

# Neuroimaging social emotional processing in PTSD: fMRI Study

Authors: Paul A. Frewen, PhD <sup>1,2,\*</sup>, David J. A. Dozois, PhD <sup>1,2</sup>,  
Richard W. J. Neufeld <sup>1,2,3</sup>, & Ruth A. Lanius, MD, PhD <sup>2,3</sup>

Departments of Psychology<sup>1</sup>, Psychiatry<sup>2</sup>, Neuroscience<sup>3</sup>, The  
University of Western Ontario.

\* Presenting Author.

# Abstract

- Studies of response to script-driven imagery in individuals with PTSD have primarily examined idiographic traumatic events. Less is known about responses to standardized events making group comparisons difficult. We investigated self-report and functional neural responses to imagery of standardized interpersonal (social) versus intrapersonal (non-social) negative and positive events in women with ( $n=14$ ) versus without ( $n=20$ ) PTSD in an fMRI study. Women with PTSD reported decreased positive affect in response to imagery of positive events, and increased negative affect, emotional avoidance, and priming of episodic recall in response to imagery of both negative and positive events; self-reported affective responses are shown. Analysis of the fMRI-BOLD signal revealed decreased response within the left dorsomedial prefrontal cortex and temporal pole specifically while imagining positive social events in the PTSD group. Women with PTSD evidenced greater response within left insula during imagery of relaxation events, whereas amygdala responses correlated with negative affect experienced during the relaxation events in women with PTSD. The results of this study have since been published in the journal *Psychological Trauma: Theory, Research, Practice & Policy*.

# Background

- Current emotion theory holds that a heuristic division can be made between social and non-social emotions (Hareli & Parkinson, 2008). Social emotions have been defined as emotions whose generation by necessity requires the self-relevance appraisal of another person's thoughts, feelings and/or actions, and have as their defining motive the performance of (often evolutionarily-significant) social functions (e.g., mate selection).
- Both positive (e.g., *admiration, gratitude, love, compassion* and *pride*) and negative (e.g., interpersonal *anger, contempt, envy, jealousy, guilt, shame,* and *pity*) valenced social emotions have been described.
- Support for the validity of distinguishing between social and non-social emotions comes from fMRI studies that suggest their functional neuroanatomical bases can be differentiated, with greater response within dorsal medial prefrontal cortex, posterior cingulate-precuneus, bilateral temporal poles and temporal-parietal junction, and right amygdala characterizing social relative to non-social emotions (e.g., Frewen et al., 2010).
- Few studies have assessed response to standardized emotional imagery in women with versus without PTSD or assessed the impact of social emotional processing in PTSD (McTeague et al., 2010)

# Method

- Twenty (20) women without PTSD completed an emotional imagery task that varied the social and valence factors of scripts in a 2x2 design while undergoing fMRI. Fourteen (14) women with PTSD predominantly related to childhood abuse completed the same task. Current chronic PTSD was diagnosed via the CAPS and childhood trauma via the CTQ.
- Participants listened to audio-scripts that described blocked negative or positive scripts that varied in terms of their social emotional relevance. They imagined the scripts were actually happening and rated afterward their positive/negative affective response. The positive emotional states rated were: “Happy”, “Physical Pleasure”, “Relaxation”, and “Increased Self-esteem”; “Increased Self-esteem” measured the social emotion of “pride” without the negative connotation often associated with that term (cf., Tracy & Robins, 2007). The negative emotional states rated were: “Anger”, “Sadness”, “Shame”, “Fear”, “Anxiety”, and “Disgust”, the first three of which were considered to be negative social emotions (Hareli & Parkinson, 2008).
- In brief, we contrasted response to vignettes involving social rejection and criticism (negative valence) with response to scripts considered to reflect the opposite: social affection and praise (positive valence). Comparably, non-social scripts provoked anxiety and fear (negative valence) or emotions considered to induce relaxation (positive valence).

# Emotional Script Types

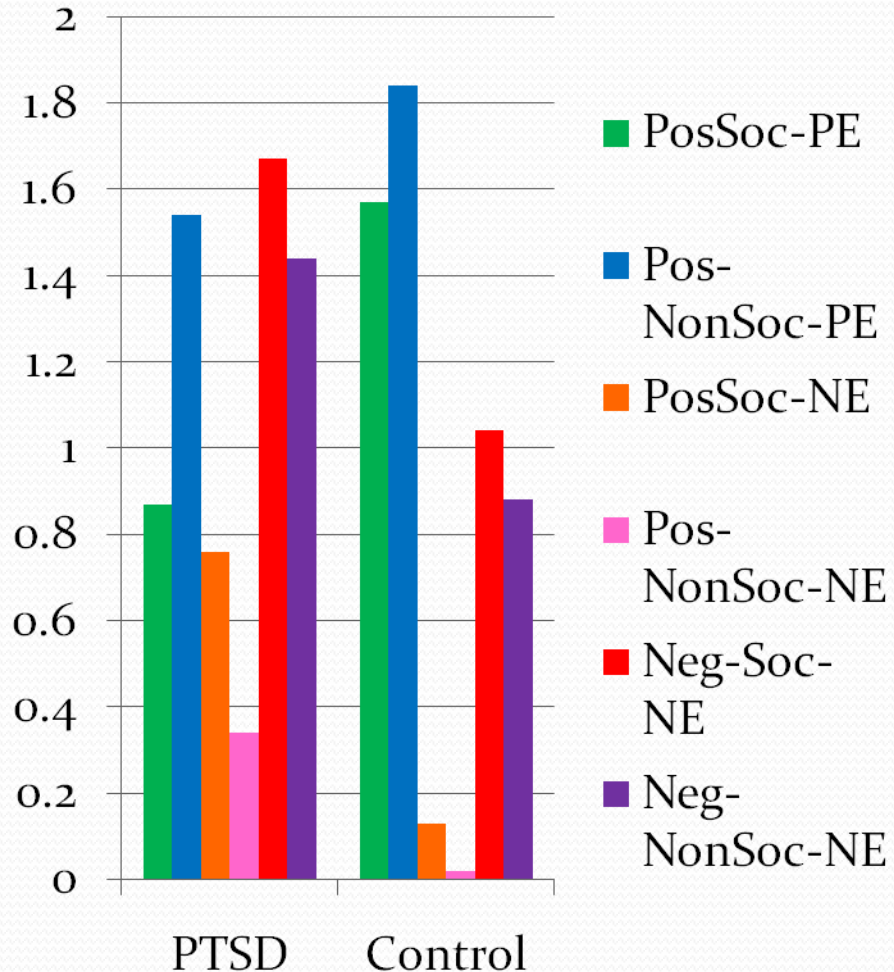
- Non-Social Negative (Fear / Anxiety):
  - Possibly being followed
  - Fearing Drowning
  - Test Anxiety

- Non-Social Positive (Relaxation):
  - Bubble bath
  - Walk on beach
  - Massage

- Social Negative (Rejection / Failure):
  - Break-up
  - Friends' negative gossip
  - Poor performance evaluation by boss

- Social Positive (Affection / Praise):
  - Greeting by hug
  - Birthday song
  - Positive work performance appraisal

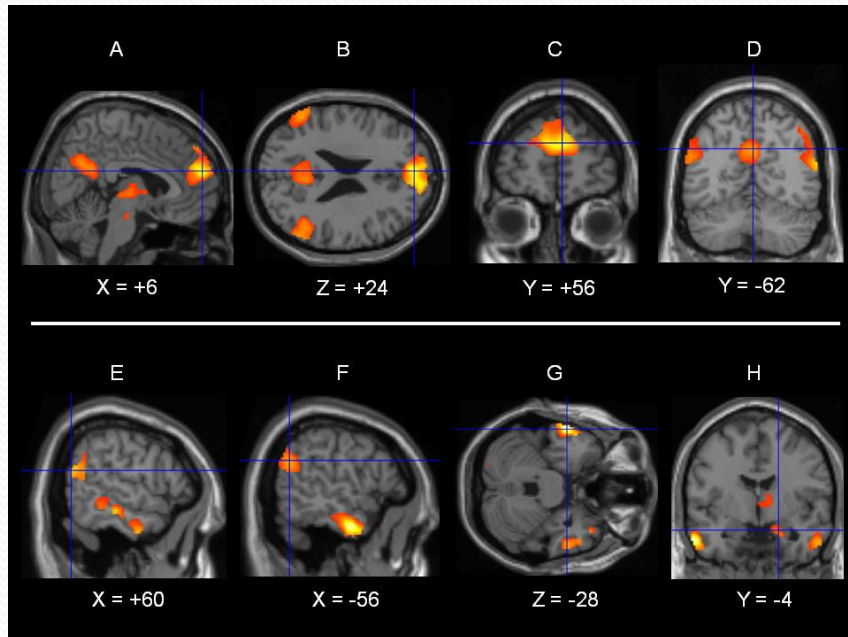
# Self-Report Emotional Responses



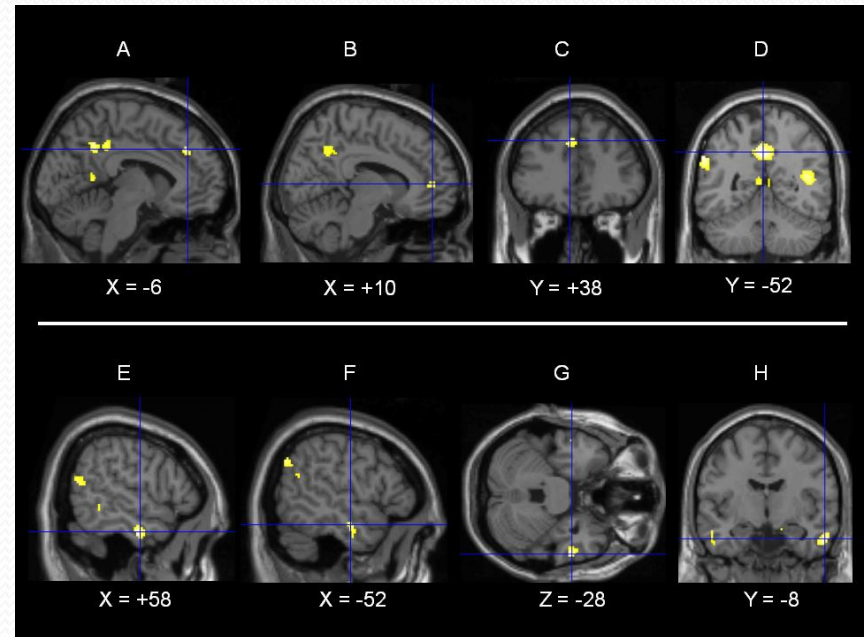
- Women with PTSD experienced less Positive Affect during both Social (Green) & Non-social (Blue) Imagined Positive Events;
- Greater Negative Affect during Social (Orange) & Non-social (Pink) Imagined Positive Events;
- and greater Negative Affect during both Social (Red) & Non-social (Purple) Imagined Negative Events;



# fMRI BOLD Response in Controls during Social Emotional Processing

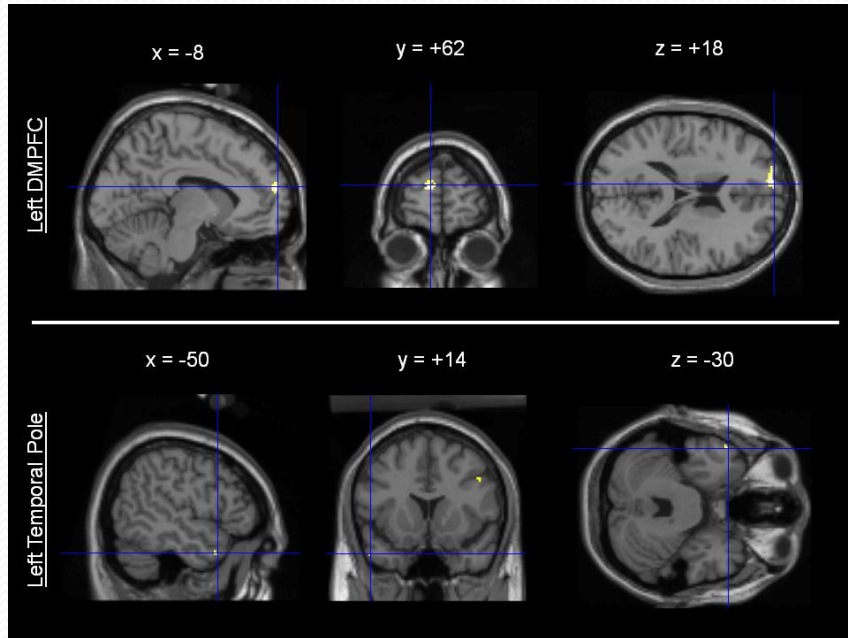


Areas where greater response was observed during social relative to non-social emotional processing independent of valence

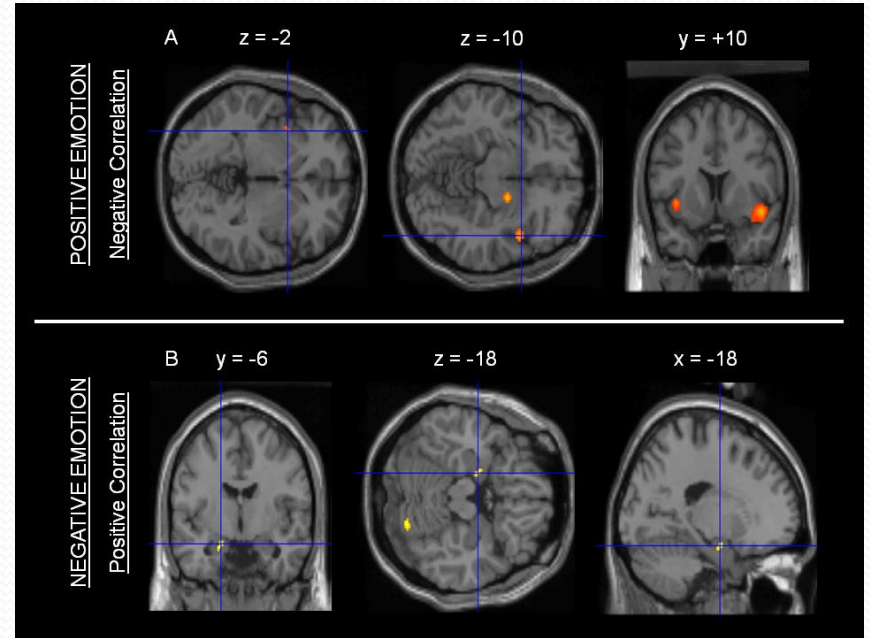


Areas where effect of greater response during social relative to non-social emotional processing was pronounced for positive relative to negative emotion scripts

# Positive Emotional Processing in Women with vs. without PTSD



Areas where women with PTSD evidenced less response than controls during positive social emotional processing



Areas where self-reported emotional responses to non-social positive scripts correlated with BOLD-fMRI response in women with PTSD



# Discussion

- We conclude that women with PTSD predominantly related to childhood trauma respond strongly to standardized emotional events that are not necessarily directly related to their criterion-A traumatic events.
- Women with PTSD were most distinct from women without PTSD in terms of their response to positive events (relative to negative events), and their response to social events (relative to non-social events). These findings are consistent with the current proposal for broadly recognizing pervasive negative social emotional states including shame, and persistent inability to experience positive emotions, as diagnostic symptoms of PTSD in DSM-V.
- Less response within dorsomedial PFC and temporal poles during positive social emotional processing may characterize women with PTSD related to childhood trauma. Lesser positive and greater negative emotional responses during attempted relaxation may covary with response within insula and amygdala.
- Studies should compare social emotional processing in individuals with histories of attachment-related trauma, in comparison with individuals who have experienced non-interpersonal traumas.

# References

- Amodio D. M., & Frith C. D. (2006). *Nature Reviews Neuroscience*, 7, 268-77.
- Andrews, B., et al. (2000). *Journal of Abnormal Psychology*, 109, 69-73.
- Britton, J. C., et al. (2006). *NeuroImage*, 31, 397-409.
- Britton, J. C., et al. (2006). *Emotion*, 6, 150-5.
- Burgdorf, J. & Panksepp, J (2006). *Neuroscience & Biobehavioral Reviews*, 30, 173-187.
- Charuvastra, A., & Cloitre, M. (2008). *Annual Review of Psychology*, 59, 301-328.
- Cloitre, M., et al. (2002). *Journal of Consulting and Clinical Psychology*, 70, 1067-1074.
- Cloitre, M., et al. (2008). *Journal of Traumatic Stress*, 21, 282-289.
- Etkin, A., & Wager, T.D. (2007). *American Journal of Psychiatry*, 164, 1476-1488.
- Elman, I., et al. (2005). *Psychiatry Research*, 135, 179-183.
- Frewen, P. A., & Lanius, R. A. (2006). *Annals of the New York Academy of Sciences*, 1071, 110-124.
- Hareli, S. & Parkinson, B. (2008). *Journal for the Theory of Social Behaviour*, 38, 131-156.
- Jatzko, A., et al. *European Archives of Psychiatry & Clinical Neuroscience*, 256, 112-114.
- Kashdan, T. B., et al. (2006). *Behaviour Research & Therapy*, 55, 457-467.
- Lanius, R. A., et al. (2003). *Biological Psychiatry*, 53, 204-210.
- McTeague, L.M., et al. (2010). *Biological Psychiatry*, 67, 346-356.
- Van der Kolk, B. A., et al. (2005). *Journal of Traumatic Stress*, 18, 389-399.