

The role of mood congruency in the implicit processing of emotional facial expressions: an ERP investigation

Abstract

Affective neuroscience research has found that congruency between a participant's current emotional state and the emotional valence of presented visual stimuli affects the processing of faces and facelike objects. Studies of inattentional blindness have found that participants more often notice unexpected face or facelike stimuli when the expression of the unexpected face is congruent with the participant's current emotional state (Becker & Leininger, 2011). Additionally, behavioral studies show that a mood manipulation exercise can yield a faster and more accurate discrimination of mood congruent faces vs. mood incongruent faces (Hietanen & Astikainen, 2012). ERP research has shown that the face-sensitive N170 component is modulated by emotional facial expressions when the processing of a face is a non-explicit part of the task (Blau, Maurer, Tottenham, & McCandliss, 2007), which mimics real-world instances of emotion recognition.

The current study used a mood-manipulation writing exercise to induce happy or sad emotional states in 14 participants. Post- mood manipulation, all subjects were shown a series of photographs of happy, sad, and neutral faces, as well as images of circles and squares, and were asked to respond when they saw a geometric shape rather than a face. The N170 component showed a significantly larger amplitude for mood incongruent faces vs. mood congruent faces across both conditions ($p = .020$). These results are consistent with research on the cross-race effect and inversion that have shown an augmented N170 in response to unfamiliar or out-group faces (Freeman, Ambady, & Holcomb, 2010; Jacques & Rossion, 2007), indicating a cognitive in-group bias toward mood congruent faces. This study could have significant real-world implications for the facilitation of empathetic response, as well as providing electrophysiological evidence of neurological processes potentially correlated with affective empathy.

Background

- Behavioral research has shown that people are typically better at remembering or attending to emotionally salient stimuli vs. neutrally valenced stimuli, even if stimuli are presented very rapidly (Harris & Pashler, 2005; Kensinger & Corkin, 2003).
- Emotional priming in behavioral paradigms has been shown to elicit a faster and more accurate identification of prime-congruent faces vs. prime-incongruent faces (Heitonen & Astikainen, 2012).
- Mood manipulation has been correlated with shifts in attention to mood congruent stimuli: studies of inattentional blindness found that participants more often reported seeing unexpected mood congruent face-like stimuli vs. mood incongruent stimuli (Becker & Leininger, 2011)
- The N170 ERP component most often correlated with presentation of faces has been shown to be modulated by social and categorical information such as the cross-race effect, the inversion effect, and differences in emotion, age, and gender, hypothetically indicating the allocation of an increased "cognitive effort" in determining an out-group face is a face (Freeman, Ambady, & Holcomb, 2010; Jacques & Rossion)
- Emotion-related modulation of the N170 has been shown to be present when identification of emotion is an implicit part of the task (Blau, Maurer, Tottenham, & McCandliss, 2007).

Acknowledgements

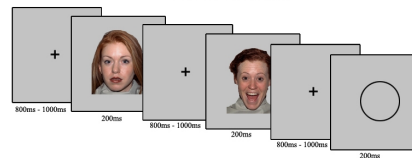
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Methods

- **Participants:** 9 right-handed participants aged 18-21 (3 males, 6 females; 6 Caucasian, 2 Asian-American, 1 Hispanic), with no family or personal history of any mood disorders, anxiety disorders, autism spectrum disorders, or epilepsy, or any personal history of traumatic brain injury or use of psychotropic medication. All participants were compensated \$10.00 US for their participation.
- **Mood Manipulation:** Mood manipulation was completed through a writing exercise in which participants were asked to recall an event in their lives that made them feel very happy or very sad (experimenter specified). Participants were given four minutes to write down descriptors of their chosen event, but were allowed to terminate the activity after 90 seconds if they felt that was sufficient. Mood check surveys were administered before and after the writing exercise to assess the participant's mood and arousal on four seven-point continuums (unpleasant/pleasant, tired/alert, happy/sad, tense/relaxed). Mood manipulation was deemed effective if participants showed any increase in happy/sad or pleasant/unpleasant subscores post-manipulation for the happy condition, or any decrease in these subscores post-manipulation for the sad condition. The reverse coded subscores for happy/sad and pleasant/unpleasant were averaged to produce a mood state score both pre- and post-manipulation, and an increase (happy) or decrease (sad) of at least .5 points post-manipulation indicated a successful manipulation.
- **Task:** Participants were told they would see a series of faces and asked to press the space bar when they saw a shape (square or circle) rather than a face. There were 10 trials of 100 faces (displayed for 200ms) for a total of 1000 faces, and non-face shape distractors (circle/square, displayed for 200ms) were weighted at 15x (faces weighted at 1x). Participants saw a screen with a fixation for 800-1000ms, and an emotional face for 200ms (target). Sets were randomized across race, gender, and expression of the face, and some faces repeated toward the end of each set due to the number of images of each expression. Faces were of people of all different genders and ethnicities, and were from the NimStim database (Tottenham, et al., 2009).

Emotional Faces Task

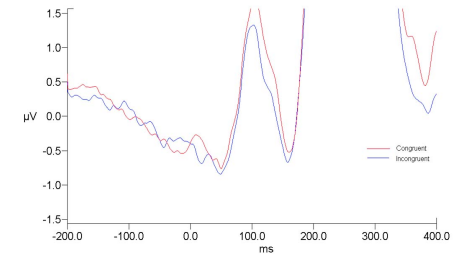


Electrophysiological Recordings:

Electroencephalograms (EEGs) were recorded from the scalp with a 32-channel electrode cap (ElectroCap International). An average mastoid reference was used, and electrode impedances were kept below 5.0kΩ. Vertical and horizontal electrodes (VEOG and HEOG) were used to record EOGs to control for interference from eye-blinks. Data was segmented into 1200ms long epochs, (-200ms – 1000ms) and then filtered with a band pass filter (high pass = .1Hz, low pass = 100Hz, 12 dB). The peak amplitude of the N170 component was identified within a time window of 130-210ms. SPSS was used for all data analysis.

ERP Results

Presentation of mood incongruent faces elicits a larger N170 response than presentation of mood congruent faces



- Participants were separated into two groups for analysis: congruent and incongruent.

Congruent:

- Happy group seeing happy faces
- Sad group seeing sad faces

Incongruent:

- Happy group seeing sad faces
- Sad group seeing happy faces

- Repeated-measures ANOVA compared peak N170 amplitudes at TP8 occipitotemporal electrode site for the congruent and incongruent conditions ($F(1, 8) = 8.432, p = .020$).
- No significance was found between congruent and incongruent faces within happy and sad groups, likely due to our small sample size (4 happy, 5 sad).

Discussion

- Presentation of mood incongruent faces elicited an augmented N170 response in comparison to the presentation of mood congruent faces, displaying the importance of current emotional state on face processing.
- Results are consistent with research findings of other out-group modifiers of the N170.
- Our paradigm was designed to mimic real-world instances of face processing – a person does not always explicitly identify the emotions of everyone they encounter on a daily basis, but may still automatically categorize emotional states.
- Emotional priming at the very least facilitates processing of others' emotional states, and has potential to facilitate processes of and related to affective empathy.
- Future directions for this research should include an explicit examination of the cross-race effect (i.e.: does emotional congruency supercede the CRE in N170 modulation?), as well as including measures of trait empathy and examining the N170 response to mood congruent and incongruent faces across individuals with low- and high-trait empathy.

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