Why are linguistic features and PTSD symptoms related? An analysis of cognitive

reappraisal and rumination

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Abstract

Often in prior literature regarding narratives of one's trauma, multiple linguistic features, such as using more self-referential language or even using less language that pertains to cognitive processing, are associated with worse symptoms of posttraumatic stress disorder, or PTSD. Past studies theorize on the reasons behind these associations, but do not examine these reasons empirically. This study, which is a secondary analysis of data from two parent studies, sought to examine the mechanisms behind two commonly discovered findings in trauma narrative research: cognitive processing language associating with fewer PTSD symptoms, and self-referential language associating with more PTSD symptoms. One-hundred and eighty-five participants were recruited, with approximately half of these participants meeting a clinical diagnosis for PTSD. Additionally, the current study uses a diverse sample on the basis of trauma type. Participants each constructed a narrative describing the events of their worst trauma. I used the linguistic analysis program, Linguistic Inquiry and Word Count, or LIWC, to analyze these narratives and determine the mean amount of cognitive-processing language and self-referential language that is used (Frattaroli, 2006). Based on prior research, I had two main hypotheses for my analyses of the participants' narratives of their trauma. My first hypothesis was that cognitive processing language and PTSD symptoms would be negatively associated, but only when not controlling for trait cognitive reappraisal. My second hypothesis is that self-referential language would be positively associated with PTSD symptoms, but only when not controlling for trait rumination. To replicate past research in a novel way, I conducted a set of analyses containing the other dimensions of LIWC, particularly focusing on death language and sensory language. I hypothesized that, as prior literature suggests, death language and sensory language would be positively associated with PTSD symptoms. Due to the variety of trauma types within

my sample, I also examined interactions between these linguistic variables and trauma type -

something that no past study has looked into with a large and balanced sample. There were

nonsignificant effects for all dimensions: cognitive processing language, β = .44, $t(157)$ = 1.82, p

= .07 self-referential language, β = .10, $t(157)$ = 1.21, p = .23, sensory language β = -.00, $t(157)$

= -.03, p = .97, and death language β = -.02, $t(157)$ = -.27, p = .79. The nonsignificant trend for

cognitive processing language was in the opposite direction as hypothesized. Results imply that

self-referential language may not be an alternate assessment of rumination as prior research

originally theorized, and that future research is necessary to study this further.

Why are linguistic features and PTSD symptoms related? An analysis of cognitive

reappraisal and rumination

Nearly 6.8% of Americans, or 22 million people, will be given a diagnosis of PTSD at some point during their lifetime (Kessler et al., 2005). This is a substantially large number of people, each suffering with an illness that greatly affects their life. In order for a diagnosis of PTSD to be made, an individual must have experienced an event that has exposed them to death, threatened death, actual or threatened serious injury, or actual or threatened sexual violence. In addition to this, the individual must also indicate that they experience symptoms of intrusion (i.e., nightmares and flashbacks), avoidance, negative alterations in cognitions and mood (i.e., negative affect, overly negative thoughts about oneself or the world), and indicate that they experience alterations in arousal and reactivity (i.e., irritability, aggression, hypervigilance; APA, 2013). In addition to detrimental symptoms, individuals with PTSD are 13 times more likely to commit suicide than individuals without PTSD (Gradus, 2017). Given these statistics, it is evident that PTSD is a serious issue in the United States, as well as other countries. It is imperative for clinicians to develop empirically based treatments that help alleviate the symptoms resulting from this disorder. The current study sought to investigate how the narratives of those with and without PTSD differ, and how those differences are explained by one's traits.

One popular therapy for PTSD is Written Exposure Therapy (WET; Sloan & Marx, 2019). This treatment involves having a patient write a narrative about their trauma during each session. During each subsequent session, the therapist discusses the previous week's narrative with the client. The patient is then encouraged to allow themselves to experience trauma-related feelings in the week following the session, instead of avoiding those feelings. This allows patients to process their symptoms and realize that nothing innately bad happens as a result of

solely thinking of one's trauma. This is an extremely effective treatment, with many patients experiencing a significant reduction of symptoms in only five sessions (Sloan & Marx, 2019).

At the heart of exposure-based treatments for trauma symptoms, including WET, is the emotional processing theory (Foa & Kozak, 1986). In WET and other exposure-based treatments for trauma symptoms, patients are strongly encouraged to use as much detail as possible in their narrative of their traumatic event (Sloan & Marx, 2004). This is based on the theory that engaging emotionally with the memory of a significant event, such as a trauma, will lead to a reduction in fear and other adverse symptoms, such as hypervigilance. Particularly, patients are encouraged to write about what things they felt, saw, or heard during the experience, relying on their senses (Sloan & Marx, 2004). Doing this can facilitate a participant's re-experiencing of those sensations, deepening their exposure and combatting the common symptom of attempting to avoid one's memories of their trauma.

There are two other exposure-based therapies important to note, as they are more widely used than WET. The first is Prolonged Exposure (PE; Foa et al., 2007), which focuses on imaginal exposure and *in vivo* exposure. Imaginal exposure entails the patient orally describing their trauma in great detail. In doing so, the participant learns to process their emotions, as posited by emotional processing theory. *In vivo* exposure involves confronting feared stimuli outside of the therapist's office. For example, if a patient is avoiding bars due to their traumatic event, the therapist may instruct the patient to go out to a bar on the weekend. All of this culminates towards an extremely effective treatment, as PE is largely seen as a first-line PTSD treatment. The other PTSD treatment of note is Cognitive Processing Therapy (CPT; Resick & Schnicke, 1992). CPT starts with the participant writing an impact statement, indicating how they view themselves and the world around them. The therapist and patient collaborate closely

during each session to work through the patient's beliefs regarding their emotional responses to a traumatic event. Specifically, the phrase 'stuck points' is used in reference to parts of one's trauma that the participant gets 'stuck' on and uses as a reason for fear. Similar to WET and PE, CPT also typically includes narratives in which patients talk about their trauma in detail.

One common thread that runs through all exposure-based therapies for PTSD is that of cognitive reappraisal (Boden et al., 2012). Exposure-based therapies are not only about thinking about one's trauma; exposure is thought to work partially due to changing negative cognitions related to the trauma. If an individual only thinks about their trauma without any sort of processing or reappraisal occurring, they may begin to ruminate on their trauma – something that has been associated with worse PTSD symptoms (Aldao et al., 2010). This is where cognitive reappraisal comes in – exposure may lead patients to think differently about their trauma. For example, an individual who experienced a sexual assault may believe that the world is a very dangerous place. The implementation of cognitive reappraisal would lead the individual instead to potentially think about how they are a person who prioritizes safety and will protect themselves if necessary.

Prior literature regarding narratives of trauma has been limited in many areas, with one of these being the reasons for why certain associations are found by researchers. There are two specific findings that have been found consistently in past research, with one being that cognitive processing language is associated with fewer PTSD symptoms (Kleim et al., 2018; Wardecker et al., 2017; Papini et al., 2014; Greenhoot et al., 2013; Jelinek et al., 2010; Alvarez-Conrad et al., 2001). This makes sense, as someone who is using more cognitive processing language may be participating in more cognitive reappraisal, thus leading to fewer PTSD symptoms. Though it is simple enough to see the reasoning behind this association, no previous study has examined this

empirically. The other consistent finding is that self-referential language (me, myself, I) is associated with more PTSD symptoms (Vine et al., 2020; Kleim et al., 2018; Pulverman et al., 2015). Researchers commonly assume that this association is due to individuals who talk about themselves more being ruminators – something that is found frequently within the depression literature (Brockmeyer et al., 2015), but has not yet been studied in those with PTSD. It is important to examine whether these suggested mechanisms might explain the associations between cognitive processing, self-referential language, and PTSD symptoms.

Another understudied area in this field of research is that of trauma type. Most studies using linguistic coding systems to research trauma narratives limited their samples to one trauma type (either interpersonal trauma involving other people as perpetrators or noninterpersonal trauma not involving perpetrators). Specifically only four of the studies with clinical samples included both trauma types (Booker et al., 2018; Bedard-Gillian et al., 2017; Rubin, 2013; Jelinek et al., 2010). All other articles honed in on one trauma type – interpersonal or non-interpersonal. Although this may be due to the difficulty in gathering a sample that is diverse in trauma type, trauma type has been known to modify one's symptom manifestations of PTSD, thus making it worthy of further research and analysis. Additionally, two of the four studies that did have a clinically based sample with both trauma types had significantly more individuals who had been through an interpersonal trauma than a non-interpersonal trauma, limiting the ability to compare trauma types within the sample (Booker et al., 2018; Bedard-Gillian et al., 2017). Another of the four articles had a very small number of individuals with PTSD, and the last, though having a balanced number of individuals with PTSD and varying trauma types, did not report findings that would be relevant to the current study (Jelinek et al., 2010; Rubin, 2010). It is also important to note that none of these past studies used the "gold standard" for PTSD

diagnosis according to the DSM-5 – the Clinician Administered PTSD Scale for the DSM-5

(CAPS-5; Weathers et al., 2013a). The current study served to build upon the prior basis of

research by including a near equal number of individuals with interpersonal and non-

interpersonal traumas, individuals with PTSD and controls, from a community-based sample

using the CAPS-5 as a method of diagnosing PTSD. This is quite novel, as the majority of past

studies have included participants with only interpersonal traumas or only non-interpersonal

traumas.

To analyze the trauma narratives, I used the Linguistic Inquiry and Word Count program,

or LIWC. This program is widely used in a variety of fields to analyze the categories and

frequencies of words (Frattaroli, 2006). LIWC contains a vocabulary of over 2,300 words, which

are placed into over 70 linguistic dimensions. These categories not only include grammatical

dimensions (e.g., verbs, pronouns), but also measure psychological processes (e.g., cognitive

processing language) and content categories (e.g., death language, emotional language). Words

put into LIWC can be placed in multiple categories, such that the word "happy" may be put into

both the categories of emotional words and adjectives. In our use of LIWC, several different

categories of words used in our narratives were measured. Many of these categories have been

examined in various other studies that used LIWC to analyze trauma narratives, and other

linguistic forms of writing (Crespo & Fernández-Lansac, 2016). Because of this, another main

objective is to replicate past research that investigates narratives of trauma. One main source of

investigation in past literature is that of I-words (i.e., me, myself, I). Many studies have found

that using I-words is related to greater symptoms of psychopathology, such as depression (Vine

et al., 2020; Kleim et al., 2018; Pulverman et al., 2015). It is believed that this is due to the

tendency of an individual identifying these adverse events as more central to their identity, and

thus, referring to themselves more frequently, or potentially due to rumination. Past studies have also examined the prevalence of death language in trauma narratives, with the majority of studies concluding that death words are associated with greater symptoms of trauma (Kleim et al., 2018; Luno et al., 2013). This mirrors the finding that people with more severe traumas that include near-death are more likely to develop PTSD and more severe symptoms from their trauma. Additionally, past research found that sensory language, such as the usage of seeing, hearing, or feeling words, is associated with symptoms of PTSD (Beaudreau, 2007; Greenhoot et al., 2014; Rubin, 2011). Prior literature indicates that cognitive processing words (i.e., think, question, because) are negatively related to PTSD symptoms (Kleim et al., 2018; Wardecker et al., 2017; Papini et al., 2014; Greenhoot et al., 2013; Jelinek et al., 2010; Alvarez-Conrad et al., 2001). This is congruent with emotional processing theory, as the usage of emotional processing language may serve as a form of cognitive reappraisal.

Objectives and Hypotheses

This project, which was a secondary analysis of data collected from two larger studies, sought to replicate prior associations between linguistic indicators and PTSD symptoms, and to understand the mechanisms behind two of the most commonly found findings in the field of trauma narrative research. To analyze what the participants write, the coding system LIWC was used (Tausczik & Pennebaker, 2009). In the parent studies, participants wrote one narrative about their trauma, and one narrative about a neutral event that occurred at around the same time as the trauma. Participants were told to include details about their sensory or perceptual processes as they wrote about their experiences. For example, if an individual's most traumatic experience was a car accident, they should include in their narrative what they felt physically at the time of the crash, and what they saw, heard, and smelled.

My first set of hypotheses are related to the linguistic dimensions as measured by LIWC. Based on prior research, I hypothesized that sensory language, self-referential language, and death language would all be positively associated with PTSD severity (measured using the total CAPS score). Contrarily, I hypothesized that cognitive processing language would be negatively associated with total CAPS score. It is increasingly important to replicate findings in this field of research (Open Science Collaboration, 2015), and I contribute to this directly with this study, as I strived to replicate these associations between these four linguistic indicators and PTSD symptoms.

My main two hypotheses include the LIWC dimensions of self-referential language and cognitive processing language. I hypothesized that the association between self-referential language and PTSD will not be significant when controlling for trait rumination. In addition, I hypothesized that the association between cognitive processing words and PTSD will not be significant when controlling for cognitive reappraisal.

Prior literature is extremely limited on how trauma type may affect one's telling of their trauma. Due to this, my analysis of this concept is largely exploratory, as I analyzed this broadly with all of the LIWC dimensions. Specifically, I sought to examine whether trauma type moderated the associations between any of the LIWC dimensions (sensory language, self-referential language, death language and cognitive processing) and CAPS scores. Given the exploratory nature of this analysis, I did not have specific predictions for the effect of trauma type on these associations.

Method

Participants

One hundred and eighty-five participants were recruited in the local community through two larger studies, though much of our sample consisted of students at UNCG. Participants were paid for their participation in the larger studies. Participants excluded in the final analyses had fewer than one hundred words for their trauma narrative or had incomplete survey results. After excluding ineligible participants, the sample consisted of one hundred and fifty-seven participants, with this number varying slightly depending on the analysis run due to missing data for some measures. Ages of participants ranged from 18 to 60, with a mean of 24.36 ($SD = 7.97$). Thirty-eight men, 146 women, and one individual who selected 'other' made up the gender composition of this study. Twenty-three participants identified as American Indian or Alaskan native, fifteen participants identified as Asian or Pacific Islander, sixty-three participants identified as Black or African American, ten participants identified as Hispanic or Latinx, fifty-three participants identified as Caucasian, eighteen participants identified as Biracial, and one participant identified as 'other.'

Materials

Trauma Type Determination. To identify the worst trauma that participants had experienced, the Life Events Checklist for DSM-5 (LEC-5; Weathers et al., 2013b) was used. This measure asks participants to specify whether or not they have experienced 17 different types of traumatic events that potentially meet Criterion A of the DSM-5 criteria for a PTSD diagnosis (e.g., sexual assault, motor vehicle accident). The LEC-5 was used to differentiate interpersonal (trauma involving other people as perpetrators) and noninterpersonal trauma (trauma not involving other people as perpetrators). Interpersonal traumas in this sample included: sexual assault, physical assault, and torture. Noninterpersonal traumas in this sample included: motor

vehicle accidents, sudden illness or death of a loved one, being exposed to someone else's trauma, and natural disasters.

PTSD Diagnosis and Symptoms. In order to diagnose PTSD among our participants, a graduate student conducted a structured clinical interview: the CAPS-5 (Weathers et al., 2013a). This interview assesses the 20 core symptoms of PTSD in the DSM-5 (APA, 2013). During this interview, the interviewer rates the severity of each of the 20 symptoms on a 5-point scale (ranging from 0 = absent to 4 = extreme/incapacitating), which are summed together to give a total severity score ranging from 0 to 80. Participants were diagnosed with PTSD if they met all DSM-5 criteria (i.e., scores of 2 or higher on at least one re-experiencing, one avoidance, two negative alterations in cognition or mood, and two arousal symptoms), with these symptoms being present for at least one month, and causing significant distress or impairment.

Rumination. To determine the trait rumination of participants, I used the Ruminative Responses Scale (Treynor et al., 2003). This scale has twenty-two items that measure brooding and reflective pondering – two aspects of rumination. Items are rated on a 4-point scale (ranging from 1 = always never to 4 = almost always). For this study, I used only the items related to brooding (items 5, 10, 13, 15, and 16) in my analyses.

Cognitive Reappraisal. To examine the trait cognitive reappraisal of participants, I used the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003). This scale has ten items that are used to measure the tendency of participants to regulate their emotions with cognitive reappraisal or expressive suppression. Each of the items are rated by the participant on a 7-point scale (ranging from 1 = strongly disagree to 7 = strongly agree). For the purposes of this study, I used only the items related to cognitive reappraisal (items 1, 3, 5, 7, 8, and 10) in my analyses.

Procedure

Before writing their narratives, participants were first clinically interviewed to determine if they met criteria for PTSD and their level of PTSD symptom severity. Interviews were recorded and administered by a graduate student, and then the recordings were reviewed by another graduate student to assess inter-rater reliability. Discrepancies in scoring were brought to the principal investigator to discuss and resolve. Through the larger parent studies, participants were asked to write, on paper, a narrative that asked the participant to explain what happened in their most traumatic experience. This traumatic experience was determined by participants indicating on the LEC-5 which event in their life was their most traumatic event, which was then confirmed during the CAPS-5 interview. Participants were encouraged to write about bodily sensations or feelings that they experienced during the event. Participants were also given a sheet of paper with various pre-written bodily sensations and feelings, such as "heart beats faster" or "stomach is in a knot" and were encouraged to use these phrases as appropriate.

Linguistic Analysis

Narratives written by participants were analyzed using the Linguistic Inquiry and Word Count software (LIWC). The narratives were all handwritten by participants, and I transcribed these from handwritten form into a typed document, which is the format required for LIWC. Narratives under one hundred words were excluded from analyses due to guidance from the LIWC manual. To test my hypotheses, I ran the sensory, cognitive processing, self-referential, and death dimensions of LIWC with the traumatic narratives.

Data Analysis Plan

I planned to run multiple separate regressions for each predictor of interest in this study. My predictor variables were the linguistic dimensions I am studying (self-referential language, cognitive processing language, death language, sensory language) in the trauma narratives. My

outcome variable was the PTSD symptom score (total CAPS-5 severity score). With the death language and sensory language variables, I planned to run two regressions. As for the self-referential language and cognitive processing language variables, I planned to run four regressions – two without any control variables, and two regressions controlling for variables of interest. For the self-referential language variable, I planned to control for trait rumination to examine whether the association between self-referential language and PTSD symptoms is still present after controlling for trait rumination – its assumed reason for the association. As for cognitive processing language, I planned to run the same type of test, controlling for trait cognitive reappraisal. As for the exploratory aspect of this study regarding trauma type, I planned to run a series of regressions examining the four linguistic dimensions, trauma type (interpersonal, noninterpersonal), and their interaction as predictors of PTSD symptoms.

Results

Sample Characteristics

I first ran a variety of descriptive tests to determine the makeup of my sample. For total PTSD severity, CAPS-5 total scores in this sample ranged from 0 to 52, with a mean of 20.53 ($SD = 11.97$). Trauma type data were available for 177 participants. One-hundred and five participants endorsed an interpersonal trauma being their worst trauma, and 72 participants endorsed a noninterpersonal trauma being their worst trauma (see Table 1).

Table 1

Sample Makeup of Worst Trauma Type

Type of Trauma	n	Percentage
Interpersonal Trauma	105	59.32%
Sexual Assault	78	44.07%
Physical Assault	26	14.69%
Torture	1	0.56%

Noninterpersonal Trauma	72	40.68%
Motor Vehicle Accident	28	15.82%
Sudden Death of Loved One	27	15.25%
Sudden Illness of Loved One	9	5.08%
Exposure/Witnessing Someone Else's Trauma	4	2.26%
Natural Disaster	4	2.26%
Total	177	100.00%

As for the narratives in the entire sample, including narratives that were later excluded due to containing less than 100 words, the word counts ranged from 62 to 671 words, with a mean of 233.08 words ($SD = 122.73$). For the descriptive statistics of the LIWC dimensions, each result is reported in terms of what percentage of the words in each narrative consisted of the words in that dimension. The prevalence of self-referential language in these narratives ranged from 0% to 19.79%, with a mean of 11.09% ($SD = 3.47$). The prevalence of cognitive processing language in these narratives ranged from 1.40% to 23.96%, with a mean of 8.83% ($SD = 3.65$). The prevalence of sensory language in these narratives ranged from 0% to 13.39%, with a mean of 4.11% ($SD = 1.89$). The prevalence of death language in these narratives ranged from 0% to 4.46%, with a mean of 0.17% ($SD = .45$).

Main Outcomes

For the tests of our primary hypotheses concerning each of the LIWC dimensions, regressions concluded in nonsignificant results for death language, $\beta = -.02$, $t(157) = -.27$, $p = .79$, sensory language $\beta = -.00$, $t(157) = -.03$, p = .97, and self-referential language, $\beta = .10$, $t(157) = 1.21$, $p = .23$. The regression for cognitive processing language also resulted in

nonsignificant results, $\beta = .44$, $t(157) = 1.82$, $p = .07$, although there was a nonsignificant trend. It is worth noting that the trend for cognitive processing language was in the opposite direction as expected. I found that greater cognitive processing language was associated with greater PTSD symptom severity, whereas I had expected that greater cognitive processing language would be associated with less PTSD symptom severity.

Due to the unexpected result for cognitive processing language, I ran post-hoc correlation tests between each of the cognitive processing subtypes and PTSD symptom severity to examine what might be driving this effect. LIWC identifies the following subtypes: insight (words such as think and know), causation (words such as because, effect), discrepancy (words such as should, would), tentativeness (words such as maybe, perhaps), certainty (words such as always, never), and differentiation (words such as hasn't, but, else). The prevalence of insight language in the trauma narratives was 0% to 8.33%, with a mean of 2.33% ($SD = 1.66$). For causation language, it ranged from 0% to 5.21% with a mean of 1.06% ($SD = .93$). For discrepancy language, it ranged from 0% to 5.26% with a mean of 1.34% ($SD = 1.12$). For tentativeness language, it ranged from 0% to 4.95%, with a mean of 1.65% ($SD = 1.09$). For certainty, it ranged from 0% to 3.57% with a mean of 0.85% ($SD = .77$). Lastly, differentiation language ranged from 0% to 5.77% with a mean of 2.31% ($SD = 1.30$). Each subtype was put into a bivariate correlation with PTSD symptom severity to see if any of the subtypes were significantly correlated with PTSD, despite the overall score not being significantly associated. Correlations were nonsignificant for insight, $r(178) = .12$, $p = .10$, causation, $r(178) = .07$, $p = .36$, discrepancy, $r(178) = .03$, $p = .71$, and certainty, $r(178) = -.02$, $p = .78$. Two of the subtypes were significantly correlated with PTSD symptom severity, with those subtypes being tentativeness, $r(178) = .16$, $p = .03$, and differentiation, $r(178) = .16$, $p = .03$.

I then ran a second round of analyses with PTSD symptoms (total CAPS score) while controlling for the variables of interest to each respective dimension (rumination for self-referential language, cognitive reappraisal for cognitive processing language). This was to determine whether the associations remained the same after eliminating the assumed 'reason' for the association. Rumination was significantly related to total CAPS score, with $\beta = .47$ $t(157) = 6.75$, $p < .001$. The regression for self-referential language controlling for rumination was nonsignificant, with $\beta = .04$, $t(157) = .626$, $p = .53$. Cognitive reappraisal was not significantly related to total CAPS score, with $\beta = -.08$, $t(157) = -.95$, $p = .34$. The regression for cognitive processing language controlling for cognitive reappraisal was also nonsignificant, with $\beta = .14$, $t(157) = 1.70$, $p = .09$.

As for the exploratory aspect of this study regarding trauma type, I first ran a regression examining trauma type as a predictor of total CAPS score, which indicated that individuals with interpersonal traumas had more PTSD symptoms, on average, than those with noninterpersonal traumas, $\beta = -0.23$, $t(157) = -2.99$, $p = .003$. I then ran a series of regressions examining the four linguistic dimensions, trauma type (interpersonal, noninterpersonal), and their interactions as predictors of PTSD symptoms. These regressions resulted in nonsignificant interactions between trauma type and self-referential language, $\beta = .27$, $t(157) = .92$, $p = .36$, cognitive processing language, $\beta = -.24$, $t(157) = -1.08$, $p = .28$, sensory language, $\beta = .12$, $t(157) = .58$, $p = .57$, and death language $\beta = -.01$, $t(157) = -.04$, $p = .97$.

Discussion

This study sought to replicate past findings in trauma narrative research, uncover the mechanisms behind these common findings, and additionally explore an under researched area in that of trauma type's effect on trauma narratives and PTSD. Despite many researchers

speculating that cognitive reappraisal is the reason for the association between cognitive

processing language and PTSD symptom severity, and rumination is the reason for the

association between self-referential language and PTSD symptom severity, no prior literature has

investigated whether or not there is evidence to support these assumptions. Even with the mostly

nonsignificant findings in this study, I have still contributed to beginning this thread of study in

trauma narrative research. The first hypothesis tested in this study related to the associations

between linguistic dimensions as measured by LIWC and total CAPS score. I hypothesized that

sensory language, death language, and self-referential language would all be positively

associated with total CAPS score, while cognitive processing language would be negatively

associated with total CAPS score. None of these results were significant. It is worth noting that

despite the lack of significant results, the result for cognitive processing language was a

statistical trend and was in the opposite direction as what was expected. For the subtypes under

cognitive processing language, I found that the subtypes of tentativeness and differentiation were

significantly associated with PTSD symptom severity, leading to the overall positive trend

between cognitive processing language and total CAPS score. These significant findings may

imply that in situations where an individual with more PTSD symptoms is engaging in more

cognitive processing language, that this may be driven by processes of tentativeness and

differentiation. As for the differentiation subtype, this includes words such as but, else, and

hasn't. Included in the tentativeness subtype, words such as maybe and perhaps are included.

With this, participants with more tentativeness and differentiation language in their trauma

narratives may have been thinking deeply about different ways their traumatic event may have

occurred – thus being associated with higher PTSD symptoms as it can be harmful to imagine

different possibilities for a traumatic event. As for the nonsignificant findings across the various

linguistic indicators, I do not believe that this indicates that these linguistic dimensions are truly not associated with total CAPS score. It is possible that by excluding participants based on word count, and simply having a small sample size, that the power for this study was not strong enough to result in significant results.

There is then the second set of hypotheses regarding how cognitive reappraisal and rumination were the potential reasons as to why cognitive processing language and self-referential language were associated with total CAPS score. I decided to run this set of analyses despite the nonsignificant results from the initial analyses and ended up with the nonsignificant results that were expected at this point. This further affirms the nonsignificant findings from the first set of hypotheses and does not imply one way or another whether or not cognitive reappraisal is a mechanism between self-referential language and total CAPS score, and whether or not rumination is a mechanism between cognitive processing language and total CAPS score.

For the third and final round of analyses, I tested to see whether or not there were any significant effects when running regressions examining the four linguistic dimensions, trauma type (interpersonal, noninterpersonal) and their interaction as predictors of PTSD symptoms. These analyses were all nonsignificant. However, I did find that interpersonal trauma was associated with greater PTSD symptom severity than noninterpersonal trauma, which is a common finding in prior research.

As for this study's weaknesses, the sample used in this study may not be generalizable to all populations. It is primarily female and consists mainly of college students. Future research should analyze the trauma narratives of a sample with more diversity in age and gender. Additionally, the sample had predominantly black and white participants; therefore, it would be beneficial for future research to be more inclusive in terms of race/ethnicity. As stated before, it

is probable that this study had a lack of power. It is possible that with the nature of one's own narratives being so unique and specific to the person writing them, that a very large sample is needed in order to truly study the linguistic features of the narratives. Future studies should consider gathering a large sample, with a large amount of writing per person. There is also the general caveat to using LIWC - that it truly only measures word count. Of course, LIWC can help studies such as this one to provide an exact count of words in specific dimensions (i.e., cognitive processing words, sensory language, emotional language), but it cannot tell us anything other than the word count – this is up to the researcher to analyze and derive conclusions from (Pennebaker et al., 2003; Tausczik & Pennebaker, 2010). A common example used to illustrate this fallacy is the differentiation between "happy" and "not happy." LIWC would not recognize this difference, and code both of these phrases as positive emotion, even though "not happy" describes a negative emotional state (Pulverman et al., 2015). Overall, future research should investigate these findings with other linguistic analysis tools, outside of a narrative format, and explore causal effects within linguistic research.

Despite this study not finding any significant results to confidently say whether or not there are associations between linguistic dimensions and PTSD symptom severity, I have, with this study, begun the investigation into what actually causes the associations between linguistic dimensions and PTSD symptom severity. Often in science, we find correlations and leave it at that, with no future research or replication work being done. With this study, I am directly contributing to attempts to replicate past research and am directly delving deeper into why certain associations exist. It is also clear from this study that, potentially, a measure such as rumination may be a much better indicator for PTSD symptom severity than linguistic dimensions. This is due to rumination being strongly associated with overall PTSD symptom

severity, but self-referential language not being associated with overall PTSD symptom severity. Not only is it easier to gather information about trait rumination, but it results in stronger associations. Future research in linguistic narratives of trauma should consider other forms of indicating overall symptom severity and invest in larger studies that focus on diverse samples with longer narratives.

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