

Posttraumatic stress disorder: Expecting the worst

Callan Lujan¹, Ezequiel Morsella^{1,2} & Mark W. Geisler¹

¹San Francisco State University
²University of California, San Francisco

The Question

Can evidence for negative expectations, as a result of posttraumatic stress disorder, be shown electrophysiologically?

Introduction

Posttraumatic stress disorder is characterized by exposure to a traumatic event, intrusion symptoms, avoidance, negative alterations to cognition and mood, and alterations in arousal.¹

Negative expectations of one's self, others or the world are a specific symptom reported within the negative alterations to mood and cognitions cluster. These appraisals lead to overgeneralized fear.²

• Eg. "The world is a dangerous place"

- This symptom is under scrutiny and is reported to be PTSD non-specific.³
- Some now suggest the elimination of the symptom cluster based on the overlap with depression and anxiety.⁴

Given the controversy, more evidence for negative expectations as part of the PTSD diagnosis is necessary.

Event-related potential studies using the "odd-ball" paradigm have looked at different neurological components underlying the discrimination between stimuli, specifically how mental representations are altered with the incoming of novel stimuli.⁵

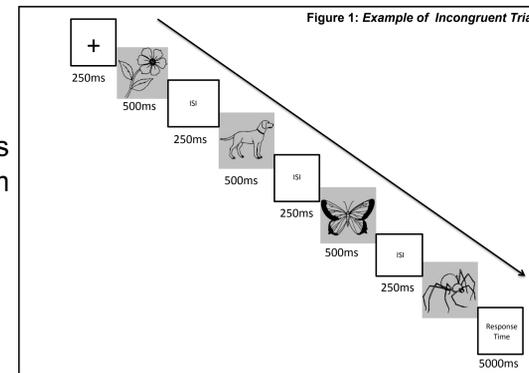
Components to index expectations:

- P300:** In the case where a new stimuli is detected, the updating of mental representations elicit a change in the neural activity and result in a larger P300 amplitude.⁶
- N400:** If a stimulus contradicts a given context (an expectancy violation), more effort is required to access semantic memory and this results in a larger N400 amplitude.^{7,8}

Hypotheses: Assuming individuals with PTSD expect negative outcomes, we predict context violations (e.g negative image following a positive context) will elicit attenuated P300 and N400 amplitudes for subclinical PTSD participants as compared to healthy controls.

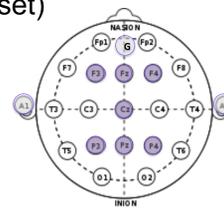
Method

- Stimuli:** The stimuli consisted of line drawings which yielded high "name agreement" and were pilot tested for valence^{9,10,11}
- Design:** Stimuli were presented to participants in sets of four images as an adapted visual oddball paradigm with standards and targets in an 8:1 ratio.
- In an effort to build an expectation, the first three images in each set were considered context images all belonging to the same valence group (positive or negative). The fourth and final image in the set was either congruent or incongruent with the context images' valence.
- Task:** Participants were asked to consider the valence of each image, responding only to the target image (the fourth in each set) with a button press indicating if they thought the image was positive ("s" key) or negative ("k" key).

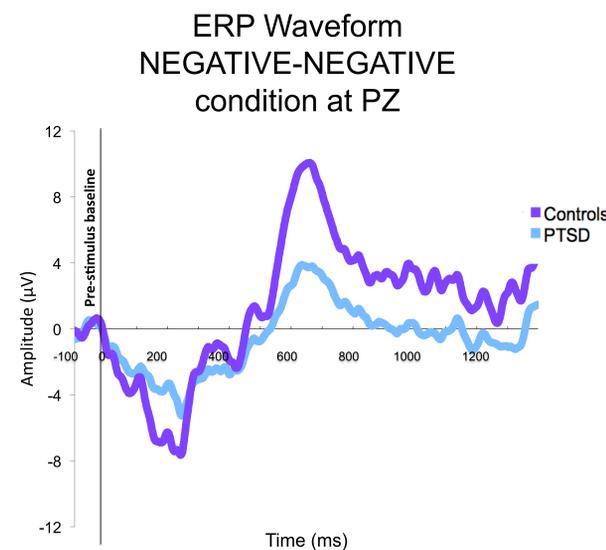


ERP Acquisition

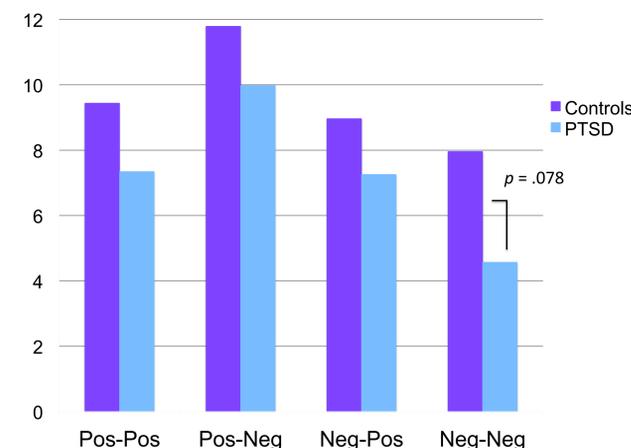
- Recorded from midline, frontal and parietal electrodes (Fz, Cz, Pz, F3, F4, P3 and P4), and sampled at rate of 1000 Hz for 1500 ms (100 ms pre-stimulus baseline). All epochs were low-pass filtered at 30 Hz after grand averaging.
- Analyses focused on P300 (500-750ms) and N400 components (650-850ms).



Preliminary Results



Mean P300 amplitude across conditions



Participants

Participants were 18 (8 male, 10 female) San Francisco State University students. Of the sample, 11 participants had experienced a trauma (determined from the Brief Trauma Questionnaire¹²) and scored above a 38 on the civilian version of the PTSD Checklist (PCL-C) meeting symptom criteria for a subclinical classification of PTSD.¹³

Results

A 7 (Electrode site: Fz x Cz x Pz x F3 x F4 x P3 x P4) x 4 (Condition: Pos-Pos x Pos-Neg x Neg-Pos x Neg-Neg) x 2 (Group: PTSD x Controls) mixed factorial ANOVA was run, with Group (PTSD/control) serving as the between subjects variable.

Condition

P300 Amplitude: There was a significant main effect of condition $F(3, 14) = 6.638, p = .005$. Bonferroni adjusted post hoc comparisons showed a significant difference between the Pos-Neg ($M = 10.885, SD = 1.093$) and Neg-Neg ($M = 6.264, SD = .899$) conditions, $t(16) = 4.51, p = .002$. Additionally, the Pos-Neg condition was significantly different from the Neg-Pos condition ($M = 8.108, SD = .972$), $t(16) = 3.12, p = .04$.

Condition x Groups

P300 Amplitude: We failed to detect a significant interaction effect of groups by condition. However, in the Neg-Neg condition, bonferroni adjusted pairwise comparisons are trending towards a significant difference between the PTSD group ($M = 4.571, SD = 1.121$) and controls ($M = 7.958, SD = 1.406$), $t(16) = 1.88, p = .078$.

Discussion

Based on these results we can see that overall, individuals with symptoms of PTSD have diminished P300 amplitudes in responses to stimuli, which is in line with previous findings¹⁴. We can also determine that the context violation of a negative image following positive images elicits more of a reaction than congruent trials. If those with symptoms of PTSD are expecting negative outcomes, the difference from controls in this condition may become significant with a greater sample size. This result is important because it would not only show that negative expectations are specific to PTSD, but also that they may be an automatic process rather than a product of rational thought.