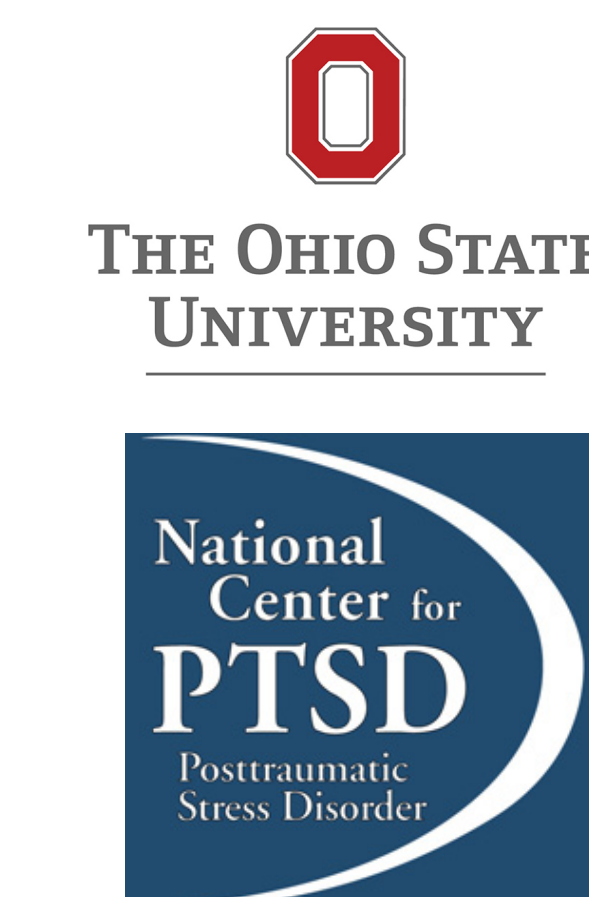


# Decreased Inhibitory Control Activity in Veterans with Post-Traumatic Stress Disorder (PTSD) during Emotion Regulation

Bruna Martins-Klein, Ph.D<sup>1,2,3,4</sup> & Jasmeet P. Hayes, Ph.D<sup>2,4,5,6</sup>

<sup>1</sup>University of Massachusetts-Amherst; <sup>2</sup>VA Boston Healthcare System; <sup>3</sup>Harvard Medical School; <sup>4</sup>Boston University; <sup>5</sup>National Center for PTSD; <sup>6</sup>The Ohio State University



## Background

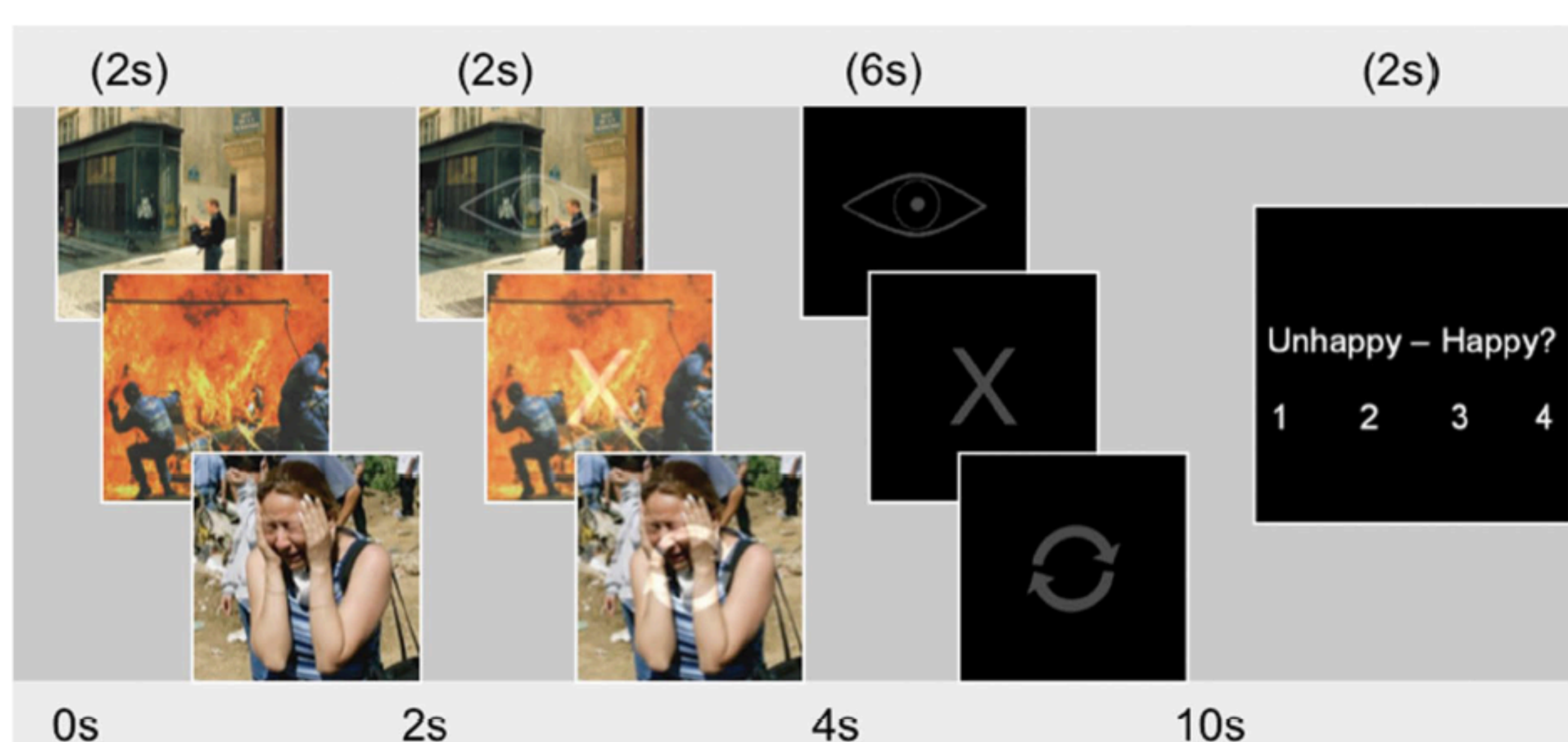
- Emotion dysregulation and hyperarousal are core deficits of PTSD
- Reappraisal and suppression are two well-studied emotion regulation strategies that decrease amygdala activation to emotionally intense stimuli.
- Little is known regarding the neural activity involved for these regulatory strategies in PTSD patients.
- In this study, we explored neural differences in PTSD emotion regulation with fMRI

## Method

### Participants

- Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF) Veterans with PTSD ( $n=15$ )
- Trauma-exposed OEF/OIF Veterans without PTSD ( $n=18$ )

### Emotion Regulation fMRI Task



**Neutral**- view neutral  
**Look**- view negative  
**Suppress**- inhibit facial emotion expressions  
**Reappraise**- reinterpret as less negative by distancing

View = View X = Suppress Reappraise = Reappraise

- 10 runs in the fMRI scanner
- 3-4 trials of each condition per run within-subject
- Post-regulation valence rating on a scale from 1 (unhappy) to 4 (happy)

### fMRI Data Preprocessing & Analysis

- Preprocessing in FSL: Motion correction with MCFLIRT, high-pass temporal filtering to 100s, slice-timing correction using Fourier-space time-series phase-shifting, and skull stripping of images with BET. Registration with FLIRT to MNI 2-mm standard space and spatial smoothing with a Gaussian kernel of full width at half maximum (FWHM) of 5mm.
- Each of 10 runs modeled by task regressors by condition: neutral, look, reappraisal, suppression, and neutral trials.
- Regressors convolved with a double-gamma hemodynamic response function, and high-pass temporal filtered.
- A second-level fixed-effect analysis- averaged functional runs for each participant.
- Third-level analyses mixed-effect analyses were performed investigating group differences across strategies by group (PTSD, No PTSD).
- Z (Gaussianised T/F) statistic images were thresholded at  $z > 2.3$  and a family-wise error-corrected cluster significance threshold of  $p = 0.05$ .
- Follow-up percent signal change extractions were conducted with FSL's Featquery. Brain activity within *a priori* Harvard-Oxford atlas ROI of the bilateral amygdala during Look-Reappraise fMRI activity maps were calculated with FSL's Fslmaths tool.

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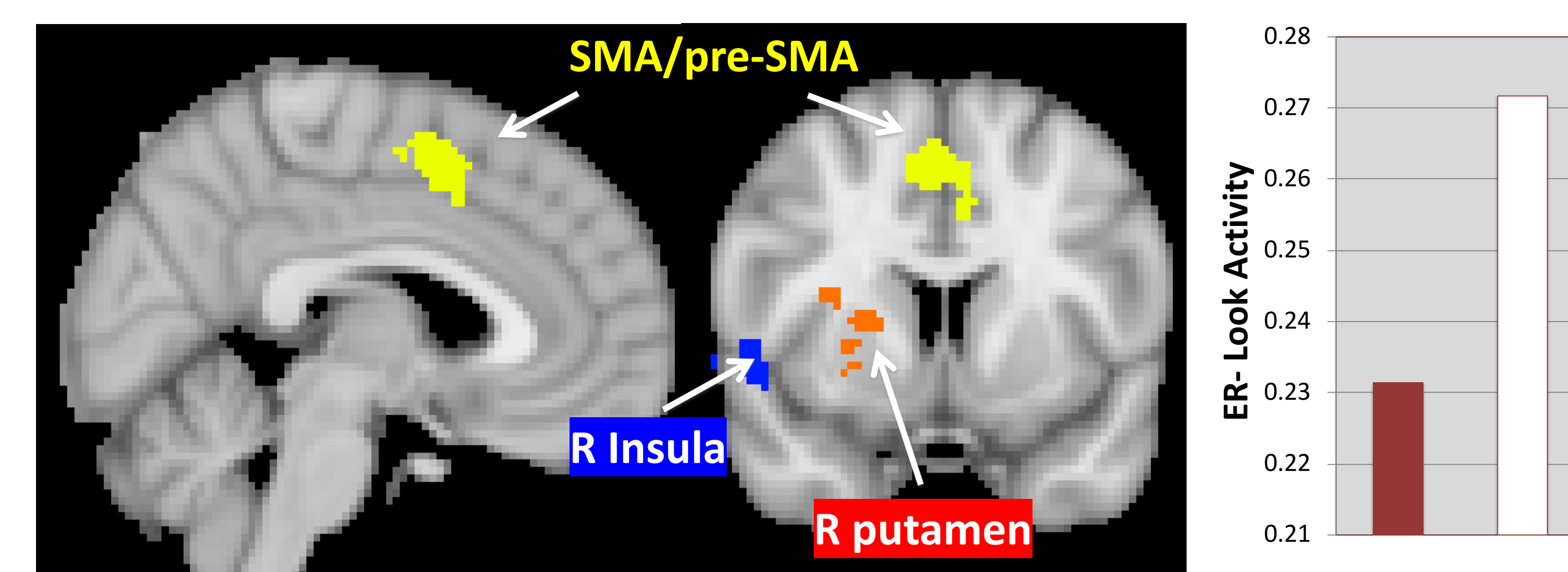
## Results

### Look- Reappraise



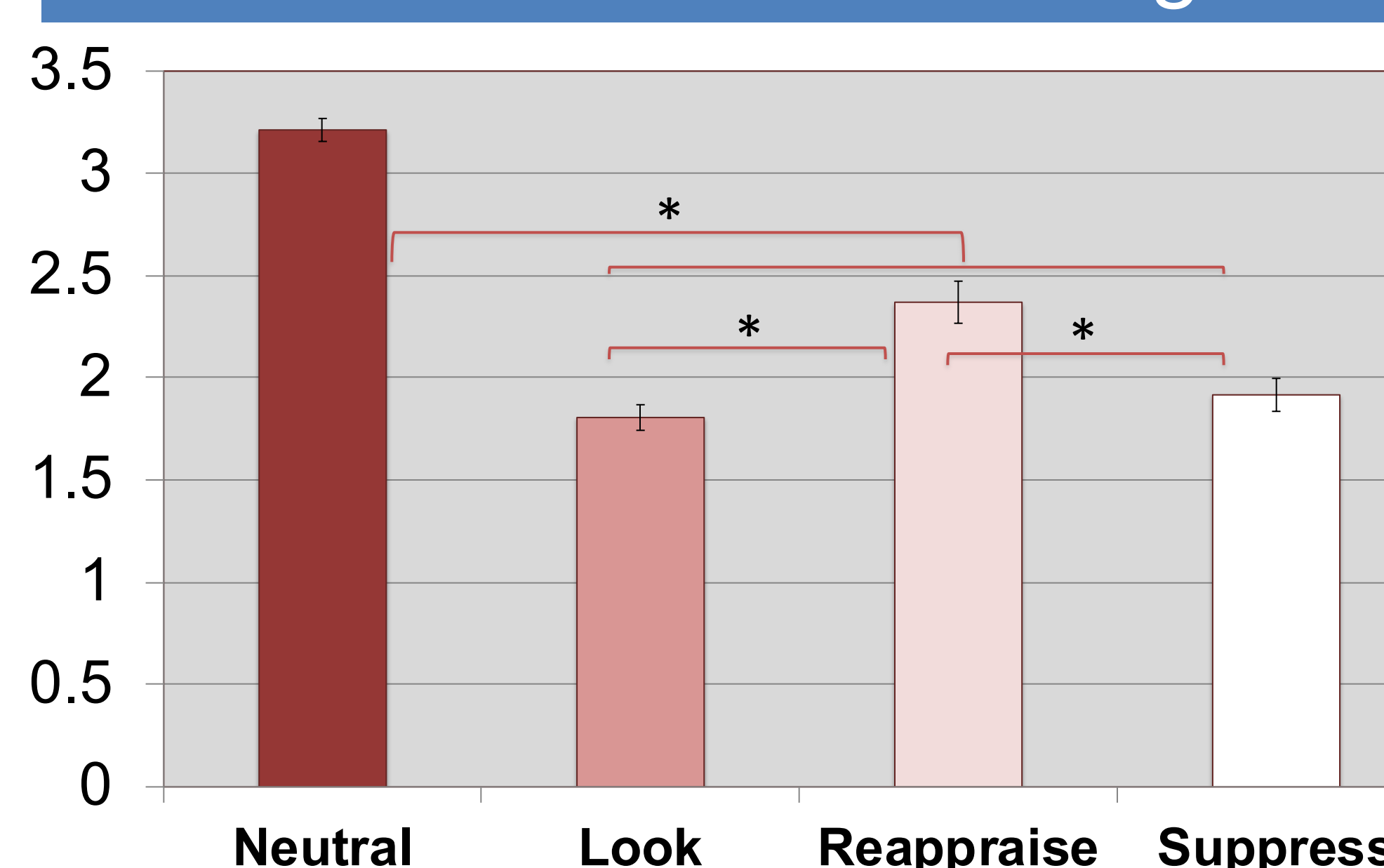
L Amygdala activity for PTSD > No PTSD.  $Z=2.3$ , unthresholded

### Emotion Regulation- Look



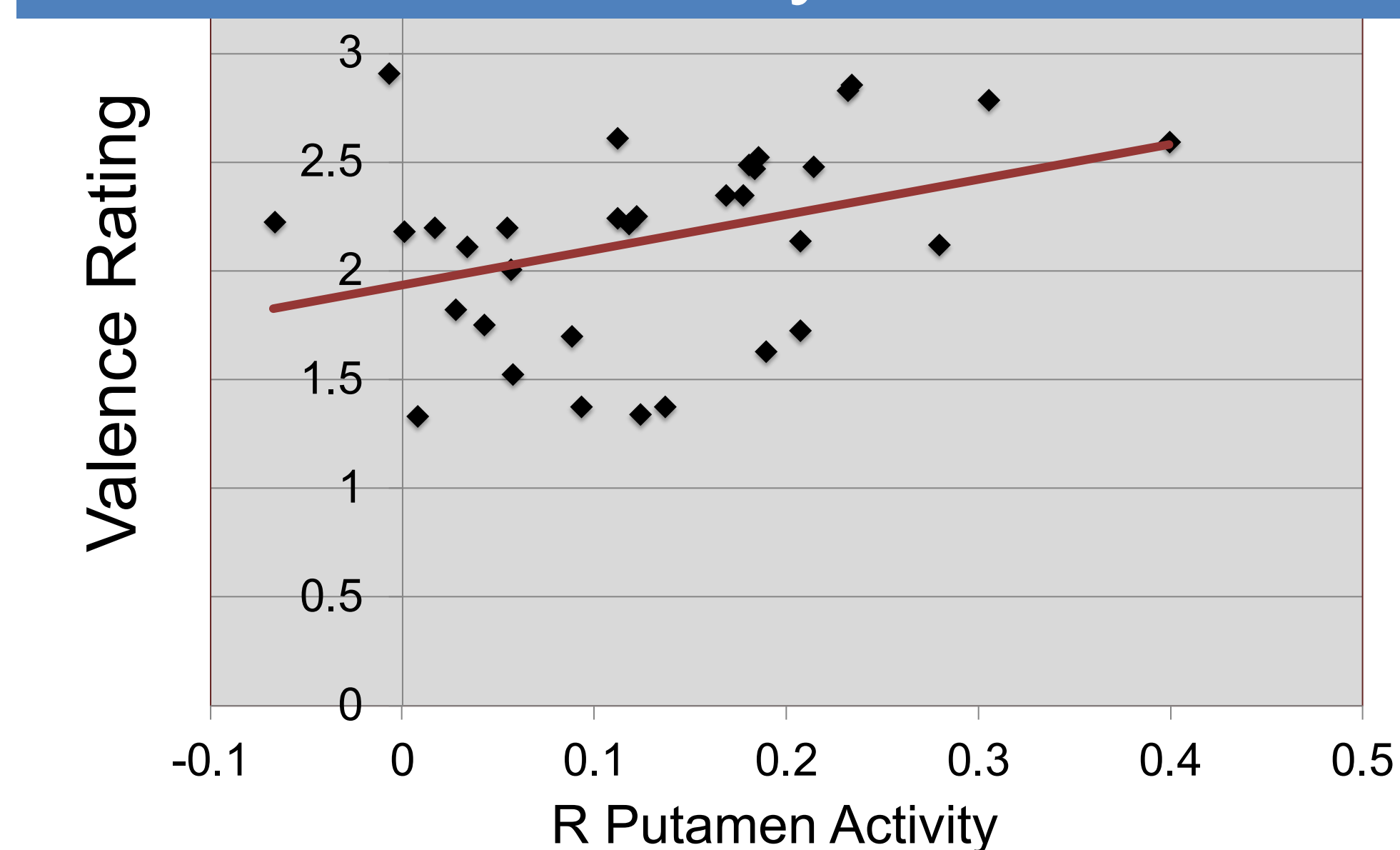
Regions more active for No PTSD > PTSD.  $Z=2.3$ , thresholded

### Post-ER Valence Ratings



Significant Main Effect of Strategy  $F(2,62) = 24.630$ ,  $p < 0.001$

### R Putamen Activity and ER success



R Putamen activity associated with positive post-regulatory valence ratings  $r(33) = 0.36$ ,  $p = 0.04$

## Discussion

- Anterior insula and preSMA network support recruitment and maintaining task sets (Dosenbach et al., 2006), implicated in ER (Morawetz et al., 2017; Hayes et al., 2010)
- R Putamen/striatum associated with valence ratings in both groups
- Striatal activity has been reported in reappraisal studies (McRae et al., 2008; Ochsner et al., 2002, 2004; van Reekum et al., 2007)
- Striatal activity implicated in reward (McClure et al., 2003; Schultz, 2004) and approach motivation (Tindell et al., 2006; Wager et al., 2007)- suggestive of greater engagement with regulatory strategy

## Conclusion

- PTSD patients fail to recruit regulatory brain regions, and hyperactivate the amygdala in response to negative stimuli compared to controls
- Future work should clarify whether lack of striatal recruitment is a consistent biomarker of emotional dysregulation and hyperarousal in PTSD