

Effects of Audibility and Linguistic Complexity on Children's Story Comprehension

INTRODUCTION

- Listening comprehension, or the ability to understand and retain spoken information, is critical for children's classroom learning and academic success
- As children get older, they need to be able to comprehend speech that includes unfamiliar words and complex syntax
- Children with mild hearing loss (HL) are at risk for delays in spoken language development, including listening comprehension (Lewis, et al., 2015). However, it is unclear if mild HL differentially affects children's understanding of spoken language that is lexically/syntactically "easy" versus "hard"
- We hypothesized that the reduced audibility caused by a simulated HL would reduce comprehension more for linguistically hard stories than easy stories, due to the increased cognitive demands of recognizing more challenging language input

RESEARCH QUESTION

To what extent does...
1) simulated mild HL, and
2) linguistic complexity
affect story comprehension in school-age children?

METHOD

Participants:

- 12 children with normal hearing, ages 9-11 ($M = 10.2$ years)
- Data collection is ongoing; target $N = 24$

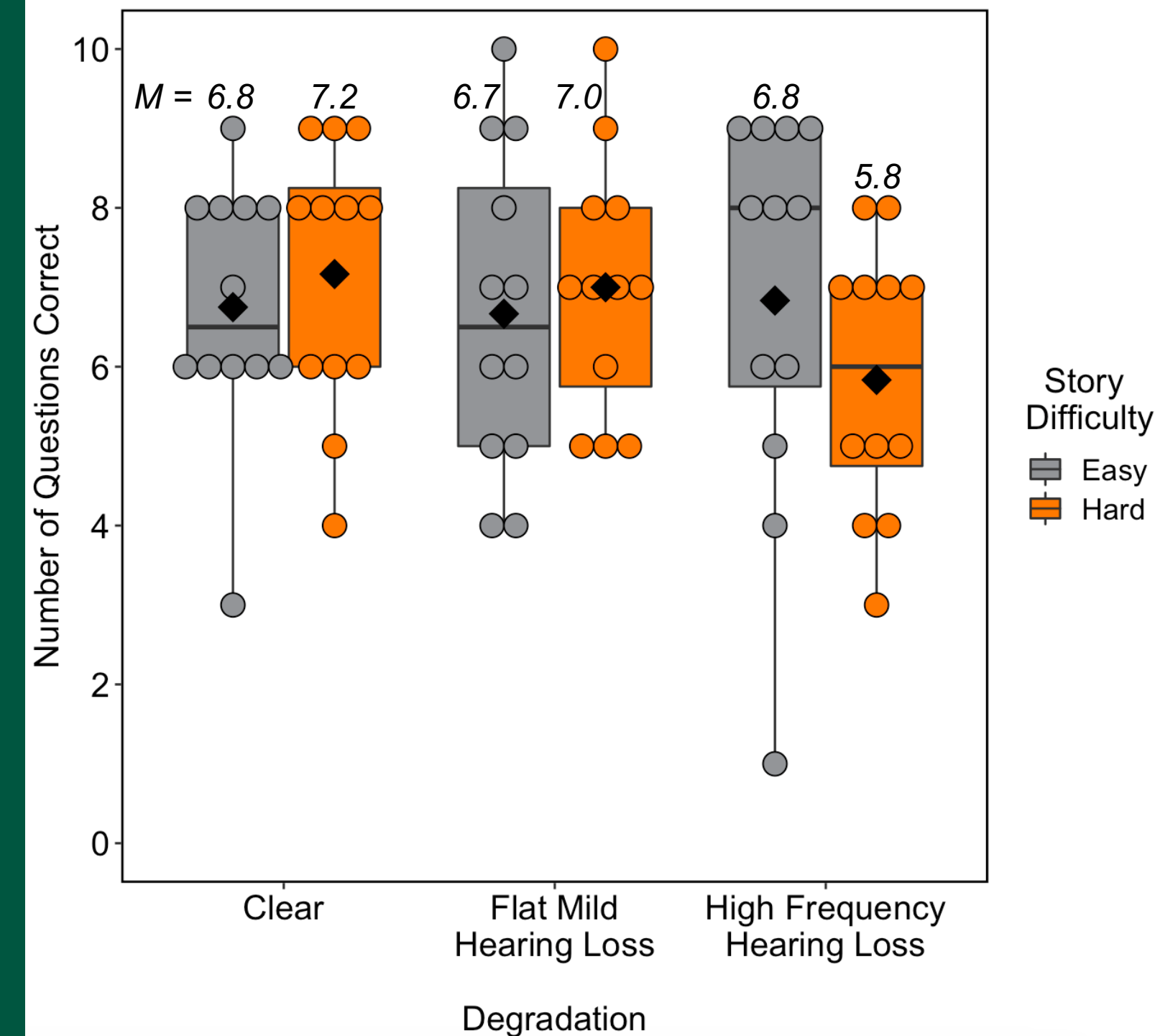
Stimuli:

- 6 stories varying in linguistic difficulty and degradation
 - 3 linguistically **easy stories** (3rd grade level), 3 linguistically **hard stories** (6th grade level)
 - Each story presented either...
 - in **clear** at 65 dB SPL (no HL simulation),
 - with simulated **flat** 35-dB HL, or
 - with simulated **high-frequency** HL
- Each story accompanied by 10 questions about story content
 - Pilot testing with 10 children ages 12-13 confirmed each set of 10 open-ended questions to be equally difficult
- All stories and questions recorded by same female talker
- All stories were similar in length (1453-1489 words, 7.5-8 min)

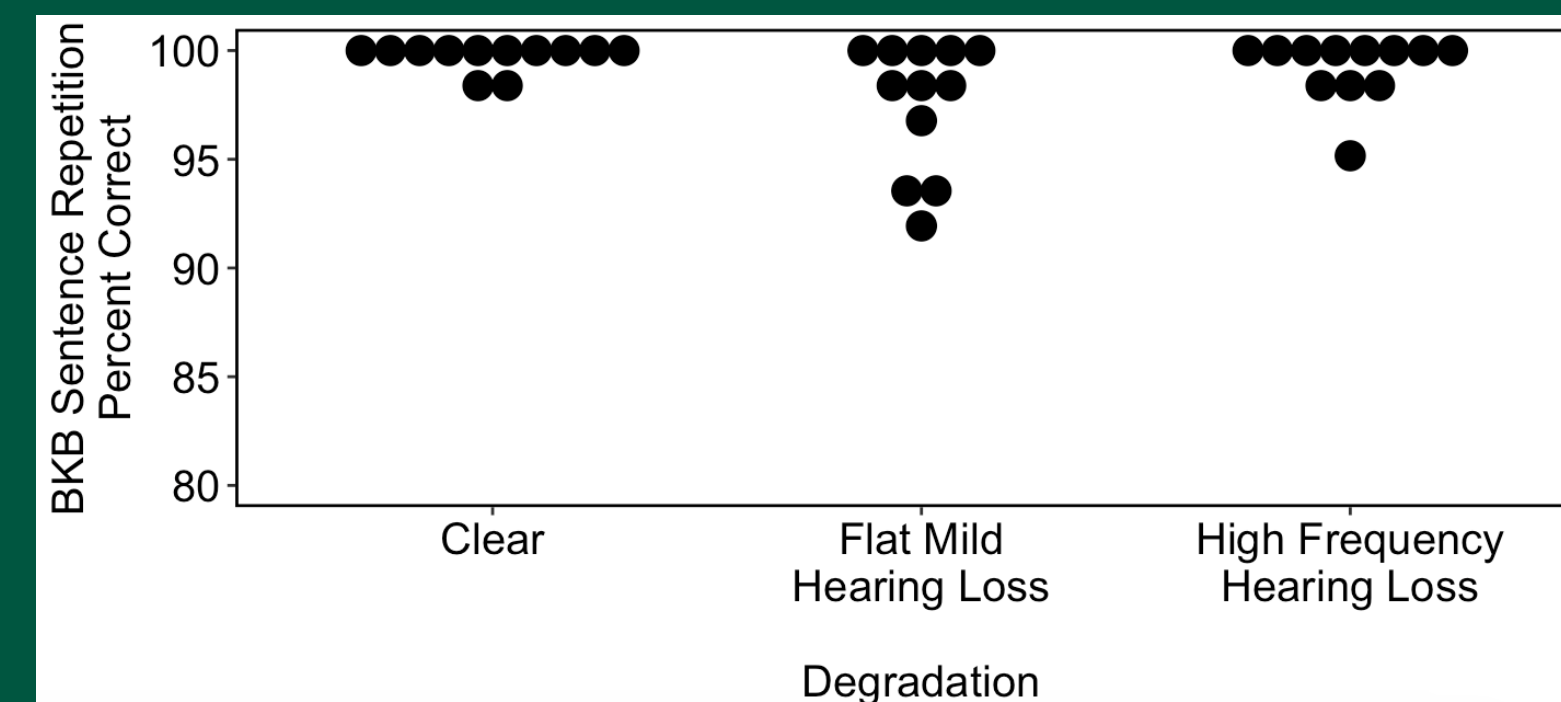
Protocol:

- Each participant listened to all 6 stories and answered questions about story content immediately following each
- Participants repeated back 20 BKB sentences in each of the 3 story conditions (clear, flat mild HL, high frequency HL)

RESULTS



Comprehension scores were lower for hard compared to easy stories only in the simulated high frequency HL condition. The interaction between story difficulty and degradation was not significant ($p = .24$); however, the study is currently under-powered because data collection is ongoing (target $N = 24$).



Sentence repetition was at ceiling level in all listening conditions ($M = 100\%$, 98% , and 99% in clear, flat, and high frequency conditions).

CONCLUSIONS

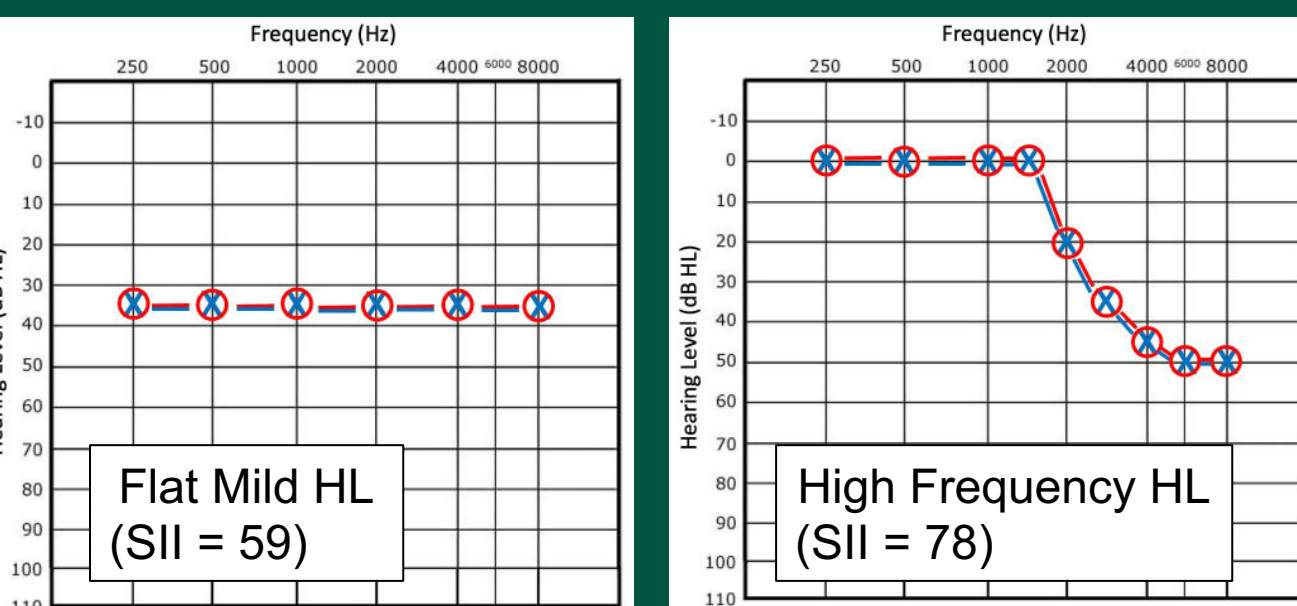
- Simulated high frequency HL appears to reduce children's story comprehension relative to listening in clear or with a simulated flat mild HL, but only when the stories contained challenging vocabulary and syntax.
- Listening to a degraded signal increases children's cognitive effort (McGarrigle et al., 2019). This increased effort may specifically impede children's processing of linguistically complex speech.
- In classroom settings, signal degradation (due to HL, background noise, etc.) may reduce children's understanding of complex speech, even when understanding of simpler speech is unaffected.
- After data collection is finished, future analyses will examine 1) retention of story content 1 week after listening to the stories, and 2) how vocabulary and working memory are associated with individual differences in story comprehension.

REFERENCES

- Lewis, et al. (2015). Effect of minimal/mild hearing loss on children's speech understanding in a simulated classroom. *Ear & Hearing*, 36, 136-144.
- McGarrigle, et al. (2019). Behavioral measures of listening effort in school-age children: Examining the effects of signal-to-noise ratio, hearing loss, and amplification. *Ear & Hearing*, 40(2), 381-392.
- Nejime & Moore (1997). Simulation of the effect of threshold elevation and loudness recruitment combined with reduced frequency selectivity on the intelligibility of speech in noise. *JASA*, 102(1), 603-615.

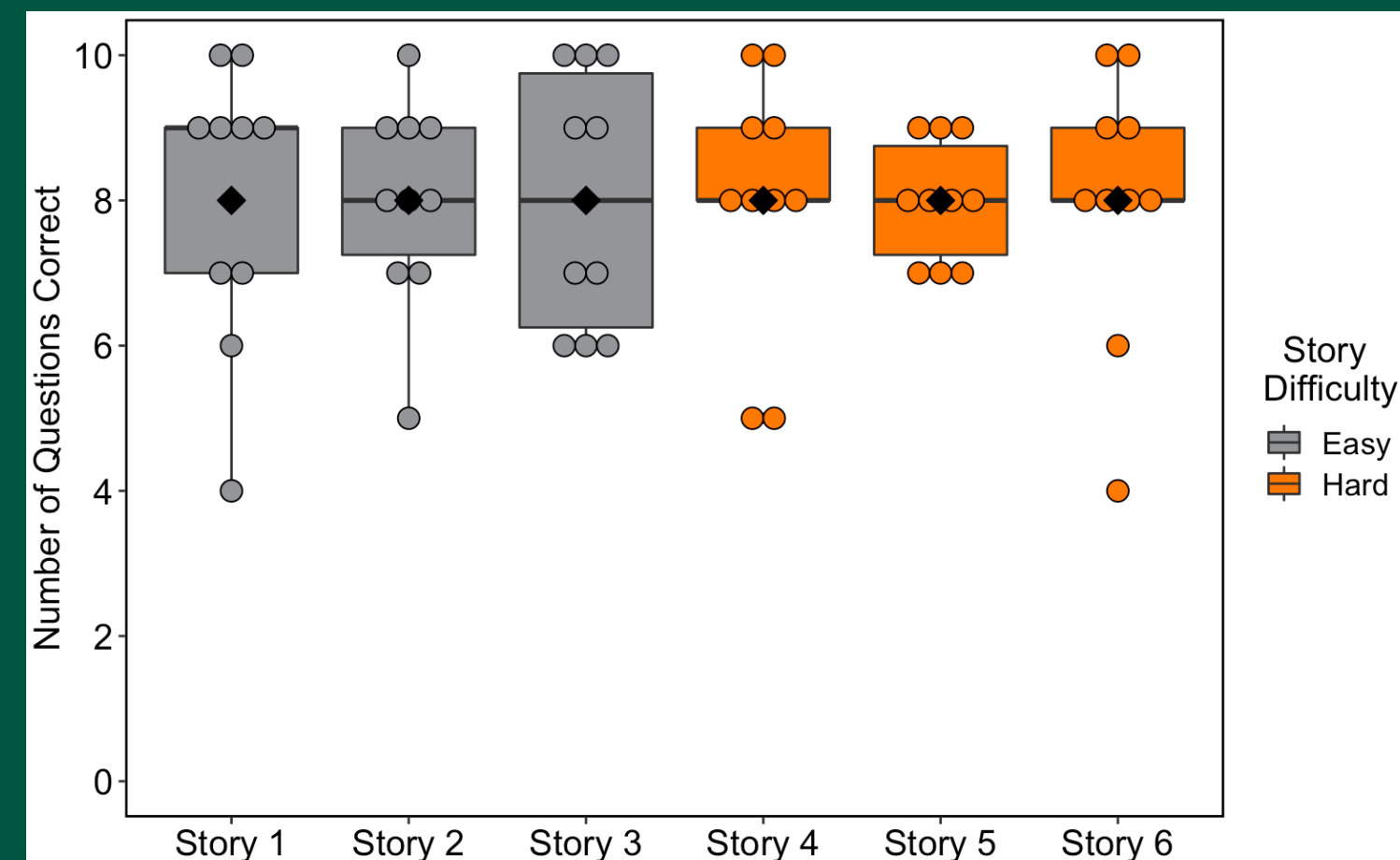
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Thresholds for the two simulated hearing losses. Simulator from Nejime & Moore (1997).

PILOT RESULTS



Pilot testing indicated that when presented in clear, question sets for all stories were equally difficult (mean percent correct = 80%)