Social Presence, Facial Feedback, and Emotion

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This study examined the influence of facial feedback on emotional experience and the influence of another's presence on facial communication. To test whether facial expressions regulate the expressers' emotional experience, subjects smelled pleasant and disgusting odors while reacting to them spontaneously, with a facial pose indicating that the odors were pleasant or with a facial pose indicating that they were disgusting. In a result that supported the facial feedback hypothesis, subjects evaluated the odors consistently with their facial poses ($p < .001$). But the odors themselves had a far greater impact on evaluations than did posing instructions. To test whether both spontaneous and deceptive emotional expressions would be more effective as communication if the expresser were in the presence of another, rather than alone, subjects smelled odors when they were alone or when seated next to another naive subject who could not see them. Contrary to prediction, subjects were *less* successful facial communicators in the presence of another. In this condition they communicated their evaluations less when they were spontaneously reacting to the odors and leaked their evaluations more when they were trying to hide their expressions ($p < .07$).

According to researchers and theorists, a facial expression in response to an emotional stimulus may have three consequences for social interaction or, alternatively, three evolutionary functions: veridical communication, deceptive communication, and emotional regulation through facial feedback.

Veridical and Deceptive Communication

First and most obviously, senders' emotional expressions provide information to receivers about the senders' emotional states, their future behavior, and, indirectly, the environmental conditions that generated those emotions. Many writers, from Darwin (1872/1965) to the present day (Andrews, 1965; Eibl-Eibesfeldt, 1973), have argued that human facial musculature and expressions have evolved to communicate information to receivers in order to change their behavior. For example, if an animal shows an angry or a threatening face, causing other animals to act submissively, the sending animal has gained the advantage of winning an agonistic encounter without the energy expenditure or risk of an actual fight. The receiving animal has also learned about the likely consequences of further interaction with the sending animal, again without a fight.

Recent work has documented that facial expressions of emotions are stereotyped behavior patterns that are probably innately communicative. The ability to send and understand a small number of pure emotional expressions seems to be universal (e.g., Eibl-Eibesfeldt, 1973; Ekman, 1972, 1973; Ekman, Friesen, & Ellsworth, 1972; Tomkins & McCarter, 1964; Vinacke, 1949; Vinacke & Fong, 1955). The ability also seems to follow a fixed developmental sequence resistant to developmental disruptions (e.g., Eibl-Eibesfeldt, 1973). In addition, the messages

This research was supported by a National Science Foundation grant and was written when the author was a visiting scientist at Bell Laboratories, Murray Hill, New Jersey.

I wish to thank the following people for comments on earlier versions of this article: Peter Bricker, Ross Buck, Bella DePaulo, Paul Ekman, and Phoebe Ellsworth.

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Journal of Personality and Social Psychology 1982, Vol. 42, No. 5, 853-863
 0022-3514/82/4205-0853$00.75

seem to be inherently meaningful, in the sense that autonomic responses to some emotional expressions are easier to learn than are responses to others (Orr & Lanzetta, 1980).

If human facial expressions of emotion evolved for the sake of communication, one might expect that for evolutionary reasons they would be most informative about the senders' intentions or emotional states when the senders were in the presence of others. That is, in the presence of another, emotional facial expressions may occur more often and in a more stereotyped form that accurately reflects the sender's emtional state (cf. Brightman, Segal, Werther, & Steiner, 1975, 1977). This hypothesis follows from the social nature of communication. Among our evolutionary ancestors, senders needed recipients before they gained an advantage from emotional displays. This is the argument implicit in most discussions in the evolution literature of the communication value of behavior (e.g., Hinde, 1974; MacKay, 1972). Even among present-day nonhuman primates, facial displays homologous to human emotional expressions occur most often in the presence of conspecifics (Hooff, 1973).

But, of course, among humans (and perhaps among other primates as well) facial expressions of emotions are also used to deceive, to provide an audience with misleading information about senders' emotional states. For example, the primate that simulates a threat face without being angry gains the same benefits from its display as the primate that is actually angry.

Just as spontaneous emotional expressions may be most prevalent, vivid, and valid in the presence of another person, so deceptive facial expressions may be most prevalent and skillful in the presence of another. Emotional deception is also an act most likely to have occurred in the presence of another throughout human evolution and throughout any individual's life. In addition, because of display rules and other social norms, senders often have heightened motivation to deceive facially in the presence of another (Ekman, 1972). By display rules, I am following Ekman and Friesen's (1969) usage and mean socially learned rules that prescribe procedures for the management of affect displays in various social settings and circumstances. For these reasons, through evolution or through early learning, the presence of conspecifics may have become an enhancer of skillful deceptive performances.

In summary, I am hypothesizing that when people experience an emotion in the presence of others, rather than alone, their faces may spontaneously reflect the emotion more accurately. At the same time they may also be more motivated and more skillful at hiding their spontaneous expressions. Clearly the occurrence of these putative, opposing tendencies makes an examination of either difficult. The contradictory literature on the effects of an audience on emotional expressions reflects this difficulty. For example, Brightman and his colleagues (Brightman et al., 1975, 1977) have found data consistent with heightened emotional expressiveness in the presence of others. Subjects in their experiments ate and evaluated pleasantly sweet and disgustingly salty sandwiches. Subjects' facial expressions corresponded to their evaluations of the sandwiches only when they ate them in the presence of other subjects.

On the other hand, Ekman and Friesen (reported in Ekman, 1972) and Kleck et al. (1976) found opposite results. For example, Ekman found that both American and Japanese students who watched stress films showed the same facial expressions of distress when they were alone. When they answered questions about new stress films in the presence of another, however, the Japanese subjects, as predicted, inhibited their negative facial expressions and simulated positive ones. Similarly, Kleck et al. found that subjects showed less facial evidence of distress from electric shock if they believed that they were observed than if they believed themselves alone.

This research, then, leaves unclear what effects a potential audience has on emotional expressions. In all of it the presence of another was confounded with facial senders' use of display rules, in ways that were neither measured nor controlled by the experimenter. When other people were present, they could always see the sender's facial expressions. As a result, senders were probably motivated to control their expressions

by intensifying or deintensifying them, depending on the perceived norms. For example, in Brightman et al.'s research (1977), in which the audience was co-acting peers, subjects may have intensified their disgust faces to show solidarity with fellow sufferers, whereas in Kleck et al.'s research (1976), in which the audience was a nonparticipant authority, subjects may have deintensified their expressions of pain to demonstrate their bravery.

To evaluate the hypotheses that humans are predisposed to be both more emotionally expressive in the presence of others and more deceptively skillful, one needs to compare their expressive behavior to an emotional stimulus when they think they are alone and when they are in the presence of others, while holding constant their differential use of display rules in the two situations.

In the present research I attempted to do this by having subjects spontaneously express emotions or pose an emotional expression while alone or in the presence of another who could not see them. Under these conditions, subjects should not have been motivated intentionally to control their facial expressions because another person could see or evaluate them. If the mere presence of another enhances the communicability of facial expressions, this procedure could test the possibility unconfounded by the expresser's use of display rules. Although people may use display rules even when alone, for example, not wanting to appear foolish even to themselves, this use of display rules should be constant across conditions.

It is possible that an actual opportunity to communicate an expression to another (i.e., the other must be able to see the expression), rather than the mere presence of another, is what enhances the communicability of emotional expressions. In this case the presence of another and the potential use of display rules are inseparable, and the present research cannot tease them apart.

Facial Feedback

Another hypothesized function of emotional expressions is to provide the senders themselves with information about the emotion they are feeling. This function was initially described by Darwin (1872/1965), was described in more detail by Tomkins (1962) and Izard (1977), and has recently been dubbed the facial feedback hypothesis (Buck, 1980; Ekman & Oster, 1979; Tourangeau & Ellsworth, 1979). In its simplest form this hypothesis states that feedback from the facial muscles is important in the subjective experience of emotion. Theorists adopting this position do not agree, however, on whether proprioceptive feedback from the facial response is a necessary component of emotional experience, a sufficient cause of emotional experience, or only a modifier of an experience generated by other means.

The basic phenomenon of emotional expression, congruence between spontaneous expressions and underlying emotions, is of course consistent with the facial feedback hypothesis. But in addition, to demonstrate a facial feedback effect, research must show that changes in facial expressions cause changes in emotional experience. In the two major paradigms testing the facial feedback hypothesis, experimenters either have directly asked subjects to manipulate their facial muscles in a static pose (e.g., Laird, 1974) or have induced subjects dynamically to intensify or deintensify a naturally occurring expression (e.g., Cupchik & Leventhal, 1974; Lanzetta, Cartwright-Smith, & Kleck, 1976). Several researchers have found the facial feedback effect using static facial poses (e.g., Laird, 1974; McArthur, Solomon, & Jaffe, 1980; but not Tourangeau & Ellsworth, 1979). But because of the dissimilarity between static poses and dynamic emotional expressions and because of the strong experimental demands in these studies, most commentators doubt the generality and validity of findings from the static posing paradigm (e.g., Ekman & Oster, 1979; Hager & Ekman, 1981; Izard, 1981; Tomkins, 1981).

Most commentators (e.g., Buck, 1980; Ekman & Oster, 1979; Tourangeau & Ellsworth, 1979) agree that the strongest evidence for the facial feedback view to date comes from research by Lanzetta et al. (1976). They found that subjects who attempted to hide the painfulness of the shock they were enduring showed decreases in both skin conductance and subjective ratings of

pain, and those who attempted to pose the expression of intense pain showed increases on both measures. Tourangeau and Ellsworth (1979), however, have argued that because pain is not a prototypical emotion, findings based on expressions of pain may not generalize to real emotions.

A second goal of the present research was to examine the influence of manipulated facial expressions on the experience of a basic and pure emotion.

Individual Differences in Encoding Ability

A third goal of the research was to examine the generality of encoding skills. Can people whose spontaneous facial expressions in response to emotional stimuli are easy to read also pose easily readable facial expressions that hide what they are actually feeling? The literature on this is inconsistent; for example, compare Hunt (1941) and Krauss and Morency (Note 1) to Zuckerman, Larrance, Hall, DeFrank, and Rosenthal (1979) and Cunningham (1977). Additional data on this issue would clearly be informative.

Overview

In summary, the first goal of the present research was to examine whether, in the presence of others, people are more emotionally expressive if one controls for their use of display rules and are also more deceptively skillful when they use display rules. The second goal was to examine whether people's facial expressions of emotions influence their emotional experience.

Disgusting and pleasant odors were used as emotional stimuli because disgust is a prototypical emotion (Ekman et al., 1972). It is both expressed and recognized similarly across cultures and occurs in both newborns and in anencephalic and hydrocephalic infants (see Ekman & Oster, 1979, for a review). In addition, odors are more direct emotional elicitors than are the photographs and films that have been used as stimuli in previous research (cf. Cupchik & Leventhal, 1974; Laird, 1974; McArthur et al., 1980; Tourangeau & Ellsworth, 1979). They are likely to elicit purer emotion and are less complex and less cognitively mediated.

Method

Procedure

Subjects were told that the research was about the validity of emotional expressions when the expresser is trying to hide the emotion. They were further told that they would go through three trials; one to introduce them to the odors, a second to practice disguising their facial expressions, and a third in which their disguised facial expressions would be videotaped. In fact, subjects went through only the first two trials and were videotaped without their knowledge. A trial consisted of a series of 24 sniffs taken from opaque test tubes, with each odor presented twice. Across subjects the odors were presented in two random orders of blocks of 12.

To accomplish these goals, sender subjects sniffed pleasant and disgusting odors. Subjects smelled the odors alone or in the presence of another naive subject who was separated from them by a gauze barrier and could not see them. They smelled the odors several times, twice while reacting spontaneously to the odors, once while facially posing that the odors were pleasant, and once while posing that the odors were highly unpleasant. They rated the pleasantness of the odors after every sniff, providing data to test the facial feedback hypothesis: That posed pleasant expressions will lead to increased evaluations of the odors and posed disgust expressions will lead to decreased evaluations of the odors, compared to the spontaneous expressions.

Unbeknownst to the subjects, their facial expressions were videotaped, and these videotapes were later judged by rater subjects. The correlations between the senders' evaluations of the odors and the judges' estimates of their evaluations provided the data to test the social presence hypothesis: That senders' spontaneous facial expressions will be more valid predictors of their evaluations when they participate with another subject, but that their posed expressions will be more deceptive and, hence, less revealing in the presence of another.

Facial Expressions

Senders. Fifty-nine high school and college students smelled and rated the pleasantness of odors. Each was paid $2.50 for approximately 1 hour's participation. One pair of subjects was eliminated during the experiment for failing to follow instructions.

Emotional stimuli. Subjects smelled 12 odors selected to represent a wide range of pleasantness, from the very pleasant vanilla and wintergreen to the very unpleasant pyridine and butyric acid. Pleasantness ratings were obtained from Cain and Johnson (1978), Harper and Smith (1968), and Moncrieff (1966). The odors varied widely and continuously on the pleasantness dimension, and some undoubtedly caused at least limited disgust among subjects. For example, among the most foul odors, Moncrieff describes pyridine as "rank, gassy, [and] repellent," butryic acid as "sour perspiration," and carbon disulphide as "spiritous [and] nauseating." Pretest subjects' attempts to rate these odors with numbers beyond the rating scale and their comments that, for example, carbon disulfide smelled like "rotting frog vomit" indicate the power of some of the

Table 1
Senders' Evaluation of Odors and Viewers' Estimates of Their Evaluation

	Senders' evaluations			Viewers' estimates		
Odor	Spontaneous expressions	Pleasant pose	Unpleasant pose	Spontaneous expressions	Pleasant pose	Unpleasant pose
Pyridine	1.78	1.34	1.44	3.01	4.58	2.17
Butyric acid	1.92	2.07	1.63	3.11	5.22	2.00
Acetic acid	2.09	2.50	1.97	3.21	4.98	2.27
Carbon disulfide	2.46	1.95	2.44	3.75	4.78	2.64
Cod liver oil	3.37	3.37	3.18	3.99	4.91	2.99
Formaldehyde	3.50	4.10	3.66	4.26	5.15	2.69
Geronial	4.36	4.84	4.05	4.24	4.85	2.61
Lime	4.86	5.08	4.97	4.31	4.95	2.49
Tangerine	5.79	6.18	5.76	4.66	4.85	2.58
Benzaldehyde	5.82	5.92	5.68	4.27	5.00	2.85
Wintergreen	5.86	6.18	5.63	4.38	5.22	2.72
Vanilla	6.06	6.42	6.13	4.47	5.04	2.69

Note. All ratings were based on 7-point scales, where 1 meant the odor was very unpleasant, 4 meant it was neutral, and 7 meant it was very pleasant.

odors for some subjects. Other odors may have been unpleasant, however, without being disgusting (e.g., acetic acid was probably more of an irritant than a disgust inducer). The odors used and subjects' pleasantness ratings of them in the present study are listed in Table 1.

The purpose of the first trial was to elicit spontaneous facial reactions to the odors. Following Lanzetta's rationale (Lanzetta et al., 1976), I assumed that the interpretation of subjects' spontaneous facial expressions would be problematic if they were concurrently posing facial expressions. For this reason a completely counterbalanced design was sacrificed to insure that the initial baseline trial evoked truly spontaneous expressive behavior.

In this spontaneous trial subjects were told, "these trials are practice trials to get you used to the odors and to the procedures. You will be smelling some strong odors, some of which are quite pleasant and some of which are unpleasant." After the experimenter instructed subjects on how to waft the odors toward themselves and answered their questions, she left the room. A slide-projected signal lasting 10 seconds instructed them to sniff the next test tube. A 20-second interstimulus interval followed to allow them time to evaluate the pleasantness of the smell and to allow the last odor to depart. Subjects were videotaped for 10 seconds during which they smelled each odor. The video camera was camouflaged, and extensive postexperimental questioning revealed that only 3 of the 59 subjects suspected that they were being videotaped or observed during the experiment. These subjects were retained in the analyses that follow.

Following the spontaneous expression trial, the experimenter reentered the subjects' room and explained the purpose of the second, or posed expression, trial. Subjects were told that this was practice for the videotaping that would occur in the third trial.

At a later date we will be showing tapes of you to a group of people who will try to guess whether you are smelling a pleasant or an unpleasant odor and how pleasant it is. Your job will be to try to convince these people that you are smelling one of two sorts of odors, either a very pleasant one or a very unpleasant one. . . . If the signal says "unpleasant," you should try to convince the people watching the videotape that you are smelling an almost unbearably disgusting smell. If the signal says "pleasant," try to convince the viewers that you are smelling one of the most pleasant odors you can imagine. . . . Try to appear natural when you attempt to simulate either an unpleasant or a pleasant odor. In past research subjects have really hammed it up and were seen as unnatural by viewers, and therefore they were not very successful at deceiving them. This trial is a practice trial for you to get used to the procedures and to simulating pleasant and unpleasant expressions. We will videotape you on the next set of trials.

During both the spontaneous and the posed trials senders rated the odor after each sniff on a 7-point scale, on which a 1 meant very unpleasant and a 7 meant very pleasant.

Social presence manipulation. Senders participated in the research either alone or in pairs. When two subjects were present, one was randomly selected to be the target subject who was videotaped and whose data was used in the analyses to follow. Thirty-eight target subjects participated in the study. Pairs of subjects were seated parallel to each other, facing the signal slide, approximately 1 m apart and separated from each other by a translucent gauze barrier. The barrier was constructed so that subjects would not see the details of each other's behavior but could see gross movements, hear each other, and strongly sense that another person was participating in all phases of the research with them.

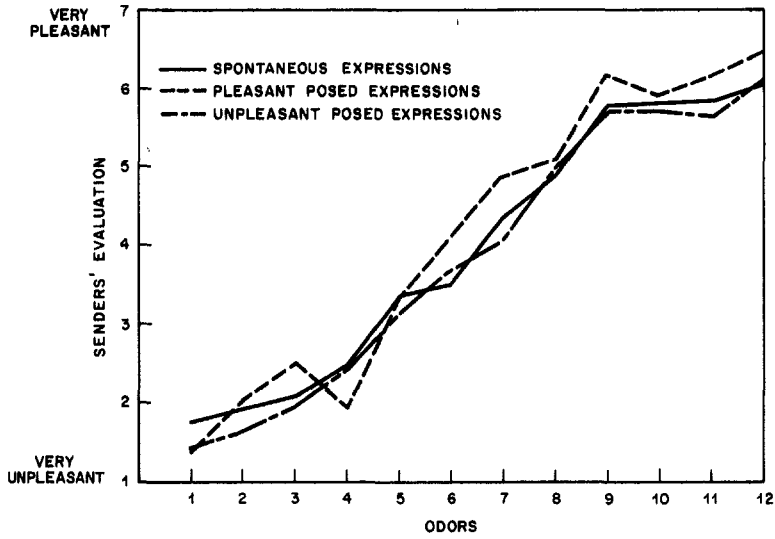

Figure 1. Senders' evaluations of 12 odors. (The odors are the following: 1 = pyridine, 2 = butryic acid, 3 = acetic acid, 4 = carbon disulfide, 5 = cod liver oil, 6 = formaldehyde, 7 = geronial, 8 = lime, 9 = tangerine, 10 = benzaldehyde, 11 = wintergreen, 12 = vanilla.)

Each member of a pair smelled the odors in a different random order. The signal slides with posing instructions were arranged so that the target subject sniffed each odor once posing a pleasant expression and once posing a disgusted expression.

Judgments of facial expressions. College-student judges watched excerpts from each of the senders' spontaneous and posed facial expressions. Seven tried to guess how pleasant the odor was that elicited the facial expression, and seven rated the naturalness of the facial expression. Trials were arranged on master tapes in random order, with the constraint that two trials from the same sender could not appear in a single, hour-long judging session.

The task for judges who rated pleasantness was to "guess after each selection how the original subject rated the odor." They were informed about the range of odors used, but not that the subjects were posing on half of the trials. They were warned, however, that some subjects "did not [take the task seriously] and even started hamming their expressions. Regardless of how phony the expressions may appear, try to guess how they originally rated the odor." Although judges estimated subjects' evaluations of the odors, for convenience I will occasionally refer to this judgment as facial pleasantness, since facial pleasantness is presumably the basis for their estimates.

The task for the other judges was "to rate the facial expression . . . for how natural or unnatural the facial expression appears, . . . regardless of its intensity." They were told that other judges had already rated the pleasantness of the expressions; since some smeller-subjects had hammed their expressions, their judgments would be used both "to throw out some trials in which the . . . facial expressions were too unnatural [and] . . . to help determine what . . . about a facial expression gives it the impression of being false or unnatural."

Raters watched each excerpt for 5 sec from the time the sender first wafted an odor toward himself or herself. Raters for each judgment participated in a group, viewing individual, silent video monitors. They were paid $25 for five hour-long judging sessions.

Results

Effects of Facial Feedback on Emotions

The data relevant to the facial feedback hypothesis are comparisons of the senders' evaluations of the odors while they were facially posing that they were pleasant and while posing that they were unpleasant. In addition, a comparison of senders' evaluations during the posed trial with their evaluations during the spontaneous expression trial provides information about changes from baseline evaluations. This is not a pure comparison, however, since the posed condition always followed the spontaneous expression condition. These data are presented in Table 1 and plotted in Figure 1.

The data were analyzed using a Social Presence (alone vs. together) × Posing Instruction (pleasant vs. unpleasant) × Odor

analysis of variance. The comparison of the evaluations while posing pleasant facial expressions with those while posing unpleasant ones shows that posing facial expressions led to evaluations of emotional stimuli consistent with the facial expressions, $F(1, 36) = 14.4$, $p < .001$. In addition, comparisons with the mean evaluations senders made while they were reacting spontaneously to the odors suggest that posing pleasant facial expressions increased evaluations, $t(11) = 1.74$, $p < .06$ (one-tailed), and posing unpleasant facial expressions decreased evaluations, $t(11) = 1.90$, $p < .05$ (one-tailed). As Figure 1 shows, the posing effect depends on the odor, $F(11, 396) = 2.78$, $p < .005$, and the interaction with the linear contrast shows that the posing effect is somewhat larger for pleasant than for unpleasant stimuli, $F(1, 36) = 4.05$, $p < .07$. Over all senders, however, evaluations made while the senders were posing pleasant facial expressions were higher than those made while the senders were posing disgust faces for 10 of the 12 odors ($p < .02$ by the sign test). Thus the facial feedback effect is highly reliable.

However, the effect is not large. The odors to which the senders were exposed had far more powerful influences on their emotional evaluations than did the posed facial expressions. Stimulus valence had highly significant effects on senders' evaluations, both for the spontaneous trial ($t = 20.33$, $p < .0001$) and for the posed trial ($t = 23.59$, $p < .0001$). In the posing condition, the difference between the most and least pleasant odors was 4.7 on the 7-point scale ($d = 4.69$ for the linear contrast), while the difference between the odors evaluated after posing pleasant and unpleasant facial expressions was only .3 scale points ($d = .63$).

Effects of Social Presence on Facial Expressions

To examine whether the presence of another person changes the quality of communication via facial expressions of emotions, I computed judges' accuracy in assessing each sender's evaluations of the odors. This is the correlation for each sender between his or her evaluations of the odors and the judges' facial pleasantness estimates, once for the spontaneous trial and once for the posed trial. Each of the two correlations for each sender is based on the number of facial expressions successfully videotaped (maximum of 24; M = 22.9). The correlations were subjected to a Trial (spontaneous vs. posed) × Social Presence (alone vs. together) analysis of variance, with trial as a within-subject factor. If social presence improves both spontaneous and posed facial communication, we would expect that senders in the presence of another would have more revealing spontaneous facial expressions and less revealing posed ones. The results of this analysis are shown in Table 2.

Table 2
Mean Correlations Between Senders' Evaluations of Odors and Viewers' Estimates of Their Evaluations

Social presence	Posing instructions: Spontaneous r	Spontaneous n[a]	Posed r	Posed n[a]	Difference r	Difference n[a]	Weighted M
Alone	.54	13	.10	14	.46	13	.31
Together	.43	18	.16	19	.27	18	.29
All senders	.48	31	.13	33			

Note. Entries are means of Pearson product-moment correlations, with each correlation based on a maximum of 24 facial expressions. The entries in the difference column are the mean differences of the spontaneous and posed correlations for senders who were successfuly videotaped in both the spontaneous and the posed conditions.

[a] Number of correlations averaged.

As one would expect, senders' facial expressions were much more valid cues to their evaluations of the odors when the senders were spontaneously expressing their emotions than when they were posing, $F(1, 29) = 47.59$, $p < .0001$. The mean accuracy correlation of .54 in the spontaneous condition shows that facial expressions can provide graded information about a sender's internal states. (Compare Ekman, Friesen, & Ancoli [1980] with Tourangeau & Ellsworth [1979].) Moreover, the mean accuracy correlation of .13 in the posing condition shows that judges could still assess

Table 3
Generality of Encoding Skill Across Posing Instructions and Odors

Posing instruction and odor	Spontaneous		Pleasant pose		Unpleasant pose	
	Bad	Good	Bad	Good	Bad	Good
Spontaneous						
Bad	1.00	.56	.04	−.30	.43	.13
Good	.97	1.00	.21	.04	−.08	−.17
Pleasant						
Bad	.22	.15	1.00	.49	−.43	−.56
Good	.26	.22	.91	1.00	−.56	−.57
Unpleasant						
Bad	.23	.10	.82	.80	1.00	.80
Good	.28	.18	.87	.84	.92	1.00

Note. Correlations above the diagonal are based on raters' judgments of facial pleasantness as a dependent measure. Correlations below the diagonal are based on judgments of facial naturalness as a dependent measure. $n = 32$ for all correlations. $|r| > .35$; $p < .05$, two-tailed. $|r| > .41$; $p < .01$, two-tailed.

senders' evaluations of the odors at better than chance levels, even when the senders were masking their emotional reactions, $t(32) = 4.02$, $p < .001$. In Ekman and Friesen's (1969) terms, emotional leakage occurred even while senders were posing.

Overall, facial expressions from senders who were in the presence of others were neither more nor less readable than those from senders who were alone ($F < 1$). Instead, the Social Presence × Posing Manipulation interaction on the accuracy correlations approached significance, $F(1, 29) = 3.17$, $p < .07$. As Table 2 shows, spontaneous expressions revealed more of senders' evaluations than did posed expressions, especially when senders were alone. This pattern, in which senders in the presence of another were poorer both at showing what they were feeling in the spontaneous condition and at hiding what they were feeling in the posed condition, contradicts the social communication hypothesis.

This degradation of both spontaneous and deceptive emotional communication in the presence of another did not occur because subjects were less expressive when together. The variation in a sender's facial expressions was approximately the same whether the sender was alone (mean facial pleasantness $SD = 1.78$) or in the presence of another (mean $SD = 1.80$; $F < 1$), and the difference between the two was independent of posing instructions (for the interaction, $F < 1$).

Individual Differences

The present data allow us to ask about the consistency of senders' nonverbal skills. Specifically, we can ask whether the quality of spontaneous and posed facial expressions from a single sender were correlated and whether this correlation was robust for expressions elicited by different odors. Overall, the data presented below show that the quality of spontaneous expressions and that of posed expressions were only slightly correlated, although the qualities of spontaneous expressions for different odors were correlated and those of posed expressions for different odors were also correlated.

One measure of the quality of a facial expression is the degree to which it communicates the correct emotion to judges. Here correct means an emotion consistent with an odor's valence for spontaneous expressions and consistent with posing instructions for posed expressions. To the extent that the encoding of facial expressions is a skill that is general across spontaneity and across eliciting stimuli, we would expect that a person who can successfully pose a pleasant face should also be able to pose an unpleasant face and should have readable spontaneous pleasant and unpleasant facial expressions as well. Operationally, this means that the pleasantness of pleasant faces, regardless of source, should be intercorrelated (i.e., posed pleasant faces and spontaneous faces in response to pleasant stimuli); that unpleasant faces, regardless of source, should be intercorrelated; and that the pleasantness of pleasant and unpleasant faces, regardless of source, should be negatively correlated. The upper half of Table 3 displays the correlations among mean pleasantness judgments based on spontaneous expressions, posed pleasant expressions, and posed unpleasant expressions following pleasant and unpleasant odors.

The data show that the same people can successfully pose either pleasant or unpleasant expressions and can do so regardless of

the odor to which they are responding (mean $r = .58$, $p < .01$; using the Fisher r to Z transform on the 6×6 matrix of correlations in Table 3, $[(r_{34} + r_{56}) - (r_{35} + r_{36} + r_{45} + r_{56})]/6 = .58$). However, success at encoding spontaneous facial expressions was only slightly related to success at encoding posed facial expressions, $[(r_{15} + r_{16} + r_{23} + r_{24}) - (r_{13} + r_{14} + r_{25} + r_{26})]/8 = .17$.

Surprisingly, people with successful spontaneous expressions in response to pleasant odors have unsuccessful expressions in response to unpleasant odors (i.e., in Table 3, $r_{12} = .56$, $p < .01$, where a negative correlation was expected). Some subjects seem to have pleasant or sour physiognomies regardless of their temporary facial expressions.

Another measure of the quality of a facial expression is how natural it appears. The bottom half of Table 3 shows the correlation among the mean naturalness judgments for spontaneous, posed pleasant, and posed unpleasant expressions in response to pleasant or unpleasant odors. The naturalness of subjects' spontaneous facial expressions was highly consistent, regardless of the type of odor eliciting it ($r_{21} = .97$, $p < .001$). Similarly, the naturalness of their posed facial expressions was highly consistent regardless of the expression posed or the eliciting odor, $(r_{43} + r_{53} + r_{63} + r_{54} + r_{64} + r_{65})/6 = .86$, $p < .001$. On the other hand, the naturalness of subjects' spontaneous expressions was only slightly related to the naturalness of their posed expressions, $(r_{31} + r_{41} + r_{51} + r_{61} + r_{32} + r_{42} + r_{52} + r_{62})/8 = .21$, $p > .10$.

We can also look at the encoding accuracy correlations to assess the generality of skill hypothesis. If senders have general encoding skills, then those who are spontaneously expressive should also be able to control their emotional expressions when they wish. Thus we could expect a negative correlation between their encoding accuracy in the spontaneous and posed conditions. The correlation between encoding accuracy for spontaneous and posed facial expressions does not support the general skill hypothesis ($r_{29} = .23$, $p < .11$). Although not statistically significant, the positive correlation is consistent with Krauss and Morency's finding (Note 1) that those who are most spontaneously expressive are least able to hide their emotions. Taken together, these data suggest the independence of spontaneous and posed expressions.

Discussion

This research addressed two questions derived from an evolutionary approach to the study of human behavior. One was whether people use the information on their own faces to interpret or modify their experience of emotion. The present experiment adds to the previous literature by supporting the facial feedback hypothesis using dynamic facial expressions, simple but novel emotional stimuli, and a prototypical emotion. Subjects rated odors as more pleasant when they were posing a pleasant face than when they were posing a disgust face.

Along with every other experiment that has presented relevant data, the present research found that the emotional valence of a stimulus has a far greater effect on emotional experience than does facial feedback (e.g., Laird, 1974; Lanzetta et al., 1976; Tourangeau & Ellsworth, 1979). In the present experiment the odors shifted mean evaluations over 15 times more than did the posing instructions. These results imply that facial feedback can modify emotional experience but is neither a necessary nor a sufficient condition for it.

The present results are open to the interpretation that the facial posing instructions influenced subjects' emotions through means other than facial feedback. For example, one strategy that subjects may have used to generate a disgust face was to imagine an odor as disgusting. Or subjects may have responded to subtle experimental demands to show consistency between their facial expressions and their evaluations of the odors. But other studies in the literature have used posing manipulations that would not directly influence a cognitive process like imagination (e.g., Cupchik & Leventhal, 1974; Kleck et al., 1976; Laird, 1974; McArthur et al., 1980) and physiological dependent measures that are insensitive to experimental demands (e.g., Kleck et al., 1976; Lanzetta et al., 1976; Zuckerman, Klorman, Larrance, & Spiegel, 1981). The methodological diversity in the literature as

a whole allows faith in the conclusion that facial feedback has a small but reliable moderating effect on the emotional experience and on the evaluation of emotional stimuli.

The second question addressed by the present research was whether people use facial expressions more effectively for communication when they are in another's presence, rather than alone. Previous research did not allow an answer to this question. In this research the mere presence of others was always confounded with senders' motivation to use display rules to modify their facial expressions, in circumstances in which the display rules were neither measured nor controlled by the researcher. Far from supporting the social communication hypothesis, the present research, although preliminary, suggests that the presence of another inhibits facial communication. Compared to senders who were alone and did not know they were being observed, senders who were in the presence of another but not observed by the other showed facial expressions that revealed less of their emotions when they were spontaneously reacting to odors but more of their emotions when they were attempting to hide them. The presence of another made their facial expressions worse for both spontaneous and deceptive emotional communication.

Why should this be? The presence of another seemed to interfere with both involuntary and voluntary facial control. Perhaps because both spontaneous and controlled facial expressions are strongly ingrained and overlearned behavior patterns, the presence of another person in an emotionally arousing situation heightened both behavior patterns, thus accentuating the interference between the two (Zajonc, 1965).

The present research also addressed other issues in nonverbal communication. Consistently with previous research, this experiment has shown that (a) facial expressions reflect emotional stimuli when senders are not trying to hide their emotions; (b) senders can use display rules to hide effectively the emotions they are experiencing; (c) although emotional deception is effective, it is not perfect, in that observers can still guess the underlying emotion at greater than chance accuracy; (d) senders who are best at communicating their emotions with spontaneous facial expressions are worst at hiding their emotions with posed expressions; and (e) nonverbal skill is not general across spontaneous and posed expressions, although it may be general across different expressions and eliciting stimuli.

Reference Note

1. Krauss, R., & Morency, N. *Nonverbal encoding and decoding of affect by first and third graders.* Paper presented at the annual meeting of the American Psychological Association, Montreal, Quebec, Canada, August 1980.

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Received May 28, 1981 ■