Summer 2012

Effect of Out-Group Exposure on the Mirror Neuron System

Mackenzie Hepker
mhepker@pugetsound.edu

Follow this and additional works at: http://soundideas.pugetsound.edu/summer_research

Part of the Cognitive Neuroscience Commons, Ecology and Evolutionary Biology Commons, and the Social Psychology Commons

Recommended Citation
http://soundideas.pugetsound.edu/summer_research/148

This Article is brought to you for free and open access by Sound Ideas. It has been accepted for inclusion in Summer Research by an authorized administrator of Sound Ideas. For more information, please contact soundideas@pugetsound.edu.
Effect of Oxytocin Administration on Mirror Neuron Activation

Mackenzie Hepker & David Andresen
University of Puget Sound

Introduction

- Mirror neurons are a class of neurons that activate both when performing an action or experiencing a sensation and when observing another doing so (Rizzolatti and Craighero, 2004).
- Oxytocin, commonly known as the “love” or “cuddle” hormone, is naturally produced in brain and has been shown to mediate similar social perceptions and behaviors as the mirror neuron system (MNS)—including empathy, trust, generosity, emotion recognition, social cognition, and intergroup perception (i.e. in-group favoritism and out-group derogation).
- Thus, oxytocin is heavily implicated in the function of the MNS. Perry et al. (2010) found that oxytocin administration increases human Mu wave suppression (indicative of mirror neuron activity) while perceiving biological motion. Oxytocin also increases emotion recognition and social cognition in autistic individuals.
- This is only the second study attempting to conclusively link oxytocin to MNS activity, in which we hypothesize the hormone plays a critical role, and the first to do so while perceiving social gestures, and in an intergroup context.

EEG Task – Gesture Recognition

- Ten-second movies of two White (in-group) and two Black (out-group) individuals making social hand gestures, half male and half female.
- Social processing engages the MNS.
- Half familiar gestures (e.g., thumbs up), and half unfamiliar (American Sign Language).
- Cover task: Participants determined whether each gesture was familiar or unfamiliar and pressed one of two keys after the movie was over.

Two EEG sessions*: One with oxytocin administration and one with placebo per subject.

EEG Analyses

- Mirror neuron activity has been shown to be significantly correlated with “Mu wave suppression,” or reduced energy in oscillatory electrophysiological activity in the Mu wave band occurring in the 8-12 Hz frequency range (Oberman et al., 2005).
- Mu-waves indicate that the MNS is “idling;” the suppression of these waves indicates synchronized neuron activation.
- Spectral power curve indicates amount of neuron activity at various frequencies.
- We expected that Mu-wave suppression would be higher for White actors than Black actors in conjunction with past studies, and that oxytocin would increase Mu suppression and potentially affect this relationship.

Results: Spectral Power

Oxytocin - Pz

Placebo - Pz

Blue region indicates greater mirror neuron activity.

Results: Suppression Index

- Less area under curve = more mu suppression (mirror neuron activation).
- Zero indicates same amount of mu activity for both fixation task and task of interest; negative values show mu-suppression.

Main Effect of Oxytocin on MNS:

- Subjects exhibited more mirror-neuron activity towards both black and white individuals when given oxytocin than when given placebo (p = 0.06, n = 13).
- There may be an interaction between ethnicity, oxytocin and mirror neuron activity, but it is not yet significant (p = 0.35).

Conclusions

- A nearly significant positive effect of oxytocin on mirror neuron activity, even with such a small sample size, indicates that oxytocin influences mirror neuron activation and may play a role in regulating social perception via the MNS.
- Oxytocin may influence intergroup perception via the MNS; increasing the sample size will shed more light on this possibility.

Further research is needed to conclude the role of oxytocin in normal MNS function and intergroup perception, such as the use of antagonsists, measuring oxytocin levels in serum given various social stimuli, and expanded experimentation. It would also be beneficial to see if the MNS is equally responsive in negative, positive and neutral contexts (all of which are enhanced by oxytocin). More data for this study will be collected Fall 2013.

Acknowledgements

Thank you to Dr. David Andreasson for all of your insight, aid, open mind and enthusiasm towards this research, and to Jeffery Kelly, Jennifer Henry and Brendan Hanesuw for assisting in data collection. This study was funded by the University of Puget Sound Science & Mathematics Summer Research Award and the University Enrichment Committee.