

Effect of Out-Group Exposure on the Mirror Neuron System



UNIVERSITY of
PUGET SOUND
Est. 1888

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).
- Mirror neuron system (MNS) activity has been shown to be greater when observing a member of the subject's in-group than that of an out-group, be the distinction racial or ideological. Lower mirror neuron activity has been correlated with greater out-group prejudice (e.g., Gustel & Inzlicht, 2010; Serino et. al, 2009).
- To function and communicate with others, one needs to identify with those around them and potentially adapt to changing social contexts—the differences in ability to connect to others may be mediated by the plasticity of the mirror neuron system itself.

Question

Is the reduced activity of the MNS to out-group members shown in prior research relatively fixed based on self-identification, or can it be altered given experience with out-group members?

Methods

Participants

- 20 participants: 8 male, 12 female

Out-group determination

- Ethnicity used to distinguish in-/out-group due to relative ease of visual distinction and self-identification
- Participants in the study were of White, Asian or other ethnicity and thus African-Americans were used as the out-group

Electroencephalography (EEG; Biosemi)

- 32 electrodes spanning entire scalp, attached with gel through a cap



EEG Task – Gesture Recognition

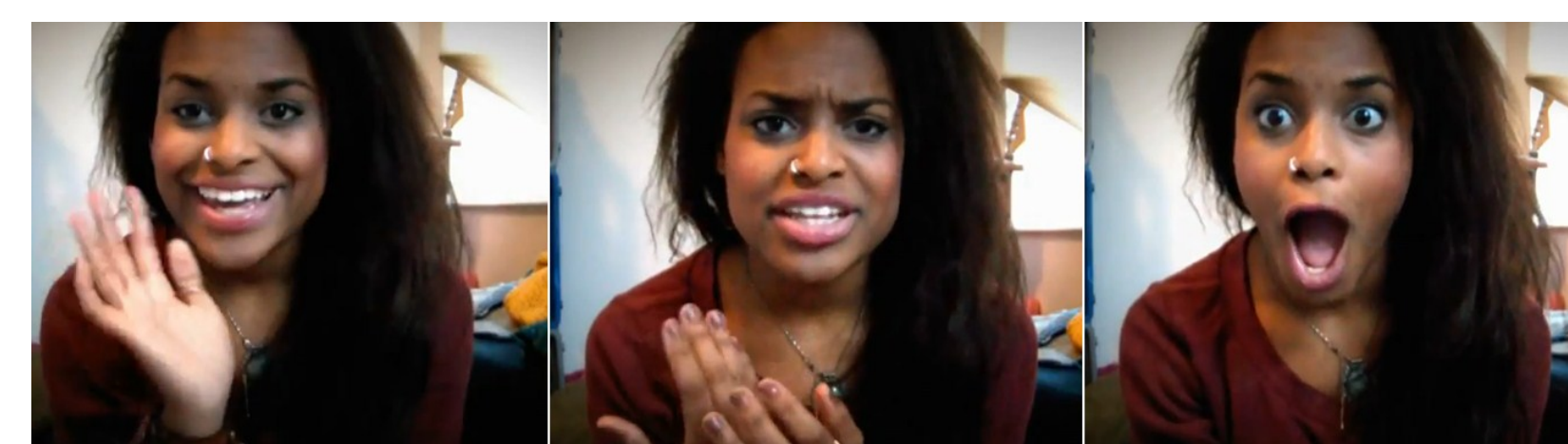
- Ten-second movies of two White and two Black individuals making social hand gestures, half male and half female
- Half familiar gestures (e.g., thumbs up), and half unfamiliar (American Sign Language)
- Cover task: Participants determined whether each gesture was familiar or unfamiliar and pressed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



- Two EEG sessions: One before exposure to out-group and one after

Exposure Task

- Participants underwent four sessions in which they determined the emotions and memorized the names of 40 ethnic out-group members: 20 Black males, 20 Black females
- Participants were tested on face/name recognition at the end of each session of the individuals they had just seen, using grayscale screenshots with neutral facial expressions and background.



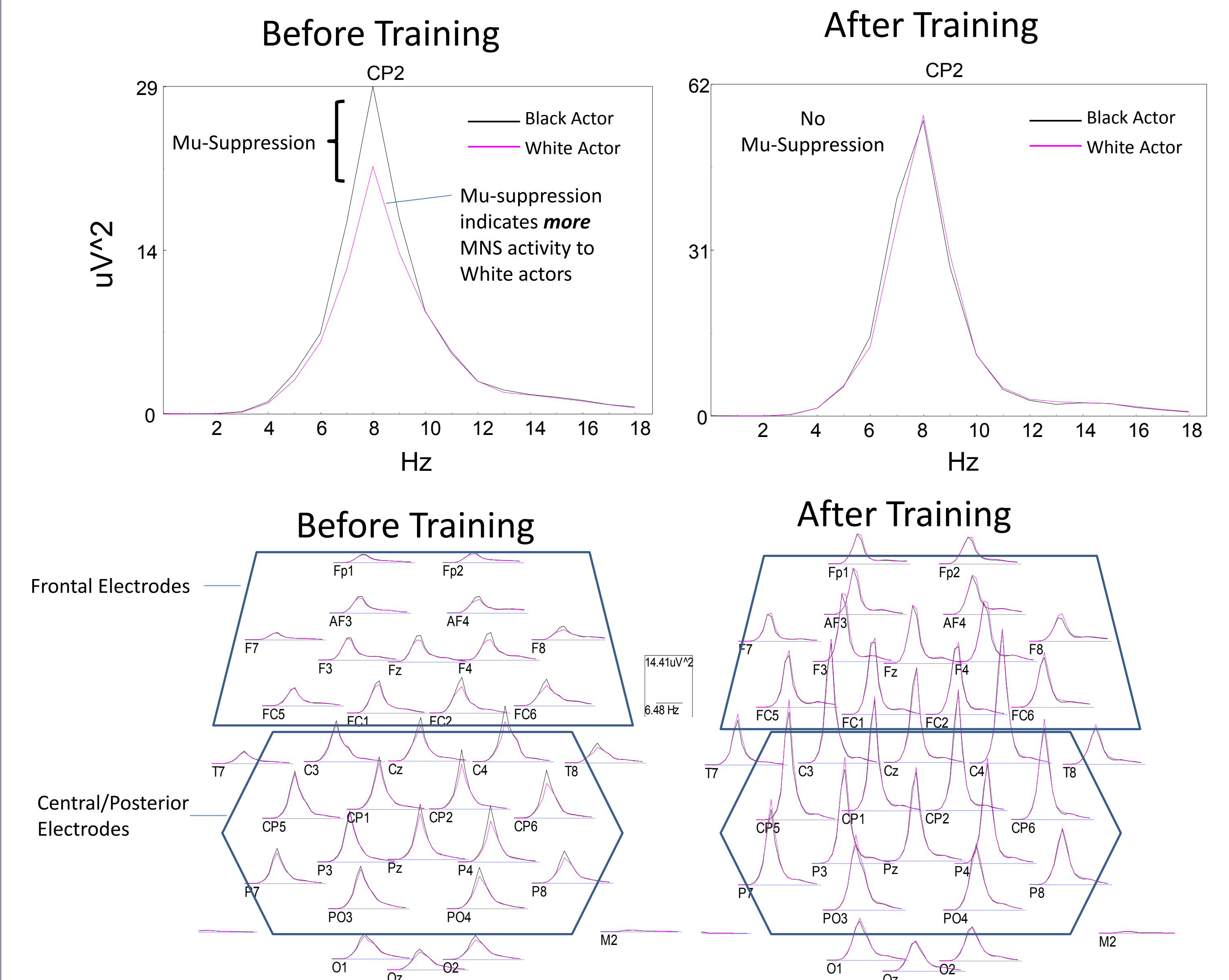
EEG Analyses

- 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 Whites than Blacks initially given greater pre-exposure to Whites; after exposure to Blacks that engaged the MNS, we expected a decreased difference in MNS response.

References:

Gutsell, J.N., and Inzlicht, M. (2010). Empathy constrained: Prejudice predicts reduced mental simulation of actions during observation of outgroups. *Journal of Experimental Social Psychology*, 26, 841-845.
 Oberman, L.M., Hubbard, E.M., McCleery, J.P., Altschuler, E.L., Ramachandran, V.S., and Pineda, J.A. (2005-2006). EEG evidence for mirror neuron dysfunction in autism spectral disorders. *Brain Research: Cognitive Brain Research*, 24, 190-8.
 Rizzolatti G., Craighero I. (2004). The mirror-neuron system. *Annual Review of Neuroscience*, 27, 169–192. doi: 10.1146/annurev.neuro.27.070203.144230.
 Serino, A., Giovagnoli, G., and Ladavas, E. (2009). I feel what you feel if you are similar to me. *PLoS One*, 4, doi:10.1371.

Results – Spectral Power



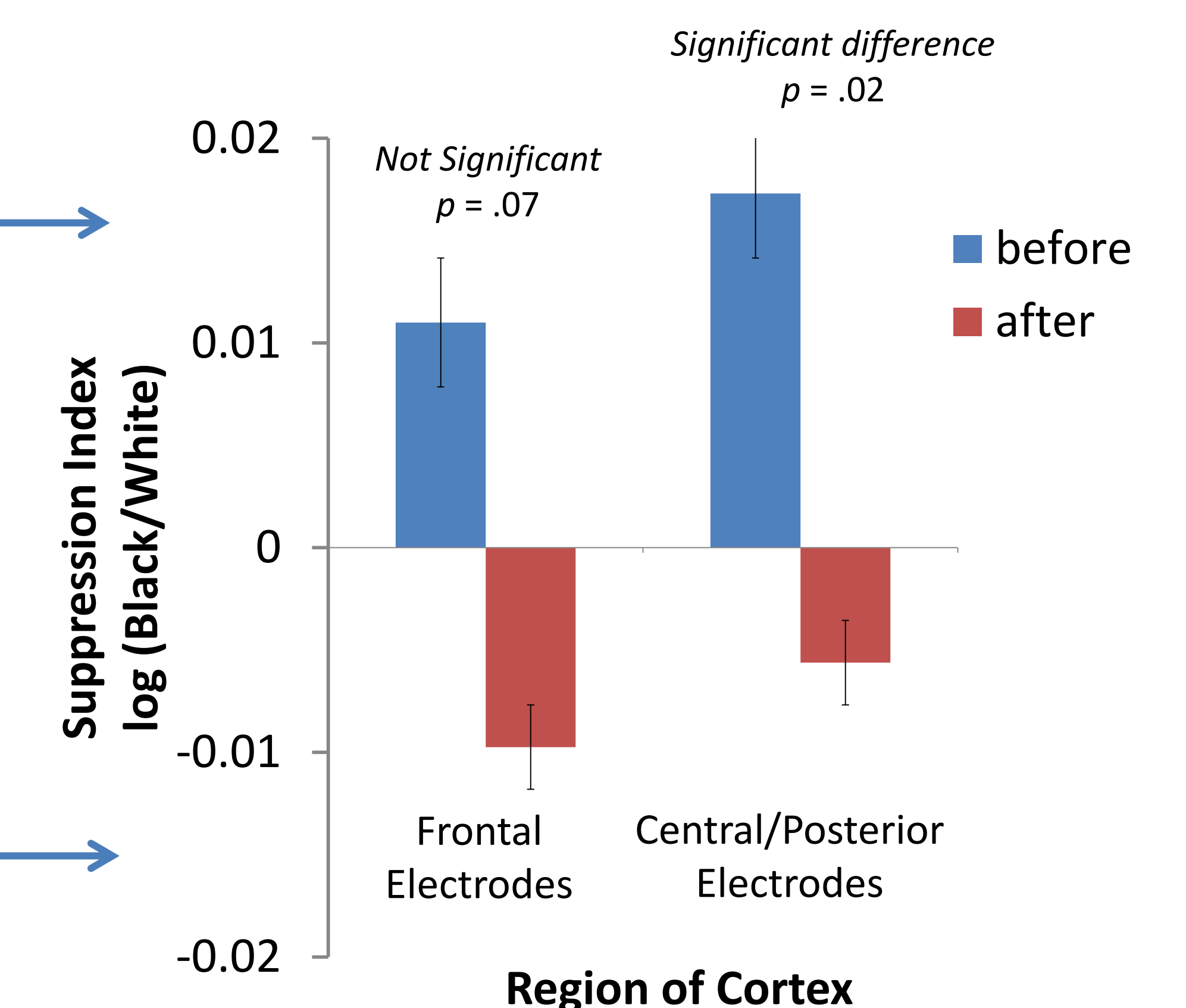
Results – Suppression Index

- Log of (Black EEG response / White EEG response)

Positive index indicates more MNS activity to White than Black actors

Zero indicates equal MNS activity to Black than White actors

Negative index indicates more MNS activity to Black than White actors



Conclusions

- Hypothesis that relative mirror neuron activation is directly related to consistent exposure to others is supported—may explain the formation of social identity at the neurological level
- First study to demonstrate plasticity of MNS with experience; very rapid reconfiguration of neural connections to adapt to novel social contexts

Acknowledgements

Thank you to Dr. David Andresen for your insight, aid and support at every step of the project, and to Dr. Tim Beyer and the rest of the Weyerhaeuser team for your help with EEG this summer. This study was funded by the Puget Sound Summer Research Grant 2012.

This study was funded in part by the Puget Sound Summer Research Grant. The \$500 was used to pay participants \$50 each for their time and contribution to our research.