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Emotional Face Expressions in Post-Traumatic Stress Disorder

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ABSTRACT

Post-traumatic Stress Disorder (PTSD) occurs following a severely traumatic event and is characterized by: re-experiencing, avoidance, emotional blunting and reactivity. Of particular interest to this study are emotional blunting, which is the reduced responsiveness to cues unrelated to the traumatic experience, and reactivity which is an increased sensitivity to event-related cues. In two studies, the N170 was recorded in response to emotional faces (happy, sad, angry, surprised, neutral) and objects. In each study, high and low scorers on the PTSD checklist formed two companion groups. Angry faces are considered a generalized threat and it was expected that the clinical group would show larger N170 (hyper-reactive) to these emotional expressions, while responses to the other emotions would be reduced (emotional blunting). Preliminary analysis suggests that both of these processes are present. Results will be discussed in terms of possible deficits in processing emotional information in PTSD as well as the development of a clinical tool to aid the diagnosis of PTSD.

Key-words: Personality; Faces; Pain; Nicotine; Applied ERPs

1. INTRODUCTION

1.1. Post-traumatic Stress Disorder

PTSD is a clinically recognized anxiety disorder, which occurs after a person witnesses or experiences a severely traumatic event.
PTSD symptoms:

1. Avoidance refers to the attempt by the sufferer to avoid event related cues.
2. Hyper-reactivity involves an increased sensitivity to external cues that trigger memories of the event.
3. Re-experiencing occurs when, through flashbacks, dreams or disturbing thoughts the sufferer relives the traumatic event.
4. Numbing, or emotional blunting, occurs when the sufferer finds it hard to experience or express feelings of affection.

PTSD can last from a few weeks to many years. It has been estimated that in 7.8% of PTSD cases the symptoms will last a lifetime. If the symptoms last fewer than three months, the condition is referred to as Acute PTSD, whereas if they last three months or more, the condition is labeled as Chronic. Nearly everyone will experience a traumatic event during the course of their lives, and although they may not all suffer from all of the symptoms afterwards, upwards of 25% will exhibit some PTSD symptomology (Hidalgo & Davidson, 2000). One method for investigating PTSD is to present a potentially threatening stimulus and examine the response to the threat. One generalized threat stimulus is an angry face. Faces have been used as a stimulus to study PTSD in studies employing several different methods. In a functional MRI study, masked faces were presented to PTSD sufferers and then each participant's amygdala responses were measured. (Rauch, Whalen, Shin, McInerney, Mackin, Lasko, Orr & Pitman, 2000). In a study that showed war-related images, including angry faces of soldiers throwing grenades, to war veterans with and without PTSD, a PET method was used to investigate cerebral blood flow (Bremmer,Stalb, Kaloupek, Southwick, Soufer, & Charney, 1999).

1.2. Face Processing

Many ERP studies investigating face perception have found a marked negativity approximately 170 ms after the presentation of facial stimuli. The N170 is an ERP that is specific to the structural encoding of faces (Elmer, 2000; Elmer & McCarthy, 1999). The N170 is larger to faces than other objects such as cars, hands and furniture. Typically, the N170 is not affected by face familiarity (Caharel, Courtay, Bernard, Lalonde, & Rebal, 2005). The N170 appears to be similar to Bruce and Young's (1988) structural encoding phase of face processing. A study done by Felmingham, Bryant and Gordon (2003) was the first, and only study thus far to examine the effects of PTSD on facial processing, specifically that of angry and neutral facial expressions. Felmingham et. al. (2003) showed one angry face and one neutral face, alternating for 40 trials total, to PTSD sufferers and controls with no history of PTSD. The ERP re-

cordings took place between 9 and 11 months after the participants experienced their respective traumatic events. Felmingham et. al (2003) were expecting their results to support a hyperactivity model of PTSD, in that the N170s of PTSD sufferers would have higher amplitudes than those of the controls. However, the ERPs for the angry and neutral faces in PTSD patients had very similar amplitudes, and the N170s to angry faces had larger amplitudes than the neutral faces in controls (Felmingham et. al., 2003). The results offer support to a decreased responsiveness, or numbing, model of PTSD. The Felmingham et. al. (2003) study had some limitations.

1. Reference: The recordings were referenced from linked ear lobes, and the ears are fairly close to the specific area of the brain where the N170 is largest.
2. Stimulus repetition: The same angry face and the same neutral face were used several times.
3. Attention/Task Demands: Attention was directed by instruction to the face stimuli and no response was used to confirm attention to any stimuli.
4. Emotional Stimuli: Only angry and neutral faces were presented.

The current study was designed to address some of the above concerns.

2. METHOD

2.1. Phase 1 Screening

Participants
Approximately 200 undergraduate Psychology students.

Procedure
Participants completed a short demographics questionnaire and a Life Experiences Survey. Only those who experienced one or more stressful events listed in the Life Experiences Survey then completed the PTSD Checklist (PCL). The PCL is a self-report PTSD screening tool used by clinicians and researchers.

2.2. Phase 2 ERP Study 1

Participants scoring just below the clinical cutoff of 44 or below 25 on the PCL were invited to participate in the ERP phase of the study. There were 11

participants (4 low and 7 high). All participants were in good general health and had no history of neurological insult (self-report).

Apparatus

1. Reference: Tip of the nose was used as a reference.
2. Stimulus Repetition: The stimuli included may different faces and were presented in random order.
3. Attention/Task Demands: The task included presentation of objects as well as faces. The task involved responding to a subset of objects (chairs).
4. Emotional Stimuli: Standardized emotional expressions of positive (happy) and negative (surprise, sad, angry) faces were used as well as neutral faces.

Electrophysiological Recording

- 40 Channel Neuroscan NuAmps system.
- Referenced - tip of the nose.
- EOG 4 common reference from the infra- and supra-orbital ridges of the
- left eye and from electrodes lateral to each eye.
- Ground - embedded in the cap between FPZ and FZ
- Digitized at a rate of 500 Hz.
- 1 and 100 Hz High- and low-pass filter settings.

Experimental Task

A visual discrimination task was used in which participants were instructed to respond quickly and accurately by pressing a button whenever they saw a picture of a chair. There were 80 stimuli in each block, with four randomized blocks altogether. There was a short break between each trial. The stimuli consisted of 20 neutral objects (a shoe, a basketball, a pot, etc.), 20 target objects (the chairs), and 40 human faces. The faces included expressions of: angry, happy, neutral, sad, and surprised from Mastumoto & Ekman, 1989. The pictures were presented one at a time on a computer monitor in a pseudo-random sequence. The duration of each stimulus was 1000 ms, with a fixed SOA of 3000 ms.

3. Data Analysis

The raw EEG data were band-pass filtered at 0.5 and 30. A regression-based technique in Neuroscan was then used to correct the data for EOG (eye) activity, and the data was then epoched at an interval of -100 ms and 900 ms. The epochs were baseline corrected, and artifacts exceeding 50 Hz were removed prior to averaging.

Changes Between Study 1 and Study 2: High scorers were above clinical cutoff.

4. Results and Discussion

1. In both studies, there was a prominent N170 to faces and it was reduced to non-target objects.
2. In both studies, the Higher PTSD scorers had lower amplitude N170 to faces than did the Lower PTSD scorers. This is consistent with the symptoms related to emotional blunting.
3. Angry faces signal a potential generalized threat. There is some indication that this threat may induce a hyper-reactivity response in the higher PTSD groups. Study one, using sub clinical scorers as the higher PTSD group did not show any difference between angry and other faces. However, in study two using clinical scorers in the higher PTSD group, there was a larger amplitude N170 to angry faces than other faces that is consistent with hyper-reactivity. A limitation of this interpretation is that the amplitude of the N170 for the higher PTSD group did not reach the level of the controls. Comparison of these results with Felmingham et al (2003) found support for a decreased responsiveness (emotional blunting) effect to angry faces. These studies found support for their findings of emotional blunting as the amplitude of the N170 was reduced for all faces. However, there was some support for hyper-reactivity to the angry faces in Study 2. Future investigations may benefit from the analysis of the types of trauma experienced. Though an angry face is considered a generalized threat stimulus, there may be certain traumatic events such as a car accident where a generalized threat may not result in hyper-reactivity. This line of research appears very promising and may eventually lead to an additional tool in the detection of PTSD.

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