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Proprioceptive Determinants of Emotional and Nonemotional Feelings

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This article reports 2 experiments that test whether both emotional and nonemotional feelings may be influenced by uninterpreted proprioceptive input. The logic of the procedure was adopted from studies by F. Strack, L. Martin, and S. Stepper (1988), who unobtrusively manipulated people's facial expressions. In the 1st experiment, a functionally equivalent technique was used to vary the posture of the body. Study 1 results revealed that success at an achievement task led to greater feelings of pride if the outcome was received in an upright position rather than in a slumped posture. Study 2 results revealed that nonemotional feelings of effort were influenced by contraction of the forehead muscle (corrugator), and Ss' self-ratings on a trait dimension reflected this experience when the facial contraction was maintained during the recall of behavioral episodes exemplifying this trait. To account for these results, a framework is proposed that draws on a distinction between *noetic* and *experiential* representations.

"Feelings" have primarily been studied in the context of research on affective states (e.g., Clark & Isen, 1982). Because they often have a positive or negative valence, feelings were frequently assumed to be akin to moods and emotions (e.g., Kleinginna & Kleinginna, 1981). As a consequence, feelings have come to be understood in the context of research about the dynamics of affect.

One finding is that the experience of affect may be influenced by proprioceptive cues. In a great number of studies (for reviews, see Adelmann & Zajonc, 1989; Izard, 1990), feedback from facial expressions has been found to determine feelings of happiness, amusement, sadness, or anger. Moreover, it has been demonstrated that such influences do not depend on the interpretation of an emotional expression (e.g., on the interpretation of the contraction of the zygomaticus muscle as "a smile"). To demonstrate such a direct influence, Strack, Martin, and Stepper (1988) had subjects hold a pen in their mouths such that a smile was either facilitated or inhibited while they rated the funniness of cartoons. Although subjects were not aware of the meaning of the particular muscle contractions, their reported amusement corresponded to the induced expressions. Unobtrusive manipulations of facial expressions to induce affective experiences were also successfully used in more recent studies by Larsen, Kasimatis, and Frey (1991); Martin, Harlow, and Strack (1992); Zajonc, Murphy, and Inglehart (1989); and Erber (1991).

Although such influences were consistently obtained for feelings of both positive and negative valence, it is unclear whether these influences generalize to (a) other dimensions of emotional expressions and (b) feelings that are nonemotional in nature. To be precise, although feelings have typically been investigated as subjective experiences that are manifestations of affect and emotion, the word *feeling* is also used to describe experiences that are not defined by an unequivocally positive or negative valence. Effort, familiarity, surprise, hunger, fatigue, and the "feeling of knowing" are examples of feelings that have no fixed valence or are evaluatively neutral. These experiences are therefore not considered emotions (see Ortony, Clore, & Collins, 1988), although they are labeled *feelings* both in everyday and scientific language (e.g., Clore, 1992; Hart, 1965; Metcalfe, 1986). Thus, the question remains: Can research findings that have been obtained for affective or emotional experiences be generalized to nonemotional experiences or feelings? More specifically, can bodily expressions determine nonemotional experiences in the same way as they influence emotional feelings?

The present article addresses these issues. In the first experiment, we attempted to determine whether uninterpreted proprioceptive cues may influence subjective experiences in a novel affective domain. Specifically, we wanted to find out if the affective experience of pride can be influenced by an unobtrusive manipulation of body posture. In the second study, we explored whether the same mechanism applies to nonemotional experiences as well. More precisely, we generated proprioceptive feedback in an unobtrusive manner to elicit both feelings of effort and judgments based on that subjective experience. In the final section of this article, we discuss the present and previous findings within a conceptual framework that differentiates between *experiential* and *noetic* representations (Strack, 1992b).

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Study 1

In addition to facial expressions, bodily posture is a peripheral reaction that is closely associated with emotional experience. This was recognized by Charles Darwin (1872/1965), who observed that proud and successful humans are likely to display an erect bearing:

> Of all the above-named complex emotions, Pride, perhaps, is the most plainly expressed. A proud man exhibits his sense of superiority over others by holding his head and body erect. He is haughty (haut), or high, and makes himself appear as large as possible; so that metaphorically he is said to be swollen or puffed up with pride. . . . The whole expression of pride stands in direct antithesis to that of humility; so that nothing need here be said of the latter state of mind. (pp. 263–264)

More than 100 years later, empirical evidence demonstrated the relationship between erectness of posture and pride. In a field study, Weisfeld and Beresford (1982) found that the body posture of male high school students was a function of the grade they had just received in a midterm exam. A change toward a more erect posture accompanied receipt of the highest grades, a change toward a less erect posture occurred in subjects who received the lowest grades, and no postural change was observed in subjects who received intermediate outcomes.

Although these correlational findings support Darwin's (1872/1965) contention, they provide no direct evidence that postural feedback exerts a causal influence on subjective experiences. Such demonstrations, however, have been provided in experimental studies conducted by Riskind (1984; Riskind & Gotay, 1982). Riskind and Gotay explicitly instructed subjects to adopt either a slumped or an upright posture and found differences in behavioral helplessness, reported stress (Riskind & Gotay, 1982), and well-being versus depression (Riskind, 1984). In a similar vein, Duclos et al. (1989) had subjects assume poses that reflected specific emotions like anger, fear, and sadness and found that the adoption of these postures resulted in corresponding emotional feelings.

These experimental findings convincingly demonstrate a causal influence of bodily postures. However, the possibility remains that the observed impact is mediated by the interpretation of the emotional meaning of the adopted expression. This is likely to be the case because explicit instructions to adopt a specific body pose direct subjects' attention toward their posture and may trigger its interpretation as an expression of an underlying feeling. Indeed, Riskind and Gotay (1982) explicitly invoked Bem's (1967) self-perception theory as an explanation of their findings and assumed that individuals infer own internal states from their observed behavior. Such an inference presupposes that the behavior is interpreted using categories that permit the postulated inference.

The mechanism just described, however, is only indirectly related to proprioceptive feedback, because it results in knowledge about one's feeling but not in the immediate experience of that feeling. As Bem (1967) has pointed out, self-knowledge is not qualitatively different from knowledge about other persons. However, there is reason to believe that one's own feelings are experienced in a way that is different from knowledge about one's own or others' internal states. To demonstrate that postural feedback influences the immediate experience of feelings, it is therefore necessary to rule out the possibility that the induced body posture is interpreted as the expression of a particular emotion.

This was attempted by generating a situational context that required subjects to adopt either an upright or a slumped body position while they received information of a personal success. On the basis of the reported findings by Weisfeld and Beresford (1982), an upright posture in combination with feedback about one's own success (Weiner, 1985) should provide the appropriate cues to experience pride. At the same time, it may facilitate the bodily expression of the emotion (e.g., Darwin, 1872/1965). In contrast, a slumped posture should not elicit pride-related bodily sensations and should inhibit the bodily expression of that emotion.

To manipulate these body postures, an experimental situation was created in which subjects were led to believe that they would participate in a study about the influence of different ergonomic working positions on the performance of different tasks. The relevant body postures were induced by varying the required positions. We expected that subjects' attention should not be directed to the maintenance of a certain posture but to the fulfillment of a specific task effectively preventing an interpretation of their body position as an emotional expression.

Above and beyond unobtrusively inducing proprioceptive feedback, the first study was designed to answer two additional questions. The first question addresses the role of the co-occurrence of proprioceptive cues and external stimuli that are necessary to elicit the experience. Investigating the facial-feedback effect, we (Strack et al., 1988, Study 2) found that the onset of the induced facial expression was important. The predicted effect was only obtained if the manipulation of the facial expressions and the ratings of the cartoons happened at the same time. To gain further insight into the importance of this synchronicity, we varied the onset of the postural manipulation relative to the feedback about performance in the task.

The second question addresses the conditions under which subjects actually use these induced experiences to generate their answers. Whether subjects use these experiences to generate responses may partly be a function of the wording of the question. This possibility was also indicated by our previous study (Strack et al., 1988, Study 2) in which the influence of the induced facial expression was more pronounced when subjects had been asked how amused they felt than when they had been asked to evaluate the funniness of the cartoons in an "objective manner." These findings suggested that the elicited feelings were more likely to become the basis for ratings of amusement than for ratings of funniness (the latter relying more heavily on aspects of the stimuli). We expect the same relationship between posture and pride. Specifically, we predict that the posturally induced feeling of pride will be more likely to enter into the response if the question focuses on the elicited feeling of pride (reflecting the respondent's experienced emotion) and less likely if subjects are asked to generate a judgment of pride (based on the outcome of an achievement test).

Method

Subjects. Ninety-nine male students of the University of Mannheim participated in the experiment. They were recruited for a study on

"influences of ergonomic working positions on task performance" and expected to be paid DM 7 (approximately $3.40 at the time). The experiment was conducted in groups of up to 6 subjects.

Procedure. After the subjects arrived, they were assigned to a seating arrangement that required them to adopt a particular body position. To prevent the sight of the unusual seating positions from exerting undesired influences on the remaining participants, subjects who were assigned to the manipulated positions were visually separated from each other and placed in cubicles. A written description of the ostensible purpose of the study was then provided, along with instructions about the tasks. Subjects were told that the study was designed to investigate the influence that different ergonomic positions common in industrial settings would exert on different tasks. To control the type of task and the individual performance, subjects were led to expect several similar assignments either in a conventional working position (seated in a standard chair at a standard table without further instructions) or in a specific ergonomic position that would be explained in the course of the study. The first type of task was an achievement test, the second a test of motor skills, and the third was concerned with filling out forms. The subjects were led to expect that they might have to adopt different positions for different tasks.

After this introduction, both the achievement test (a selection of Raven's, 1958, progressive matrices) and the motor test were administered. The latter merely served as a filler task during which the experimenter had the opportunity to generate an evaluation of the subjects' performance in the achievement test. After the completion of the motor task, subjects were asked to fill out a questionnaire that was described as the third task in the series. On the first page, subjects found information about the results of the achievement test. All subjects were told that their performance was far above the average. Specifically, they were informed that their performance was in the highest of four possible categories. The subsequent pages contained the questions that constituted the dependent variables.

After completing the questionnaire, subjects were probed for suspicion. No one mentioned a connection between his working position and an emotional expression or emotional feelings. No participant uttered any doubts about the ostensible purpose of the study or recognized its actual intention. Subjects were then fully debriefed, paid, and sworn to secrecy.

Manipulation of postures. To induce the relevant postures, subjects were asked to adopt either a conventional working position that corresponded to their normal writing position or one of two ergonomic positions. In one of them (upright-posture condition), subjects were seated on a standard chair in front of a standard table and were explicitly instructed to adopt an upright body position throughout the tasks. In the other ergonomic position (slumped-posture condition), subjects had to perform the tasks sitting on a standard chair in front of a table, the surface of which was lower than the seat of the chair. Thus, this slumped posture was induced solely by the seating arrangement, and subjects were not explicitly instructed to adopt a particular body position.

Manipulation of posture onset. Recall that subjects first completed an achievement task (Raven's progressive matrices), then a motor task, and finally, a questionnaire task in which performance feedback was embedded. It was thus possible to manipulate posture in experimental subjects during any (or all) of the three tasks. Some experimental subjects assumed the ergonomic position (i.e., upright or slumped) only during the third task in which performance evaluations were provided (and their effects assessed by questionnaire). Other experimental subjects assumed the ergonomic position during both the second and the third task. A third group of experimental subjects assumed the assigned ergonomic position only during the first achievement task and a fourth group during the first and the third tasks. It should be noted that when experimental subjects did not assume the ergonomic position, they completed tasks in the conventional working position. It was thus possible to systematically vary whether experimental subjects were in the upright or slumped position during the third (questionnaire) task and to vary in which—if any—previous task they had assumed the upright or slumped position.[1] A fifth (control) group of subjects completed all tasks in the conventional position. In short, subjects received feedback on the achievement task and answered the subsequent questionnaire in either the conventional working position or in one of the two ergonomic positions. In addition, for experimental subjects, the first and second tasks were either performed in the conventional working position or in the same ergonomic position as in the third phase of the study. Thus, during the three parts of the study, subjects in the experimental groups adopted both one of the ergonomic positions and the conventional position. To avoid uncontrolled influences from the experimenter, immediate interactions with the subjects were avoided, and instructions and success feedback were provided in a written form.

Dependent variables. After the feedback from the achievement task, subjects' feeling of pride was assessed using the questionnaire. For this purpose, subjects were given eight mood adjectives and asked to indicate on 10-point scales to what degree each feeling described their present subjective state. The adjectives were (in the order of their presentation) cheerful, relaxed, proud, amused, depressed, angry, aggressive, and sad. Ratings of the proud adjective reflected subjects' feeling of pride. The mood adjectives were followed by a series of questions, the first of which asked for a judgment of pride ("How proud are you of your result in the achievement test? "). Responses were provided on a 9-point scale ranging from *not at all proud* (1) to *very proud* (9). Remaining questions were about general mood and different aspects of the working position (e.g., posture comfort ratings).

Results

Feeling of pride. Subjects' responses were analyzed in a 2 (posture at ratings: upright vs. slumped) × 4 (posture onset) analysis of variance (ANOVA) with a nonfactorial control group (no posture manipulation). The analysis yielded no reliable main effects for posture, $F(1, 90) = 1.80$, $p < .20$, or for onset ($F < 1$). However, there was a significant interaction of both factors, $F(3, 90) = 3.29$, $p < .04$. This interaction was diagnosed using a simple effects analysis. This analysis revealed that subjects in the upright posture felt prouder than subjects in the slumped posture if they changed from the conventional to the manipulated position at the time they received the success feedback. As is apparent from Figure 1 (Panel A), this was true whether the achievement task was completed in a conventional (i.e., non-manipulated) position, $t(90) = 2.35$, $p < .03$ (Condition 1), or in the same position in which the success feedback was administered, $t(90) = 2.01$, $p < .05$ (Condition 4). There were no significant differences between the two postures for the remaining onset conditions. More specifically, the intensity of felt pride was similar for the upright and slumped positions if subjects maintained the same posture during the motor task

[1] For reasons of experimental logistics, no conditions were included that would require subjects to assume more than one ergonomic position. Also absent are conditions in which the ergonomic position is held throughout all three tasks. These possible variations were omitted because they produced an augmentation effect in a previous study (Stepper, 1992, Experiment 1). That is, significantly higher ratings of pride were obtained if all tasks were completed in the slumped position rather than in the upright posture.

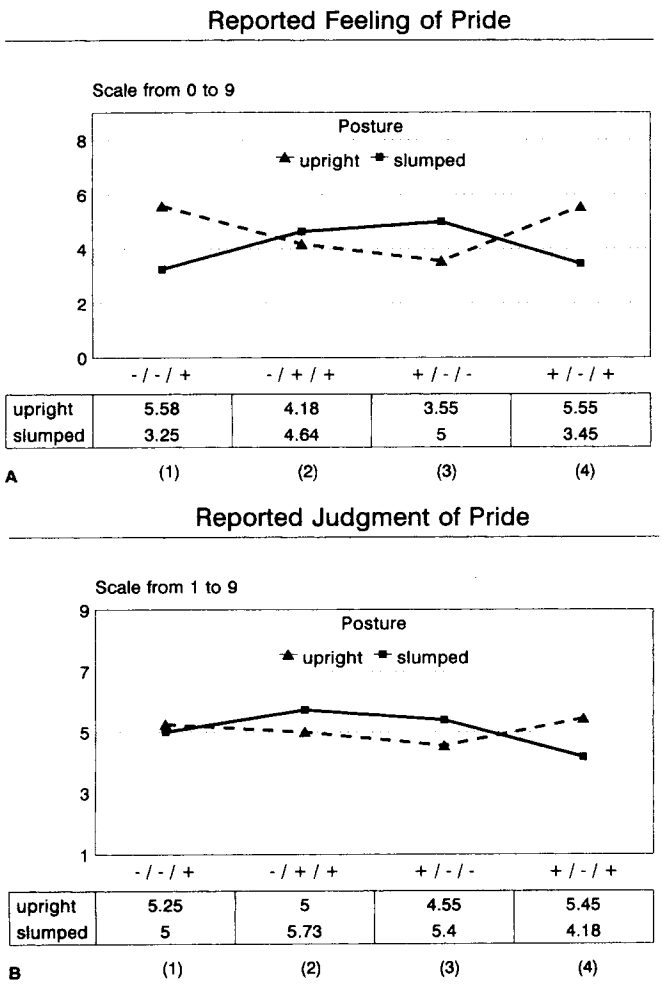

Figure 1. Panel A: Reported feeling of pride for Study 1; Panel B: Reported judgment of pride. (The four conditions are described by three plus and minus signs. + stands for posture manipulated and − stands for posture not manipulated. The three positions symbolize the phases of the experiment. Thus, the −/−/+ of Condition 1 stand for posture not manipulated at achievement test, posture not manipulated at motor test, and posture manipulated at success feedback.)

and when they received the feedback ($t < 1$; Condition 2). If the manipulation of the posture applied only to the achievement task and the rest of the experiment was completed in a conventional posture (Condition 3), the obtained mean difference was not significant, $t(90) = 1.37$, $p < .18$.

To find out which of the two postural conditions contributed more to the obtained difference, subjects' ratings were compared with those of the control subjects, whose posture was not manipulated at all ($M = 5.80$). Such comparisons suggest that the posture effect was due to slumped position. Individual contrasts revealed that whenever the two postures differentially affected feeling of pride, it was the slumped but not the upright condition that differed from the control condition. Thus, slumped subjects' feeling of pride in the critical conditions differed significantly from subjects' feeling of pride in the control condition (Condition 1: $t(90) = 2.45$, $p < .02$; Condition 4: $t(90) = 2.21$, $p < .04$), whereas feeling of pride in upright subjects did not (both ts < 1).

Judgment of pride. As expected, no significant main effects (Fs < 1) and no interaction, $F(3, 90) = 1.79$, $p < .16$, resulted for judgment of pride (see Panel B of Figure 1 for judgment of pride means).

General mood and specific emotions. When subjects were asked how good or bad they felt, the pattern of responses paralleled that of feeling of pride. For these general mood ratings, a significant interaction between posture and posture onset obtained, $F(3, 90) = 2.90$, $p < .05$. Specifically, the differences between postures were most pronounced in the predicted direction if the posture was adopted at the time of the task feedback. The means for general mood are depicted in Figure 2.

The previous interaction, however, was not significant for any of the specific positive or negative emotions (all ps $> .09$): for cheerful, $F(3, 90) = 1.29$, $p < .30$; for relaxed, $F(3, 90) = 2.12$, $p < .10$; for amused, $F(3, 90) = 1.81$, $p < .15$; for depressed, $F < 1$; for angry, $F < 1$; for aggressive, $F(3, 90) = 1.45$, $p < .24$; and for sad, $F(3, 90) = 1.65$, $p < .20$. Thus, although ratings of pride and general mood were significantly related to manipulated posture, ratings of other emotions—less strongly associated in the literature with body posture—were not.

Influence of working positions. When subjects were asked, using the questionnaire task, how comfortable their momentary working position was, the induced posture showed a significant main effect, $F(1, 90) = 36.89$, $p < .001$. Subjects in an upright posture assessed their working position as more comfortable than subjects in a slumped body position. A significant main effect also obtained for the onset of the posture, $F(3, 90) = 9.04$, $p < .001$. This suggests that subjects felt most comfortable if their posture was not manipulated when comfort was as-

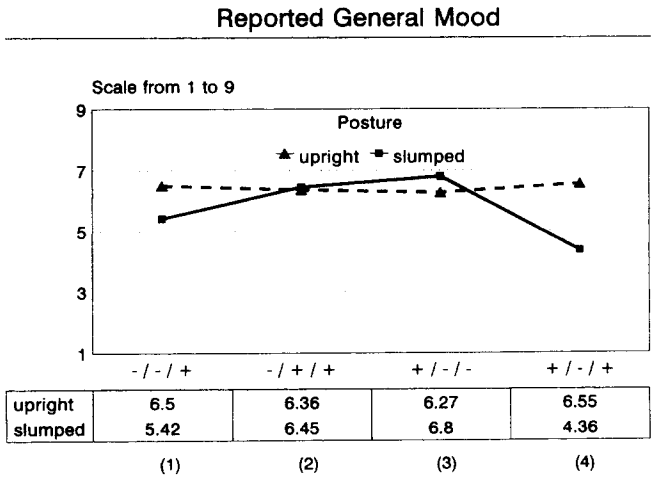

Figure 2. Ratings of general mood for Study 1. (The four conditions are described by three plus and minus signs. + stands for posture manipulated and − stands for posture not manipulated. The three positions symbolize the phases of the experiment. Thus, the −/−/+ of Condition 1 stand for posture not manipulated at achievement test, posture not manipulated at motor test, and posture manipulated at success feedback.)

sessed at the time of the posture manipulation (see Table 1). However, there was no significant interaction between ergonomic position and posture onset, $F(3, 90) = 2.46$, $p < .08$.

Discussion

The results of this study provide further support for the hypothesis that persons' posture may influence specific posture-related feelings. The findings show that a posture adopted when people learn about their own success influences their feeling of pride. Specifically, people feel prouder if they assume an upright posture as compared with a body position in which the upper part of the body is bent over, regardless of their assumed posture at the time they completed the task for which they received favorable feedback.

In contrast with previous studies, body position was manipulated unobtrusively by creating specific seating arrangements such that subjects' attention was not directed toward their posture. The present methodology allows us to winnow the mechanisms underlying the influence of body posture on subjective experiences and eliminates the possibility that interpretations of a posture as expressive of a given emotion guide inferences based on internal states. In combination with our previous examinations of facial influences on emotion (Strack et al., 1988), the present findings demonstrate that proprioceptive feedback influences peoples' feelings in a direct fashion without an interpretational mediation. Moreover, this impact is specifically directed toward the emotion of pride. Although global affect showed a similar pattern, other specific emotions were not affected.

In addition, these results suggest that people are able to differentiate between reporting feelings and making judgments. When subjects were asked to report their current feelings, their reports of emotional experience hinged on the manipulated posture. When they were asked to provide judgments in response to the outcome, however, no influence of posture was observed. This result suggests that subjects did not use their experienced feeling but based their response merely on the feedback about their performance. The fact that both questions were semantically similar and were perceived to belong together may have contributed to subjects attempting to differentiate their answers (see Strack, Schwarz, & Wänke, 1991, Experiment 2).

Table 1
Study 1: Ratings of Comfort of Posture

Condition	Manipulation of posture onset: Achievement test	Motor test	Success feedback	Posture: Upright	Slumped
1	−	−	+	4.50	2.83
2	−	+	+	5.18	2.18
3	+	−	−	6.36	5.60
4	+	−	+	5.91	2.82

Note. + stands for posture manipulated; − stands for posture not manipulated. Ratings of comfort were provided on a scale ranging from 1 (*very uncomfortable*) to 9 (*very comfortable*).

The results also shed some light on the conditions under which such a postural influence is likely to occur. They suggest that the joint onset of the external (i.e., information about achievement outcome) and internal feedback (i.e., the proprioceptive feedback from body posture) is necessary to produce the predicted effect. People felt prouder in an upright than in a slumped position only when manipulated posture and performance feedback co-occurred. One reason for this finding may be derived from research in other domains (e.g., Helson, 1964) suggesting that a longer maintenance of a posture may result in habituation (Helson, 1964) such that the intensity of the postural influence is strongest at its onset and decreases over time. This is consistent with a basic physiological principle according to which effects of neural impingements are typically produced by changes in sensory input and not by its mere state (Deutsch & Deutsch, 1973). Thus, it is the adoption of a particular body posture and not its state that seems to exert its strongest effect on experienced feelings. In the case of emotions, the joint occurrence of bodily changes and the activation of the appropriate cognitive contents are likely to provide the optimal conditions for a full-blown emotional experience.

An alternative explanation for the present finding could be advanced. Specifically, it could be argued that decreased comfort—and consequent experienced unpleasantness—in the slumped condition may have artifactually lowered feelings of pride at the time of performance feedback. However, the obtained interaction between posture and its onset in the current study renders the above alternative interpretation of results unlikely (i.e., it is unlikely that the discomfort inherent in assuming a slumped position attenuated reported feelings of pride). More specifically, the differential effects of assumed posture on reported comfort obtained not only when posture was manipulated solely at the onset of the third questionnaire task but also when posture had been manipulated earlier in the series of tasks. Ratings of comfort lend credence to this assertion. Recall that feelings of pride were a function of interactive effects of manipulated posture and posture onset. In contrast, ratings of comfort were a function of the independent effects of manipulated posture (i.e., upright subjects reported greater comfort overall than did slumped subjects) and posture onset (i.e., subjects reported greatest comfort when posture was not manipulated). Were discomfort the underlying mechanism driving subjects' reported feelings of pride, one would expect a comparable Posture × Posture Onset interaction. Such an interaction did not obtain. Finally, the fact that no other reports of specific positive or negative emotion were influenced by the posture manipulation suggests that discomfort per se was not responsible for differences in reported feelings of pride.

Although the unobtrusive manipulation of posture in the present study ruled out an explanation based on an interpretation of emotional expression, it did not address specific mediating mechanisms. Thus, it is necessary to speculate about possible underlying processes. From a biological perspective, Weisfeld and Beresford (1982) argued that erectness of posture functions as a signal of dominance or social success to other members of a species. Thus, Weisfeld and Beresford assumed evolutionary origins of this neurally based relationship between pride and posture.

Another explanation is provided by the *vascular theory of*

emotion (Zajonc et al., 1989). This theory holds that besides specific facial muscular movements, nasal respiration is seen as a dominant factor in cooling the brain. Zajonc et al. (1989) found that cooled air introduced into subjects' nasal cavity was experienced as pleasurable, whereas warm air was experienced as aversive.

Apropos of the present study, it is possible that respiration may have played a mediating role. Both the onset and the maintenance of the erect posture may have increased the depth of breathing and thus increased the oxygen content of the blood, cooling of the brain, and subsequent neurochemical processes that determine emotional reactions.

Although this interpretation is speculative, it is consistent with our observation that subjects whose posture was not manipulated during the course of the experiment felt as proud as subjects who adopted an upright posture at the time of the feedback. From a respiratory perspective, subjects whose posture was not manipulated were free to express their feeling of pride when they received the positive feedback by spontaneously adopting an upright position and taking a deep breath.

An alternative mediating mechanism to account for the present findings is *interoceptive conditioning.* As Buck (1980) suggested, experiential and expressional elements of a feeling may become associated over time and operate as conditioned stimuli and responses. Buck (1980) assumed that although experiential and expressive systems are independent at the outset, they become interconnected in the course of human development. Specifically, situations that evoke pride (e.g., success at a difficult task) are situations that evoke an upright posture. Through such repeated co-occurrence, the postural concomitant of an emotion may acquire the capability of eliciting the experience. Relevant evidence comes from studies conducted by Lang and his associates (e.g., Lang, Bradley, & Cuthbert, 1990) who found that automatic reactions such as the blink reflex became facilitated if subjects were put into the appropriate emotional states (e.g., fear). By reversing this mechanism, it seems plausible that subjective experiences can be promoted by eliciting the concomitant bodily reactions.

The present results suggest that the inhibition of the appropriate bodily expression of the emotion had a stronger effect than its facilitation. This finding lends partial support to Darwin's (1872/1965) notion that an expression caused by an emotional stimulus can be modified by inhibitory or facilitative circumstances, thus attenuating or intensifying the emotional experience. Current results are less compatible with James's (1890) contention that the appropriate bodily reaction is the sole cause for the emotion.

Independent of the mediating mechanisms, this study shows that our previous finding of a direct facial influence on the emotional experience (Strack et al., 1988) may be generalized to another expressive dimension. It further suggests the possibility that any physical expression of feeling influences experience, even if the bodily response is not recognized as a particular expression of an emotion.

Study 2

The second experiment was conducted to extend the logic of the procedure suggested by Strack et al. (1988). More specifically, in this second study we manipulated expressions of nonaffective feelings in an unobtrusive manner to investigate the influence of those feelings on related judgments.

In research on judgmental heuristics (e.g., Kahneman, Slovic, & Tversky, 1982), the ease or difficulty of a cognitive operation has frequently been recognized to be an important basis of judgments. Most notably, it has been found that the ease of retrieval from memory is used to generate judgments of frequency and probability (e.g., Tversky & Kahneman, 1973). This "availability heuristic" predicts that when it is easier to bring a certain content to mind, estimates of frequency or probability related to that content are higher.

Of course, it could be argued that because a greater number of instances of a category are generated when retrieval is easy than when retrieval is difficult, frequency or probability judgments will be higher in response to the greater number of instances generated. This alternative interpretation of availability phenomena was ruled out in a recent study by Schwarz et al. (1991). These authors considered the possibility that judgments are not influenced by the subjective experience of ease versus difficulty but rather by the fact that more information will be retrieved under "easy" retrieval than under "difficult" retrieval conditions. To test these two competing explanations, Schwarz et al. (1991) conducted a series of experiments in which subjects had to recall either 6 or 12 episodes of their own behavior that exemplified a certain trait. In this study, it was more difficult to remember 12 than to remember 6 behaviors. However, 12 behavioral instances are a broader base for a dispositional inference than only 6 instances. The results provided clear support for the experiential interpretation: Subjects who had to recall 12 instances of a certain type of behavior assigned themselves the corresponding trait to a lesser degree than subjects who had to remember only 6 episodes, despite the fact that subjects in the former condition had a larger pool of instances from which to draw trait inferences. The obtained findings suggest that subjects used the mental effort they experienced to infer the degree to which they possessed the trait implied by the particular behavioral episodes.

Feeling of mental effort may hold properties similar to properties of feelings of affect and emotion such as amusement and pride. If so, feeling of mental effort should not only be influenced by task difficulty but also by its bodily expression and concomitant proprioceptive feedback. Such feedback may be provided by contractions of the corrugator muscle that was considered by Darwin to be the expression of "the perception of something difficult . . . either in thought or action" (Darwin, 1872/1965, p. 223; see also Ekman, 1979). Empirical support for the relation between mental effort and corrugator contraction comes from research by Cacioppo, Petty, and Morris (1985), who found that cognitive effort is often accompanied by a visible or invisible activation of the forehead muscle. Similarly, when Larsen et al. (1991) induced anger by having people furrow their brows, subjects with furrowed brows reported expending somewhat more effort than subjects in the control condition.

Thus, if people can be induced to contract the corrugator muscle by means that are unrelated to the difficulty of a task, it should be possible to influence both the felt effort and self-judgments based on that experience. This was accomplished in

the following experiment using the Schwarz et al. (1991) paradigm.

Method

Subjects. Seventy-two female and male students at the University of Mannheim served as subjects. They were recruited for a study on "abilities of emotional expression" and were paid DM 10 (approximately $6.25 at the time) for their participation. Up to 6 subjects participated in one experimental session.

Experimental design. This 2 × 2 factorial design used the factors Facial Contraction (forehead vs. light smile) and Type of Reported Behavior (high self-assurance vs. low self-assurance).

Procedure. After the subjects arrived, they were assigned to separate cubicles, and the experimenter explained the alleged purpose of the experiment. The study was described as concerned with the effectiveness of nonverbal communication. In particular, subjects were told that certain social circumstances may distort emotional expressions, causing observers to draw inappropriate inferences about people's actual feelings. Ostensibly, the present study was designed to determine if certain tasks interfere with emotional expressions. To enable us to study such influences, subjects would be required to assume certain elements of full-blown emotional expressions while performing different tasks.

After this introduction, the experimenter asked the subjects to adopt a facial expression indicative of either a negative or a positive mood state. In response to this request, subjects were either required to furrow their brow (i.e., contract the corrugator muscle) or to adopt a light smile (contract the zygomaticus muscle). While maintaining this expression, subjects had to recollect six autobiographical episodes that conveyed either high or low self-assurance. Subsequently, they completed a questionnaire that included the dependent variables.

Dependent variables. The main dependent variable was a self-rating on the dimension of self-assurance. Subjects had to provide their ratings on a scale from 1 (*not at all self-assured*) to 9 (*very self-assured*). Because it was essential for purposes of this study that subjects maintain the required expression during the entire course of the experiment and because there was no contextual manipulation (e.g., holding a pen or conforming to a certain seating arrangement) that would "ecologically" ensure the fulfillment of this condition, we asked subjects if they succeeded in maintaining their assigned facial expressions. Specifically, using a scale from 1 (*not well at all*) to 9 (*very well*) subjects indicated how well they had succeeded in maintaining the expression over the course of the study. Subsequent control questions addressed subjects' effort at maintaining the expression (1 = *not at all strenuous* and 9 = *very strenuous*) and their general mood (1 = *bad* and 9 = *good*). In the concluding debriefing phase, participants were probed for potential suspicion about the actual purpose of the study. No subject, however, entertained any hypotheses that did not correspond to the cover story.

Results

Manipulation check. As expected, subjects' assessments of exertion differed as a function of the adopted expression. Subjects who furrowed their brows reported more experienced effort in maintaining the expression ($M = 7.03$) than subjects who adopted a light smile ($M = 5.18$), $F(1, 69) = 14.30$, $p < .001$. Nevertheless, both groups reported equal success in sustaining the expression during the task (both Ms = 5.58; $F < 1$).

Self-assurance. Because the predicted effect was contingent on subjects' maintaining the facial contraction during the entire course of the experiment, they were classified according to their success in the assigned task. The criterion was the midpoint of the scale on which subjects rated the degree to which they succeeded at maintaining the required expression. We expected that judgments of subjects who were able to maintain the expression (i.e., rated their success above the scale midpoint) would be influenced in the predicted direction, whereas no such influence should be observed for subjects who were unsuccessful at fulfilling the requirement (i.e., rated their success at or below the scale midpoint).

Results of a 2 × 2 × 2 (Expression × Type of Reported Behavior × Success) ANOVA revealed a highly significant three-way interaction, $F(1, 64) = 8.94$, $p < .005$. The source of this significant three-way interaction was a significant two-way interaction between expression and type of reported behavior for "successful" subjects, $F(1, 40) = 8.50$, $p < .01$, but not for subjects unsuccessful at sustaining the facial contraction, $F(1, 24) = 2.23$, $p < .15$.

Inspection of Table 2 reveals that judgments of successful subjects showed exactly the predicted pattern. That is, subjects who contracted the forehead while they reported behavioral episodes of high self-assurance rated themselves as less self-assured ($M = 4.42$) than subjects who adopted a light smile ($M = 6.10$). In contrast, subjects who described episodes of low self-assurance rated themselves higher on this dimension in the forehead condition ($M = 5.77$) than in the light smile condition ($M = 4.56$).

General mood. A main effect of general mood obtained. Subjects who adopted a light smile felt better than subjects who furrowed their brow, $F(1, 68) = 8.95$, $p < .005$. However, this main effect was modified by a significant two-way interaction between expression and type of reported behavior, $F(1, 68) = 4.17$, $p < .05$. "Frowning" subjects reported feeling better when they reported examples of low self-assurance (Ms = 5.55 and 4.47 for low and high self-assurance, respectively). "Smiling" subjects reported feeling slightly better when they reported ex-

Table 2
Ratings of Self-Assurance for Subjects Who Reported Succeeding and Failing at Continuously Maintaining a Posed Facial Expression

Facial contraction	Type of reported behavior: High self-assurance	Type of reported behavior: Low self-assurance
Successful at maintaining the expression (>5)		
Forehead[a]	4.42	5.77
Light smile[b]	6.10	4.56
Unsuccessful at maintaining the expression (≤5)		
Forehead[c]	5.57	4.86
Light smile[d]	4.33	5.50

Note. Ratings were given on a 9-point scale, where a lower value stands for lower self-assurance and a higher value for higher self-assurance.
[a] *n*s for high and low self-assurance, respectively, are 12 and 13. [b] *n*s for high and low self-assurance, respectively, are 10 and 9. [c] $n = 7$ for both high and low self-assurance. [d] *n*s for high and low self-assurance, respectively, are 6 and 8.

Table 3
Study 2: Ratings of General Mood

Facial contraction	Type of reported behavior: High self-assurance	Type of reported behavior: Low self-assurance
Forehead	4.47	5.55
Light smile	6.75	6.00

Note. Ratings were given on a 9-point scale, where a lower value stands for bad mood and a higher value for good mood.

amples of high self-assurance (*M*s = 6.00 and 6.75 for low and high self-assurance, respectively; see Table 3).

Discussion

The present study provides evidence that manipulating the expression of nonemotional feelings may exert a causal influence on the experience of those feelings. As for amusement (Strack et al., 1988) and pride (Study 1), both feelings of effort and judgments that are based on those feelings were a function of facial expressions in Study 2. Again, this was the case even when subjects were prevented from interpreting their facial actions as manifestations of the particular feeling. These findings suggest that both emotional and nonemotional feelings are partly determined by proprioceptive cues that operate in a direct fashion without intervening inferences about the meaning of the expressions. Again, interoceptive conditioning (Buck, 1980) seems to be a plausible underlying mechanism.

Moreover, the present results provide further evidence for the contention that the availability heuristic (Tversky & Kahneman, 1973) is based on the quality of the feeling associated with a mental operation and not on its consequences.

In the present experiment, frowning subjects' mood was less positive than smiling subjects' mood. Although this finding is consistent with the outcome of previous tests of the facial-feedback hypothesis (e.g., Laird, 1974), an alternative explanation is feasible. Specifically, it could be argued that elicited affect mediates judgment but not the felt effort.

Such mechanisms would explain trait ascriptions for subjects who had to generate episodes of highly self-assured behaviors. The negative affect that was elicited by the corrugator manipulation might well have been used as information to infer low assurance (Schwarz & Clore, 1983). Alternatively, negative affect may have resulted in mood-congruent recall of low-assurance episodes (Bower, 1981). These underlying processes, however, do not explain the results for subjects who had to recall behaviors of low self-assurance; these subjects judged themselves to be more self-assured under the corrugator condition. Thus, the experience of effort seems to provide the most parsimonious explanation of the present data.

General Discussion

The present experiments provide further support for the contention that feelings may be influenced by proprioceptive cues. Consistent with previous research (e.g., Erber, 1991; Larsen et al., 1991; Martin et al., 1992; Strack et al., 1988; Zajonc et al., 1989), current findings demonstrate that such influences occur without a cognitive interpretation of the induced bodily action. Moreover, they are not confined to facial expressions but apply equally to variations in posture. Finally, the results show that the same mechanisms apply to feelings that are not affectively defined, feelings that are evaluatively neutral or mixed.

Taken together, these findings raise the question: What do feelings have in common and how are they different from other psychological representations? One answer is provided by our finding that feelings can be influenced by sensory input without cognitive interpretation. This suggests that a person does not need to know the meaning of a bodily reaction to have a feeling. Unlike the construal of feelings advanced by self-perception theory (Bem, 1967), feelings do not require inferences based on a person's reactions (cf. Olson, 1990, 1992). Rather, feelings are "immediately given" to the individual and have a distinct phenomenal quality. In contrast, an individual's state inferred from interpreted evidence does not share this phenomenal quality and does not differ from the knowledge of other people's internal states (Bem, 1967).

Thus, it seems justified to revive[2] a distinction between noetic and experiential representations. Using different terminologies, similar distinctions between knowledge and experience have been introduced by scholars of the human mind since St. Augustine. William James (1890, see also Buck, 1990) used the terms *knowledge about* and *knowledge by acquaintance* to differentiate between noetic and experiential representations. Whereas knowledge about is closely related to propositional representations as they are studied in cognitive psychology (e.g., Lachman, Lachman, & Butterfield, 1979), knowledge by acquaintance is more closely related to sensory processes than to judgments and inferences. As Bertrand Russell noted, knowledge by acquaintance is "direct sensory awareness without the intermediary of any process of inference or any knowledge of truths" (1912, p. 73, cited in Buck, 1988).

Only the latter type of representation has the phenomenal quality of immediacy that characterizes the experience of feelings. On the basis of the present findings, we suggest that it is exactly the concurrent sensory input that produces that distinctive quality. Experiential representations can therefore be construed as perceptions (e.g., Buck, 1985) that are elicited and upheld by peripheral sensory stimulation. Thus, experiences are based on sensations that are elicited either by stimuli of the external world or by interoceptive and proprioceptive cues. Most important, such experiential representations do not require inferences that are based on the semantic interpretation of the stimuli. One does not need to identify arrow heads as *arrow heads* to fall prey to the Müller-Lyer illusion. Neither does one need to rely on interpretation of bodily or facial actions as expressions of pride or effort to experience those feelings.

[2] A similar distinction was introduced by Franz Brentano (1928), who titled one of his books *Vom sinnlichen und noetischen Bewußtsein* (Sensory and Noetic Consciousness). See also Reisenzein and Schönpflug (1992). The term *noetic* (and variants of it) has later been used by Tulving (1985) to relate different memory systems and varieties of consciousness.

Our findings support the contention that nonemotional feelings (e.g., Clore, 1992), such as feelings of familiarity, boredom, expectation, or effort, are different from corresponding self-knowledge to the extent that they are based on sensory cues that are impinging on the person. Expectation, for example, increases when people generate visual images of the outcome (e.g., Carroll, 1978; Strack, 1983). Experienced fatigue or expended effort to attend (Damrad-Frye & Laird, 1989) may be the sensory basis of feelings of boredom. Experienced familiarity may be based on the fluency of perception (Jacoby & Dallas, 1981). Thus, it should be possible to influence such experiences and the judgments that are based on them (Strack, 1992a) by manipulating the associated proprioceptive cues.

The present view (for a more detailed description, see Strack, 1992b) deviates not only from Bem's (1967) position but also from James's (1890) notion and from the two-factor model proposed by Schachter and Singer (1962). On the one hand, we do not argue, as James (1890) did, that a particular bodily expression is the emotion or that an emotional experience is solely determined by a specific physical reaction. To feel proud, it is not sufficient to adopt an upright posture. Rather, specific noetic information (e.g., that of success in a difficult task) needs to be activated. In fact, Stepper (1992) found that the manipulated body position influenced experienced pride in the predicted manner only if subjects received above average feedback. No such effect was obtained if the feedback was average.

On the other hand, unlike Schachter and Singer (1962), we do not assume that particular emotions are experienced as a consequence of identifying the causes of unspecific bodily feedback. Rather, we contend that a specific experiential representation is elicited if a certain configuration of specific bodily cues and noetic information matches a template (e.g., Selfridge, 1959) that the person has acquired both through learning and genetic endowment. Such experiential templates require a specific type of concurrent sensory input, and it is neither necessary nor sufficient for a person to form a noetic representation of the sensory input (e.g., the knowledge that one's heart rate changed; Kerber & Coles, 1978; Valins, 1966). Often, persons are unable to identify the specific underlying bodily cues even when they have pronounced global experiences of internal states (Mihevic, 1981; Pennebaker, Gonder-Frederick, Cox, & Hoover, 1985).

If sensory input is missing, a person may have a mere noetic representation of an experience. The memory of a past experience is an example. People may remember how they felt after failing an examination, although they are not reexperiencing that particular sinking feeling. Interestingly, by simulating a sensory input through imagery (for neuropsychological evidence, see Farah, 1988) it is possible to turn a recollection of an emotional event from the past into an emotional experience in the present (e.g., Strack, Schwarz, & Gschneidinger, 1985).

Of course, experiential representations may be semantically labeled and thus acquire a noetic component. This is always the case when people are asked how they feel, be it in a casual conversation or in a standardized questionnaire. Such dual representations of feelings and emotions may be the rule rather than the exception. However, experiential representations do not require a semantic interpretation. Evidence suggests that infants have feelings before they have acquired the semantic concepts (e.g., Leventhal, 1980).

To conclude, the present findings can be best interpreted by drawing on a distinction between noetic and experiential representations. Such a conceptualization, however, would not be confined to affect and emotion but would be a general model of different modes of making contact with our environment and ourselves. As a fringe benefit, the ongoing debate about the primacy of affect or cognition (Lazarus, 1982; Zajonc, 1980) may eventually become obsolete and be replaced by an integrative exploration of the manifold interactions between feeling and knowing.

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