INTUITION AND FACIAL FEEDBACK

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by

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The undersigned, appointed by the dean of the Graduate School, have examined the thesis entitled

INTUITION AND FACIAL FEEDBACK

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ABSTRACT

Smiles and frowns are commonly thought of as expressions of underlying emotional states. Yet there is strong evidence that these and other facial expressions play a role in emotional experience itself. Several facial feedback studies have found individual differences in susceptibility to facial manipulations. We suggest that differences in intuitive processing style contribute to facial feedback effects, particularly when individuals are in a positive mood. The current study examined the possible interaction between the intuitive processing system, mood, and facial expression in predicting the evaluation of stimuli. A significant three-way interaction between intuitive processing, positive mood, and facial expression was found in predicting evaluations. Interpretations and future directions are discussed.

Intuition and Facial Feedback

Smiles and frowns are commonly thought of as expressions of underlying emotional states. Yet there is strong evidence that these and other facial expressions play a role in emotional experience itself. Indeed, a great deal of research has demonstrated that many different types of bodily feedback can alter a person's evaluation of emotional experience, such as facial expressions (e.g., Andreasson, 2008; Martin, Harlow, & Strack, 1992), body posture (e.g., Duclos, Laird, Schneider, Sexter, Stern, Van Lighten, 1989; Flack, Laird, & Cavallaro, 1999), head movements (e.g., Tom, Pettersen, Lau, Burton, Cook, 1991; Well & Petty, 1980), and even hand gestures (e.g., Chandler & Schwarz, 2008).

The facial feedback hypothesis (Tourangeau & Ellsworth, 1979) suggests that facial muscle movements which mimic expressions of happiness, sadness and other emotions can influence a person's actual experience of these affective states. A variety of studies provide evidence for the role of facial feedback in emotional experience (e.g., Davis, Senghas, & Ochsner, 2009; Hess, Kappas, McHugo, Lanzetta, & Kleck, 1992; Soussignan, 2002; Strack, Martin, & Stepper, 1988; Zajonc, Murphy, & Inglehart, 1989). Although facial feedback effects are widely recognized, it is notable that these effects are often small (for a review, see Matsumoto, 1987). In addition, there have been published studies that have not found main effects of facial expression condition (e.g., Andreasson, 2008; Tourangeau & Ellsworth, 1979). As such, considering individual differences in facial feedback effects may be crucial in achieving a better understanding of when and for whom such effects do emerge (Kosslyn, et al., 2002). The present study examined the contributions of individual differences in intuitive processing style and state positive affect (PA) in producing facial feedback effects. In order to appreciate the potential role of these variables in facial feedback, it may be helpful to review the mechanisms by which visceral cues are thought to influence affect and evaluations.

The Facial Feedback Hypothesis

The notion that bodily sensations play a role in emotional experience was initially formulated by Charles Darwin (1872/1965), William James (1890/1950), and Carl Lange (1922). For example, Darwin (1872/1965) theorized that bodily or visceral cues can affect the degree to which a given emotion is felt. Both James and Lange suggested that visceral sensations precede the phenomenological experience of emotions. Building on these early ideas, psychologists have shown that facial expressions congruent with an emotion will increase that emotional experience, whereas incongruent expressions decrease such experiences (e.g., Davis, Senghas, & Ochsner, 2009; Hess, Kappas, McHugo, Lanzetta, & Kleck, 1992; Soussignan, 2002; Strack, Martin, & Stepper, 1988). In addition, research has also shown that facial expressions alone are sufficient to produce an emotional response, even in the absence of an evoking stimulus (e.g., Duncan & Laird, 1977; Levenson, Ekman, Friesen, 1990; Zajonc, et al., 1989).

Facial feedback research has used a number of different methods in assessing the affective changes that occur due to facial manipulations. One of the most common methods is to have participants evaluate emotional stimuli, such as comics (e.g., Strack, et al., 1988), stories (e.g., Martin, et al., 1992), videos (e.g., Gross & Levenson, 1997), or even odors (e.g., Kraut, 1982). Inherent in this methodology is the notion of *misattribution of mood*, in which the feelings elicited from one source are mistakenly attributed to another source (e.g., Chaiken & Stangor, 1987; Petty & Cacioppo, 1983; Schumann, & Thorson, 1990; Schwarz & Clore, 1983; Topolinski & Strack, 2009b). A classic example of misattribution comes from a study conducted by Schwarz and Clore (1983) in which participants' ratings of their satisfaction with life was shown to be significantly higher on sunny days than on rainy days. These results have been interpreted as indicating that the positive mood created by the sunny day was misattributed to the participants' life satisfaction. Similarly, in facial feedback studies, the affect elicited by the facial expressions is thought to be used in evaluating the dependent variables (Gray, Harrison, Wiens, & Critchley, 2007; Martin, et al., 1992). Thus, participants posing different facial expressions produce different ratings due to the misattribution of *the particular feelings evoked* by the expression onto the target of evaluation. For example, if smiling produces subtle PA, that affect can be ascribed to the amusingness of a comic.

Individual Differences in Facial Feedback Effects

A number of facial feedback studies have found individual differences in susceptibility to these manipulations. As initially assessed by Laird and Crosby (1974) in a study where the effects of facial expression were measured over multiple instances, individuals consistently responded differentially to these manipulations. Explaining this intra-individual consistency in responses to facial feedback has been the topic of a few studies. Although most recently emotional empathy was shown to act as a moderator, such that individuals high in empathy rated humorous films as being funnier when in the happy facial condition (Andreasson & Dimberg, 2008), older studies suggest that characteristics associated with sensitivity for internal states play a role in facial feedback effects. For example, research has shown enhanced facial feedback effects for individuals who tend to focus on self-produced cues (i.e., from one's own behavior), compared to situational cues (i.e., from the context; Duncan & Laird, 1977; Laird & Crosby, 1974). Rhodewalt and Comer (1979) found that participants who were susceptible to the facial feedback manipulations tended to be field independent (i.e., less swayed by the influence of the environment as compared to internal bodily states). The tendency to focus on self-produced and internal cues, both suggest that facial feedback manipulations are especially likely to occur for individuals who attend to inner personal states. Such attention to internal cues or "gut feelings" has been conceptualized as intuitive information processing, and this prior work provides indirect evidence for the role of intuitive information processing in facial feedback effects.

Intuitive Processing and Facial Feedback

Intuition may be defined as processing information based on vague hunches or gut feelings that suggest knowing without awareness of the processes that led to such knowledge (e.g., Deutsch & Strack, 2008; Dienes & Perner, 1996; Epstein, 1991; 1994). In cognitive–

experiential self-theory (CEST, e.g., Epstein, 1991; 1994; 2008), intuitive information processing occurs in the experiential system. The experiential system operates automatically and is emotionally based (e.g., Topolinski & Strack, 2008). Intuitive judgments are thought to be guided by internal impressions that are experienced phenomenologically as hunches or vibes (Epstein, 2008). Intuitive processing is characterized as rapid and driven by heuristics. This processing style contrasts with the cognitive system that involves slower, deliberate, rational, and conscious information processing (e.g., Alonso & Fernandez-Berrocal, 2003). A number of dual processing theories suggest that situational demands determine the type of processing that is used, with intuitive processing being used for quick decisions, while a more analytic, effortful processing style is used when problems require a more reflective mindset (e.g., Betsch & Kunz, 2008; Kuhl, 2000; Novak & Hoffman, 2009). CEST presents these two processing styles as reflective of two different self systems and provides a means of measuring individual differences in the general tendency to rely on one system or the other (Pacini & Epstein, 1999).

The potential association between intuitive processing and facial feedback is suggested by the very description of facial feedback effects. For instance, Laird (1984) has suggested that the effect of a facial expression on emotion is "automatic, very rapid, and that people are unaware of either the process or the constituent elements of the final integrated experience" (p. 916). The influence of facial feedback may be understood as just the kind of vague hunch to which the intuitive system responds.

The notion that intuitive processing promotes facial feedback effects would help explain why the facial feedback study conducted by Strack et al. (1988), which involved an assessment of humorous cartoons, showed significant results for only the affective evaluations of the cartoons (i.e., “What feeling was elicited in you by looking at the cartoons?”), whereas the more cognitive-orientated appraisals (i.e., “How funny do you think these cartoons are if you try to apply an ‘objective’ standard?”) showed no difference between facial conditions. It could be that Strack et al. did not find differences between groups when administering the cognitive assessment because the particular questions emphasized analytical processing and disrupted the intuitive mindset.

If facial feedback effects occur through intuitive (rather than rational) processing, then individuals who are more dispositionally prone to attend to these gut reactions or vibes should show the strongest effects. In the current study, we measured such individual differences in a person's tendency to use intuitive processing using the Faith in Intuition (FI) subscale of the Rational Experiential Inventory (Pacini & Epstein, 1999). This scale measures, essentially, the extent to which a person is prone to trust his or her hunches, gut feelings, and emotions. Although this line of reasoning suggests essentially a moderating role of individual differences in intuition on facial feedback effects (with highly intuitive individuals being most prone to facial feedback effects), we also considered the potential contribution PA may have to these effects, because PA has been shown to play an important role in intuitive processing, as we now consider.

The Role of Positive Affect in Intuitive Processing

A variety of studies have demonstrated the important relationship between PA and intuition. For example, research has shown that PA enhances the accuracy of intuitive judgments (e.g., Baumann & Kuhl, 2002; Bolte, Goschke, & Kuhl, 2003). In addition, many studies have shown that PA shifts the balance to intuitive processing (e.g., Bless, Clore, Schwarz, Golisano, Rabe, & Wolk, 1996; Ruder & Bless, 2003).

Furthermore, research has shown that individual differences in intuitive processing are more likely to influence beliefs and behaviors when individuals are also in a good mood. For example, in a study by King, Burton, Hicks, and Drigotas (2007), PA interacted with individual differences in intuitive processing in predicting beliefs in paranormal activity and susceptibility to sympathetic magic. Participants high in trait intuition were more likely to endorse paranormal belief and behave in ways indicative of sympathetic magic only when also high in (induced or naturally occurring) PA. Similar results have been reported for PA, individual differences in intuitive processing, and referential thinking (the tendency to find self-relevant meaning in random events; King & Hicks, 2009). Most recently, research has demonstrated that the relationship between PA and intuitive judgment accuracy was moderated by individual differences in intuition (Hicks, Cicero, Trent, Burton, & King, 2010, Study 3). Based on these results, it has been suggested that PA activates the intuitive system, clearing the mental path of rational second-guessing (King et al., 2007; Hicks, et al., 2010). These studies suggest that the intuitive system is most likely to influence cognitive processes and behavior when the individual is in a particularly good mood. Thus, the present study examined not only the potential moderating role of individual differences in intuition on facial feedback effects, but also the interaction of PA and intuition in producing such effects. Past research would suggest that those who are high in intuition *and* PA should be most susceptible to facial feedback effects.

Facial Expressions as Intuitive Information

A final consideration is the role of facial expressions, themselves, in conveying information for intuitive processing. Research has shown that when stimuli are easily processed (or when they make sense) facial musculature activity indicative of PA is likely to occur. In research examining semantic coherence judgments, participants are presented with word triads (i.e., three words shown together) and are asked whether they believed there was a fourth word that could relate to all three words (e.g., *falling, actor, dust* imply *star*; Mednick, 1962). Topolinski, Likowski, Weyers, and Strack (2009) found that processing of coherent word triads (those that share a fourth common associate) led to activation of the smiling muscle zygomaticus major (related to PA; see also Cacioppo, Petty, Losch, & Kim, 1986) and inhibition of the frowning muscle corrugator supercilii (related to NA; Cacioppo, et al., 1986). Based on this work, Topolinski and Strack (2008; 2009a; 2009c) have proposed a model of intuitive judgments that suggests a role for these facial expressions in driving these judgments.

Topolinski and Strack's model focuses on processing ease and subtle indicators of PA as important links in the chain of intuitive judgments. From this perspective, processing fluency leads to brief, subtle, and positive changes in core affect. Core affect is a free-floating, consciously accessible affective state which can be attributed (or misattributed) to a person, condition, state, or event (Barrett, et al., 2007; Russell, 2003; Russell & Barrett, 1999). According to Topolinski and Strack (e.g., 2009a) this fluency-triggered affect then leads to the experiential "gut feeling" that drives intuitive judgments.

Of great relevance to the present studies, Topolinski and Strack (2009a) demonstrated that facial expressions play a vital link in providing information about ease of processing. In one study, they had participants briefly pose positive and negative facial expressions prior to engaging in a semantic coherence task. These facial manipulations effectively short-circuited the accuracy of coherence judgments: Participants were more likely to judge a given triad as coherent when engaged in a positive facial expression and less likely when engaged in a negative facial expression (Topolinski & Strack, 2009a). These results suggest that the core affect produced by positive facial expressions was mistakenly attributed to ease of processing, which then led to an increase in false-positives. Additionally, the negative facial expression inhibited the production of core affect normally produced from coherent triads, which led to more false-negatives. These results provide support for the idea that facial feedback effects are the result of participants attributing the core affect created from their facial expressions onto targets of evaluation. Further, the inclusion of facial expressions as key variables in intuitive judgments also lends credibility to the idea that facial feedback effects are intricately linked to intuitive processes.

As already mentioned, Hicks, et al. (2010; Study 3) showed that individuals high in trait intuition who experienced a positive affect induction were better at discriminating between coherent and incoherent linguistic triads. These investigators posited two suggestions as to the underlying mechanisms for the effects. First, it may be that highly intuitive individuals who are in a good mood are more apt to recognize the core affect elicited from processing fluency. Second, it may be that such individuals are more likely to trust the experiential feelings that emerge as a result of this fluency. In either case, since the core affect created from facial expressions could increase both the chances of recognition of “gut feelings” or the acceptance of these, we predicted that highly intuitive people who were also high in PA would be the most susceptible to facial feedback effects.

Overview of the present study

The current study tested the hypothesis that facial feedback effects are moderated by individual differences in intuitive processing and PA. Specifically, we examined the interaction of naturally occurring PA with individual differences in intuition to test the prediction that intuitive individuals who are also high on initial PA will be the most susceptible to these effects.

The study began with the measurement of participants' intuitive processing style and state mood. Participants were then randomly assigned to a facial expression condition, consisting of either a positive, negative, or neutral expression. Clearly, positive mood tends to facilitate intuitive processing and Epstein (1998) has suggested that the experiential system is particularly attentive to opportunities for reward and appetitive motivation. As such, it may be that the effects of intuition (and PA) will only occur in response to a positive facial expression. Thus, we were also interested in how a *negative* facial expression would interact with FI and PA in predicting evaluations and mood. We hypothesize that initial PA might still interact with the intuitive processing system to bring about results congruent with the negative expression, resulting in lower evaluations and mood when compared to the positive and neutral groups. Essentially, including a negative facial expression condition allowed us to examine whether happy, intuitive individuals are influenced by visceral cues regardless of the valence of those cues. Having a neutral facial condition provided a non-valenced group to contrast with the other two.

Three dependent measures were used to assess facial feedback effects. Participants were first shown nonsense Chinese-like symbols and told that each symbol represented an adjective that was either negative or positive. They were then asked to rate how negative or positive they thought the adjective was that each symbol represented. Participants were then asked for an affective evaluation of several comics. The third dependent measure was the participants' rating of their own current mood.

Once again, we predicted that individual differences in intuitive processing and state PA would interact to promote susceptibility to facial feedback effects. For each of our three dependent measures, these predictions were that, for those high on intuition and PA posing a positive facial expression, ambiguous symbols would be rated as more positively, comics would be rated as more amusing, and post-manipulation mood would be rated as more positive. With regard to the neutral and negative facial conditions, we expected that ratings would be less positive, especially for those high on intuition and PA.

Methods

Participants

Participants were 162 undergraduate students (120 females) who received course credit for an introductory psychology course. Ages ranged from 17 to 30 (M = 18.53, SD = 1.33).

Initial Measures

Prior to the facial feedback manipulation, participants completed measures of individual differences in intuitive processing and state mood. After finishing the facial manipulation tasks, participants completed measures of task difficulty and unpleasantness which were used as covariates.

Intuitive processing. Five items from the Faith in Intuition (FI) subscale of the Rational Experiential Inventory (REI; Pacini & Epstein, 1999) were used to measure a person's tendency to rely on intuitive processing (M = 6.74, SD = 1.38, α = .83). Past research has shown the REI to have a high degree of reliability (.87 for both sub-scales for Handley, Newstead, & Wright, 2000; .87 for the rational sub-scale and .91 for the experiential sub-scale for Pacini & Epstein, 1999). A sample item from the FI subscale is "I believe in trusting my hunches." Items were rated on a scale of '0' (Strongly disagree) to '10' (Strongly agree).

State mood. Participants next completed a questionnaire assessing four positive affect descriptors (PA), including "happy", "pleased", "joyful", and "cheerful" (M = 6.33, SD = 1.52, α = .81).[1] Items were rated on a scale of '0' (Strongly disagree) to '10' (Strongly agree).

Covariates

Task difficulty and unpleasantness. After completing the facial feedback manipulation, participants were asked the single item, "How difficult was the facial muscle task overall?" as a measure of task difficulty (M = 2.12, SD = 2.13). Immediately following, participants were asked the single item, "How unpleasant was the facial muscle task overall?" as a measure of task unpleasantness (M = 1.24, SD = 1.88). Both items were rated on a scale of '0' (Not at all) to '10' (Very much).

Outcome Measures

After being assigned a particular facial expression condition, participants were shown Chinese-like symbols and were asked to rate how negative or positive they thought the adjective was that each symbol represented. They were then asked for an affective evaluation of several comics, followed by an assessment of their own current mood.

Symbol ratings. Participants were shown ten nonsense symbols (see Appendix A) and were told that each symbol represented an adjective that was either positive or negative. They were then asked to rate how negative or positive they thought the adjective was that each symbol represents. The scale was from -3 (Very negative) to +3 (Very positive) and did not allow for a neutral "0" response. These particular symbols have been used in previous studies as ambiguous stimuli (e.g., Hull, 1920; Murphy & Zajonc, 1993).

Comic ratings. Participants were asked to rate five comics in terms of: "How amusing do you feel this comic is?" from a 0 to 5 scale with 0 being "Not at all amusing" and 5 being "Very much amusing".

Post mood. Participants were asked to rate how much they felt four positive affect descriptors (Post PA), including "happy", "pleased", "joyful", and "cheerful".[2] Items were rated on a scale of '0' (Strongly disagree) to '10' (Strongly agree).[2]

Procedure

Upon arrival, participants were brought into a small seminar room and asked to fill out a questionnaire relating to general and demographic information "before beginning the experiment". The questionnaire packet included the FI scale, the mood measure, and a variety of demographic questions.

As part of the cover story, all participants were told: "In this study, we use a facial electromyogram, also known as an EMG, to measure facial muscle activity. We have the EMG hooked up to a computer in the other room. Two EMG sensors will be placed on your face so that the EMG software can collect data. Research has shown that while engaged in a task, certain facial muscles will activate at a subliminal level with such a low degree of activity that they are essentially unnoticeable to observers and even the person exhibiting them, but EMG sensors can pick up on this activity. We'll be looking at that activity for this study, particularly the orbicularis oculi facial muscles." Participants were then led into a computer cubicle.

Two EMG sensors, which were connected to a machine that essentially did nothing but provide the illusion of EMG data being collected (see Tamir, Robinson, Clore, Martin, & Whitaker, 2004; and Laird, Wagener, Halal, & Szegda, 1982), were placed on the participants' faces, one by each of their temples. As noted prior, posture has shown to have an effect on people's feelings (e.g., Duclos et al., 1989), and so participants were specifically instructed to maintain an upright, yet relaxed, body posture throughout the experiment. Participants were then given instructions to pose a particular facial expression for each condition. The resulting expressions are shown in Figure 1.

Positive Facial Expression. For the positive facial expression condition, we followed Strack, Martin, and Stepper (1988) by having participants hold an object lightly with their teeth in a horizontal position (although we used wooden popsicle sticks instead of a pen; similar to Andreasson, 2008).

Participants in the positive facial expression condition were told: “You have been randomly assigned to the group that will activate the orbicularis oculi facial muscle. You can do this by putting this (the researcher was holding a popsicle stick) between your teeth, holding it very lightly, and raising your cheeks away from the stick. So please take one of these sticks and try to do this now, and I will guide you through the steps” (See Figure 1). These particular directions were created to induce participants to express a Duchenne smile (Duchenne, 1862/1990; Ekman, 1992). Unlike the basic smile, which recruits only the zygomaticus major muscles, the Duchenne smile also involves the orbicularis oculi, which typically creates wrinkles outside the corners of each eye. Research has shown that the Duchenne smile is more often present when participants report feeling positive emotions (see Ekman, 1992; and Soussignan, 2002 for reviews).

Negative Facial Expression. For the negative facial expression, we combined ideas from Andreasson’s (2008) study and Martin, Harlow, and Strack’s (1992) study. Andreasson (2008) used a wooden stick that the participant held between their protruded lips as a “sulky” condition so that facial muscles associated with smiling could not be used. In Martin et al.’s study (1992), for their “anger” condition, participants bit down firmly on a piece of paper towel. We wanted to produce a negative expression, while being able to mitigate the chances of the participant contracting facial muscles related to smiling. To accomplish this, we had participants bite down on a wooden stick while protruding their lips around it. Another difference with this study and Andreason’s (2008) is that for this procedure the stick will be protruding out from the mouth as opposed to horizontally across the lips. This is similar to the “lips” condition in Strack, Martin, and Stepper’s study (1988) that was used to inhibit smiling. This kind of lip pressing causes the contraction of the orbicularis oris muscles, which are involved in the expression of anger (e.g., Ekman & Friesen, 1975).

Participants in this condition were told: “You have been randomly assigned to the group that will activate the orbicularis oculi facial muscle. You can do this by putting this (the researcher was holding a popsicle stick) in your mouth, pressing your teeth on the stick lightly, and wrapping your lips around it. So please take one of these sticks and try to do this, and I will guide you through the steps" (see Figure 1).

Neutral Facial Expression. For the neutral facial expression condition we had participants attempt to maintain a relaxed and emotionless expression while having a wooden (popsicle) stick between their lips. Participants in this condition were told: "You have been randomly assigned to the group that will relax the orbicularis oculi facial muscle. You can do this by putting this (the researcher was holding a popsicle stick) between your lips lightly and trying to keep your facial muscles relaxed. So please take one of these sticks and try to do this now" (see Figure 1).

All three groups were then told: "The EMG software works in waves, and so we will be doing three waves of data collection today. But each wave takes only a couple minutes. And since just sitting there while data is being collected isn't the most interesting thing to do, we've set up some comics and symbols that we will be using next semester for you to rate so we can get an idea as to what results we may get, along with a couple other random things to make the time go by. But don't worry, everything is integrated and automatic, so all you need to do is follow the instructions."

To lend more credibility to the muscle-sensor device, the researcher then brought up a program that ostensibly showed the last person's EMG data. The researcher displayed the program Cool Edit 2000 (Syntrillium, Phoenix, AZ) that contained a complex series of buttons and a sample of a sound file that was in waveform view. The researcher stated, "And that was the last participant's data", then brought up another screen within the program that did not contain a wave file and stated, "Okay, we are set there."

All participants then rated the ten symbols, five comics, and their current mood on the computer using MediaLab software (Empirisoft, New York, NY). It has been suggested (e.g. Ekman, 1984; Matsumoto, 1987) that the duration of the facial expression may be of concern in facial feedback studies, since maintaining an expression for an unnaturally long period of time could lead to awareness of the affective meaning of the expression and discounting by the participant. In an attempt to control for such effects, we had participants stop the facial manipulation in-between each evaluative task. It is worth noting, though, that past studies have been successful in producing facial feedback effects while having participants hold their expressions for over two minutes (Laird, Wagener, Halal, & Szegda, 1982; Rhodewalt & Comer, 1979).

Prior to each set of ratings, the computer program informed participants: “The EMG software has begun processing. Please begin the instructed facial muscle manipulation (using the wooden stick), as well as maintain an upright, yet relaxed, body posture. You will be informed when enough data has been collected. Click the ‘continue’ button when you are ready.” After each task, the program stated: “This session of EMG data collection has been completed. You may now stop the facial muscle manipulation and then click continue.” Additional comics and symbols were displayed behind this window to give the illusion that the EMG software was a separate program that had interrupted the rating tasks, to bolster the notion that the rating tasks were just something to do while the data was being collected and not the main focus of the experiment.

Once the participant completed all the tasks, a message on the computer screen popped up stating that sufficient data had been gathered in terms of EMG activity. The program then informed the participant that they may remove the EMG sensors, throw away the wooden stick, and return to the seminar room.

The researcher then gave the participant a separate paper questionnaire to assess task difficulty and unpleasantness, if the participant understood Chinese characters, and whether the participant believed that there were any ulterior motives to the experiment. Finally, participants were verbally debriefed and asked not to discuss the study with anyone who might participate.

Results

Preliminary Analyses

Within the items that probed for suspicion, one participant stated that during the tasks she believed that the facial muscle manipulation may have been related to emotions, and so her data were removed. The remaining 161 participants did not express any suspicions related to the true purpose of the experiment.

Table 1 shows the descriptive statistics and correlations for the main measures. FI was positively correlated with PA, as well as with Post-PA, both of which were highly correlated with each other. PA was also positively related to Symbol ratings, but unrelated to comic ratings. There was also a correlation between Post-PA and symbol ratings. There was no correlation between comic and symbol ratings. With the exception of the symbols composites, all measures showed acceptable reliability. (We return to the lack of reliability for the symbols ratings momentarily.)

One-way analyses of variance (ANOVA) on ratings of difficulty and unpleasantness by condition showed no significant differences (difficulty: $F(2, 158) = 1.36$, $p = .26$; unpleasantness: $F(2, 158) = 1.52$, $p = .22$).

One-way ANOVAs tested for facial feedback effects on the three dependent measures (symbol ratings, comic ratings, and post-manipulation mood). For all three dependent variables there were no significant differences across conditions (symbol ratings: $F(2, 158) = .24$, $p = .79$; comic ratings: $F(2, 158) = 1.26$, $p = .29$; and Post-PA: $F(2, 158) = .09$, $p = .91$). Although these results suggest that facial feedback effects did not emerge, in general, they do not rule out the possibility of such effects within the context of individual differences in FI and PA, and so analyses next turned to the main predictions of the study.

Intuition, Positive Affect, & Facial Condition

To test whether FI, PA, and facial condition significantly contributed to predicting the dependent variables, hierarchical regression equations were computed. For all of these analyses, the covariates of difficulty and unpleasantness, as well scores on the FI scale and PA ratings were converted to mean deviation scores (Aiken & West, 1991). The three facial conditions were represented by two dummy variables. The first dummy coded the positive facial condition as 1 and the other two conditions (negative and neutral) as 0. The second coded the negative condition as 1 and the other two conditions (positive and neutral) as 0. The two- and three-way interactions were represented by the products of these dummies and the mean deviation scores for FI and PA.

Symbol Ratings

As can be seen in Table 1, the reliability of the symbol ratings composite (α = .02) was essentially zero, indicating that aggregating these ratings to produce a composite is inappropriate. The wording of the instructions for this particular task may have contributed to this lack of reliability. Participants were asked to "mark how positive or negative you feel the adjective may be that the Chinese symbol represents." A likely assumption by the participants was that the collection consisted of a relatively equal number of positive and negative symbols. Therefore, to examine the potential facial feedback effects on this variable, we decided to examine just the *first symbol rating*. Although focusing on a single rating is not optimal, using this first rating makes sense, since it was the first response given by participants to an ambiguous stimulus during the manipulation.

For the first analysis, evaluations of the first symbol were regressed hierarchically on the covariates (Step 1), followed by the main effects of condition (the two dummy variables), FI, and PA (Step 2), all possible two-way interactions (Step 3), and finally the three-way interactions (Step 4). In this analysis, the only significant change in R^2 occurred on the fourth step, consisting of the three-way interactions (R^2_{change} = .037, p = .05). Of these interactions, only the interaction involving the first condition dummy variable (positive vs. negative & neutral) was significant (β = .23, p = .05). Not including the covariates in the regression equation, β = .21 for the three-way, (p = .065).

In order to examine this significant three-way interaction further, we dropped the predictors associated with the second dummy variable (negative vs. positive & neutral). As can be seen in Table 2, the first three steps, consisting of the covariates, main effects, and two-way interactions, did not contribute to a significant R^2 change. The fourth step, consisting of the three-way interaction between FI, PA, and facial condition, did contribute significantly to a change in R^2. Not including the covariates in the regression equation still resulted in a significant three-way interaction (R^2_{change} = .029, β = .21, p = .03).

To probe this three-way interaction, hierarchical regression equations were computed within the positive condition and within the negative and neutral conditions combined. Figure 2 shows the means generated for those high and low (± 1 *SD* from the mean) in FI and PA within the facial conditions. Although neither of the two-way interactions reached significance, examining the differing patterns across facial condition reveals that individual differences in intuitive processing moderated the relationship between state PA and evaluations of the stimuli across the facial expression conditions. Within the negative and neutral conditions combined, for participants high in intuition, PA was essentially unrelated to symbol ratings (or showed a very slight negative trend). In the positive expression condition, PA related to more positive symbol ratings for those high in intuition. Put another way, for intuitive individuals, when facial expressions conflicted with PA, PA did not inform evaluations of the symbol. However, when facial expressions were positive, PA was strongly related to those evaluations. For those low on intuition, PA was related to evaluations when it conflicted with facial expression condition but not while they were posing a positive facial expression. Indeed, for these individuals, the positive facial expression appears to have led to a discounting of or correction for current affect in their evaluations of the affective tone of the symbol. Thus, although the unreliability of the measure precluded analyses of the aggregated symbol ratings, analyses of the first symbol provide preliminary support for the notion that FI and PA play a role in facial feedback effects. The significant three-way interaction suggests that the negative/neutral facial expressions dampened the relationship between PA and symbol ratings among those high on intuition, whereas positive facial expressions enhanced this relationship. Next, analyses turned to the comic ratings.

Comic ratings

For the first analysis, the aggregated comic ratings were regressed hierarchically on the covariates (Step 1), followed by the main effects of condition (the two dummy variables), FI, and PA (Step 2), all possible two-way interactions (Step 3), and finally the three-way interactions (Step 4). Similar to the first symbol results, in this analysis, the only significant predictor was the three-way interaction between FI, PA, and the facial condition dummy variable (positive vs. negative & neutral; $\beta = .23$, $p = .049$). Not including the covariates in the regression equation, $\beta = .22$ for this interaction ($p = .059$). Once again, in order to examine this interaction, we dropped the predictors associated with the second dummy variable (negative vs. positive & neutral), regressing comic ratings on the covariates, the dummy variable for positive (vs. other) facial expressions, FI, PA, and their two- and three-way interactions.

As can be seen in Table 3, the first three steps, consisting of the covariates, the main effects, and the two-way interactions did not contribute to a significant change in R^2. The fourth step, consisting of the three-way interaction between FI, PA, and facial condition, did significantly contribute to R^2. Not including the covariates in the regression equation still resulted in a significant three-way interaction ($R^2_{change} = .032$, $\beta = .22$, $p = .02$). In order to decompose this three-way interaction, hierarchical regression equations were computed within each level of the condition dummy variable. Figure 3 shows the means generated for those high and low (± 1 *SD* from the mean) in FI and PA for each facial condition. Within the negative and neutral facial conditions combined there was a significant interaction between FI and PA in predicting comic ratings ($R^2_{change} = .049$, $\beta = -.22$, $p = .02$). No significant interaction was found between FI and PA within the positive facial condition. Within the negative/neutral condition, for participants high in intuition, PA was related to somewhat lower ratings. An opposite effect was found in the positive condition, such that PA related to enhanced ratings for those high in intuition who were posing a positive facial expression. Overall, the pattern for those high on intuition is similar to that found for the symbol ratings across the facial expression conditions, with the negative/neutral expression leading to a lower reliance on PA in evaluations, while the positive expression led to greater reliance on PA in evaluations.

Thus, with regard to the comic ratings, predictions were partially supported. As predicted, FI and PA interacted to predict enhanced effects of facial expression on these ratings. However, and importantly, differential effects of the negative and neutral expressions were not found. Past research has shown that inhibiting the ability to portray facial expressions can affect emotional experience (e.g., Davis, Senghas, & Ochsner, 2009; Gross & Levenson, 1997; McCanne & Anderson, 1987). The present results suggest that negative and neutral expressions may both be viewed as inhibiting facial activity associated with PA.

Post-Manipulation PA

Finally, analyses examined whether FI and PA interacted with condition to produce facial feedback effects on self-report positive mood. In all analyses, no significant interactions were found, and only initial PA served as a significant predictor of later PA (e.g., in the initial equation, β for pre-PA = .77, $p < .001$). Since Post-PA may have at least partially been a function of amusement in response to the comics, we conducted the same hierarchical analyses as before but included the comic ratings composite (converted to a mean deviation score) as a covariate on the first step of the equation. Again, only initial PA served as a significant predictor (β for pre-PA = .77, $p < .001$) and there were no significant interactions. These results, clearly, do not support predictions, but it is notable that the lack of variance left to be explained in Post-PA controlling for the main effects of Pre-PA render these null results unsurprising.

Discussion

The current study provides support for the hypothesis that individual differences in intuition and state PA interact to promote increased susceptibility to facial feedback. Specifically, individual differences in intuition moderated the relationship between PA and evaluations of an ambiguous stimulus (the symbol) as well as mildly amusing comics. These results add to the facial feedback literature by not only further acknowledging the importance of assessing individual differences, but also specifically identifying the role intuitive processing and positive affect play in such effects. Considering that we did not find a simple moderating effect for faith in intuition, these results also complement past research involving individual differences in intuitive processing (King, et al., 2007; King & Hicks, 2009) by adding further support to the idea that PA is an important variable to consider when assessing a person's reliance on intuition (Hicks, et al., 2010). In line with the interpretation by King, et al. (2007), the intuitive system may provide the initial inclination to listen to the feelings elicited from a facial expression, whereas PA informs the participant that such feelings are to be trusted. As such, we did find the hypothesized three-way interaction of FI, PA and facial condition in predicting first symbol and comic composite ratings when contrasting the positive expression with the other expressions (negative and neutral).

In assessing whether a negative facial expression (compared to positive and neutral expressions) would interact with FI and PA to produce significantly more negative evaluations, the predicted three-way interaction was not found. These results can be attributed to the fact that both the negative and neutral conditions restricted the ability portray positive expressions, which has been shown to dampen emotional experience (e.g., Davis, Senghas, & Ochsner, 2009; Gross & Levenson, 1997), thus producing similar results. Considering we did not have negative stimuli for evaluation, the lack of differential effects of the neutral and negative expressions suggests that the present results might be understood in terms of the general match vs. mismatch of facial expressions with the affective tone of the stimuli.

In terms of the positive versus other conditions results for the first symbol and comic evaluations, we suggest that two different processes were occurring for participants high in intuition versus those low in intuition. For highly intuitive participants, PA related to a greater reliance on their intuition (Fredrickson, 1998), which, taking into consideration the results of past studies (Hicks, et al., 2010; King, et al., 2007; King & Hicks, 2009), increased the impact of their facial expressions. This would explain why, for participants high in intuition in the neutral/negative conditions combined, PA was related to lower evaluations. Alternatively, in the positive condition, PA was related to *higher* evaluations for those high in intuition. This would suggest that for highly intuitive participants in both facial conditions, PA was related to facial expressions being more influential, thus leading participants to misattribute the feelings created by their expressions onto the evaluations. Such an interpretation is in keeping with the notion that PA may not so much activate intuitive processing as inhibit rational second-guessing, discounting, or correction (Hicks, et al., 2010).

The Congruence of Facial Expression and Stimuli

Taking into account the fact that the comics were meant to be amusing, and that no negatively valenced stimuli were used in the present study, an alternative interpretation pertaining to the high FI participants is also possible. Highly intuitive people are, by definition, more affected by gut feelings. In interpreting the three-way interaction between FI, PA, and facial condition, it is also possible that highly intuitive people are more affected by an incongruence in affective sources. This can be interpreted as different sources of affect that produce conflicting feelings. Robinson and Demaree (2007) described this as “expressive dissonance,” and showed that such a form of incongruence resulted in participants performing worse on memory tasks and displaying greater sympathetic arousal. Within the current study, for participants high in intuition and in the negative/neutral condition, the higher in PA they were the more their initial mood conflicted with their assigned negative/neutral facial condition. This contrast may have produced a negative core affect, which was then attributed to the symbol or comics. This process can also explain the results for the highly intuitive participants in the positive condition: the *lower* in PA they were the more their initial mood conflicted with their assigned *positive* facial condition, thus producing a negative core affect, which was then attributed to the symbol or comics.

For participants low in FI, opposite slope trends were generally found. These participants (having reported a low faith in intuitive thinking) might not have relied very much on the “gut feelings" elicited from the facial expressions, and may have even had a reaction to the expressions they were assigned to make. This notion is in line with past research suggesting that when attention is drawn to an irrelevant source of feelings the influence of such a source on evaluations is reduced or eliminated (e.g., Cesario, Grant, & Higgins, 2004; Schwarz & Clore, 1983; Wilson & Brekke, 1994). This process would help explain why, for participants low in intuition in the negative/neutral conditions combined, PA related to *higher* ratings, despite their expressions. It is possible that, the higher their initial mood was, the more apparent it became that it contrasted with their facial condition, thus motivating them to discount their expression as an evaluative source. In a similar sense, for those low in intuition in the positive condition, PA related to *lower* ratings, again as perhaps a reactance to the presumed effects of their assigned facial expression. It would seem plausible that participants low in intuition would be more attentive to the fact that the facial expression enacted may be an irrelevant source of information, especially when the incongruence between their initial mood and their expression was more pronounced.

Facial expressions have been shown to have an integral part in intuitive processing (e.g., Topolinski, et al., 2009; Topolinski & Strack, 2009a), which may help explain the relatively minor role PA played for highly intuitive people within the negative/neutral condition. The present results suggest that facial expressions may provide a gateway that connects intuitive processing to current mood. For intuitive individuals, only when their expressions suggested positive mood did these individuals follow their current PA in making evaluations. Perhaps the negative or neutral facial expressions led intuitive participants to discount their initial mood, which would explain as to why there was essentially little difference in evaluations. This is particularly relevant to past research that has looked at individual differences in faith in intuition and has shown significant effects of PA (Hicks, et al., 2010; King, et al., 2007; King & Hicks, 2009). In all of the previous studies of PA and intuition, highly intuitive individuals have been found to use PA as a source of information for a variety of judgments. The present results in the negative and neutral conditions stand out as an interesting exception. When a facial expression did not support this reliance on PA, highly intuitive individuals did not rely on PA in rendering judgments. These results suggest that the importance of researching mood-congruent facial expressions in the relationship between mood and judgments, particularly for those who are highly intuitive.

Many studies have shown that different processing styles produce distinct behaviors and evaluations (e.g., Epstein, Lipson, Holstein, & Huh, 1992; Jordan, Whitfield, & Zeigler-Hill, 2007; Simon, et al., 1997). This reasoning would lend itself well to the appropriateness of interpreting the present results in terms of different mental processes. We suggest that for intuitive participants, PA led to a misattribution of the core affect created by the facial expression onto the symbol and comics. Alternatively, for participants low in intuition, the more their mood conflicted with the facial expression, the more the potential for misattribution became apparent, and thus a more deliberate attempt was made to not allow their expressions affect their evaluations.

Limitations and Future Directions

The low reliability of the symbol ratings composite suggested to us that perhaps our method of administering the evaluation task led to sporadic answers. The wording of the instructions for this particular task is what we would suggest most likely led to this problem. Participants were asked to “mark how positive or negative you feel the adjective may be that the Chinese symbol represents.” As noted earlier, it is likely that the participants took on the assumption that the collection of symbols consisted of a relatively equal number of both positive and negative symbols. One suggestion for future studies wishing to use this stimulus in a similar manner would be to not describe the symbols as being either positive or negative in nature, and to instead have participants simply rate how much they like each symbol (similar to the comic evaluations).

Past facial feedback research has used a variety of dependent variables in assessing the effects that certain facial expressions have on participants. Our current study included positive stimuli (i.e., comics) and neutral stimuli (i.e., ambiguous symbols). Future research could explore the potential effects that intuitive processing and mood have on facial feedback in terms of negative stimuli. Several past studies have already used negative stimuli within a facial feedback paradigm (e.g., Gross & Levenson, 1997; Soussignan, 2002), so it would just be a matter of measuring the additional individual difference variables. We would expect to find similar results as those found in the current study, such that for participants high in FI, PA would lead them to be more swayed by their assigned facial expression, and thus find the negative stimuli more negative if portraying a negative facial expression, and less negative if portraying a positive facial expression. In fact, not having a negative stimulus for a dependent variable may be the reason why we did not observe any significant differences between the negative and neutral facial conditions in the current study.

As mentioned earlier, past research on the misattribution of mood has shown that such effects can be reduced or eliminated if participants become aware that their moods could be attributable to a different source (e.g., Cesario, Grant, & Higgins, 2004; Schwarz & Clore, 1983; Wilson & Brekke, 1994). Facial feedback methodologies that attempt to conceal the fact that facial expressions are being enacted can be seen as inherently attempting to thwart the possibility of participants becoming aware of the potential for misattribution. Typical methods of concealment include using cover stories and having researchers guide participants in performing emotion-analogous facial movements, as opposed to overtly requesting the enactment of emotion-related facial expressions (e.g., Andreasson & Dimberg, 2008; Larsen, Kasimatis, & Frey, 1992; Strack, Martin, & Stepper, 1988; Zajonc, Murphy, & Inglehart, 1989). Whether specific cues informing participants of the irrelevance of facial expressions to feedback effects causes them to discount such feelings has yet to be directly assessed in facial feedback research (see Davis, Senghas, & Ochsner, 2009). Future research could examine this issue by including a group that is explicitly told their facial muscle arrangements may have an effect on their mood and subsequent decisions. It may be that participants informed of their facial expressions as a potential irrelevant source of information would discount those expressions. The desire to not misattribute feelings elicited by the facial expression may even cause participants to discount their initial mood – which could be thought of as misattributing one source due to not wanting to misattribute another. In terms of individual differences in intuition and PA, considering that highly intuitive, happy people are particularly likely to listen to experiential vibes; this discounting effect may be less pronounced in such a group.

Both intuitive processing and mood are amenable to laboratory manipulations. As such, to strengthen the case for this relationship, the next step would be to manipulate intuitive mindset and mood. For example, in the study conducted by Simon et al. (1997), the appearance and manner of the experimenter was varied between informal and formal as a means of putting participants in either an intuitive or analytic mode of thinking. Such a manipulation might prove useful in establishing the causal role of intuitive processing in facial feedback effects. It would also be interesting to examine whether PA continues to play a role in these effects even when intuitive mindset is experimentally induced. In terms of manipulating mood, a number of procedures have been successfully used in past research (for a review see Westermann, Spies, Stahl, & Hesse, 1996).

The present results suggest that, as long as we are in the right mindset, we tend to believe what our body tells us. Considering the research pertaining to visceral cues beyond facial expressions, there are many other methodologies that could be employed in which a broader understanding of the interaction of intuitive processing style and bodily feedback could be developed. As mentioned earlier, research has shown feedback effects involving posture (e.g., Duclos, Laird, Schneider, Sexter, Stern, Van Lighten, 1989; Flack, Laird, & Cavallaro, 1999), head movements (e.g., Tom, Pettersen, Lau, Burton, Cook, 1991; Wells & Petty, 1980), hand gestures (e.g., Chandler & Schwarz, 2008), as well as others. For example, yawning (indicating boredom; e.g., Provine & Hamernik, 1986) or leg shaking (indicating anxiety; e.g., Monti, Kolko, Fingeret, & Zwick, 1984) might be interesting directions to pursue.

An additional possibility is suggested by a study conducted by Mori and Mori (2007) involving "passive" facial feedback. This study entailed having water droplets placed near the lacrimal ducts of participants and allowing them to flow down the cheek like real tears. A control group had water droplets flow down their temples. The experimental group showed a bias towards self-reported sadness. This is the only study involving such a cutaneous sensation, so attempting to replicate the results would have merit alone. Conducting such an experiment could lend support to the idea that perhaps muscular movements normally associated with an emotionally-connected activity are not necessary for feedback effects, and that perhaps the physical sensations alone associated with an activity can be sufficient to produce such effects. It may be, though, that such leaps from mere physical sensations to the evocation of emotions can only occur when someone is in a highly intuitive mindset and in a particularly good mood. The current study, and past research, provides initial support for this contention, but only future research will bring us towards the answers to such questions.

Footnotes

[1] Negative affect (NA) was also assessed with four negative affect descriptors, including "sad", "angry", "frustrated", and "disappointed" (*M* = 1.55, *SD* = 1.41, α = .72). No significant results were found in the analyses incorporating this composite variable and therefore they are not discussed.

[2] An outcome measure of negative affect (Post NA) was also assessed with four negative affect descriptors, including “sad”, “nervous”, “angry”, and “frustrated”. No significant results were found in the analyses incorporating this composite variable and therefore they are not discussed.

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Table 1

Descriptive Statistics, Reliabilities, and Correlations among Measures

	1	2	4	5	6
1. FI	**.83**	.41**	.14	.14	.24**
2. PA		**.81**	.11	.27**	.74**
4. Comics			**.48**	.07	.15
5. Symbols				**.02**	.32**
6. Post PA					**.87**
M	6.74	6.33	3.51	4.26	6.49
SD	1.38	1.52	0.83	0.60	2.04

Note. $N = 161$. Coefficients on the diagonal in bold are alpha reliabilities.
FI = Faith in Intuition; PA = Positive affect rated prior to facial manipulation;
Comics = composite ratings of comics; Symbols = composite ratings of symbols;
Post PA = Positive affect rated during facial manipulation.
* $p < .05$. ** $p < .01$.

Table 2

Hierarchical Regression Predicting First Symbol as a Function of Faith in Intuition, Positive Affect, and facial condition controlling for ratings of difficulty and unpleasantness

Variables entered on step	B	β
Constant	2.94	
Covariates (R^2_{change} = .019, *ns*)		
Difficulty	-.05	-.06
Unpleasantness	-.10	-.11
Main effects (R^2_{change} = .006, *ns*)		
Faith in Intuition	-.16	-.14
Positive Affect	.06	.05
Facial Condition	.01	.00
2-Way interactions (R^2_{change} = .015, *ns*)		
Faith in Intuition X Positive Affect	-.08	-.11
Faith in Intuition X Facial Condition	.39	.18†
Positive Affect X Facial Condition	-.14	-.08
3-Way interaction (R^2_{change} = .030, $p < .05$)		
Faith in Intuition X Positive Affect X Facial Condition	.28	.22*

Note. Multiple $R = .27$, $R^2 = .07$, $F(1,151) = 4.92$, $p = .03$; facial condition was coded: 0 = Negative & Neutral facial expression, 1 = Positive facial expression.

† p = .08 * $p < .05$.

Table 3

Hierarchical Regression Predicting comic ratings as a Function of Faith in Intuition, Positive Affect, and facial condition controlling for ratings of difficulty and unpleasantness

Variables entered on step	B	β
Constant	2.63	
Covariates (R^2_{change} = .009, *ns*)		
Difficulty	.00	.00
Unpleasantness	-.04	-.09
Main effects (R^2_{change} = .029, *ns*)		
Faith in Intuition	.04	.07
Positive Affect	.01	.02
Facial Condition	-.28	-.16†
2-Way interactions (R^2_{change} = .021, *ns*)		
Faith in Intuition X Positive Affect	-.08	-.23*
Faith in Intuition X Facial Condition	.09	.08
Positive Affect X Facial Condition	.05	.06
3-Way interaction (R^2_{change} = .034, $p < .05$)		
Faith in Intuition X Positive Affect X Facial Condition	.15	.23*

Note. Multiple R = .31, R^2 = .09, $F(1,151)$ = 5.59, p = .02; facial condition was coded: 0 = Neutral & Negative facial expression, 1 = Positive facial expression.

† p = .08 * $p < .05$.

Figure Captions

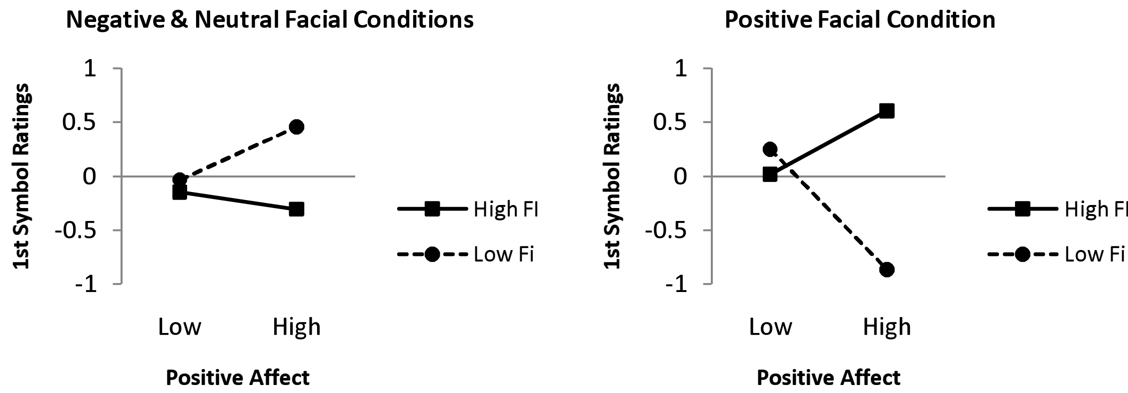
Figure 1. Illustrations of the techniques used to induce the facial expressions: (a) positive, (b) negative, and (c) neutral.

Figure 2. The interaction of facial condition (negative vs. positive & neutral) and Faith in Intuition (FI) predicting First Symbol Ratings.

Figure 3. The interaction of facial condition (negative & neutral vs. positive), Positive Affect (PA), and Faith in Intuition (FI) predicting Comic Ratings.

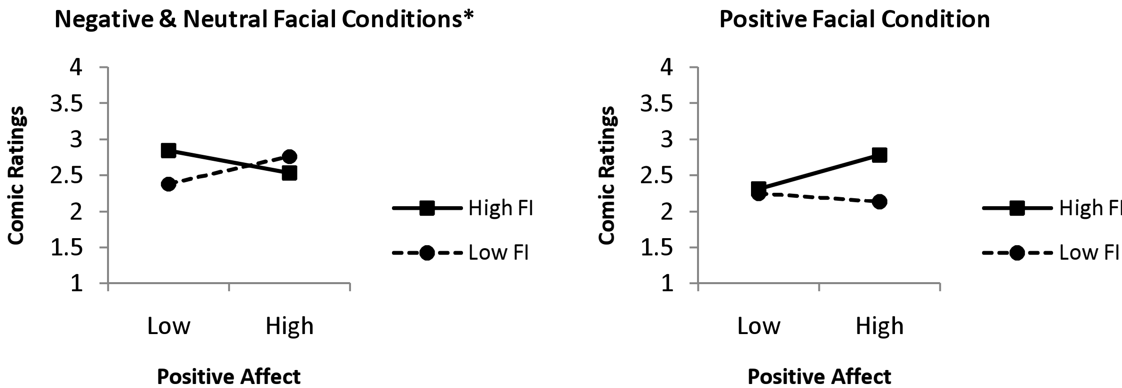
Figure 1.

Figure 2.



Note. Symbol ratings were from -3 (Very negative) to 3 (Very positive).

Figure 3.



Note. Comic ratings were from 0 (Not at all amusing) to 5 (Very much amusing).

*Significant interaction between FI and PA ($p < .05$).

Appendix A.

Examples of the Symbols Used.