

Speech Perception in Noise for Bilingual Children

Introduction

The Hispanic population is one of the fastest growing populations across the United States. According to the U.S. Census Bureau (2013), 4.4 million students who were in public schools in the United States were second language learners and of those, 71% used Spanish as their first language. Due to this continuously growing population, it is extremely important for audiologists to have a way to test this population and accurately determine their speech perception abilities.

Being able to communicate in the presence of noise is a challenging task for individuals with normal hearing, and especially those with hearing loss. Speech in noise ability can be measured using SNR-50 and SNR Loss. SNR 50 is the signal-to-noise ratio (SNR) where 50% of speech is repeated correctly. SNR Loss is the increase in SNR that is required by a listener to obtain 50% of speech information correctly compared to a person with normal hearing.

Research has shown that bilingual adult listeners with normal hearing perform more poorly in their second language when the signal is degraded or presented in noise, yet they typically perform as well as Native English listeners under quiet conditions (Mendel & Widner, 2016). Crandall and Smaldino (1996) also found that children who used English as a second language showed poorer speech perception scores across most SNRs, suggesting as the SNRs became less favorable, the differences between the groups increased.

Purpose

The purpose of this study was to determine the speech perception in noise performance of children who are bilingual native Spanish listeners for whom English is their second language compared to monolingual English listeners. Speech-in-noise tests in English were used to determine if bilingual children had more difficulty than monolingual children. The findings from this study are particularly important for children in classroom environments because incidental learning is crucial to their educational development

Research Questions

1. For bilingual children whose first language is Spanish, what is their speech perception in noise compared to monolingual English speaking children?
2. How does speech perception performance with bilingual children compare to that of bilingual adults?

Acknowledgment

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Sarah Frankel, Helen Lee Gresham, & Lisa Lucks Mendel
The University of Memphis School of Communication Sciences and Disorders

Method

Participants:

Monolinguals	Bilinguals
Native English Speakers	Non-native English Speakers (Spanish as first language)
N= 18 (9 females, 9 males)	N= 15 (9 females, 6 males)
Age range: 6-17	Age Range: 6-17
Mean: 11	Mean: 12

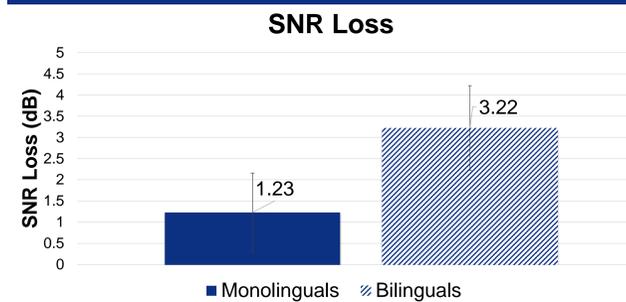
Procedure:

1. Participant / parent signed an informed consent
2. Bilingual participants completed proficiency questionnaire
3. Otoscopy
4. Tympanometry
5. Air Conduction Thresholds (250 to 8000 Hz)
6. Speech in Noise Testing
 1. BKB-SIN
 2. HINT

Speech in Noise Testing

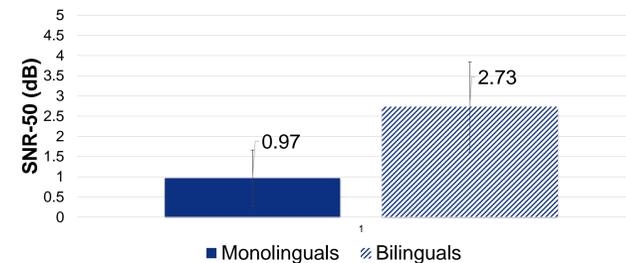
	BKB-SIN	HINT-C
Number of Lists	18 list pairs (10 sentences)	13 lists (10 sentences)
Stimuli	Sentences	Sentences
Presentation Level	70 dB HL	65 dB HL
Background	4-Talker Babble	Speech-shaped noise
SNR Range	+21 to 0 dB	+5 dB SNR
SNR Step Size	3 dB	NA

BKB-SIN



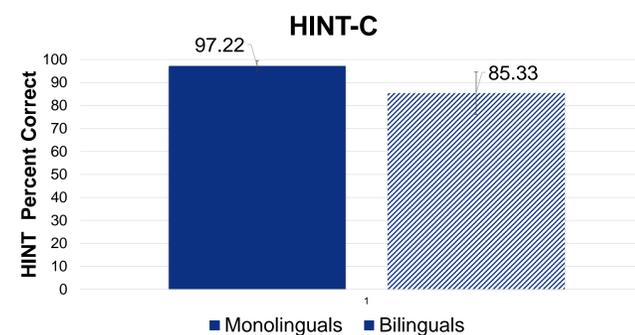
Mean SNR loss values (in dB) along with ± 1 standard deviations for monolingual and bilingual speaking children on the BKB-SIN test. Bilingual performance was significantly poorer than monolingual performance ($p < 0.05$).

SNR-50



Mean SNR loss values (in dB) along with ± 1 standard deviations for monolingual and bilingual speaking children on the BKB-SIN test. Bilingual performance was significantly poorer than monolingual performance ($p < 0.05$).

HINT-C



Mean percent correct scores along with a ± 1 standard deviations on the HINT-C test for monolingual and bilingual speaking children. Bilingual performance was significantly poorer than monolingual performance ($p < 0.05$).

Results

- The average PTA of the participants in the monolingual group was not statistically different from that of the participants in the bilingual group suggesting that hearing ability did not have an impact on the findings.
- The SNR loss for the bilingual children was significantly greater ($p < 0.05$) than that of the monolingual children.
- The average SNR-50 for bilingual children was significantly greater ($p < 0.05$) than that of the monolingual children.
- On average, the bilingual children exhibited a mild SNR Loss on the BKB-SIN.
- The mean SNR Loss for the monolingual children was within normal limits.
- When conducting the HINT, the percent of sentences correctly repeated back was significantly higher ($p < 0.05$) for the monolingual group than for the bilingual group.

Conclusions

Our findings support the hypothesis that bilingual English-speaking children whose first language is Spanish have poorer speech perception in noise ability than children who are monolingual English speakers.

Future Directions

1. Measure speech perception in noise of non-native English speaking children and adults who have hearing loss and whose first language is Spanish.
2. Measure speech perception in noise of other non-native English-speaking children to determine if similar findings are seen with other languages.

References

Crandall C.C., & Smaldino J.J. (1996). Speech Perception in noise by children for whom English is a second language. *American Journal of Audiology*, 5(3), 47-51.

Mendel, L.L. & Widner H. (2016). Speech Perception in noise for bilingual listeners with normal hearing, *International Journal of Audiology*, 55:2.126-134.

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