

Emotion

Seeing Yourself Helps You See Others

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BRIEF REPORT

Seeing Yourself Helps You See Others

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It has been proposed that self-face representations are involved in interpreting facial emotions of others. We experimentally primed participants' self-face representations. In Study 1, we assessed eye tracking patterns and performance on a facial emotion discrimination task, and in Study 2, we assessed emotion ratings between self and nonself groups. Results show that experimental priming of self-face representations increases visual exploration of faces, facilitates the speed of facial expression processing, and increases the emotional distance between expressions. These findings suggest that the ability to interpret facial expressions of others is intimately associated with the representations we have of our own faces.

Keywords: self-face, emotion, affect, embodied emotion, facial expression, priming

Facial expressions are perhaps the most complex and rich stimuli to convey social information. Expression expertise is shaped by a lifetime of experience with other people's facial expressions and, as many recent theories have proposed, experience with our own faces. Theories of embodied cognition (Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005), mirror neurons (Rizzolatti & Craighero, 2004; Gallese & Umiltà, 2002), and theory of mind (Meltzoff & Decety, 2003) all suggest that our ability to recognize emotional expressions is intimately related to the internal representation we have of our own facial expressions (Niedenthal, 2007). In addition, facial feedback and emotional contagion helps us to decipher observed expressions and serves to amplify identical emotions in the observer (Tomkins, 1962; Hatfield, Cacioppo, & Rapson, 1994; Nummenmaa, Hirvonen, Parkkola, & Hietanen, 2008).

Self-face representations differ from other faces in several aspects; self-face representations receive enervations originating from concurrent emotional feedback, sensory-motor feedback, and visual feedback, which together serve to richly and in multiple modalities embellish the observer's own facial representations (as described in Niedenthal, 2007). Thus, in our lifelong processing of facial expressions, there is a bidirectional strengthening of our own face representations and others', and arguably, the representation of our own face serves to facilitate the ability to interpret others' faces. The current study tests to what degree our self-face representations facilitate face expression processing in general.

Several recent studies have shown that the self-face influences facial expression processing. Stel and colleagues (2009) have

shown that the self-face can be used to facilitate the detection of lies. Subjects who were instructed to suppress facial mimicry out-performed control groups in lie detection. The authors suggested that under normal conditions, the self-face naturally aids in empathizing with others and can lead subjects astray to be more easily fooled. Because explicit instruction to inhibit self-face expressions can sometimes lead subjects to use alternate and unintended cognitive strategies (Davis, 2009; Davis, Senghas, & Ochsner, 2009; Strack, Martin, & Stepper, 1988), other studies have avoided explicit instructions to suppress facial expressions. For example, Neta, Norris, & Whelan (2009) have shown that one's own naturally generated facial expressions (indexed by electromyography activity) predict whether an individual interprets ambiguous facial expressions as positive or negative, suggesting that one's own face influences perceived valence of others' expressions. More dramatically, Davis and colleagues (2010) controlled for the self-face's expressivity by the use of Botox. They assessed whether self-face expressivity can influence facial expression recognition by comparing two patient groups that have undergone Botox treatment, which paralyzes muscles important for facial expressions. They found that weakened self-face expressions impaired facial expression processing, particularly for difficult-to-interpret facial expressions.

Taken together, the aforementioned studies demonstrate how the presence or absence of one's own facial expression can influence our perception of others. The larger question remains, which is to what extent self-face *representation* influences face perception of others. The existing studies indexed the degree to which physical changes in the self-face influences face perception of others, but have thus far only focused on the presence or absence of self-face expression. If it is the case that when we process the faces of others we are simultaneously activating online representations of our own faces, then we hypothesize that underlying the generation of the self-face is the mental representation of one's own face. The hypothesis motivating the current study is that interpretation of others' facial expressions is facilitated by activating representations of one's own face, and therefore, experimentally activating

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self-face representations should facilitate facial expression processing in general.

In the present study, we directly assessed the influence of self-face representations on face expression processing. We experimentally activated self-face representations by priming subjects with videos of their own or another's facial expressions and then compared performance on a facial expression discrimination task between experimental and control groups. We used graded expressions, because subtle or ambiguous expressions require more processing to interpret than expressions with clear meaning (Neta, Norris, & Whelan, 2009; Davis et al., 2010). Graded stimuli are recognized as distinct emotions (e.g., happy or angry) (Calder, 1996), but their ability to be classified into discrete categories may be impacted by laboratory manipulation; in the current study, we manipulated the degree to which self-face representations are activated.

In Experiment 1, we used a combination of behavioral and eye tracking methods to examine the effects of activating self-face representations on facial emotion discrimination and on the visual exploration of others' faces. Experiment 2 was performed to determine whether activating self-face representations influences subjective appraisals of emotions.

General Methods

Participants

A total of 98 subjects were tested (72 in Experiment 1, 26 in Experiment 2). All participants were screened to rule out neurological disorders, serious medical conditions, and substance abuse issues. All experimental manipulations were approved by the University of California, Los Angeles (UCLA) Institutional Review Board. Subjects were compensated with course credit.

Preexperiment Between-Subjects Manipulation

Participants were randomly assigned to conditions where they were either primed with activation of self or nonself representations. To produce these primes, participants either viewed videos of their own facial expressions or of another gender- and ethnically matched participant's facial expressions, producing, respectively, the self and nonself conditions. These expressions were generated in response to viewing counterbalanced emotional movie clips (a positive valence clip of "The Best Bits of Mr. Bean" and a negative valence clip of "My Bodyguard" (PolyGram Entertainment, 1999; 20th Century Fox, 1980; Bensafi, Brown, Khan, Levenson, & Sobel, 2004; Gross & Levenson, 1995).

Participants were explicitly informed that their faces were to be recorded while watching two short emotional movie clips. They were instructed to ignore the camera and to respond as they naturally would. Participants viewed the positive and negative valence videos in counterbalanced order for three minutes each. For each participant a total of 30 s of smiling and 30 s of frowning were extracted out of their videos using Microsoft Movie Maker (we tried to obtain a continuous emotion segment when possible). We produced a 60-s prime video of each participant's positive and negative (and counterbalanced in the reverse order) facial expressions. A participant's own movie would serve as his or her self prime for those participants randomized to the self condition,

whereas a different participant's movie would serve as a nonself prime for those participants randomized to the nonself condition. Filming was completed with a Samsung digital camera at a 480 × 640 pixel resolution in a frontal view at a distance of 57 cm.

Computer Interface

The computerized tasks were administered using E-Prime Professional v2 (Psychology Software Tools, Inc., 2002) on a PC desktop running Windows XP. All participants were seated 57 cm from the monitor with their heads rested comfortably in a chinrest. The LCD monitor resolution is 1024 × 768 with a standard refresh rate of 60 Hz.

Test Stimuli

Facial stimuli used in the emotion discrimination task consisted of faces from the NimStim Face Stimulus Set (Tottenham et al., 2009).

Eye Tracking

Participants' eye movements were recorded via an Applied Science Laboratories (ASL) eye tracker. Precise correspondence between a participant's gaze and the corresponding tracking position was achieved through repeated calibrations of nine points forming the midpoints and endpoints of a square on the monitor screen. Recordings consisted of a temporal resolution of 17 frames per second and a screen resolution of 640 × 480 pixels.

Questionnaires

After viewing their prime videos (either self or nonself), participants completed the Positive and Negative Affective Schedule (PANAS; Watson, Clark, & Tellegen, 1988) and the Spielberger State/Trait Anxiety Inventory (STAI-SA/TA; Spielberger, Gorsuch, & Lushene, 1970).

Experiment 1

Participants

Seventy-two (35 male, mean age 19.79) undergraduate students (42% Asian American, 32% European American, 8% Hispanic, 18% Other) from UCLA participated for course credit.

Materials

Morphed NimStim facial expressions for an emotion discrimination task used two sets of faces that changed from 1) "neutral" to "happy" and 2) "neutral" to "angry," with the same model expressing each emotion (Kirsh & Mounts, 2007). The program Magic Morph (iTinysoft, 2002) was used in creating the digital morphs, with the start emotion (i.e., neutral) and target emotion (e.g., happy) matched on 75 feature points (e.g., left eye corner of start emotion face is matched to the left eye corner of the target emotion face). Magic Morph interpolates the start and target image via these points and creates compilation images according to set percentage increments, resulting in 20 images ranging from 0% happy/100% neutral to 100% happy/0% neutral. A set of eight

male and eight female models (four European American and four African American for each gender) was selected for use. Happy and Angry versions were made, and the resultant image was 506×650 pixels that subtended approximately 17×22 visual degrees on the monitor. Each participant judged 170 individual faces, 10 faces per model (one practice trial and 16 experimental trials). Ten morphed intensities for each model were used. In this way, we were able to generate a set of facial expressions that contained both extreme as well as more subtle versions of each expression.

To maximize the effect of the prime stimuli on face expression processing in our random assignment design, we chose dynamic movie clips rather than static images to capitalize on the richer array of visual information that can be provided by the former (Gibson, 1966; Dodwell, Humphrey, & Muir, 1987). Motion of the face can convey the three dimensional information about facial structure (O'Toole, Roark, & Abdi, 2002) and can demonstrate the production of an emotion. Moreover, it has been shown that movies of faces promote better recognition than static images (Otsuka et al., 2009).

Procedure

Task. Subjects randomly assigned to the self condition were primed with 60-s videos of their own facial expressions, whereas subjects in the nonself condition were primed with 60-s videos of another participant's expressions.

After priming and questionnaires, participants were administered a facial emotion discrimination task (Figure 1). Blocks of either Angry and Neutral or Happy and Neutral morphed faces were presented in counterbalanced order. Within each block, single faces were presented in a pseudorandom order for 500 ms each. The nose of the stimulus was positioned to meet the initial gaze of the subject, at the center of the screen. Participants were given 1000 ms to respond to whether the face was "neutral" or "angry"

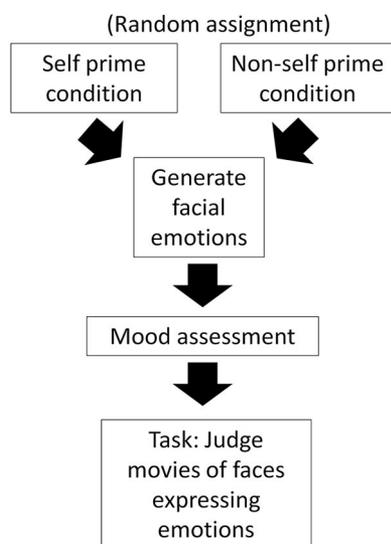


Figure 1. Participants were randomly assigned to either the self or nonself condition, generated facial emotions and primed according to their assigned condition, completed mood inventories, and engaged in experiment tasks.

in the Neutral-Angry faces condition or "neutral" or "happy" in the Neutral-Happy faces condition. Participants responded bimanually on a standard USB keyboard for all experiments. They were instructed to respond as quickly and as accurately as possible. No feedback was provided.

Eye tracking coding. The eye tracking measure was obtained by counting the number of frames (17 ms/frame) where the participant's gaze focused on one of two Areas Of Interest (AOI), the Eye region or the Mouth region. The vertical limits for the Eye region included the inferior border of the eyebrow and the inferior border of the orb of the eye socket. The horizontal limits extended to the lateral eye sockets of each eye. For the Mouth region, the vertical limits included the edges of the upper and lower lips, and the horizontal limits encompassed the endpoints of the lips on the left and right sides.

Data preprocessing. We normalized the Reaction Time (RT) scores and summed over all morphed emotional intensities to create a normalized RT Area Under the Curve (AUC), with greater AUC scores conveying longer overall responses.

Experiment 1 Results

RT

We conducted a repeated measures ANOVA with Prime (Self, Nonself) \times Emotion Category (Happy, Angry), with normalized RT AUC as the dependent measure. We found a significant interaction of Prime \times Emotion Category ($F(1, 70) = 5.64$, $MSE = 0.005$, $p = .020$, $\eta^2 = .08$). Specifically, pairwise comparisons showed that the self prime significantly decreased response time for discriminating Happy-Neutral faces compared with the nonself prime $t(70) = 2.40$, $p = .019$ (Figure 2a), whereas the nonself prime increased response time to Angry-Neutral faces compared to the self prime $t(70) = 2.34$, $p = .022$ (Figure 2b). The self prime also significantly reduced the response time to faces in the Happy-Neutral condition, relative to the Angry-Neutral condition $t(37) = 2.38$, $p = .023$. No other effects were significant.

To assess the possibility of a speed/accuracy trade off, we conducted a Prime (Self, Nonself) \times Emotion Category (Happy, Angry) repeated measures ANOVA, with accuracy as the dependent measure. A correct answer was defined as an answer for which the morphed stimulus contained more than 50% of the emotion identified. For example, a "neutral" response was coded as correct for a stimulus of 75% Neutral and 25% Happy. We did not find a significant interaction between Prime and Emotion Category ($F(1, 70) = 1.22$, $MSE = 0.002$, $p > .05$, $\eta^2 = .02$), nor any main effects of Prime ($F(1, 70) = 0.50$, $MSE = 0.01$, $p > .05$) or Emotion Category ($F(1, 70) = 3.85$, $MSE = 0.002$, $p > .05$, $\eta^2 = .05$).

Mood Check

To examine whether the effects of the self prime on expression discrimination were caused by general mood changes attributable to our manipulation, we administered the PANAS and the STAI inventories after subjects were primed.

Negative Affect scores between the self prime ($M = 13.61$, $SD = 3.37$) and the nonself prime ($M = 15.53$, $SD = 4.94$) revealed no group differences, $t(70) = 1.95$, $p > .05$. Positive Affect scores between the self prime ($M = 25.87$, $SD = 7.51$) and the nonself prime

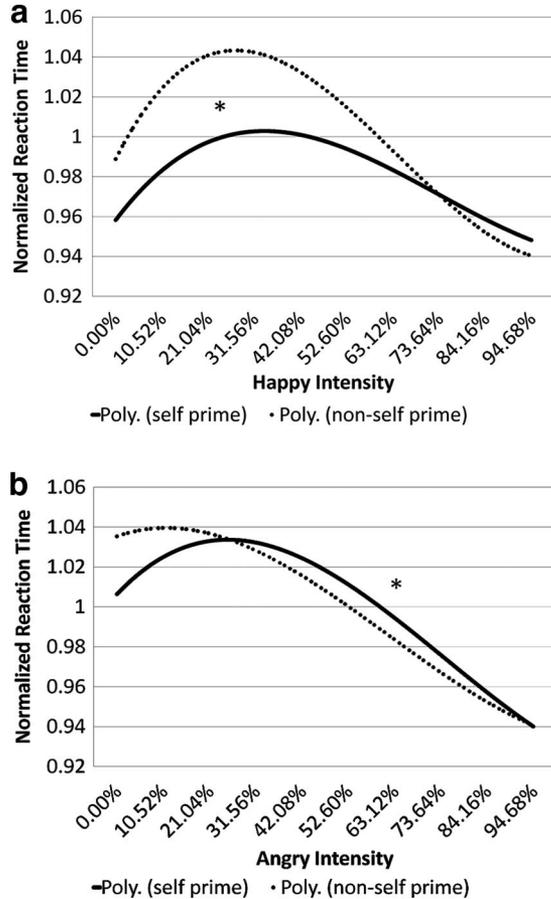


Figure 2. a, Significant interaction of Prime by Emotion Condition for normalized RT Area Under the Curve (AUC) (fitted curves, 3rd order polynomial). The self prime significantly facilitated the speed of discriminating Happy from Neutral faces. b, Significant interaction of Prime by Emotion Condition for normalized RT Area Under the Curve (AUC) (fitted curves, 3rd order polynomial). However, the nonself prime did not reduce the speed of discriminating Angry from Neutral faces.

($M = 25.26$, $SD = 8.53$) were also not significantly different, $t(70) = 0.32$, $p > .05$ for the two groups of subjects.

Additionally, state anxiety as measured by the STAI-SA was not significantly different for participants in the self prime ($M = 36.66$, $SD = 9.27$) and the nonself prime ($M = 39.88$, $SD = 10.69$), $t(70) = 1.37$, $p > .05$, nor were the STAI-TA scores measuring trait anxiety significantly different for the self prime ($M = 40.47$, $SD = 9.47$) and the nonself prime ($M = 41.97$, $SD = 9.97$), $t(70) = 0.65$, $p > .05$ groups.

Results from Experiment 1 revealed that activating self-face representations facilitates the recognition of Happy-Neutral faces. We hypothesized that priming self-face representations could influence the way participants explored the facial expressions of others, and we used eye tracking methods to test this hypothesis.

Eye Tracking

We conducted a repeated measures ANOVA with Prime (Self, Nonself) \times Emotion Condition (Angry, Happy) \times Face AOI

(Eyes, Mouth), with frame count as our dependent measure. Sixty-six participants achieved successful eye tracking and were included in this analysis.

We found a significant interaction of Prime \times Face AOI ($F(1, 64) = 4.30$, $MSE = 376.92$, $p = .042$, $\eta^2 = .06$) (Figure 3). Specifically, after the prime of the nonself face, subjects' visual exploration was limited to the eye region (eye $>$ mouth; $t(29) = 2.32$, $p = .028$). In contrast, after exposure to the self-face, participants showed evidence of exploring *both* the regions of the eyes and mouth, $t(35) = 0.24$, $p > .05$. The self prime was significantly more effective at bringing looks to the mouth region, compared with the nonself prime, $t(64) = 2.21$, $p = .031$. All other comparisons proved insignificant.

Results from eye tracking revealed that exposure to the self prime increases active exploration of facial regions, compared with the nonself prime. Additional exploration of both the eye and mouth regions may be critical for distinguishing emotional from neutral expressions. Because discrimination became faster after activation of self-face representations, we hypothesized that exploration engenders the perception of greater emotional distance between the emotional and neutral expressions. Therefore, we tested the hypothesis that activating self-face representations alters the perceived emotional meaning of the facial expressions of others.

Experiment 2

Experiment 2 examined whether activating self-face representations changes how the valences of faces are perceived. We used the same priming manipulation as used in Experiment 1 and examined how activation of the self-face representation influenced participants' ratings of the emotionality of faces shown.

Participants

Twenty-six (14 male, mean age 20.54) undergraduate students (41% Asian American, 26% European American, 15% Hispanic, 18% Other) from UCLA participated for course credit.

Materials

Experiment 2 used the same faces as were used in Experiment 1, in their original form, without morphing. The same eight male

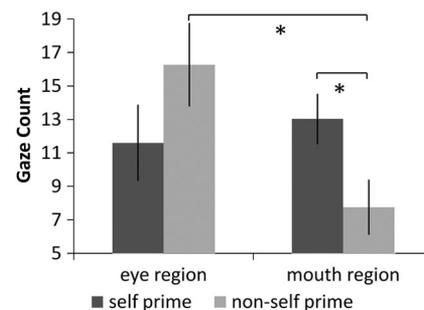


Figure 3. Significant interaction of Prime \times Face AOI for gaze count. Self prime subjects gaze both at eye and mouth regions, whereas nonself prime subjects gaze at the mouth region significantly less. Error bars represent one standard error of the mean.

and eight female models (four European American and four African American for each gender) were selected from the Happy and Angry sets. Two conditions were created; in the Happy Emotion Condition, there were 16 100% emotional (happy) and 16 100% neutral faces. In the Angry Emotion Condition, there were 16 100% emotional (angry) and 16 100% neutral faces. The images were of the same dimensions as the stimuli in Experiment 1.

Procedure

Task. As in Experiment 1, participants were randomly assigned to view either their own (self prime) or a matched participant's (nonsell prime) videos for 60 s.

After the prime manipulation and questionnaires, participants performed two emotion rating tasks, which were the Happy Emotion and Angry Emotion conditions (counterbalanced). Participants were instructed: "Please rate each face on a scale of 1–9, 1 being Negative, 5 being Neutral, and 9 being Positive." For each trial, participants saw a single face presented in a pseudorandom order at the center of the screen, where the face remained until the participant responded via a standard USB keyboard. No feedback was provided.

Experiment 2 Results

Rating Scores

We conducted a repeated measures ANOVA with Prime (Self, Nonsell) \times Emotion Condition (Angry, Happy) \times Emotionality (Emotional, Neutral), with rating scores as our dependent measure.

We found a significant interaction of Prime \times Emotionality ($F(1, 24) = 4.25, MSE = 0.23, p = .050, \eta^2 = .15$) (Figure 4). Specifically, the self prime shifted the perception of neutral faces such that they were viewed as significantly more negative than they were after the nonsell prime, $t(24) = 3.13, p = .005$. All other comparisons were insignificant.

Mood Check

To assess whether our results were attributable to our prime manipulation or a general mood change, we again administered the PANAS and STAI inventories after exposure to the self and

nonsell primes. Negative Affect scores between the self prime ($M = 17.00, SD = 7.96$) and nonsell prime ($M = 16.92, SD = 5.87$) were not significantly different, $t(24) = 0.03, p > .05$. Positive Affect scores between the self prime ($M = 28.23, SD = 6.74$) and nonsell prime ($M = 29.08, SD = 6.63$) also proved to be not significantly different, $t(24) = 0.32, p > .05$.

An analysis of STAI-SA scores, our index of state anxiety, between the self prime ($M = 40.69, SD = 9.29$) and nonsell prime ($M = 40.00, SD = 10.79$) revealed no significant group differences, $t(24) = 0.18, p > .05$. Lastly, our index of trait anxiety, STAI-TA scores, were also not significantly different for the self prime ($M = 45.31, SD = 8.92$) and nonsell prime ($M = 41.15, SD = 10.49$), $t(24) = 1.09, p > .05$.

Discussion

This study examined whether self-face representations are involved in processing the facial expressions of others. We provided evidence supporting the hypothesis that activation of self-face representations enhances face expression processing. In Experiment 1, we demonstrated that the self prime increased the speed of categorization of faces, specifically for Happy-Neutral emotions. To address why this facilitation might be specific to Happy-Neutral distinctions, we examined the valence ratings of neutral and emotional faces in new subjects. In Experiment 2, we showed that self prime subjects rated neutral faces more negatively than nonsell prime subjects. Our results show that activating self-face representations shifted the neutral face's valence to become *more negative*, and thus *increased the emotional difference* between neutral and happy faces. Or, put another way, activating self-representations resulted in more robust category boundaries between happy and neutral faces.

Happy and angry faces tend to be categorized unambiguously as positively and negatively valenced stimuli, respectively (Horstmann & Bauland, 2006; Calvo & Nummenmaa, 2009). Other expressions such as surprised and neutral faces might be more ambiguous in terms of interpretation (reflecting a positive, neutral, or negative emotion; Neta & Whalen, 2010) and therefore amenable to individual differences and contextual changes (Kim et al., 2004; Neta, Norris, & Whelan, 2009; Russell & Fehr, 1987; Somerville & Whalen, 2006) and malleable in their interpretation. In the context of positively valenced faces, neutral faces should take on a more negative valence (Russell & Fehr, 1987, 1988; but see Ekman & O'Sullivan, 1988) and the opposite should be true when neutral faces are presented in the context of angry faces. The self-prime was effective in magnifying the distance between happy and neutral faces, although it was not effective in doing so in the angry-neutral condition. While it is not clear why the self-prime was only effective in facilitating happy-neutral distinctions, this result may be explained by the greater perceptual similarity between angry and neutral faces than happy and neutral faces.

To conclude, differentiation of happy and neutral was facilitated after activation of self-face representations. Although we did not observe a slowdown in processing of Angry-Neutral faces, we believe this is attributable to a floor effect in slowing to angry faces. We also examined how activating self-face representations might influence this categorical boundary change, by assessing gaze to key features of the face. We observed that participants in the self prime group were significantly more likely to explore both

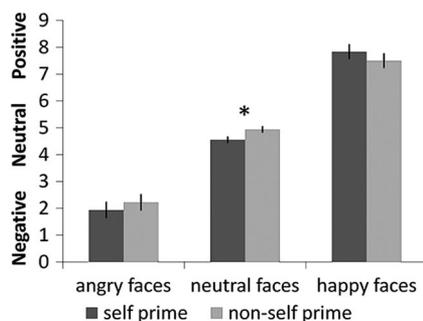


Figure 4. Significant interaction of Prime \times Emotionality for valence rating scores. The self prime shifts valence judgments of neutral faces to be more negative compared with the nonsell prime. Error bars represent one standard error of the mean.

the upper eye regions and lower mouth regions than the nonself prime group, and previous work has shown that when exploration of the face increases to include multiple features, face processing improves (Henderson, Williams, & Falk, 2005). In contrast, nonself prime subjects viewed less of the face than self prime subjects. Our results, in sum, demonstrate that activating self-face representations increases exploration of faces, increases the valence distance between happy and neutral, and thus enhances the speed of differentiation between happy and neutral expressions.

It is unclear how exactly our laboratory priming manipulation created this behavioral difference, but we do know it is not the result of mood changes, as activation of the self-face representation did not alter mood (as measured by the PANAS and the STAI inventories). We also administered identical preexperiment manipulations for generating spontaneous expressions, video recording, and video editing between both groups. Lastly, concerns of speed/accuracy tradeoffs motivated us to compare raw categorization response differences between groups and conduct a separate analysis of accuracy. However, we did not find significant group differences in our emotion discrimination task.

There is a rapidly growing literature examining the role of the self-face in social perception and cognition. Several studies have shown that the expressions of *other* people's faces can influence our *own* emotions (Dimberg, 1982; Dimberg & Petterson, 2000; Laird et al., 1994), suggesting a contagion effect that may be supported by midline structures involved in social evaluation (Northoff & Bermpohl, 2004; Northoff et al., 2006; Platek, Critton, Myers, & Gallup, 2003; Platek, Mohamed, & Gallup, 2005; Seger, Stone, & Keenan, 2004; Schneider et al., 2008) as well as the mirror neuron system that have been shown to support social mimicry (Dapretto et al., 2006; Gallese & Goldman, 1998; Hadjikhani, Joseph, Snyder, & Tager-flusberg, 2006; McIntosh, Reichmann-Decker, Winkielman, & Wilbarger, 2006; Uddin, Iacoboni, Lange, & Keenan, 2007). A second line of research examined how our *own* face influences our perception of others. These studies have shown that inhibiting facial expression (via Botox or explicit instruction) weakens face expression processing (Havas, Glenberg, Gutowski, Lucarelli, & Davidson, 2009; Hennenlotter et al., 2008; Stel, van Dijk, & Olivier, 2009) or that individual differences in expressivity of one's own face predicts interpretation (Neta, Norris, & Whelan, 2009). The current study adds to this growing literature by showing that visual exposure to one's *own* facial expressions can *enhance* recognition of facial expressions in others. Access to the rich representational value of one's own face makes the self-face a unique stimulus, which might serve to amplify the activity of neural regions involved in successful face expression processing. This latter suggestion would predict activity in response to the self-face in regions that have traditionally been recruited by facial expressions of others (e.g., amygdala and fusiform gyrus) but would predict activity in a greater magnitude. Regardless of specific neural systems involved, these behavioral data reveal the importance of the self-face to our perceptual system in general.

This study lends support to current theories of embodied cognition and suggests that representations of one's own face, perhaps as a result of numerous inputs (e.g., visual, sensorimotor, emotional, tactile, or mnemonic), are intimately associated with how we process others' facial expressions. Indeed, neural regions that support general face processing (e.g., the fusiform gyrus) show

greater activation to images of the self-face, over and above activity in response to faces of others (Sugiura et al., 2005), suggesting that the self-face may be more effective in activating face processing networks in general. Representation of one's own face is a means of learning about others' faces. The phenomena of neonate mimicry (Meltzoff & Moore, 1977) and, later in life, unconscious mimicry (Dimberg & Petterson, 2000; Dimberg, Thunberg, & Elmehed, 2000) may contribute to the construction of facial and emotional representations.

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