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Brief report

Sentence completion test in combat veterans with and without PTSD: preliminary findings

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Abstract

This study used a sentence completion task to assess semantic choice in combat veterans. Twenty-eight combat veterans with ($n=14$) and without ($n=14$) posttraumatic stress disorder (PTSD) filled in the final word for 33 incomplete sentences after receiving a combat prime. The veterans with PTSD completed sentences with significantly more trauma-relevant final words than those without PTSD. Findings are interpreted with respect to current language models and information-processing theories of PTSD.

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1. Introduction

Information-processing theories of posttraumatic stress disorder (PTSD) (Chemtob et al., 1988; Litz and Keane, 1989) suggest that the disorder is characterized by an information-processing bias toward ambiguous and potentially threatening information. While investigators have used a variety of tasks to assess possible biases in PTSD (for

review, see McNally, 1998), sentence completion tasks have not been among them. This is somewhat surprising given the simplicity and adaptability of these tasks and their demonstrated usefulness in testing both cognitive priming effects and semantic expectation (Kutas and Hillyard, 1984; Williams and Colombo, 1995).

There are a number of models that describe how individuals use sentence context to constrain semantic (i.e. word) choices. These models share the basic assumption that words and their sensory and phonemic representations are stored in the brain in associative networks (Kintsch and van Dijk, 1978; Gernsbacher, 1991). During sentence

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processing, components (or nodes) of this network are activated by the words themselves and their context. As the sentence progresses and the context builds, however, inhibitory mechanisms are also engaged that ‘turn off’ or ‘suppress’ those nodes that were previously activated but no longer could sensibly complete the sentence.

One would predict that in PTSD subjects; trauma-relevant schemas (Chemtob et al., 1988; Litz and Keane, 1989) would lead to both a heightened activation and a lack of suppression of trauma associates. Thus, in sentences in which trauma-relevant endings are semantically possible, such endings would be endorsed more often in individuals with PTSD, even in comparison to subjects who have had similar traumatic experiences but did not develop PTSD.

As an initial step in a study designed to investigate semantic biases in individuals diagnosed with PTSD, combat veterans with and without PTSD wrote in a final word to 33 sentences that could be correctly completed with either military or non-military endings. It was predicted that individuals with PTSD would complete more ambiguous sentences with military endings than combat comparison subjects.

2. Methods

2.1. Subjects

Twenty-eight Vietnam combat veterans participated in the sentence completion task as a part of a larger study of PTSD at the Boston VA Medical Center. Participants were recruited through fliers located in the hospital or local veterans’ organizations. All potential subjects were screened over the phone to exclude those with a history of seizures, neurological disorders, and substance abuse within the past year. All veterans were required to have served in the Vietnam theatre and to report at least ‘light’ combat according to the Combat Exposure Scale (CES).

2.2. Procedures

All subjects participated in two experimental sessions. The first session began with all subjects

reading and signing a consent form. This was followed by administration of a battery of instruments that included the Clinician Administered PTSD Scale (CAPS; Blake et al., 1995), the Beck Depression Inventory (Beck and Steer, 1987) and the CES (Keane et al., 1989). A medical student (MLK) who was trained and experienced in structured interviewing conducted all interviews.

The second session consisted of a series of psychophysiological recordings that occurred during emotional priming procedures. The procedures, which have been detailed elsewhere (Keane et al., 1998), required the subjects to view a series of slides with neutral and military content. When the physiological recording was complete, the subject was asked to complete a 33-item sentence completion task. Items were generated by experts in PTSD and were constructed so that the sentences could be accurately completed with words of military and non-military content. (Example: ‘He was almost hit by a _____’ could be completed with either the word ‘rock’ or the word ‘bullet’.) All sentences were between 5 and 11 words long and ended with a blank. Subjects were asked to complete the sentences as quickly as possible with the first word that came to mind.

Three independent raters (MOK, MLK, LLL) without knowledge of the subjects’ group assignment judged final words as either ‘Military,’ ‘Non-military,’ or ‘Ambiguous’. A response was rated as ‘Ambiguous’ if it was not clearly in the first two categories. The three raters agreed on 84% of the trials. Discrepancies between raters were settled by majority (two of three raters). On those trials in which the three raters each gave a different rating to a given sentence (1.7%), the response was considered ‘Ambiguous’. Total scores for military, non-military, and ambiguous endings were generated for each subject.

2.3. Proposed analyses

Hypotheses were tested using a multivariate analyses of variance (MANOVA) repeated measures with ‘Group’ (PTSD, No PTSD) as the between-subjects factor and ‘Ending’ as the within-subjects factor (Military, Ambiguous, Non-military). A follow-up repeated measures ANOVA

used combat exposure as a covariate to remove from the analyses the variance associated with the amount and severity of combat exposure. The ‘Ending’ factor was parsed further into orthogonal quadratic (Military/Non-military vs. Ambiguous) and linear (Military vs. Non-military) contrasts. The study’s primary hypothesis that subjects with PTSD would complete sentences with more military related endings would be supported by a significant Group \times Ending interaction with a significant linear contrast in which PTSD subjects responded with relatively more military than non-military endings than No PTSD subjects.

3. Results

3.1. Demographic data

Independent *t*-tests (two-tailed, $\alpha=0.05$) revealed that the PTSD and No PTSD subjects did not differ with respect to their age (mean=52.4, S.D.=4.7) and highest level of education (mean=8.0, S.D.=2.2; equivalent to ‘some college’). The two groups did differ with respect to their reports of combat exposure on the CES (PTSD: mean=25.8, S.D.=10.8; No PTSD: mean=15.7, S.D.=9.7 ($t(26)=2.60$, $P<0.05$)) but not the number of months spent in the war-zone (mean=13.8, S.D.=5.8). Chi-square analyses revealed that the two groups did not differ significantly with respect to race and religious preference, but No PTSD subjects were more likely to be currently married ($\chi^2(5)=12.6$, $P=0.03$) and more likely to be currently employed ($\chi^2(3)=13.1$, $P=0.01$).

3.2. Sentence completions

The number of military, non-military, and ambiguous sentence endings for each was calculated for each subject. Values were submitted to the repeated measures ANOVA outlined above. As predicted, there was a significant Group \times Ending interaction, $F(1.18, 27)=5.43$, $P=0.02$, indicating that the groups differed with respect to their word choices (Fig. 1). Analyses of the within-subjects contrasts revealed a significant linear effect, $F(1, 26)=5.80$, $P=0.02$, with PTSD subjects producing significantly more military endings

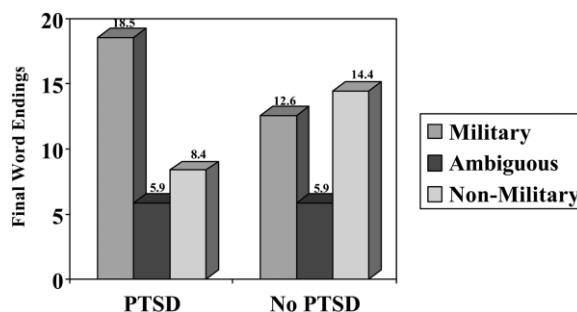


Fig. 1. Military, ambiguous, and non-military final word endings for PTSD and No PTSD subjects.

than non-military endings, an effect that was not present in the No PTSD subjects. Findings were still significant when combat exposure scores served as a covariate. With ‘Combat Exposure’ as a covariate, ‘Group’ significantly interacted with ‘Ending’, $F(1.2, 30.6)=3.87$, $P=0.05$, but the covariate ‘Combat,’ $F(1.2, 30.61)=0.02$, $P=0.91$ did not, indicating that the significant effects were not likely to be driven by the higher levels of combat exposure in subjects with PTSD. The relative specificity of PTSD symptoms in affecting the dependent variable is further supported by the significant correlation of military endings with the overall PTSD score on the CAPS, $r(28)=3.9$, $P=0.04$, but not combat exposure scores, number of months spent in the war zone, or Beck Depression Inventory scores.

4. Discussion

In this study, combat veterans diagnosed with PTSD showed a bias toward military endings during a sentence completion task in which the sentences could be sensibly completed with both military and non-military final words. This preliminary work is consistent with data from other cognitive paradigms that have found biases in PTSD subjects in the accessibility, encoding, and retrieval of trauma-relevant information. The sentence completion task used in this study, however, differs in a number of important ways from more commonly used paradigms in the study of PTSD (e.g. the modified Stroop Task). In contrast to other studies in which subjects are asked to

respond to discrete stimuli of known psychometric properties, in this study subjects were asked to generate unique responses to ambiguous stimuli, and thus the task assessed the relatively spontaneous accessibility and retrieval of trauma information.

Current information-processing theories (Chemtob et al., 1988; Litz and Keane, 1989) propose that individuals with PTSD have rigid cognitive schemas that differ from those of others in their ease of activation and retrieval, particularly after reminders of their trauma. These data are entirely consistent with such theories. When presented with ambiguous stimuli after a trauma-prime, subjects with PTSD interpreted more of these sentences as leading to trauma-relevant endings. These findings are intriguing because similar biases in interpretation of ambiguous or neutral stimuli are thought to be at the core of the initiation and maintenance of behaviors such as hypervigilance and avoidance.

In addition, the sentence completion task is useful given its flexibility and its ability to assess both the activation and suppression of semantic choices. Current theories of language comprehension emphasize equally the processes of activation and suppression in syntactical and semantic choices. When a final word is chosen in a sentence paradigm, the word must not only be *activated* by the ongoing context but it also must remain *unsuppressed*. Which of these operations was responsible for our findings in PTSD subjects was not tested in the current study. It is possible that the increase in military endings demonstrated by the PTSD subjects was due to the excessive activation of trauma-relevant endings to the ambiguous sentences that were not activated in the non-PTSD group. Conversely, it is also possible that both groups activated trauma-relevant endings equally, but the PTSD subjects did not suppress them. One could speculate that the trauma-prime may have served to activate trauma-schemas in both groups, thus emphasizing the role on non-suppression in the military bias. However, the present design cannot speak to whether the emotional priming procedure produced a carry-over effect that influenced semantic choices during the sentence completion task.

Future work using sentence completions could answer these questions by having subjects perform this task both before and after emotional priming procedures. The current study is limited by its lack of a baseline assessment of sentence completions in combat veterans. Establishing normative data under neutral conditions in military veterans in general and in combat veterans without PTSD will be an essential first step in better understanding semantic processing and trauma-related biases in veterans with PTSD. The relative contribution of activation and suppression in trauma-related biases could be assessed using both computer-based administrations, in which voice-activated reaction times are recorded, as well as concurrent event-related potentials (e.g. the N400 paradigm) that can assess semantic expectancies in ambiguous sentences. Using such techniques will aid in the understanding of how subjects with PTSD apply trauma-schemas to a wide range of neutral or ambiguous situations.

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Appendix A: Sentence completion task

1. He was almost hit by a_____.
2. The night sky was full of_____.
3. The air was heavy with the smell of_____.
4. We could smell the burning_____.
5. The silence was broken by the_____.
6. The group waded through the_____.
7. His job was to take the sand and fill the_____.
8. He filled the bags with_____.
9. His heart raced with_____.
10. The air pulsed with the beat of the_____.
11. The field was littered with_____.
12. The man lay very still on the_____.
13. The last time he saw his friend it was in a_____.
14. Circling above him there was a_____.
15. It is hot and humid in the_____.
16. The river was just swimming with_____.
17. The tank was filled with_____.
18. He saw movement in the_____.

19. Just off the trail, he stepped on a _____.
20. The night sky was lit up by the _____.
21. He sprayed the whole area with _____.
22. His friend had a big hole in his _____.
23. The unfortunate man lost his _____.
24. He had a bad case of jungle _____.
25. That day, the men had to cover four _____.
26. He was told to take _____.
27. He asked him to unzip the _____.
28. He couldn't wait to go on _____.
29. He expected to be overseas about _____.
30. He began to feel his time was _____.
31. The man jumped into the _____.
32. The trees were destroyed due to the heavy _____.
33. His job was to run the _____.

References

- Beck, A.T., Steer, R.A., 1987. Beck Depression Inventory Manual. The Psychological Corporation, San Antonio.
- Blake, D.D., Weathers, F.W., Nagy, L.M., Kaloupek, D.G., Gusman, F.D., Charney, D.S., Keane, T.M., 1995. The development of a clinician-administered PTSD scale. *Journal of Traumatic Stress* 8, 75–90.
- Chemtob, C.M., Roitblat, H.L., Hamada, R.S., Carlson, J.G., Twentyman, C.T., 1988. A cognitive action theory of post-traumatic stress disorder. *Journal of Anxiety Disorders* 2, 253–275.
- Gernsbacher, M.A., 1991. Cognitive processes and mechanisms in language comprehension: the structure building framework. In: Bower, G.H. (Ed.), *The Psychology of Learning and Motivation*, vol. 27. Academic Press, San Diego.
- Keane, T.M., Fairbank, J.A., Caddell, J.M., Zimering, R.T., Taylor, K.L., Mora, C.A., 1989. Clinical evaluation of a measure to assess combat exposure. *Psychological Assessment: A Journal of Consulting and Clinical Psychology* 1, 52–55.
- Keane, T.M., Kolb, L.C., Kaloupek, D.G., Orr, S.P., Blanchard, E.B., Thomas, R.G., Hsieh, F.Y., Lavori, P.W., 1998. Utility of psychophysiology measurement in the diagnosis of post-traumatic stress disorder: results from a Department of Veteran's Affairs cooperative study. *Journal of Consulting and Clinical Psychology* 66, 914–923.
- Kintsch, W., van Dijk, T.A., 1978. Toward a model of context comprehension and production. *Psychological Review* 85, 363–394.
- Kutas, M., Hillyard, S., 1984. Brain potentials during reading reflect word expectancy and semantic association. *Nature* 307, 161–163.
- Litz, B.T., Keane, T.M., 1989. Information processing in anxiety disorders: application to the understanding of post-traumatic stress disorder. *Clinical Psychology Review* 9, 243–257.
- McNally, R.J., 1998. Experimental approaches to cognitive abnormality in posttraumatic stress disorder. *Clinical Psychology Review* 18, 971–982.
- Williams, J.N., Colombo, L., 1995. Constraints on the range of context-independent priming from ambiguous words. *Psychological Research* 58, 38–50.