

The Effect of Demand Characteristics on Facial Feedback Effects

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Abstract

Previous facial feedback experiments have resulted in mixed outcomes and small effect sizes. Because of this, researchers have suggested that variability in experimental validity may be to blame, namely demand characteristics. To address this, we created an experiment to see how demand characteristics might influence the facial feedback effect. We told participants different hypotheses about the facial feedback effect: that it exists, or that it doesn't. Then, we had participants smile, scowl, and maintain a neutral expression. We found that demand characteristics influence facial feedback effects. Our results confirm that telling participants that the effect is real increases facial feedback effects and that telling participants that the effect is not real decreases facial feedback effects. Interestingly, we found a small, yet significant, effect even after telling participants that we were trying to prove that the facial feedback hypothesis is false. This finding shows that facial feedback isn't completely driven by demand characteristics.

Introduction

Many modern theories of emotion posit that sensorimotor feedback from the peripheral nervous system influences emotion (James, 1884). According to these theories, changes in the peripheral nervous system should lead to changes in emotional experience. One way of investigating this prediction is by manipulating facial expressions of emotion. The facial feedback hypothesis posits that when individuals make a facial expression of an emotion, then that physical change influences their emotional experience towards that emotion (Adelmann & Zajonc, 1989). This hypothesis is derived from broader theories that suggest sensorimotor feedback from the peripheral nervous system creates emotional experience. For example, the simple act of posing a smile can produce happiness; feeling happy can be influenced by them smiling in addition to the person's happiness influencing them to smile.

To date, evidence for the facial feedback hypothesis has been mixed. A seminal study found that the facial feedback effect occurred when participants unknowingly made smiling faces and evaluated humorous material (Strack, Martin, & Stepper, 1988). They directed participants to hold a pen in their mouth in two different ways to create and inhibit a smile. After performing tasks using the pen, they were asked to rate a cartoon on its funniness. They found that the cartoons were rated the funniest when creating a smile with the pen, and least funny when inhibiting a smile. However, recent replications of this study have failed, with some attributing this failure to the effect being either weak or completely false (Wagenmakers et al. 2016; Strack, 2017). This hypothesis has also been tested using other experimental models. Researchers have found that making the facial expression and/or postures of various emotions such as fear, happiness, anger, and disgust resulted in participants rating higher levels of the corresponding emotions (Larsen, Kasmatas, & Frey, 1992; Duclos et al., 1989). However, a facial feedback effect has not been found for surprise (Reisenzein, Studtmann, & Horstmann, 2013). Nevertheless, an examination of the cumulative evidence via meta analysis suggests that facial feedback can have a small effect on emotional experience (Coles, Larsen, & Lench, 2019). Despite this, the evidence remains mixed.

Demand Characteristics

As explained below, a common explanation is that these effects are not real, but are the result of demand characteristics (Kaiser & Davey, 2017). Demand characteristics are cues in a study that make participants aware of the study's hypothesis (Orne, 1962). While demand characteristics come in many forms (Sharpe & Whelton, 2016), the most popular has to do with the result of hypothesis awareness and the "good participant" role (Orne, 1962). A participant becomes aware of the hypothesis. Then, as a result of this awareness and wanting to please the researcher, the participant reports what they think the researcher wants to hear, not what they are truly experiencing.

Demand characteristics are particularly concerning to facial feedback researchers for multiple reasons. First, many methods used in facial feedback research may alert participants about the experimenter's interest in studying facial feedback effects. For example, a participant directed to raise their cheeks and show their teeth might guess they are being asked to smile. Second, self-reports are the primary means to measure emotions, which are easily changed by the participant. Emotions are subjective in nature, which necessitates subjectivity within these experiments (Larsen & Fredrickson, 1999). Consequently, if participants become aware that the experimenter is testing the effects of posed smiles on happiness, they have the ability to adjust their self-reports accordingly. Third, if references to popular media are any indication (Spector, 2017), people believe that smiling influences happiness. As such, participants do not need formal education on the facial feedback hypothesis to deduce that the experimenter is interested in the effects of smiling on happiness. To summarize, facial feedback experiments are particularly vulnerable to demand characteristics because it is easy for participants to guess that the experiment is interested in emotions, participants can easily change their self-reports of emotions, and many participants are familiar with the idea of facial feedback.

To address these concerns, facial feedback researchers have Kaiser & Davey (2017) found that when controlling for participant's awareness of the hypothesis, the facial feedback effect was only found in participants that were aware of the study's interest in emotion. In this study, participants were told to change eyebrow and cheek muscles to create a smile, a frown, and a neutral expression while reading statements that were clearly positive, clearly negative, and ambiguous. Then, participants completed a

two part debrief to determine awareness of the study's hypothesis; participants that mentioned emotional expressions in an open-response portion were deemed aware, participants that selected relevant hypotheses from a checklist of possibilities were deemed to have prompted awareness, and those that did neither were completely unaware. This study only found a facial feedback effect in participants that were completely aware, not in those who had prompted awareness or were unaware. Specifically, while all groups had a main effect for statement type, the aware group was the only one who had a main effect of pose on their ratings of the ambiguous statement. This study corroborates previous beliefs that facial feedback effects may be driven by demand characteristics.

Addressing Demand Characteristics in Facial Feedback Experiments

To date, facial feedback researchers have used two broad approaches to addressing demand characteristics. First, some researchers measure and control for the degree to which participants are aware of the purpose of the experiment, often through a digital survey or in-person interview. If there is any indication that the participant believed that the experiment had to do with emotions, then their data is analyzed, and either controlled or excluded as statistically appropriate (Duclos et al., 1989; Reisenzein & Studtmann, 2007). However, there are a few limitations of this method. First, these interviews do not occur until the end of the experiment, so it is often unclear if participants were aware of the purpose of the study during vs. after the study. Furthermore, participants who are already trying to be good participants might also intentionally deny awareness of the experiment's purpose (Orne, 1962).

A second approach that facial feedback researchers use to address concerns about demand characteristics is to deceive the participant about the true nature of the study. For example, Strack, Martin, & Stepper (1988) influenced participants to smile or pout by directing them to hold a pen in their mouth in different ways. However, deception requires more complicated directions that may be unclear to the participant. Consequently, participants may be unable to follow these directions correctly and may create expressions that do not resemble a genuine expression of emotion (Soussignan, 2002). Another flaw is that after this, an interview must be conducted to determine the experimenter's success in deceiving the participant. Because of this, the experiment then involves previously mentioned issues of

trusting the participant's word and our own assumptions on the relationship between participant awareness and demand characteristics.

Our experiment seeks to examine the effects of demand characteristics using a third approach: *manipulating* demand characteristics. To do this, we will present participants with explicit hypotheses and examine how each hypothesis changes as a result. In our study, we either told participants that we believe that the facial feedback effect exists, told them that the facial feedback effect does not exist, or kept the participants unaware of our interest in the facial feedback effect. While eliminating demand characteristics may be a simpler experimental model, manipulating them provides a more rigorous test. If the facial feedback effect is false and is driven solely by demand characteristics, then there should be no effect found when participants are told that the effect is false. However, finding the effect in this condition would be strong evidence that the facial feedback effect exists.

We hypothesize that participants are told that the facial feedback effect exists, then demand characteristics will cause them to report more intense emotions than if we tell them nothing or that we do not believe in the facial feedback hypothesis. Furthermore, we also believe that telling the participant that we do not believe in the facial feedback hypothesis will influence participants to report a null effect.

Method

Design

Two hundred fifty undergraduates from the University of Tennessee - Knoxville participated in this study. Our experiment followed a 3 (demand characteristic: confirmative, disputative, control) x 3 (pose: smile, scowl, neutral) mixed-design, where demand characteristics and pose were manipulated between- and within-subjects, respectively. For our demand characteristics manipulation, we changed whether researchers endorsed the facial feedback hypothesis or not, with a control group where our interest in facial feedback was not mentioned. Prior to the experiment, the computer randomly assigned the participant to the confirmative characteristic, disputative characteristic, or control group. Then, during the experiment, each participant completed happy, angry, and neutral facial expressions two times each.

Procedure

Participants were told that they were participating in a study examining the effect of small movements on galvanic skin response (GSR). This was done so that participants in each condition would be aware of our interest in facial movements without causing suspicion to those in the control condition. Participants were then read a different script based on whether they were assigned to (1) a *confirmative characteristic* condition, (2) a *disputative characteristic* condition, or (3) a control condition. In the confirmative [disputative] characteristic conditions, participants were told:

“Researchers know that facial expression influences skin responses. However, they are not sure why. Some researchers think that this happens because posing a facial expression of emotion causes you to feel that emotion. That is, smiling may make you happier and scowling may make you angrier. We believe this is [is not] true. We are running this study to prove our hypothesis that posing a facial expression does [does not] cause you to experience that emotion.”

We overtly stated our hypotheses in reduce the chance that a participant would remain unaware of our experimental intent. Conversely, participants in the disputative demand condition were told that a common hypothesis of why facial expressions have a significant effect on GSR readings is that facial expressions influence emotion, but that we believed that this hypothesis is false and that we are running our experiment to prove it. Participants in the control group condition were not told of our interest in emotion prior to the experiment. We included this treatment to have a measurement of facial feedback effects without experimenter influence. After giving consent, the researcher attached two electrodes to the participant's left hand and told the participant to begin the experiment.

During the experiment, participants completed two blocks wherein they posed happy, angry, and neutral facial expressions for five seconds. The order of facial expressions was randomized within block. During the happy trial, participants were told to pull their cheeks towards their ears. During the anger trial, they were told to bring their eyebrows in and down towards their nose. During the neutral trial, they were told to maintain a blank neutral expression. After posing each facial expression, participants were asked to report their emotions using the Discrete Emotion Questionnaire (Harmon-Jones et al, 2016).

At the end of the experiment, participants were interviewed about their thoughts about the study. Experimenters were directed to administer a guided but flexible interview to determine whether participants were (a) aware of our interest in testing the relationship between facial expressions and emotions and (b) believed in the facial feedback hypothesis. All of these were measured on a scale of 0 to 4, with 0 being completely unaware and 4 being completely aware.

Results

Manipulation Checks

To ensure the validity of our results, it was important for us to demonstrate that our manipulations were successful. One way to examine this is by analyzing participant awareness. If our manipulation was successful, participants should be more aware we are testing facial feedback effects in the confirmative and disputative characteristic conditions when compared to the control condition. A one-way ANOVA test showed that awareness varied by demand characteristic condition, $F(2, 247) = 31.07, p < .001$. To investigate these differences, we conducted follow-up pairwise comparisons with Tukey HSD adjustments. We did not find that participants were more aware we were testing facial feedback effects in the confirmative characteristics condition than in the disputative characteristics condition ($M_{\text{diff}} = 0.41$, 95% CI [-0.05, 0.87], $p = .09$). However, participants were more aware we were testing facial feedback effects in the confirmative characteristics condition ($M = 2.93, SD = 1.21; M_{\text{diff}} = 1.54$, 95% CI [1.07, 2.01], $p < .001$) and disputative characteristic condition ($M = 2.52, SD = 1.38; M_{\text{diff}} = 1.13$, 95% CI [0.65, 1.60], $p < .001$) than in the control condition ($M = 1.39, SD = 1.22$). Because participants in the confirmative and disputative characteristic conditions were more aware of our interest in facial feedback than the control group, we can confirm that we successfully manipulated participant awareness of our hypotheses.

Another way of examining whether our demand characteristics manipulation was successful is to examine whether it influenced participants' beliefs about facial feedback effects. A one-way ANOVA confirmed that belief in the facial feedback hypothesis varied by demand characteristic condition, $F(2, 231) = 27.35, p < .001$. A follow-up pairwise comparisons with Tukey HSD adjustments found that participants were more convinced that facial feedback influences emotion in the confirmative

characteristic condition ($M = 2.84$, $SD = 1.22$) than in the disputative characteristic condition ($M = 1.34$, $SD = 1.39$, $M_{diff} = 1.49$, 95% CI [1.01, 1.98], $p < .001$) Furthermore, participants were more convinced that facial feedback influences emotion in the confirmative characteristic condition than in the control condition ($M = 2.31$, $SD = 1.38$, $M_{diff} = .52$, 95% CI [-.002, 1.04], $p = .049$). Finally, participants were more convinced that facial feedback influences emotion in the control condition than in the disputative characteristic condition ($M_{diff} = .97$, 95% CI [0.45, 1.49], $p < .001$). These results show that introducing confirmative characteristics increased belief in the facial feedback hypothesis (Fig. 2).

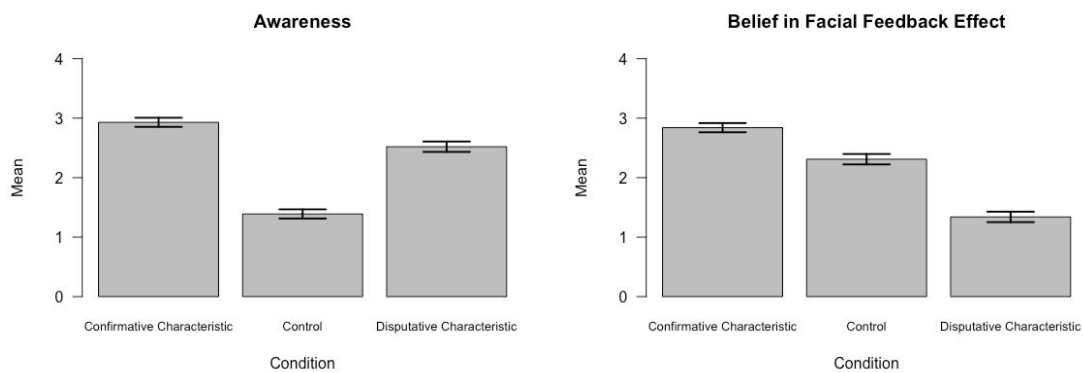


Figure 1. Participants' mean reported levels of awareness of our hypothesis and belief in the facial feedback effect in the confirmative characteristic, control, and disputative characteristic conditions. Error bars represent one standard error.

Self-reported Emotional Experience

We used a pair of multi-level models to analyze self-reported emotional experience ratings of happiness and anger. We entered pose and demand condition as effects-coded factors and random-intercepts for each participant.

Happiness

Consistent with the results of Coles et al. (2019), our analysis found a facial feedback effect for happiness. The multi-level analysis found a main effect of pose on self-reported happiness $F(2, 1235) = 246.03$, $p < .001$. A least-squares pairwise comparison found that participants reported more happiness

when posing smiling expressions ($M = 2.16$, $SD = 1.30$) versus neutral expressions ($M = 1.33$, $SD = 0.69$, $M_{diff} = 0.83$, 95% CI [0.74, 0.92], $p < .001$) and scowling expressions ($M = 1.24$, $SD = 0.56$, $M_{diff} = 0.92$, 95% CI [0.83, 1.01], $p < .001$). However, participants did not report more happiness when posing scowling expressions versus neutral expressions ($M_{diff} = 0.09$, 95% CI [0.00, 0.18], $p = .05$).

In addition to the effect of pose, we also found a main effect of demand characteristic condition $F(2, 247) = 7.34$, $p < .001$. In a follow-up least-squares pairwise comparisons, we did not find a significant difference in happiness ratings between participants in the confirmative characteristic condition ($M = 1.72$, $SD = 1.12$) and the control condition ($M = 1.63$, $SD = 1.01$, $M_{diff} = 0.09$, 95% CI [-0.09, 0.26], $p < .35$). However, participants reported significantly more happiness in the confirmative characteristic condition than the disputative characteristic condition ($M = 1.39$, $SD = 0.82$, $M_{diff} = 0.32$, 95% CI [0.15, 0.50], $p < .001$). Finally, participants reported more happiness in the control condition than the disputative characteristic condition ($M_{diff} = 0.24$, 95% CI [0.06, 0.42], $p = .008$).

Anger

Similarly to happiness, we found a significant facial feedback effect for anger. Our experiment found a main effect of pose on self-reported anger $F(2, 1235) = 146.33$, $p < .001$. A least-squares pairwise comparison found that participants reported more anger when posing scowling expressions ($M = 1.69$, $SD = 0.97$) versus neutral expressions ($M = 1.21$, $SD = 0.51$, $M_{diff} = 0.48$, 95% CI [0.42, 0.55], $p < .001$). We also found that participants reported more anger when posing scowling expressions versus smiling expressions ($M = 1.19$, $SD = 0.46$, $M_{diff} = 0.51$, 95% CI [0.44, 0.57], $p < .001$). However, participants did not report more anger when posing smiling expressions versus neutral expressions ($M_{diff} = -0.02$, 95% CI [-0.09, 0.04], $p = .51$).

In addition to the effect of pose, we also found an effect of demand characteristic condition, $F(2, 247) = 9.50$, $p < .001$. In a follow-up least-squares pairwise comparisons, we did not find a significant difference in anger ratings between participants in the confirmative characteristic condition ($M = 1.51$, $SD = 0.86$) and the control condition ($M = 1.37$, $SD = 0.71$, $M_{diff} = 0.14$, 95% CI [0.002, 0.48], $p = .05$). In addition, we did not find a significant difference in anger ratings between participants in the disputative characteristic condition than the control condition ($M = 1.21$, $SD = 0.54$, $M_{diff} = 0.30$, 95% CI [0.17, 0.44], p

< .001). However, participants reported significantly more anger in the confirmative characteristics condition than the disputative characteristic condition ($M_{diff} = 0.16$, 95% CI [0.02, 0.30], $p = .02$).

The role of demand characteristics

While previous results served to replicate previous findings, investigating the interaction of demand characteristics and facial expression on emotion provides more novel results. We found a significant pose by demand characteristics interaction ($F(4, 1235) = 24.60$, $p < .001$). First, there was a large facial feedback effect in the confirmative characteristic condition ($F(2, 1235) = 191.47$, $p < .001$, $d_{rm} = 1.19$). Next, there was a weaker, but significant, facial feedback effect in the control condition ($F(2, 1235) = 85.53$, $p < .001$, $d_{rm} = 0.92$). Most important, there was a small, but significant, facial feedback effect in the disputative characteristic condition ($F(2, 1235) = 16.79$, $p < .001$, $d_{rm} = 0.51$; Fig. 2). This result shows that while demand characteristics are able to influence participants towards a null hypothesis, the facial feedback effect is robust enough to remain significant despite unfavorable experimental conditions.

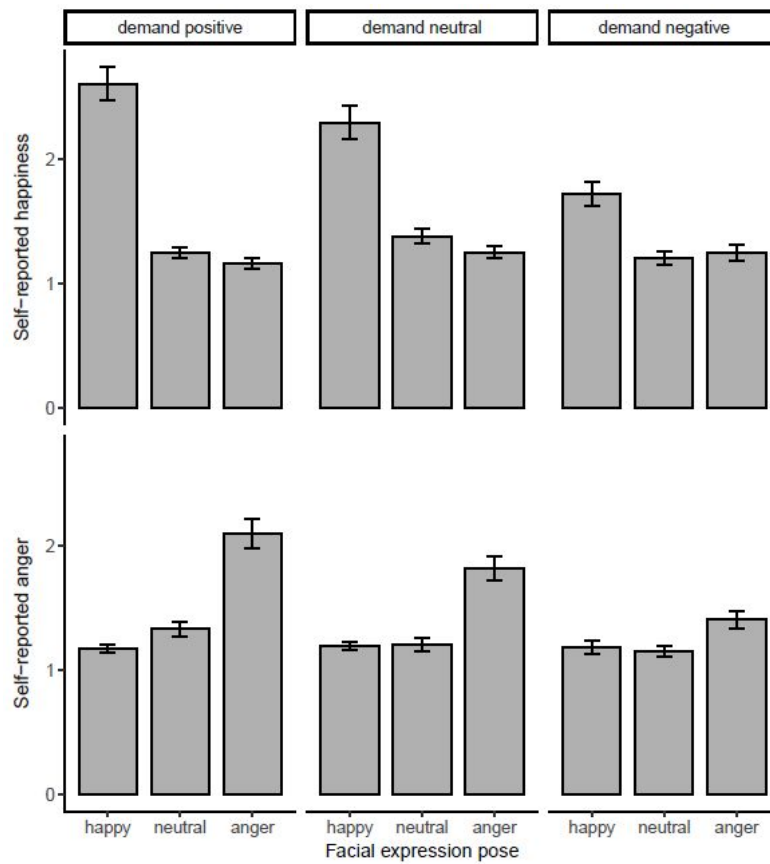


Figure 2. Mean happy and anger reports after posing happy, neutral, and angry expressions in the confirmative characteristic, disputative characteristic, and control conditions. Error bars represent one standard error.

Discussion

In this study, we examined how demand characteristics affect facial feedback results. While previous experiments address demand characteristics by deception, measurement, and statistical control, this study sought to experimentally manipulate them. Participants were told different hypotheses and then instructed to smile, scowl, and maintain neutral expressions. Our analyses revealed a significant facial feedback effect. Additionally, we found that demand characteristics have a significant effect on facial feedback results. When participants were told that the facial feedback effect is true, they reported feeling significantly happier when smiling and angrier when scowling as compared to the other groups. Conversely, those who were told that the effect is false reported the least happiness when smiling and

anger when scowling. Most importantly, a significant facial feedback effect was still found in the disputative characteristic condition. These results not only provide an example of a successful facial feedback study but also give more insight as to how this effect interacts with demand characteristics.

Facial feedback experiments have yielded mixed results, which leads many to question its validity. Our control condition was the most similar to previous facial feedback experiments (Coles et al, 2019). Thus, finding the effect in this condition provides a successful replication of the Many Smiles Collaboration and agrees with previous meta-analytic evidence (Coles, Larsen, & Lench, 2019; Coles, et al., 2019).

Our manipulation of demand characteristics yielded more novel results. Consistent with previous results, participants reported stronger facial feedback results when told that we believed the hypothesis is true. Most important, we found a reduced, but significant facial feedback effect when participants were told that the hypothesis is false. If facial feedback effects were completely driven by demand characteristics, then there should be no effect in this condition. Finding this effect after this strong test shows that facial feedback cannot be driven solely by demand characteristics.

Conclusion

Through our research, we can conclude that the facial feedback hypothesis is not driven solely by demand characteristics. However, there are still questions about demand characteristics and the facial feedback effect. The first question is if the effect of demand characteristics differ between types of facial feedback effects. There are two types of facial feedback effects: initiation and modulation (Coles, et al., 2019). Our study followed an initiation procedure, meaning that we investigated if facial expressions can produce emotion without an emotional stimulus. In modulation studies, researchers investigate how participants' facial expressions change their evaluation of stimuli, e.g. comics (Strack, Martin, and Stepper, 1988). By showing participants these stimuli, it may be easier for the participant to become aware of the hypothesis. With higher awareness comes more opportunity for the participant to be influenced. Studying facial feedback modulation effects using our experimental model would provide more information on how demand characteristics influence facial feedback participants.

The second question is how large the facial feedback effect truly is. Our control condition was most similar to other studies, but it is similarly susceptible to demand characteristics. Participants reported a moderate effect size, but the true facial feedback effect may be smaller. The most conservative result we have is from the disputative characteristic condition. This condition shifted the goal of a good participant from confirming the facial feedback hypothesis to rejecting it, and the effect found could be smaller than what is accurate. If researchers want evidence for the existence of an effect, then finding an effect using this conservative design will provide strong evidence. However, this model may not provide accurate information on the effect size. While we have demonstrated that the facial feedback effect exists, we must distinguish between genuine facial feedback effects and demand characteristics in order to understand their influence on the participant.

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