2023-04-03

The Impact of Speech Pause on the Perceived Effectiveness and Likability of a Speaker's Communication

Rebecca Lyman
Brigham Young University

The Impact of Speech Pause on the Perceived Effectiveness

and Likability of a Speaker's Communication

Rebecca Lyman

A thesis submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of

Master of Science

Shawn L. Nissen, Chair
Tyson G. Harmon
Kathryn L. Cabbage

Department of Communication Disorders

Brigham Young University

ABSTRACT

The Impact of Speech Pause on the Perceived Effectiveness
and Likability of a Speaker's Communication

Rebecca Lyman
Department of Communication Disorders, BYU
Master of Science

The purpose of this study was to examine how length and location of speech pausing affects a listeners' perception of likability and communication effectiveness. Furthermore, the end goal of this study is to understand how to better assess atypical speech pause for persons with aphasia (PWA). Speech samples were collected from two neurotypical speakers over the age of 75. The speech samples were the recorded responses of picture description tasks found in the Western Aphasia Battery (WAB) and the Boston Diagnostic Aphasia Examination (BDAE). These speech samples were then modified to include artificial pauses located both within sentence and between sentence, as well as differing lengths of three seconds, five seconds, and seven seconds. Forty-one listeners (31 female, 8 male) were recruited to listen to the 28 speech samples. Using a visual analogy scale, listeners rated each sample on their perception of likability and communication effectiveness. Communication effectiveness and likability ratings were significantly higher for between-utterance pauses. Likewise, ratings were highest for the baseline (no pause) stimuli and decreased as pause length increased. Across all conditions, ratings for the male speaker were rated slightly greater than that of the female speaker. Results of this study provide preliminary evidence that longer speech pause, especially found within utterance, affect the likability and communication effectiveness of PWA. It is hoped that additional research regarding speech pause will be conducted to determine how best to assess speech pause in PWA.

Keywords: aphasia, speech pause, prosody, speech tempo, speaker likability

ACKNOWLEDGMENTS

I would like to express my appreciation for all the support and assistance I have had throughout the course of this project. I would firstly like to thank my committee chair, Dr. Nissen, for his mentorship, direction, and positive outlook throughout the process and completion of this study. I would also like to thank my committee chair members, Dr. Cabbage and Dr. Harmon, for their valuable input and feedback. Lastly, I would like to thank my friends and family for their constant support and encouragement.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

DESCRIPTION OF THESIS STRUCTURE AND CONTENT

This thesis, *The Impact of Speech Pause on the Perceived Effectiveness and Likability of a Speaker's Communication,* is part of a larger study exploring the impact of pause on speech communication in people with aphasia. Portions of this thesis may be submitted for publication, with the thesis author being included in the list of contributing coauthors. An annotated bibliography is provided in Appendix A, and the consent form used in this study is provided in Appendix B.

Introduction

Effective speech includes much more than just the words we say. Consider how much can be communicated with added emphasis, a speaker's tone of voice, or even silence. These unassumingly important prosodic aspects of speech can convey affective, contextual, and syntactic information. Prosodic features are defined as elements of language represented by pitch, loudness, and tempo. At times, the word "prosody" has been used synonymously with the word "suprasegmentals." However, because these elements are an inherent part of speech production, this term can be misrepresentative (Clark et al., 2007). Typical speakers use pitch, loudness, and tempo to effectively communicate their message, in the same way they use segmental aspects of speech. For instance, differences in pitch at the end of a sentence can mark either the intonation of a question or a statement, loudness may communicate stress to highlight a specific word in an utterance, and tempo can be expressed through the use of pauses in speech to mark syntactic boundaries or to create emphasis. Since pitch, loudness, and tempo play a crucial role in communicative effectiveness, impairments in the use of these prosodic aspects may compromise the overall communicative effectiveness of a speaker's message.

Patterns of Communicative Pause in Typical Speakers

Tempo can be defined as all prosodic aspects that influence the cadence and rhythmic patterns of speech. Three prosodic patterns that influence a speaker's speech tempo are segmental duration, speaking rate, and communicative pause (Shriberg et al., 2003). Communicative pause can include both filled and unfilled pauses. Filled pauses include spoken sounds or words that fill a break in connected speech or provide the speaker time to formulate an upcoming word or phrase, while unfilled pauses include segments of silence (Angelopoulou et al., 2018). The efficient or impaired use of both types of pauses can impact a speaker's communicative effectiveness.

For the purposes of this paper, the term "pause" will be used to refer to communicative unfilled periods of silence of an extended length. It is important to recognize that researchers have yet to universally agree upon the quantitative value of what "extended length" of pause refers. One textbook defines communicative pause as "any silence that is at least 200 milliseconds" (Shriberg et al., 2003). However, in a research study regarding length and syntactic location of speech pause by Goldman-Eisler (1972), a fluent transition was considered to be 0-500 ms in duration, and speech pause was defined as any duration longer than 500 milliseconds (ms). Another study by Campione and Veronis (2002), defined a brief pause as any silence less than 200 ms. They considered long pauses to be greater than 2000 ms and found that these only appeared only in spontaneous speech. Despite differing definitions regarding the length of a typical pause, it is recognized that typical speakers use speech pause according to predictable patterns.

At first, it may seem unusual to think that unfilled pauses or silence can impact the way that we communicate. However, with a closer look, speech pause can serve several different functions in communication, such as (a) creating anticipation for the communicative listener, (b) conveying hesitation, (c) denoting cognitive load, or (d) marking syntactic boundaries (Oomen & Postma, 2001; Shriberg et al., 2003).

First, creating a sense of anticipation for the listener can be created by pausing before a word or sentence to express emphasis of a particular message to the listener. For example, if you are saying, "To the people of this nation, thank you," you might insert a pause before the phrase "thank you" in order to emphasize your genuine gratitude. One research study focused on the pause patterns of the well-known speaker, former President Barack Obama. In this study, researchers found that President Obama regularly used pause to create a dramatic effect in his discourse, by pausing for as long as 2.5 seconds (s) before certain phrases (O'Connell et al., 2010). A different research study also about President Obama found that up to 30-40% of the duration of his speeches were filled with pauses that had the purpose of creating a sense of anticipation is his audience (Ichizaki, 2016).

Second, pause can be used to convey hesitation or thoughtfulness. For instance, if a speaker asked someone to do a favor for them and they pause for a long time before responding, it may convey hesitation in their willingness or ability to fulfill the speaker's request. One research study looked at how length of pause following a proposition or request determined perceived willingness to fulfill the request. Results showed that a pause of 600 ms or longer following a request resulted in a negative rating from the listeners (Roberts & Francis, 2013). Speech pause has also been found to represent thoughtfulness and the careful crafting of words or phrases. In a research article concerning motivational interviews (MI), 74% of MI practitioners reported deliberate insertion of pauses after their clients had spoken to allow time for any further thoughts, and to allow time for the MIs to gather their own thoughts and decide how to respond (Carr & Smith, 2014).

Third, a speaker's pause may also result from a relatively high cognitive load when expressing a message (Carr & Smith, 2014). Cognitive load refers to one's cognitive capacity related to their working memory, and the mental effort required to perform well as the capacity is allocated amongst different tasks (Kirschner, 2002). One research study indicated that 14 of 18 subjects that were assigned to read aloud while multitasking (reading while exploring a sand-paper figure with one of their hands) had significantly more pauses in their speech as compared to the group who were reading without multitasking (Oomen & Postma, 2001). Another research study showed that if speakers are talking in their second language, they will pause more frequently and in inappropriate places, compared to native speakers, as they plan words or segments of speech (Bilá & Džambová, 2011).

Fourth, typical communicative pause can also be used to mark syntactic boundaries in speech. Yang (2004) studied how pause length and frequency may vary depending on syntactical sentence markers such as commas (for within utterances) or phrase boundaries (for between utterances). Specifically, the author found that pauses between sentences are around 460 ms, whereas pauses between phrases and clauses were shorter, around 350 ms. In this same study, Yang found that 60 - 88% of pauses by typical speakers marked a boundary, or an end of a phrase. This range depended on the type of speech that the sample came from, with narrative samples containing the highest number of phrases that contained a boundary-marking pause. Yang also researched the typical rate of pause by using speech samples from a variety of venues including TV interviews, a news interview, and a single speaker radio story. Yang discovered that, on average, pauses that marked syntactic boundaries lasted about one second, while pauses that did not mark syntactic boundaries lasted around 500 ms. A similar study by Goldman-Eisler (1972) showed that 77.9% of spontaneous sentences were divided by a pause longer than 500 ms, while 66.3% of pauses found between clauses within sentences were less than 500 ms. Typical speech pauses that mark syntactic boundaries are so consistent that one research study found that 64% of pause time could be predicted in an oral speech based on syntactic analysis (Brown & Miron, 1971).

Patterns of Communicative Pause in Speakers With Neurological Impairment

Considering that pause serves several different functions in typical communication, it is important to recognize that likewise the disordered use of pause can greatly impair an individual's communicative effectiveness. If pauses within a speaker's expressions are either too long or too short, they may be perceived as distracting, confusing, or rude to the listener (Roberts & Francis, 2013). Such pause impairments can be a result of the lack of development but are often caused by acquired neurological damage. Pause has been found to be affected in a variety of neurological disorders such as Parkinson's Disease (Smith & Caplan, 2018), Multiple Sclerosis (Feenaughty et al., 2021), Cerebral Palsy (Darling-White et al., 2018), and Huntington's disease (Saldert et al., 2010).

Although disordered pause can result from a variety of different neurologic etiologies, one highly effected population is persons with aphasia (PWA; Hird & Kirsner, 2010). One research study compared the pause patterns between PWA who also had apraxia of speech (AOS), PWA, and neurotypical individuals. It was found that during a single task condition, PWA with AOS had a mean pause time of 36%, PWA had a mean pause time of 40%, and the control group had a mean pause time of only 20%. This shows that overall, PWA pause much more than healthy, neurotypical individuals (Harmon et al., 2019).

Aphasia is an acquired communication disorder caused by brain damage, characterized by an impairment of language modalities, and is not a sensory or intellectual deficit (Hallowell, 2017). There are differing types of aphasia that are broadly characterized by the individual's speech output ability, which may be categorized into fluent and non-fluent subtypes. In general, those with fluent types of aphasia will have more copious amounts of continuous speech that include semantic inconsistencies, paraphasias, and an increase in the amount of empty speech

(Vigliecca, 2019). Non-fluent subtypes of aphasia will often be characterized by effortful, halting speech, with speech pauses of increased length and frequency. Speech for individuals with non-fluent aphasia will also have disordered pitch contours, disordered grammar, and reduced speech output (Patterson et al., 2006).

Pauses for persons with non-fluent aphasia can happen both within utterances and between utterances. Angelopoulou et al. (2018) investigated speech pause distribution, duration, and rate among individuals with aphasia and how they compare to speech pause patterns in healthy individuals. Results for healthy individuals complemented results from other studies discussed previously (Yang, 2004), indicating that the majority of short pauses were found within utterances, while majority of long pauses were found between utterances. However, for PWA, results revealed that more short pauses within utterances were produced overall. In addition, PWA produced significantly more long pauses both between and within utterances. Thomas (2021) similarly found that persons with non-fluent aphasia produce longer pauses in both within utterances and between utterances than those with fluent aphasia. In the same study, results indicated that for within utterances, people with non-fluent aphasia produced pauses longer than 1,000 ms, while people with fluent aphasia had the highest proportion of pauses shorter than 250 ms.

Clinical Assessment of Speech Pause in Persons With Aphasia

In order to assess communication in PWA, Speech language pathologists (SLPs) use a variety of formal and informal assessment batteries (Verna et al., 2009). Informal assessments often rely on a clinician's knowledge and experience assisting PWA, whereas formal or standardized assessments are helpful in quantifying results, measuring treatment progress, and eliminating clinician bias in assessment. Although tests such as the Western Aphasia Battery

(WAB; Kertesz & Raven, 2007), the Boston Diagnostic Aphasia Examination (BDAE; Roth, 2011), the Ross Information Processing Assessment (RIPA-2; Ross-Swain, 1996), the Quick Aphasia Battery (QAB; Wilson et al., 2018), and the Cognitive Linguistic Quick Test (CLQT; Helm-Estabrooks, 2001) have been developed to evaluate the fluency and effectiveness of speech in PWA. Currently, there are no standardized assessments which directly measures the impact of atypical patterns of speech pause in PWA.

The WAB, a commonly used test to assess the communication abilities of PWA, indirectly measures patterns of speech pause through a descriptive scale used to measure speech fluency. This scale includes descriptions for the clinician to use such as, "halting speech," "some hesitations," "effortful," "word-finding difficulties," and so forth. However, the test battery does not quantitatively measure the length or frequency of pause, nor does it interpret how patterns of atypical pause might perceptually impact the communicative effectiveness of a speaker's intended message.

The BDAE is another commonly used test for PWA. The BDAE includes several subtests that assess domains of speech and language, such as conversational and expository speech, oral expression, and auditory comprehension. Speech pause is indirectly scored in the conversational and expository subtest using an "Aphasia Severity Rating Scale", which contains descriptive categories such as "fragmentary expression" or the "loss of fluency in speech." In addition, in the Auditory Comprehension subtest, the administrator of the test is instructed to differentially score individual's responses by the length of delay. If a PWAs response is within five seconds, the score is 1, whereas if the response is more than five seconds, the score is .5 points.

The RIPA-2 is another test created to evaluate the memory, orientation, and communication in PWA due to brain injuries. This test is scored in a way that provides the administrator the ability to add “diacritical scores” to an individual’s responses. One of these diacritic markers note if a patient’s speech is “delayed”, either by a filled or un-filled pause. This measurement is limited however, considering it is only evaluating pauses that come before an utterance, and there is no guidance for what constitutes a delay nor a place to quantify the length of delay.

The CLQT is an assessment for patients with neurological dysfunction that assesses attention, memory, executive functioning, language, and visuospatial awareness. The scoring section in the CLQT includes an area to describe the patient’s answer, much like the RIPA-2. However, the CLQT is more specific in the delayed description, as it is only counted to be a delay if it is more than five s. Although this is more of a standardized description, there is no part of this test that measures a pause that is mid-utterance.

The QAB is a test that is designed for PWA and is made to be a short assessment, around 15 minutes. In this test, the scoring for question responses is based on correctness of the answer, a delay of more than three seconds, and self-correction. The scoring also explains that if the delay is more than six seconds, the administrator should count the answer as incorrect. These are the only part of the assessment that accounts for any kind of pause.

The CLQT and the QAB are two assessments that get closer to quantifying pause. The CLQT has a spot to score response to questions that marks if they take five or more seconds to respond (this is called a “five second delay”). Similarly, the QAB has a way to score where the clinician gives the client six seconds to respond. If they respond after three seconds, the answer is marked as delayed, and the client is given partial credit.

Although the CLQT and the QAB get closer to quantifying pause, there are still several gaps in the assessment of pause in these assessments. The CLQT and the QAB only test before sentence pauses and limit the pausing to be at a specific amount of time. The times of pause in the tests (five seconds or three seconds) are ambiguous and it is unclear as to why these lengths of pause were chosen. For example, it is unclear whether a three or a five second pause makes a significant difference in communicative effectiveness.

None of the above-mentioned assessments have research-backed reasons for their methods of assessing atypical pause. As discussed earlier, atypical pause influences communicative effectiveness, especially when the pause is incorrectly placed or too long. It would be advantageous to discover which lengths and locations of pause most negatively affect communication to better understand how atypical pause may affect the communication of PWA.

Purpose of This Study

In order to further quantify the impact atypical pause may have on the communication effectiveness, and provide data that may assist clinicians in their assessment and treatment of speech in PWA, this study will examine the following research questions:

1. How does the length and location (within or between utterance) of pause affect the communicative effectiveness of the speaker?
   It is expected that listener ratings for communication effectiveness will significantly decrease as pause length increases.
2. Does the perceived likability of the speaker change as a function of the length and location of speech pause?
   We hypothesize that listener ratings for likability will significantly decrease as pause length increases.
3. Does the communicative effectiveness and likability of the speaker differ depending on the gender of the speaker?

It is expected that the communicative effectiveness and likability ratings of the speakers will have no significant difference based on gender.

Methods

Participants

Forty-one adult (31 females and 10 males) speakers of American English were recruited to participate as listeners in the study. Participants exhibited typical hearing at the time of data collection as measured by a pure tone hearing screening with threshold levels of 25 dB at 500 Hz, 1 kHz, 2 kHz, 4 kHz, and 8 kHz. Ages of the listeners participating in the study ranged from 19 to 56 years of age. Individuals younger than 18 years of age were excluded from the study due to the possible continuing development of their speech and language, whereas older individuals over the age of 65 were excluded due to the increased incidence of hearing impairment within this age group. Participants read and signed an informed consent form required by the university's Institutional Review Board. Listeners were given monetary compensation ($10 of cash) for their time.

Stimuli

This study used simulated responses from two commonly used assessments for aphasia, the BDAE and the WAB, to examine the perceptual impact of speech pause on communication. Specifically, four baseline responses were recorded using two picture description tasks, both answered by the two speakers. The baseline responses for each elicitation task were initially recorded by a neurotypical female speaker, and a neurotypical male speaker, both above the age of 75 years. Neither speaker had history of speech or hearing impairment. To help focus the listeners' attention on the impact of extended pauses on communicative effectiveness, the baseline responses recorded by the neurotypical speakers did not contain other speech impairments common in aphasic speech (e.g., dysprosody, agrammatism, fillers).

Responses to the picture description tasks from both the WAB and the BDAE were in response to the instruction to “tell me what is happening in this picture.” The picture from the BDAE involves a scene in the kitchen in which a mother is washing dishes and several children are eating cookies. The picture from the WAB is an outside scene of a couple having a picnic and several young children playing on the beach, with a fisherman catching a fish from a pier in the background. Participant responses to each of the description tasks is listed below.

BDAE Indoor Scene

Male Response: *I see a young boy standing on a stool that is tipping precariously. He is reaching up into the cookie jar on a shelf in the cupboard. And it’s probably his sister that is, uh, receiving a cookie out of his hand as she’s got her arm extending looking up at him very appreciatively. Through the open window I see an outside scene with a tree and lattice work.*

Female Response: *It looks like the mother is uh washing dishes however the water in the sink is overflowing and getting onto the floor. Meanwhile, a little boy is up on a stool, which he’s falling off of and getting in the cookie jar and handing some cookies down to his sister. You want me to describe… She’s looking out the window and there’s a pathway and another house nearby with grass and trees.*

WAB Outdoor Scene

Male Response: *A couple uh sitting on a blanket with a picnic hamper. The fellow is uh studiously reading his book. His sandals are off his feet, he looks relaxed. His companion* *is pouring a glass of uh Kool-Aid. And she's kneeling down listening to the radio, probably playing some neat music. Off to the right I see a young boy.*

Female Response: *It looks like a lake and there's a girl who's making a sandcastle. She's got a pail and a shovel next to her. And beyond that there's a dock and there's a guy on the dock and he's fishing, and he's caught a fish! And there's a sailboat out there and a couple of people are on the sailboat and their sail says 470. And then back on the shore there's a nice house with a car in the driveway.*

Response Pause Recording and Editing

The "baseline" recordings of the simulated responses for each task were recorded using a Blue Yeti USB microphone. The recordings were saved as .wav files at a sampling rate of 44.1 kHZ and a quantization of 24 bits. The four response recordings were then modified using Adobe Audition editing software to remove natural extended pauses. The baseline recordings were then edited again to include artificial extended pauses of three, five, and seven seconds both between and within utterance types. The study by Price (2021), evaluated listener's perceptions of communicative effectiveness and likability of shorter pause lengths between 250 ms and one second. Thus, this study seeks to extend our understanding regarding the perceptual impact of longer lengths of pause (three, five, and seven seconds). In addition, these longer durations of pause more closely align with the lengths of pause used in standardized aphasia assessments (i.e., BDAE, ClQT, QAB). Including the baseline production for each set of stimuli, this process resulted in 28 different stimuli for the listeners to rate (two responses x two speakers x three extended pause durations x two utterance types + four baseline recordings).

The between-utterance stimuli were created by adding the different extended pause lengths at the approximate beginning, middle, and end of each simulated response, as shown in the following example. To control the overall duration of the speech samples presented to listeners, only a portion of the picture description response was used for each speaker.

> *I see a young boy standing on a stool that is tipping precariously.* ***[inserted pause]*** *He is reaching up into the cookie jar on a shelf in the cupboard.* ***[inserted pause]*** *And it's probably his sister that is uh receiving a cookie out of his hand as she's got her arm extending looking up at him very appreciatively.* ***[inserted pause]*** *Through the open window I see an outside scene with a tree and lattice work.*

The within-utterance stimuli were created by adding the different extended pause lengths within the second, fourth, and sixth sentences within the approximate middle of each simulated response. An example is shown below:

> *I see a young boy standing on a* ***[inserted pause]*** *stool that is tipping precariously. He is reaching up into the* ***[inserted pause]*** *cookie jar on a shelf in the cupboard. And it's probably his sister that is uh receiving a cookie out of his hand as she's got her arm extending looking up at him very appreciatively. Through the open window* ***[inserted pause]*** *I see an outside scene with a tree and lattice work.*

Procedures

The data were collected in one 30-minute session. The study was conducted in an empty, quiet room using a pair of open ear headphones (Sennheiser 650 HD). Participants began by completing a short training which included a standardized explanation of the study along with directions of how to participate. Participants then began listening to and rating the stimuli.

The set of 28 baseline and modified stimuli were randomly presented to the listeners. Each stimulus presentation was prompted by a mouse click, after which the listener was instructed to rate the communicative effectiveness of the speaker on a visual analog scale of 0 -

100, as shown in Figure 1. The top of the visual analog scale was marked by five descriptive points of reference (i.e., "Very Poor," "Poor," "Average," "Good," and "Very Good"). Listener ratings to each simulated response were automatically saved and exported to an Excel spreadsheet by a custom-written software program for further analysis.

Statistical Analysis

A mixed-model repeated measure analysis of variance (ANOVA) was used to analyze the listener rating data as a function of the length of the extended pauses, and the type of utterance pause (within, between). The dependent variables being measured are the scaled listener ratings of communication effectiveness and likability. Descriptive statistics of mean, standard deviation, and range were reported for the dependent variables. The ANOVA results also include a measure of effect size.

Measurement Reliability

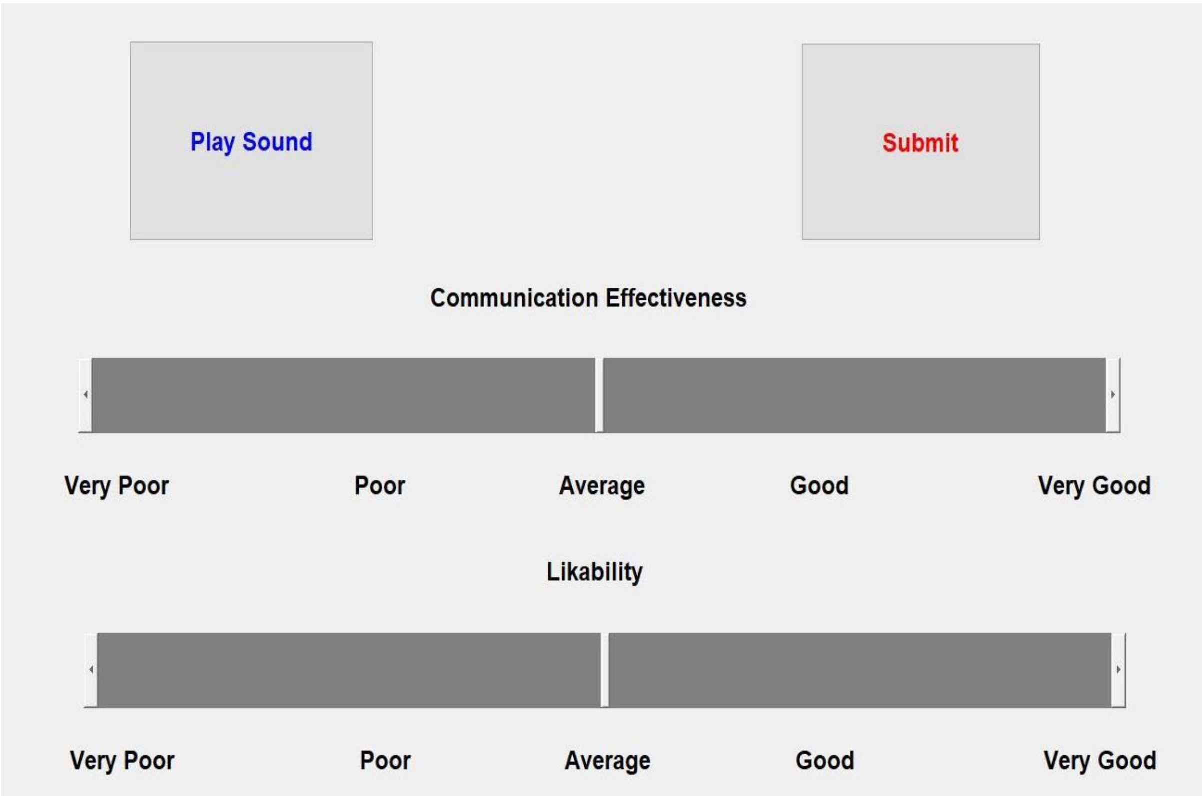
To examine reliability of listener ratings, 15% of the stimuli were randomly rated a second time by each participant. For communicative effectiveness, the first and second sets of ratings had a Pearson correlation of $r = .69$, $p < .001$, with a mean intra-rater absolute difference of 23.3 on a scale of 0 – 100. For likability, the sets of ratings were correlated at $r = .70$, $p < .001$, with a mean intra-rater absolute difference of 23.4 on a scale of 0 – 100. Two listeners exhibited mean differences above 50 for both rating scales.

Results

The mean listener ratings and standard deviations for each speaker's communicative effectiveness and associated likability are described as a function of speaker gender, pause duration, and pause duration in the following section. The modified speech samples are also compared to the unedited samples, which serve as the baseline or control condition for the study.

Figure 1

Visual Analog Scale Used by Listeners to Submit Perceptual Ratings



Communicative Effectiveness

Speaker Gender

Listener ratings for communicative effectiveness were found to differ significantly as a function of the speaker's gender, $F(1,40) = 4.88$, $p = 0.03$, $\eta^2_p = .11$. Across all conditions ratings for the male speaker ($M = 60.04$) were rated somewhat higher than that of the female speaker ($M = 55.6$). Although the listener ratings were statistically significant between the two speakers, the patterns of differences between the baseline condition and the different types of inserted pauses were similar. A detailed listing of the communicative effectiveness ratings for the female and male speaker stimuli can be found in Tables 1 and 2, respectively.

Table 1

Ratings of Communicative Effectiveness and Likability Across Pause Position and Pause Duration for the Male Speaker

Pause Position	Pause Duration	Communicative Effectiveness[b]		Likability[b]	
		Mean	*SD*	Mean	*SD*
Between Utterance	3 seconds	57.88	8.18	56.02	15.11
	5 seconds	56.39	40.61	52.06	23.22
	7 seconds	49.48	16.56	49.07	8.83
Within Utterance	3 seconds	49.34	8.18	49.79	15.11
	5 seconds	49.51	40.61	49.44	23.22
	7 seconds	46.93	16.56	47.23	8.83
Baseline[a]	n/a	76.92	8.18	72.45	15.11

Note. [a] Pause durations varied according to each speaker's natural speech patterns; [b] calculated on a 0 – 100 scale.

Pause Duration and Location

The ANOVA also indicated a significant difference in the listener ratings of communicative effectiveness across pause duration, $F(2,80) = 18.42$, $p < 001$, $\eta^2_p = .32$ and as a function of the pause location, $F(2,80) = 76.00$, $p < 001$, $\eta^2_p = .66$. An associated interaction between pause duration and the location was also found to be significant, $F(4,160) = 9.33$, $p < .001$, $\eta^2_p = .19$. As shown in Figure 2, when collapsed across speaker, the mean listener ratings for communication effectiveness decreased as pause duration increased. Pairwise comparisons found significant differences between each of the pause durations (three, five, and seven seconds), as well as the baseline condition. In addition, it was observed that mean listener ratings across each duration were consistently lower for within-utterance pauses as compared to between-utterance pauses.

Table 2

Ratings of Communicative Effectiveness and Likability Across Pause Position and Pause Duration for the Female Speaker

Pause Position	Pause Duration	Communicative Effectiveness[b]		Likability[b]	
		Mean	*SD*	Mean	*SD*
Between Utterance	3 seconds	56.55	8.18	52.67	15.11
	5 seconds	52.56	40.61	49.57	23.22
	7 seconds	46.81	16.56	46.02	8.83
Within Utterance	3 seconds	49.97	8.18	48.79	15.11
	5 seconds	43.96	40.61	43.62	23.22
	7 seconds	43.74	16.56	40.47	8.83
Baseline[a]	n/a	71.72	8.18	67.04	15.11

Note. [a] Pause durations varied according to each speaker's natural speech patterns; [b] calculated on a 0 – 100 scale.

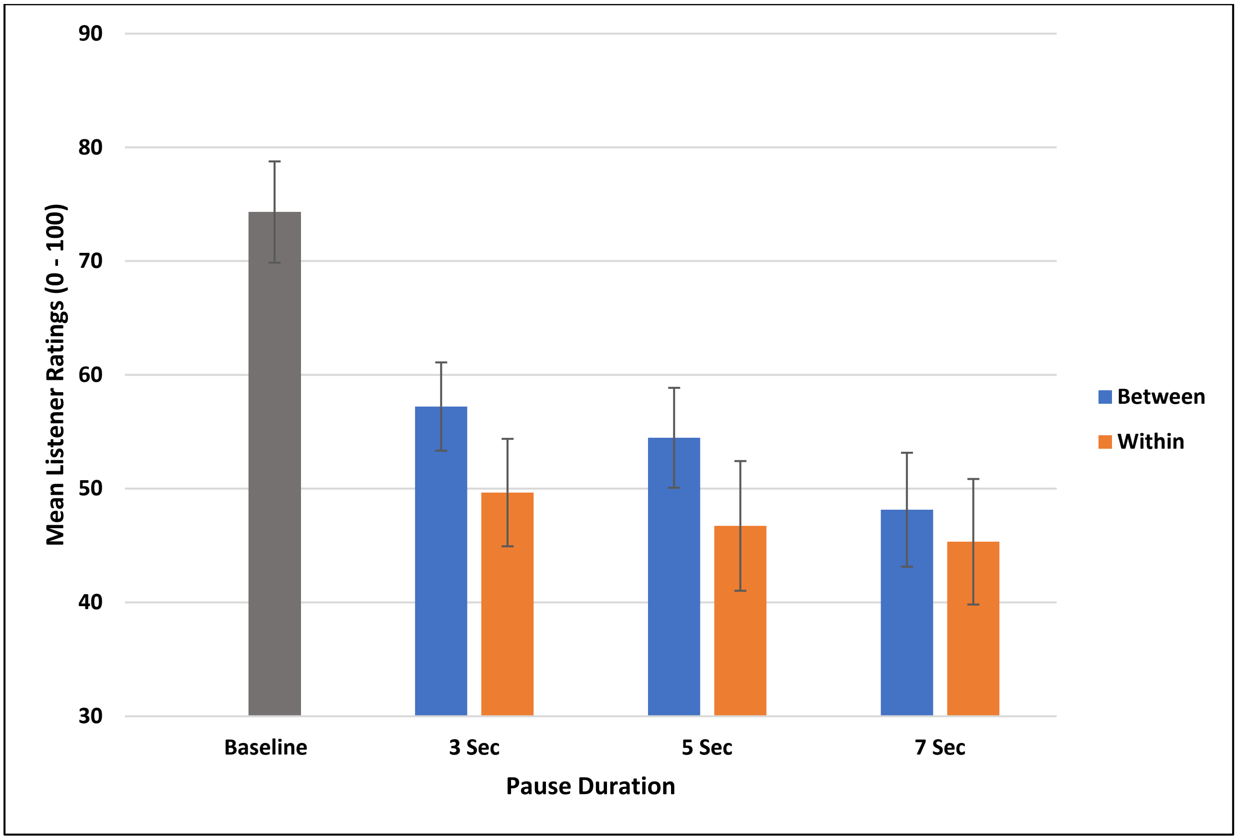
Likability

Speaker Gender

Listener ratings for likability were found to differ significantly as a function of the speaker's gender, $F(1,40) = 4.09$, $p = 0.05$, $\eta^2_p = .09$. Across all conditions ratings for the male speaker ($M = 23.5$) were rated slightly greater than that of the female speaker ($M = 27.7$). While the listener ratings were statistically significant between the two speakers, the patterns of differences between the baseline condition and the different types of inserted pauses were similar. A thorough listing of the likability ratings for the female and male speaker stimuli can be found in Tables 1 and 2, respectively.

Figure 2

Mean Ratings of Communicative Effectiveness as a Function of Pause Position and Pause Duration

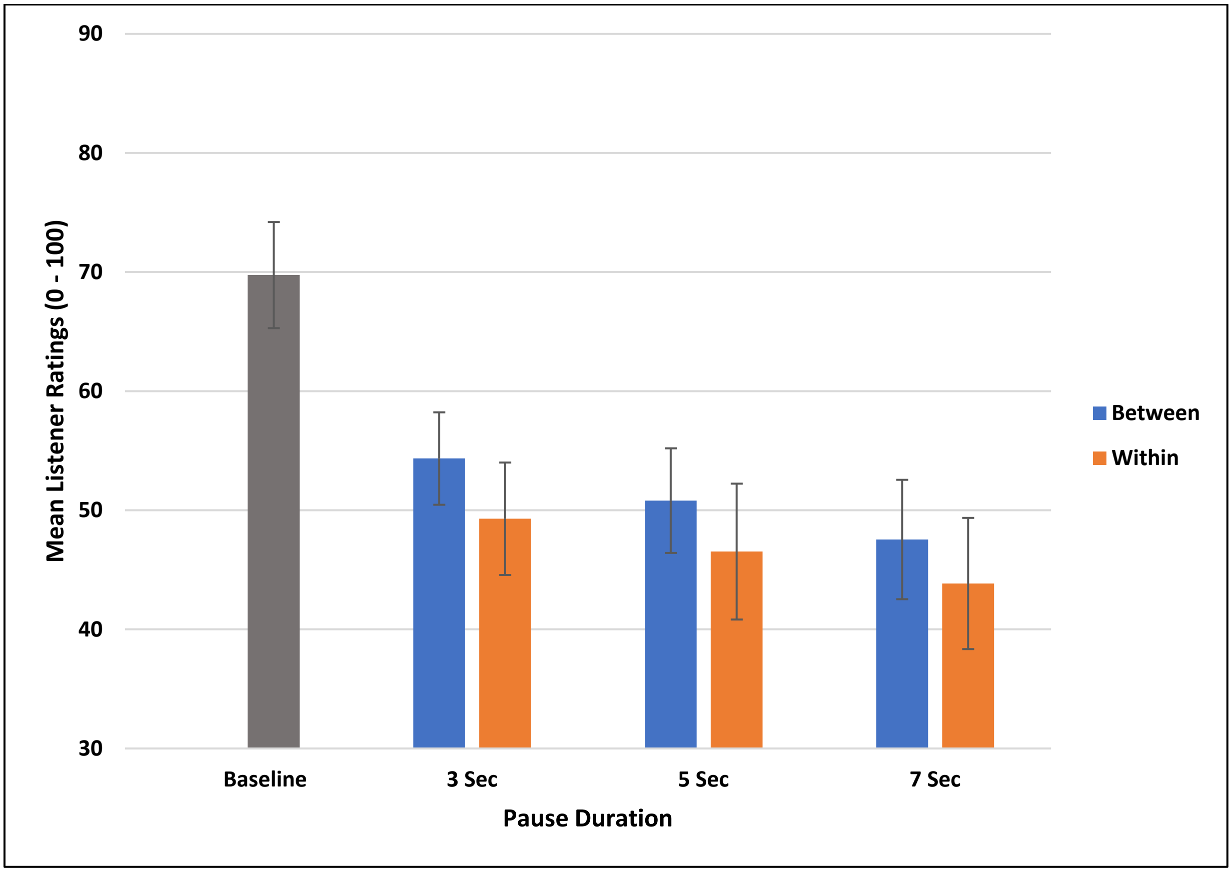


Pause Duration and Location

ANOVA also revealed a significant difference in the listener ratings of likability across pause duration, $F(2,80) = 18.39$, $p < 001$, $\eta^2_p = .32$ and as a function of the pause location, $F(2,80) = 66.33$, $p < 001$, $\eta^2_p = .62$. An associated interaction between pause duration and the location was also found to be significant, $F(4,160) = 6.63$, $p < .001$, $\eta^2_p = .14$. As shown in Figure 3, when collapsed across speaker, the mean listener ratings for likability decreased as pause duration increased. Pairwise comparisons indicated significant differences between each of the pause durations (three, five, and seven seconds), as well as the baseline condition. Furthermore, it was discovered that mean listener ratings across each duration were lower for within-utterance pauses as compared to between-utterance pauses.

Figure 3

Mean Ratings of Speech Likability as a Function of Pause Position and Pause Duration



Discussion

The purpose of this study was to provide empirical data about the perceptual implications of extended unfilled pauses within and between a speaker's utterances. The study examined how speaker gender, and the duration and location of a speech pause might influence a listener's perception of a speaker's communicative effectiveness and likability. The underlying rationale for this study is to provide data that a SLP might use to more accurately assess how impaired pause patterns in PWA might affect their communication and personal relationships.

As expected, this study showed that the difference of listener's ratings between speaker gender were not clinically significant. Although ratings were slightly greater for the male speaker than the female speaker across all conditions, the patterns of differences between the baseline condition and the different types of inserted pauses were similar. This may mean that the reasons the male speaker was rated slightly higher were due to other factors other than speech pause. These reasons could include the difference of suprasegmentals of the male and female speaker such as intonation, tone, or pitch. Furthermore, it may include the difference of semantics or use of syntax that each speakers used. However, despite the ratings being slightly higher for the male speaker under all conditions, the pattern of ratings for length and location of speech pause were consistent between speaker gender. This further validates the overarching finding of this study that communication effectiveness and likability decrease as pause length increases, and when located within utterances.

The length and location of the modified pauses had a significant impact on the listeners' perception of communicative effectiveness. As could be expected, results of the study revealed that listeners rated communication effectiveness highest for the baseline condition which contained no pauses. Furthermore, listeners' ratings decreased as pause length increased. These results seem to indicate that listener's perceptions of communication effectiveness worsen as speech pause length increases, whether the pause is found within or between utterances. However, the findings indicate that there were significantly lower ratings for all pauses that occurred within utterances. This finding suggests that pauses within utterances most negatively affect how listeners perceive a PWA's communication effectiveness, and that pauses between utterances only mildly affect ratings. However, additional data regarding lexical location of a pause would be beneficial to know where within an utterance most negatively affects communication effectiveness ratings.

This finding supports the claims of Collard et al. (2008) who found that filled pauses distract the listener's from understanding the entire message of the speaker. Although Collard et al.'s findings focused on the retention of the message received by the listener, his findings support the current study as retention is related to communication effectiveness. If there are more pauses, the listener won't retain as much of the message, and therefore the communication is less effective. Another study by Gayraud et al. (2011) found that, when compared with neurotypical speakers, persons with Alzheimer's Disease (AD) are more likely to have silent pauses in non-syntactic boundaries. Although the study by Gayraud et al. (2011) regards pause patterns for persons with AD, his study supports the current study as the findings of both show that pauses in non-syntactic boundaries are the most negative to communication effectiveness. Furthermore, these studies suggest that neurological deficits, as found in AD or aphasia, may create disordered changes in use of pause compared to healthy individuals.

The underlying rationale for this study was to understand how disordered pause in PWA can better be assessed by communication specialists. The results of this study show that although there is a steady decline in ratings as pause length increases, there is no marked decrease in ratings going from three seconds to five seconds to seven seconds. Future studies might investigate at what length of pause is there a marked decrease in ratings. Nonetheless, the current study provides clinical insights regarding the administration of picture description tasks by showing that even a three second pause consistently impacts both the perceived likability and communication effectiveness of listeners. Furthermore, as mentioned previously, this study suggests that within sentence pauses have a more negative perceptual impact on listeners than between sentence pauses. This is clinically relevant because no current aphasia assessments assess the length of pause within sentences. The CLQT and the QAB measure and rate patients on pauses that happen before answers, but not the pauses that occur within running speech. This finding may suggest that in future formal or informal aphasia assessments, it may be beneficial to include scores that correspond to pauses longer than three seconds that occur within sentences.

Another aim of this study was to examine how listeners perceive the likability of speech with differing lengths of speech pause for both within and between utterances. Results of the current study revealed that listeners rated likability in the same pattern that communication effectiveness was rated—the baseline condition which contained no pauses was rated the highest and listeners' ratings of likability decreased as pause length increased. Furthermore, results of this study revealed that likability was rated significantly lower for within-utterance pauses as compared to between utterance pauses. Considering the similar rating patterns of communication effectiveness and likability, this may imply that the better the communication effectiveness is, the more likable the speaker is. Inversely, the poorer the communication effectiveness, the less likable the speaker is. The difference in likability ratings for between-utterance pause and within-utterance pause was around five points lower for within-utterance pauses. This result may suggest that clinicians should be more concerned with within-utterance pauses, since it may affect the perceived likability more significantly.

The findings about speech pause and likability from the current study are supported by another study by Lay and Burron (1968) who found that listeners used more positive words when describing speech with no hesitations or pauses. Another study by Harmon et al. (2015) found that the least fluent group (aphasic speech) was on average rated the lowest across nine Likert scales pertaining to the likability of the speech. The same study found that the neurotypical group's speech was rated the highest for likability. This finding supports the current study as it also found that higher amounts of pause correlate to lower ratings of likability for the listener. Likability of communication style is a clinically important measurement because it relates to social and emotional implications for PWA. The ultimate goal for all PWA is to improve their quality of life which often revolves around their personal relationships. In one qualitative study by Hallé et al. (2010), relationship changes were studied between daughters who had aphasic mothers due to strokes. Results consistently showed that when daughters perceived the communication to be difficult with their mother, they felt limited in the means they had to improve their relationship with their mothers (Hallé et al., 2010). Therefore, it is crucial to consider how the listeners' perceived likability affects PWA, and how this may also affect their relationships and emotions.

The results of this study revealed a significant interaction between the location of a speech pause and the length of the pause duration. Longer durations had a greater impact on pauses occurring between utterances, compared to pauses occurring between utterances. This finding may indicate that a shorter pause length (three seconds) more markedly affects within utterances pauses, while a longer pause length (seven seconds) continues to have a more marked effect on between utterances. This is clinically relevant because it may suggest that although within utterances are rated lower by listeners, there is still a threshold to how long syntactically appropriate pauses (such as a between utterance pause) are perceived as part of typical communication.

Limitations and Future Research

There are a number of limitations involved in the current study. Although the data in the current study trended in the way we thought it would and it was statistically significant, we thought that the results would be more marked. This tells us that the differences in listener ratings may have been smaller, however they were very consistent across all listeners.

One limitation could be how the length and repetitive nature of the study impacted listeners' attention to the perceptual task. Although this is the nature of many research studies, this may have had an effect on the attention and effort the subjects put forth into the ratings. This in turn may have impacted the intra-rater reliability. In the statistical analysis of the results, it was found that two listeners exhibited mean differences of over 50% in their responses. For the current study, the average intra-rater reliability was 23% for both communication effectiveness and likability. The two listeners that were above 50% intra-rater reliability may have skewed the overall intra-rather reliability of results. In order to avoid this, future studies may want to establish a reliability criteria in which to include a subject's data.

The speakers in this study self-reported that they were neurotypical. Although it was not suspected that either of the speakers in this study exhibited cognitive or communicative impairment, it may be valuable in future research to evaluate the speaker's status using a formal cognitive screening or assessment.

Another limitation of the current study may be the imbalance in the number of listeners who identified as male or female. Thereby allowing statistical examination of the role that listener gender may play in their listener ratings of extended pausing. In addition, it may be appropriate for future studies to evaluate speech samples from a larger group of male and female speakers of varying ages. A larger number of speakers may also help control for listener bias toward individual speech and voice characteristics, such as vocabulary usage, voice timbre, speech rate, or overall speaking fundamental frequency (F0). For instance, the mean F0 of the speech samples used in the current study was 145 Hz (SD = 23.5 Hz) for the male speaker and 166 Hz (SD = 39.17) for the female speaker. The F0 for the female speaker is slightly lower than what is generally expected for a female voice. Having listeners evaluate speech samples from a number of different male and female speakers would limit a bias toward a particular speech or voice characteristic.

Future studies should also attempt to randomize the order of the rating scale that goes from "very poor" to "very good" (see Figure 3). In the current study, this rating scale always popped up in the same order, with "very poor" on the left and "very good" on the right. In a medical article by McManus (2009), we learn that 90% of humans are right-handed and only 10% are left-handed. For right-handed people, it is easier to pull a computer mouse to the right, which for this study correlated with the "very good" side of the scale. This may have been the reason for the less marked results that we found in the current study.

Another potential limitation is a negative avoidance effect that the participants may have felt during the study. Negative avoidance is the tendency that people have to rate in a positively skewed manner. For example, in a research study by Chevalier and Mayzlin (2006), it was found that on Amazon.com and BarnesandNoble.com, book reviews were overwhelmingly positive at both websites. This negative avoidance tendency may have played a role in the current study was participants may have felt reluctant to poorly rate a speaker. Negative avoidance could be a reason that the results were less marked than expected.

These methodological characteristics such as moving a computer mouse cross body, and having a bias toward positivity with regard to the speaker may have impacted the results of the current study. In order to control for the right handedness bias, future studies should use a matched control to flip the scale so that “very poor” and “very good” sides are on both the left and the right of the screen. In order to control for the negative avoidance, future studies should use buttons instead of a visual analogy scale. This would control for negative bias by forcing participants to choose between five discrete ratings.

Conclusion

Despite the limitations of the current study, this work provides preliminary insight into how differences in atypical speech pause, often found in the speech of PWA, might impact the communication effectiveness and perceived likability for these individuals. More specifically, it provides statistically significant data that pauses within utterances are less effective and less likable than pauses between utterances. Therefore, it may be beneficial for standardized aphasia assessments to clarify if pauses are happening between utterances or within utterances. In addition, it could be beneficial for speech-language pathologists to help PWA reduce pauses that happen within utterances.

Persons with aphasia present a vast array of speech and language deficits that can create obstacles for them as they work to improve their quality of life. The data collected in this study can help SLPs better provide PWA with strategies to improve their likability and communication effectiveness through decreasing pause duration, especially within utterances. It is hoped that as these factors improve, the quality of life for patients with aphasia will also improve.

References

Angelopoulou, G., Kasselimis, D., Makrydakis, G., Varkanitsa, M., Roussos, P., Goutsos, D., Evdokimidis, I., & Potagas, C. (2018). Silent pauses in aphasia. *Neuropsychologia*, *114*, 41-49. https://doi.org/10.1016/j.neuropsychologia.2018.04.006

Bilá, M., & Džambová, A. (2011). A preliminary study on the function of silent pauses in L1 and L2 speakers of English and German. *Brno Studies in English, 37*(1), 21-39. https://doi.org/10.5817/bse2011-1-2

Brown, E., & Miron, M. S. (1971). Lexical and syntactic predictors of the distribution of pause time in reading. *Journal of Verbal Learning and Verbal Behavior*, *10*(6), 658–667. https://doi.org/10.1016/s0022-5371(71)80072-5

Campione, E., & Veronis, J. (2002, April 11-13). *A large-scale multilingual study of silent pause duration* [Paper Presentation]. Speech Prosody 2002, Aix-en-Provence, France. https://www.isca-speech.org/archive/pdfs/speechprosody_2002/campione02_speechprosody.pdf

Carr, E. S., & Smith, Y. (2014). The poetics of therapeutic practice: Motivational interviewing and the powers of pause. *Culture, Medicine, and Psychiatry*, *38*(1), 83-114. https://doi.org/10.1007/s11013-013-9352-9

Chevalier, J. A., & Mayzlin, D. (2006). The effect of word of mouth on sales: Online book reviews. *Journal of Marketing Research*, *43*(3), 345-354. https://doi.org/10.1509/jmkr.43.3.345

Clark, J., Yallop, C., & Fletcher, J. (2007). *An introduction to phonetics and phonology* (3rd ed.). Blackwell Publishing.

Collard, P., Corley, M., MacGregor, L. J., & Donaldson, D. I. (2008). Attention orienting effects of hesitations in speech: Evidence from ERPs. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *34*(3), 696–702. https://doi.org/10.1037/0278-7393.34.3.696

Darling-White, M., Sakash, A., & Hustad, K. C. (2018). Characteristics of speech rate in children with cerebral palsy: A longitudinal study. *Journal of Speech, Language, and Hearing Research*, *61*(10), 2502-2515. https://doi.org/10.1044/2018_JSLHR-S-17-0003

Feenaughty, L., Guo, L., Weinstock-Guttman, B., Ray, M., Benedict, R., & Tjaden, K. (2021). Impact of cognitive impairment and dysarthria on spoken language in Multiple Sclerosis. *Journal of the International Neuropsychological Society, 27*(5), 450-460. https://doi.org/10.1017/S1355617720001113

Gayraud, F., Lee, H., & Barkat-Defradas, M. (2011). Syntactic and lexical context of pauses and hesitations in the discourse of Alzheimer patients and healthy elderly subjects. *Clinical Linguistics & Phonetics*, *25*(3), 198–209. https://doi.org/10.3109/02699206.2010.521612

Goldman-Eisler, F. (1972). Pauses, clauses, sentences. *Language and Speech*, *15*(2), 103–113. https://doi.org/10.1177/002383097201500201

Hallé, M. C., Duhamel, F., & Le Dorze, G. (2010). The daughter–mother relationship in the presence of Aphasia: How daughters view changes over the first year poststroke. *Qualitative Health Research*, *21*(4), 549-562. https://doi.org/10.1177/1049732310391274

Hallowell, B. (2017). *Aphasia and other acquired neurogenic language disorders: A guide for clinical excellence*. Plural Publishing.

Harmon, T. G., Jacks, A., & Haley, K. L. (2019). Speech fluency in acquired apraxia of speech during narrative discourse: Group comparisons and dual-task effects. *American Journal of Speech-Language Pathology*, *28*(2S), 905-914. https://doi.org/10.1044/2018_ajslp-msc18-18-0107

Harmon, T. G., Jacks, A., Haley, K. L., & Faldowski, R. A. (2015). Listener perceptions of simulated fluent speech in nonfluent aphasia. *Aphasiology*, *30*(8), 922-924. https://doi.org/10.1080/02687038.2015.1077925

Helm-Estabrooks, N. (2001) *Cognitive linguistic quick test: CLQT*. PsychCorp (Firm), & Pearson Education.

Hird, K., & Kirsner, K. (2010). Objective measurement of fluency in natural language production: A dynamic systems approach. *Journal of Neurolinguistics*, *23*(5), 518–530. https://doi.org/10.1016/j.jneuroling.2010.03.001

Ichizaki, K. (2016). オバマ大統領の発話分析—対話と演説—. *音声研究*, *20*(3), 1-12. https://doi.org/10.24467/onseikenkyu.20.3_1

Kertesz, A. & Raven, J. C. (2007). *The Western Aphasia Battery-Revised: WAB-R.* PsychCorp.

Kirschner, P. A. (2002). Cognitive load theory: Implications of cognitive load theory on the design of learning. *Learning and Instruction, 12*(1), 1-10. https://https://doi.org/10.1016/S0959-4752(01)00014-7

Lay, C. H., & Burron, B. F. (1968). Perception of the personality of the hesitant speaker. *Perceptual and Motor Skills*, *26*(3), 951-956. https://doi.org/10.2466/pms.1968.26.3.951

McManus, I. (2009). The history and geography of human handedness. *Language Lateralization and Psychosis*, 37–58. https://doi.org/10.1017/cbo9780511576744.004

O'Connell, D. C., Kowal, S., Sabin, E. J., Lamia, J. F., & Dannevik, M. (2010). Start-up rhetoric in eight speeches of Barack Obama. *Journal of Psycholinguistic Research, 39*(5), 393-409. http://dx.doi.org/10.1007/s10936-010-9147-x

Oomen, C. C. E., & Postma, A. (2001). Effects of divided attention on the production of filled pauses and repetitions. *Journal of Speech Language and Hearing Research*, *44*(5), 997–1004. https://doi.org/10.1044/1092-4388(2001/078

Patterson, K., Graham, N., Ralph, M. A. L., & Hodges, J. (2006). Progressive non-fluent aphasia is not a progressive form of non-fluent (post-stroke) aphasia. *Aphasiology*, *20*(9), 1018–1034. https://doi.org/10.1080/02687030600739463

Price, J. M. (2021). *The perceived effect of pause length and location on speaker likability and communicative effectiveness* [Master's thesis, Brigham Young University]. BYU ScholarsArchive. https://scholarsarchive.byu.edu/etd/9144/

Roberts, F., & Francis, A. L. (2013). Identifying a temporal threshold of tolerance for silent gaps after requests. *The Journal of the Acoustical Society of America*, *133*(6), EL471–EL477. https://doi.org/10.1121/1.4802900

Ross-Swain, D. (1996). *RIPA-2: Ross Information Processing Assessment*. Pro-Ed.

Roth, C. (2011). Boston diagnostic aphasia examination. In *Encyclopedia of clinical neuropsychology* (pp. 428–430). Springer, New York.

Saldert, C., Fors, A., Ströberg, S., & Hartelius, L. (2010). Comprehension of complex discourse in different stages of Huntington's disease. *International Journal of Language &Amp; Communication Disorders*, *45*(6), 656–669. https://doi.org/10.3109/13682820903494742

Shriberg, L. D., Kent, R. D., & Munson, B. (2003). *Clinical phonetics*. Allyn and Bacon.

Smith, K. M., & Caplan, D. N. (2018). Communication impairment in Parkinson's disease: Impact of motor and cognitive symptoms on speech and language. *Brain and Language, 185*, 38-46. https://doi.org/10.1016/j.bandl.2018.08.002

Thomas, B. K. (2021). *Quantifying speech pause durations in speakers with nonfluent and fluent aphasia* [Master's thesis, Brigham Young University]. BYU ScholarsArchive. https://scholarsarchive.byu.edu/etd/8939/

Verna, A., Davidson, B., & Rose, T. (2009). Speech-language pathology services for people with aphasia: A survey of current practice in Australia. *International Journal of Speech-Language Pathology*, *11*(3), 191–205. https://doi.org/10.1080/17549500902726059

Vigliecca, N. S. (2019). Validity and features of spontaneous speech in acute aphasia as evaluated with the Brief Aphasia Evaluation: Is fluent aphasia more severe than nonfluent aphasia? *CoDAS*, *31*(1). https://doi.org/10.1590/2317-1782/20192018048

Wilson, S. M., Eriksson, D. K., Schneck, S. M., & Lucanie, J. M. (2018). A quick aphasia battery for efficient, reliable, and multidimensional assessment of language function. *PLOS ONE*, *13*(2), Article e0192773. https://doi.org/10.1371/journal.pone.0192773

Yang, L. (2004, March 23 - 26). *Duration and pauses as cues to discourse boundaries in speech* [Paper presentation]. Speech Prosody 2004, Nara, Japan. https://www.isca-speech.org/archive_open/sp2004/sp04_267.html

APPENDIX A

Annotated Bibliography

Angelopoulou, G., Kasselimis, D., Makrydakis, G., Varkanitsa, M., Roussos, P., Goutsos, D., Evdokimidis, I, & Potagas, C. (2018). Silent pauses in aphasia. *Neuropsychologia, 114,* 41–49. https://doi.org/10.1016/j.neuropsychologia.2018.04.006

Objective: This study was to compare pause length and location between individuals with aphasia to neurologically healthy individuals. *Method*: Eighteen patients with aphasia (ages 40-74) were assessed with the a few different standardized assessments. MRI or CT scans were collected from each participant so that the sites of lesions could be identifies and recorded. *Conclusions*: Individuals with aphasia use more frequent and longer pauses both between and within utterances. *Relevance to current study*: This study shows that people with aphasia use more pauses and longer pauses.

Broen, P. A., & Siegel, G. M. (1972). Variations in normal speech disfluencies. *Language and Speech*, *15*(3), 219–231. https://doi.org/10.1177/002383097201500302

Objective: The objective of this study was to understand how disfluencies in typical speakers' speech were affected by their perceived importance of the speaking situation. *Method:* They used 40 college students and asked them each to do three different speaking tasks. Each had an "alone" task where they were asked to speak about anything they wanted, and each ended with a "conversation" task where they conversed with the experimenter. Between they either spoke in front of a TV or in front of an imaginary audience. They were then asked to rate the way they felt about the importance of each scenario and then estimate how many disfluencies they had in each task. *Conclusion:* It was concluded that the higher the subjects rated the scenario, the more disfluencies they

guessed they had, yet the less disfluencies they in reality had. Most rated the conversation as the least important, and most had the most disfluencies in the conversation. *Relevance to Study:* This study shows that pauses happen in both conversational speech and in discourse speech.

Collard, P., Corley, M., MacGregor, L. J., & Donaldson, D. I. (2008). Attention orienting effects of hesitations in speech: Evidence from ERPs. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *34*(3), 696–702. https://doi.org/10.1037/0278-7393.34.3.696

Objective: This study was looking at how hesitations in speech such as "er," "um," or prolonged words affected the attention of a listener. *Method:* Using mismatch negativity and P300, they had participants listen to both fluent and non-fluent phrases, some of which had been modified to have increases in amplitude and frequency for certain words. Afterwards, participants were asked to take a survey to identify words that they had heard. *Conclusion:* It was discovered that the words that were preceded by hesitations were more likely to be remembered by the listeners. *Relevance to Study:* This study shows that pauses have a significant effect on the communicative effectiveness of listeners.

Gayraud, F., Lee, H., & Barkat-Defradas, M. (2011). Syntactic and lexical context of pauses and hesitations in the discourse of Alzheimer patients and healthy elderly subjects. *Clinical Linguistics & Phonetics*, *25*(3), 198–209. https://doi.org/10.3109/02699206.2010.521612

Objective: The purpose of this study was to learn more about planning difficulties in Alzheimer's Disease (AD) by observing the nature of their pauses in conversation. *Methods:* The researchers compared 20 AD patients with 20 similar healthy people to see the differences in their pauses in duration, distribution and frequency. The natural spontaneous speech was collected and transcribed manually by researchers who carefully measured the pauses. *Conclusion:* The researchers found that AD patient's produce more silent pauses while healthy people use more filled pauses. In addition, it was observed that AD patients' pauses occur more often outside syntactical boundaries. The duration of the pauses was similar between the two groups, but the frequency was more in patients with AD. *Relevance to Study:* Neurological deficits create disordered changes in use of pause compared to healthy individuals.

Heldner, M., & Edlund, J. (2010). Pauses, gaps and overlaps in conversations. *Journal of Phonetics, 38*(4), 555-568. https://doi.org.erl.lib.byu.edu/10.1016/j.wocn.2010.08.002 *Objective:* The purpose of this paper was to look at pauses, gaps, and overlaps in conversational turn-taking scenarios. A big part of this study was to quantify the frequency of gaps, pauses, and overlaps for the end goal of improving speech technology applications. *Method:* The researchers used speech samples from three different languages – Dutch, Swedish, and Scottish English in conversational settings like in person and telephone conversations. They then used a software called VADER to measure the pauses, gaps, and overlaps in the conversation and then analyzed the results. *Conclusion:* In conclusion, researchers found that timing of turn-taking in conversations is more distributed and less precise than other researchers have claimed. They also found that it is more common to have a noticeable gap and a little bit of overlap in turn taking than no gap and no overlap. They conclude that a big factor in this is understanding context and prosodic cues and the next challenge in technology applications is to incorporate prosodic cues somehow. *Relevance to the study:* Much of conversation has no pause in it at all, therefore, the frequent pauses seen in persons with aphasia are disordered and dysfunctional.

Huang, Lan-fen & Gráf, Tomáš. (2020). Speech rate and pausing in english: Comparing learners at different levels of proficiency with native speakers. *Taiwan Journal of TESOL, 17*(1). 57-86. https://doi.org/10.30397/TJTESOL.202004_17(1).0003.

Objective: The objective of this study was to quantify fluency for second language learners so that they would have something more concrete to work towards. *Method:* This was done by giving participants three different tasks, then looking at frequency, length, and place of pauses between second language learners and native speakers. *Conclusion:* The conclusion of this study was that, as hypothesized, the native speakers pause less and speak at a faster rate than those that are learning English. They found the differences to be significant. Since the researchers were able to quantify the length of pauses, locate the pauses, and also count the frequency, the result was a clear pause and rate pattern of normalcy for native speakers. This allows learners to have a quantitative goal to work towards. *Relevance to Study:* This is relevant to this study because it adds additional data that shows what normal pause looks like. It shows three different speech samples.

Martin, J. G. (1970). On judging pauses in spontaneous speech. *Journal of Verbal Learning and Verbal Behavior, 9*(1)*,* 75-77. https://doi.org/10.1016/S0022-5371(70)80010-X.

Objective: The purpose of this study was to identify some patterns between grammar and acoustics and to compare listener judgements against physical measures. *Methods:* Researchers recorded 60 speech samples of people describing Thematic Apperception Test Cards. These recordings were then analyzed for unfilled pauses only and noted where they took place grammatically. They also measured the length of three syllables preceding each pause. *Conclusion:* Researchers found that longer syllables usually precede and accompany the perception of a silent pause whether it is there or not and independent of grammatical cues. *Relevance to Study:* This study gives more information about where pauses occur in speech in typical speakers, which gives us a better goal point for PWA to reach.

Osada, N. (2002). Analysis of pause occurrence in three kinds of modified speech: Public address, caretaker talk, and foreigner talk. *Journal of Pan-Pacific Association of Applied Linguistics*, *7*(1), 77–123. https://eric.ed.gov/?id=EJ678013

Objective: The purpose of this study was to analyze the difference in pause in modified speech verses in unmodified speech. *Method:* three different kinds of modified aural speech were used (inaugural addresses, fairy tales, Voice of America (VOA) – Special) to compare against three kinds of unmodified speech (stories, VOA – Standard, AP Network News). 270 ms was used as the cut-off for the minimum pause length. Five things were measured including speech rate, articulation rate, pause unit length, individual pause length, and pause percentage to overall speech time. ANOVA was used to find each quantitative value. *Conclusions:* Results of this study confirm the five original hypotheses. They found that both the speech rate and articulation rate of modified speech are slower than that of unmodified speech. Also, that the pause unit length of modified speech is shorter than that of unmodified speech but the individual pause length of modified speech is longer than that of unmodified speech. Finally, that the percentage of pause of overall speech time in modified speech is higher than that in unmodified speech. *Relevance to current study:* This study is significant for the current study as it analyzes typical speech and the differences that can be found in modified and unmodified speech.

Ovchinnikova, I. (2018). Effect of the content complexity on hesitations in adolescents' narratives. *Psychology of Language and Communication*, *22*(1), 1-20. https://doi.org/10.2478/plc-2018-0001

Objective: The objective of this research was to understand the frequency and location of self-corrections, hesitations, and pauses in adolescents during narrative retell. *Methods:* This research was performed by both Russian and English-speaking adolescents that retold the "Frog, Where are You?" story. Research was focused on the descriptions of pictures 12 and 21. *Conclusion:* It was concluded that adolescents have less self-corrections than both children and adults but that these are compensated with more filled and silent pausing. The most common kind of pause for narrative retell was a filled intro-clause pause that made up 40% of the pauses. However, there were more silent pauses for the descriptions of pictures 12 and 21. Although filled pauses were more common, in duration the filled pauses were much shorter than the silent pauses. *Relevance to Study:* This is interesting information looking at pausing for narrative retell. The only downside is that it is focusing on adolescents. However, this is still relevant to our study as it displays the patterns of both silent and filled pauses for narrative retell in typical speakers.

APPENDIX B

Consent Form

Consent to be a Research Subject

Title of the Research Study: Communicative Impact of Speech Characteristics - Perception
Principal Investigator: Shawn Nissen, Ph.D.
IRB ID#: 2022-087

Introduction

This research study is being conducted by Shawn Nissen, Ph.D., at Brigham Young University to determine how the characteristics of an individual's speech impacts their ability to communicate effectively. You were invited to participate because you are a native speaker of English.

Procedures

If you agree to participate in this research study, the following will occur:

- You will be asked to complete a short questionnaire that asks about your age in months/years, native language, and if you speak another language.
- you will participate in a hearing screening by listening to beeps through headphones while seated in a listening booth in the Taylor building on the Brigham Young University campus
- you will listen to a series of sentences and short conversations and rate each sample on how well it was spoken using a computer mouse to select and drag a slider button on a computer screen
- the entire study will take 30 minutes to complete

Risks/Discomforts

There are minimal risks for participation in this study. You may encounter some discomfort from wearing the over-the-ear headphones. You will take a short break in the middle of the study to limit possible discomfort from wearing the headphones. There is also a small risk that your participation in the study may be known to others by your signing the consent form. In addition, information about your age and language status may be known to others. The consent forms will be kept in a locked cabinet within a locked room to decrease this risk.

In Case of Research Related Injury

BYU makes no commitment to provide financial compensation or free medical care should you be injured as a result of your participation in this research. Nonetheless, in the event of such an injury, after seeking appropriate medical attention, please contact Shawn Nissen at (801) 422-5056 or shawn_nissen@byu.edu.

Benefits
There are no direct benefits to you. It is hoped this study will provide understanding in how to help individuals learn to communicate more effectively.

Confidentiality
All data, including records of your listening responses, will be kept on password-protected computers in a locked laboratory and only those directly involved with the research will have access to them. The consent forms with the participant signatures is what will be stored in a locked cabinet.
De-identified data from this study may be shared with the research community, with journals in which study results are published, and with databases and data repositories used for research. We will remove or code any personal information that could directly identify you before the study data are shared. Despite these measures, we cannot guarantee anonymity of your personal data.

Data Sharing
We will keep the information we collect about you during this research study for analysis and for potential use in future research projects.

De-identified data from this study may be shared with the research community, with journals in which study results are published, and with databases and data repositories used for research. We will remove or code any personal information that could directly identify you before the study data are shared. Despite these measures, we cannot guarantee anonymity of your personal data.

The results of this study could be shared in articles and presentations, but will not include any information that identifies you unless you give permission for use of information that identifies you in articles and presentations.

Compensation
You will receive $10 in cash for your participation in this study.

Participation
Participation in this research study is voluntary. You have the right to withdraw at any time or refuse to participate without penalty.

Questions about the Research
If you have questions regarding this study, you can contact the principal investigator Shawn Nissen at (801) 422-5056 or shawn_nissen@byu.edu.

Questions about Your Rights as Research Participants
If you have questions regarding your rights as a research participant contact Human Research Protections Program by phone at (801) 422-1461; or by email: BYU.HRPP@byu.edu

Statement of Consent
I have read, understood, and received a copy of the above consent and desire of my own free will to participate in this study.

Name (printed): ________________________________ Date: ____________

Signature: _____________________________________