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## The effect of facial feedback on the evaluation of statements describing everyday situations and the role of awareness



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### A B S T R A C T

According to theories of embodiment enacting a smile or a frown can positively or negatively influence one's evaluations, even without awareness of one's facial activity. While some previous studies found evidence for facial feedback effects, recent replication attempts could not confirm these findings. Are our decisions throughout the day amenable to the state of our facial muscles? We tested the effect of smiling and frowning on the evaluation of emotional sentences describing everyday situations. While most previous studies based their assessment of awareness on verbal debriefing interviews without explicitly defined criteria, we employed a written debriefing questionnaire in order to avoid potential bias when identifying participants' awareness. Our results indicate that smiling/frowning increased/decreased sentence ratings only for participants aware of their expressions. This emphasizes the importance of more rigorous awareness tests in facial feedback studies. Our results support the view that facial feedback cannot necessarily influence us without conscious mediation.

### 1. Introduction

Human beings constantly evaluate their surroundings to identify both beneficial opportunities and situations that might pose a potential threat. Theories of embodiment suggest that our evaluations are partly shaped by the states of our body (Barrett & Lindquist, 2008; Laird & Lacasse, 2013; Niedenthal, 2007). For example it has been suggested that afferent feedback from the tension in our emotion-relevant facial muscles can influence our processing of affective stimuli (Adelmann & Zajonc, 1989; McIntosh, 1996). Simply put, we might perceive our surroundings as more positive when smiling and more negative when frowning. This so-called facial feedback theory was supported by some previous studies which found that people who are enacting smiles (as opposed to either frowning or being prevented from smiling) gave more positive ratings for stimuli like cartoons (Dzokoto, Wallace, Peters, & Bentsi-Enchill, 2014; Laird, 1974; Strack, Martin, & Stepper, 1988) facial expressions (Dimberg & Söderkvist, 2011) or short video clips (Davis, Senghas, & Ochsner, 2009; Soussignan, 2002). However, a recent replication project of several laboratory groups found no effect of facial expressions on the evaluation of cartoons, despite a sample size of altogether about 1.000 participants (Wagenmakers, Beek, Dijkhoff, & Gronau, 2016). Thus, there is currently a debate about the generalizability of earlier found facial feedback effects. Are our decisions throughout the day really amenable to the state of our facial muscles? The current experiment tests the effect of facial muscle activation (smiling and frowning) on the evaluation of sentences describing everyday situations. These situations were chosen to be either clearly positive/negative or ambiguous in their affective value, in order to see if facial influence is stronger in cases where the valence value of a situation is less determined. Since the facial feedback hypothesis proposes that the effect of facial activation does not depend on the conscious appreciation of one's facial expressions, we compared the extent of facial feedback

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effects between participants with and without awareness of their emotional expressions.

Previous studies employed the evaluation of short statements describing common life events as an approximation of everyday decision making, especially with respect to trait-related interpretation biases. It was found that people with high levels of trait anxiety (Hirsch & Mathews, 1997; Voncken, Bögels, & De Vries, 2003; Wenzel & Lystad, 2005) or diagnosed anxiety disorders (Eysenck, Mogg, May, Richards, & Mathews, 1991; Stopa & Clark, 2000) tend to interpret especially ambiguous statements as more negative. Some findings even suggest that such interpretation biases might help to maintain emotional disorders (Hayes, Hirsch, Krebs, & Mathews, 2010; Murphy, Hirsch, Mathews, Smith, & Clark, 2007; Saleminck, van den Hout, & Kindt, 2010; Stopa & Clark, 2000). While such maladaptive interpretative tendencies are often explained with respect to cognitive mechanisms (e.g. Behar, DiMarco, Hekler, Mohlman, & Staples, 2009; Clark, 2001; Mathews & MacLeod, 2005), embodiment theories propose that body activity is important for affective processing (Barrett & Lindquist, 2008; Winkielman, Niedenthal, Wielgosz, Eelen, & Kavanagh, 2015). The current study tests the possibility that manipulating participants' facial muscle activation might influence the rating of verbal descriptions of events similar to those employed in experiments measuring pathologically-relevant interpretation biases. Since some theories of embodiment propose that bodily feedback might be especially relevant when making decisions under uncertainty (Bechara & Damasio, 2005), we test the effect of facial feedback on both clearly valenced and ambiguous descriptions. As the latter are less determined in their emotional value, one could suspect that any influence due to changes in facial expressions are stronger in this case.

Investigating the role of facial feedback for the processing of affective sentences is also relevant for theories of languages processing. Embodiment accounts suggests that understanding a sentence might partially rely on bodily feedback related to its meaning (Barsalou, 1999; Buccino et al., 2005; Zwaan, 2004). In line with this view it has been found that selective suppression of facial feedback during the reading of emotional sentences (e.g. blocking of smiles for positive statements) can lead to an increase in comprehension time (Havas, Glenberg, Gutowski, Lucarelli, & Davidson, 2010; Havas, Glenberg, & Rinck, 2007), as well as EEG responses indicating increased processing effort (Davis, Winkielman, & Coulson, 2015). While these studies mainly measured the effect of facial activity on time and effort needed to comprehend emotional sentences, it is less clear if muscle tension affects the actual interpretative outcome as well. Davis et al. (2015) for example found no effect of facial feedback on subsequent ratings of target sentences. Since their procedure was optimized for EEG measurements during reading, the ratings were performed only after a delay of several seconds when emotion-relevant facial activation was not enacted anymore which might have diminished the effect on the ratings. Thus, the current study more directly tests the role of facial feedback on evaluative outcomes by ensuring that facial activation is present during both the reading and rating of emotional sentences.

One important goal of the current study was to investigate the role of task-awareness for the facial feedback effect on evaluations. It has often been considered crucial for the interpretation of feedback effects if participants are aware that they currently perform emotional expressions (McIntosh, 1996; Zajonc, Murphy, & Inglehart, 1989). If facial actions could influence participants without them being aware of their expressions, then this would suggest that facial muscle tension can directly shape one's interpretative tendencies via bodily afferent feedback. If such effects were only found for participants aware of their expressions, then such results might be explained either due to demand or expectancy effects, or due to the activation of expression-congruent associations in the participant (e.g., the instruction to perform a smile could function as a prime of the concept of happiness; Buck, 1980; Laird, 1974; Zajonc et al., 1989). Thus, one challenge of facial feedback studies has been to demonstrate feedback effects in the absence of conscious knowledge about the emotional relevance of one's current expressions. Note that this would still allow for participants to have conscious changes in their emotional states (e.g. they might be happier during smiling), as long as they are not aware that these changes are supposed to be elicited by their facial actions. Previous studies used non-emotional cover-stories in order to avoid participants becoming aware of the emotional relevance of their expressions. Facial feedback effects were found after the exclusion of task-aware participants in most previously published reports (e.g. Dimberg & Söderkvist, 2011; Ito, Chiao, Devine, Lorig, & Cacioppo, 2006; Strack et al., 1988), but not all of them (Reisenzein & Studtmann, 2007; Wagenmakers et al., 2016). Given the relevance of awareness for understanding such findings, it is important to consider how task awareness should be assessed. Almost all facial feedback studies report using a verbal debriefing interview in order to measure participants' task awareness. However, research on experiment compliance suggests that participants are less likely to admit experiment-relevant knowledge in verbal as compared to questionnaire-based debriefings (Newberry, 1973). Most publications concerning facial feedback do not report a standardized, pre-defined set of debriefing questions or state explicit criteria for classifying the answers as showing task awareness. This makes it hard for other researchers to critically evaluate the claims of researchers concerning the awareness of their participants. Importantly, debriefing interviews are themselves susceptible to demand effect (Orne, 1962), both on the side of the experimenter (who might be implicitly biased in wanting to succeed with the cover story), and the participant (who can be reluctant to contradict the 'authoritative' cover story in a direct conversation; Blackhart, Brown, Clark, Pierce, & Shell, 2012). As a possible improvement in this respect, Davis et al. (2009) and Soussignan (2004) used a written debriefing questionnaire and explicit criteria for identifying task-aware participants. While these studies excluded task-aware participants from their analysis, the current study employs this approach for a direct comparison of aware and unaware participants. This will clarify how far any effect of facial feedback on verbal statements might depend on participants' conscious knowledge about their facial expressions. As the approach for identifying aware participants can vary considerably between studies, probing the role of task awareness might be an important step in explaining the divergent in study results concerning facial feedback.

Overall, the current study assessed the effect of smiling, frowning or (as a control) no specific facial movements on the affective evaluations of a range of statements involving everyday situations that were either positive, negative or ambiguous in their emotional valence. The main dependent variable of interest were participants' ratings of these situations while performing the intended facial expressions. In order to ensure that the emotional muscles were selectively activated during the ratings, we also measured facial

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