Published in final edited form as:

Emotion. 2013 April ; 13(2): 196–202. doi:10.1037/a0030755.

Exposure to the Self-Face Facilitates Identification of Dynamic Facial Expressions: Influences on Individual Differences

Yuan Hang Li¹ and Nim Tottenham¹

¹University of California Los Angeles

Abstract

A growing literature suggests that the self-face is involved in processing the facial expressions of others. We experimentally activated self-face representations to assess its effects on the recognition of dynamically emerging facial expressions of others. We exposed participants to videos of either their own faces (self-face prime) or faces of others (nonself-face prime) prior to a facial expression judgment task. Our results show that experimentally activating self-face representations results in earlier recognition of dynamically emerging facial expression. As a group, participants in the self-face prime condition recognized expressions earlier (when less affective perceptual information was available) compared to participants in the nonself-face prime condition. There were individual differences in performance, such that poorer expression identification was associated with higher autism traits (in this neurocognitively healthy sample). However, when randomized into the self-face prime condition, participants with high autism traits performed as well as those with low autism traits. Taken together, these data suggest that the ability to recognize facial expressions in others is linked with the internal representations of our own faces.

Keywords

self-face; emotion; affect; facial expression; priming; dynamic expression; autism

Introduction

Within the vast number of faces that we see, there is perhaps no other face that has more meaning to us than our own face. This is so because by adulthood, our own face is in the unique position of possessing years of detailed visual, tactile, motor, and sensory-feedback experiences, which would result in a highly-elaborated representation of the self-face. Studies that have examined facial motor activity during observation of others' expressions (reviewed in Hatfield, Cacioppo, & Rapson, 1993) or brain activations during perception and production of facial expressions (Hennenlotter et al., 2005; van der Gaag, Minderaa, & Keysers, 2007) have suggested that this representation is activated repeatedly, via sensory-motor feedback during facial expression production or perception of others' facial expressions. Thus, repeated co-activations of representations of the self-face and other's

faces can lead to strong bi-directional links between the two processes. The goal of the current study was to examine this link by examining whether activations of self-face representations has a facilitating effect on the understanding of others' expressed emotion.

Several studies have demonstrated that facial expressions of the perceiver can modify how external emotional information is processed. For example, using electromyography, Neta and colleagues (2009) showed that the degree of activity in the facial corrugator supercilii muscles of participants viewing ambiguous facial expressions was associated with a negative interpretation of those faces. Experimental manipulations of the perceiver's face have shown that *inhibiting* facial expressions (and presumably the associated self-face representations), by either asking participants to bite down on a pen (Oberman, Winkielman, & Ramachandran, 2007) or by chemically manipulating facial muscles, impairs recognizing facial expressions of others (Davis, Senghas, Brandt, & Ochsner, 2010; Havas, Glenberg, Gutowski, Lucarelli, & Davidson, 2009; Hennenlotter et al., 2008). Data like these support embodied cognition theories, which emphasize the physical state memories of emotional knowledge that can be accessed in the future to facilitate processing similar exemplars (Niedenthal, 2007). Presumably, the inhibition of facial motor activity impairs the recognition of other's expressions by removing access to this emotional knowledge. The first aim of the current study is to examine to what extent *activation* of self-face representations can facilitate processing facial expressions of others.

Recently, Li and Tottenham (in press) have experimentally primed participants with self-face representations prior to a face emotion discrimination task and showed that the self-face prime manipulation aided in the recognition of static images of facial expressions. In the current paper, we extended these findings by using more ecologically valid stimuli; that is, we examined the effect of self-face priming on the identification of dynamic facial expressions as they would emerge naturally from neutral expressions. We chose to use dynamic facial expressions because they allowed us to assess early-stage recognition of emotions, prior to the full development of the facial expression. Moreover, previous work has shown that recognition of dynamic facial expressions can be influenced by the temporal unfolding of expressions (Kamachi et al., 2001), perhaps as a result of a dynamic expression's ability to increase mimicry (Sato, Kochiyama, Yoshikawa, Naito, & Matsumura, 2004) and the recruitment of neural regions that aid in face expression processing (LaBar, Crupain, Voyvodic, & McCarthy, 2003). In the current study, we created dynamic stimuli through a morphing procedure that produced facial emotion that transitioned from neutral into either happy or angry faces. This procedure allows for equidistant temporal spacing between facial transitions. Because dynamic displays of emotion recruit mental strategies that may be distinct from those elicited by static images (Kilts, Egan, Gideon, Ely, & Hoffman, 2003), we re-examined the effect of a self-face prime activation on the perception of facial expressions using dynamically emerging expressions.

Despite robust facial expression processing in adulthood, there are nonetheless individual differences in performance, and personality traits can influence the accuracy and speed of expression recognition. One of the most common traits associated with poor facial expression processing is autism. Within a healthy population of adults, there are large individual differences in Autism-Spectrum Quotients (AQ), a measure of autistic traits in

adults of normal intelligence (Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001b). Individuals with higher AQ scores, despite being neurocognitively healthy, show more inaccuracies when matching expressions to the appropriate emotion label than individuals with lower AQ scores (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001a). This result was anticipated by Baron-Cohen and colleagues since autism spectrum disorders are associated with extremely poor face processing skills (Ashwin, Chapman, Colle, & Baron-Cohen, 2006; Philip et al., 2010; Wright et al., 2008). The importance of the Baron-Cohen study was in its showing that AQ variation within a *typical sample* was associated with variation in facial expression processing skills. Critical to the current study, research has also shown that the link between the self-face and processing others' faces is weak in autism (i.e., spontaneous mimicry is rare or impaired in individuals with autism spectrum disorders (McIntosh, Reichmann-Decker, Winkielman, & Wilbarger, 2006; Oberman et al., 2007), suggesting that the benefits to processing expressions by others afforded by self-face representations are less available to individuals with high AQ scores. Therefore, we anticipated that an experimental manipulation that increases access to self-face representations might result in faster face emotion processing performance in individuals with high AQ scores. Thus, the second aim of the present study was to examine the individual differences in expression identification as they relate to AQ score, and whether administration of the self-face prime manipulation would result in faster face expression processing for those individuals with higher AQ scores.

In this study, we randomly assigned typical participants to the self or nonself condition to examine how self-face primes influence performance on a dynamically emerging facial expression judgment task. We predicted that the self-face prime manipulation would result in faster identification of dynamic facial expression of others as it has been shown to do with static facial expressions. Moreover, we predicted that high AQ scores would be correlated with poorer emotion processing as has been shown previously, and that randomization to the self-face prime condition would result in faster facial emotion processing in those individuals with high AQ scores.

Methods

Participants

Sixty (34 female, mean age 19.6) healthy undergraduate students (38.3% Asian-American, 33.3% European-American, 8.33% Hispanic, 20% Other) participated for course credit. Participants were all initially assessed for right handedness as indexed by a modified version of the Edinburgh handedness inventory (Oldfield, 1979). Participants were also excluded based upon substance abuse issues, serious medical complications, epilepsy, or other neurological disorders. This study was approved by the University of California, Los Angeles Institutional Review Board.

Design and Materials

Paper-and-pencil questionnaires—Participants were administered the Autism Spectrum Quotient (AQ) questionnaire (Woodbury-Smith et al., 2005), which consists of 4-point likert scale questions that assess five different domains associated with the autism

spectrum: social skills; communication skills; imagination; attention to detail; and attention switching/tolerance of change, and the internal consistency and test-retest reliability have been found to be satisfactory (Hoekstra et al., 2008). They were also administered a mood-check (PANAS; Watson, Clark, & Tellegen, 1988) described below. Lastly, the Spielberger State/Trait Anxiety Inventory (STAI-SA/TA; Spielberger, Gorsuch, & Lushene, 1970) was also administered, which measures current and long-term anxiety in adults. Test-retest correlations for the state and trait inventories are respectively .40 and .86, and demonstrate adequate reliability (Rule & Traver, 1983; Tilton, 2008).

Creation of the Prime Stimuli

Participants were randomly assigned to either the self-face prime condition or nonself-face prime condition. To create the experimental conditions, participants in the self-face prime condition were shown a one-minute video clip of their own facial expressions, and participants in the nonself-face prime condition were shown a one-minute video clip of a different participant's face who was matched on gender and ethnicity. We chose to prime participants with videos as opposed to static images to capitalize on the rich, dynamic, and three-dimensional expression of emotion that moving pictures can provide (Gibson, 1966; Dodwell, Humphrey, & Muir, 1987; O'Toole et al., 2002). To create the priming videos, we exposed participants to two separate emotion-inducing movie clips, and each was three minutes in duration. A positively valenced clip of "The Best Bits of Mr. Bean" and a negatively valenced clip of "My Bodyguard" (PolyGram Entertainment, 1999; 20th Century Fox, 1980) were shown in counterbalanced order. These movies have previously been shown to effectively elicit emotional expressions in the experimental setting (Bensafi, Brown, Khan, Levenson, & Sobel, 2004; Gross & Levenson, 1995; Li & Tottenham, in press). While participants watched these expression-eliciting movies, we recorded their natural emotional expressions. Participants were explicitly told that they will be recorded. They were instructed to ignore the camera and respond as they naturally would. We recorded participants from a distance of 57cm in direct view of the front of their faces at a resolution of 480 by 640 pixels using a Samsung digital camera.

While participants completed paper-and-pencil assessments, trained research assistants extracted 30 seconds of each participant smiling and 30 seconds of each participant frowning from their recorded videos using Microsoft Movie Maker (we tried to obtain continuous emotional expression when possible) and produced one 60-second prime video for each participant. To objectively produce expression videos, those video segments judged to contain each participant's *maximal* expression intensity were selected and compiled into the final prime videos. These video clips were presented in serial order (e.g., positive, then negative), and the order of the positive and negative expression clips were counterbalanced for all participants. We randomly assigned participants to either the self-face prime or nonself-face prime condition, such that a participant randomly assigned to the self-face prime condition would view his/her own prime video, whereas a participant randomly assigned to the nonself-face prime condition would view another participant's gender- and ethnicity- matched prime video.

Mood Check

To ensure that any observable effects in expression processing were attributable to our experimental manipulation rather than a change in participants' mood, participants were administered the Positive and Negative Affective Schedule (PANAS; Watson, Clark, & Tellegen, 1988), a 20-item self report questionnaire. The positive affect index reflects enthusiasm, alertness, and pleasurable engagement whereas the negative affect index reflect distress and unpleasurable engagement. This measure has been shown to be reliable for the positive and negative scales (Cronbach's $\alpha = .89$ & $.85$ respectively; Crawford & Henry, 2004).

Emotional Judgment Task

Following the prime administration (self or nonself) and mood check, participants were administered the experimental emotion judgment task in which neutral faces dynamically changed into a happy or an angry expression. Face stimuli (Tottenham et al., 2009) consisted of 13 European-American men and women, and 13 African-American men and women. Participants were instructed to decide whether the neutral face was becoming 'happy' or 'angry' as quickly and as accurately as possible. Each trial consisted of a stimulus "movie" composed of 20 separate images of an individual's face, morphed from neutral to the emotions 'happy' or 'angry' (Kirsh & Mounts, 2007). These movies played for 2200ms, with 300ms for the initial neutral image, and 100ms for each subsequent emotional image. We began with a longer duration of the neutral face to ensure that participants had time to orient themselves to the stimulus. For example, a 0% happy (100% neutral) face was displayed for 300ms, followed by a 5% happy (95% neutral) face for 100ms, and so forth. A trial was considered accurate if the neutral face morphed into an angry face and the participant selected the "angry" button; it was considered accurate if the neutral face morphed into a happy face and the participant selected the "happy" button. Participants were exposed to two practice trials and 52 experimental trials (26 'happy', 26 'angry'), mixed in random order. The movie was 506×650 pixels and subtended approximately 17×22 visual degrees on the monitor. The experiment was conducted in E-Prime v.2 (Psychology Software Tools, Inc., 2002) on a PC desktop running Windows XP. Participants sat 57cm from an LCD monitor on a resolution of 1024×768 and a refresh rate of 60hz.

Procedure

Participants were invited into the laboratory to participate in a facial judgment task. They were first told that they would watch a couple of short emotional films. They were told that prior to the facial judgment task, they would watch either a video of themselves or of a different individual having watched these movie clips. Participants were randomly assigned to the self or nonself conditions (Figure 1). Both groups viewed emotional movie clips to create the prime videos (to later be used for either the self or nonself primes). Participants were told: "We will show you two video clips. We will be recording you, but please ignore the camera and attend to the video clips as you naturally would." Following the creation of the prime videos, the self-face prime group viewed 60-second clips of their own faces while the nonself-face prime group viewed faces of different participants. Participants were told, "You will see a video of yourself/someone else [depending on the condition to which

participant was randomized] viewing the video clips from earlier. Just attend to that video as you naturally would.” Participants were then administered mood check questionnaires and given the experimental task. Participants were told, “Next, we will have you judge the emotions of some faces. The program will always start with a face in the middle of the screen, just look ahead naturally. Your job is to judge whether that face is becoming happy or angry by pressing these buttons (show buttons) for angry and these for happy.” Participants responded bimanually on a USB keyboard.

Results

Reaction Time

We conducted a repeated measures ANOVA with Prime (Self, Nonself) x Emotion Category (Happy, Angry) with Reaction Time (RT) as the dependent variable using only correct trials. We found a significant main effect of Prime ($F(1, 58) = 4.02$, $MSE = 269858.23$, $p = .05$, $\eta^2 = .07$) showing that the self-face prime group ($M = 1161.40$, $SD = 211.59$) was significantly faster compared to the nonself-face prime group ($M = 1351.61$, $SD = 481.17$) (Figure 2). These reaction times occurred at the point in which an expression (either happy or angry) had reached approximately 40% of its maximum intensity for those in the self-prime group and 55% of its maximum intensity for those in the nonself prime group. That is, shorter RT values suggest that participants randomized to the self-face prime condition required *less affective perceptual information* to reach a correct decision. We also found a significant main effect of Emotion Category, showing that happy emotion movies were recognized earlier than angry emotion movies ($F(1, 58) = 29.42$, $MSE = 6312.93$, $p < .01$, $\eta^2 = .38$).

Accuracy

We conducted a repeated measures ANOVA with Prime (Self, Nonself) x Emotion Category (Happy, Angry) with accuracy as the dependent variable. The accuracy means for both groups were high (Self: $M = 0.98$, $SD = 0.03$; Nonself: $M = 0.97$, $SD = 0.03$), and we did not find any significant main effects or interactions ($F(1, 58) = 1.853$, $MSE = 0.002$, $p > .05$, $\eta^2 = .031$).

Mood Check

To rule out the possibility that the obtained results were due to a change in the participants' mood rather than our priming manipulation, we administered both the PANAS and STAI inventories after the priming sessions.

Positive Affect scores between the self-face prime group ($M = 26.94$, $SD = 7.56$) and the nonself-face prime group ($M = 23.59$, $SD = 8.93$) showed no group differences $t(58) = 1.57$, $p > .05$. Negative Affect scores between the self-face prime group ($M = 14.19$, $SD = 3.43$) and the nonself-face prime group ($M = 15.86$, $SD = 4.98$) were also not different $t(58) = 1.52$, $p > .05$ between groups.

The STAI-SA state anxiety scores were not different for self-face prime group ($M = 36.90$, $SD = 9.45$) and the nonself-face prime group ($M = 39.14$, $SD = 10.08$) $t(58) = 0.89$, $p > .05$,

nor were there any group differences in the STAI-TA trait anxiety scores $t(58) = 1.06, p > .05$ for the self-face prime group ($M = 40.00, SD = 9.93$) and the nonself-face prime group ($M = 42.79, SD = 10.45$).

Individual Differences in Response to the Self-face Prime

The second aim of the current study was to examine how the self-face prime influenced individual differences in facial expression processing. We were interested in the AQ because autism traits have previously been associated with difficulties processing facial emotion (Baron-Cohen et al., 2001a), and the AQ is a continuous personality measure in which high scores that allow us to examine the association between autism traits and facial emotion judgments within a typical sample of adults without a clinical diagnosis of autism. Specifically, we were interested in the moderating role of the self-prime in the association between facial emotion judgment and AQ within a typical sample. We compared the AQ score for the self-face prime group ($M = 15.71, SD = 5.54$) and nonself-face prime ($M = 16.24, SD = 5.20$) group and found no differences in AQ scores for the two experimental conditions $t(58) = 0.38, p > .05$. We used a criterion of using only participants with RTs within three standard deviations of their between-subject group means to counter the possible effect of outliers; no participants warranted removal. First, to examine the association between AQ and facial emotion judgment, we conducted a repeated measures ANCOVA with Emotion Category (Happy, Angry) and AQ score (continuous) as the within-subject factors on the dependent variable of RT. We found a significant main effect of AQ ($F(1, 58) = 4.469, MSE = 267906.126, p < .05, \eta^2 = .07$), where greater AQ scores were associated with slower RT. Secondly, to assess the potential moderating effect of the self-prime, we performed a regression analysis on average reaction time on the facial emotion judgments with the independent variables of AQ, Prime condition, and an interaction term for AQXPrime Condition (we recentered AQ prior to creating the interaction term to avoid collinearity). There was a main effect for prime condition ($\beta = .24, p < .05$) such that, reaction time was faster for those participants randomized to the self-prime condition. Moreover, as Figure 3 showed, there was a PrimeXAQ interaction for reaction time ($\beta = .45, p < .006$). Post hoc tests using the Aiken and West (1991) method of recentering AQ scores to extreme values showed that participants with higher AQ scores who were randomized into the self prime condition had significantly faster reaction times to correctly identify face expressions than those randomized to the nonself prime condition ($\beta = 1.06, p < .001$), in that those with higher AQ scores in the nonself prime condition needed a 40% increase in facial affect information to reach a correct decision (that is, more happy or more angry information). Of those participants in the nonself prime condition, higher AQ was associated with longer reaction times than those with lower AQ scores ($\beta = .48, p < .01$), whereas there was no association between AQ score and reaction time in the self prime condition ($\beta = -.16, p = .39$). Prime condition did not show a significant effect for those participants with lower AQ scores ($\beta = -.51, p = .08$).

Discussion

This study examined the link between one's own face and interpreting the emotions of others by testing whether representations of the self-face facilitate processing of others'

dynamically emerging facial expressions. Those participants who viewed their own facial expressions prior to task onset showed better facial expression processing in that they required less affective information in the face stimulus (i.e., they correctly identified more subtle versions of each expression) in order to reach a correct decision about the displayed affect than participants primed with another's facial expressions. These effects were not the effect of mood alterations, as mood was not different between the two groups following administration of the prime (self or nonself). Instructions, filming, and video processing were also identical in both between-subject conditions. Instead, we interpret these findings as evidence that viewing one's own facial expressions activates a self-face representation, which is an enriched representation of faces expressions that can facilitate recognizing emotions in others. These findings are consistent with previous work using static facial expressions (Li & Tottenham, in press), suggesting that despite significant perceptual differences between static and dynamic expression stimuli, activation of the self-face representation can facilitate recognizing emotions in others' faces, by increasing speed in the case of static stimuli (Li & Tottenham, in press), and by decreasing the amount of affective perceptual information needed to reach a correct decision in the case of dynamic stimuli in the current study.

The current study also investigated whether certain individuals would benefit most from the self-face prime manipulation. Specifically, we anticipated that individuals with the poorest facial expression processing skills would show the largest effect of the self-face prime. In our sample, we showed that individuals with higher autism traits (high AQ scores) were slower to recognize emerging facial emotions (i.e., required more affective perceptual information for correct identification), consistent with previous findings of poor face expression processing associated with autism (Ashwin, Chapman, Colle, & Baron-Cohen, 2006; Baron-Cohen et al., 2001a; Philip et al., 2010; Wright et al., 2008). However, in the context of the self-face prime condition, there was no difference in facial emotion judgment reaction time between those participants with high AQ and those with low scores. If a participant with a high AQ score was randomized to the self-face prime condition, then reaction time was significantly faster than high AQ participants in the nonself prime condition. That is, correct decisions were reached with significantly less affective perceptual information in the face following the self face prime. Thus, although there were no differences in AQ scores between the self and the nonself prime groups, the findings suggest that, relative to the nonself prime condition, the experimental presentation of the self-face prime resulted in faster reactions times for expression processing of others for those participants with the highest AQ scores.

Our results show that the self-face prime manipulation resulted in a significant group difference in face expression processing skills, particularly in high AQ participants. The current study cannot address the underlying mechanisms involved in this effect, although, previous findings may provide some insight. Studies have shown that autism traits have been associated with poor facial mimicry (McIntosh et al., 2006) and decreased recruitment of neural regions associated with mimicry (Dapretto et al., 2006; Hadjikhani, Joseph, Snyder, & Tager-flusberg, 2006; McIntosh et al., 2006; Williams, Whiten, & Singh, 2004; Williams, Whiten, Suddendorf, Perrett, 2001). Therefore, it is possible that certain individuals, like those with higher autism traits, have diminished access to the self-face

representation when viewing expressions of others, which decreases their ability to recognize the expressions of others. If true, then the presentation of self-face primes may boost access to these self-face representations and increase recognition of emotions in others. These findings are consistent with theories on embodied cognition (Niedenthal, 2007), which emphasize the physical state of the perceiver during emotion processing. Previous findings show that one's own physical state (e.g., facial expression) can influence emotion processing (e.g., a frowning expression can increase negative appraisals of stimuli; Larsen, Kasimatis, & Frey, 1992). The current findings build on these types of findings by showing that experimentally activating the *internal* representations of one's own face can facilitate emotion processing. This implies that the mechanism by which bodily states influence perception is via activation of the internal representation. Because all participants in this study first created emotional expressions, but only those who were given the self-face prime videos showed enhancement, we believe that the activation of the internal representation is the operating factor. The stimulation of self-face representations may correspond to an *amplification* of the neural substrates that have been traditionally associated with facial expression processing (e.g., the amygdala and fusiform gyrus) or even an increase in mimicry during facial expression processing. It is a large limitation of the current study design that we cannot test these possibilities, and future studies that incorporate facial electromyography and neuroimaging techniques will provide additional insight into the proposed mechanisms linking self-face representations and processing the emotions of others.

The findings from this study are important because they show that interpreting others' facial expressions is subject to not only individual differences but also to transient mental states, such as momentary activations of internal representations. These data provide evidence that internal representations are capable of influencing emotion perception and that the internal representation of one's own face might be part of the mechanism by which we understand the emotions of others.

References

- Aiken, L.S.; West, S.G. Multiple Regression: Testing and interpreting interactions. Newbury Park, CA: Sage; 1991.
- Ashwin E, Chapman E, Colle L, Baron-Cohen S. Impaired recognition of negative basic emotions in autism: a test of the amygdala theory. *Social neuroscience*. 2006; 1(3-4):349-63. [PubMed: 18633799]
- Baron-Cohen S, Wheelwright S, Hill J, Raste Y, Plumb I. The "Reading the Mind in the Eyes" Test Revised Version: A Study with Normal Adults, and Adults with Asperger Syndrome or High-functioning Autism. *Psychiatry: Interpersonal and Biological Processes*. 2001a; 42(2):241-251.
- Baron-Cohen S, Wheelwright S, Skinner R, Martin J, Clubley E. The autism-spectrum quotient (AQ): evidence from Asperger syndrome/high-functioning autism, males and females, scientists and mathematicians. *Journal of Autism and Developmental Disorders*. 2001b; 31(1):5-17. [PubMed: 11439754]
- Bensafi M, Brown WM, Khan R, Levenson B, Sobel N. Sniffing human sex-steroid derived compounds modulates mood, memory and autonomic nervous system function in specific behavioral contexts. *Behavioural Brain Research*. 2004; 152(1):11-22. [PubMed: 15135965]
- Crawford JR, Henry JD. The positive and negative affect schedule (PANAS): construct validity, measurement properties and normative data in a large non-clinical sample. *The British Journal of Clinical Psychology*. 2004; 43(3):245-65. [PubMed: 15333231]

- Dapretto M, Davies MS, Pfeifer JH, Scott AA, Sigman M, Bookheimer SY, et al. Understanding emotions in others: mirror neuron dysfunction in children with autism spectrum disorders. *Nature Neuroscience*. 2006; 9(1):28–30.
- Davis JJ, Senghas A, Brandt F, Ochsner KN. The effects of BOTOX injections on emotional experience. *Emotion*. 2010; 10(3):433–40. [PubMed: 20515231]
- Gross JJ, Levenson RW. Emotion elicitation using films. *Cognition and Emotion*. 1995; 9(1):87–108.
- Hadjikhani N, Joseph RM, Snyder J, Tager-Flusberg H. Anatomical Differences in the Mirror Neuron System and Social Cognition Network in Autism. *Brain*. 2006; 16 (9):1276–1282.
- Hatfield E, Cacioppo JT, Rapson RL. Emotional Contagion. *Current Directions in Psychological Science*. 1993; 2(3):96–99.
- Havas DA, Glenberg AM, Gutowski K, Lucarelli M, Davidson RJ. Cosmetic Use of Botulinum Toxin-A Affects Processing of Emotional Language. *Psychological Science*. 2010; 21(7):895–900. [PubMed: 20548056]
- Hennenlotter A, Dresel C, Castrop F, Ceballos-Baumann AO, Wohlschlaeger AM, Haslinger B. The Link between Facial Feedback and Neural Activity within Central Circuitries of Emotion--New Insights from Botulinum Toxin-Induced Denervation of Frown Muscles. *Cerebral Cortex*. 2008; 19(3):537–542. [PubMed: 18562330]
- Hennenlotter A, Schroeder U, Erhard P, Castrop F, Haslinger B, Stoecker D, Lange KW, Ceballos-Baumann AO. A common neural basis for receptive and expressive communication of pleasant facial affect. *Neuroimage*. 2005; 26(2):581–591. [PubMed: 15907315]
- Hoekstra RA, Bartels M, Cath DC, Boomsma DI. Factor structure, reliability and criterion validity of the Autism-Spectrum Quotient (AQ): a study in Dutch population and patient groups. *Journal of Autism and Developmental Disorders*. 2008; 38(8):1555–1566. [PubMed: 18302013]
- Kamachi M, Bruce V, Mukaida S, Gyoba J, Yoshikawa S, Akamatsu S. Dynamic properties influence the perception of facial expressions. *Perception*. 2001; 30:875–887. [PubMed: 11515959]
- Kilts CD, Egan G, Gideon DA, Ely TD, Hoffman JM. Dissociable neural pathways are involved in the recognition of emotion in static and dynamic facial expressions. *Neuroimage*. 2003; 18:156–168. [PubMed: 12507452]
- Kirsh SJ, Mounts JR. Violent video game play impacts facial emotion recognition. *Aggressive Behavior*. 2007; 33:353–358. [PubMed: 17593563]
- LaBar KS, Crupain MJ, Voyvodic JT, McCarthy G. Dynamic perception of facial affect and identity in the human brain. *Cerebral Cortex*. 2003; 13:1023–1033. [PubMed: 12967919]
- Larsen RJ, Kasimatis M, Frey K. Facilitating the Furrowed Brow: An Unobtrusive Test of the Facial Feedback Hypothesis Applied to Unpleasant Affect. *Cognition and Emotion*. 1992; 6(5):321–338.
- Li YH, Tottenham N. Seeing Yourself Helps You See Others. *Emotion*. in press.
- McIntosh DN, Reichmann-Decker A, Winkelman P, Wilbarger JL. When the social mirror breaks: deficits in automatic, but not voluntary, mimicry of emotional facial expressions in autism. *Developmental Science*. 2006; 9(3):295–302. [PubMed: 16669800]
- Neta M, Norris CJ, Whalen PJ. Corrugator muscle responses are associated with individual differences in positivity-negativity bias. *Emotion*. 2009; 9(5):640–648. [PubMed: 19803586]
- Niedenthal PM. Embodying emotion. *Science*. 2007; 316(5827):1002–1005. [PubMed: 17510358]
- Oberman LM, Winkelman P, Ramachandran VS. Face to face: blocking facial mimicry can selectively impair recognition of emotional expressions. *Social Neuroscience*. 2007; 2(3–4):167–78. [PubMed: 18633815]
- Oldfield RC. The Assessment and Analysis of Handedness: The Edinburgh Inventory. *Neuropsychologia*. 1971; 9:97–113. [PubMed: 5146491]
- Philip RCM, Whalley HC, Stanfield AC, Sprengelmeyer R, Santos IM, Young AW, et al. Deficits in facial, body movement and vocal emotional processing in autism spectrum disorders. *Psychological Medicine*. 2010; 40(11):1919–29. [PubMed: 20102666]
- Psychology Software Tools, Inc. E-Prime. 2002. Available: <http://www.pstnet.com/E-Prime/default.htm>
- Rule WR, Traver MD. Test-Retest Reliabilities of State-Trait Anxiety Inventory in a Stressful Social Analogue Situation. *Journal of Personality Assessment*. 1983; 47(3):276–277. [PubMed: 6886960]

- Sato W, Yoshikawa S. The dynamic aspects of emotional facial expressions. *Cognition and Emotion*. 2004; 18:701–710.
- Spielberger, CD.; Gorsuch, RC.; Lushene, RE. *Manual for the State Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press; 1970.
- Tilton, SR. *Review of the State-Trait Anxiety Inventory (STAI)*. Ohio University; 2008.
- Tottenham N, Tanaka J, Leon AC, McCarry T, Nurse M, Hare TA, Marcus DJ, Westerlund A, Casey BJ, Nelson CA. The NimStim set of facial expressions: judgments from untrained research participants. *Psychiatry Research*. 2009; 168(3):242–249. [PubMed: 19564050]
- van der Gaag C, Minderaa RB, Keyzers C. Facial expressions: what the mirror neuron system can and cannot tell us. *Social Neuroscience*. 2007; 2(3–4):179–222. [PubMed: 18633816]
- Watson D, Clark LA, Tellegen A. Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of Personality and Social Psychology*. 1988; 54(6): 1063–70. [PubMed: 3397865]
- Williams JHG, Whiten A, Singh T. A systematic review of action imitation in autistic spectrum disorder. *Journal of Autism and Developmental Disorders*. 2004; 34(3):285–99. [PubMed: 15264497]
- Williams JH, Whiten A, Suddendorf T, Perrett DI. Imitation, mirror neurons and autism. *Neuroscience and Biobehavioral reviews*. 2001; 25(4):287–95. [PubMed: 11445135]
- Woodbury-Smith MR, Robinson J, Wheelwright S, Baron-Cohen S. Screening adults for Asperger Syndrome using the AQ: a preliminary study of its diagnostic validity in clinical practice. *J Autism Dev Disord*. 2005; 35(3):331–5. [PubMed: 16119474]
- Wright B, Clarke N, Jordan J, Young AW, Clarke P, Miles J, et al. Emotion recognition in faces and the use of visual context in young people with high-functioning autism spectrum disorders. *Autism: the International Journal of Research and Practice*. 2008; 12(6):607–26. [PubMed: 19005031]

Figure 1.
Illustration of Experimental Procedure.

Figure 2.

Activation with the Self-Face Prime Facilitates Facial Expression Processing. There was a significant main effect of Prime showing that the self-face prime group was significantly faster (that is, required less affective perceptual information) than the nonself-face group. Error bars represent one standard error of the mean.

Figure 3.

The Self-face prime moderates the association between Autism Quotient Score and reaction time in the dynamic facial expression judgment task. There was a significant interaction of Prime and AQ scores in the dynamic facial expression judgment task, such that participants with high AQ scores required more affective perceptual information if randomized to the nonself prime condition, but not if randomized to the self-prime condition.