EEG study of perceptual bias in facial expressions, mood, and the mirror-neuron system

Laurel Olfson
lolfson@pugetsound.edu

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**Introduction**

- Recent studies suggest the mood-congruency perceptual biases, that mood may alter our perceptions to interpret the world in a manner consistent with our mood (e.g. Lopez-Duran, Kuhlman, George, & Kovacs, 2013; Qin, 2012).
- Individuals in a somewhat depressed mood (but not clinically depressed) rated happy and neutral faces as having a lower intensity compared with individuals not in a happier mood (Qin, 2012).
- One explanation for the interaction between mood and perception of facial expressions may be empathy, or the ability to experience the emotions and feelings of another.
- The human mirror neuron system (MNS) may be an important brain system underlying social cognition abilities such as empathy (e.g. Carr, Iacoboni, Dubeau, Mazziotta, & Lenzi, 2003; Montgomery & Haxby, 2008).
- Prior research has shown the increased MNS activity is correlated with suppression of a particular waveform called the mu-wave. Thus, we measured mu-wave suppression as an indicator of MNS activity.
- The potential link between the human MNS and differential perception of facial expressions given normal variations in mood is unknown.

**Subjects**

- Results include 8 student subjects from the University of Puget Sound.

**Task**

- Participants filled out several questionnaires assessing their current mood.
- Participants then viewed faces via a computer monitor and indicated by pressing the keyboard whether they believed the face to be happy or sad while brain activity was measured via EEG.

**Stimuli**

- Happy and sad faces were morphed using Fantomorph software.
- The neutral, or ambiguous, faces were chosen by a selection of individuals not participating in the study. This face was not always the halfway point in the morph sequence.

**Mood Assessment**

- **Daily Life Questionnaire**
  - Schraufnagl, Blumenfeld, & Einstein, 2012)
- **Mood Questionnaire**
  - Kolin, Skolnick, (2009)
- **Positive and Negative Aspect Scale**
  - Watson, Clark, & Tellegen, (1988)
- **Analysis**: Scores from the three questionnaires were summed. Higher scores indicated a happier mood, lower scores a sadder mood.
  - A median split was used to create the ‘Positive’ and ‘Negative’ mood groups.

**EEG Analysis**

- Electrodes were averaged across the entire brain.
- EEG analyzed using fast-Fourier transform to produce spectral density plot.
- Mu-wave power assessed as are under the curve between 8-13 Hz (integral).
- Mu-wave power normed by each subject’s overall average mu-wave power, such that 1.0 is average, >1.0 is increased mu-wave power and <1.0 is suppressed mu-wave power.

**Results**

- Congruency between stimuli and participant mood causes increased mu-wave suppression.

**Conclusions**

- **Morph manipulation accurately captured the transition between seeing a face as sad or happy**.
- **Being in a negative mood shifts the curve to the left from those in a positive mood**. Thus, more of the morphed faces were perceived as “Sad” including those well into the “Happy” morphs.
- Reduced mu-wave activity to happy faces for participants in more positive mood.
- Reduced mu-wave activity to sad faces for participants in more negative mood.
- Taken together, results suggest the human mirror neuron system is involved in mood-congruency perceptual effects.

**References**


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