

## BEHAVIORAL PREDICTIONS BASED ON PERCEPTIONS OF FACIAL EXPRESSIONS OF EMOTION<sup>1</sup>

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*Current theory and research on the emotions have tended to overlook the importance and possible role of perception on the activation of or change in the feeling states of the individual. Consequently the interaction of the perceptual subsystem with the individual in a predictive or behavioral way has likewise been largely ignored by emotion researchers. Ironically other fields of research gives us some insight to the perceptual and affective processes. In this study subjects were presented with thirty different photographs of people posing in several different emotions. In addition to asking some "traditional" questions as identifying the emotion expressed or rating how strongly or well the emotions were communicated, subjects were also asked to make predictions as to how often they would either see or perform each expression. The pattern of results obtained was generally consistent with what was expected, and were important in at least two ways: (1) Neutral expressions were found to vary in similar ways with other affective expressions, implying that what we have been considering as neutral may in actuality be a lower-level interaction of affects, rather than a state of non-affect; (2) these results open the way for studies involving the process of perception, and provide a framework from which we can describe the role of the perceptual subsystem within the affect system.*

Over a hundred years ago Darwin introduced us to the first systematic analysis of facial expressions in his seminal work, *The Expression of Emotions in Man and Animals* (Darwin, 1965/1872). Since then research on facial expressions has grown in enormous popularity, and works on the subject ranging from the social significance of facial behaviors in interaction to implications of the neural structures governing the control of the facial musculature, can be seen in major psychological journals and in privately-authored books (e.g., Ekman, 1973, 1983; Ekman and Friesen, 1975; Izard, 1971; Tomkins, 1962, 1963). While many contemporary theorists of facial expression favorably entertain the thesis that facial expressions of emotion play a vital role in the mediation of the one's affective state, a viewpoint in agreement with Darwin, less emphasis has been placed on the role of the perception of emotion in the mediation of affective states.

Although expression and perception are vital processes relating to the accurate

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<sup>1</sup> I would like to gratefully acknowledge the assistance of Lisa Stefani and Catherine Palter, who served as experimenters. I would also like to thank R.B. Zajonc, for his assistance during the stimuli-production and rating.

communication of one's emotions, a complementary role of perception in terms of the possibility of its being a major component in modulating the affective experience of the perceiver has largely been ignored. While the accurate perception of emotional expressions is needed vital to the communication of affective states, its role in affective or cognitive processes in human life may not be limited to such a passive existence. We may ask questions relating not only to whether perception of another's affective state may provide the necessary stimulus or feedback of one's own emotional state, but we may also ask whether the perception of one's emotional expressions can tell us something about that person's cognitive functioning, or how we may think. The present study was designed to elaborate on the exact nature of the perceptual process.

Prototypic expressions of several emotions (happiness, surprise, anger, sadness, fear, and disgust) have been found to exist panculturally (Ekman and Friesen, 1975). A basic paradigm for testing the issue of expressive universality has been to ask subjects to identify a stimulus photograph or slide, to match a photograph to a story designed to exemplify a particular emotion, or to facially express how he or she would feel in certain situations. These studies have answered important questions concerning some aspects of perception and expression, especially in relation to their value in the communication process; but other questions concerning how the perception of another's affective state interacts in a phenomenological or predictive/behavioral way to the perceiver remain. The notion that such perception interacts in more than merely a communicative mode receives support from other sources. Bandura and his associates, for example, have amply demonstrated the effectiveness of social or observational learning (e.g., Bandura, 1977; Bandura and Walters, 1963). Studies of television, aggression, and prosocial behavior also provide a link between perception and behavior (e.g., Liebert and Baron, 1972). Also, Bower and his associates have provided evidence for a mood-state-dependent memory, wherein the remembering of personal episodes or of information related to one's self may provide another link between emotional perception (this time self-perception) and subsequent feelings, thoughts, or behaviors (e.g., Bower, 1981; Bower, *et al.*, 1981; see also Holmes, 1970; Meltzer, 1930).

In the present study in addition to asking subjects "traditional" questions such as identifying an expression or rating the strength or quality of the expression, subjects were also asked other questions concerning what the perception of the expression meant to them, such as how often they thought they would see or perform certain expressions. It was hypothesized that, in general, differential results in ratings of probability for both seeing and performing certain expressions would be found across emotions, and that positively-valenced stimuli would be rated more likely to be seen and performed than negatively-valenced stimuli.

## METHOD

### MATERIALS

Photographs of six different emotional states were taken (happiness, surprise, sadness, fear, angry, and neutral). Ten undergraduates served as posers in each of the affective states. Of the ten posers, five were men and five were women. Each poser was asked to produce an expression that he or she thought was characteristic of the particular emotion that was to be conveyed. Four pictures of each expression were taken, thereby producing 240 different photographs (10 posers x 6 emotions x 4 pictures of each emotion). Each of the 3 inch by 5 inch photographs were, in turn, presented to 25 undergraduates who rated each set of four pictures of each emotion for each poser into a hierarchy of "best example for this emotion" to "worst

example for this emotion." These ratings were analyzed, and the one photograph of each set of four emotions for each power that was rated "the best" most frequently was selected for subsequent use. There were, therefore, altogether 30 different photographs of five female posers and 30 different photographs of five female posers and 30 different photographs of five male posers. Because there is evidence which suggests that sex differences in both encoding and decoding of nonverbal cues exist (e.g., Hall, 1978), it was decided that only the 30 photographs of the five females were to be used in this experiment.

## SUBJECTS

Fifteen female undergraduates served as subjects in this study. Because of the reasons outlined above, it was established beforehand that the sex of the encoder and decoder would be kept congruent in order to minimize the differential effects that may have been produced by the addition of another factor (i.e., gender) in the study. All subjects were comparable in terms of age ( $M = 20.9$  years).

## PROCEDURE

All subjects were tested individually. The subject was told simply that she would be participating in a study that involved looking at some photographs of faces, and then making some judgments about them. To insure that the subject understood what was required of her, the experimenter explained that she would go through the first two stimuli with the subject, and that the subject was to proceed with the remainder of the task individually.

The experimenter produced a 3 inch x 5 inch (7.6cm x 12.7cm) "dummy" photograph that was not used in the study. After presenting it to the subject for 5 seconds, the experimenter then assisted the subject in answering a series of five questions regarding the photograph. In going through each of the questions the experimenter made sure that the subject understood what the question was asking. The questions had to do with making a judgment of the emotion expressed, rating how well and how strongly the emotion was expressed, and the likelihood of seeing and performing the expression within the course of an average day. In making a judgment of the emotion expressed subjects were asked to select one emotion from a list of seven (happy, surprise, neutral, sad, fear, anger, disgust) in a forced-choice procedure. Subjects separately rated how well or how strongly the emotion was expressed on a seven point scale ranging from 1 (ot well at all/ not strongly at all) to 7 (very well/very strongly). Likewise, they rated the likelihood of either their seeing someone else perform the expression or their performing the expression within the course of an average day on a seven point scale, ranging from 1 (not likely at all) to 7 (very likely). After the subject had recorded her rating on each question, the experimenter repeated this procedure with a second dummy photograph. The data on these first two stimuli were not included in the results. If the subject had any problem understanding any of the questions, the experimenter would explain it to her according to pre-established criteria concerning the amount of information that could be given the subjects.

The stimulus photographs were presented randomly to control for any deleterious effects that the order of presentation might have had on some of the judgments. Following the presentation of the 30 stimuli that the subject was to rate, she was told that that was all, informed as to the nature and rationale of the questions, and was thanked for her participation in the study.

## RESULTS

### WHICH EMOTION?

Upon presentation of each stimulus photograph subjects selected one emotion

word of a total of seven possible responses in an attempt to identify the emotion expressed. The data and chi-square statistic for each affect category is presented in Table 1. Each stimulus was perceived as expressing the emotion intended originally, thus offering us a check as to the reliability of our stimulus photographs. Moreover, patterns of errors, especially between sad stimuli and neutral response, and fear stimuli with surprise responses, are congruent with what is known of patterns of errors in both the voice and face, and of the particular muscle groups innervated in these effective expressions (Davitz, 1964; Ekman, 1982; Ekman and Friesen, 1975).

TABLE 1: RAW SCORES AND CHI SQUARES FOR RESPONSES TO IDENTIFYING WHICH EMOTION THE PHOTOGRAPH DEPICTED

<i>Stimulus</i>	<i>Responses</i>							
	<i>HA</i>	<i>SU</i>	<i>NE</i>	<i>SA</i>	<i>FE</i>	<i>AN</i>	<i>DI</i>	
<i>HA</i>	73	1	1	0	0	0	0	422.67*
<i>SU</i>	3	48	6	0	15	1	2	165.77*
<i>NE</i>	1	1	53	4	0	8	8	200.87*
<i>SA</i>	0	1	21	29	0	14	10	72.40*
<i>FE</i>	3	16	6	1	34	2	13	77.25*
<i>AN</i>	0	1	11	1	0	45	17	152.51*

\*  $p < .001$

*HA* = Happy

*SU* = Surprise

*NE* = Neutral

*SA* = Sadness

*FE* = Fear

*AN* = Anger

*DI* = Disgust

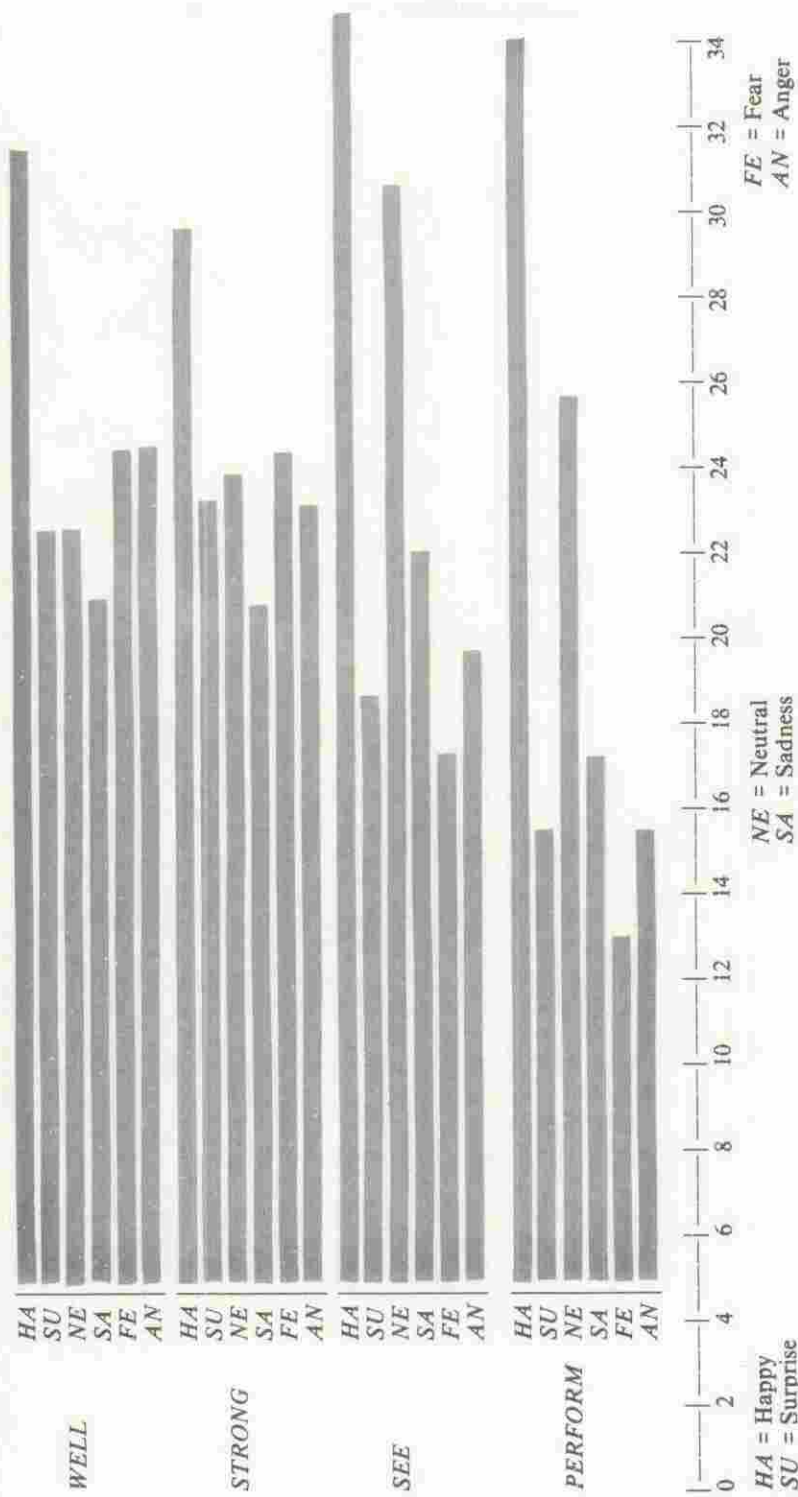
#### HOW WELL WAS THE EMOTION EXPRESSED?

After identifying a stimulus photograph with an emotion word, the subjects then proceeded to rate how well the emotion was expressed. In all analyses in which the subject made a rating on a seven point scale, the scores for a subject for the five different photographs of an emotion were added together to produce the subject's total score for that emotion. This was done for each subject across all six emotions for each of the four seven point scales that the subjects responded to. The means of the scores for all ratings are presented in Figure 1.

In general the data indicated that ratings of how well the emotion was expressed were significantly different across all six emotions ( $F(5,70) = 16.28$ ,  $R^2 = .22$ ,  $P < .001$ ). In order to test hypotheses concerning whether neutral expressions were rated differently than the other more "affectively loaded" expressions, or whether positively-valenced emotions, the analysis proceeded according to a set of planned comparisons established a priori to justify the grouping of certain levels. In all analyses of each scale subsequent to the initial "omnibus" analysis (Keppel, 1982), a Scheffé test was performed because of the number of both pairwise and complex comparisons.

To test whether neutral expressions were rated differently than other expressions, it was first necessary to compare the means of the other five emotions to justify the grouping of these levels. The analysis, however, indicated that the means were not comparable ( $F(4,56) = R^2 = .28$ ,  $p < .001$ ). The data indicated that

Figure 1: Means of responses for questions concerning how well, how strong, and likelihood of seeing or performing the emotion expressed



the ratings for the happy stimuli contributed to much of the variance of the scores at these five levels, and indeed, the fact that the ratings for surprise, sadness, fear, and anger were comparable was borne out ( $F(3,42) = 2.33$ , N.S.), thus justifying the groupings of these emotions. Happy stimuli were rated as much better expressed than these four types of stimuli ( $F(1,14) = 92.09$ ,  $R^2 = .41$ ,  $p < .001$ ), but there were no differences in ratings for neutral stimuli and the combined levels of surprise, sadness, fear, and anger ( $F < 1$ ). Happy stimuli were, moreover, rated as being better expressed than neutral stimuli ( $F(1,14) = 20.56$ ,  $R^2 = .26$ ,  $p < .01$ ).

#### HOW STRONGLY WAS THE EMOTION EXPRESSED?

In general the ratings for each of the six emotions differed significantly as to how strongly the subjects thought they were expressed ( $F(5,70) = 9.80$ ,  $R^2 = .20$ ,  $p < .001$ ). Moreover, the ratings for the emotions happiness, surprise, sadness, fear and anger were found to vary significantly ( $F(4,56) = 15.20$ ,  $R^2 = .25$ ,  $p < .025$ ). Happy expressions were rated as being expressed more strongly than both neutral expressions ( $F(1,14) = 22.75$ ,  $R^2 = .18$ ,  $p < .01$ ) and the combined ratings of surprise, sadness, fear, and anger ( $F(1,14) = 24.58$ ,  $R^2 = .31$ ,  $p < .001$ ). The ratings for neutral expressions, however, did not differ significantly from the ratings for this combined group ( $F < 1$ ). The results of this scale and the previous scale thus indicated that happy expressions were judged as being better expressed and more strongly expressed than all other types of stimuli. The analysis also indicated that happy expressions were judged as being better expressed and more strongly expressed than all other types of stimuli. The analysis also indicated that there were no differences in how subjects rated neutral expressions in comparison to surprise, sadness, fear, and angry expressions in terms of how well or how strongly they were expressed.

#### LIKELIHOOD TO SEE OR DO IN ONE DAY

The analysis of the scores subjects gave concerning the likelihood of their seeing or performing a certain expression within the course of an average day indicated that, in general, ratings differed as a function of the expressed emotion for both seeing ( $F(5,70) = 44.40$ ,  $R^2 = .58$ ,  $p < .001$ ) and performing ( $F(5,70) = 48.58$ ,  $R^2 = .55$ ,  $p < .001$ ) the expression. Moreover, ratings for the five more "actively loaded" expressions differed as a function of the emotion expressed ( $F(4,56) = 45.62$ ,  $R^2 = .55$ ,  $p < .001$ ; and  $F(4,56) = 63.03$ ,  $R^2 = .57$ ,  $p < .001$ , for seeing and performing, respectively).

Subjects rated happy expressions as more likely to be seen than both surprise expressions ( $F(1,14) = 89.00$ ,  $R^2 = .68$ ,  $p < .001$ ) and the combined ratings of sadness, fear, and anger ( $F(1,14) = 137.26$ ,  $R^2 = .73$ ,  $p < .001$ ). The comparison between ratings of seeing happy expressions and seeing neutral expressions, however, only approached significance ( $F(1,14) = 11.02$ ,  $R^2 = .21$ ,  $p < .10$ , with Scheffe's correction). Moreover, neutral expressions were judged significantly more likely to be seen than both surprise expressions ( $F(1,14) = 50.46$ ,  $R^2 = .55$ ,  $p < .001$ ) and the combined ratings for sadness, fear, and anger ( $F(1,14) = 81.65$ ,  $R^2 = .61$ ,  $p < .001$ ).

Analysis of subjects' ratings of the likelihood to perform certain expressions revealed that happy expressions were judged to be performed more highly than surprise expressions ( $F(1,14) = 87.74$ ,  $R^2 = .66$ ,  $p < .001$ ), neutral expressions ( $F(1,14) = 20.84$ ,  $R^2 = .29$ ,  $p < .01$ ), and the combined groups of sadness, fear, and anger ( $F(1,14) = 141.02$ ,  $R^2 = .68$ ,  $p < .001$ ). Neutral expressions were rated as significantly more likely to be performed than surprise expressions ( $F(1,14) = 23.92$ ,  $R^2 = .32$ ,  $p < .001$ ) and the combined ratings of sadness, fear, and anger ( $F(1,14) = 44.01$ ,  $R^2 = .40$ ,  $p < .001$ ). Thus, as in the previous scales concerning how well or

how strongly an emotion was expressed, subjects rated happy expressions as being more likely to be both seen and performed than all the other expressions. Unlike the previous scales, however, which found no differences between ratings of neutral expressions and surprise, sadness, fear, and anger expressions, subjects rated the probability of both seeing and performing neutral expressions higher than the probabilities for these four emotions.

### DISCUSSION

Previous research on perception of facial expressions have been concerned primarily with the accurate identification of an expressor's emotional state. Such research has relegated the role of perception to a relatively simple state in the communication process. The results of this study, however, suggest that expression and perception of different emotions have different meanings, both concerning the judged quality of certain affective expressions and the judged probability of either seeing or performing such expressions. Moreover, happiness was rated as being the best and strongest expression, and as being the most probable to both see and do. Neutral expressions were no different from surprise, sadness, fear, and anger in the quality of the expression, but was rated as being more likely to be seen and performed than these four emotions. The finding that happiness received the highest ratings overall is not surprising; indeed, what we know of happiness and positive affect in terms of memory, information relating to one's self, and their significance both as primary affects and as secondary social rewards, leads us to suspect that the pervasiveness of this emotion within human life would take such large importance.

It is interesting, however, to speculate about the changes in judgment from quality to predictive/behavioral for neutral expressions. For example, theorists who have offered evidence for the primacy of affect in relation to cognition (e.g. Zajonc, 1980), have suggested that purely affective states devoid of cognitive activity can and indeed do occur, whereas there can be no purely cognitive state devoid of affective experience. This implies that what we have been calling the "neutral" state cannot in actuality be a neutral state. In this framework neutral states become less-affective than other emotional states such as happiness, anger, or sadness, but they do not become affect-less. If, in reality, such less-affective states are engaged in regularly, both from a perceptual and expressive viewpoint, while at the same time totally affect-less states rarely occur, this would seem to indicate that what we have been calling "neutral" takes on some previously disregarded significance, both as a personal feeling state and as a communicative component. The fact that we have found that subjects will judge probabilities of seeing and performing such facial behaviors as higher than other "primary" emotions suggests, however weakly, that we explore this possibility more. The primacy of affect may indeed be reflected in the face, but perhaps only in a less-affective state.

While these findings can undoubtedly be subjected to several viable interpretations, their strongest contributions may be made in allowing us to explore the potential importance that the perceptual subsystem in emotion theory may occupy. Posing questions about not what an expressor feels at a specific point in time, but about how one perceives expressions, differences in perception as a function of the type of expression, and the perception's meaning to one's own affective or cognitive state will fill in some of the gaps left in current emotion theory. Moreover, asking questions concerning not only these issues, but also about how a perception guides our thinking about the future, in terms of changes in affect, cognition, or behavior of both the expressor or the perceiver will enable us to not only refine our

conceptions of the communication process, but also to elucidate on the nature of and interrelationship between the affective and cognitive systems.

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