Symposium on Emotion

FACIAL EXPRESSIONS OF EMOTION: New Findings, New Questions

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Abstract—*The evidence on universals in facial expression of emotion, renewed controversy about that evidence, and new findings on cultural differences are reviewed. New findings on the capability for voluntarily made facial expressions to generate changes in both autonomic and central nervous system activity are discussed, and possible mechanisms by which this could occur are outlined. Finally, new work which has identified how to distinguish the smile of enjoyment from other types of smiling is described.*

This paper focuses on the evidence and issues regarding observable facial expression of emotion (for nonobservable facial activity, see Tassinary & Cacioppo, this issue). I will not describe the major methodological advances which for the first time provide techniques for measuring observable facial behavior objectively (but see my review [Ekman, 1982]). Instead I will focus on two new findings and one set of studies dating back 20 years. I will begin with those older studies, of universals in facial expression, because they provide the background for the newer research and also because there is renewed controversy about universals, as well as some new findings and a number of unanswered questions.

UNIVERSAL FACIAL EXPRESSIONS

From 1920 through 1960 many influential psychologists maintained that facial expressions are socially learned and culturally variable, with no fixed relationship between an expression and what it signifies (Bruner & Tagiuri, 1954; Hunt, 1941; Klineberg, 1938; Landis, 1924; Munn, 1940). In the early 1970s there were two challenges: a critical reevaluation of the experiments which had supported that position (Ekman, Friesen, & Ellsworth, 1972) and, more important, new data. Izard and also Friesen and I conducted similar studies of literate cultures, working independently but at the same time. Izard's work and ours was influenced by Tomkins's writings on emotion (1962) and his advice on the conduct of the research we performed.

In each culture subjects chose the emotion terms which fit photographs of posed Caucasian facial expressions. Although Izard (1971) and I (Ekman, Sorenson, & Friesen, 1969) showed different photographs, gave our subjects somewhat different lists of emotion terms, and examined people in different cultures, we both obtained consistent evidence of agreement across more than a dozen Western and non-Western literate cultures in the labeling of enjoyment, anger, fear, sadness, disgust, and surprise facial expressions.

In order to rule out the possibility that such agreement could be due to members of every culture having learned expressions from a shared mass media input, Friesen and I (Ekman, 1972; Ekman & Friesen, 1971; Ekman et al., 1969) also studied a visually isolated preliterate culture in New Guinea. We replicated our findings for literate cultures, as did Heider and Rosch a few years later in another visually isolated culture in what is now West Irian. Although surprise expressions were distinguished from anger, sadness, disgust, and enjoyment expressions in both preliterate cultures, surprise was not distinguished from fear expressions in one of these cultures. Friesen and I also reversed the research design and found that when New Guineans posed facial expressions they were understandable to Western observers (Ekman & Friesen, 1971).

To reconcile these findings of universality with the many reports by cultural anthropologists of dissimilar facial expressions, we (Ekman & Friesen, 1969) postulated *display rules* to refer to what we presume each culture teaches its members about the management of expression in social contexts. Cultural differences in display rules could explain how universal expressions might be modified to create, on occasion, the appearance of culture-specific facial expressions of emotion. We tested this idea in a study comparing the spontaneous expressions shown by Japanese and Americans when they were alone, and presumably no display rules should operate, and when they were with another person (Ekman, 1972; Friesen, 1972). As predicted, there was no difference between cultures in the expressions shown in response to films of unpleasant scenes when the subjects thought they were alone. However, when an authority figure was present the Japanese more than the Americans masked negative expressions with the semblance of smile.

We, like Izard, interpreted the evidence in terms of universal facial expressions as posited by Tomkins (1962) and (much earlier) by Darwin (1872). Consistent with an evolutionary view of expression were other reports of similarities in expression in other primates and in early appearance developmentally. Recently, there have been some challenges to that interpretation. Lutz and White (1986) cited anthropologists who regard emotions as social constructions and reported cultures in which the emotions proposed as universal are neither named nor expressed. Unfortunately, such reports are not substantiated by quantitative methods nor protected against the potential for bias or error when the information is obtained by the single observer who formulated the hypothesis under study. Ortony and Turner (1990) provided a different challenge, speculating that it is only the components of expressions, not the full emotional expres-

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sions, which are universal; but see my rebuttal (Ekman, in press-a) and one by Izard (in press).

A new line of studies has found consistent evidence of cultural differences in the perception of the strength of an emotion rather than of which emotion is shown in a facial expression. Japanese make less intense attributions than do Americans (Ekman et al., 1987) regardless of whether the person showing the emotion is Japanese or American, male or female (Matsumoto & Ekman, 1989). This difference appears to be specific to the interpretation of facial expressions of emotions, since it was not found in the judgment of either nonfacial emotional stimuli or facial nonemotional stimuli (Matsumoto & Kudoh, 1991).

A number of empirical questions remain about universals in facial expression. Although there is evidence of more than one different expression for each emotion (up to five visibly different expressions for some emotions) in Western cultures, we do not know how many of those different expressions which signal a single emotion are shown universally (Ekman & Friesen, 1975, 1978). Nor is there certain knowledge about whether there are other emotions in addition to anger, fear, disgust, sadness, enjoyment, and surprise that have universal expressions. There is some evidence, although it is contradictory, for universal facial expressions for contempt, interest, shame, and guilt. Little is known also about cross-cultural differences in display rules, as a function of sex, role, age, and social context (but see recent work by Matsumoto, in press). These and other questions about universals have recently been reviewed (Ekman, 1989b).

FACIAL ACTION GENERATES EMOTION PHYSIOLOGY

Most emotion theorists emphasize the involuntary nature of emotional experience, ignoring those instances when people choose to generate an emotion through reminiscence or by adopting the physical actions associated with a particular emotion (e.g., speaking more softly to deintensify anger or smiling to generate enjoyment). Facial expression from this vantage point is seen as one of a number of emotional responses that are generated centrally when an emotion is called forth by, for example, an event, memory, or image.

A new role for facial expression was found in my collaborative study with Levenson and Friesen (Ekman, Levenson, & Friesen, 1983). Voluntarily performing certain facial muscular actions generated involuntary changes in autonomic nervous system (ANS) activity. We did not ask subjects to pose emotions, but instead to follow muscle-by-muscle instructions to create on their faces one of the expressions which had been found to be universal. For example, rather than ask a subject to pose anger we said: "Pull your eyebrows down and together; raise your upper eyelids and tighten your lower eyelids; narrow your lips and press them together." Different patterns of ANS activity occurred when subjects made the muscular movements which had been found universally for the emotions of anger, fear, sadness, and disgust.

This work has since been replicated in three more experiments (Levenson, Carstensen, Friesen, & Ekman, 1991; Levenson, Ekman, & Friesen, 1990), and a number of possible artifacts which could have been responsible for this phenomenon have been ruled out. The findings were again obtained in a very different culture—the Minangkabau of Sumatra, Indonesia, who are fundamentalist Moslem and matrilineal—suggesting that this phenomenon may be pan-cultural (Ekman, 1989a).

It appears that the specific patterns of ANS activity that were generated by making the different facial expressions are not unique to this task, but are the same as are found in more conventional emotion-arousing tasks. This lack of specificity confirms my proposal (Ekman, 1984, in press-b) that emotions are characterized by patterned changes in both expression and physiology, changes which are distinctive for each emotion, and which are not (in large part) specific to the means by which the emotion was aroused. This latter point is most readily noted with facial expression, which can signal that someone is angry, for example, without providing any clue as to what made the person angry.

When subjects followed our instructions to make these facial expressions, most reported not simply a physiological change but the experience of an emotion. In response to an open-ended question about what emotions, sensations, or memories they experienced, there were few reports of memories or sensations, while on 78% of the trials the subjects reported feeling an emotion. More information on this point, on the issue of generality, and on the details of the emotion-specific patterns of ANS activity can be found in Levenson's paper in this issue and also in Levenson et al. (1990).

Before turning to the question of *how* voluntarily making different facial configurations generates different patterns of physiology, let me broaden our focus to consider central nervous system (CNS), not just ANS, physiology. In a study employing the same muscle-by-muscle instructions used to study ANS activity, subjects created the various facial configurations while left and right frontal, temporal, and parietal electroencephalographic (EEG) activity was measured. Different patterns of EEG activity occurred when subjects made the muscular movements which had been found universally for the emotions of happiness, anger, fear, sadness, and disgust (Davidson & Ekman, 1991; Ekman & Davidson, 1991).

In unpublished research Friesen, Levenson, and I have formulated nine different explanations of how voluntary facial action generates emotion-specific physiology. Here I will indicate only three broad divisions among these explanations, leaving out the specific details relevant to subdistinctions within each of these divisions. The first explanation, which is the one we endorse, posits a central, hard-wired connection between the motor cortex and other areas of the brain involved in directing the physiological changes which occur during emotion. The second group of explanations proposes that such a connection is learned, not hard-wired. Such learning could be common to all members of our species or culture-specific. (Our findings in Indonesia raise questions but cannot rule out the viability of the culture-specific variation.) The third set of explanations emphasizes peripheral feedback from the facial actions themselves, rather than a central connection between the brain areas which direct those facial movements and other brain areas. This view includes variations in terms of

whether feedback comes from the muscles, the skin, or temperature changes and whether it is hard-wired or requires learning. This explanation is consistent with the views of Izard (in press), Laird (Laird, 1974; Duclos et al., 1989), Tomkins (1962), and Zajonc (1985).

For now, there is no clear empirical basis for a definitive choice among these explanations. Through studies of people with facial paralysis who have no possibility of peripheral facial action or feedback we hope to challenge the third category of explanations, but this work is not yet complete, and the results may not be unambiguous.

THE SMILE OF ENJOYMENT

The last focus of research which I will discuss—the smile—has misled many psychologists and anthropologists. Failing to recognize that there are different types of smiling which may have different meanings has led to confusing and contradictory results. The appearance of smiling of some form in unpleasant circumstances led anthropologists such as Birdwhistell (1970) and LaBarre (1947) to proclaim that facial expressions have different meanings in different cultures. Landis (1924) concluded that smiling is a meaningless expression because his subjects showed some form of smiling in response to unpleasant as well as to pleasant stimuli. More recently, studies of interpersonal deception have obtained contradictory findings on smiling.

The confusion might have been avoided if scientists in this century had read the work of French neuroanatomist Duchenne de Bologne, who wrote in 1862. Although this work was not translated into English until recently (Duchenne, 1862/1990), Charles Darwin (1872) described Duchenne's ideas about smiling in his own book on expression. Duchenne said that the smile of enjoyment could be distinguished from deliberately produced smiles by considering two facial muscles: *zygomaticus major*, which pulls the lip corners up obliquely, and *orbicularis oculi*, which orbits the eye, pulling the skin from the cheeks and forehead toward the eyeball. According to Duchenne, "The first [*zygomaticus major*] obeys the will but the second [*orbicularis oculi*] is only put in play by the sweet emotions of the soul; the . . . fake joy, the deceitful laugh, cannot provoke the contraction of this latter muscle . . ." (p. 126). The *orbicularis oculi* "does not obey the will; it is only brought into play by a true feeling. . . . Its inertia in smiling unmasks a false friend" (p. 72).

We (Ekman & Friesen, 1982) adopted Duchenne's proposal and also suggested three other ways in which enjoyment smiles could be distinguished from other forms of smiling: by the action of certain other muscles, by the extent of bilateral symmetry, and by the timing of the smile. While there has been some empirical support for each of these means of distinguishing enjoyment from nonenjoyment smiles (Ekman, Friesen, & O'Sullivan, 1988, on other muscular differences; Ekman, Hager, & Friesen, 1981, and Hager & Ekman, 1985, on symmetry; Hess & Kleck, in press, on timing), many more studies have tested Duchenne's proposal, and it is this work I will now review. In all of these studies the smile with *orbicularis oculi* (which in his honor I have called the *Duchenne smile*) is compared with other kinds of smiling (social smiles, masking smiles, etc.) which do not include that muscle. Three types of evidence support Duchenne's distinction.

1. *Social Context.* We (Ekman et al., 1988) found more Duchenne smiles when subjects truthfully described pleasant feelings than when they claimed to be feeling pleasant but were actually experiencing strong negative emotions. In another study, in which people were not asked to deceive but simply watched emotion-inducing films while alone, there were more Duchenne smiles when they watched pleasant than when they watched unpleasant films, but there was no difference in how often other kinds of smiling occurred (Ekman, Davidson, & Friesen, 1990). Ten-month-old infants showed more Duchenne smiles when approached by their mothers, and more of other kinds of smiling when approached by a stranger (Fox & Davidson, 1988). Five- to 7-year-old children showed more Duchenne smiles when they succeeded in a game, and more other kinds of smiling when they failed (Schneider, Josephs, & Friedrich, 1988). Psychiatrically depressed patients showed more Duchenne smiles at time of discharge from a hospital than at time of admission, with no difference in other kinds of smiling (Matsumoto, 1987). Similarly, there was more Duchenne smiling in late as compared with early psychotherapy sessions, but only among patients who had improved (Steiner, 1986).
2. *Persons.* Schizophrenic patients showed fewer Duchenne smiles than normal individuals, but there was no difference between the groups in other kinds of smiling (Krause, Steimer, Sanger-Alt, & Wanger, 1989). Nonabusive mothers showed more Duchenne smiles than abusive mothers when interacting with a child (Bugental, Blue, & Lewis, 1990). Levenson and Gottman found happily married couples showed more Duchenne smiles than unhappily married couples, but there was no difference in other kinds of smiling (Levenson, 1989).
3. *Other Emotional Responses.* Only the Duchenne smile correlated with self-reports of positive emotions after subjects had seen two films intended to induce positive affect, and only the Duchenne smile predicted which of the positive films each subject reported liking best (Ekman et al., 1990). In that same study different patterns of regional brain activity were found when the subjects showed the Duchenne as compared with other smiles. The study of 10-month-old infants (Fox & Davidson, 1988) also found differences in regional brain activity when the infants showed Duchenne or other kinds of smiling. Also, patterns of regional brain activity when subjects deliberately performed a Duchenne smile differed from those found when a non-Duchenne smile was performed (Ekman & Davidson, 1991), results consistent with Fox and Davidson's study of infants and my own (Ekman et al., 1990) study of spontaneous smiling.

This is a remarkable convergence of evidence supporting the distinction between Duchenne and other kinds of smiling. No account should be taken of stud-

ies that claim to show smiles are unrelated to emotion (e.g., Fridlund, 1991) and continue to treat all smiles as a single category, not separating Duchenne from non-Duchenne smiles.

Recent work has shown that the Duchenne smile is recognizable to observers, who were able to distinguish enjoyment from non-enjoyment smiles when they viewed a series of smiles (Frank, Ekman, & Friesen, 1991). However, the Duchenne smile was not related to observers' attributions when this type of smiling was embedded within the usual context, competing for attention with speech content, voice, and gesture (O'Sullivan, Ekman, Friesen, & Scherer, 1991).

One of the questions remaining about smiles is whether the different positive emotions (e.g., amusement, contentment, relief) have distinctive forms of smiling or whether all the positive emotions share one signal, in which case the particular emotion can be inferred only from other behavioral or contextual cues. A similar question can be raised as to whether there are distinctive forms of non-enjoyment smiles (e.g., compliance, embarrassment, grin-and-bear-it).

OTHER ISSUES ABOUT EXPRESSION

In closing let me mention three major questions about observable facial expressions. Every student who examines expression itself, not its recognition, must be impressed with individual differences in the speed, magnitude, and duration of expression as well as variations in which facial expression of emotion occurs in response to a particular event. It is not known whether such differences are consistent across emotions or situations, or over time. We also do not know whether facial activity is a necessary part of any emotional experience. Under what circumstances, and with what kinds of people, might there be evidence of physiological changes relevant to emotion and the subjective experience of emotion with no evidence of visible expression or nonvisible electromyographic facial activity? Another issue requiring study is whether personality traits, moods, and psychopathology have facial markers or are second-order inferences drawn from the occurrence of facial expressions of emotion.

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