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### AZBIO Sentence Accuracy for English as a Second Language Adults in Quiet and Background Noise

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HONS 497

Honors Thesis

AZBIO Sentence Accuracy for English as a Second Language Adults  
in Quiet and Background Noise

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**Abstract**

The objective of this study is to examine indications of a significant difference in listening ability between native English speakers and English as a Second Language (ESL) students in quiet and background noise, specifically on the AZBIO Sentence test. Three Language groups were analyzed: Korean, Portuguese, and Spanish. AZBIO lists were used to assess ESL students' ability to repeat sentences. An analysis of errors was completed to determine variance and similarities between the four language groups. Native English speakers had no difficulty repeating sentences in either condition, ESL students' data suggested more difficulty in both quiet and background noise and a variance in age of acquisition of English.

*Key Words:* ESL, speech discrimination, AZBIO sentence test, age of acquisition.

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in Quiet and Background Noise.

Speech discrimination is an important skill that may be affected by many factors, including language competency and auditory processing ability. There is a need to investigate a deficit in speech discrimination ability among English as a Second Language (ESL) adults, and to specifically examine the effect of these two factors. Several research studies have been conducted investigating speech perception and understanding in background noise of ESL students (e.g., Carlo, 2009; von Hapsburg & Pena, 2002). The majority of these studies found decreased scores on speech-in-noise testing for the ESL students. In certain cases, there was no notable difficulty with speech discrimination in quiet environments, but the scores were significantly lower in the presence of background noise (Stuart, Zhang, & Swink, 2010). This indicates that an auditory figure ground deficit is prevalent in ESL students, complicating their ability to process speech in noise.

Findings of an auditory processing deficit are consistent among many language groups. Research studies have compared native English speakers to native Chinese (Stuart, Zhang, & Swink, 2010), Spanish (Carlo, 2009), and Arabic (Tabri, Chacra, & Pring, 2010) speakers. The overall conclusion in this field of research is that it is unclear whether bilingualism affects performance on speech reception threshold tasks as much as it affects performance on tasks that require auditory processing (von Hapsburg & Pena, 2002). Further research is needed to examine the connection between bilingualism and low speech discrimination scores, but there is speculation that an auditory processing development issue is the cause. The purpose of this study was to investigate this speculation by comparing ESL adults ability to repeat sentences in quiet

to their abilities in background noise, and by comparing their overall sentence repetition abilities to that of native English speakers.

The primary research questions of this study were to determine if there was a significant difference between the ESL participants' scores in quiet and background noise, if there was a significant difference between the three language subgroups, and if age of acquisition of English impacted the overall score. Because this study did not include right vs. left ear as a factor, each participant's right and left ear scores were combined into one score.

### **Method**

#### **Participants**

In order to investigate the accuracy in sentence repetition tasks of ESL adults, three groups of ESL participants of differing languages as well as a control group of native English speakers were evaluated. The control group included fifteen native English speakers, and the ESL subgroups included eleven Korean, fourteen Portuguese, and fifteen Spanish speakers. All participants were at least eighteen years of age and were enrolled in Andrews University at either the undergraduate or graduate level. Before testing sentence accuracy, participants were given a hearing screening to assure hearing abilities within normal limits at 500-4000 Hz as well as word recognition in quiet at a normal conversational level to assure speech discrimination ability in English above 85%. Throughout data collection, only one volunteer did not pass the hearing screening or achieve a word recognition above 85%. They were not included in this study to assure that all participants had hearing within normal limits.

**Procedure**

The test procedures consisted of four AZBIO sentence tests: two in quiet and two in background noise at a +10 signal-to-noise ratio presented to the right and left ear separately. Recorded materials were used for speech discrimination and AZBIO sentence tests, using both male and female voices. All testing was conducted at a normal conversational level in a sound isolated chamber.

The AZBIO sentence test is a set of English sentence lists that are formatted to test speech discrimination ability and are meant to isolate that skill by removing language as a component of testing. This is accomplished by using sentences composed with standard English grammar rules that have low predictability and vary in length and complexity. The test was developed and is mainly used for testing cochlear implant candidacy (Shapiro & Roland, 2010). The AZBIO sentences were chosen for their wide range of complexity representing the varying difficulty of the English language. Examples of both low and higher predictability AZBIO sentences are presented in Appendix B.

Prior to testing, participants were given a case history form that included information about their primary language and years of formal English training. Besides allowing the participants to be separated into language groups, this case history provided us with information about the age at which each participant was first introduced to English. This created categories within the ESL groups of those who had learned English prior to, or at the age of, eight years old and those who learned it after age eight.

### **Data Analysis**

To determine if there was a significant difference between the mean scores in quiet and background noise, the mean scores of all ESL participants were combined. Given that the total points possible for the quiet and background tests were different, it was necessary to first convert the raw scores to percentages in order to compare them. The null hypothesis that the mean scores were the same in quiet and in background noise was tested. In particular, the one-tailed alternative hypothesis that the mean score in background was less than the mean score in quiet was tested using a paired t-test.

To determine whether there was a difference in overall score between Korean, Portuguese, and Spanish speakers, the quiet and background scores for each participant were combined and the null hypothesis that the three means were equal was tested using a one-way ANOVA.

To determine whether the age of acquisition (AOA) for English significantly impacted scores, the mean combined scores for age of acquisition less than or equal to 8 to that of age of acquisition greater than 8 were compared using a t-test for independent means.

All statistical tests were carried out at the  $\alpha = 0.05$  level of significance.

### **Results**

The results of the comparison between the scores in quiet and those in background noise are represented in Table A1. When all ESL students' right and left scores were combined, the mean score in quiet was significantly higher than the mean score in background noise ( $t = -1.759$ ,  $p = 0.043$ ,  $n = 40$ ). This shows that the addition of background noise made the sentence repetition

task much more difficult for the majority of ESL students. In fact, their overall scores dropped significantly with the addition of background noise.

The results of the comparison between ESL subgroups are presented in Table A2. When the overall scores of Korean<sup>a</sup>, Portuguese<sup>b</sup>, and Spanish<sup>c</sup> speakers were compared, the mean scores between the three groups were significantly different ( $F= 4.517, p=0.017, ^a n=11, ^b n=14, ^c n=15$ ). This finding supports the suggestion of an underlying language component as a cause of the speech discrimination deficit seen among ESL students. Additionally, this result supports the inclusion of slower auditory processing development in the emerging language as another cause.

The results of the analysis of the age of acquisition groups is presented in Table A3. When all scores for all ESL students were combined and the mean score for those of age less than or equal to eight<sup>d</sup> to that of those greater than eight<sup>e</sup> were compared, the mean score those in the earlier age group (sample mean = 528.09) was significantly higher than the mean for the older age group (sample mean = 443.50) ( $t= 3.829, p<0.001, ^d n=23, ^e n=17$ ). The disparity found between the two groups implies a significant impact of age of acquisition on speech discrimination in the second language.

### Discussion

The results of this study duplicate previous research (Regal, Kim, & Neufville, 2015) indicating that ESL students have more difficulty repeating sentences in background noise than native English speakers. The results also showed that ESL students have more difficulty repeating sentences in quiet when compared to native English speakers. The initial inquiry of this study was to determine whether there was a deficit due to language differences or auditory



processing ability. However, with the conclusion of the project and analysis of the data, it seems that this is not a question of either or, but that both possible causes are present.

The significant difference between ESL groups suggests that language is component to the speech discrimination deficit. Because each language group scored differently, it is likely that primary language has an effect on the difficulty of competently learning a second language. Further research should be done to investigate the differences in overall score among the ESL subgroups, specifically asking what other contributing factors may lead to acquisition of a second language. Age seems to be one factor, but are there other factors that allow some language learners to develop a second more or less competently? In the comparison of the three subgroups, the Spanish group had the highest mean score and the lowest standard deviation, meaning that there was less variability in their scores. A possible explanation for this is that on average, the majority of Spanish participants had earlier ages of acquisition of English compared to the other two language groups.

The results of this study show that age of acquisition for English is a factor for sentence repetition accuracy. The significant difference in age of acquisition groups is a strong indicator that learning a language at a much younger age is beneficial. For those who learn a language at an earlier age, an easier transition to college can be expected because they are able to reach norms by adulthood. This conclusion was based on the fact that many of the participants who learned English before age eight scored in the same range as the native English speakers. The findings that all three languages had difficulty compared to English speakers, indicates a concern for accurate note taking skills at the university level. A survey conducted at four major universities about the academic skills necessary for ESL students to succeed found that

professors from every major on these campuses were concerned about their ESL students' note taking abilities (Ferris & Tagg, 1996). However, in this survey, the respondents felt that general listening comprehension should be a higher priority for ESL teachers than lecture note-taking (Ferris & Tagg, 1996). A student's speech discrimination and auditory processing ability play a large role in the accuracy and effectiveness of their notes. If general listening comprehension improves, an assumption can be made that note taking ability will improve.

Another consideration in this area of research is the students' own views of their aural skills. In a survey conducted on three major university campuses, ESL students ranked necessary aural skills and problem areas (Ferris, 1998). The top three in both areas were: class participation, small-group work, and group projects (Ferris, 1998). These three skills are encountered often on university colleges. A study looking to evaluate and update intensive English programs at the University of Oregon, found that ESL students likely need practice in listening to informal lectures and quick announcements, following descriptions of data presented visually, as well as asking and answering questions (Sheppard et al, 2015). It is clear that listening ability and note taking skills are important factors at a university level. So the question then remains, if ESL students have significantly lower speech discrimination ability and vocabulary, as well as difficulty with auditory short term memory when compared to native English speakers, how are they succeeding in these areas? Further research comparing noting skills is recommended. In addition, further research should explore possible remediation to improve underlying auditory and language skills to increase ESL acquisition.

Limitations to this study include uneven distributions of age of acquisition groups which may have skewed results in comparison of the three groups. In previous research the Korean

students had more difficulty (Regal, Kim, & Neufville, 2015), and anecdotally it seemed during testing that this was the case. It seemed like Korean participants who struggled with the test had more difficulty than the other language groups specifically needing more time to complete the sentence repetition tasks than the others. However, more of the Korean participants had age of acquisition under eight and did not necessarily have difficulty, while the majority of the Portuguese participants had learned English much later in life. In fact, the group with age of acquisition over eight was made up mostly by Portuguese speakers. In further research it may be beneficial to gather even groups of data for each language and each age of acquisition group to more accurately compare the languages.

This study may also be limited by the choice to only investigate three primary languages. A more in depth study of ESL sentence accuracy could include a larger selection of ESL students in order to increase generalizability of the results. It is recommended that further research include larger samples and a more diverse selection of participants (e.g., Arabic, Chinese, Hindi speakers).

### **Summary Points and Clinical Implications**

Native English speakers had no difficulty with sentence repetition tasks in quiet or in background noise and ESL participants had significantly lower scores in quiet compared to native English and significantly lower scores in background noise compared to their scores in quiet. These findings imply both language difference and auditory processing skills affect speech discrimination skills in the second language of bilingual adults. Due to the significant difference in scores found between the ESL subgroups (Korean, Portuguese, and Spanish), further investigation into primary language as an aspect of the speech discrimination deficit among ESL

adults is recommended. In addition, participants with an age of acquisition of eight or less had scores significantly better than those with age of acquisition over eight, indicating that the age at which a second language is acquired is an important factor in the development of auditory processing ability and overall language skills in the second language.

The results of this research have implications on cochlear implant candidacy. The AZBIO sentence lists were created to provide an unbiased evaluation of a patient's performance in everyday listening environments. Because the AZBIO sentence tests are used for the purpose of determining candidacy, it is important that people with hearing ability within normal limits be able to complete the sentence tasks with no difficulty. However, based on the results of this research, it can be seen that this is not the case for ESL adults. ESL participants in this study had hearing within normal limits and on average received a score of 86.50% on sentences in quiet and 84.91% in background noise, while the average score for native English speakers was above 90%. According to Spahr et al. (2012), the average score of cochlear implant users ranged from 46 to 86 percent. If ESL students who have hearing within normal limits have consistently lower scores compared to native English speakers, and even fall into the score range of cochlear implant candidates, then the question arises of whether this is an adequate evaluation for ESL adults. The findings of this research support the need for cross cultural testing materials; namely, the production and use of speech discrimination tests in other languages. An assumption can be made that the ESL participants in this study would have scores among the range of native English speakers had they been tested in their native language, rather than in English. However, there is not an equivalent set of sentences to the AZBIO lists in languages other than English.

It is also important to consider the ESL participants difficulty with background noise. Due to heating or cooling systems, other people making noise, computer noise, and other various noises in and outside the classroom, the typical classroom is rarely quiet (Knecht, Nelson, Whitelaw, & Feth, 2002; McCormick Richburg & Hill, 2014). At the university level, adequate auditory processing skills in background noise are vital in the classroom as educators tend to give primarily verbal instruction, often without visual aid. Any deficit in auditory processing skills in English which affect the ability to listen in background noise are important to acknowledge. In the same sense, a language based difficulty that changes a student's ability to listen and understand in or out of the classroom should be acknowledged.

Acknowledging a speech discrimination deficit in ESL adults has implications on the need for, and structure of, speech therapy for school-aged ESL learners. There is an underlying need to develop auditory skills in a second language. In particular, children learning a second language need exposure to sounds that are not in their native language. A change in therapy to include auditory training for ESL children may help to facilitate the development of auditory processing in English. This theory is based on the results of this research which showed that ESL adults who learned English before the age of eight were able to develop the necessary language and auditory processing skills to achieve competency in English overtime. Due to these findings, it is believed that the incorporation of auditory processing training into speech therapy would be beneficial to children learning English as a second language and allow them to transition more easily into the university level.

Once an ESL person reaches the college age, there are still ways in which they can receive help in order to succeed. For example, the provision of appropriate classroom

accommodations such as note takers and visual aids. Many universities already provide note taking assistance as a service for students with disabilities, this program could be extended to support ESL students as well. This would provide ESL students who are struggling significantly with speech discrimination and auditory listening tasks with a means of acquiring accurate notes in their classes and enable them to be more successful at the university level. It could also be beneficial to instruct university professors in what ESL students in their classes may need and to suggest consistent use of visual aids in the classroom. Visual aids are a way to ensure that ESL students are receiving and understanding the information in a class even if they are unable to consistently understand the spoken lecture. Based on the findings of this research, there is a need to further examine the success of ESL university level students taking into account the implications of lower speech discrimination ability among ESL students. Continued research and changes to ESL programs may be necessary in order to provide access to appropriate accommodations.

Suggestions for further research include investigation into primary language differences and their effect on speech discrimination in a second language. It is also suggested that research be done to examine the note taking ability of ESL students as well as possible remediation and classroom accommodations to promote success at the university level. Finally, research investigating the effect of age of acquisition on second language competency and the importance of development of underlying auditory skills in a second language would be beneficial to this field of study.

### References

- Carlo, M. (2009). A review of the effects of bilingualism on speech recognition performance. *Perspectives on Hearing and Hearing Disorders: Research and Diagnostics*, 13, 14-20.
- Ferris, D. (1998). Students' views of academic aural/oral skills: A comparative needs analysis. *TESOL Quarterly*, 32(2), 289-318. doi:10.2307/3587585
- Ferris, D., & Tagg, T. (1996). Academic listening/speaking tasks for ESL students: Problems, suggestions, and implications. *TESOL Quarterly*, 30(2), 297-320. doi:10.2307/3588145
- Knecht, H. A., Nelson, P. B., Whitelaw, G. M., & Feth, L. L. (2002). Background noise levels and reverberation times in unoccupied classrooms. *American Journal of Audiology*, 11(2), 65-71.
- McCormick Richburg, C., & Hill, A. L. (2014). Minimal hearing loss: Implications and management options for educational settings. *SIG 9 Perspectives on Hearing and Hearing Disorders in Childhood*, 24(2), 40-53.
- Regal, D., Kim, B., & Neufville C. (2015). Determination of auditory processing ability, specifically tolerance fading memory, among English as a Second Language (ESL) students at the university level, to develop practical and effective strategies to succeed in an English class setting.
- Shapiro, W.H., & Roland, J.T. (2010). Expanded cochlear implant candidacy criteria. *ASHA.org*

Sheppard, B., Rice, J., Rice, K., DeCoster, B., Drummond-Sardell, R., & Soelberg, N. (2015).

Re-evaluating the speaking and listening demands of university classes for novice international students. *University of Oregon American English Institute ORTESOL Journal Vol. 32*.

Spahr, A.J., Dorman, M.F., Litvak, L.M., Van Wie, S., Gifford, R.H., Loizou, P.C.....Cook, S.

(2012). Development and validation of the AzBio sentence lists. *Ear Hear Jan-FEB; 33(1): 112-117. doi: 10.1097/AUD.0b013e31822c2549*

Stuart, A., Zhang, J., & Swink, S. (2010). Reception thresholds for sentences in quiet and noise

for monolingual English and bilingual Mandarin-English listeners. *Journal of the American Academy of Audiology, 21(4), 239-248*.

Tabri, D., Chacra, K., & Pring, T. (2010). Speech perception in noise by monolingual, bilingual

and trilingual listeners. *International Journal of Language & Communication Disorders, 1-12*.

Von Hapsburg, D., & Peña, E. (2002). Understanding bilingualism and its impact on speech

audiometry. *Journal of Speech, Language, and Hearing Research, 45, 202-213*.



## Appendix A

## Data Analysis

Table A1

*ESL Participants' Mean Scores and Standard Deviation*

| Condition        | Mean Score | Standard Deviation |
|------------------|------------|--------------------|
| Quiet            | 0.8650     | 0.16313            |
| Background Noise | 0.8491     | 0.12220            |

Table A2

*Comparison of Overall Scores between ESL Groups*

| Language Group          | Mean Score | Standard Deviation |
|-------------------------|------------|--------------------|
| Korean <sup>a</sup>     | 489.9091   | 91.71091           |
| Portuguese <sup>b</sup> | 447.3571   | 90.11924           |
| Spanish <sup>c</sup>    | 529.9512   | 39.92696           |
| Total*                  | 490.9512   | 81.29912           |

\*ESL groups combined score.

Table A3

*Mean Scores for Age of Acquisition Groups*

| AOA                             | Mean Score | Standard Deviation |
|---------------------------------|------------|--------------------|
| $\leq 8$ years old <sup>d</sup> | 528.09     | 62.93641           |
| $> 8$ years old <sup>c</sup>    | 443.50     | 78.58772           |

Appendix B

The AZBIO Sentence Test

Table B1

*Examples of High Predictability Sentences*

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**Please pass the salt**

**Have a nice lunch**

**Don't get me started**

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Table B2

*Examples of Low Predictability Sentences*

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**Nothing tastes sweeter than self-discipline**

**She was top banana in the shock department**

**The camel is not the most comfortable animal on which to ride**

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