

Utah State University

DigitalCommons@USU

Undergraduate Honors Capstone Projects

Honors Program

5-2018

Does Talker Familiarity or Time of Testing Facilitate Sentence Recognition When Listening in Noise?

Madison S. Buntrock
Utah State University

Follow this and additional works at: <https://digitalcommons.usu.edu/honors>

 Part of the [Communication Sciences and Disorders Commons](#)

Recommended Citation

Buntrock, Madison S., "Does Talker Familiarity or Time of Testing Facilitate Sentence Recognition When Listening in Noise?" (2018). *Undergraduate Honors Capstone Projects*. 439.
<https://digitalcommons.usu.edu/honors/439>

This Thesis is brought to you for free and open access by the Honors Program at DigitalCommons@USU. It has been accepted for inclusion in Undergraduate Honors Capstone Projects by an authorized administrator of DigitalCommons@USU. For more information, please contact rebecca.nelson@usu.edu.



**[DOES TALKER FAMILIARITY OR TIME OF TESTING
FACILITATE SENTENCE RECOGNITION WHEN LISTENING
IN NOISE?]**

by

[Madison S. Buntrock]

**Capstone submitted in partial fulfillment of
the requirements for graduation with**

**UNIVERSITY HONORS
[may be changed in consultation with Honors]**

with a major in

**[Communicative Disorders]
in the Department of [Communicative Disorders and Deaf Education]**

Approved:

Capstone Mentor
Dr. [Brittan Barker]

Departmental Honors Advisor
Dr. [Sonia Manuel-Dupont]

Committee Member [optional]
Dr. [Type committee member's name]

University Honors Program Director
Dr. Kristine Miller

**UTAH STATE UNIVERSITY
Logan, UT**

Does Talker familiarity or time of testing facilitate sentence recognition when listening in noise?

Madison S. Buntrock

Utah State University

Author Note

For completion of Utah State University's Honors Program.

This project was also awarded an Undergraduate Research and Creative Opportunities Grant
(URCO).

Abstract

At the most elementary level, the speech signal is comprised of two parts: linguistic information and indexical information. The linguistic information is the phonetic information of the signal and indexical information is speaker specific and is the paralinguistic information of the signal. Part of this indexical information is talker specific characteristics; which have been shown to help people understand speech. The talker specific characteristic we looked at was talker familiarity. Talker familiarity has been shown to help babies segment speech and adults listen in noise and recall stories. We looked at talker familiarity to see if it would benefit typically developing adults listen in ecologically valid background noise. Our hypotheses were: two significant main effects and interaction. Our study had two independent variables; talker (*familiar, novel*) and time of testing (*Time 1, Time 2*) and the dependent variable was keyword accuracy. A total of 93 individuals participated in this study; 41 of which were familiar with the talker due to the talker being their university professor. Our results showed a main effect of talker and a main effect of time of testing but there was no interaction between talker and time of testing. Implications are discussed.

Keywords: [Talker specific characteristics, Sentence recognition, Familiarity, listening in noise]

Does Talker familiarity or time of testing facilitate sentence recognition when listening in noise?

Intelligibility. At the most elementary level there are two parts of the speech signal (Pisoni, 1997). The first part is the linguistic information which is the phonetic information of the signal. The second part of the speech signal is the indexical information which includes paralinguistic information, acoustic properties, and talker specific characteristics (Pisoni, 1997). Talker-specific characteristics, or the characteristics attributed to the talker, fall in the category of indexical information (Pisoni, 1997). These characteristics vary but include: gender (Munson et al., 2006), age (McLennan and Luce, 2005), emotional state (Murray and Arnott 1993), dialect (Hagiwara, 1997), rate of speech (Nygaard, 2008), familiarity (Barker and Newman, 2004), and state of sobriety (Pisoni and Martin, 1989). Past research indicates that talker specific information plays a large role in a listener's ability to understand a talker, otherwise known as intelligibility (Bradlow et al., 1996; Pisoni, 1997; McLennan and Luce, 2005). Understanding a talker's spoken message is crucial to quality of life. Individuals with communication difficulties, such as those with hearing loss, report lower quality of life when they feel they cannot understand the people they want to interact with and talking to (Tye-Murray et al., 2008; Dalton et al., 2003). However, much is still unknown about how humans process and understand speech. Furthermore, listening to a talker often occurs in the presence of noise. Making researchers' ability to understand speech intelligibility in real-life listening situations, even more challenging. Understanding a talker in noise is something that individuals with (Souza et al., 2013; Festen and Plomp, 1990) and without hearing loss (Festen and Plomp, 1990) find challenging. Past literature suggested that talker-specific characteristics could improve intelligibility and subsequently facilitate listening in the presence of noise (Bradlow et al., 1996; Pisoni, 1997; McLennan and Luce, 2005). More studies on talker-specific characteristics are needed if we are to better

understand intelligibility; such a stronger understanding of intelligibility (especially in real-life settings, such as in the presence of noise) increases the potential to better help those with hearing loss and others with challenges understanding speech. For our study we wanted to contribute to this need and determine whether or not the talker-specific characteristic of talker familiarity could increase sentence recognition scores for listeners in the presence of noise.

Talker Familiarity. Talker familiarity broadly is a listener recognizing the voice of the talker. There is no universal definition of what constitutes talker familiarity. Some studies define familiarity as friendships or marriages that have lasted for twenty years; others define familiarity as a mother and their infants at 7.45 months old; and still other studies define familiarity as students and their university professor over the course of their semester (Souza et al., 2013; Barker and Newman, 2004; Newman and Evers 2007).

Familiarity can help adults recall stories, adults recognize words, and babies segment speech (Souza et al., 2013; Barker and Newman, 2004; Newman and Evers 2007; Yonan and Sommers, 2000). Talker familiarity may be a talker specific characteristic that aids understanding in speech significantly enough that it may be worth exploiting to help individuals that have difficulty listening in noise; particularly people with hearing loss (Souza et al., 2013; Yonan and Sommers, 2000). Currently, the bulk of research shows familiarity in a one-sided light due to using family relationships; so although we think familiarity shows a strong benefit in challenging listening situations; we were interested in looking at familiarity from a different perspective-a talker one is not related to- to get a more generalizable understanding of this talker specific characteristic. Past studies also often relied on family bonds for the stimuli creation used in talker-familiarity research (Souza et al., 2013; Yonan and Sommers, 2000). These studies showed a benefit and suggested that familiarity benefits the listener. However, there are few studies that

looked at familiarity with those unrelated to, but familiar with, the listener (Yonan and Sommers, 2000; Newman and Evers, 2007). We argue that people we are familiar with but not related to: coworkers, neighbors, church members, baristas, etc. are common communication partners. We need more research on a listener's familiarity with these communication partners if we want to better understand talker familiarity and how it affects understanding the speech signal.

An important factor to making familiarity more generalizable is testing familiarity in as ecologically valid an environment as possible. In daily life we often encounter people we are familiar with but not related to, and face speech in noisy environments outside of the quiet confines of the lab (e.g., a restaurant or in the office). In the present study, we aimed to create a more naturalistic listening task than those of past research and explore talker familiarity's effect on speech recognition scores in the presence of a multitalker babble. This ultimately led to our research question: would talker familiarity or time of testing increase word recognition scores in background noise?

Methods

Design

This study had two independent variables: talker (familiar, novel) and time of testing (Time 1, Time 2). Our dependent variable was keyword accuracy reported in percentage correct.

We predicted two significant main effects and interaction. Specifically, we predicted that the people familiar with the talker would have significantly higher keyword accuracy than those people unfamiliar or novel to the talker. We also predicted word recognition would be higher when the participants were tested at a later time and with more hours of exposure

We predicted that there would be a relationship between the familiar participants with the time of testing meaning the familiar group would do better than the novel at both times of testing

Participants

We recruited a total of 97, native English speakers to participate in the study. We divided the participants into two groups based on their familiarity with the professor who recorded the target stimuli. We recruited participants in the familiar talker group ($n = 39$; 2 males) from the professor's senior-level undergraduate course during the 1st week of the semester. The participants' ages ranged from 19 to 28 years ($M = 22.7$ years). These same participants were tested in the 2nd and 3rd weeks of the semester (Time 1) and again in the 12th and 13th weeks of the semester (Time 2). All but 4 students participated at both time points ($N = 93$). We recruited participants in the novel talker group ($n = 31$; 21 males) from the university's research participant pool during the 6th and 7th weeks of the semester (Time 1) and 14th and 15th weeks of the semester (Time 2). Their ages ranged from 18 to 26 years ($M = 20.0$ years). Five of the individuals who participated at Time 1 also participated at Time 2. Therefore, 48 individuals had information at only one-time point. Given the structure of the experiment (described below), the design, in conjunction with the statistical analyses, were appropriate to test for differences across groups. All participants were compensated with either course credit or extra credit in their classes.

Materials

We used *E-Prime 2.0* experimental software (Psychology Software Tools, Pittsburgh, PA) to execute the experiment on a Dell computer monitor equipped with *Sennheiser HD 280 Pro* circumaural headphones. The experimental setup was located in a double-walled sound booth.

Sentence stimuli. The aforementioned professor of the undergraduate course recorded 100 English sentences randomly chosen from the IEEE corpus (1969) to serve as the target stimuli. She was a female, native speaker of American English, aged 29 years. The recordings were made using a *Shure* Professional SM81-LC microphone and a *Mackie* Mixer digital recorder in a double-walled sound booth. A researcher edited and equated the audio files across the total root-mean squared (r.m.s) values using *Adobe Audition* (Version CC; Adobe Systems, 2015) sound editing software.

Background noise. We used 4-talker babble as background noise for this study. The 4-talker babble consisted of an audio mix of 4 female speaking sentences from the IEEE corpus (1969) that were not used as target stimuli. These recordings were made following the same procedure outline above. A researcher equated total r.m.s. values across the background noise to yield a -2 dB signal-to-noise ratio (SNR). We chose the SNR based on pilot data yielding a M keyword accuracy of 61% at this SNR.

Procedure

Participants first were oriented to the study and gave consent to be in the study. Then the participants were screened for normal hearing. Recall, participants in early testing groups completed the experimental task during the 2nd and 3rd weeks of the semester (Time 1) and participants in the later testing groups completed the experimental task during the 12th through 15th weeks of the semester (Time 2). After the participant sat down in front of the computer and monitor setup in the double-walled sound booth, the experiment began. For participants in the novel talker group the participant was first presented with the following instructions on the monitor: "You will listen to a woman, speaking a number of different sentences while noise plays

in the background. Your job is to type exactly what you hear her say, while ignoring the background noise”. For participants in the familiar talker group, the participant was presented the instructions “You will listen to a Dr. Leopold your professor for COMD 3700, speaking a number of different sentences while noise plays in the background. Your job is to type exactly what you hear her say, while ignoring the background noise”. For the participants in the novel talker group, the instructions did not reference the talker’s identity. After the instructions, the participant completed two practice trials followed by 40 test trials. For each trial, after the target sentence was presented while background noise played continuously throughout the task, the participant was instructed to type out the target sentence using the computer’s keyboard. The order of the sentences was counterbalanced across participants. The experimental session was self-paced and each participant had an hour to complete it. After the participant finished all of the test trials, they completed a questionnaire reporting whether or not they recognized the talker, if they could identify the talker, and how often they attended the professor’s class each week. The novel participants were also asked if they were familiar with the talker. Data from the questionnaire confirmed that all of the participants in the familiar group knew the talker and that she was their professor; it also confirmed that the familiar participants had a minimum of 3 hours of exposure a week to her voice based on class attendance. The questionnaire data also confirmed that the participants in the novel talker group did not know the talker.

Results

We scored the participants’ final responses using keyword accuracy (e.g., Bradlow, Torretta, and Pisoni, 1996). Obvious spelling errors were counted as correct, but added or deleted morphemes were counted as incorrect. We calculated descriptive statistics across all participants

(M; SD) using these keyword accuracy scores (see Table 1). Three mixed effects models were used to assess the effect of talker on keyword accuracy (see Table 2).

Variable	Talker	
	Familiar	Novel
Age (in years)	22.8 (2.01)	20.0 (1.88)
Male	2 (5.4%)	20 (38.5%)
Keyword accuracy		
Time 1	0.437 (0.107)	0.398 (0.095)
Time 2	0.543 (0.088)	0.432 (0.119)

Table 1. Shows descriptive statistics of time of testing (*Time 1*, *Time 2*) and familiar (*familiar*, *novel*) variables.

First, the intra-class correlation was assessed, showing a high value ($r = 0.69$), demonstrating the need for using linear mixed effects models over other approaches that depend on the independence of observations (e.g., *ANOVA*, linear regression).

	Model Estimate (Standard Error)	
	Model 1	Model 2

	n = 89	n = 89
Talker: Novel	-0.08 (0.02)	-0.06 (0.02)
Time of testing	0.10 (0.01)	0.11 (0.01)
Talker x Time		-0.04 (0.02)

Table 2. Three mixed effects models; talker (*familiar, novel*), time of testing (*Time 1, Time 2*) and talker and time of testing were used to assess the effects of the variables on keyword accuracy.

To assess the main effects of talker, Model 1 included the main effects of both talker and time of testing. Both talker and time statistically significantly predicted keyword accuracy, where the novel talker condition had .08 lower accuracy across both time points ($p < .001$, all p -values reported for the mixed effects model uses the Satterthwaite approximation to degrees of freedom; CITE). Additionally, across both talker conditions, time predicted a .10 increase in keyword accuracy ($p < .001$). Model 2, in addition to the main effects, included the interaction between talker and time of testing. The interaction was not significant ($p = .064$). Although not significant, it is noteworthy to describe the patterns in the data as they approached significance. Figure 2 shows the interaction between talker and time of testing where the novel condition does not significantly improve ($p = .088$) and the familiar talker condition does significantly improve ($p < .001$). Finally, we assessed the simple main effects of the interaction using linear regression.

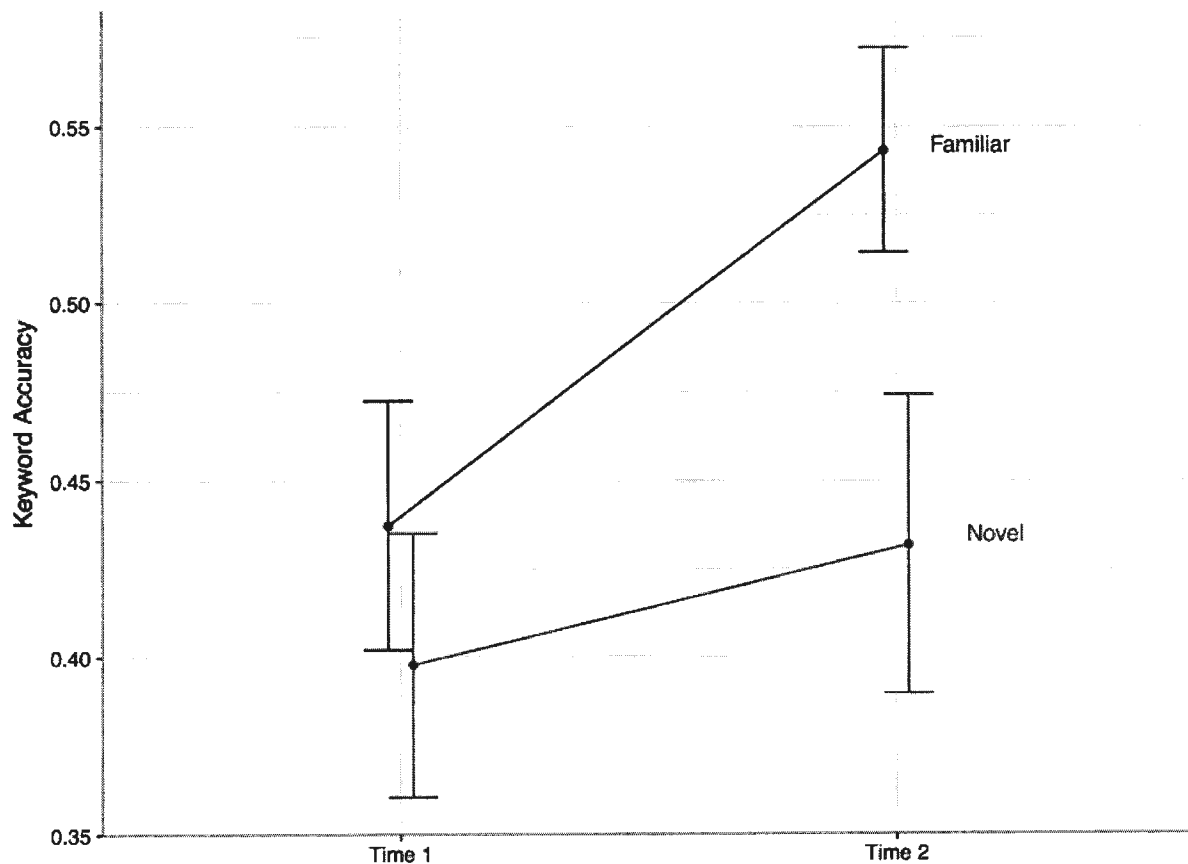


Figure 2. Shows the independent variable of time of testing (*Time 1*, *Time 2*) and corresponding keyword accuracy. There was a main effect of time of testing.

The talker groups were not significantly different at Time 1 ($b = 0.04, p = .137$), but were significantly different at Time 2 ($b = 0.11, p < .001$). In summary, there was a main effect of talker familiarity, the familiar group had significantly higher keyword accuracy scores than the novel group; and there was a main effect of time of testing, keyword accuracy scores improved significantly at the later time of testing. However, there was no significant interaction of talker familiarity and time of testing; meaning that the familiar group at the later time of testing did not have significantly higher accuracy scores; as we hypothesized.

Discussion

In this study we examined sentence recognition in the presence of background noise while manipulating the listeners' degree of familiarity with the target talker. As predicted, listeners' listening to the voice of their familiar professor demonstrated significantly better keyword accuracy than the novel listeners. These data replicate previous work (e.g., Souza, et al., 2013; Newman & Evers, 2007) showing when listeners are faced with challenging listening situations familiarity with the talker aids speech understanding. Our second hypothesis—participants would perform better at the later time of testing compared to the earlier time—was also supported by our analyses. Not surprisingly, these data are similar to those of past research suggesting that practicing a task improves accuracy (Pérez-Vidal, 2015; Reed, 1924). There was no interaction between talker familiarity and time of testing.

Familiarity with the talker. This suggests that talker familiarity yields a benefit in listening tasks. This talker specific characteristic could facilitate better word recognition outside of the clinic and sound booth. In our study we used a talker that was not related to any of the listeners. However, participants in the experimental, familiar group were familiar with the talker's voice because the talker was their professor. Thus our data showed that the benefits of this short-term familiarity—our participants had a total of 15 hours of exposure—are similar to that of past research of long-term familiarity (Souza et al., 2013; Barker and Newman, 2004). It also showed that even typically developing adults with normal hearing benefit from knowing the talker when presented with challenging listening situations. It is important to keep exploring various degrees of talker familiarity if we want to gain a deeper understanding of talker familiarity and implications in speech understanding, specifically in noise. It is possible that a further understanding of how to utilize talker familiarity in listening tasks will help individuals

minimize the negative effects of hearing loss and help develop strategies to help people listen in noise and interact more wholly in daily life (Tye-Murray et al., 2008).

Time of testing. There was a significant difference in performance between the listeners during the earlier and later times of testing; as time passed, all of the listeners improved significantly on the sentence recognition task. This can be attributed the practice effect (Pérez-Vidal, 2015; Reed, 1924). All listeners improved at week 12 (*time 2 of testing*) completing the listening task after having previous exposure to the task. It is interesting that there was no interaction between familiarity and time of testing; due to the fact that familiarity builds and exposure to a task increases accuracy; so it would suggest that there should have been an interaction between familiarity (Pérez-Vidal, 2015; Newman and Evers 2007).

Limitations

As with all studies, this study has limitations. The first limitation is the attrition of our novel listeners. Our novel listeners were recruited via our university's participant database but the program does not allow for participants to take the same study twice. In order to bring the same participants in twice our research lab would have had to keep track of their random ID number and tried to reach out via email to bring them back in; which a lot of novel participants are unlikely to respond to. This limited our ability to have a completely within-subjects experimental design, thus we recruited novel participants at both times of testing. Although at both times of testing the novel participants were novel to the talker; it would be ideal to have a completely within-subjects experimental design and use the same novel group of listeners twice; in order to give each participant the exact same treatment.

Furthermore, a limitation of our study was a lack of diversity; 23 students identified as male out of 93 participants. Also, the majority of our participants were white; which is not an accurate representation of the general population. Thus, limiting the generalizability of our results.

Future Directions

In the future, we plan to continue to explore the talker familiarity effect. It would be ideal that the participants of the familiar group were in a year-long class that met at least twice a week to have a broader definition of long term familiarity. A longitudinal study over a year with multiple assessment would give us such an opportunity. This is our next step: to study the bounds of talker familiarity, at different times, and with different hours of exposure to better understand talker familiarity's role in intelligibility of the speech signal.

Conclusion

In summary, the present study suggested that the talker specific characteristic of familiarity can yield significant improvement to sentence recognition in noise, even when there is no familial relationship between the listener and the talker. This new knowledge suggests that the talker specific characteristic of familiarity may be aiding in intelligibility of the talker more than originally thought and could have implications in the clinic; particularly individuals with hearing loss. Even more, the data suggest talker familiarity can help listeners with word recognition in challenging listening situations. Practicing tasks with individuals who have hearing loss also could help increase word recognition; in study all participants had higher keyword accuracy scores at time 2. Overall, our study suggests that talker familiarity helps listeners understand the speech signal in background noise.

Acknowledgements

We would like to thank Dr. Sarah Leopold not only for help shaping this project but also for volunteering her time to be our talker and her COMD 3700 class for participating in the study as our familiar group. We would also like to thank her Speech and Auditory Perception lab for being accommodating in this project.

I would also like to thank the Spoken Language Processing lab for their time helping gather data; particularly Madi Murphy and Shea Long. I would also like to acknowledge the Spoken Language Processing lab's principal investigator- Dr. Barker, my mentor, for all her time working with me on this project and helping me reach goals I did not know were possible.

References

- Adobe Systems. (2015). Adobe Audition CC (Version 8) [Computer software]. San Jose, CA.
- Barker, B. A., & Newman, R. S. (2004). Listen to your mother! The role of talker familiarity in infant streaming. *Cognition*, *94*, B45-B53. doi: 10.1016/j.cognition.2004.06.001
- Bates, D., Maechler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, *67*, 1-48. doi: 10.18637/jss.v067.i01.
- Borrie, S. A., McAuliffe, M. J., Liss, J. M., O'Beirne, G. A., & Anderson, T. J. (2013). The role of linguistic and indexical information in improved recognition of dysarthric speech. *The Journal of the Acoustical Society of America*, *133*(1), 474-482. doi:10.1121/1.4770239
- Bradlow, A. R., Torretta, G. M., & Pisoni, D. B. (1996). Intelligibility of normal speech I: Global and fine-grained acoustic-phonetic talker characteristics. *Speech Communication*, *20*, 255-272.
- Cooke, M. (2003). Glimpsing speech. *J. Phonetics* [https://doi.org/10.1016/S0095-4470\(03\)00013-5](https://doi.org/10.1016/S0095-4470(03)00013-5) 31, 579-584
- Dalton, D. S., Cruickshanks, K. J., Klein, B. K., Klein, R., Wiley, T. L., & Nondahl, D. M. (2003). The Impact of Hearing Loss on Quality of Life in Older Adults. *Gerontologist*, *43*(5), 661-668.
- IEEE. (1969). IEEE recommended practice for speech quality measurements. *IEEE Transactions on Audio and Electroacoustics*, *17*, 225-246.

- Festen, J. M., & Plomp, R. (1990). Effects of fluctuating noise and interfering speech on the speech-reception threshold for impaired and normal hearing. *The Journal of the Acoustical Society of America*, 88, 1725-1736. doi: 10.1121/1.400247
- Hagiwara R. (1997). "Dialect variation and formant frequency: The American English vowels revisited," *J. Acoust. Soc. Am.* 102, 655–658 doi:10.1121/1.419712
- McLennan, C. T., & Luce, P. A. (2005). Examining the time course of indexical specificity effects in spoken word recognition. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 31, 306-321. doi: 10.1037/0278-7393.31.2.306
- Munson B., McDonald E. C., DeBoe N. L., and White A. R. (2006). "The acoustic and perceptual bases of judgments of women and men's sexual orientation from read speech," *J. Phonet.* 34, 202–240 doi:10.1016/j.wocn.2005.05.003
- Murry I. R., and Arnott J. L. (1993). " Toward the simulation of emotion in synthetic speech: A review of the literature on human vocal emotion," *J. Acoust. Soc. Am.* 93, 1097–1108 doi:10.1121/1.405558
- Newman, R. S., & Evers, S. (2007). The effect of talker familiarity on stream segregation. *Journal of Phonetics*, 35, 85-103. doi:10.1016/j.wocn.2005.10.004
- Nygaard L. C., Sommers M. S., and Pisoni D. B. (1994). "Speech perception as a talker-contingent process," *Psychol. Sci.* 5, 42–46 doi:10.1111/j.1467-9280.1994.tb00612.x
- Pérez-Vidal, C. (2015). Practice Makes Best: Contrasting Learning Contexts, Comparing Learner Progress. *International Journal Of Multilingualism*, 12(4), 453-470. doi: 10.1080/14790718.2015.1071019

- Pisoni, D. B., & Martin, C. S. (1989). Effects of Alcohol on the Acoustic-Phonetic Properties of Speech: Perceptual and Acoustic Analyses. *Alcoholism, Clinical and Experimental Research, 13*(4), 577–587.
- Pisoni, D. B. (1997). Some thoughts on "normalization" in speech perception. In K. Johnson & J. W. Mullennix (Eds.), *Talker variability in speech processing* (pp. 9-32). San Diego, CA: Academic Press.
- Psychology Software Tools, Inc. [E-Prime 2.0]. (2012). Retrieved from <http://www.pstnet.com>.
- R Core Team. (2016). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL: <https://www.R-project.org/>.
- Reed, H. B. (1924). The effect of training on individual differences. *Journal of Experimental Psychology, 7*(3), 186-200. doi:<http://dx.doi.org/dist.lib.usu.edu/10.1037/h0074912>
- Souza, P., Gehani, N., Wright, R., & McCloy, D. (2013). The advantage of knowing the talker. *Journal of the American Academy of Audiology, 24*, 689-700. doi:10.3766/jaaa.24.8.6
- Theodore, R. M., Blumstein, S. E., & Luthra, S. (2015). Attention modulates specificity effects in spoken word recognition: Challenges to the time-course hypothesis. *Attention, Perception, & Psychophysics, 77*, 1674-1684. doi:10.3758/s13414-015-0854-0
- Tye-Murray, N., Spry, J. L., & Mauzé, E. (2008). Aural Rehabilitation for the Workplace: Listening in Our Offices Helps Clients Listen in Theirs. *ASHA Leader, 13*(16), 14. doi:10.1044/leader.ftr2.13162008.14
- Yonan, C. A., & Sommers, M. S. (2000). The effects of talker familiarity on spoken word identification in younger and older listeners. *Psychology & Aging, 15*, 88-99. doi:10.1037/0882-7974.15.1.88

Tables

Table 1.

Variable	Talker	
	Familiar	Novel
Age (in years)	22.8 (2.01)	20.0 (1.88)
Male	2 (5.4%)	20 (38.5%)
Keyword accuracy		
Time 1	0.437 (0.107)	0.398 (0.095)
Time 2	0.543 (0.088)	0.432 (0.119)

Table 1. Shows descriptive statistics of time of testing (Time 1, Time 2) and familiar (familiar, novel) variables.

Table 2.

Model Estimate <i>(Standard Error)</i>
--

	Model 1	Model 2
	n = 89	n = 89
Talker: Novel	-0.08	-0.06
	(0.02)	(0.02)
Time of testing	0.10	0.11
	(0.01)	(0.01)
Talker x Time		-0.04
		(0.02)

Table 2. Three mixed effects models; talker (familiar, novel), time of testing (Time 1, Time 2), and talker and time of testing were used to assess the effects of the variables on keyword accuracy.

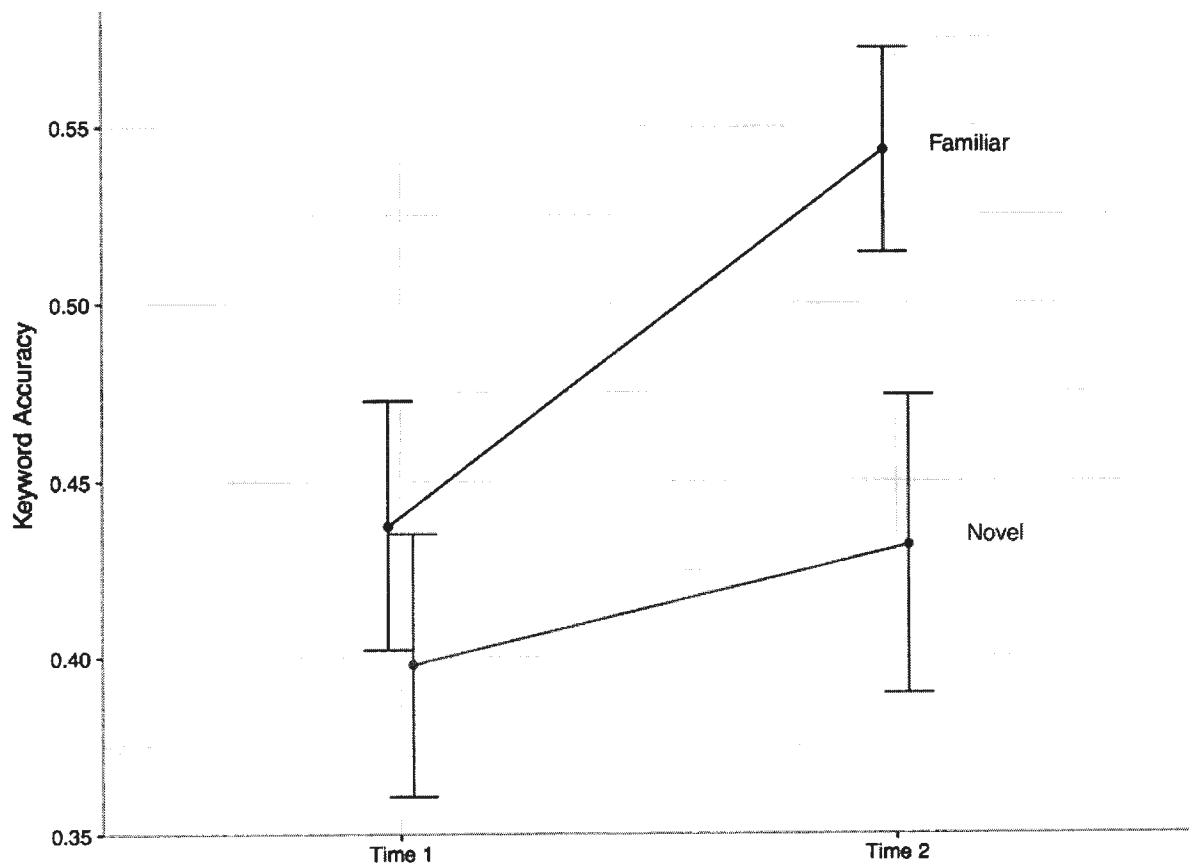


Figure 2. Shows the independent variable of time of testing (Time 1, Time 2) and corresponding keyword accuracy. There was a main effect of time of testing.

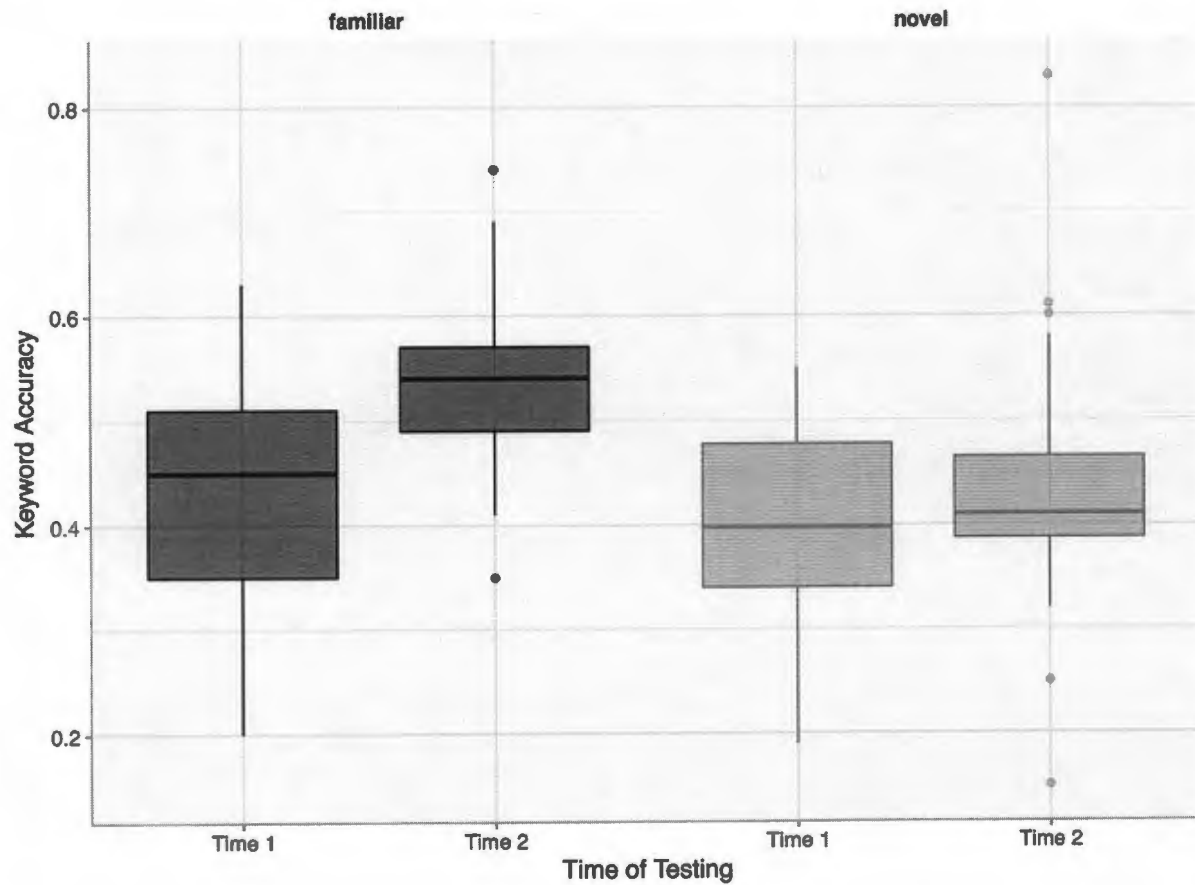


Figure 2. Box plot of the talker variable (*Familiar, novel*) and time of testing (*Time 1, Time 2*) and on the y-axis is the keyword accuracy scores. This data suggests that there was a main effect of talker and a main effect of time but no interaction.

Reflection

This thesis capstone was a very challenging yet rewarding project. This project contributed to my field of study and contributed to my experiences at USU immensely. For this project I had the opportunity to apply and to be awarded an Undergraduate Research and Creative Opportunities (URCO) grant. As a student it was a unique experience to get to build my research project with the help of Dr. Barker. It was scaffolded so I challenged myself and often felt like I was taking an insurmountable risk but was always supported by my mentor. I had the opportunity to learn valuable research skills and take a research graduate level class. These experiences helped me not only begin the task of understanding reading research but also of summarizing it and assimilating it into a lit search, which informed my study. This experience also deepened my understanding not only of my field but also of the current hot topics and nuances of our field. I created the experiment stimuli, collected data from participants, scored the data, and analyzed the data. All of this required critical thinking and problem solving. Creating and piloting the stimuli was particularly tricky and required problem solving. It took collaboration with my other research lab members, other professors, and my mentor to troubleshoot this project into a sound research study that is currently in preparation for publication.

This project was influential in deciding my career goals. I started my undergraduate career steadfast in my decision to be a speech therapist. I had so much conviction that being a clinician was my calling despite my trepidation that I would have certain aspects of myself dissatisfied. As I continued taking classes and becoming aware of the logistics of my chosen path; I was sure of my choice of field but unsure how I fit in. Certain aspects kept me content enough to stay in my field but I was worried that I would not have a strong enough voice or

would be constrained by procedures that were not working. I also began my thesis around this time. I had just started in my program and my thesis when I consistently would spend hours throughout my weekend reading research and I was concerned that there was not a strong enough element of research in my curriculum. When I began programming the experiment and understanding how and why Dr. Barker and I reached these choices, I felt incredibly overwhelmed; however, I also noticed that this was the first time in my academic career that I felt challenged and intellectually stimulated. I spent a lot of time being frustrated that creating a research experiment was not coming natural to me—as all my other experiences in academia had been- but I knew it was an incredibly thrilling experience to truly learn and understand how research is made and the rationale behind experiences. After I tidied up my research study and was awarded the URCO grant, I took some time to focus more on my capstone project and helped out around my research lab; I became almost homesick for being in the thick of research and running my thesis project. I realized from this experience of my thesis project that being in the thick of scientific studies is where I need to be. I now am pursuing my PhD in the fall and even more; conducting research similar to my project fulfills all of my expectations of a career. Without this project I would have not found my tribe and also made the decision to spend my life conducting research.

This experience was made possible by my incredibly meaningful relationship with my mentor; Dr. Barker. She has always listened to my concerns and ideas to provide true scaffolding and support. Without her I would not have had access to this invaluable experience which made me a competitive graduate school applicant. Not only did I learn how to complete solid research, write research, and present research; she also gave me skills to be an advocate for myself and seek out opportunities.

Overall, this project of completing the scientific method and completing a research study has provided me with much more than I expected when I began. It taught me invaluable practical skills: how to program an experiment, edit sound files, equate sound files, read research, etc. I also learned other important skills: explaining research to professionals and to the general public; preparing visually interesting presentations; advocating for my needs; and overall learning how to communicate better in a student/mentor relationship; to name a few. Via this project I also became well acquainted with most the faculty in my program and learned about various perspectives in my field of communicative disorders. Due to this project I also was able to take a graduate level research class and learn from graduate students—what concerns are relevant to them and what the controversial topics are in our field. I had opportunities to practice writing in a scientific style and for different audiences. I wrote and was awarded the URCO grant, I wrote this project into a manuscript for publication, and I also wrote my thesis on this work. This also gave me an experience at Utah State University's Research Symposium and this Spring at the National Conference on Undergraduate Research to learn broadly about other disciplines and their opinions on my work. This project also taught me that it is important to me to be a collaborative and interdisciplinary researcher; I look forward to being a collaborative researcher in the future.

This research will impact others in the future because it will keep driving the field of communicative disorders forward and help those who have disorders. Until we fully understand how language—specifically intelligibility works in typically developing individuals our care to those who are atypical is not as good as it one day will be. This capstone was the most challenging aspect of my experience at Utah State but it was the most rewarding; it truly was invaluable and gave me the tools necessary to pursue my ideal career.

Author's Biography

Madison Buntrock is a senior undergraduate student in Communicative Disorders and Deaf Education with a minor in Yoga Studies at Utah State University (USU). She volunteers as a research assistant in Dr. Brittan Barker's Spoken Language Processing Lab. Madison also works as an undergraduate research assistant in Dr. Renee Lucero's Listening and Spoken Language Lab. She is a part of USU's Honors College Program and is a Community Engaged Scholar. Madison also volunteers at Sound Beginnings, a Listening and Spoken Language preschool for children who are deaf or hard-of-hearing, and for Cache Valley school district, creating alternative and augmentative communication device toolkits. Madison is scheduled to begin the pursuit of her Ph.D. in Speech and Hearing Sciences in the fall of 2018 at the University of Maryland.