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DECODING FACES: THE CONTRIBUTION OF SELF-EXPRESSIVNESS LEVEL AND MIMICRY PROCESSES TO EMOTIONAL UNDERSTANDING

By

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Decoding Faces: The Contribution of Self-Expressiveness Level and Mimicry Processes to Emotional Understanding

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Abstract

Facial expressions provide valuable information in making judgments about internal emotional states. Evaluation of facial expressions can occur through mimicry processes via the mirror neuron system (MNS) pathway, where a decoder mimics a target's facial expression and proprioceptive perception prompts emotion recognition. Female participants rated emotional facial expressions when mimicry was inhibited by immobilization of facial muscles and when mimicry was uncontrolled, and were evaluated for self-expressiveness level. A mixed ANOVA was conducted to determine how self-expressiveness level and manipulation of facial muscles impacted recognition accuracy for facial expressions. Main effects of self-expressiveness level and facial muscle manipulation were not found to be significant ($p > .05$), nor did these variables appear to interact ($p > .05$). The results of this study suggest that an individual's self-expressiveness level and use of mimicry processes may not play a central role in emotion recognition.

Keywords: self-expressiveness, mimicry, facial expression, emotion recognition

Decoding Faces: The Contribution of Self-Expressiveness Level and Mimicry Processes to Emotional Understanding

Whether it is with close friends and family, acquaintances, or strangers in the street, accurate recognition of emotion in others is crucial for both initiating and preserving relationships, as well as providing a foundation for social interactions in daily life (Keltner & Kring, 1998). While sources such as body language, tonality and content of speech, and movement patterns can all provide valuable information about a person's emotional state, facial expressions stand as a rich source of information to be utilized in making judgments about emotional states (Ekman, Friesen, & Ancoli, 1980; Elfenbein & Ambady, 2002). Components of assessing facial expressions include detection of type of facial expression as well as level of intensity of that facial expression.

A variety of factors have been implicated in an individual's ability to accurately determine emotional facial expression type. Notably, an individual's self-expressiveness level has been shown to be related to their ability to make accurate interpretations (Halberstadt, Dennis, & Hess, 2011). Gender of the decoder and the emotional intensity of the target facial expression have also been shown to influence an individual's ability to accurately recognize emotional facial expressions (Hoffmann, et al. 2010). The attempt by an interpreter to control their own emotional expression while identifying the emotions of others has also been shown to affect the speed at which accurate identification of facial expression occurs (Schneider, Hempel, & Lynch, 2013). Research has shown that interpreters utilize mimicry behavior in their observation of others (Condon & Ogston, 1967; Kendon, 1970), and that inability to mimic presented facial expressions impairs an individual's ability to accurately detect those expressions

(Oberman, Winkielman, & Ramachandran, 2007). This paper focuses on how some of these qualities of the interpreter affect their ability to accurately recognize emotional facial expressions in others. Specifically, the role of self-expressiveness level and the ability to mimic emotional facial expressions of others is investigated here.

Self-expressiveness. Self-expressiveness level is the extent to which an individual gives external indication of their internal emotional state. Self-expressiveness functions in communication, and has been shown to play a role in accurate interpretation of other's emotional facial expressions at varying intensity levels (Halberstadt, Dennis, & Hess, 2011). It is important to recognize that expression of emotions is consciously and unconsciously governed in large part by social rules (Planalp & Fitness, 1999). Depending on the nature of the relationship with the other person, expression management techniques are utilized as needed to abide by implicit social norms and to maintain harmony in relationships (Hayes & Metts, 2013). More specifically, Hayes and Metts (2013) found that expression of positive emotions are more likely to be falsified due to social contextual forces, while negative emotions are more likely to be repressed.

The importance an individual places on perceived social rules is likely to impact their level of self-expression on a daily basis. Halberstadt, Dennis, & Hess (2011) found that expression accuracy ratings showed a 40 percent improvement with each standard deviation increase in self-expressiveness score; participants in this experiment were not given instructions to imitate expressions, nor was their ability to mimic the presented facial expressions inhibited in any way. Rather, natural expressive level was exhibited here, suggesting that qualities associated with a higher level of self-expressiveness may be instrumental in accurate emotional recognition.

Gender. Gender differences have also been observed with regard to overall level of self-expressiveness. While the idea that women are more self-expressive than men is ubiquitous throughout popular culture, it is one cliché which is generally corroborated by scientific studies (Briton & Hall, 1995; Hess, et al. 2000; Kring & Gordon, 1998; LaFrance, Hecht, & Paluck, 2003). It is notable that women are particularly better at accurately identifying facial emotion in less intense, or more ambiguous, displays of emotion (Hall & Matsumoto, 2004). Further, women have also proved to be quicker than men at correctly recognizing emotion in faces progressing from low intensity to high intensity (Montagne, Kessels, Frigerio, De Haan, & Perrett, 2005). The suggestion that women are better at identifying emotionality at low intensity is especially significant considering that typical facial expressions in everyday life are far more likely to be of a more ambiguous variety, or expressed at lower intensities (Motley & Camden, 1988). A meta-analysis conducted on ability to accurately identify facial expressions reported that in the majority of these studies, women outperformed men (Hall, 1978), suggesting either that women's high self-expressiveness level may be advantageous in determining emotional facial expressions in others or that there is some gender difference in the way emotional understanding occurs.

While many studies find gender differences in accuracy and speed of emotion recognition, not all studies report these results (Grimshaw, Bulman-Fleming, & Ngo, 2004; Rahman, Wilson, & Abrahams, 2004). Further investigation reveals that studies which find no gender difference in emotional recognition accuracy typically use stereotypical, or exaggerated, facial expression stimuli (Rahman et al., 2004). To examine this gendered effect, or lack thereof, a follow up study was conducted to specifically address this phenomenon associated with stereotypical stimuli (Hoffmann, Kessler, Eppel, Rukavina, and Traue, 2010). In Experiment 1, Hoffman et al. (2010) presented stereotypical facial stimuli at high intensity (100% emotional) and low intensity (50% emotional, mixed with neutral facial expression) to male and female participants, and measured for emotion recognition accuracy. As predicted, female participants significantly outperformed male participants for low-intensity stimuli, but not for high-intensity stimuli. In Experiment 2, facial expression stimuli were further mixed with neutral faces so that intensity ranged from 40% emotionality to 100% emotionality, in 10% steps, as a means to draw out a threshold for when these gender differences appear. No gender differences were observed for the high-intensity category (80-100% emotionality), however female participants outperformed male participants in both the mid-intensity (60-70% emotionality) and low-intensity (40-50%) categories (Hoffmann, et al. 2010). Interestingly, male participants showed significant improvement from low- to mid- to high-intensity categories, while women only showed significant increase in accuracy between the low-intensity and mid-intensity categories. These results suggest that the threshold of intensity for accurate emotion recognition is lower for women than it is for men, as well as show that once this threshold is reached, enhancing the clarity of the expression does not result in a subsequent increase in accuracy for either gender.

Level of self-expressiveness impacts an individual’s ability to make accurate judgments about a target’s emotional facial expression. While level of self-expressiveness appears to differ between the genders, these corresponding differences in accuracy seem to also relate to the emotional intensity at which the facial stimuli are presented. Though these differences are apparent, the mechanism by which these judgments are made is less clear. High self-expressiveness inherently implies increased use of facial muscles in comparison to low self-expressiveness; therefore an observer's mimicry of a target's facial expression is a likely candidate by which judgments are made due to the high amount of facial expressivity it requires.

Mimicry. Mimicry is one method individuals use to discern the quality of another person's emotional state. Mimicry is defined as physical imitation of any quality a target individual expresses. Displays of mimicry include imitation of another's posture and movements (Chartrand & Bargh, 1999), speech tonality and pronunciation (Neumann & Strack, 2000), and breathing patterns (McFarland, 2001), in addition to facial expression (Dimberg, 1982). The many applications of mimicry reflect the varied methods an individual can use to gather information on the emotions of another based on their body language, tonality, and facial expressions. The evidence that behaviors similar to the target increase recognition of a perceived action while contradictory behaviors inhibit such recognition, supports the efficacy of mimicry as a means to assist in the correct identification of facial expressions (Reed & Farah, 1995; Tucker & Ellis, 1998). Illustrating this point about contextual compatibility between an actor and a target, Tucker and Ellis (1998) presented 'graspable' objects at either a left or right turning orientation (compatible with left or right hand turning action, respectively) and upright or inverted orientation, then measured the speed at which a particular hand (left or right) was used to make a push-button response indicating whether the object in question was upright or inverted. They found that response times were decreased when the left-right orientation was compatible with the response hand (e.g., right turning, right hand response), and that when the horizontal orientation was also compatible with the response hand, response times and error rates were similarly decreased. These results illustrate that compatibility between an object and an action facilitates accuracy of response; similarly, facilitation of expression recognition may occur when compatibility between a target's facial expression and the decoder's facial expression, established through the decoder's mimicry, is present.

There are two main theories regarding the mechanism underlying the process of mimicry-based understanding. On one hand, mimicry is interpreted by some as an echo of emotional contagion (Laird, et al. 1994). Emotional contagion ascribes an observer's facial expression imitation to their experience of that particular emotion as prompted by detecting the emotion in another person. In this case, mimicry behavior is seen as a consequence of previous emotional understanding, rather than a mechanism by which that understanding occurs. Other research suggests the opposite—that understanding of a witnessed facial expression is derived from the process of mimicking (Niedenthal, Brauer, Halberstadt, & Innes-Ker, 2001). From an embodiment theory perspective, the purpose of facial mimicry is to assist in the reenactment of another's mental state, in order to gain an understanding of that state (Niedenthal, 2007). This model relates to simulation theory models of empathy which suggest that an individual actively experiences the emotional state in question prior to recognizing that state in another (Goldman & Sripada, 2005). In one experiment, participants with happy expressions were able to more quickly identify facial expressions changing from happy to sad than were participants with sad expressions, and vice versa (Niedenthal, et al. 2001). By contrast the inability to utilize facial muscles that would be involved in mimicry resulted in the slower detection of facial expression changes in comparison to a condition where mimicry was not impeded (Neidenthal, et al. 2001). The previous study reported greater expression identification accuracy for happy faces compared to fearful or sad facial stimuli, leaving open the question of whether recognition of some types of expression are more dependent on mimicry than others. From the same study it is also unclear which muscles are actively engaged or inhibited in the reported mimicry, as the inhibition condition carried out by participants holding a pen horizontally in their mouth was not able to focus on particular muscles involved, but facial muscles in general.

In addressing deficits in the study by Niedenthal et al. (2001), Oberman et al. (2007) correlated specific muscle immobilization with deficits in recognition of specific, muscularly associated expressions. The follow up study by Oberman et al. (2007) attempted to address the previously indicated weakness by first identifying the particular muscles which engage when facial mimicry of particular expressions occur, such that facial muscles used to create a smiling face were isolated, muscles used to create an angry face were isolated, and so on. They then showed that the experimental manipulations of observer facial muscles used in their Experiment 2 engaged, and in doing so inhibited, those specific facial muscles that are used in imitation of a particular emotional expression. For instance, the manipulation “bite” in Experiment 2 entails the participant biting on a pen placed horizontally in their mouth, without letting their lips touch it, as a means to engage the facial muscles which are active in mimicking smiling faces. Compared to all other manipulations in this experiment, accuracy for happy expression recognition was significantly impaired in the bite condition (Oberman, Winkielman, & Ramachandran, 2007). A study by Ponari, Conson, D’Amico, Grossi, and Trojano (2012) corroborated these results with their similar finding that interference in an interpreter's muscle activation (i.e. inhibition of mimicry) for a specific emotion was also found to lower accuracy for the recognition of that same facial expression in another person.

Mirror neuron system and mimicry. On a functional level, a neural basis for this interference effect may lie in the relatively recent discovery of mirror neurons in the brain. Researchers working with macaque monkeys found that both carrying out an action and observation of a similar action carried out by the researcher activated the same area of neurons in the brain, specifically in the F5 region of the premotor cortex (Di Pellegrino, Fadiga, Fogassi, Gallese, & Rizzolatti, 1992). While a base function of the premotor cortex is appropriate action selection, it appears that understanding of social group culture via understanding actions executed within the social setting is relevant to action selection as carried out by this brain region (Di Pellegrino, et al. 1992). The term *mirror neuron system* (MNS) was chosen to represent this phenomenon based on the assumption that activation of these neurons in the premotor cortex due only to observation of actions by another, revealed a type of simulation process of understanding. Further research has concluded that MNS activation primarily occurs in response to performed activity, rather than to static states (Gallese, Fadiga, Fogassi, & Rizzolatti, 1996). Mimicry is a process of active facial muscle engagement, and can be argued to be the means of activating the MNS as described by Gallese et al. (1996). In light of this research, mimicry remains a likely possibility to be the mechanism by which MNS contribute to understanding in others.

Though much of preliminary research on MNS has been done with primates, mimicry of facial expression by human participants has also been shown to activate a similar system in the premotor cortex in a similar fashion (Carr, Iacoboni, Dubeau, Mazziotta, & Lenzi, 2003; Iacoboni & Dapretto, 2006). Other research has increased understanding of MNS in humans as organized based on muscle engagement in the action in question, rather than along somatotopic maps (Goldenberg & Karnath, 2006). The presence of MNS as related to mimicry processes suggests a relationship of this system with recognition of facial expressions in others. It is theorized that activation of MNS regions provides a representation of emotional content, assisting the interpreter to simulate and recognize that emotion (Carr, et al. 2003). This concept is corroborated by studies where deliberate imitation of facial expressions results in activation of MNS areas (van der Gaag, Minderaa, & Keysers, 2007), and is further supported by investigations into unconscious facial mimicry, where transcranial magnetic stimulation (TMS) evidence correlates higher facial expression accuracy with increased activation of the motor cortex region (Enticott, Johnston, Herring, Hoy, & Fitzgerald, 2008). As there was no evidence of significant MNS activation in general face processing or pattern recognition, the latter study broadly establishes a link between emotional cognition in a social context and activation of MNS in the premotor cortex. This link provides further evidence of MNS activation as a mechanism by which emotional understanding may occur.

The most comprehensive study of MNS brain regions and concurrent emotional processing to date corroborates the active role of MNS in evaluation of emotional facial expressions, finding that unconscious mimicry reactions to emotional facial expressions correlate with specific areas of the MNS (Likowski, et al. 2012). In this study, fMRI data was used in conjunction with electromyography (EMG) measurements which not only correlated the extent of facial muscle activation with specific brain regions in the MNS, as was previously established by van der Gaag and colleagues (2007), but also revealed concurrent activation in brain regions traditionally concerned with emotional processing. These results support the currently theorized role of MNS in emotional understanding, as the conjunction of action selection and emotionality pathways contributed to simulation theories of emotional understanding. Despite a strong body of evidence for the role of mimicry and MNS in emotional processing, not all research supports this view. Interestingly, a study utilizing participants with Moebius syndrome, a congenital condition characterized by extensive facial paralysis from birth, found no difference in ability to accurately recognize emotional facial expressions in comparison to healthy adults (Bogart & Matsumoto, 2010). However, as recognized by the authors, further investigation on a behavioral and neurological level should be conducted on possible compensatory methods that may have developed over time as a means to optimize functioning in daily social contexts.

Disorders characterized by impaired social interaction, such as autism spectrum disorders (ASD), also show evidence which reflect the necessary role of MNS in emotional processing. Dapretto, et al. (2006) found no difference in ability to imitate or observe emotional expression between normally developing children and high functioning autistic children, although importantly, there was no significant evidence of MNS activation in the autistic children. In the same study, the authors noted that severity of autistic symptoms was negatively correlated with engagement of MNS areas. Other studies have found decreased spontaneous mimicry in participants with more severe autism, identified by high AQ scores, (McIntosh, Reichmann-Decker, Winkielman, &

Wilbarger, 2006) some specifically with women participants (Hermans, van Wingen, Bos, Putman, & van Honk, 2009). In light of the social difficulties associated with autism, evidence of lower spontaneous mimicry in more severely autistic patients further emphasizes the role of this process in emotion processing. Similarly, the lack of MNS activation in autistic children, even when successful expression imitation takes place, underscores the importance of the MNS as a link between mimicry procedures and emotion recognition as it appears successful mimicry unaccompanied by MNS activation is not sufficient for emotion recognition in others.

Mimicry, self-expressiveness, and gender. Mimicry appears to interact with self-expressiveness level, and self-expressiveness as related to gender. Notably, Halberstadt, Dennis, & Hess' (2011) found that high self-expressive individuals have an advantage over low-expressive individuals for accurate recognition of emotional facial expressions in others. Individuals with high self-expressiveness may rely more on muscle engagement in their experience of emotion, therefore the information about another's facial expressions that is gained from mimicry processes may be emphasized. As discussed previously however, gender differences have been associated with level of self-expressiveness such that women are generally found to be more self-expressive than men.

A study examining inhibition of facial mimicry in men and women found no difference in accuracy of emotion recognition between the genders, but that female response time was slower than men for an inhibition condition (Stel & van Knippenberg, 2008). The inhibition condition in this experiment was induced by instructing participants to avoid facial movements. No difference in accuracy between the genders is consistent with the threshold concept for emotional recognition, as prototypical, exaggerated facial stimuli were used in this experiment. Greater speed deficits (i.e. more difficulty in deciphering emotional facial expressions) of female participants for the inhibition condition suggests that mimicry may play a more significant role in woman's emotional processing compared to males, for whom recognition speed was not as impacted, possibly due to overall higher self-expressiveness in women (Stel & van Knippenberg, 2008). Studies involving speed of emotional recognition lend additional weight to the idea that the differential in self-expressiveness level between the genders may contribute to corresponding differences in accuracy. Emotion perception can occur through two pathways: long, identifying equivalent sensory input with stored memory, and short, where proprioceptive perception prompts emotion recognition. Cases in which the inhibition of mimicry mechanisms resulted in speed deficits for women suggest that women could have a greater reliance than men on the short route of processing (Stel & van Knippenberg, 2008). It may be that observed differences in facial recognition abilities between women and men may be derived from the way in which self-expressiveness level interacts with emotional processing pathways.

Next steps. Though these studies delve into important concerns regarding emotion recognition and processing, some questions remain unanswered. For instance, do individuals with a higher self-expressiveness level rely more heavily on mimicry than low self-expressive individuals when making judgments about facial expressions? This study attempts to gain insight into this question by examining accuracy of emotion recognition for low-, mid-, and high-expressive female participants both when mimicking ability is inhibited by external manipulations and when it is uncontrolled. Utilization of low-intensity and mid-intensity facial stimuli will more precisely approximate an everyday decoding context than very high-intensity, prototypical stimuli, and will be used in conjunction with only female participants to emphasize self-expressiveness as a factor which influences ability to recognize emotionality in others. While male patterns of expression accuracy based on self-expressiveness are expected to follow the same general pattern of females, the generally greater range of self-expressiveness in females will be more advantageous in elucidating how variability in this characteristic impacts accuracy of judgments. These characteristic should be investigated in men at a later time. Participants will each view a facial expression stimulus set two times—once when their facial muscles are immobilized and once when facial muscles are uncontrolled. Facial expression stimuli will include low-intensity (40-50% emotional, e.g., 40% intensity indicates 40% emotional expression morphed with 60% neutral facial expression) and mid-intensity stimuli (60-70% emotional). Participants will also answer survey questions which evaluate their level of self-expressiveness. Scoring will indicate high-expressive (top third of scores), mid-expressive (middle third of scores), and low-expressive (bottom third of scores) individuals. These groups will be compared for emotion expression accuracy within the facial muscle immobilization condition (bite condition) and the uncontrolled facial muscle condition (lip condition) for exclusively happy-faced stimuli due to the immobilization condition specifically targeting facial muscles involved in creating and mimicking a happy expression.

Hypotheses. Inhibition of facial muscles is expected to decrease the accuracy of higher expressive individuals to a greater degree in comparison with lower expressive individuals for happy-faced stimuli. Higher expressive individuals more extensively use facial muscles in every day expression, and rely on use of those muscles in mimicry processes when making judgments about the emotional facial expressions of others. Therefore, it is hypothesized that higher expressive participants with immobilized facial muscles will show greater deficits in emotional recognition accuracy for low-intensity and mid-intensity happy-faced stimuli than lower expressive participants with immobilized facial muscles. Based on the suggested emotional intensity threshold and previously established greater accuracy of high-expressive individuals compared to low-expressive individuals, in the uncontrolled condition, it is expected that higher expressive participants will outperform lower expressive participants for low-intensity happy-faced stimuli, but no differences in accuracy will be observed in the mid-intensity category.

Method

Subjects

Participants were 39 female adults, ranging in age from 18 to 22 years old with a mean of 20.4 years. Participant composition was 64.1% Caucasian, 23.1% Asian/Pacific Islander, 10.3% Mixed, and 2.6% African-American. Participants were recruited by flyers placed in or handed out in approved areas of a small, liberal arts women's college and neighboring areas, and/or through an ongoing Facebook event. Compensation for participation was the chance to win one of six $15 Amazon gift cards in a raffle. All participants were treated within the APA Ethical Principals of Psychologists.

Materials

Emotion Identification. Facial expression stimuli were drawn from the Facial Expression of Emotion: Stimuli and Tests (FEEST, Young, Perrett, Calder, Sprengelmeyer, & Ekman, 2002). Participants were asked to identify the primary emotion displayed in each facial expression as a forced choice among happiness, surprise, fear, sadness, disgust, and anger by writing down the appropriate response. Images varied in emotional intensity level from 40%-70% emotional (e.g., 40% emotional intensity describes an image blended with 40% emotional expression and 60% neutral expression). Images of sad, happy, and fearful expressions were included in the stimulus set, however only responses to happy-faced stimuli were analyzed as the facial muscle manipulation targeted those muscles used in forming a happy expression. A male and a female representation of each of the three expression types at each intensity level were included in the stimulus presentation for a total of 24 images. For example, there were 8 total happy expressions included in the stimulus presentation, with 4 images in each intensity category (low or mid) between both gender representations (See Figure 1).

Self-Expressiveness. Level of self-expressiveness was evaluated using the Berkeley Expressivity Questionnaire (BEQ, Gross & John, 1995) (Appendix A). This 16-item scale was designed to measure emotional expressiveness and strength of emotional experience. There were four positive expressiveness items (e.g., “Whenever I feel positive emotions, people can easily see exactly what I am feeling”), six negative expressiveness items (e.g., “It is difficult for me to hide my fear”), and six impulse-strength items (e.g., “I am sometimes unable to hide my feelings even though I would like to”). Responses were given on a scale 7 point scale (“strongly disagree” to “strongly agree”) with some items reverse scored. Self-expressiveness will be considered “High” for scores 81 or above, and “Low” for scores 80 and below. Reliability alpha is .85 for BEQ when scoring includes all items, and the scale shows robust construct validity for emotional expressivity (Gross & John, 1995).

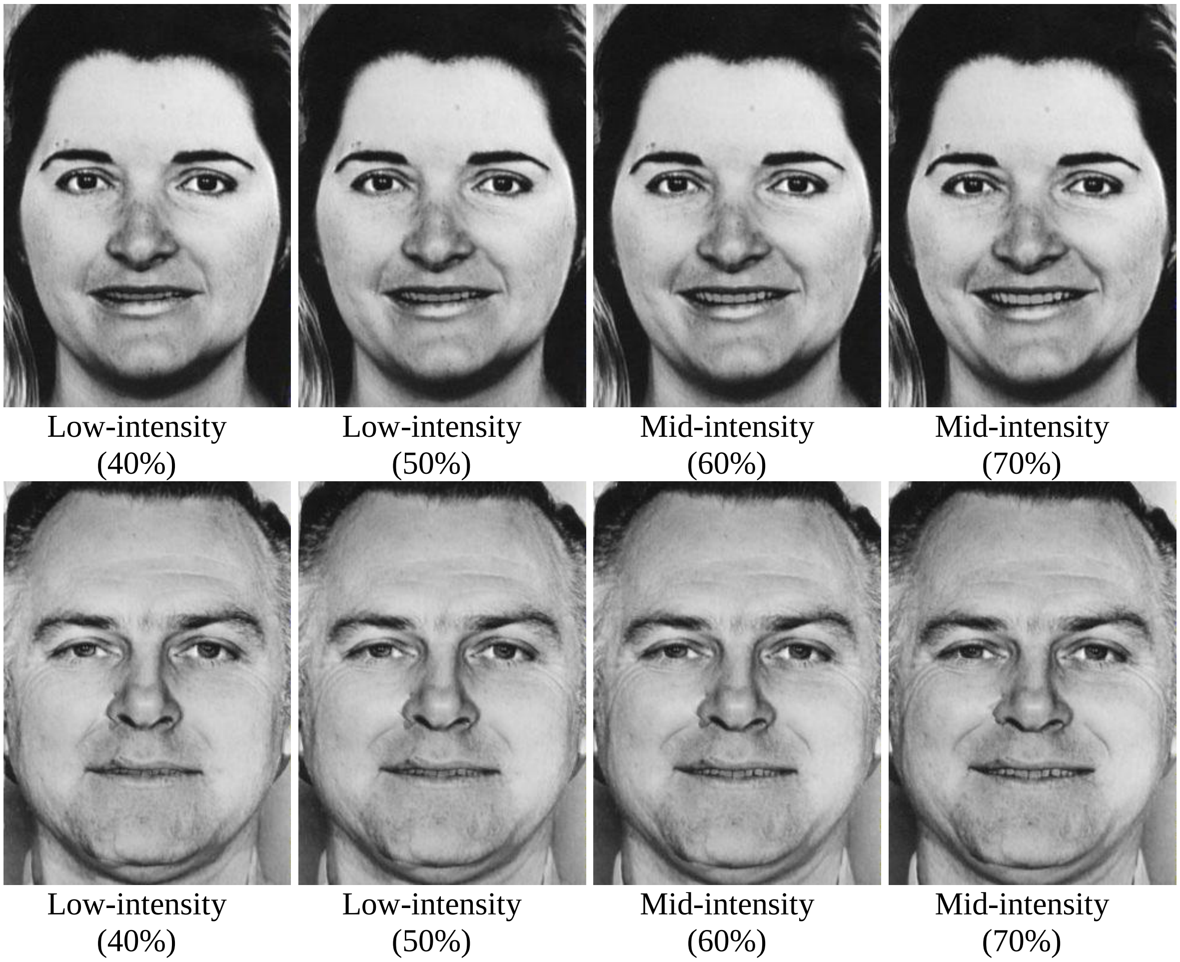

Figure 1. Expression intensity levels for happy facial expressions

Mood. Current mood was evaluated using the Brief Mood Introspection Scale (BMIS, Mayer & Gaschke, 1988). This 16-item scale asked participants to indicate how accurately a given word or phrase described their current mood. Responses were given from 1 to 4, as “definitely do not feel” to “definitely feel.” According to the pleasant-unpleasant scoring method, items were scored to determine quality of mood in terms of “pleasantness” by grouping items as pleasant (e.g., “lively, happy, caring”) or unpleasant (e.g., “gloomy, jittery, grouchy”). Unpleasant grouped responses were reverse-scored along this scale. A higher score indicates a more pleasant mood. Reliability alphas for each item range from 0.76 to 0.83, and strong construct validity (Mayer & Gaschke, 1988).

Procedure

Research was conducted in half-hour sessions, with one participant per session. At the beginning of an experiment session, the experimenter described the research procedures to the participant. Upon providing consent, participants completed the emotional identification task. Images varied in intensity, and participants viewed each intensity level 2 times over the course of stimuli presentation. To provide variety within the stimulus set three facial expressions (happy, sad, fearful) were utilized, although only response to happy-faced stimuli were analyzed, and were presented in a randomized order for both expression type and intensity level. Each facial expression appeared for 2 s and participants were allowed up to 10 s to record their response of the primary emotion displayed in each expression. Accuracy of the response was assessed. Responses were recorded by writing the appropriate letters on a sheet of paper, where “SI” indicated surprise, “FE” indicates fear, “HA” indicates happiness, “SA” indicates sad, and “DI” indicates disgust. Between facial expression presentations, a black screen with a centered white “+” was visible as an orienting stimulus. Facial expression stimuli were presented on a 12.75 in x 7.25 in computer screen using PowerPoint software.

Each participant viewed 48 faces in total, and rated expressions for expression type for each face using a pen and paper. Participants viewed a set of 24 faces twice, counterbalanced with either the “bite” or “lip” condition occurring first. The bite condition required that the participant hold a pen horizontally in their mouth with their teeth and without letting the pen touch their lips, immobilizing their facial muscles and effectively preventing mimicry of happy facial expressions. The lip condition required that participants hold a pen loosely between their lips, without engaging facial muscles, to control for potential task effects in the bite condition while still allowing facial mimicry to occur. Each participant completed six practice trials of the expression rating process before recorded trials began.

Following this task, participants completed a survey evaluating their level of self-expressiveness, quality of current mood, and gathering relevant demographic information. An online survey tool, SurveyMonkey, was utilized to collect responses to all survey questions. After completing the research tasks, participants were debriefed and thanked.

Analysis

The data were analyzed with 2 two-way analysis of variances (ANOVAs) to examine the effects of self-expressiveness level and facial muscle manipulation type on recognition accuracy for both low-intensity and mid-intensity happy facial expressions. Self-expressiveness level was classified as either “low,” “mid,” or “high” based on a cumulative score from the Berkeley Expressivity Questionnaire (BEQ). Groups were created post-data collection, with the high expressive group comprised of the highest third of the scores in the overall data set, the mid expressive comprised of the middle third, and the low expressive group comprised of the lowest third. Primary analysis was for accurate recognition of happy type expressions, with accuracy represented as the percentage of happy stimuli which were incorrectly identified. Self-expressiveness groups were compared for current mood using a one-way ANOVA to ensure there were no significant differences.

Results

Of the 39 women who participated, 13 were included in the low-expressive group (BEQ score of 73.0 or lower), 12 were included in the mid-expressive group (score between 74.0 and 82.0), and 14 were included in the high-expressive group (score of 83.0 or higher). Mean self-expressiveness score was 79.51 (SD = 12.113). A one-way ANOVA comparing self-expressiveness groups on reported mood found no significant differences at an alpha level of .05, $F(2,38) = 0.13$, $p = 0.987$.

Two two-way ANOVAs were conducted to examine whether self-expressiveness level (low, mid, high) had an effect on recognition accuracy for low-intensity and mid-intensity happy facial expressions (Table 1) depending on the presence of a facial muscle immobilization (lip, bite). There were outliers in the data set as assessed by inspection of a boxplot for values greater than 1.5 inter-quartile range units from the 25^{th} and 75^{th} percentiles. Shapiro-Wilk's test determined that recognition accuracy scores were not normally distributed for any of the self-expressiveness groups ($p < .000$). There was only homogeneity of variance for low-intensity stimuli in the bite condition ($p = .230$), as assessed by Levene's test of homogeneity of variances ($p > .05$). For low-intensity and mid-intensity stimuli in the lip condition, and for mid-intensity stimuli in the bite condition, homogeneity of variance was not upheld ($p < .05$). Homogeneity of covariances could not be evaluated by Box's test of equality of covariance matrices because there were fewer than two nonsingular cell covariance matrices. Because ANOVA is relatively robust with respect to violations of its assumptions, the mixed

ANOVA test was conducted despite the presence of outliers, lack of normality of the data set, and heterogeneity of variances.

Table 1

Recognition Accuracy Means for Low-Intensity and Mid-Intensity Stimuli by Self-Expressiveness Level

Manip	Stimuli Intensity	Self-Expressiveness Level	Mean Errors (%)	Standard Deviation (%)	N
Lip Condition	Low	Low	0.0%	0.0%	13
		Mid	2.1%	3.8%	12
		High	0.6%	2.2%	14
	Mid	Low	0.0%	0.0%	13
		Mid	1.4%	4.8%	12
		High	3.0%	5.3%	14
Bite Condition	Low	Low	1.3%	3.1%	13
		Mid	1.4%	3.2%	12
		High	2.4%	3.9%	14
	Mid	Low	1.3%	4.6%	13
		Mid	0.0%	0.0%	12
		High	0.0%	0.0%	14

Note: Accuracy is compared here by examining the mean percentage of wrong answers given for happy facial expressions (e.g. for low-intensity stimuli in lip condition, the high self-expressiveness group missed an average of 0.6% faces)

Low-intensity stimuli. There was no statistically significant interaction between self-expressiveness level (low, mid, high) and muscle manipulation (lip, bite) for accurate recognition of low-intensity stimuli, $F(2, 36) = 1.252$, $p = .298$, partial $\eta^2 = .065$. The main effect of facial muscle manipulation (lip, bite) did not show a statistically significant difference in accurate recognition of low-intensity stimuli, $F(1, 36) = 1.406$, $p = .244$, partial $\eta^2 = .038$. The main effect of group showed no statistical difference in recognition accuracy among self-expressiveness levels for low-intensity stimuli, $F(2, 36) = .888$, $p = .420$, partial $\eta^2 = .047$.

Mid-intensity stimuli. There was no statistically significant interaction between self-expressiveness level (low, mid, high) and muscle manipulation (lip, bite) for accurate recognition of mid-intensity stimuli, $F(2, 36) = 2.556$, $p = .092$, partial $\eta^2 = .124$. The main effect of facial muscle manipulation (lip, bite) did not show a statistically significant difference in accurate recognition of mid-intensity stimuli, $F(1, 36) = 1.692$, $p = .202$, partial $\eta^2 = .045$. The main effect of group showed no statistical difference in recognition accuracy among self-expressiveness levels for mid-intensity stimuli, $F(2, 36) = .501$, $p = .610$, partial $\eta^2 = .027$.

Overall accuracy in the lip condition. A Pearson's correlation between self-expressiveness level and overall accuracy (for combined happy, sad, and fearful facial stimuli) in the lip condition was not found to be statistically significant at an alpha level of .05, $r(37) = -.080$, $p = .628$, indicating that the two variables are not related in this sample.

Discussion

This study attempted to examine differences in an individual's ability to accurately identify facial expressions in another based on the identifier's self-expressiveness level. Hypotheses were generated in light of the proposed role mimicry processes play in making these judgments, and in conjunction with a higher expressive individual's more extensive use of facial muscles in every day communication compared to lower expressive individuals. There was no significant interaction effect between self-expressiveness level and facial muscle manipulation for low-intensity stimuli or mid-intensity stimuli. Similarly, main effects of self-expressiveness level and manipulation type were not found to be significant for either low-intensity or mid-intensity stimuli.

Overall, self-expressiveness score and recognition accuracy in the lip condition, an approximation of a daily decoding context, were not found to be significantly related.

One difficulty is the subtle nature of the phenomenon being investigated. Accurately interpreting facial expressions in an everyday context is a vital part of social interaction, and one which is put into daily practice by the average individual. Any group differences in ability to decode expressions are likely to be very small. A relatively small sample size in combination with this small effect size considerably impeded the power to find significance for the tests in question.

While the inclusion of more stimuli in each intensity category (i.e. more than 4 images of each facial type at each intensity level), for example using a greater number of people to create the stimuli, might have counter-acted the low statistical power of this design in each category, such a method was not possible, or feasible. This study was designed to look at how self-expressiveness level and facial muscle manipulation affected ability to accurately recognize happy expressions at specific intensity levels, and therefore required a validated stimulus set of facial expression at appropriate intensity intervals (i.e. 10% increments of emotion intensity morphed with neutral facial expressions). Creation of this kind of stimuli set requires the use of trained actors, morphing software, and rigorous validation before use in widespread research. There is currently only one set of facial stimuli (used in this experiment) that satisfies the requirements for this design, and it only includes photographs for two individuals (one male, one female) where an emotional expression was morphed with a neutral expression at 10% intensity levels. Although one other facial expression data set that fits the appropriate requirements is currently being validated, with the current limitations of available stimuli it was not possible to include more images. Recognition accuracy measures are also more greatly threatened by measurement bias when there are fewer items because any variability in responses has a larger effect on disrupting any trends within the data. Future researchers could utilize morphing software to make their own set of stimulus as needed by their research design.

Despite the benefits that can be gained from including more items in each category, such inclusion should be balanced with time constraints imposed by the design. It may be counterproductive to include more items due to the impractical amount of time that would have been needed for the evaluation task to be accomplished. This is an especially relevant concern for a study using muscle manipulations like the one presented here, where physical fatigue of a clenched jaw in the bite manipulation could negatively affect the quality of data collected.

Even if sample size was increased, trends in mean accuracy were only consistent with hypotheses in the bite condition for low-intensity stimuli. In this condition, accuracy decreased as self-expressiveness level increased (M_L = 1.3%, M_M = 1.4%, M_H = 2.4%) in accordance with the present theory that inhibition of facial muscles would more greatly impact the recognition accuracy of higher self-expressive individuals due to their greater reliance on using mimicry to make judgments about facial expressions.

In all other conditions, actual trends in accuracy were not in accordance with expected trends. For low-intensity stimuli in the lip condition, the low self-expressiveness group made no mistakes, although this group was expected to be less accurate than the mid-expressive and high-expressive groups. In fact, low-expressive individuals were the most accurate group in three out of the four possible conditions of the present study. Over time low-expressive individuals may have developed other means of making judgments about facial expressions which circumvents the mimicry pathway, as accurately judging facial expressions is not only a critical skill for social interaction, but also an activity which occurs regularly in daily life.

Self-expressiveness group differences in accuracy for mid-intensity stimuli of the lip condition were not found to be significant as was hypothesized; moreover the differences in the means for this category did not trend as expected. Where it was anticipated that the expected trend of lower self-expressiveness leading to more recognition errors for low-intensity stimuli would also extend to high-intensity stimuli, merely to a lesser, non-significant degree, this was not the case. Instead, higher rates of error were associated with an increase in self-expressiveness level (M_H = 3.0%, M_M = 1.4%, M_L = 0.0%). At the same time, the high self-expressive group performed worse for mid-intensity stimuli (M_H = 3.0%) than for low-intensity stimuli (M_H = 0.6%), further suggesting that intensity level of stimuli does not interact with self-expressiveness level with regard to accuracy in facial expression judgments.

For mid-intensity stimuli in the bite condition, trending means were again contrary to expectations such that the low-expressive group was less accurate (M_L = 1.3%) than the mid-expressive group (M_M = 0.0%) and high-expressive group (M_H = 0.0%). Particularly, the results of the mid-expressive and high-expressive group in this condition, making no judgment errors, as well as the complete accuracy of the low-expressive group for both low-intensity and mid-intensity stimuli in the lip condition, illustrate the possibility of a floor effect. It may be that the recognition test administered was not challenging enough to reveal true differences in group abilities, therefore inhibiting significance attainment. A more difficult test utilizing facial expression stimuli at even lower intensities would prevent actual recognition ability from being obscured as occurred when 100% accuracy was attained by multiple groups in this experiment. The more challenging test would allow recognition abilities to be evaluated more fully and could reveal greater differences.

Therefore, the relative ease of this test is a likely explanation for the discrepancy between results in previous literature and the present study, namely that a higher level of self-expressiveness did not result in greater accuracy than lower levels of self-expressiveness when facial muscles were uncontrolled. Previous studies which used a similar procedure for rating emotional expressions and found that relationship between self-expressiveness and accuracy typically involved a shorter appearance of each stimuli that was rated, around 500 ms (Oberman, et al. 2007). This difference in procedure and results may be related, although whether it is the product of a more difficult test or of tapping into a different route of emotional processes is unclear. Utilizing electroencephalogram (EEG) methods would allow a more targeted exploration of immediate and delayed brain activity in response to stimuli presentation.

Participants remarked with surprise when they were told that no “disgust,” “anger,” or “surprise” faces were included in the stimuli set, and several stated that they included a few of those particular answers in more ambiguous cases because they were concerned that those answer options had not yet been utilized. Other research corroborates this tendency of expectancy bias in a variety of contexts (Kukucka & Kassin, 2013; Nickerson 1998; Rusconi, Sacchi, Toscano, & Cherubini, 2012). This potential for bias and the resulting inclusion of inaccurate responses at potentially higher rates than would normally occur if those response options were not available, suggests a potentially greater overall recognition inaccuracy for this sample that may have obscured inaccuracies being tested for by this design. Though the incongruence between response options and actual stimuli possibly increased inaccuracies, congruency would likely have resulted in perfect accuracy for at least some conditions. Congruency of response options to stimuli included in the stimulus presentation set is more important when an overall more challenging test is utilized so that the error rates will not be biased due to expectancy effects. These issues highlight the importance of creating a stimulus presentation set that is challenging in a way that does not introduce expectancy bias into the design.

Alternatively, the results may suggest that the role mimicry processes play in recognition of facial expressions may not be as central as previously supposed. Though mean group differences proved to be nonsignificant in the current study, the trends in these differences which contradict previous literature emphasize the need for further, more comprehensive investigation into how mimicry processes, by way of the mirror neuron system (MNS) pathway, contribute to emotional understanding via the short route of emotional processing. Many studies approach emotional processing from embodied and simulationist theory perspective, implicitly favoring this short route with procedures that usually involve mimicry of expressions in order to make judgments about emotional facial stimuli. Another popular theory describes emotional processing via a long route, where sensory input is matched with stored memory. Targeted research examining the ways in which these two emotional processing pathways complement one another may shed light on inconsistencies within each theory.

Due to restrictions of design, sample size, and relevant resources, this experiment does not provide adequate evidence for conclusions to be drawn. The research questions presented here should be re-evaluated utilizing a larger sample size and a more challenging range of facial stimuli to be rated. Overall, more research is needed to better explicate how individual traits like self-expressiveness contribute to emotional understanding, the circumstances in which long and short route pathways of emotional processing dominate, and the extent of interconnection among mimicry processes and MNS pathways with more traditional emotion processing regions.

References

Bogart, K.R., & Matsumoto, D. (2010). Facial mimicry is not necessary to recognize emotion: Facial expression recognition by people with Moebius syndrome. *Social Neuroscience, 5,* 241-251. doi: 10.1080/17470910903395692

Briton, N.J., & Hall, J.A. (1995). Beliefs about female and male nonverbal communication. *Sex Roles, 32,* 79-90. doi: 10.1007/BF01544758

Carr, L., Iacoboni, M., Dubeau, M-C., Mazziotta, J.C., & Lenzi, G.L. (2003). Neural mechanisms of empathy in humans: A relay from neural systems for imitation to limbic areas. *Proceedings of the National Academy of Sciences, 100,* 5497-5502. doi: 10.1073/pnas.0935845100

Chartrand, T.L., & Bargh, J.A. (1999). The chameleon effect: The perception-behavior link and social interaction. *Journal of Personality and Social Psychology, 76,* 893-910. doi: 10.1037/0022-3514.76.6.893

Condon, W.S., & Ogston, W.D. (1967). A segmentation of behavior. *Journal of Psychiatric Research, 5,* 221-235. doi: 10.1016/0022-3956(67)90004-0

Dapretto, M., Davies, M.S., Pfeifer, J.H., Scott, A.A., Sigman, M., Bookheimer, S.Y., & Iacoboni, M. (2006). Understanding emotions in others: Mirror neuron dysfunction in children with autism spectrum disorders. *Nature Neuroscience, 9,* 28-30. doi: 10.1038/nn1611

di Pellegrino, G., Fadiga, L., Fogassi, L., Gallese, V., & Rizzolatti, G. (1992). Understanding motor events: A neurophysiological study. *Experimental Brain Research, 91,* 176-180. doi: 10.1007/BF00230027

Dimberg, U. (1982). Facial reactions to facial expressions. *Psychophysiology, 19,* 643-647. doi: 10.1111/j.1469-8986.1982.tb02516.x

Ekman, P., Friesen, W.V., & Ancoli, S. (1980). Facial signs of emotional experience. *Journal of Personality and Social Psychology, 39,* 1125-1134.

Elfenbein, H.A., & Ambady, N. (2002). On the universality and cultural specificity of emotion recognition: A meta-analysis. *Psychological Bulletin, 128,* 203-235. doi: 10.1037//0033-2909.128.2.203

Enticott, P.G., Johnston, P.J., Herring, S.E., Hoy, K. E., & Fitzgerald, P.B. (2008). Mirror neuron activation is associated with facial emotion processing. *Neuropsychologica, 46,* 2851-2854. doi: 10.1016/j.neuropsychologia.2008.04.022

Gallese, V., Fadiga, L., Fogassi, L., & Rizzolatti, G. (1996). Action recognition in the premotor cortex. *Brain, 119,* 593-609. doi: 10.1093/brain/119.2.593

Goldenberg, G., & Karnath, H-O. (2006). The neural basis of imitation is body part specific. *The Journal of Neuroscience, 26,* 6282-6287. doi: 10.1523/JNEUROSCI.0638-06.2006

Goldman, A. I., & Sripada, C. S. (2005). Simulationist models of face-based emotion recognition. *Cognition, 94*, 193-213. doi: 10.1016/j.cognition.2004.01.005

Grimshaw, G.M., Bulman-Fleming, M.B., & Ngo, C. (2004). A signal-detection analysis of sex differences in the perception of emotional faces. *Brain and Cognition*, *54,* 248-250. doi: 10.1016/j.bandc.2004.02.029

Gross, J.J., & John, O.P. (1995). Facets of emotional expressivity: Three self-report factors and their correlates. *Personality and Individual Differences, 19,* 555-568. doi: 10.1037/0022-3514.72.2.435

Halberstadt, A.G., Dennis, P.A., & Hess, U. (2011). The influence of family expressiveness, individuals' own emotionality, and self-expressiveness on perceptions of others' facial expressions. *Journal of Nonverbal Behavior, 35,* 35-50. doi: 10.1007/s10919-010-00995

Hall, J.A. (1978). Gender effects in decoding non-verbal cues. *Psychological Bulletin, 85,* 845-857. doi: 10.1037/0033-2909.85.4.845

Hall, J.A., & Matsumoto, D. (2004). Gender differences in judgments of multiple emotions from facial expressions. *Emotion, 4,* 201-206. doi: 10.1037/1528-3542.4.2.201

Hayes, J.G., & Metts, S. (2008). Managing the expression of emotion. *Western Journal of Communication, 72,* 374-396. doi: 10.1080/10570310802446031

Hermans, E.J., van Wingen, G., Bos, P.A., Putman, P., & van Honk, J. (2009). Reduced spontaneous facial mimicry in women with autistic traits. *Biological Psychology, 80,* 348-353. doi: 10.1016/j.biopsycho.2008.12.002

Hess, U., Senécal, S., Kirouac, G., Herrera, P., Philippot, P., & Kleck, R.E. (2000). Emotional expressivity in men and women: Stereotypes and self-perceptions. *Cognition and Emotion, 14,* 609-642. doi: 10.1080/02699930050117648

Hoffman, H., Kessler, H., Eppel, T., Rukavina, S., & Traue, H.C. (2010). Expression intensity, gender and facial emotion recognition: Women recognize only subtle facial emotions better than men. *Acta Psychologica, 135,* 278-283. doi: 10.1016/j.actpsy.2010.07.012

Iacoboni, M., & Dapretto, M. (2006). The mirror neuron system and the consequences of its dysfunction. *Nature Reviews Neuroscience, 7,* 942-951. doi: 10.1038/nrn2024

Keltner, D., & Kring, A.M. (1998). Emotion, social function, and psychopathology. *Review of General Psychology*, *2*, 320-342. doi: 10.1111/1467-8721.00005

Kendon, A. (1970). Movement coordination in social interaction: some examples described. *Acta Psychologica, 32*, 101-125. doi: 10.1016/0001-6918(70)90094-6

Kring, A.M., & Gordon, A.H. (1998). Sex differences in emotion: Expression, experience, and physiology. *Journal of Personality and Social Psychology, 74,* 686-703. doi: 10.1037/0022-3514.74.3.686

Kukucka, J., & Kassin, S.M. (2013, December 16). Do confessions taint perceptions of handwriting evidence? An empirical test of the forensic confirmation bias. *Law and Human Behavior.* Advance online publication. doi: 10.1037/lhb0000066

LaFrance, M., Hecht, M.A., & Paluck, E.L. (2003). The contingent smile: A meta-analysis of sex differences in smiling. *Psychological Bulletin, 129,* 305-334. doi: 10.1o37/0033-2909.129.2.305

Laird, J.D., Alibozak, T., Davainis, D., Deignan, K., Fontanella, K., Hong, J., Levy, B., & Pacheco, C. (1994). Individual differences in the effects of spontaneous mimicry on emotional contagion. *Motivation and Emotion, 18,* 231-247. doi: 10.1007/BF02254830

Likowski, K.U., Mühlberger, A., Gerdes, A.B.M., Wieser, M.J., Pauli, P., & Weyers, P. (2012). Facial mimicry and the mirror neuron system: Simultaneous acquisition of facial electromyography and functional magnetic resonance imaging. *Frontiers in Human Neuroscience, 6,* 65-74. doi: 10.3389/fnhum.2012.00214.

Mayer, J. D., & Gaschke, Y. N. (1988). The experience and meta-experience of mood. *Journal of Personality and Social Psychology, 55*, 102-111. doi: 10.1037/0022-3514.55.1.102

McIntosh, D.N., Reichmann-Decker, A., Winkielman, P., & Wilbarger, J.L. (2006). When the social mirror breaks: Deficits in automatic, but not voluntary, mimicry of emotional facial expressions in autism. *Developmental Science, 9,* 295-302. doi: 10.1111/j.1467-7687.2006.00492.x

McFarland, D.H. (2001). Respiratory markers of conversational interaction. *Journal of Speech, Language, and Hearing Research, 44,* 128-148. doi: 10.1044/1092-4388(2001/012)

Montagne, B., Kessels, R.P.C., Frigerio, E., de Haan, E.H.F., & Perrett, D.I. (2005). Sex differences in the perception of affective facial expressions: Do men really lack emotional sensitivity? *Cognitive Processing, 6,* 136-141. doi: 10.1007/s10339-005-0050-6

Motley, M., & Camden, C. (1988). Facial expression of emotion: A comparison of posed expressions versus spontaneous expressions in an interpersonal communications setting. *Western Journal of Speech and Communication, 52,* 1-22. doi: 10.1080/10570318809389622

Neumann, R., & Strack, F. (2000). "Mood contagion": The automatic transfer of mood between persons. *Journal of Personality and Social Psychology, 79,* 211-223. doi: 10.1037//0022-3514.79.2.211

Nickerson, R.S. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Review of General Psychology, 2,* 175-220. doi: 1089-2680/98/$3.00

Niedenthal, P.M. (2007). Embodying emotion. *Science, 316,* 1002-1005. doi: 10.1126/science.1136930

Niedenthal, P.M., Brauer, M., Halberstadt, J.B. & Innes-Ker, A.H. (2001). When did her smile drop? Facial mimicry and the influences of emotional state on the detection of change in emotional expression. *Cognition and Emotion, 15,* 853-864. doi: 10.1080/02699930143000194

Oberman, L. M., Winkielman, P., & Ramachandran, V.S. (2007). Face to face: Blocking facial mimicry can selectively impair recognition of emotional expressions. *Social Neuroscience, 2*, 167-178. doi:10.1080/17470910701391943

Planalp, S., & Fitness, J. (1999). Thinking/feeling about social and personal relationships. *Journal of Social and Personal Relationships, 16,* 731-750. doi: 10.1177/0265407599166004

Ponari, M., Conson, M., D'Amico, N.P., Grossi, D., & Trojano, L. (2012). Mapping correspondence between facial mimicry and emotion recognition in healthy subjects. *Emotion, 12,* 1398-1403. doi: 10.1037/a0028588

Rahman, Q., Wilson, G.D., & Abrahams, S. (2004). Sex, sexual orientation, and identification of positive and negative facial affect. *Brain and Cognition, 54,* 179-185. doi: 10.1016/j.bandc.2004.01.002

Reed, C.L., & Farah, M.J. (1995). The psychological reality of the body schema: A test with normal participants. *Journal of Experimental Psychology: Human Perception and Performance, 21,* 334-343. doi: 10.1037/0096-1523.21.2.334

Rusconi, R., Sacchi, S., Toscano, A., & Cherubini, P. (2012). Confirming expectations in asymmetric and symmetric social hypothesis testing. *Experimental Psychology, 59,* 243-250. doi: 10.1027/1618-3169/a000149

Schneider, K.G., Hempel, R.J., & Lynch, T.R. (2013). That 'poker face' just might lose you the game! The impact of expressive suppression and mimicry on sensitivity to facial expressions of emotion. *Emotion, 13,* 852-866. doi: 10.1037/a0032847

Stel, M., & van Knippenberg, A. (2008). The role of facial mimicry in the recognition of affect. *Psychological Science, 19,* 984-985. doi: 10.1111/j.1467-9280.2008.02188.x

Tucker, M., & Ellis, R. (1998). On the relations between seen objects and components of potential actions. *Journal of Experimental Psychology: Human Perception and Performance, 24,* 830-846. doi: 10.1037/0096-1523.24.3.830

van der Gaag, C., Minderaa, R.B., & Keysers, C. (2007). Facial expressions: What the mirror neuron system can and cannot tell us. *Social Neuroscience*, *2*, 179-222. doi: 10.1080/17470910701376878

Young, A., Perrett, D., Calder, A., Sprengelmeyer, R., & Ekman, P. (2002). Facial Expression of Emotion: Stimuli and Tests (FEEST). [Slides]. Retrieved from http://pearsonassessmentsupport.com/support/index.php?View=entry&EntryID=825

Appendix A: Berkeley Expressivity Questionnaire

For each statement below, please indicate your agreement or disagreement. Do so by filling in the blank in front of each item with the appropriate number from the following rating scale:

1	2	3	4	5	6	7
strongly disagree			neutral			strongly agree

_______1. Whenever I feel positive emotions, people can easily see exactly what I am feeling.

______ 2. I sometimes cry during sad movies.

______ 3. People often do not know what I am feeling.

______ 4. I laugh out loud when someone tells me a joke that I think is funny.

______ 5. It is difficult for me to hide my fear.

______ 6. When I'm happy, my feelings show.

______ 7. My body reacts very strongly to emotional situations.

______ 8. I've learned it is better to suppress my anger than to show it.

______ 9. No matter how nervous or upset I am, I tend to keep a calm exterior.

______10. I am an emotionally expressive person.

______11. I have strong emotions.

______12. I am sometimes unable to hide my feelings, even though I would like to.

______ 13. Whenever I feel negative emotions, people can easily see exactly what I am feeling.

______ 14. There have been times when I have not been able to stop crying even though I tried to stop.

______ 15. I experience my emotions very strongly.

______ 16. What I'm feeling is written all over my face.