

# 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

## 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)
- Cognitive Evaluation: Weschler Intelligence Test for Children-Fifth Edition (WISC-V; Weschler, 2014)

### 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 loud speaker at 65 dBA

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

## Results

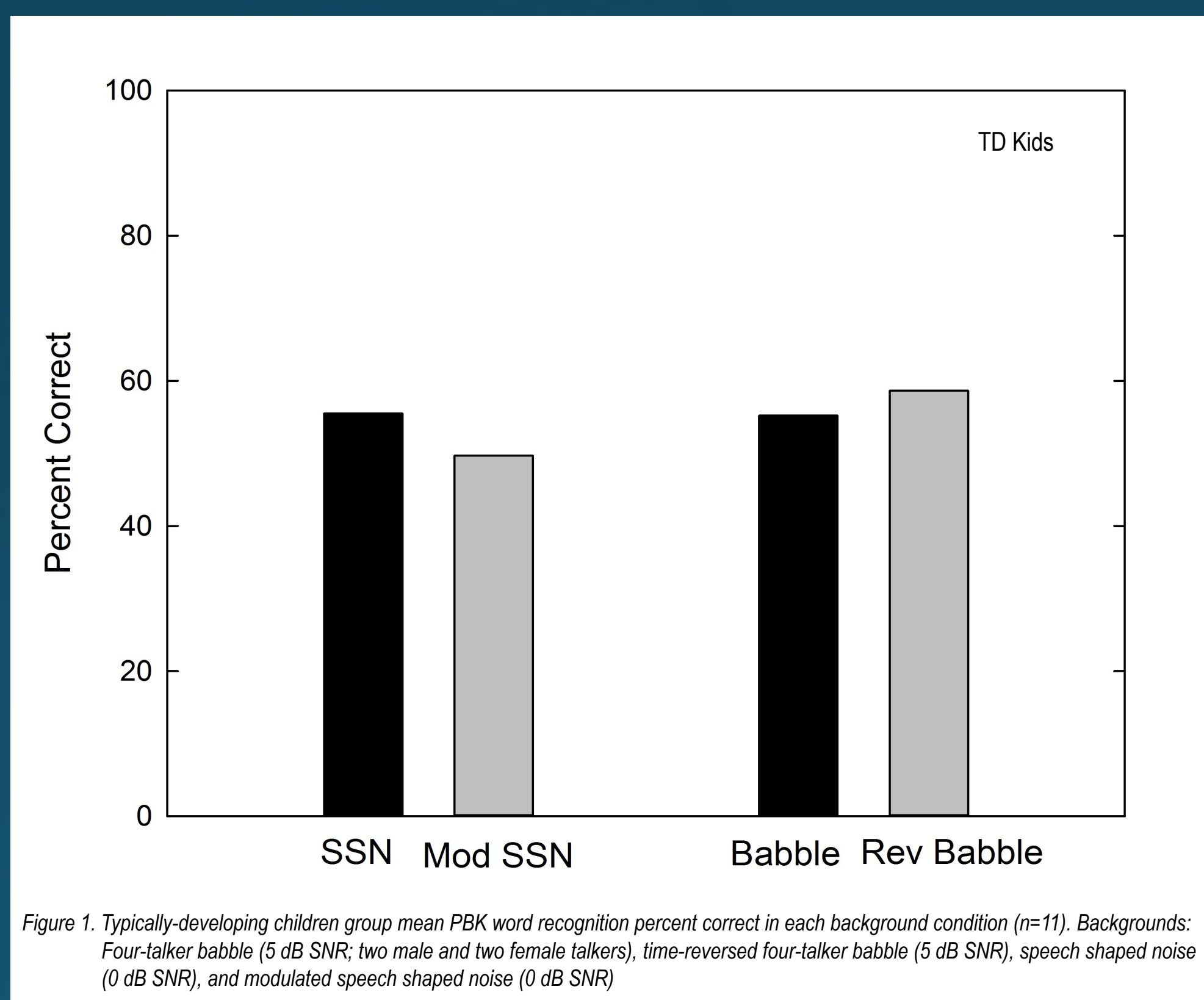


Figure 1. Typically-developing children group mean PBK word recognition percent correct in each background condition (n=11). Backgrounds: Four-talker babble (5 dB SNR, two male and two female talkers), time-reversed four-talker babble (5 dB SNR), speech shaped noise (0 dB SNR), and modulated speech shaped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

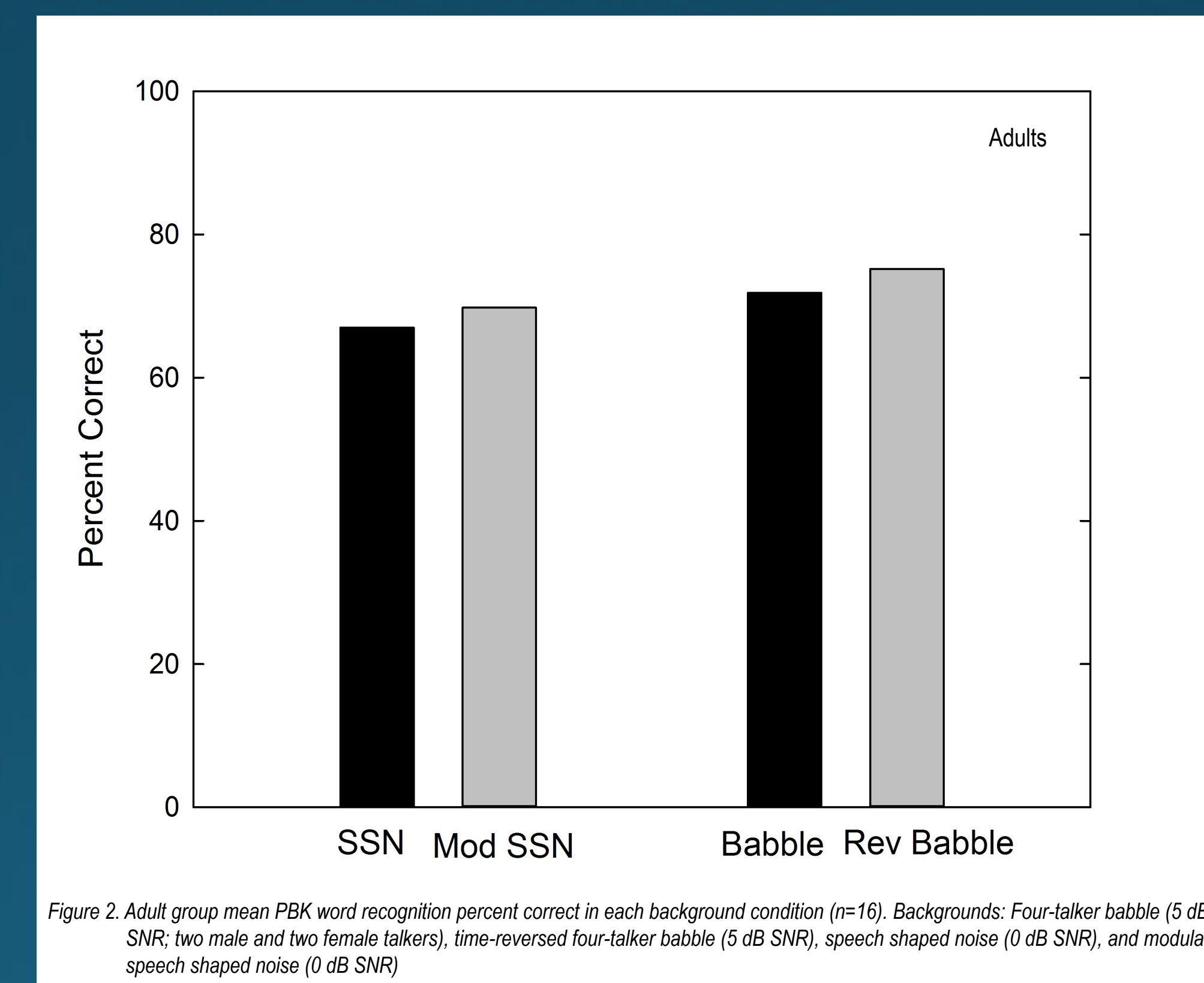


Figure 2. Adult group mean PBK word recognition percent correct in each background condition (n=16). Backgrounds: Four-talker babble (5 dB SNR, two male and two female talkers), time-reversed four-talker babble (5 dB SNR), speech shaped noise (0 dB SNR), and modulated speech shaped noise (0 dB SNR)

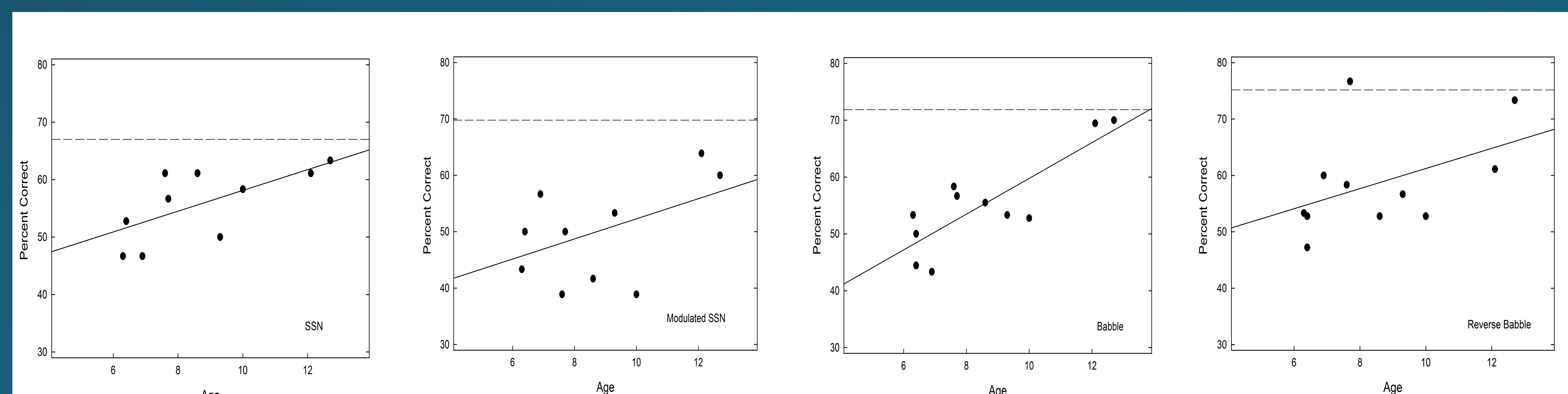


Figure 3. Typically-developing children group PBK word recognition percent correct for each listener correlated with age in each background condition (n=11). (From left to right: Speech shaped noise (0 dB SNR), Modulated speech shaped noise (0 dB SNR), four-talker babble (5 dB SNR), time-reversed four-talker babble (5 dB SNR)) Adult group mean of PBK word recognition percent correct in each background condition included for reference (n=16).

## 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

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