN, modulated SSN, babble and time-reversal babble.
- There is a consistent positive correlation between age and speech-in-noise task performance.
- Unknown yet whether children with ASD will display same performance and pattern of performance than children without ASD.
- Unknown whether children with ASD will show the same improvement in performance with increasing age.
- Children’s reduced ability to understand speech in noise has important implications for educational outcome such as reading.

Future Directions

- This study aims to include 60 participants total to fully describe patterns of performance (20 TD, 20 ASD; 20 adults).
- This study also seek to understand reading comprehension in a noisy classroom setting (four-talker babble).
- Long term goal is to ultimately implement effective clinical and educational interventions.

Recruitment is ongoing!

References

Haskins HL. (1949). A phonetically balanced test of speech discrimination for native and non-native English speaker. (Current: n=0)

Weschler Intelligence Test for Children (Fifth ed.). Bloomington, MN: Pearson.


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