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.

Methods

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)

Second Clinic Visit:
- 144 words in noise (Phonetically Balanced Word List-Kindergarten, PBK; Haskins, 1949)
- 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

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

Results

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

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-reverse 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!

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