



# The effect of oxytocin on the processing of fear stimuli: An EEG study

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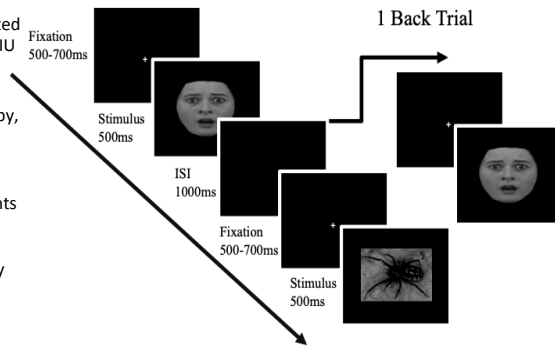
## Background

Oxytocin facilitates social bonding, potentially by reducing the perceived fear relevance<sup>1</sup> or salience<sup>2</sup> of stimuli. Intranasal oxytocin can be used to determine how the hormone prompts this anxiolytic effect. fMRI research has revealed that oxytocin attenuates amygdala activity to fear faces<sup>3</sup> especially in anxious individuals<sup>4</sup>; however it is unknown if this trend exists for general, non-social threats. Presently, no research has investigated the effect of oxytocin on the temporal dynamics of face and general threat processing.

**Aim:** to use electroencephalography to investigate the effect of oxytocin on the neural mechanisms that process faces and fear-relevant stimuli.

## Methods

- N = 30 men
- Two counterbalanced, double blind, repeated measures sessions (receiving placebo or 24IU oxytocin) ~ one week apart.
- 64 + 2 ExG electrode setup.
- One-back task featuring faces (fearful, happy, or neutral) and non-faces (fear relevant: snakes/spiders, non-fear: mushrooms/flowers). 100 presentations per category.
- Stimuli are presented for 500ms, participants are asked to key-press respond to repetitions.
- Leibowitz Social Anxiety Scale, Beck Anxiety Inventory, State-Trait Anxiety Scale.



## Results

No difference in state anxiety between oxytocin and placebo sessions,  $t(29) = 0.51, p > .05$

### Non-Faces

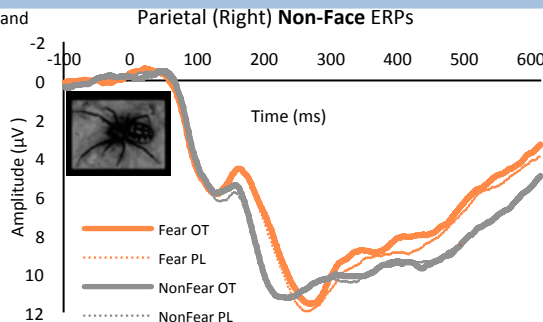
No oxytocin effects.

#### Parietal electrodes

- N170: Main effect of fear
  - Left:  $F(1,29) = 19.69, p < .001$
  - Right:  $F(1,29) = 16.97, p < .001$
- P2: Main effect of fear
  - Right:  $F(1,29) = 11.05, p = .002$

#### Occipital electrodes

- P2: Main effect of fear
  - $F(1,29) = 8.89, p = .006$



## Results

### Faces

#### Parietal electrodes

- N170: Main effect of fear
  - Left:  $F(1,29) = 7.31, p = .001$
  - Right:  $F(1,29) = 6.139, p = .001$
- P2: Main effect of fear
  - Left:  $F(1,29) = 8.98, p < .001$
  - Right:  $F(1,29) = 13.49, p < .001$

#### P2: Main effect of Oxytocin

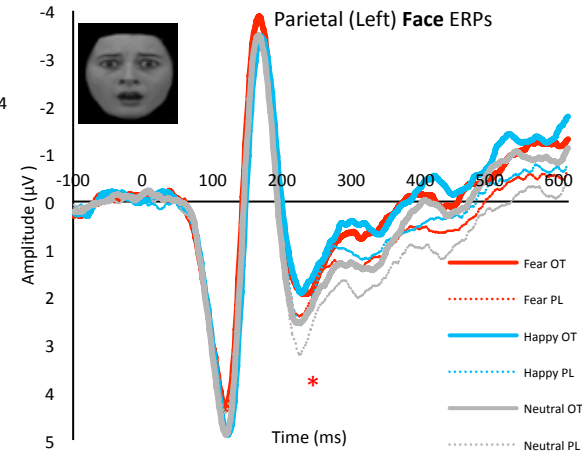
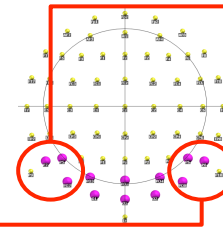
- Left:  $F(1,29) = 4.56, p = .041$

#### Occipital electrodes

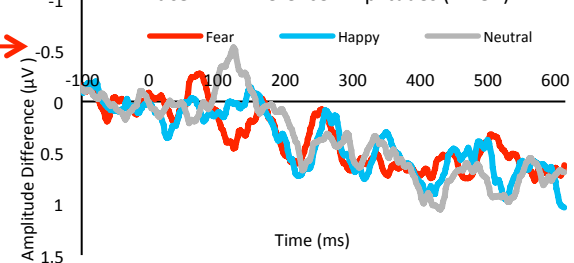
- Main effects of fear and oxytocin emerges and remains after 150ms
  - $P < .05$

#### Anxiety (BAI)

- Neutral faces:
  - Amplitude change =  $1.38 \pm 0.06 \times \text{BAI}, R^2 = 0.15$
- Fearful faces:
  - Amplitude change =  $1.29 \pm 0.06 \times \text{BAI}, R^2 = 0.14$
- Happy faces: n.s.



### Face ERP Difference Amplitudes (PL-OT)



## Discussion

Our results indicate that oxytocin reduces the perceived salience of faces regardless of emotional valence, and that this effect does not extend to non-face stimuli. The effect of oxytocin on later, but not early neural responses suggests that the hormone does not influence the rapid automatic structural processing of faces, but diminishes the later stages of salience appraisal through the amygdala, and that this attenuation is modulated by anxiety. Additionally, the oxytocin effect over occipital electrodes could indicate an attenuation of the feedback loop between the amygdala and primary visual cortex.

**These findings suggest oxytocin may attenuate later stage salience appraisal of faces through the amygdala, which in turn could facilitate social bonding.**

## References

- Lee H.J., Macbeth A.H., Pagani J.H., Young W.S. (2009). Oxytocin: the great facilitator of life. *Prog Neurobiol*, 88:127-151.
- Domes, G., Normann, C., & Heinrichs, M. (2016). The effect of oxytocin on attention to angry and happy faces in chronic depression. *BMC Psychiatry*, 16(92).
- Di Simplicio, M., Massey-Chase, R., Cowen, P., & Harmer, C. (2009). Oxytocin enhances processing of positive versus negative emotional information in healthy male volunteers. *Journal of Psychopharmacology*, 23(3), 241-248.
- Kirsch, P., Esslinger, C., Chen, Q., Mier, D., Lis, S., Siddhanti, S., Gruppe, H., Mattay, V. S., Gallhofer, B., & Meyer-Lindenberg, A. (2005). Oxytocin modulates neural circuitry for social cognition and fear in humans. *The Journal of Neuroscience: The Official Journal of the Society for Neuroscience*, 25(49), 11489-11493.
- Labuschagne, L., Phan, K., Wood, A., Angstadt, M., Chua, P., Heinrichs, M., Stout, J., & Nathan, P. (2010). Oxytocin Attenuates Amygdala Reactivity to Fear in Generalized Social Anxiety Disorder. *Neuropsychopharmacology*, 35(12), 2403-2413.
- Lipp, O. V. (2006). Of Snakes and Flowers: Does Preferential Detection of Pictures of Fear-Relevant Animals in Visual Search Reflect on Fear-Relevance? *Emotion*, 6(2), 296-308.