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 Lists-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 ioud speaker at 65 dBA

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

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-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!

References


Figure 1. Typically developing children group PBK word recognition percent correct in each background condition (n=11). Backgrounds: Four-talker babble (5 dB SNR), time-reversed four-talker babble (5 dB SNR), speech shaped noise (0 dB SNR), and modulated speech shaped noise (0 dB SNR).

Figure 2. Adult group mean PBK word recognition percent correct in each background condition (n=16). Backgrounds: Four-talker babble (5 dB SNR), speech shaped noise (0 dB SNR), and modulated speech shaped noise (0 dB SNR).

Figure 3. Typically developing children group PBK word recognition percent correct in each background condition (n=11). (From left to right: Speech shaped noise (0 dB SNR), Modulated speech shaped noise (0 dB SNR), from left to right: Speech shaped noise (0 dB SNR), Modulated speech shaped noise (0 dB SNR), from left to right: Speech shaped noise (0 dB SNR), Modulated speech shaped noise (0 dB SNR).)

Figure 4. Typically developing children group PBK word recognition percent correct in each background condition (n=11). (From left to right: Speech shaped noise (0 dB SNR), Modulated speech shaped noise (0 dB SNR), from left to right: Speech shaped noise (0 dB SNR), Modulated speech shaped noise (0 dB SNR), from left to right: Speech shaped noise (0 dB SNR), Modulated speech shaped noise (0 dB SNR).)

Figure 5. Typically developing children group PBK word recognition percent correct in each background condition (n=11). (From left to right: Speech shaped noise (0 dB SNR), Modulated speech shaped noise (0 dB SNR), from left to right: Speech shaped noise (0 dB SNR), Modulated speech shaped noise (0 dB SNR), from left to right: Speech shaped noise (0 dB SNR), Modulated speech shaped noise (0 dB SNR).)