Language in Trauma: A Pilot Study of Pause Frequency

as a Predictor of Cognitive Change Due to Post Traumatic Stress Disorder

by

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ABSTRACT

With the rise of Posttraumatic Stress Disorder (PTSD) among adults in the United States, understanding the processes of trauma, trauma related disorders, and the long-term impact of living with them is an area of continued focus for researchers. This is especially a concern in the case of current and former military service members (veterans), whose work activities and deployment cycles place them at an increased risk of exposure to trauma-inducing experiences but who have a low rate of self-referral to healthcare professionals. There is thus an urgent need for developing procedures for early diagnosis and treatment. The present study examines how the tools and findings of the field of linguistics may contribute to the field of trauma research. Previous research has shown that cognition and language production are closely linked. This study focuses on the role of prosody in PTSD and pilots a procedure for the data collection and analysis. Data consist of monologic talk from a sample of student-veterans and analyzed with speech software (Praat) for pauses greater than 250 milliseconds per 100 words. The pause frequency was compared to a PCL-5 score, an assessment used to check for PTSD symptoms and evaluate need for further assessment and possible diagnosis of PTSD. This pilot study found the methods successfully elicited data that could be used to measure and test the research questions. Although the findings of the study were inconclusive due to limitations of the participant pool, it found that the research model proved effect as a model for future linguistic research on trauma.

DEDICATION

There are so many people I would like to dedicate this paper too, that it would take so

long to name them all. Fortunately, this is my paper and I can take as long as I want to in

this section. First and foremost, this paper, and truly all the work I have ever done, is

dedicated to my mother, Rosi Southee, from whom everything good about me comes

from. My work ethic, tenacity, humor, and relentlessness have all come from watching

those very same things in her my entire life. Everything I have accomplished in life is

because of my mother and I am blessed to have her. To my god mother, Cass, who taught

me so much in life and has loved me as her own every step of the way. To my younger

sibling, Rae, for whom every day I aspire to be an inspiration for. I hope that everything

I'm doing has made you three proud, I try every day to be my best and that's all because

of you.

This paper is dedicated to so many friends who have supported me along the way. To

Mikey, my day one, who despite admitting he doesn't even know what this paper is

about, has always supported me, been there for me, and created memories with me. To

Chelsea, who through the highs and the lows, high school musical, and HORSE, never

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good memories. To my gossip girls, Tori, Bryttney and Jansen, who were my

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CHAPTER 1

INTRODUCTION

Following the events of September 11th, 2001, the United States began its since-named "War on Terror," a trans-decade war that was primarily composed of two major military operations: Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF). Spanning from 2001 until 2014, OEF and OIF were in many ways the defining experience for military members since their inception, and the effects of these operations continue to be felt to this day. The human cost of the operations and their successors was immense; through 2018 the War would claim approximately 500,000 lives across military and civilian populations (Crawford, 2018). Cost was not limited to death, the Defense Casualty Analysis System kept record of 31,993 soldiers wounded in action during OIF, and 20,147 wounded in action in OEF (*DCAS - Conflict Casualties*, 2020). These injuries were distributed across approximately 1.5 million troop years (a unit that represents one soldier deployed for one year [regardless of whether multiple soldiers filled that role]) between September 2001 and December 2011 with roughly 73% of the active component deployed during that time (Baiocchi, 2013). Such exposure to war, injury, and death has resulted in an enormous emotional toll on both military members and civilians present. This results in veterans being disproportionately affected by trauma and trauma related disorders in comparison to the population as a whole.

Research has shown that almost 90% of adults will experience an event that would be defined as traumatic for the purpose of diagnosis during the course of their lifetime (Kilpatrick et al., 2013), with the standard rate of post-traumatic stress disorder(PTSD) development being 8.7% of the population by the age of 75 (as cited in

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American Psychiatric Association, 2013). Post-traumatic stress disorder is a mental health condition characterized by a family of symptoms such as reoccurring, intrusive thoughts about a traumatic experience, intense physiological responses to cues that relate to a traumatic experience, avoidance of such stimuli, negative thoughts, moods, and emotional states, irritability, recklessness, hypervigilance, and sleep disturbances that extend for a period greater than three months following exposure to a traumatic event (American Psychiatric Association, 2013). Among veterans, estimates of a PTSD diagnosis ranged from 11 to 22% (*How Common Is PTSD in Veterans?*, 2018). In 2017, the United States Department of Veteran Affairs (VA) recorded 6139 total suicides and veterans with a PTSD diagnosis accounted for 55 suicides per 100,000 veterans (Office of Mental Health and Suicide Prevention, 2019) Another report published by the VA in 2012, noted that "PTSD diagnoses in homeless veterans were about 3 times higher than those in their domiciled counterparts" (*Homeless Incidence and Risk Factors for Becoming Homeless in Veterans*, 2012).

In the short term, exposure to traumatic stimulus can result in hypervigilance, (American Psychiatric Association, 2013; Bower & Sivers, 1998; Palmer, 2002), attention and concentration deficits (American Psychiatric Association, 2013; Sutker et al., 1995; Vasterling et al., 1998), flashbacks and intrusive memories (American Psychiatric Association, 2013; Hellawell & Brewin, 2004; Merckelbach et al., 2003) and impulsivity and aggressive behavior (American Psychiatric Association, 2013; Cima et al., 2008; Cuomo et al., 2008). These cognitive effects of trauma have been shown to contribute to the development and the exacerbation of existing symptoms of comorbid psychiatric disorders such as borderline personality disorder (Fernando et al., 2014;

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Goodman & Yehuda, 2002; Sabo, 1997), depression (Fernando et al., 2014; Lewis et al., 2010; Schulz et al., 2014), and anxiety (Adamec & Shallow, 1993; Beck et al., 2015; Grant et. al., 2008) among others. In the case of transient stress responses (Bryant et al., 2011) immediate therapeutic interventions can assist individuals in the processing and understanding their traumatic events which can help in minimizing and alleviating symptoms.

In some cases, especially when untreated, the symptoms of traumatic exposure will persist. Long term consequences of trauma and post-traumatic stress disorder have shown to measurably reduce general "quality of well-being" (Holbrook et al., 2002), with a sharply increased risk of suicidality (Marshall et al., 2001; Ramsawh et al., 2014; Tarrier & Gregg, 2004) and violent and aggressive patterns of behavior (Byrd & Davis, 2009; Collins & Bailey, 1990; Orcutt et al., 2003), and increase risk of other mental health disorders (Adamec & Shallow, 1993; Fernando et al., 2014; Goodman & Yehuda; Lewis et al., 2010). The reduction in quality of well-being is especially concerning but given the nature of the symptoms of trauma related disorders, it is unsurprising that they are not conducive to maintaining healthy lifestyles or relationships (Monson et al., 2009). Aggressive behavior, hypervigilance (which can often present similarly to paranoia [Freeman et al., 2013]), impulsivity, and sleep disorders contributing to this issue. For many, trauma becomes a part of their personal and social identity, which can contribute to further ostracization (Brewin et al., 2011; Berntsen & Rubin, 2007).

The effects of trauma can have a catastrophic effect on a person's life; understanding the processes and implications of trauma going untreated is key to successful treatment. Various assessments and therapeutic tools can be used to

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understand trauma and the surrounding issues, but one field that is under-utilized is linguistics. It is argued here that linguistics can positively contribute to the field of trauma research, ultimately beneitting those affected by trauma and trauma related disorders.

Statement of Problem

Thus far, there does not appear to be a robust application of linguistic methodologies or tools to trauma research, with only a few studies that are specifically targeted at the processes and discursive features involved with and surrounding trauma. This prompts the overarching question of this thesis: *How can the tools and findings of linguistics contribute to trauma research?*

One major issue of concern in clinical psychology is the diagnosis of PTSD. PTSD diagnosis relies heavily on self-reporting, which can be unreliable in veteran populations (Goode & Swift, 2019; Reit, 2009). Even those who would be willing to self-report face both social and professional obstacles in doing so (Hoge & Cotting, 2004), such difficulties are exacerbated by a work-life cycle that involves regular relocation and contributes to inconsistent healthcare treatment and success (Tong, 2018). However, the military presents a unique opportunity in that Periodic Health Assessments (PHA) are performed annually as a standard procedure and are already recognized as an advantageous model in comparison to civilian healthcare models (Oh et al., 2020). While prevention in mental health is a part of the PHA, it still relies on self-reporting. Introduction of objective measures (like the neurological exams already included in the PHA) for mental health would almost certainly contribute to successful mental health treatments in military populations. However, no cost-effective, non-invasive methods of

objectively monitoring for PTSD exist. Phonetics and prosody are a possible area where investigation could be expanded, and a methodology to utilize some subset of prosody should be tested to determine if it can be used in this area of research. This raises two questions the present study seeks to answer: *Can pause frequency (per 100 words) be used to reliably predict whether an individual does or does not have PTSD? And if so is pause frequency correlated with PCL-5 assessment scores which is based off of PTSD symptomatology?*

Potential Contributions

This study seeks to contribute to the research on trauma and PTSD in two ways. First, it seeks to identify areas that can be expanded upon in the currently existing literature regarding trauma and PTSD, particularly in the realm of diagnosis and assessment, as well as the long-term effects PTSD can have on individuals and cultural attitudes. Through reviewing the existing literature and identifying areas of concern, future research can better address the adverse effects of trauma and trauma related disorders. The present study aims to expand existing literature on PTSD and cognitive disorders, using phonetic analysis of speech to identify changes in cognitive function as a product of trauma exposure. By testing pause frequency as a reliable measure for predicting these changes, diagnostic accuracy can both be improved and rely less on self-reporting measures. The objective is to establish if the methods introduced in this study would act as a reliable methodology for future studies of similar nature, across an array of different disorders and diseases that affect cognitive function, and even as a general tool for testing cognitive function in the absence of suspected diseases or disorders. While this paper is written with an emphasis on veteran populations and uses veterans as its

subject population, the results of the study and the literature review aim to be broadly applicable across populations.

Organization of Chapters

This thesis reviews relevant literature in trauma studies and neurolinguistics, and then reports the methodology and findings of a pilot test of linguistic measures of cognitive function as it relates to PTSD. Chapter 2 begins with a review of the literature in psychology, sociology, and cognitive science related to trauma and PTSD. Topics in linguistics and trauma are first reviewed in order to touch on aspects of trauma studies that linguistics has already informed, and deficits in the same area are touched on. Following this, other aspects of trauma research including diagnosis, identity, and community discourse are reviewed in order of the deficits previously listed, and how linguistics can contribute.

Chapter 3 provides a literature review of cognitive science and pause studies. This review highlights how pauses are linked to cognitive function and brain health, and how cognitive, speech language, and neuroscience researchers are already utilizing pauses as a way to explore, predict and follow brain function for neurodegenerative diseases and how it relates to the present study.

Chapter 4 outlines the methods for the study design, participant recruitment, and data collection. This chapter also reviews tools used for the study, and how data was analyzed once collected. Chapter 5 presents the results of the pilot study and the major findings as a result of them. Following the results, Chapter 6 discusses the findings of the study and what they mean for the field. Limitations are then highlighted and explained, and insights of note for future research and studies similar in nature.

Chapter 7 closes out the thesis as the conclusion, summarizing the thesis and findings, and the possibilities of future research based on the literature reviewed and the findings of the study.

CHAPTER 2

LINGUISTICS AND TRAUMA RESEARCH

This thesis explores trauma research in order to identify what research currently exists that brings together linguistics and other fields to understand trauma for the purpose of better understanding trauma and its impact on communication and language production and understanding. There exists some linguistics research that relates to trauma that investiaged refugee and immigrant populations and how trauma in their histories shapes their host language acquisition (Corvo & Peterson, 2005; Warriner, 2007), though some look also at mental health (Beiser & Hou, 2001). Trauma research of this nature has helped lead to better understandings of how trauma impacts integration success (how well an individual integrates into a new community), but it is more focused on language acquisition and informs on how second language efforts could be modified support these populations. While helpful, this does not expand the understanding of trauma in the direction this thesis intends. Whereas such studies use trauma as a medium to understand language and language acquisition, this present study draws on language and linguistics to understand trauma.

In regard to treatment, discourse is often used as a device for recovery, being the underlying premise of most types of therapy (O'Connor, 2014). A study by Pennebaker and Beall (1986) found that writing about trauma was shown to have a positive interaction with treatment efficacy, showing positive impacts on both mental and physical health, represented in a decrease in treatment facility visits. It becomes quickly apparent that the expression of trauma can have positive effect towards the treatment of trauma-related mental health disorders. The implications of Pennebaker and Beall's work is that

the very basic step of simply expressing trauma, through speech or text, can be helpful

for treatment. This is reinforced by research that has suggested working with a literacy

teacher can be used to assist in the building of coping mechanisms in response to trauma

and how to communicate regarding trauma (Wolpow & Askov, 1998).

Alvarez-Conrad and colleagues (2001) investigated how trauma is reflected in

language, looking at the narrative choices made in treatment therapy by sexual assault

survivors. As Alvarez notes, recovery of PTSD has been shown to be related to

measurable changes in narrative production such as their organizational pattern, utterance

length, or use of emotional words (e.g., Amir et al., 1998; Prior, 2019). In their study,

Alvarez-Conrad and colleagues aimed to find how lexical choice was reflected in this

process, and they found that symptom severity and post-traumatic stress was correlated

with an increase of words associated with death and dying. This is very much a relevant

finding in relation to linguistic analysis of PTSD, and shows that within trauma

narratives, lexical choices[1] can be a direct reflection of mental health in some capacity.

The limits of such a study however, are that the nature of trauma narratives are a heavily

emotional and psychological burden on the individual as they process their traumas, so

speech analyses may indicate the present cognitive burden of processing trauma in real

time, not the standard cognitive burden of having PTSD. This acknowledgement was

made by Santiago Papini and colleagues (2015), where they stated

> Given that significant avoidance and numbing accompany PTSD, an exploration
> of the linguistic traits of non-trauma-related narratives may prove valuable in
> developing new avenues for symptom detection and intervention wherein explicit
> reporting of distress is not central. (Papini, 2015 p. 2)

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[1] Lexical choice refers to the decision-making process for selecting words used for constructing
speech

Understanding if the variance in speech occur with all narratives would allow researchers to understand if previously established changes are exclusively a coping mechanism applied to trauma narratives, or a more holistic mechanism used in all speech. This becomes increasingly important when contextualized with the demographics of sexual assault victims who have an incredibly low reporting rate (80% of student victims will not report an assault, 67% non-student victims will not report; Sinozich, 2014) and veterans who come from a historically hyper-masculine environment that rejects mental health services (in one study a veteran stated that seeking mental health services "clashed with her self-image as a Marine"; True, 2015, p. 1447). The findings of Papini's study confirmed those of previous studies (e.g., He et al., 2019; Todorov et al., 2020) and thus Papini et al. decided to see if the findings of Alvarez et al. (2001) would extend to non-trauma related narratives in indivuduals with PTSD. When prompted with TAT cards[2] and asked to produce a narrative based on those images, individuals diagnosed with PTSD produced narratives with more 'death' words (e.g., lethal, kill) than those without a diagnosis, suggesting that the findings by Alvarez-Conrad et al. reflect deeper changes in cognitive function, not just the topic or events being discussed. Interestingly, another finding of the Papini et. al. study was an increase of third-person singular pronouns, which was stated to reflect "research utilizing trauma narratives: first-person plural pronoun use, which may signal the availability of social support, has been negatively correlated with PTSD symptoms" (Papini, 2015, p. 5). One study explored trauma related to September 11th, looking at the predictive ability of linguistic factors in narratives of

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[2] TAT cards - Thematic Apperception Test, are a psychometric tool created primarily as a personality assessment, that is used to elicit stories from patients and participants (Moretti & Rossini, 2018).

students following the attack and established "both acute and lasting PTSD symptoms can be indexed or predicted through linguistic indices sampled during the immediate aftermath of the trauma" (D'Andrea, 2011).

Together, the above studies suggest that PTSD has a salient impact on the lexical decision-making of individuals afflicted with it, to the point of some predictability. This seems to occur below a conscious level as it spreads beyond conversations and narratives directly related to the trauma. Instead, it appears that individuals with PTSD experience changes in their linguistic processing. Research focused on word choice and semantic connections reflects a deeply ingrained facilitation of PTSD, and points to potential methods of predicting and capturing trauma related cognitive changes without relying on self-reporting (Alvarez-Conrad et al, 2001; D'Andrea, 2011; He et al., 2019; Papini et al., 2015).

Research around trauma has relied on narratives and other discourse data to gain an understanding of how trauma impacts individuals and communities in many ways such as how research into how trauma presents itself in clinical settings relies heavily on narratives (Waterman, 2020; Webb & Jobson, 2011), as well as how it interacts with identity (Berntsen & Rubin, 2007; Brewin et al., 2011; Maitlis, 2009). The analysis of conversations was the centerpiece of Berwin et al's study that explored how mental health was modified by trauma exposure, which identified that trauma itself was not the catalyst for changes in mental health but instead how identity and belonging filtered the trauma for mental health. Discourse analysis is used in trauma studies to gather insight into what is being said and expanding an understanding of the speaker.

There is a continued need for applying linguistic methods to trauma research, with some of the previously discussed research defining the genre and most studies following done to confirm their findings. Further research being done could help in expanding these fields given appropriate application of linguistic methods.

Identifying Areas of Contributions

As the previous section identified the current literature from linguistics in trauma studies, it becomes possible to begin answering the first question of this study: how can linguistics expand the field of trauma study as it relates to PTSD? Identifying these areas for contribution depend on points of emphasis for PTSD research. Previous research on veterans and PTSD has identified points of focus for the field as "[research] on mechanisms, screening, diagnosis, treatment, or barriers related to PTSD" (Committee on the Assessment of Ongoing Efforts in the Treatment of Posttraumatic Stress Disorder et al., 2014). Mechanisms, screening, and diagnosis can be considered a group of interests covered under diagnosis and assessment of PTSD. Following this, treatment would cover both psychotherapies and pharmacological therapies and their successes, but also long-term impact of both treated and untreated PTSD and trauma related disorders. The last focus identified is barriers which covers "awareness, accessibility, availability, and acceptability" (Committee on the Assessment of Ongoing Efforts in the Treatment of Posttraumatic Stress Disorder et al., 2014), forms of health care utilization disparities.
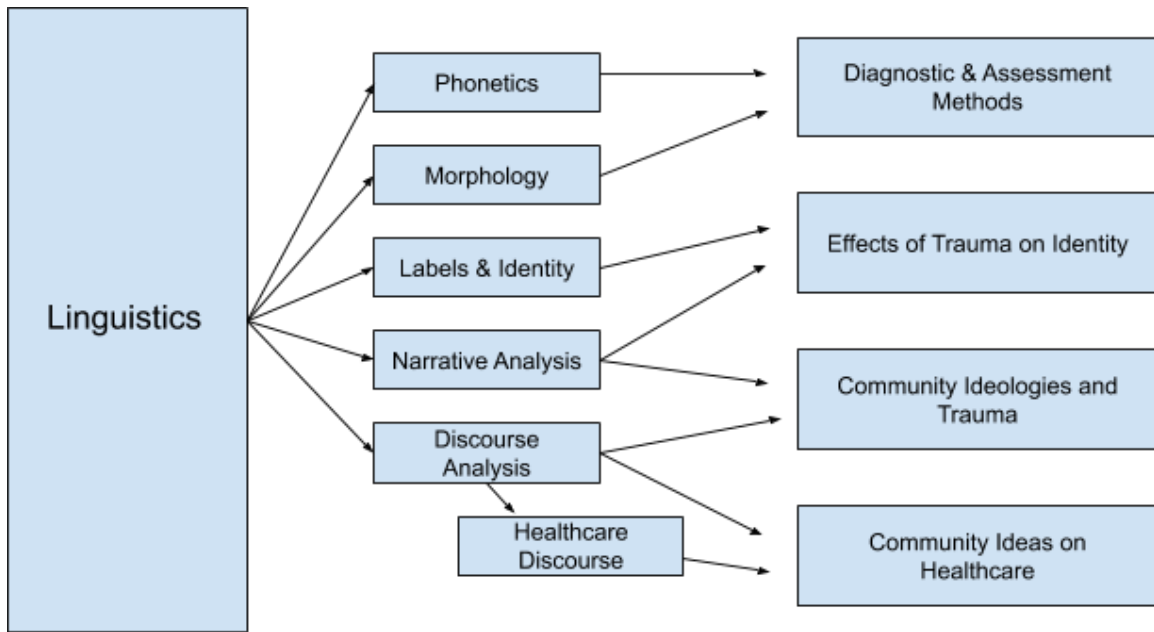
Figure 1: Areas of Contribution for Linguistics

For this thesis, the focuses identified by the Committee on the Assessment of Ongoing Efforts in the Treatment of Posttraumatic Stress Disorder were reorganized as: Diagnostic/Assessment Methods, Long Term Effects on Identity, Community Ideologies, and Health Care Utilization Disparities. Figure 1 represents an organization of these focuses and identifies how linguistics can contribute to them. While not all linguistic subfields are represented in this figure, it highlights major subfields that could directly contribute to the foci mentioned above. The following sections aim to give brief overviews of these different areas, and how the designated linguistic subfields can further contribute to these areas to expand on them.

Diagnosing and Assessing PTSD

Post-traumatic stress disorder is a psychological disorder that presents in a multitude of ways across both the short and the long term. The hallmark indications of post-traumatic stress, as a requirement for the diagnosis by the APA involves "intrusion

symptoms associated with the traumatic event(s), beginning after the traumatic event(s) occurred" (2013, p. 271) to include nightmares of the events, dissociative flashbacks, and psychosomatic stress responses as a result of events similar to the traumatizing event (American Psychiatric Association, 2013). As a psychological disorder, the diagnosis of PTSD primarily comes from three major avenues: self-referral to psychological treatment, capturing on health screening, or the result of assessment during psychiatric in-patient assessment. Unfortunately, the former two (self-referral and health screening self-reporting) are highly inconsistent avenues for diagnosis and assessment. For self-referral and help-seeking behaviors, it has been found that a "concerningly" low 50% of those with PTSD symptoms will self-refer (Sheerin et al., 2016, p. 5). Research into obstacles surrounding help-seeking behaviors have found that stigma related to how their peers, leadership and family will view them, as well as worries about feelings of "otherness" are major obstacles for military members (Goode & Swift, 2019; Hoge & Cotting, 2004; Wilson et al., 2015). Additional studies have found the self-reporting of neurocognitive symptoms among veteran populations as they related to PTSD to be highly inconsistent (Russo & Fingerhut, 2017). Ideally, symptoms would be captured prior to a psychological break that calls for in-patient assessment.

Seeing diagnostic methods outside of these has become a centerpiece for trauma and PTSD research. Studies into children with PTSD have shown only 12% of the current diagnostic criteria in children can be observed by clinicians (Scheeringa et al., 2001), and with emotional hiding[3] being significantly associated with PTSD symptoms (Duax et al.,

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[3] Emotional hiding refers to an active effort "to withhold or avoid talking about their emotions and problems with various social support agents" (Duax et al., 2014 p. 572)

2014) and previously mentioned obstacles in self-referral due to stigma, it is unlikely that adults concerned about a diagnosis will be willing to express symptoms associated with PTSD in general health appointments. Further studies have suggested that some neurobiological markers exist that can be used to detect differences in brain function from neurotypical populations (Michopoulos et al., 2015) and those with similar disorders (Raji et al., 2015). There also appears to be some genetic factor that influences susceptibility to developing the disorder (Flaquer et al., 201 5; Lee & Lee, 2006). However, Lee & Lee recognized the limited usefulness of this as PTSD is an event related disorder, and even with usefulness both brain scans and genetic testing are invasive to a degree and not reasonable tools for standard health screenings.

Structured clinical interviewing (SCI) utilizes assessment tools to target specific diagnostic criteria and establish a diagnosis or need for follow up and further diagnosis (Weiss, 2004; Wright et al., 2008). When testing the reliability of SCI, inter-rater reliability tests found it to be "excellent" for Axis I disorders to include PTSD. Clinicians can utilize this tool to form a tentative diagnosis and gain an understanding of the experiences of their patients, however SCI requires a patient to both forthright and honest with the issues that face, which can be difficult with many demographics that come from cultures that stigmatize talking about trauma and mental health.

Non-invasive, objective tools for diagnosis could help in supplementing diagnostic procedure, but also in establishing when patients should be given more thorough examination if the patients answers seem inconsistent with clinician and peer observations. Linguistic tools such as phonetic assessment, looking at speech aspects such as pause rate, speech rate, intonation, and pitch could give insight into involuntary

changes in speech due to cognitive changes. Additionally, lexical assessments could be used to assess word choice which could give insights into feelings about the self, avoidant symptoms, and other changes that could potentially be part of the coping mechanism of trauma disorders. These linguistic tools could be utilized discretely as to not trigger the patient, or to cause them to become guarded or defensive as it relates to potential diagnosis.

Intersection of Trauma and Identity

Understanding how trauma impacts identity is an incredibly important topic due to the life-changing nature the symptoms of PTSD can have. As recent as February 2020, the Journal of Adolescence Special Issue on Trauma and Identity (Berman et al., 2020) recognized a "considerable lack" of research focusing specifically on the intersection of trauma and identity. The research that does exist, however, shows a considerable impact on identity, views of the self, and shifts in identity as a product of being traumatized and the related consequences. Waterman (2020) recognized that while symptomology of post trauma disorders (acute stress, post-traumatic stress, or simply grief) remains relatively consistent along a spectrum, how trauma and identity interact can be far more variable. Of the 9 taxonomic classes of post trauma identity proposed by Waterman, only one is the consistent continuation of identity. Examples of how experiencers of traumatic events can have varying levels of change in identity from acute to paradigm can be found in the literature (Berman, 2016; Ertorer, 2014; Skarstein & Schultz, 2018; Wiley, 2014). Other research has found that identity can be dramatically shaped by traumatic events; such as in the case of Vietnam Era veterans. Those who appeared to integrate their Vietnam veteran status into their identity struggled more with their non-trauma related memory

recollection and maintenance than those who did not (McNally et al., 1995). While in

Chinese parents who experienced a loss of a child, identity was reconstructed around the

label "shiduers" *(*lit. "people whose child has died), which resulted in dramatic changes

in social and cultural status, due to political policies on childbearing (Zheng & Lawson,

2015).

Traumatized veterans in particular struggle with the navigation of two identities

that are imposed on them by social conventions, given "national hero" status, but also

stigmatized as "broken" especially when considering mental health services (Feinstein,

2015). Other studies found that in those without mental health disorders, the barriers with

the largest percentage of positive results were those surrounding identity or social

perceptions ("I would be seen as weak" 31%, "Members of my unit might have less

confidence in me" 33%, "It would be too embarrassing" 18%, "My unit leadership might

treat me differently" 33%), while those who met criteria for mental health disorders saw

similar trends at a higher rate (65%, 59%, 41%, 63% respectively) (Hoge & Cotting,

2004). Research in the two identities of "soldiers" (or warrior, as they are often regarded

as), and "survivor" (or victim, as many sufferers of mental health disorders are regarded

as), is rife with the recognition of this troubling dichotomy (Adams et al., 2019; Reit,

2009; Romaniuk & Kidd, 2018)

Models of trauma integration[4] into identity show that negative integration can

have adverse effects on the individual; Waterman (2020) recognized such effects as

identity delay (putting off key milestones due to trauma), identity threat (calling into

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[4] Trauma integration is the process in which an individual uses trauma to inform the continuous
formation of their identity.

question key aspects of identity), identity loss or alteration (changing or even complete removal of key aspects of identity due to trauma, for example an avid runner who was assaulted during a night run may give up running entirely), and even shaping or centering identity by/around trauma (treating their trauma as a major part or whole sum of their identity and using it to guide their life). Further, Berntsen & Rubin (2007) demonstrated that negative trauma integration, which they capture through survey questions to reflect how dynamically trauma altered their life, decision making, and worldview, could be used to predict PTSD symptomology. Contrary to this, positive integration of trauma into identity has been shown to allow the individual to continue onto parts of their life that brings fulfillment (Maitlis, Sally, 2009), avoid the stressors of social stigmas regarding their trauma and self-victimizing and even positively contribute to community discourse regarding types of traumatization and victims. (Ralston, 2015). Key goals in therapy following trauma exposure typically center on creating positive integration in clients, especially when being seen immediately following trauma (Wilson et al., 2001).

In understanding the process of trauma integration and establishing what insights can be drawn from the process, linguistics offers two major methodological and theoretical tools. Narrative analysis, which is already largely used as a therapeutic process (O'Connor, 2014), provides insights into how ideas around events and the identity are formed. Current research in linguistics looks at aspects of identity such as racial, social, or sexual identity (among others) in a variety of contexts and provides insights into the formation of identity as a product of experience (Jones, 2016; Khoo & Ganapathy, 2016; Lindblom, 2015). Linguistic research on labels looks at both individual and community discourse as it relates to labels, and titles given to people, and how that

impacts identity, feelings of belonging, and provides a wealth of insight into individuals

both with the label, and labeling others (Fitzgerald, 2015; Oxley, 2015; Read, 2013). As

trauma interacts with identity, and the way traumatized people are both labeled and label

themselves is a major point of concern and interest, linguistic research could provide

invaluable insight in helping to understand the social and internal constructions of

identity formed as a result of trauma.

Community Ideologies, Trauma and Healthcare

The movement of ideologies, attitudes and beliefs between a community and its

members is bidirectional. The experiences and ideologies of the individuals collectively

modify community attitudes, while community attitudes shape individuals' approaches

and formation of beliefs over time, with a major component of ideologies for trauma in

communities being informed by intergenerational trauma. Intergenerational trauma

"generally refers to the ways in which trauma experienced in one generation affects the

health and well-being of descendants of future generations" (Sangalang & Vang, 2017)

with multidimensional effects that extend to "familial, social, cultural, neurobiological

and possibly even genetic" realms (DeAngelis, 2019, para. 4). The cultural and

intergenerational trauma can have measured effects on many domains of life for affected

cultures, and the people that consider themselves a part of it (Ford, 2014; Halloran, 2019;

Kidron, 2003; Kim, 2007; Mohatt et al., 2014). Shared experiences of individuals across

a culture—may they be a singular large event experienced either first hand or witnessed

(Lu, 2015; Rinker & Lawler, 2018), or smaller events experienced by individuals and

shared within their community (Jacobs et al., 2006; Ross, 2013)—appear to become

artifacts within the community that they use to inform themselves culturally and maintain their culture's survival.

Individuals inform their decisions in daily life based on the ideologies received from their culture. Trauma research should aim to understand how community ideas and ideologies about trauma inform individuals in the various domains of their life, focusing on "culturally relevant treatment" for specific groups (Committee on the Assessment of Ongoing Efforts in the Treatment of Posttraumatic Stress Disorder et al., 2014). Recognition of cultural attitudes has been shown to be a driving force in decision making even when contrary to one's own personal ideologies. One theory on decision making in social situations, named the social tuning hypothesis (Sinclair et al., 2005) or Shared Reality Theory (Van Lange et al., 2012) suggested that individuals will make decisions through a low-conscious awareness of what is socially appropriate, and use that as the driving force for their decision making in order to feel socially "in". Several studies have explored this phenomenon, investigating the confidence in stimuli based on the context of shared experience (Shteynberg, 2010), and predicting individuals attitudes based on intergroup behaviors on a macro scale (Conley et al., 2016). Social Tuning as a concept would help in explaining how ideas and attitudes, especially those regarding health care move through community and inform decisions.

Similar to Social Tuning, Pluralistic Ignorance describes the phenomenon where the individuals composing a group have personal beliefs about a norm contrary to what they think is the socially accepted belief, and that others in their group share that socially accepted belief, despite that not being the case. According to Prentice & Miller (1996) 'The norm may be a general, largely implicit prescription regarding appropriate social

behavior, or it may be a more specific and explicit prescription regarding how to act as a member of a particular group". Attitudes regarding things like alcohol, and associated risk taking behavior have been explored in college students (Suls & Green, 2003), establishing this phenomenon among them, and while some gendered differences were present the primary findings were a dissonance between what the majority actually believed, and what they were perceived to believe in line with pluralistic ignorance theory. More in line with the subject of this chapter, attitudes of police officers regarding mental health care access found pluralistic ignorance was also present (Karaffa & Koch, 2016), and considering the professional and cultural overlap of police officers and veterans this becomes especially interesting in the context of this paper. Even in healthcare pluralistic ignorance impacted healthcare choices and perceptions in emergency care following self-harm (Artis & Smith, 2013).

In researching the intersection of healthcare and trauma, many healthcare institutions have begun utilizing Trauma Informed Care as a model for working with communities. Trauma-informed care "is grounded in a person-centered approach, recovery-oriented practices, and empowerment strategies" (Kelly et al., 2014) and relies on not only an ability to understand the experiences that an individual has as being part of a community, but being able to recognize the indications of trauma within an individual. Research into psychological trauma has shown that trauma informed care can have a measurable impact in ways such as reduced time to discharge for in-patient facilities (Greenwald et al., 2012) and that trauma informed settings help improve provider-patient relationships and build autonomy in patients (Reeves, 2015). Trauma Informed Care calls for healthcare systems to take into account the variety of types of trauma the communities

they serve experience, and work to help build relationships that can address that trauma as a part of standard medical care, and be sensitive to that trauma in order to allow them to even provide medical care.

It would appear that while current research has indicated there are both internal and external factors that determine an individual likelihood of seeking health care (Sangalang & Vang, 2017), external forces override personal perspectives in many cases. Understanding the cultural origination of attitudes about healthcare, physicians, and mental health support would allow for rhetoric within communities to be targeted and shaped in such a way to undo these ingrained ideas. The research into where different community's trauma comes from, and how that informs individuals within the community healthcare decisions is an overlapping area, not two distinct ones. Linguistic research into narrative analysis, as previously discussed, would help in understanding individuals' experiences that were impacted by communities. In addition to this, discourse within the community should be examined and scrutinized to understand how conversations about trauma occur (or are avoided), and information about trauma and traumatic events is shared explicitly or implicitly, which would help in adjusting healthcare communication to account for these factors. Discourse analysis has long been used to understand communities' views of many phenomena, including cultural identity (Baker, 1994; Jones, 2014), politics (Stapleton & Wilson, 2010; van Dijk, 2006), religion (Buttny et al., 2013;Saghaye-Biria, 2012) and perceptions of other communities (De Cort et al., 2016). As a subfield of its own, medical discourse has been analyzed to understand how healthcare workers orient themselves to patients (Ainsworth-Vaughn, 1992; Barton & Eggly, 2009; Fioramonte, 2014; Wodak, 2006). Ainsworth-Vaugh (2005) identified

medical discourse as an area of research that demands continued interest due to "disparities between doctor and patient and the consequentiality of the talk" (p. 464), and as research into trauma expands, understanding that discourse specific to the context of trauma is imminently important. Linguistic research can inform both halves of this arena, by examining community discourse and narratives as it relates to trauma and as it relates to health care and can utilize the existing understanding of medical discourse to continue this examination into actual medical care.

CHAPTER 3

STUDY: SPEECH PAUSES AS POSTTRAUMATIC STRESS DISORDER

SYMPTOM SEVERITY PREDICTOR

With phonetics and prosody being an area identified in this thesis for expansion in trauma research, this study develops and tests a methodology to determine if symptomatology of post-traumatic stress disorder can be predicted through pause frequency in monologic discourse. Current research shows that cognition and language share a close link and that speech can be used to monitor cognitive change. To test the effectiveness of this approach, this study compared the pauses per 100 words to the score on a PCL-5 (Appendix A), a 20-question assessment tool that asks about frequency of symptoms via a 4-point scale used by the Department of Defense and by some civilian clinicians (Weathers et. al, 2013; Wortmann et al., 2016). As studies in cognitive science assessing other disorders have shown that speech is a reliable measure for cognitive function, this study aims to produce a reliable methodological approach to assessing speech features as they relate to PTSD and to highlight potential uses of this measure to develop objective and non-intrusive measures for assessment and analysis.

Veterans are the focal population for this study, and student veterans from institutions around the country were recruited as participants. The study uses prompts about education to elicit monologic discourse for the purpose of assessment of pause frequency (Kahng, 2014), in order to establish the relationship between cognitive function and PTSD that is expressed through speech.

This pilot study is formulated with the intent to create a methodology that can answer the following two research questions:

1. Can pause frequency (per 100 words) be used to reliably predict whether an individual does or does not have PTSD?

2. Is pause frequency correlated with PCL-5 assessment scores which is based off of PTSD symptomatology?

The research hypothesis for this study is that due to the affect symptoms of PTSD have on cognitive function (Qureshi et al., 2011; Schuitevoerder et al., 2013), a measurable depression in cognitive function would be reflected in speech, and such findings would be distinguishable from a control group without a PTSD diagnosis. If that is the case, we would expect a positive correlation with PCL-5 scores and the general distribution of pause frequency across all participants, with increasing pause frequency as symptomology increases.

Cognitive Function and Speech Pauses

Pauses are an area of interest in linguistics due to the purposes they fulfill within speech. Pausing has both physiological and psychological reasons, making a consensus definition for them difficult. Acting as a set of cues, there are defined differences between hesitation pauses (periods of silence between utterance) and breath pauses (periods of silences marked with inhalation or exhalation) (Goldman-Eisler, 1958), as well as filler pauses such as [ʌ:] or [ʌ:m] (Trouvain et. al, 2016). Studies focused on pauses should differentiate between the types of pauses being researched or explain when all are being observed. One of the earliest works focusing entirely on pauses by Goldman-Eisler (1958) argued that pauses less than 250ms were articulatory gaps in speech needed to transition from one phoneme to another, while other studies have used thresholds as low at 80ms (Levin et al., 1967). Hieke (1983) argued that while Goldman-Eisler's 250ms

cut-off had been adopted as the "standard" for many researchers, a standard of 100ms could be used. However, in Hieke's finding, articulatory pauses were captured in ranges of 130ms to 250ms which could confound data that aims to look at pauses relating to psychological processes. These three types of pauses are often functionally linked together as acoustic-psychological pauses (Igras-Cybulska et al., 2016; Kendall, 2009), and specifically distinguishing between breath pauses and silent pauses has been shown to have minimal change to findings, stating that when asking the "question of whether breath pauses and non-breath pauses overlap [it was] found that, in terms of pause location, that 'there were no systematic differences between the breathing and no-breathing conditions'"(as cited in Kendall, 2009).

The research literature on pauses is reflective of a psycholinguistic academic field that explores cognitive function and speech ability such observing L1 and L2 differences, (Takavoli 2010; Trouvain et. al, 2016), or observing changes following disease and disorders that alter neurological function (Huber et al, 2012; Pistono et. al, 2019).

Research focusing on discourse have used pause measurement to track cognitive loads and cognitive functioning in both speakers and observants, reflecting changes in cognitive processing ability through changes in pause patterns, rates and length. Buller and Burgoon theorized that lying was an act that increased cognitive loads, positing;

> Finally, we assume that deception and deception detection are complex tasks that add further cognitive demands beyond those already associated with conducting conversation. Deceivers must strategically manipulate information to craft plausible messages "on-line" all the while attending to partner reactions for information about success or failure. Detectors in turn must choose whether to mask or reveal their suspicions while searching for clues to deception. (1996, pg 210)

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Thus, the linguistic choices (both conscious and unconscious) made by people who are lying, should reflect that increase in cognitive load. Buller and Burgoon's theory would later be backed by DePaulo et al. in their work, showing indicators that "liars may have been more preoccupied than truth tellers" (2003, pg. 103). With confidence that lying increases cognitive load, other work in deception focuses on looking for cues that reflect that deception. Mann et. al made observations of a group of behaviors including non-linguistic cues (Gaze aversion, blinking, self-manipulations, hand/finger movements), and linguistic cues including speech disturbances (including filler pauses) and pauses which were defined as moments of silence greater than 0.5 seconds between words (2002). Within this work, Mann et. al. showed that one of two most reliable indicators of deception was pause measurement, where 81% of speakers were shown to have increased lengths of pauses (2002). The work in deception shows that cognitive load increases and linguistic pauses (both filler and hesitation) share some level of relation, which follows a reasonable proposal that increased cognitive processing requirements and larger cognitive load impede an individual's ability to speak naturally without decoherence. This is further backed in research in neurology and brain disorders, where speech pathologists regularly use speech as a mechanism to diagnose and measure treatment efficacy. Research into pauses have also focused on Parkinson's Disease, which has been known to have an impact on speech, with dysarthria being a known symptom ("Parkinson's disease" 2018).

Research into contrastive rhythm has shown rhythm can be used to differentiate healthy individuals from those suffering from Parkinson's Disease and other dysarthrias, as well as 80% accuracy in distinguishing between various forms of dysarthrias (Liss et.

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al, 2009). Other studies have looked at gross speech analysis and found reliable measures of cognitive loads within individuals with Parkinson's Disease as well. Work by Kara Smith and her peers aimed to analyze linguistic markers indicating word finding difficulty in patients with Parkinson's. They measured multiple instruments, including pauses and speech rate. This study found that pauses were more likely to be present between utterances in patients with Parkinson's Disease in comparison to their controls and was also found to be the "single predictive factor of patient-reported [word finding difficulty] in our model" (Smith, 2018 p. 1696). Similarly, in another study that investigated how aging and Parkinson's Disease interacted with speech production, Jiyeon Lee et. al, analyzed story retell. Their study revealed that "production of pauses during connected speech reflects cognitive processes underlying language production beyond respiratory-physiological processes in aging and [Parkinson's Disease]" and called for further review in order to differentiate effects of aging from Parkinson's Disease. This would suggest that the effects of Parkinson's Disease on cognitive function present a change in pauses that is unable to be attributed to aging or reduction in ability due to physiological changes by Parkinson's Disease.

Another study investigating individuals with Alzheimer's Disease (Pistono et al., 2016) tested pause frequency with memory recall and found that participants with early stage Alzheimer's Disease with mild cognitive impairment (MCI) positively correlated with pause rate in episodic memory performance. This further supports that the cognitive impairment can be directly reflected in speech production.

The findings of these studies show collectively that not only are cognitive function and speech closely related, but in both neurologically healthy populations and in

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populations with cognitive decline from neurodegenerative disorders, there is a relationship between cognitive factors and pausing in speech. With an understanding that not only does PTSD cause an increased cognitive load with certain symptoms (hypervigilance for example) but has also been shown to be linked to cognitive decline with worsening symptoms (Qureshi et al., 2011), exploring this avenue with PTSD and trauma exposure is worthwhile. An objective measure for cognitive function can be seen as a welcomed addition to the toolbox of methods clinicians currently have. Developing efficient ways of diagnosing and assessing PTSD and PTSD treatment efficacy in veterans could have life-saving consequences, adding even greater urgency to this area of investigation.

CHAPTER 4

METHODOLOGY

Recruitment Procedure

Participant recruitment was conducted in two phases. Due to the changes to academic institutions across the country as a result of COVID-19, the original research design was modified in order to accommodate for the changes in modality (from face-to-face to online) at Arizona State University, which acts as the distinguishing feature between the first and second phases of recruitment. For the first phase, participants were recruited based on 3 criteria: they are (a) current students at Arizona State University, (b) who were active military members, (or had prior service), and (c) were between 21 and 45 years old. The data collection method that will be explained in the next section relied on question prompts about educational choices to elicit speech samples. Because veterans were the focal, I elected to use veterans as both the control group and variable group in order to minimize other potential differences between participants and to maximize the likelihood that the cause of PTSD in the participants was similar in nature. Finally, the age range was chosen in order to control for age effects on speech. While studies have shown major effects on speech typically begin around the ages of 70 (Kemper et al., 2003; Mortensen et al., 2006), others have suggested physiological changes such as lung elasticity could have effects as early as 20 years prior to that (Huber & Spruill, 2008), and cognitive changes in adults can begin to become apparent typically around 50 to 60 years of age (Salthouse, 2009). Another consideration was that the "War on Terror", which much of the modern information on PTSD in veterans is sourced from, began following September 11th, 2001. By limiting the age range to 45, it ensured that the participants

would have served during that period. Participants were given $5 in compensation for their participation.

In the first phase of recruitment, participants were recruited through two mediums. First, an email script (Appendix B) was sent out through the Pat Tillman Veteran Center (PTVC) at Arizona State University. The PTVC has an email listserv of all military affiliated students associated with the university, allowing them to contact any potential participants on my behalf. The email script informed potential participants that a study was being conducted, that they would be asked about educational choices following their service, and that audio recordings would be made of the meetings. Contact information was provided in the email and potential participants could reach out to the researcher. Additionally, a flyer with similar information was created to be left at the PTVC so any potential participants could reach out if they saw the flyer and were interested. These methods only produced 4 participants for the study.

Due to the COVID-19 pandemic, following Spring Break 2020, Arizona State University elected to transfer all face-to-face classes and activities to fully online meetings. This reduced my ability to recruit at the PTVC as well as removing my ability to conduct in-person interviews, triggering the need for a second recruitment phase. In this phase, the same information utilized in the first phase of recruitment was posted on social media platforms including Facebook, Instagram, and Reddit. Reddit, a forum based social media platform has a variety of pages called "Subreddits", some of which are military focused. Participation requirements and other study details were advertised along with the researcher's email address. This method produced 32 interested participants, with 17 that consented to participate in the study. At this stage of recruitment, participant

interviews were conducted using the Zoom tele-conferencing interface. All participants were asked to pass my information along to any interested and eligible participants. This method, snowball sampling (Naderifar et al., 2017) produced one additional participant, bringing the total number of participants to 22.

It should be noted that upon actually conducting the study, 2 participants did not produce monologic talk in excess of 100 words. A third participant was not included because they did not provide a completed PCL-5 in order to extract a score for analysis. This left the study with 19 participants for the final analysis.

Participants

Recruitment was not done with the intention to favor any one branch, gender, or demographic area. Potential participants were informed that this study was related to PTSD but that they did not need to have PTSD in order to participate. Any individuals with PTSD from trauma not associated with the military were excluded from participation. Protected classes of individuals (e.g., minors, incarcerated individuals, those belonging to indigenous populations, and adult's incapable of giving consent on their own) were also excluded. See Table 1 for participants' demographic details.

Table 1

Participant Demographics

	n	%
Gender		
Male	15	.78
Female	4	.22
Age		
21 - 25	5	.26
26 - 30	7	.37
31 - 35	3	.16
36 - 40	1	.05
41 - 45	3	.16
Branch of Service		
Army	5	.26
Navy	7	.37
Air Force	2	.11
Marine Corps	4	.21
Coast Guard	1	.05
Combat Exposure		
Yes	6	.32
No	13	.68
Mental Health Diagnosis		
Yes	5	.26
No	14	.74

	M	SD
Length of Service	6.92 years	5.15
Time Since Service	3.19 years	3.81
Number of Deployments	2.41	2.21

Note. N = 19

Of the demographic information collected, some was for inclusionary criteria (e.g., age, branch of service), and other was to control for other factors such as associated mental health disorders that may influence speech. It should be noted that the definition of a "deployment" varies between each branch of the military, and that combat exposure is not a defining trait of a deployment. Number of deployments was captured as a part of demographic information, but in terms of controls the combat exposure was the preferred control. None of the participants that successfully completed the pilot study and produced data that could be utilized had a PTSD diagnosis. This is explained in depth in the Discussion section. All participants were first language English speakers.

Data Collection

Whether conducted in person or over Zoom, the procedure for data collection was the same. When a participant expressed interest in the study, they were sent the Consent Form (Appendix C) which informed them of the general procedures of the study, the intent to utilize data for phonetic analysis related to PTSD, and that they would be compensated $5 cash or via mobile payment services. Upon returning the consent form, a meeting time was scheduled.

Participants were informed of the general procedure as follows: they would be asked a series of questions about their education and they would be given as much time as needed to answer. They were asked to speak for at least 90 seconds, if they needed to speak longer than that they could. They were instructed that a hand gesture would be used when they reached 90 seconds of speaking but would not be interrupted. If participants

failed to reach the 90 second mark, the researcher offered prompts to elicit a longer response (how this impacted analysis is explained in the next section). Following the speaking portion, they were be asked for demographic information, then given the PCL-5 to fill out. As the PCL-5 is a standard form used by all branches of the military as a part of their standard medical operations, all participants expressed familiarity with the form except one (this participant was also an outlier in that their service had ended 15 years ago, the largest gap between service and participation). Participants were instructed that their participation was anonymous, and that the scores from the PCL-5 were assigned with their pseudonym (Participant #). Finally, participants were informed of the purpose of the study outside of its advertised intent and were given the option to withdraw their participation. No participants chose to opt out at this stage, though several did ask additional questions about the objective of the study, how it would be achieved, and what data would be used.

The full script used to prompt for the study can be found in Appendix D. Participants were prompted with the following questions:

What school and program are you enrolled in?

Why did you choose that school and program?

Does it, and if so how, relate to your military service at all?

The questions served a dual purpose. First, the study was advertised as a study on educational decision-making post-service. These questions allowed the study to maintain this appearance and recruit participants in the appropriate subject pool. Secondary to that, the topic of the questions was something with which these student participants were likely familiar; talking about one's educational decisions is a frequent topic with

advisors, friends an family. This aimed to produce natural monologues without adding any additional cognitive load, a similar procedure that has been used in the past (Kahng, 2014). Some participants requested to have the questions written down, and several participants paused during the course of their monologues in order to ask for the next question to be answered (how this was addressed in analysis is discussed later in this section).

Participants were given the instruction "You can begin whenever you're ready" and the recorder was turned on at this point. For the interviews conducted in person, I actively engaged with the speaker by nodding but made sure not to speak to avoid interfering with the recording. For the interviews conducted on Zoom the same procedure was used, however I used the mute feature so that any sound I made would not be recorded. The objective was to produce naturalistic or conversational speech, which in part relies on active engagement by the audience. By responding non-verbally with the participant, I aimed to help encourage the participant to continue to speak and facilitate them feeling like this was a conversation and not a study.

Participants were reassured they could stop and revoke permission at any point during the duration of the study, but no participant did so. When the participant was finished speaking, they were asked the demographic questions. As mentioned in the previous section, the definition of a "deployment" varies from branch to branch. The nature of US Navy deployments on a ship and their rotating schedule means that even the person-to-person definition of a deployment varied. Due to this, participants were told that it would be defined as any time spent outside of the continental United States that was not considered a permanent duty station. Following collection of demographic

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information, participants were given the PCL-5 (Appendix A) to complete and reassured

that I only counted their scores and did not use their individual answers as a part of my

assessment process.

The interviews conducted in person, they were recorded on a handheld digital

recording device. Audio files were extracted from the device, uploaded onto the computer

and converted from WMA to WAV files. For interviews conducted on the Zoom

platform, the software exports files as m4a, which were also converted to WAV for

editing on Praat[5] (Boersma & Weenink, 2018).

Data Analysis

The editing process for both types of interviews (whether done in person or over

Zoom) was the same. First, files were cut down to remove any conversation or periods of

silence prior to the participant speaking, so that the first section of every interview was an

utterance. Then they were cut down to remove any periods of silence from the last

utterance the participant made and the researcher confirming they were completed. If the

participant verbalized their completion (such as saying "and that's all"), that utterance

was included as a part of their speech sample.

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[5] PRAAT is a free to use speech analysis software that allows users to upload, edit, and analyze a variety of speech features.
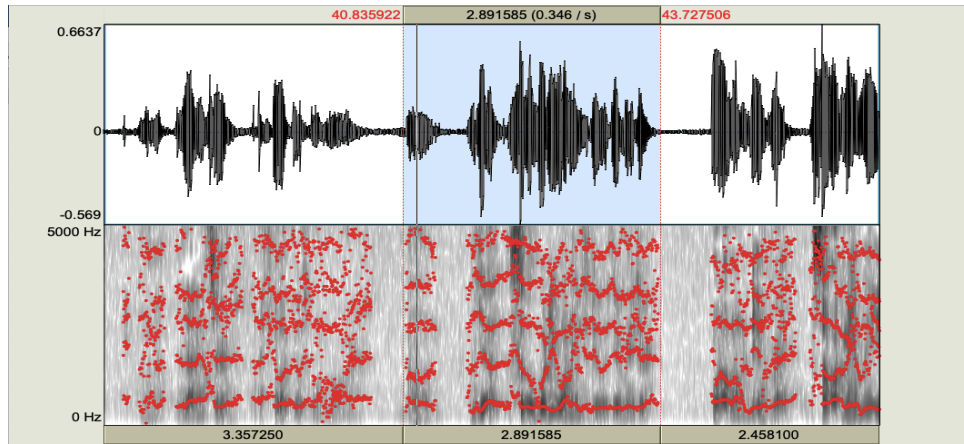
Figure 2: The highlighted portion is where the researcher spoke, surrounded by two periods of silence.
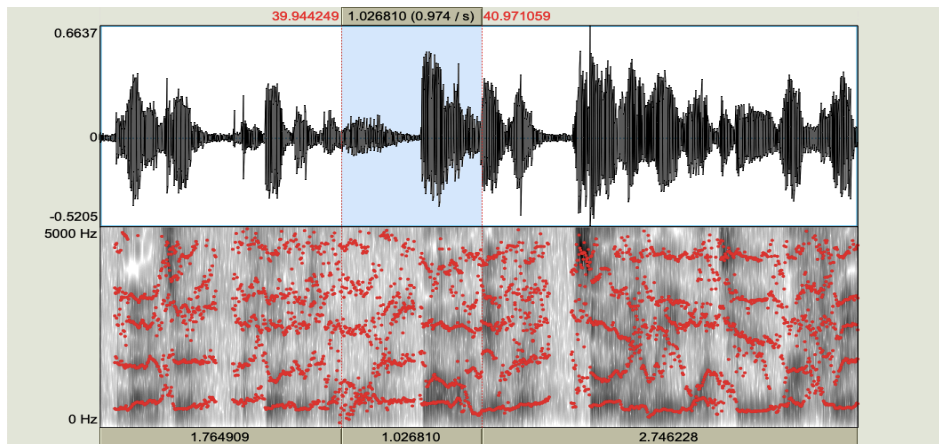
Figure 3: This same period is shown here as in Figure 2, with the researcher's, and the surrounding silences removed. The highlighted segment shows the uninterrupted transition of the participants speech.

Then, careful review of the recording was done to extract parts of the recording that the researcher spoke (shown in Figures 2 and Figures 3). If the participant asked a question, the period of silence following the question, the researcher's response, and the period of silence between the researcher's response and the participant continuing were also removed (this is consistent with procedures used by Pistono et al., 2019). The result would be that there would not be a substantial (greater than 250ms) pause between their question, and their continuation following the answer. This was done because the aim of

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the study was to capture silent and filled pauses, not conversational ones. If the participant asked a question that they answered themselves, it was considered a part of their speech sample and not removed.

Once this was established, the Annotate to Textgrid (silences)[6] feature native to PRAAT was used. For the setting the Minimum Pitch (Hz) was set to 60, and the minimal silent interval duration (seconds) was set to 0.25. The 0.25 seconds was done based on previously discussed research in order to avoid accounting for articulatory and transitional pauses as silent pauses (Goldman-Eisler, F., 1968; Pistono et al., 2016; Rochester, 1973). While earlier works have measured pauses through the use of stopwatches, relying on finetuned materials (Hieke, 1983), speech analysis software have been used in more recent studies (Kendall, 2009; Redford, 2013) The Minimum Pitch was based on a series of tests to most accurately capture the pauses without under adjusting, or over adjusting and capturing fricatives.

Once a textgrid was generated with the calculated periods of silence, I manually adjusted the silent periods through the recording by careful analysis of spectrograms and waveforms. The purpose of the manual adjustment was to address a few criteria to ensure accurate data.

    1. Fricatives, especially word final fricatives, were often captured in the silent range, and the pause period would need to be adjusted not to include them.

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[6] This feature automatically marks the boundaries for silences based on the parameters set, allowing the program to recognize and mark when sound is and isn't being produced. It then produces a Textgrid for PRAAT where words can be assigned to each segment, allowing them to be identified as "utterance" or "silence"

2. Background noise was sometimes captured as an utterance during silent periods and needed to be removed.

3. Filled pauses (/ʌ/ and /ʌm/) were captured as utterances and had to be adjusted to be counted as pauses.

Filled pauses were exclusively considered to be /ʌ/ and /ʌm/ due to ability to accurately distinguish them from otherwise meaningful speech (Christenfeld, 2016), and that they are consistently included in the class of filled pauses across the literature (Clark, 2002; Hallin et al., 2016; Laserna et al., 2014). In evaluating silences, consecutive silences were considered as a single period of silence. That is if the participant has a silent pause, followed by a filled pause leading into an utterance or any similar sequence, it was considered and labeled as a single pause for the sake of analysis, as has been done in previous studies (Kahng, 2014), shown in Figures 4 and 5.
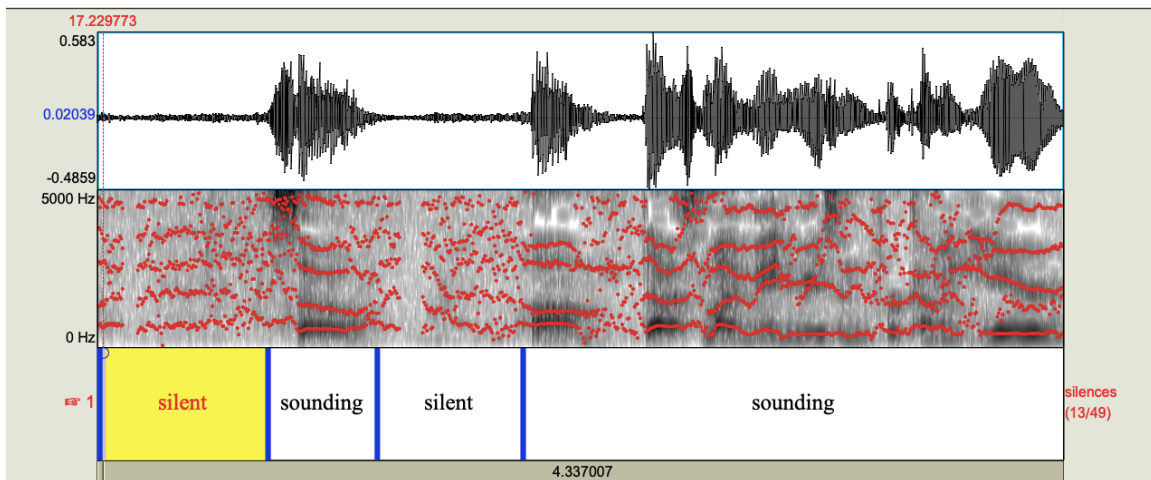
Figure 4: This segment the participant is saying "So uhm thats my main reason for coming here" with the "uhm" being identified as part of the speech.

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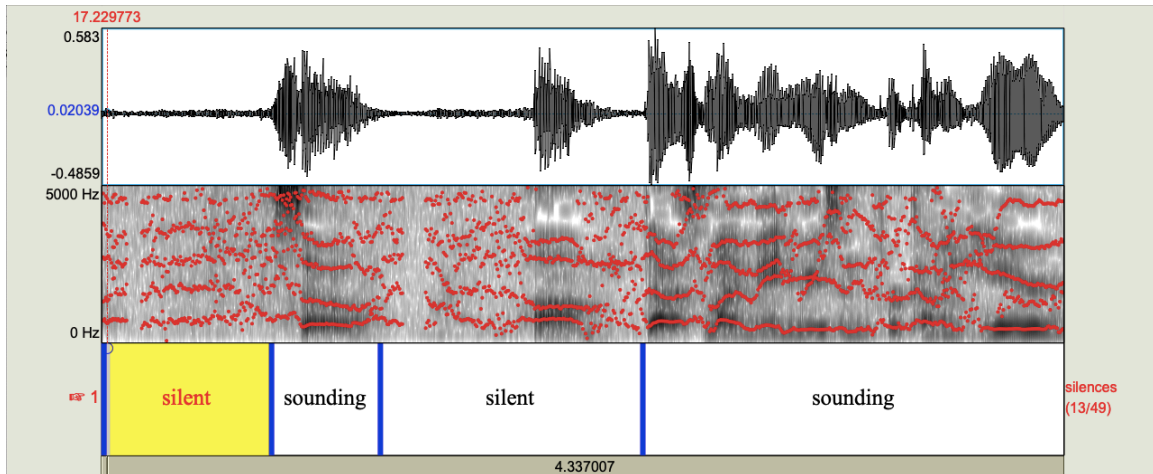
Figure 5: This is the same segment as Figure 4, with the silent period extended to capture both the filler pause and the period of silence following it before the participant resumes speaking.

Once the data was properly labeled, it was saved with the text grid and exported as a table for analysis. Following this, transcriptions of the monologue were carefully written. All monologues were transcribed utterance by utterance and done on two separate occasions to ensure accuracy. Pause frequency was calculated as pauses per 100 words and plotted against the individual PCL-5 scores.

CHAPTER 5

RESULTS

Findings of the study were inconclusive, due to limitations in the participant pool.

Because a sample to population comparison is recommended to have a minimum

threshold of 30, the study participant pool of 19 was not large enough to be considered

able to produce significant data. No significant trend became apparent in the data, which

is visible on the data below in Figure 6. Due to the variability in the data, it was

immediately apparent that a lack of trend was present, and no statistical analysis was

deemed necessary. PCL scores were distributed between the range of 0 to 49, and pause

frequency were distributed between the range of 4.32 and 11.39.
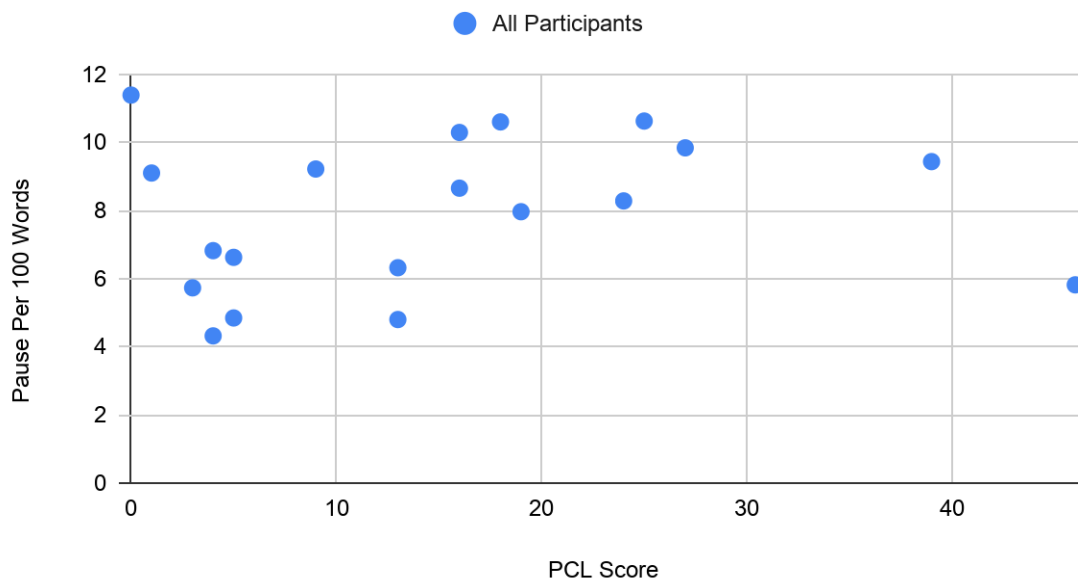
Figure 6: Study Findings

The 10-point ranges for the PCL-5 (0-9,10-19,20-29,30-39, 40+) show a great amount of

variability in the initial groups. For the two groups under twenty, the most frequent

pauser had greater than 200% the pauses than the least frequent pauser in the respective groups. It could be potentially notable that of the 5 participants that scored over 20 on the PCL-5, only one participant had less than 8 pauses per 100 words. However, that one outlier was also the highest scorer on the PCL-5, which would have had a great effect on any statistical analysis intended to establish a trend. When the two participants who scored over 30 (the threshold that merits further evaluation for PTSD) are removed, a positive trend does form in the remaining 17 participants, shown in Figure 7. This suggests that a correlation between trauma symptoms and pause frequency may exist, and higher saturation of participants over the score of 30 is needed for evaluation.
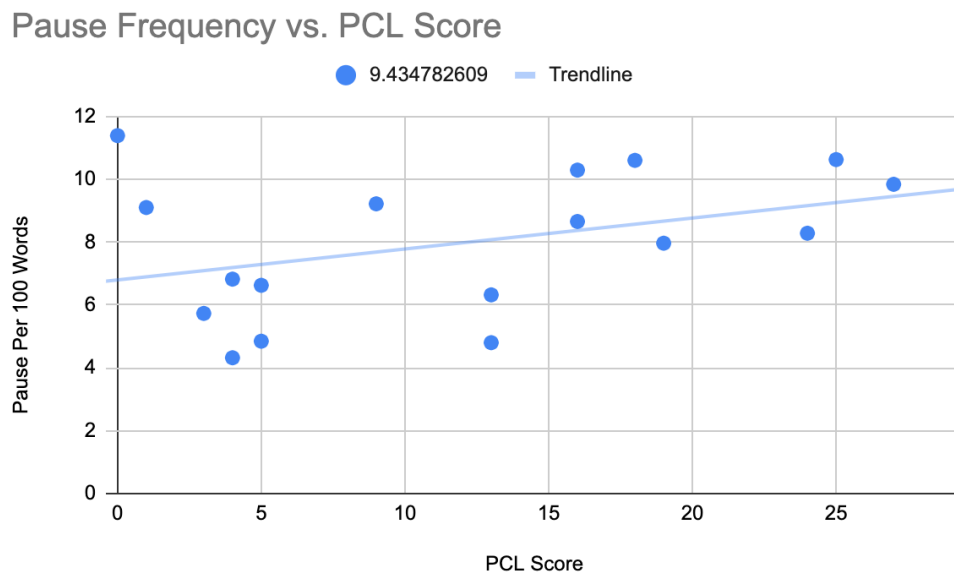
Figure 7: Sub-threshhold participants

Despite the intent of the study to compare participants with PTSD to those without, there were no participants who fulfilled the requirements of the study that had a PTSD diagnosis. It is of note that of the 10 participants that had combat exposure or a

diagnosed mental health disorder (one participant fell into both groups), 7 of the 10

participants produced more than 8 pauses per 100 words as shown in Figure 8.

Control, Mental Health Dx., Combat Exposure and Both
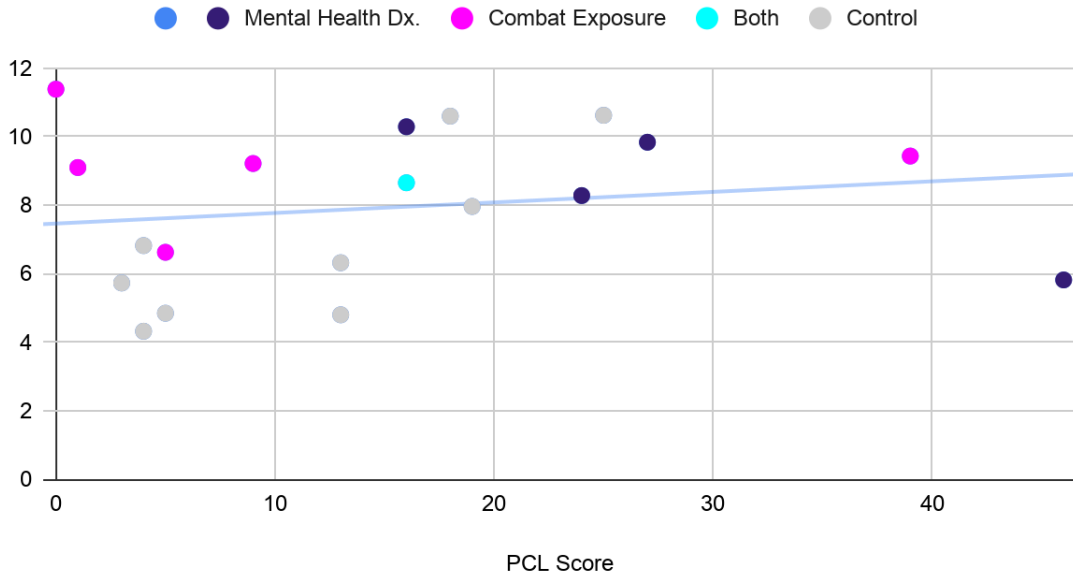
Figure 8: Findings for Combat and Mental Health

CHAPTER 6

DISCUSSION

The aim of this study was to apply some of the tools of linguistics to trauma

research by creating a methodology that could reliably be used in the future to test for

linguistic indicators of trauma on a larger sample size. The elicitation method

successfully produced monologic speech samples that were able to be used for data in 20

of the 22 participants. The methods of recording the participants, in person and via Zoom,

produced clear data for editing and analysis. This pilot study shows through its methods

and tentative findings that future studies can use more naturalistic settings, rather than

sound booths, to still produce clear data that can be used for research. As one of the goals

was to produce as natural a conversation as possible for the purpose of analysis, knowing

that software like Zoom or a handheld digital recorder still produces clear audio data that

can be used for pause analysis is key to being able to maintain that standard. Future

studies could replicate these methods on a larger scale.

The findings were inconclusive due to several factors that will be discussed, but

there are still some things of note about the data. The expectations of the study were that

there would be a direct relationship between the pause rate of the individuals and their

scores on the PCL-5, with the number of pauses per 100 words increasing with the score.

The research literature has suggested that the cognitive disorders can be reflected in

pause frequency (Liss et. al, 2009; Pistono et al., 2016; Smith, 2018), and with the

increased cognitive demands created by PTSD it was expected this correlation could also

hold true for those with the disorder. A meaningful trend could not be established due to

a failure to meet a sample size threshold of 30, however a positive trend did become

apparent when looking at only the participants who scored below a 33 on the PCL-5 (n=17). In this group, a positive trend formed which may suggest there is some positive correlation between the symptoms one experiences and pause frequency. A large sample size would be necessary to further evaluate this, and saturation would need to be obtained in participants with PTSD in order to establish if the trend continues.

O interesting trend was with the participants that had combat exposure or non-PTSD mental health diagnosis. A total of 10 participants (5 with combat exposure, 4 with a mental health diagnosis, 1 with both) fell into these demographic groups and of those 10, 7 had a score equal to or higher than the pause frequency. While the present data set cannot establish if there is any correlation between combat exposure or other mental health diagnoses and pause frequency,this is something worth exploring in the future. Interestingly, there did not appear to be a correlation with pause frequency and number of deployments in the combat exposed participants, however some deployments could have frequent combat, and some could have zero, so number of deployments is not a reliable way to predict combat exposure.

There are a few factors at play here that could be responsible for the distribution of these two groups. The first is that, as mentioned, self-reporting is not an entirely reliable method for diagnosing or capturing PTSD (which is the driving force behind this entire study). It's entirely possible that the participants with combat exposure were not properly reporting how they were affected by the trauma and that their PCL-5 score should be higher. However, the research literature has shown that combat exposure will not always result in the development of PTSD (Frueh et al., 2005). While this could be attributed to underreporting of symptoms, there isn't a substantial reason to believe this

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could have impacted the results. Additionally, it is possible that other mental health disorders could interact with cognitive ability (Biringer et al., 2005; Donovan et al., 2017) and speech production; however the participants were not surveyed for specific disorders so there is no way to know what disorders the participants were diagnosed with in order to control for this. Future research would need to consider ways to tease apart PTSD- and non-PTSD-related (e.g.; anxiety, bi-polar) influences on performance. Of those with mental health diagnosis, 2 of the 5 still scored under the trendline, and of those with combat exposure 1 of the 6 scored under the trend. Research focusing on these factors would be necessary in order to appropriately establish if these factors are directly related to the pause frequency.

This process did highlight two concerns in the analysis that could have influenced the results of the study. The first was that participants often used non-standard fillers as a way of creating a period of time without producing any utterances. For example, it was not uncommon for participants to pair filler pauses with other discourse markets. For example, "But uh" (/bʌt ʌ/) was a very common utterance, but only /ʌ/ was considered a pause. Similarly, the utterance "so" (/soʊ/)" was often used while the /oʊ/ was held over 250ms. While the /soʊ/ functioned as a pause, it was not considered a pause within the parameters of the study. In addition to this, words that ended in sonorants would often be held for periods over 250ms, or intrude on periods of pauses, shortening the pause period. For one participant they produced the phrase "computer science classes and math classes" with the word final /s/ in classes being held for 350ms. The parameters for this study did not account for sonorants being used in place of pauses and no literature exploring this phenomenon as it relates to pausing could be found.

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Another challenge faced here was the definite article "a", which can be produced as /ʌ/. Through the data analysis, particularly when the researcher was going through the data and expanding boundaries to include filler pauses, an evaluation had to be made regarding whether a /ʌ/ was meant to be a filler pause or a definite article. This process was done based on interpretation of the surrounding utterances but was an unforeseen complicated that should be considered in future research.

Beyond the contributions of this study to research on pauses and trauma in speech production, it has also highlighted several key areas (Chapter 2) in which linguistics can provide conceptual and methodological insights for trauma research. The linguistic fields shown in Figure 1 (pg. 13) have the potential to make meaningful contributions to trauma research. By highlighting these areas, it is hoped that linguists and other language researchers will pursue more interdisciplinary work on trauma.

Limitations

There were several limitations to the study that influenced the results and findings. The limitations were largely due to participant recruitment. This study was conducted in the first 6 months of 2020, with the first phase of recruitment beginning in February of 2020. Unfortunately, the 2020 COVID-19 pandemic created many difficulties for recruitment. During spring break, Arizona State University announced on March 11th that classes would transition exclusively to an online model, and on the 13th announced that all on campus events would be closed through the end of the Spring Semester (*Novel Coronavirus | Arizona State University*, n.d.). The change in modality at ASU removed virtually any opportunity to recruit in person as originally intended with the study design, as the activity on campus reduced to virtually zero. This required that

the study be reevaluated, and the recruitment method transitioned into the second phase of recruitment. Recruiting through social media required approval in some instances (on Reddit, Facebook groups, or through student veteran pages on Instagram) which also slowed the process.

This change resulted in an inability to meet with potential participants face-to-face, and instead only allowed passive recruitment through the currently existing channels such as the email listserv and the PTVC Instagram page. The small number of participants was the first major limitation to the study, as it did not become worthwhile to do a statistical analysis with such a small sample size. The range of the scores on the PCL-5 and the range in pause frequency would require a far larger number of participants in order to reach saturation and get reliable enough data to get statistically significant data.

While the total number of participants was a major limitation itself, the research question regarding the comparison of controls and those with a PTSD diagnosis could not be answered due to the lack of any participants with a PTSD diagnosis. Of the three participants that were eliminated, two of them did have a PTSD diagnosis, but did not meet sufficient criteria to be included in the study. This limitation could have been caused by two factors. The first possible cause is that veterans with PTSD may be less inclined to pursue degrees or to participate in extra-curricular activities like academic studies. While there is sparse research on this topic, one study did find that "[p]osttraumatic stress was also linked to lower academic performance (GPA), greater academic amotivation, and lower academic persistence" (Barry et al., 2012). Because the recruitment process relied on participant self-selection, individuals with PTSD may have

been less inclined to participate. Another possible reason could simply be that 2 participants with PTSD of 22 total participants roughly represents an equal distribution when compared to the actual population. With such a small sample size it's not wholly reliable to make this assumption but it could explain the ratio of participants with PTSD to those without. If the former proposal is the cause, this could be addressed by including in the recruitment a call for participants with PTSD. However, this could potentially eliminate interested participants as several participants reached out after reading the consent form with concern that they weren't eligible because they did not have PTSD. Careful wording would be necessary in order to account for these concerns.

Another limitation found through this study was in the tools used in the data collection, particularly the PCL-5. The PCL-5 uses a range of 0 to 80, with a score of 31-33 being sufficient for a provisional diagnosis of PTSD in accordance with the VA Standards (*PTSD Checklist for DSM-5 (PCL-5) - PTSD*, n.d.). With only two of the final 19 participants scoring over this benchmark, analysis becomes difficult. For the sake of establishing a trend, the PCL-5 would truly only be useful if a number of participants with PTSD were recruited and their scores could be recorded. It is entirely possible that those without a PTSD diagnosis did have the disorder undiagnosed, or that scores under the 31 provisional diagnosis could be reflective of an increased cognitive load. However, as the study was intended to see of cognitive function as it relates to PTSD symptomology, it's difficult to establish if the symptoms present in lower scoring participants are PTSD symptomology, or simply the byproduct of general stress and anxiety, other disorders, health issues, or simply due to things happening currently in their life. A larger sample size may have helped establish whether the variability within

the lowing scoring participants was a consistent trend throughout the range of the PCL-5, or if the variation would narrow as score increases as predicted. If that did occur it would be far more reasonable to say that while lower scoring symptomology can't be directly related to cognitive function, the narrowing suggests that as the score increases it becomes more predictably related.

While other tools could be used, the purpose was to measure symptomology, which would likely be highlighted in a similar matter with any other tools. Multiple tools might be appropriate for the purpose of checking for internal validity. Multiple tools would be especially important given the final limitation of the study; there was an inability to control for comorbid mental health diagnoses. As PTSD is known to be comorbid with depression and anxiety among other disorders (Goodman & Yehuda; Fernando et al., 2014; Lewis et al., 2010) being able to control for mental health diagnoses is key to obtaining results that can conclusively attribute difference in speech to PTSD. As other factors could influence cognitive function or speech ability, being unable to control for these issues is a major limitation that must be acknowledged in the research. Given the tentative findings surrounding the distribution of participants with mental health disorders, this is a particularly relevant concern that should be addressed in future research.

Future Studies

Future studies could potentially use this pilot study as a model with a larger sample size in order to test the hypothesis and to answer the research questions. Although the data and results were inconclusive, this study did find that the methods of analysis were sound and worked consistently across participants. As the questions were designed

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to elicit monologic talk from students, future iterations of the study could change the questions to be focused towards professions/careers or lifestyles, as long as the questions elicited sufficient example of monologic talk. Multiple questions similar in style and nature could be used across participants in different demographics (e.g., professional veterans, student veterans, etc.) in order to maximize potential size of the participants.

More careful selection for participants with PTSD is also necessary, as previously mentioned. Whether this is done through purposeful recruitment of those with official (i.e., medical) diagnosis of PTSD or adjusting the recruitment pool by successfully contacting potential participants with PTSD, this would definitely be needed in order to adjust for the disparity of veterans with and without PTSD. Conducting the study in an environment that is more heavily populated with potential participants with PTSD, or active recruitment of participants with PTSD would be needed in order to have a successful model in the future.

Additionally, given the tentative realizations of this study in regard to the distribution of participants with mental health disorders or combat exposure, it may be appropriate to eliminate participants with other mental health disorders, or more carefully survey for mental health disorders. As this study used a simple *yes/no* field for the mental health demographic, the actual diagnosis may be more appropriate and could potentially elucidate interesting findings. Future studies could potentially conduct studies focused exclusively on these demographic groups. Combat exposure can certainly be traumatic, and it is entirely possible that participants with combat exposure had posttraumatic stress related anxieties or disorders that would not be captured by the PCL-5. It is important to note that this study was intentionally designed in such a way as to capture trauma as a

direct result of combat exposure and to minimize trauma exposure from other sources, so

studies of similar design would not be able to separate these factors.

CHAPTER 7

CONCLUSION

This paper set out with the overarching goal to establish what ways the field of linguistics could uniquely contribute to trauma research. The major areas of trauma research were identified, and relevant research was reviewed and expanded upon to establish what areas could be contributed to by linguistic research. It was suggested that areas of diagnosis and assessment could benefit from linguistic research in phonetics, and morphology, with some existing linguistic research already suggesting that there is the ability to utilize morphological changes to predict symptom occurrence in PTSD (DAndrea, 2011). Research into the intersection of trauma and identity could be expanded upon by research into label and narratives in linguistics, which is already heavily exploring these areas as they relate to identity. Additionally, the area of barriers to treatment, such as culture, community and stigma can be explored through discourse analysis into community attitudes regarding both trauma and healthcare, but also through expanding a very large body of healthcare discourse analysis to also explore trauma and trauma informed care.

As a subset of this goal a proposed methodology tested if it was possible to capture data that could be used to test whether pause frequency (per 100 words) was related to PTSD symptoms and distinguish participants with PTSD from those without. The pilot study conducted with the proposed methodology produced clear data that was able to be used for analysis. While no analysis was done due to the limited number of participants, the methodology could be replicated in the future for a larger study.

The answering of these two questions acts as a call to action for linguists and trauma researchers to collaborate more closely in the future. Linguistic research is a largely untapped source for trauma research. The methodologies and tools of linguistics have much to contribute to trauma research—especially in terms of identifying and assessing trauma—and could potentially help many people affected by trauma throughout the world. Veterans in particular are disproportionately impacted by trauma as a professional hazard and there are organizations such as the Department of Veterans Affairs that have vested interests in conducting research to understand the experiences of veterans both during and post service and how they process trauma and its aftermath. With suicidality increasing in veterans with PTSD (U.S. Department of Veterans Affairs, 2019), there is an urgent demand for more expansive research so that this trend can be reversed. This thesis is another step in the right direction in accomplishing this goal.

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APPENDIX A

PCL-5

PCL-5

Instructions: Below is a list of problems that people sometimes have in response to a very stressful experience. Please read each problem carefully and then circle one of the numbers to the right to indicate how much you have been bothered by that problem <u>in the past month</u>.

In the past month, how much were you bothered by:	Not at all	A little bit	Moderately	Quite a bit	Extremely
1. Repeated, disturbing, and unwanted memories of the stressful experience?	0	1	2	3	4
2. Repeated, disturbing dreams of the stressful experience?	0	1	2	3	4
3. Suddenly feeling or acting as if the stressful experience were actually happening again (as if you were actually back there reliving it)?	0	1	2	3	4
4. Feeling very upset when something reminded you of the stressful experience?	0	1	2	3	4
5. Having strong physical reactions when something reminded you of the stressful experience (for example, heart pounding, trouble breathing, sweating)?	0	1	2	3	4
6. Avoiding memories, thoughts, or feelings related to the stressful experience?	0	1	2	3	4
7. Avoiding external reminders of the stressful experience (for example, people, places, conversations, activities, objects, or situations)?	0	1	2	3	4
8. Trouble remembering important parts of the stressful experience?	0	1	2	3	4
9. Having strong negative beliefs about yourself, other people, or the world (for example, having thoughts such as: I am bad, there is something seriously wrong with me, no one can be trusted, the world is completely dangerous)?	0	1	2	3	4
10. Blaming yourself or someone else for the stressful experience or what happened after it?	0	1	2	3	4
11. Having strong negative feelings such as fear, horror, anger, guilt, or shame?	0	1	2	3	4
12. Loss of interest in activities that you used to enjoy?	0	1	2	3	4
13. Feeling distant or cut off from other people?	0	1	2	3	4
14. Trouble experiencing positive feelings (for example, being unable to feel happiness or have loving feelings for people close to you)?	0	1	2	3	4
15. Irritable behavior, angry outbursts, or acting aggressively?	0	1	2	3	4
16. Taking too many risks or doing things that could cause you harm?	0	1	2	3	4
17. Being "superalert" or watchful or on guard?	0	1	2	3	4
18. Feeling jumpy or easily startled?	0	1	2	3	4
19. Having difficulty concentrating?	0	1	2	3	4
20. Trouble falling or staying asleep?	0	1	2	3	4

APPENDIX B

EMAIL SCRIPT

Dear Veterans,

I am a Army veteran at Arizona State University inviting other student veterans to participate in a short study as a part of my master's thesis research. The study will only take 15 to 30 minutes of your time. For the study, I am asking participants to speak about their post-service education decisions and to fill out a brief survey. I hope to use this research to help other veterans in the future as a part of their post-deployment reintegration. If you are a former or current service member 21 to 45 years of age, please reach out to me if you are interested in participating!

I will meet you on campus or via Zoom and work around your schedule. You will receive $5 for your time! If you are interested in participating and/or have any questions, please contact me at rsouthee@asu.edu or southee.richard@gmail.com.

Please note: Those who are currently undocumented immigrants, or considered part of any native
communities, or have diagnosed hearing issues are not able to participate. Also, any participants
diagnosed with PTSD not related to their military service, and any service members with reported hearing loss requiring a hearing aide cannot participate. By consenting to participate in this study you are affirming that you meet the requisite criteria.

Thank you in advance for your consideration.

Very Respectfully,

Richard Southee
MA Linguistics & Applied Linguistics
Department of English
Arizona State University

APPENDIX C

CONSENT FORM

Consent Form: Social Behavioral

Title of research study: *A Reliability Test of Speech Pause Rate in Student Veterans With PTSD as a Measure of Cognitive Function*

Investigator: Richard Southee

Why am I being invited to take part in a research study?
We invite you to take part in a research study because this study is interested in the speech patterns of US military veterans.

Why is this research being done?
The objective of this research is to expand our understanding of the relationship between speech and PTSD, and how neurocognitive changes as a result of trauma may result in a distinct change in speech patterns and prosody that could be used to better evaluate veterans.

How long will the research last?
We expect that individuals will spend 15 to 30 minutes participating in the proposed activities and related surveys.

How many people will be studied?
We expect about 100 people will participate in this research study, all participants will be prior or current servicemembers, must be ages 21 to 45, of sound mind and body to consent, not currently imprisoned, and a native english speaker. Those who are currently undocumented immigrants, or considered part of any native communities, or have diagnosed hearing issues are not able to participate. Any participants diagnosed with PTSD not related to their service, and any service members with reported hearing loss cannot participate. By consenting to the study you are affirming that you meet the requisite criteria to participate.

What happens if I say yes, I want to be in this research?
If you agree to participate in the study, you will be asked a series of questions with the intent to elicit you to produce a narrative or monologue. The response will be recorded for later use. Following elicitation and recording, you will be asked to fill out demographic information (age, sex, time in service, branch of service, deployment related information and mental health related information) and to fill out a PCL-5.

What happens if I say yes, but I change my mind later?
You can leave the research at any time it will not be held against you. You will be compensated for your time regardless of if you agree to allow researchers to utilize you data.

Is there any way being in this study could be bad for me?
This study has no associated physical risk. However, the study culminates with a PCL-5, the standard military form used for PTSD health assessment within the military which involves questions of your psychological state. The PCL-5 is a survey tool regularly used within military service and service members should be familiar with the form, if you have any questions about the content of the form at this time or at any time during the process please direct them to the researcher. If answering these questions could be potentially triggering for you, we request that you do not participate in the study. Researchers will provide information on campus resources for psychological support.

What happens to the information collected for the research?

Efforts will be made to limit the use and disclosure of your personal information, including research study records, to people who have a need to review this information. We cannot promise complete secrecy. The results of this study may be used in reports, presentations or publications but your name will not be used. All personal information will be anonymized at the time of data collection, and will be stored on a secure server for research access. Only listed researchers will have access to the data. We are also asking your permission to audio record the interview. Only the research team will have access to the recordings. Any published quotes will be anonymous, and audio recording will be stored on the basis of a numeric identifier as a pseudonym without any identifiable information. To protect your identity, please refrain from using names or other identifying information during the interview. Let me know if, at any time, you do not want to be recorded and I will stop.

What else do I need to know?

This research is being funded by the Pat Tillman Veteran Center via the Veteran's Education Fund. Compensation for participation is $5 that will be provided to the participants after completion of the study. If you are found to be ineligible to participate at the time of consent or elect not to complete the study after starting you will still be compensated in full for their time.

Who can I talk to?

If you have questions, concerns, or complaints, talk to the researcher, Richard southee, at rsouthee@asu.edu or the PI Matthew Prior at Matthew.Prior@asu.edu

This research has been reviewed and approved by the Social Behavioral IRB. You may talk to them at (480) 965-6788 or by email at research.integrity@asu.edu if:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You have questions about your rights as a research participant.
- You want to get information or provide input about this research.

Signature Block for Capable Adult

Your signature documents your permission to take part in this research.

Signature of participant	Date

Printed name of participant

Signature of person obtaining consent	Date

Printed name of person obtaining consent

APPENDIX D

RESEARCHER ELICITATION SCRIPT

Researcher: This study should only take 15 to 20 minutes. I'm going to ask you a few questions about your education and I ask you to answer to your best ability. Please speak directly into the microphone. Include as much detail as you feel comfortable with, if any additional information is needed, I'll prompt you to expand on that topic and if you feel uncomfortable doing so, please just say so and we will leave it at that. After the narrative you produce, I will have some questions for you to collect demographic information, and a survey to fill out. You will be asked all questions at once, and then you will be given as much time as necessary to talk. I ask that your response be at least 90 seconds. I will have a timer going, and I will raise my hand to signal that you've reached 90 seconds, however if you are still answering the questions you are encouraged to continue. Do you have any questions?

[Questions/Concerns spoken here]

Researcher: Please tell me what school and program you attend, why you chose that school and program, and how it relates to your military service if at all.

APPENDIX E

ASU IRB STUDY APPROVAL

ASU Knowledge Enterprise Development

APPROVAL: EXPEDITED REVIEW

Matthew Prior
CLAS-H: English
480/727-0905

Dear Matthew Prior:

On 2/16/2020 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	A Reliability Test of Speech Pause Rate in Student Veterans With PTSD as a Measure of Cognitive Function
Investigator:	Matthew Prior
IRB ID:	STUDY00011346
Category of review:	
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	• Consent Form, Category: Consent Form; • Demographics Survey, Category: Screening forms; • Email Advertisement, Category: Recruitment Materials; • IRB Social Behavior, Category: IRB Protocol; • PCL-5, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions);

The IRB approved the protocol from 2/16/2020 to 2/15/2025 inclusive. Three weeks before 2/15/2025 you are to submit a completed Continuing Review application and required attachments to request continuing approval or closure.

If continuing review approval is not granted before the expiration date of 2/15/2025 approval of this protocol expires on that date. When consent is appropriate, you must use final, watermarked versions available under the "Documents" tab in ERA-IRB.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

cc: Richard Southee
        Richard Southee