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LINGUISTICS FEATURES AND TRAUMA: AN INTEGRATED NEUROLINGUISTIC AND COMPUTATIONAL ANALYSIS OF PTSD NARRATIVES-A PILOT STUDY

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Abstract

Post-Traumatic Stress Disorder (PTSD) related to linguistic differences in the representation and structuring of traumatic experience. A computational linguistic analysis of these linguistic differences may allow exploring the morphosyntactic features of trauma-related stories. This pilot study has been designed to analyze selected morphosyntactic features of the stories narrated by PTSD patients and healthy controls through an integrated Neurolinguistic and computational approach. For this purpose, the study has recruited 40 participants, including 20 patients of PTSD and 20 controls from a tertiary care hospital in Lahore, Pakistan. Selected morphosyntactic features are being analyzed in terms of part of speech patterns, pronouns, verb tense, negation, dependency patterns, sentence complexity, and morphological properties. A comparative analysis of PTSD and non-PTSD narratives has performed to detect differences. The study has shown different morphosyntactic features of the stories of individuals diagnosed with PTSD and healthy control participants. Thus, the present study provides preliminary evidence on the possible significance of linguistic structure in the analysis of trauma-related language. The integrated framework combines computational identification of linguistic structure with Neurolinguistic interpretation of possible significance of this structure. Being a pilot study and having a relatively small number of participants, the findings of this study cannot be generalized. The pilot study demonstrates the potential of an integrated Neurolinguistic and computational approach to the study of PTSD-related language and provides a preliminary basis for further research.

Keywords: *Computational Linguistics, Morphosyntactic Features, Neurolinguistics, Pilot Study, Post-Traumatic Stress Disorder, Trauma Narratives.*

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1. Background of the Study

PTSD may affect the linguistic structure and structuring of the representation of traumatic experience. Research on language use and structure related to PTSD included investigation of linguistic characteristics like pronouns, verb tenses, and narrative structure as potential indicators of this disorder (Alpert et al., 2015). Linguistic structure, however, varies significantly across individual participants and narrative contexts, hence the need for further research.

Advancement in Natural Language Processing have made it possible to identify and measure morphosyntactic features like part-of-speech patterns, pronouns, verb tense, negation, sentence complexity and morphology that combined with Neurolinguistic interpretation of linguistic patterns. It may help to better understand linguistic aspects of the trauma-related narratives. This pilot study has been examined the selected morphosyntactic features in the stories of PTSD patients 20 and healthy controls 20, recruited from a tertiary care hospital in Lahore, Pakistan. This study aimed to compare these two groups of participants to investigate the potential of an integrated Neurolinguistic and computational approach to PTSD-related language. The findings of the pilot study have been seen as preliminary evidence for further research rather than a definite set of linguistic markers of PTSD.

1.1. Introduction

Post-traumatic stress disorder (PTSD) is a psychological condition that may result from exposure to traumatic experiences and affects memory, emotion regulation, cognition and behavior (American Psychiatric Association, 2013). Besides clinical interviews and standardized measures, linguistic analysis provides a valuable perspective to explore how individuals represent and structure their traumatic experiences. Previous researches have suggested the presence of differences between PTSD and non-PTSD narratives with reverence to the use of pronouns, temporal organization, emotional and cognitive language and narrative structure (Alpert et al., 2015; O'Kearney & Perrott, 2006).

Morphosyntactic analysis allows studying these differences based on grammatical and structural features of language like part-of-speech patterns, pronoun usage, verb tense, negation, dependency relations and sentence complexity. Recent research has pointed to the potential of computational linguistic methods in identifying patterns linked to PTSD, yet noted inconsistencies in findings and the necessity of further validation (Quillivic et al., 2025; Yu et al., 2025). This research encourages the investigation of multiple linguistic features rather than looking for a single characteristic that can indicate PTSD.

This study integrates Neurolinguistic Programming (NLP-1) as an interpretive perspective with Natural Language Processing (NLP-2) as a computational technique that can help to identify and analyze linguistic structure. NLP-1 offers concepts for linguistic and subjective interpretation of language, while NLP-2 allows to identify and interpret

observable morphosyntactic patterns in language. However, Neurolinguistic Programming is not viewed as an established clinical method for the diagnosis and treatment of PTSD, due to the lack of sufficient evidence regarding its efficacy in health interventions (Sturt et al., 2012).

With this background, the present pilot study aims to compare selected morphosyntactic features in stories told by 20 PTSD patients and 20 controls recruited from a tertiary care hospital in Lahore. The study intends to identify the possible differences between the groups and explore the potential of the above-mentioned integrated approach to the study of PTSD-related language. The findings will be considered as preliminary evidence for further research rather than a set of definite linguistic markers of PTSD. With this background, the present pilot study aims to compare selected morphosyntactic features in stories told by 20 PTSD patients and 20 controls recruited from a tertiary care hospital in Lahore. The study intends to identify the possible differences between the groups and explore the potential of the above-mentioned integrated approach to the study of PTSD-related language. The findings can be considered as preliminary evidence for further research rather than a set of definite linguistic markers of PTSD.

1.2. Problem Statement

Post-traumatic stress disorder (PTSD) may affect how individuals represent and structure their experiences through language. Previous research on language use and structure has explored their potential association with PTSD through the investigation of linguistic characteristics like pronouns, verb tenses, sentence complexity, and narrative organization (Alpert et al., 2015). Further research is required to find out how selected morphosyntactic features may differ in the case of PTSD and non-PTSD participants. Moreover, a computational linguistic analysis of the structure of language alone may fail to explain the significance of these features. Integrating computational analysis with Neurolinguistic interpretation may help to understand the significance of linguistic structure of the stories in PTSD patients and controls.

In the Pakistani context, further research is required to explore the potential of this integrated approach to PTSD-related narratives. The present study addresses this gap in knowledge by comparing selected morphosyntactic features in the stories of 20 PTSD patients and 20 controls recruited from a tertiary care hospital in Lahore. The focus of the study is to identify the possible differences in grammatical and structural patterns through the computational analysis and Neurolinguistic interpretation of these patterns. Being a pilot study, it aims to provide preliminary evidence for further research rather than establishing diagnostic markers of PTSD.

1.3. Research Objectives

1. To compare selected morphosyntactic features in the narratives of participants with PTSD and non-PTSD participants.
2. To explore the potential of an integrated Neurolinguistic and computational approach to identifying and interpreting morphosyntactic patterns in PTSD-related narratives.

1.4. Research Questions

1. What differences exist in the selected morphosyntactic features between the narratives of participants with PTSD and non-PTSD participants?
2. How can an integrated Neurolinguistic and computational approach help to identify and interpret morphosyntactic patterns in PTSD-related narratives?

1.5. Significance of the Study

The present pilot study is significant in that it explores the potential relationship between morphosyntactic features and Post-Traumatic Stress Disorder (PTSD) through an integrated Neurolinguistic and computational approach. By comparing the stories of patients with PTSD and healthy controls, the study aims to find out whether selected linguistic features like pronouns, verb tenses, negation, and sentence structure may show any differences between the two groups. The integration of computational analysis with Neurolinguistic interpretation allows exploring the possible significance of linguistic patterns.

Furthermore, the study may contribute to the development of preliminary evidence in a Pakistani clinical context where further research on computational analysis of trauma-related language is needed. Its findings can help to identify adequate linguistic features for further investigation and inform further research in computational linguistics, Neurolinguistics, and mental health. Being a pilot study involving 40 participants, its results may be exploratory and cannot be regarded as definite diagnostic markers of PTSD. Nevertheless, the study will provide a basis for further integrated approaches to the linguistic investigation of trauma-related narratives.

2. Literature Review

2.1. Trauma, PTSD, and Narrative Language

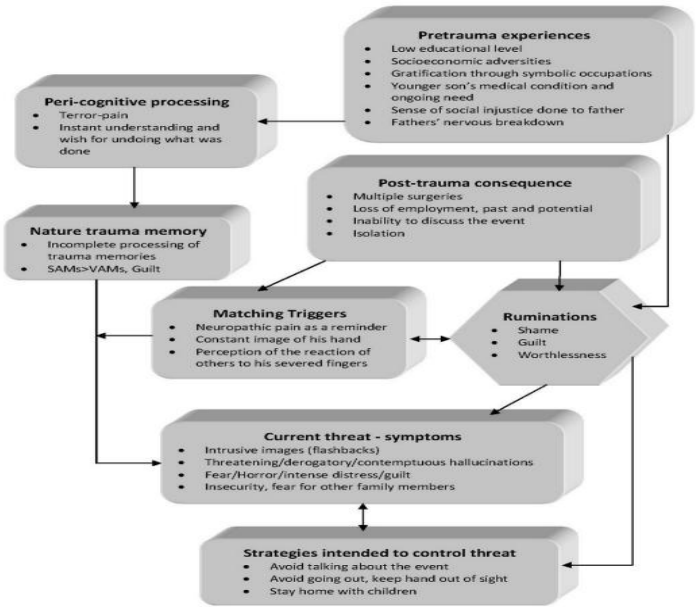
Language plays an important role in how individuals organize and convey their experiences of trauma. Narratives of traumatic experiences are not only the descriptions of events, but also involve the reconstruction of memories, emotions, temporal relations and self-representations. Therefore, researchers have increasingly studied linguistic characteristics of trauma narratives to learn how PTSD can be manifested through language. Earlier studies had found associations between the severity of PTSD and linguistic features like emotional language, pronoun use, cognitive-processing language, fragmentation, and narrative disorganization. Recently, some reviews noted linguistic

characteristics related to PTSD as emotional language, pronouns, cognitive-processing words, narrative length, temporal orientation, discourse disorganization, sensory-perceptual language, and dysfluencies.

Experiences of trauma can affect not only the emotional and cognitive functioning, but also the way individuals organize and communicate personal experiences. Trauma narratives may contain unique patterns of temporal organization, emotional language, and narrative structure. Earlier research had proposed that individuals with PTSD may have difficulties in organizing traumatic memories into a narrative, causing differences in the way traumatic experiences are linguistically represented (Crespo & Fernández-Lansac, 2016; O'Kearney & Perrott, 2006).

The relationship between language and PTSD, however, is not similar in all narrative contexts. A recent review of non-trauma narratives revealed moderate evidence that higher PTSD symptom severity, especially avoidance and numbing, is associated with greater usage of negative emotion words and fewer positive emotion words. At the same time, findings concerning pronouns and cognitive-processing words were inconclusive, indicating the necessity to interpret linguistic markers in connection with narrative context rather than viewing them as universal indicators of PTSD. This fact is important for the present study because it supports the necessity to examine the structure of language rather than rely on isolated lexical categories.

2.2. Persistent PTSD (adapted from Ehlers and Clark)



Case formulation – (Persistent PTSD, adapted from Ehlers and Clark [6]) Figure 1 Case formulation – (Persistent PTSD, adapted from Ehlers and Clark [6]).

Language has been also associated with the representation of self in cases of PTSD. Some research reported increased usage of first-person singular pronouns in PTSD related narratives, reflecting the self-focused or self-immersed processing in the case of trauma. In an earlier prospective study, increased usage of first-person singular pronouns, fewer cognitive-processing words and more death-related words in the trauma narratives predicted higher PTSD symptoms in the follow-up. Similar research comparing individuals with and without PTSD found differences in the usage of singular and plural pronouns. These findings illustrate the potential value of examining how speakers position themselves in narratives of traumatic experiences.

2.3. Morphosyntactic Features and PTSD Narratives

Research has increasingly shown that linguistic features can provide useful information about PTSD and its associated symptoms. Various linguistic features like pronouns, emotional language, temporal orientation, narrative length have been studied to find the potential markers of trauma-related psychological processes. Yet, findings have differed across various studies, indicating that PTSD cannot be reliably characterized by a single linguistic feature (Quillivic et al., 2025; Yu et al., 2025).

Verb tenses are particularly relevant to trauma stories because memories of trauma may involve specific relations between past events and present experience. The linguistic representation of temporal information is thus useful for examining how speakers position the events of trauma in relation to present time. Pronouns are also particularly important because they represent grammatical mechanisms of self-reference and reference to others. Rather than just counting pronouns, the examination of their syntactic environment may provide more detailed information about the way of positioning the agent and participants. Linguistic agentivity has been recently discussed as an important dimension of the traumatic discourse and pronoun interpretation may benefit from consideration of verbs and sentence context along with pronouns.

Alpert et al. (2015) found that linguistic features, including pronouns, are associated with PTSD diagnosis and symptom severity. However, recent systematic findings suggest that pronoun usage is inconsistent across studies and should thus be considered as a part of a larger linguistic profile rather than an independent diagnostic marker (Yu et al., 2025).

Temporal orientation is another important dimension of PTSD narratives. Individuals narrating their traumatic experiences may exhibit specific patterns in the usage of past, present and future tenses. The research suggesting that disruptions in the temporal organization of the traumatic memories are reflected in narrative language, hence the relevance of tense and temporal orientation for PTSD research (O'Kearney & Perrott, 2006; Quillivic et al., 2025).

Negative linguistic expression is also important for the analysis of trauma and psychological distress. PTSD narratives may include greater usage of negative emotional and cognitive language, reflecting speaker's perception of distressing experiences and negative evaluation. Recent reviews have identified affective and cognitive linguistic features as potentially relevant to PTSD, although noting the necessity to further validate these features (Quillivic et al., 2025; Yu et al., 2025). Some previous researches had found differences in the organization and coherence of PTSD narratives, indicating the necessity to examine linguistic structure along with lexical and emotional features (Crespo & Fernández-Lansac, 2016; O'Kearney & Perrott, 2006).

2.4. Computational Analysis and Mental-Health Language

Computational Analysis has increasingly become an important methodological tool in mental-health research. It helps researchers to turn spoken or written language into structured linguistic data and analyze linguistic patterns in large or complex datasets. Depending on the research goal, computational linguistic analysis includes tokenization, part-of-speech tagging, morphological analysis, dependency parsing, syntactic analysis, sentiment analysis, lexical categorization, semantic representation, and machine-learning classification.

In PTSD research, computational methods have been used to identify linguistic features associated with diagnosis and symptom severity. A recent interdisciplinary study demonstrated the application of statistical, lexical, semantic, morphosyntactic, graph-based, readability, and contextual-embedding features in the computational models of PTSD-related language. Specifically, pronouns and verb tenses are identified as morphosyntactic features among the language variables analyzed in the study.

Computational linguistic analysis allows identifying linguistic patterns like grammatical, lexical, syntactic and semantic in large collections of clinical narratives and electronic health records. Recent research has shown the feasibility of applying NLP techniques to PTSD-related clinical data, indicating the usefulness of computational linguistic analysis for mental-health research (Miranda et al., 2024).

Current advancements in computational mental-health research have emphasized the necessity to combine linguistically interpretable features with clinically meaningful information. A systematic review by Natural Language Processing for Mental Health Interventions (2023) has shown that mental-health NLP research has used various approaches like lexical frequency analysis, n-grams, word embedding, sentiment analysis, and machine-learning models. Recently, Rao et al. (2026) reviewed 101 studies of NLP applied to psychiatric clinical notes and have highlighted the necessity to use interpretable and hybrid computational approaches. These developments encourage the use of structured linguistic features in exploratory clinical research. Nevertheless, findings from psychiatric clinical notes and broader mental-health applications cannot be automatically

transferred to the case of PTSD narratives. The present pilot study, thus, provides context-specific preliminary evidence that needs to be confirmed in larger samples and validated further in terms of linguistic tools used.

2.5. Neurolinguistic Programming as an Interpretive Perspective

The second component of the present framework is Neurolinguistic Programming. It emerged in the 1970s and has been defined as an approach focusing on communication, modeling, language, subjective experience, and behavioral patterns. Discussions of NLP in the academic literature have also characterized NLP as a controversial field with rather limited empirical research and ongoing debates about its theoretical foundation.

Empirical status of NLP needs to be carefully considered in the present study. Systematic review of experimental research found insufficient evidence to support NLP as a health intervention and noted substantial limitations in the quantity and quality of research on NLP. Recent discussions have likewise pointed out some theoretical and evidentiary deficiencies in this field. That is why the current study does not regard Neurolinguistic Programming as a valid diagnostic or therapeutic approach to the problem under consideration. Instead it is used as a theoretical perspective for the interpretation of language and representation. Specifically, the current study is based on the concepts from the following NLP models: Representational Systems Model, Reframing, Anchoring, Meta Model and Timeline Therapy. This difference should be noted explicitly. While applying Neurolinguistic Programming models to this case, one should not think that they prove the existence or intensity of PTSD.

The current research uses the selected models in order to explore possible interpretations of linguistic patterns in relation to the issues of representation, organization in time, self-representation and experience construction. This also differs the current research from those investigating NLP as a therapeutic intervention. The purpose of the current study is not to examine how NLP affects PTSD symptoms, but whether the selected linguistic concepts of NLP can help to interpret the patterns found using computational approach.

2.6. Integrating Neurolinguistic Programming and Natural Language Processing

The integration of the two methods represents the main conceptual contribution of the current study. Though they are abbreviated as NLP-1, Neurolinguistic Programming and NLP-2 as Natural Language Processing that represent completely different approaches.

Natural Language Processing helps to explain linguistic patterns occurring in a narrative. For instance, computational analysis can show the frequency and distribution of pronouns, verb tenses, parts of speech, negations, syntactic dependencies or sentences structures. The Neurolinguistic Programming approach provides an opportunity to find out how certain linguistic patterns can be explained with respect to the issues of representation

and experience construction. This means that the integration creates a two-tier framework for analysis: computational identification and theoretically informed interpretation.

Though the high number of first-person pronouns can be identified using computational approach, the significance of this pattern cannot be determined only on the basis of its frequency. The explanation of this pattern may require considering verbs, contextual factors, temporal organization and positioning of the speaker in the narrative. Similarly, though the pattern of verb tenses can be identified using computation, its interpretation will depend on the fact whether the speaker describes the past event, recurrent memories or the present experience associated with this event.

While the computational approach allows to find and quantify certain linguistic patterns, numerical linguistic analysis may not reveal all the interpretive dimensions of personal experience. Thus, the integration of the two frameworks allows to combine computational identification of linguistic structures and theoretically informed interpretation of language and subjective representation. This approach may help to reveal the more complex aspects of how the experiences related to trauma are represented in language (Quillivic et al., 2025; Yu et al., 2025).

2.7. Research Gap

There are three areas of opportunity that are indicated in the literature. First, while there has been a significant increase in linguistic research on PTSD, most of the available research has focused on lexical, emotional, cognitive-processing, and general narrative features. Secondly, systematic investigation of a broader range of morphosyntactic features, however, is rather limited, with recent studies beginning to investigate the morphosyntactic characteristics more directly, such as in the case of pronouns and verb tense. Thirdly, there is a lack of interdisciplinary research that brings together linguistics, psychology and computational methods. Such frameworks are beginning to appear in Western research, but research in Western countries is trailing and with the limited insights into regional trauma manifestation (Coppersmith et al., 2021; Schwartz et al., 2013).

3. Research Methodology and Framework

3.1. Neurolinguistic Programming as a Framework

Neurolinguistic Programming (NLP-1) provides the interpretive dimension of the current study by paying attention to the issue of the relationship between language, internal representation, and cognition and experience patterns. In the context of trauma narratives, language may indicate the way how individuals organize, represent and reconstruct the traumatic experiences. In the current study, Neurolinguistic Programming will not be used as a therapeutic technique, but as an analytical perspective on linguistic patterns of the individuals with post-traumatic stress disorder (PTSD).

Five NLP-1 models are included into the framework: the Meta Model, Representational Systems Model, Reframing, Anchoring and Timeline Therapy. The Meta Model helps to reveal the patterns of deletion, generalization and distortion in the verbal expression. The Representational Systems Model calls the attention to the linguistic indicators of sensory and experiential representation. The issue of reframing refers to the changes in the interpretation or meaning of the experience, while anchoring relates to the recurring association between certain experiences and language and emotions. Finally, the Timeline Therapy provides the perspective on the organization of experiences in the past, present and future states.

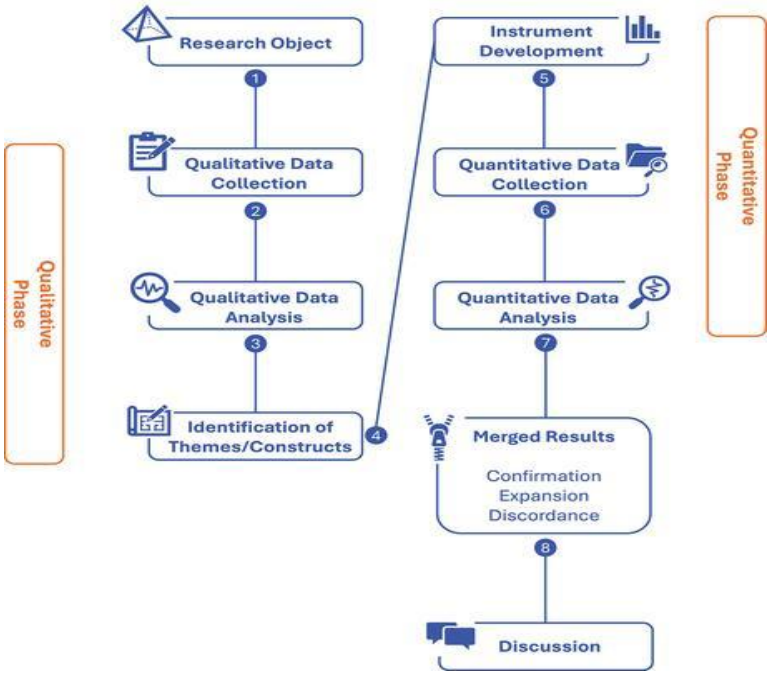
In the current framework, these models are not considered independently as therapeutic techniques. They represent additional perspectives for the identification of patterns in trauma-related discourse. In other words, the inclusion of these models allows the analysis to go further than the structural properties of language and pay attention to the ways how traumatic experiences are represented and organized in language.

3.2. Computational Analysis (Natural Language Processing) as a Framework

The Natural Language Processing (NLP-2) provides the computational dimension of the current study. It allows to identify and measure the linguistic structures that may be hard to detect manually. NLP-2 framework is mainly concerned with the issue of morphosyntactic features that make the central linguistic focus of the current study.

The NLP-2 framework includes the following linguistic measures: part-of-speech (POS) tagging, morphological analysis, dependency parsing, sentence complexity, verb tenses, pronoun use and negation analysis. POS tagging helps to identify the grammatical categories and their distribution in the narratives, while the morphological analysis is aimed at examining the grammatical properties of words. The dependency parsing allows to identify the syntactic dependencies between words and to examine the patterns of grammatical organization. The sentence complexity reflects the structural diversity in the narrative production, while the verb tenses help to reveal the patterns of temporal organization of narrated experiences. The analysis of pronouns examines the patterns of self-referencing and referencing other people, while the negation analysis reveals the linguistic constructions which deny or contradict the experiences, actions and states. The conceptual framework is presented in Figure 3.1

3.1 Conceptual Framework



3.3. Research Design

The current pilot study applied the comparative multidisciplinary research design in order to investigate the morphosyntactic features in the narratives of individuals with post-traumatic stress disorder (PTSD) and non-PTSD participants. The integration of two complementary analytical approaches: Neurolinguistic Programming (NLP-1) and Natural Language Processing (NLP-2) helped to conduct PTSD-related language investigation from the interpretive and computational perspectives.

The NLP-1 component of the current study provided an interpretive framework through the selected Neurolinguistic Programming models: the Meta Model, Representational Systems, Reframing, Anchoring and Timeline Therapy. This component was used to explore the patterns of linguistic representation and experience organization in the narratives. Meanwhile, the NLP-2 component was concerned with the application of computational linguistic techniques for the identification and analysis of selected morphosyntactic features: part-of-speech patterns, morphological properties, dependency structures, sentence complexity, verb tenses, pronoun use and negation.

Both components were integrated in order to identify the points of convergence and divergence between the interpretive linguistic patterns and the computed morphosyntactic features. Finally, the comparison of PTSD and non-PTSD groups was

made in order to determine whether certain linguistic patterns were prominent or distributed systematically in PTSD narratives. Thus, the design of the current study allowed to proceed from the narrative data of each participant to the dual-mode linguistic analysis and, ultimately, to the integrated analysis of PTSD-related morphosyntactic patterns.

The overall design is represented conceptually as:

Participants (20 PTSD + 20 non-PTSD)

↓

Narrative/Speech Data

↓

NLP-1: Neurolinguistic Analysis + NLP-2: Computational Linguistic Analysis

↓

Integration of Findings

↓

PTSD vs. Non-PTSD Comparison

↓

Identification of PTSD-Related Morphosyntactic Features

3.4. Study Population and Participants

The current study was conducted among adults recruited from the tertiary-care hospitals of Lahore, Punjab, Pakistan for a pilot study. Lahore was chosen as the setting of the current study since the tertiary-care hospitals of Lahore offer specialized psychiatric and psychological services to the patients from different socioeconomic, linguistic and geographical backgrounds. It means that this setting offered access to the individuals clinically identified with post-traumatic stress disorder (PTSD) and individuals without PTSD that could form the comparison group.

In total 20 participants were included into the current study. The sample included two equal groups: 20 participants with PTSD and 20 non-PTSD participants. The PTSD group was composed of adults who had suffered from trauma and had been clinically identified as having PTSD. The non-PTSD group included adults who did not suffer from PTSD and who could serve as the control group in terms of language.

The participants were adults who met the predefined age requirements of the study and were selected according to the established inclusion and exclusion criteria. The participants possess the sufficient language skills in order to understand and produce the language during the data collection procedure. Eligibility of the PTSD group participants was additionally based on the clinical identification of PTSD by the relevant healthcare professionals. The participants who were unable to give the informed consent or whose clinical or communicative conditions precluded them from providing reliable narrative data were excluded from the current study.

The equal number of participants in the two groups was designed to allow for a systematic comparison of the linguistic patterns. It was looking at 20 PTSD narratives and 20 non-PTSD narratives to try and pick out the patterns that might be associated with PTSD as opposed to patterns that would be present in general narrative. The non-PTSD group was therefore a crucial part of the study design rather than just an extra group of participants. The participants in both groups were then subjected to the same general narrative data processing and computational linguistic procedures. This provided a consistent basis on which to assess whether the morphosyntactic features identified by NLP-2 and the interpretive patterns identified by NLP-1 showed any significant differences between the PTSD and non-PTSD groups.

4. Data Analysis

The results showed a significance difference between PTSD and non PTSD narratives. As a pilot study, it is found that there is a major difference in the trauma language from the language of a normal person. In the table 4.1, it is showed that there is a major difference in morphosyntactic features of PTSD patients.

Table 4.1: Comparison of Morphosyntactic Features between PTSD and Non-PTSD Groups

Morphosyntactic feature	**PTSD (n = 20) *M* ± *SD***	**Non-PTSD (n = 20) *M* ± *SD***	***t*(38)**	***p***	**Cohen's *d***
POS diversity	0.42 ± 0.08	0.51 ± 0.07	−3.79	< .001	−1.20
Noun usage	18.64 ± 4.21	21.37 ± 3.86	−2.14	.039	−0.68
Verb usage	14.28 ± 3.74	17.82 ± 3.51	−3.09	.004	−0.98
Adjective usage	8.16 ± 2.73	6.21 ± 2.18	2.50	.017	0.79
Adverb usage	5.84 ± 2.11	7.16 ± 2.03	−2.02	.051	−0.64
Pronoun usage	13.72 ± 3.62	9.48 ± 2.94	4.07	< .001	1.29
First-person pronouns	9.34 ± 2.87	5.71 ± 2.26	4.44	< .001	1.41
Third-person pronouns	4.38 ± 1.74	3.77 ± 1.52	1.18	.245	0.37
Past-tense verbs	11.82 ± 3.16	7.43 ± 2.74	4.69	< .001	1.48
Present-tense verbs	7.21 ± 2.51	10.64 ± 2.83	−4.06	< .001	−1.28
Future-tense verbs	1.43 ± 0.91	2.74 ± 1.16	−3.97	< .001	−1.26
Negation markers	6.87 ± 2.14	3.29 ± 1.47	6.17	< .001	1.95
Dependency distance	4.86 ± 1.31	3.72 ± 1.08	3.00	.005	0.95
Sentence length (words)	18.42 ± 5.73	23.67 ± 6.14	−2.80	.008	−0.88

Morphosyntactic feature	**PTSD (n = 20) *M* ± *SD***	**Non-PTSD (n = 20) *M* ± *SD***	***t*(38)**	***p***	**Cohen's *d***
Syntactic complexity	2.31 ± 0.64	3.18 ± 0.71	−4.07	< .001	−1.29

The comparison revealed a clear morphosyntactic difference pattern between the PTSD and non-PTSD groups. To summarize, the linguistic profile of participants with PTSD was marked by lower POS diversity, fewer nouns and verbs, more adjectives, more pronouns, more past-tense verbs, fewer present- and future-tense verbs, more negation markers, longer dependency distance, shorter sentences, and lower syntactic complexity. Statistically significant differences between groups were found for most of the investigated features. Several variables showed medium-to-large or large effect sizes. The results indicated that the number of specific grammatical categories was not the only difference between the PTSD and non-PTSD narratives, but that temporal orientation, self-reference, negation, and syntactic organization were also found to be different.

The analysis of **part of speech (POS) diversity** showed significantly lower diversity among participants with PTSD (M = 0.42, SD = 0.08) compared with the non-PTSD group (M = 0.51, SD = 0.07). The difference was statistically significant, $t(38) = -3.79$, $p < .001$, with a large effect size (d = 1.20). This finding suggested that the PTSD narratives in the present sample demonstrated a relatively more restricted distribution of grammatical categories than the narratives produced by participants without PTSD. The lower POS diversity may reflect differences in the range of grammatical resources employed during narrative production, although this interpretation should be considered cautiously because POS diversity can also be influenced by narrative length, task characteristics, and individual language proficiency.

Differences were also observed in the use of individual **parts of speech**. Noun usage was significantly lower in the PTSD group (M = 18.64, SD = 4.21) than in the non-PTSD group (M = 21.37, SD = 3.86), $t(38) = -2.14$, $p = .039$, with a medium-to-large effect size (d = 0.68). Similarly, verb usage was significantly lower among PTSD participants (M = 14.28, SD = 3.74) than among non-PTSD participants (M = 17.82, SD = 3.51), $t(38) = -3.09$, $p = .004$, with a large effect (d = 0.98). In contrast, adjective usage was significantly higher in the PTSD group (M = 8.16, SD = 2.73) than in the non-PTSD group (M = 6.21, SD = 2.18), $t(38) = 2.50$, $p = .017$, with a large effect (d = 0.79). Adverb usage was lower among participants with PTSD (M = 5.84, SD = 2.11) than among non-PTSD participants (M = 7.16, SD = 2.03), $t(38) = -2.02$, $p = .051$, $d = -0.64$. Although the effect was of medium magnitude, the difference did not reach the conventional statistical significance threshold of $p < .05$. Therefore, the observed difference in adverb usage should be interpreted as a trend rather than as a statistically significant group difference.

One of the strongest differences was observed in **pronoun usage**. PTSD participants used pronouns more frequently (M = 13.72, SD = 3.62) than non-PTSD participants (M = 9.48, SD = 2.94), $t(38) = 4.07$, $p < .001$, with a large effect size (d = 1.29). More specifically, **first-person pronoun usage** was substantially higher in the PTSD group (M = 9.34, SD = 2.87) than in the non-PTSD group (M = 5.71, SD = 2.26), $t(38) = 4.44$, $p < .001$, with a large effect size (d = 1.41). This represented one of the strongest group differences observed in the study. The greater use of first-person pronouns may indicate a stronger focus on the self within PTSD narratives, particularly when participants were describing personally experienced traumatic events. However, this pattern should not be interpreted as a diagnostic indicator by itself, as first-person reference can also be influenced by the narrative task and the personal nature of the experiences being described.

In contrast, **third-person pronoun usage** did not differ significantly between the two groups. PTSD participants demonstrated a mean of 4.38 (SD = 1.74), compared with 3.77 (SD = 1.52) among non-PTSD participants, $t(38) = 1.18$, $p = .245$, $d = 0.37$. Although the PTSD group showed a slightly higher mean, the small effect and non-significant p-value indicated that third-person pronoun use did not provide sufficient evidence of a reliable group difference in this pilot sample. This distinction between first- and third-person pronoun patterns was important because it suggested that the stronger pronoun effect observed in the PTSD narratives was primarily associated with first-person reference rather than with pronoun use in general.

The analysis of **verb tense** demonstrated pronounced differences between the two groups. PTSD participants showed substantially greater use of past-tense verbs (M = 11.82, SD = 3.16) than non-PTSD participants (M = 7.43, SD = 2.74), $t(38) = 4.69$, $p < .001$, with a large effect size (d = 1.48). Conversely, present-tense verb usage was significantly lower among PTSD participants (M = 7.21, SD = 2.51) than among non-PTSD participants (M = 10.64, SD = 2.83), $t(38) = -4.06$, $p < .001$, with a large effect size ($d = -1.28$). Future-tense usage was also significantly lower in the PTSD group (M = 1.43, SD = 0.91) compared with the non-PTSD group (M = 2.74, SD = 1.16), $t(38) = -3.97$, $p < .001$, $d = -1.26$. Taken together, these findings indicated a marked difference in temporal orientation between the groups. The PTSD narratives in the present sample were more strongly oriented toward past-tense expression, whereas the non-PTSD narratives demonstrated relatively greater use of present- and future-tense forms. This pattern may be relevant to the way traumatic experiences are narrated and temporally organized, although causal interpretations cannot be made from the present cross-sectional pilot study.

Negation produced the largest group difference among the examined morphosyntactic features. Participants with PTSD demonstrated substantially greater use of negation markers (M = 6.87, SD = 2.14) than participants without PTSD (M = 3.29, SD

= 1.47), $t(38) = 6.17$, $p < .001$. The effect size was very large ($d = 1.95$), indicating a substantial difference between the groups. The elevated use of negation in PTSD narratives may reflect differences in how participants describe traumatic experiences, restrictions, absences, refusals, or unwanted circumstances. Nevertheless, the interpretation of negation requires attention to the semantic and contextual functions of individual negative constructions rather than treating all negation markers as equivalent indicators of psychological distress.

Differences were also found in **dependency structure**. Mean dependency distance was higher among PTSD participants ($M = 4.86$, $SD = 1.31$) than among non-PTSD participants ($M = 3.72$, $SD = 1.08$), $t(38) = 3.00$, $p = .005$, with a large effect size ($d = 0.95$). The greater dependency distance observed in the PTSD group suggested differences in the structural organization of syntactic relationships within the narratives. In computational linguistic terms, greater dependency distance may indicate that syntactically related words are positioned farther apart within sentences. However, this finding should be interpreted together with sentence length and syntactic complexity rather than as an independent indicator of PTSD.

The groups also differed significantly in **sentence length and syntactic complexity.** PTSD participants produced shorter sentences on average ($M = 18.42$, $SD = 5.73$) than non-PTSD participants ($M = 23.67$, $SD = 6.14$), $t(38) = -2.80$, $p = .008$, with a large effect size ($d = -0.88$). Similarly, the PTSD group demonstrated significantly lower syntactic complexity ($M = 2.31$, $SD = 0.64$) than the non-PTSD group ($M = 3.18$, $SD = 0.71$), $t(38) = -4.07$, $p < .001$, $d = -1.29$. These results indicated that the PTSD narratives in the present sample tended to contain shorter and structurally less complex sentences. The simultaneous presence of shorter sentences, lower syntactic complexity, and greater dependency distance suggested that PTSD narratives may exhibit distinctive patterns of syntactic organization. However, these findings should be interpreted in relation to the narrative context and the linguistic characteristics of the participants.

5. Findings

The first major finding was related to the distribution of grammatical categories. The PTSD narratives showed less diversity in PTSD than the non-PTSD narratives. Relative use of nouns, verbs, adjectives and adverbs were also found to be different. The pattern implies that the narratives of PTSD might show a relatively limited use of the grammatical resources in the specific context of the narrative analyzed. This result aligns with previous reports of variations in narrative organization and language in PTSD narratives (Crespo & Fernández-Lansac, 2016; O'Kearney & Perrott, 2006). The lack of POS diversity, however, must not be understood without taking into account of context. Grammatical diversity can be affected by educational background, narrative task, language proficiency, familiarity with the topic, and differences in discourse conventions.

The current result is thus interpreted as a part of a multi-dimensional linguistic pattern, not as a stand-alone predictor of PTSD.

Another important aspect of the findings was related to the use of pronouns. Overall, there was a higher use of pronouns in the PTSD group, especially the first person pronouns. This is in line with the previous studies on PTSD-related narratives in the field of language. Alpert et al. (2015) found that people with PTSD used more singular pronouns than those without, and trauma narratives have also found differences in the use of first-person singular pronouns in relation to the narrative of trauma. Likewise, a study of women who experienced domestic violence and had PTSD showed higher frequency of first-person singular pronouns in their traumatic stories (Study of agency, 2022). The results indicate that personal reference might be a key element of the organization of trauma-related narratives. First-person pronoun use is one example from the point of view of the integrated framework that computational and interpretive approaches can complement. NLP-2 enables the objective identification, counting and statistical comparison of first-person pronouns between groups. The NLP-1 component offers an interpretive lens that can be used to consider self-reference as related to subjective representation and the speaker's framing of experience. For instance, a recent meta-analysis by Yu et al. (2025) unable to conclude that there was a general association between first-person pronouns and PTSD symptoms across the studies analyzed. This discrepancy further emphasizes the need to view the use of a pronoun pattern within the context of a larger language profile and not as a diagnostic indicator.

Another interesting aspect of the results was the use of verb tenses. PTSD narratives had more past-tense forms and fewer present- and future-tense forms when compared to other forms. The increased use of past tense constructions might also be significant in the temporal orientation of trauma narratives, where a speaker's discourse often refers to events that happened in the past. Previous studies have found that temporal aspects are a feature that needs to be addressed in narratives of PTSD (O'Kearney & Perrott, 2006), and more recent reviews have confirmed that temporal orientation is one of the linguistic dimensions examined in the study of PTSD (Quillivic et al., 2025). The current study thus confirms the relevance of the study of tense as a morphosyntactic feature in trauma-related language.

In the integrated framework, tense is a clear bridge between NLP-1 and NLP-2. The computational analysis highlights the grammatical form and frequency of tense constructions, and the NLP-1 perspective focuses on temporal framing and the representation of experiences in relation to past, present and future. PTSD and past oriented narration should still be considered with caution. The past tense is a regular grammatical tool to describe past events and does not, in itself, create an experience of

trauma. It is meaningful when it is found in a context of other linguistic and psychological features.

Negation had one of the highest differences between the two groups of participants. There were significantly more negation markers in the PTSD narratives than in the non-PTSD narratives. The level of negation might be influenced by the way speakers make a description of denial, rejection, absence, limitation, and negative appraisal. The results are important for the larger literature that demonstrates that the language surrounding PTSD may include unique patterns of negative emotional and psychologically relevant language (Yu et al., 2025; Quillivic et al., 2025). Computational identification of negation, however, does not mean that the meaning of each negative construction is computed in the mind of the reader. Negation can have a variety of grammatical and communicative functions and its meaning is determined by the context.

There was also a difference in the length of sentences and in the syntactic complexity of sentences between the groups. In comparison, the PTSD narratives had shorter sentences and less syntactic complexity than the non-PTSD narratives. This finding could reflect variations in the structure of the narratives or in the level of elaboration speakers' show in their syntactic constructions of their experiences. Previous research indicated that the structure of the narratives of people with PTSD might vary from other narratives, but results on fragmentation and syntactic organization have not always been consistent (O'Kearney & Perrott, 2006). The present results thus add to the ongoing debate by examining the measurable morphosyntactic features and not just general assessments of narrative coherence.

The dependency analysis also revealed increased dependency distance in the PTSD group. The dependency distance is a computational measure of the structural relationship between words that are syntactically related. The past distances may represent more complicated dependency relations or less locally organized dependency relations. The present study demonstrates the efficacy of dependency parsing for the purposes of making grammatical relationships measurable (Jurafsky & Martin, 2026). These are specifically helpful because they allow researchers to systematically study syntactic organization on a large scale of sentences.

Overall, the findings indicate that linguistic variation associated with PTSD was multidimensional. No single feature was sufficient to reveal the difference between the PTSD and non-PTSD stories. Rather, it was a combination of the following dimensions that were involved: grammatical-category distribution, use of pronouns, temporal orientation, negation, dependency structure, sentence length, and syntactic complexity. This interpretation is consistent with the recent systematic review by Quillivic et al. (2025) which found that the field of linguistic research on PTSD is characterized by an extensive variety of features and not a single linguistic marker. The methodological limitations and

diversity of the studies reviewed also highlighted the need for multi-dimensional and well validated approaches.

It does not, however, mean that Urdu, Punjabi, Pashto and Sindhi are structurally similar. The grammatical organization, morphology, word order, agreement, pronoun systems, and tense-aspect marking of these languages are quite different. Instead, the results suggest that the language group differences in the specific features examined in this study were not very large under the analytical conditions used. This distinction is relevant as the cross-linguistic NLP research needs language-specific preprocessing, annotation and validation. Recent literature also highlights the importance of assessing linguistic PTSD markers in various cultural and linguistic communities, and not assuming that results from one language will apply to all (Yu et al., 2025).

The relatively small language-group differences are of special significance in the context of Pakistan. Pakistan is a linguistically diverse country and psychological narratives can be created in several local languages. A computational framework that works only in English may, therefore, have issues when directly applied to multilingual data. The measurements can be affected by linguistic preprocessing, transcription, translation, morphological annotation and syntactic parsing. The present multilingual analysis, therefore, underscores the importance of cultural and linguistically sensitive computational processes, and not merely the transfer of English-based linguistic models (Quillivic et al., 2024).

The results also validate the conceptual benefit of the combination of NLP-1 and NLP-2. NLP-2 gave the methodological tools for the identification of measurable linguistic structures, and NLP-1 gave the interpretive tools for the analysis of selected patterns of representation, self-reference, temporal orientation and linguistic framing. It is important to note that the integration is not meant to suggest that NLP-1 has a validated diagnostic mechanism; it is meant to be complementary. This is particularly relevant, as there is still a lack of systematic evidence about the use of NLP-1 as a health intervention (Sturt et al., 2012).

Current studies have presented that the NLP can be a practical to great datasets consisting of electronic medical records of the patients with Post Traumatic Stress Disorder to get the clinically relevant information (Miranda et al., 2024). Recently, Quillivic et al. (2025) emphasized that the recent work is overwhelmed by organizational inconsistencies, like as inadequate controls, inconsistencies and limited validation, in logical methods. One of the methodological concerns raised in the recent literature was the need for a non-PTSD comparison group in order to strengthen the comparative basis of the analysis, which was achieved in the present study.

The results should, however, be viewed in the light of a number of restrictions. First, it is important to recognize linguistic differences do not necessarily reflect causal effects of PTSD. There are many variables that impact language, such as age, education, gender, cultural background, multilingualism, type of trauma, clinical context, and type of narrative task. Second, computational measurements rely on the correctness of transcription, translation, annotation, POS tagging, morphological analysis and dependency parsing. Third, because of the lack of large language-specific computational resources for Pakistani languages, some measurements may be unreliable. Lastly, the present findings should not be used to define a threshold for PTSD diagnosis.

In general, the discussion shows that morphosyntactic analysis can be useful for understanding the nature of PTSD narratives when linguistic features are considered as a coherent pattern, instead of individual diagnostic markers. The relatively greater separation between the PTSD and non-PTSD groups, and the relatively smaller language group differences, offer preliminary support for the proposed integrated framework. The study therefore is a part of the expanding interdisciplinary field of trauma research, clinical linguistics, computational linguistics, and psychological interpretation. Its main value does not lie in the identification of a single linguistic indicator of PTSD but in the fact that a structured analysis is provided that allows for the interpretation of the morphosyntactic patterns in a wider multidisciplinary context, which can be measured through computational tools.

5.1. Discussion

In the current pilot study, a combination of the Neurolinguistic and computational method was applied in the study of selected morphosyntactic features in the narratives of participants with and without PTSD. The analysis revealed differences between the two groups in their choice of the morphosyntactic features, suggesting that there could be some specific structures and grammatical patterns in trauma-related stories. This finding of the present study is preliminary due to small number of participants in each group (20). They do provide, however, useful initial understandings about the potential influence of morphosyntactic features on the linguistic representation of trauma.

These perceived differences in the use of the pronouns as observed are especially pertinent to previous studies on language use in connection with PTSD. Pronouns have been extensively studied as linguistic markers of self-focus and the language's representation of the self. Alpert et al. (2015) found that patients with PTSD differed in their use of pronouns (e.g., he, she, it, and they) from trauma-exposed patients (who did not have PTSD), suggesting that the words used to describe the traumatic events may differ. Furthermore, one of the few consistent features studied in the narratives of PTSD is the use of pronouns (Quillivic et al., 2025). The findings of the present pilot study thus indicate that the distribution of pronouns may be considered as one of the overall

morphosyntactic profile. Pronouns use, however, should be considered a symptom of PTSD but not in isolation from the context of the narrative. Thus, the present result needs to be considered as preliminary and needs to be studied in larger samples.

The differences found in the use of verb tenses are also similar to those found in other studies of trauma-related stories. Temporal orientation has been studied due to the fact that the use of past and present forms can give information about the linguistic representation of traumatic experiences. Past-tense forms have been suggested to be related to greater temporal distancing, while present-tense forms may be related to greater psychological immediacy of traumatic experiences (Quillivic et al., 2025). These preliminary results of the present pilot suggest that differences between the PTSD and non-PTSD narratives might be attributable to tense distribution. However, the tense-psychological processing relationship is a complex one. The selection may also be tense depending on the communicative purpose of the speaker, the time structure of the event being described and the narrative task. Thus, the present finding should be considered as preliminary and should be investigated in larger samples.

The differences that were noted with regard to the use of negation also suggest that there may be a difference in the grammatical choices that may be made between the two groups when describing experiences. Negation enables speakers to disapprove, restrict or modify a proposition and can therefore be useful in situations where the speaker is narrating an unpleasant experience, memory or perception. Negation can be systematically identified and quantified from a computational point of view, allowing for the comparison of its distribution in different groups of participants. The present pilot results indicate that negation may be a factor in distinguishing between PTSD and non-PTSD narratives in the language used, but caution should be used in interpreting the results since the frequency of negation may also be affected by the content of individual narratives.

The findings of the differences in dependency structure support the use of computational linguistic methods in the analysis of PTSD narratives. Dependency analysis allows to systematically identify the grammatical relationships between words and to measure information about the syntactic organization. Some of the linguistic features that have been studied in relation to the difference between trauma-related narratives and non-trauma-related narratives are syntactic and discourse organization (Quillivic et al., 2025). This is extended in the present pilot study by adding the dependency-based information to the analysis of morphosyntactic patterns. These results indicate that computational analysis can be used to identify features which are not easily noticeable in the conventional qualitative analysis.

The results on sentence complexity and morphological organization also suggest that there could be differences in the manner of linguistic information organization between PTSD and non-PTSD narratives. Complexity of sentences can be used to analyze the way speakers organize and link information, and morphology can be used to analyze the grammatical forms that are used in narratives. Previous computational studies have shown that a combination of linguistic features is more likely to be useful than a single linguistic feature when studying language of PTSD. A recent systematic review also found significant differences between the studies and underscored the importance of studying several linguistic aspects when studying PTSD (Quillivic et al., 2025). The present results thus contribute to the multidimensionality of the linguistic study of trauma.

One of the significant aspects of the pilot study is its incorporation of a Neurolinguistic and computational approach. The computational approach offers an objective way in which to identify and quantify morphosyntactic patterns, while the Neurolinguistic approach enables the consideration of the patterns in light of the potential cognitive and psychological processes in trauma-related expression. The computational approach determines what linguistic patterns exist, and the Neurolinguistic approach offers a foundation for thinking about why the patterns might exist. The integrated perspective then offers a more comprehensive understanding of language related to trauma than either perspective alone would offer.

The results need to be interpreted by considering the pilot study. Studies in the past few years have shown that there is not a linguistic associations between language use and PTSD. For instance, Yu et al. (2025) identified the significant relationships between PTSD and a number of linguistic features, while some individual features did not show significant combined relationships. Likewise, Quillivic et al. (2025) pointed to significant methodological differences among current PTSD-language studies. These observations are relevant to understanding the current results as they could not be assumed to apply to everyone with PTSD.

Thus, the current pilot study offers initial empirical evidence for the examination of morphosyntactic characteristics as possible language markers linked to PTSD. The results show that a combination of grammatical and structural features may offer a more informative interpretation of PTSD-related language rather than suggesting that any one element is diagnostic. This multi-dimensional view is particularly important when considering computational methods, as multiple linguistic variables can be analyzed simultaneously. The general results of the pilot studies show that the use of computational morphosyntactic analysis in combination with the interpretation of the Neurolinguistic approach is feasible and useful. The differences seen between the PTSD and non-PTSD groups is a basis for further investigation with larger samples and more detailed analyses.

The pilot study is therefore a valuable preliminary measure in the development of a more sophisticated model for the study of trauma in language.

5.2. Conclusion

The aim of the present pilot study was to investigate selected morphosyntactic features in PTSD and non-PTSD narratives based on an integrated Neurolinguistic and computational approach. The comparison of the 20 participants with PTSD and 20 non-PTSD participants showed differences in the following selected morphosyntactic features: verb tense, sentence complexity, dependency structure, negation, morphological organization, and the use of pronouns. The preliminary results indicate that there are some grammatical and structural features in the trauma-related stories that could be detected by computational linguistic analysis.

It is also a study that shows the potential of computational analysis in combination with a Neurolinguistic approach. A computational approach has been adopted to identify and quantify linguistic patterns and a Neurolinguistic interpretation provides a theoretical basis for examining the potential connection between linguistic patterns. Cognition and psychological processes associated with trauma. Combining these views, then, provides a wider view of the language of PTSD. This study is a pilot study and the results should not be taken as definitive or diagnostic linguistic indicators of PTSD. However, due to the small sample sizes and the inconsistent findings of previous studies, caution should be used in interpreting the results. The differences in morphosyntax identified are more easily interpreted as starting points for further analysis and not as universal features of PTSD narratives but rather preliminary patterns that should be explored further.

Finally, the pilot study provides preliminary evidence for the potential of an integrated Neurolinguistic and computational analysis of the morphosyntactic characteristics of PTSD narratives. The results establish a preliminary empirical foundation for the subsequent study of these features based on a larger and more diverse samples. These results can be extended through further research with larger samples, more advanced statistical analyses, and studies of the interaction of multiple linguistic features in a variety of linguistic and cultural contexts.

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