Fundamentals of nonverbal behavior

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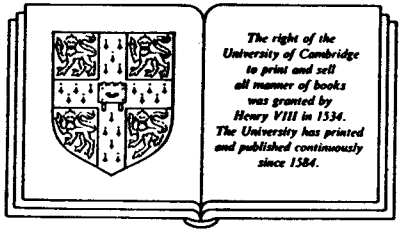

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5. Facial expression: Methods, means, and moues

PAUL EKMAN AND MAUREEN O'SULLIVAN

. . . so your face bids me, though you say nothing.
– Fool to King Lear

Introduction

Poets and philosophers often focus on the face as central to human communication, but the interest of psychologists in facial expression has been more episodic. At first, many well-known researchers such as Allport (1924), Landis (1924), Goodenough (1932), Guilford (1929), and Klineberg (1938) studied facial expressions of emotion. Several influential reviewers (Bruner & Tagiuri, 1954; Hunt, 1941; Tagiuri, 1968), however, argued that there were no consistent answers to fundamental questions such as whether information provided by facial expressions was accurate or whether facial expressions of emotion were universal. During the next 20 years there were comparatively few studies of facial expression, with the exception of Schlosberg's reports (1941, 1952, 1954) that categorical judgments of emotion could be ordered in terms of underlying dimensions.

A number of more recent developments have contributed to the resurgence of interest in facial expression, including methodological, theoretical, and technological advancements. Indeed, part of the difficulty in obtaining consistent results in the early facial expression studies was the lack of well-defined, objective methods for describing facial behavior. Since 1970, several reliable facial measurement techniques have been developed, which have allowed greater precision within studies and greater comparability across studies than was possible earlier. This

This chapter incorporates some material from Ekman (1989) and Fridlund, Ekman and Oster (1987). Paul Ekman's work is supported by a Research Scientist Award from the National Institute of Mental Health (MH 06092).

chapter will compare and contrast several different facial measurement techniques. We shall then illustrate the reason for using such time-consuming methods by examining recent findings concerning a specific facial expression: the smile. The exactitude of the current measurement methods permits us to explore subtle differences among smiles that were not possible even 20 years ago.

In addition to advances in measurement techniques, theoretical breakthroughs and empirical findings also have contributed to a resurgence of interest in facial expression. Tomkins (1962, 1963) provided a theoretical rationale for studying the face as a means for learning about personality and emotion. He also showed that observers could obtain very high agreement in judging emotion if the facial expressions were carefully selected to reveal what he believes are the innate facial affects (Tomkins & McCarter, 1964). Tomkins greatly influenced both Ekman and Izard in planning their initial cross-cultural studies of facial expression. The resulting evidence of universality in facial expression also rekindled interest in this topic.

The evidence for universals in facial expression fits not only with Tomkins's theory but also with the newly emerging interest in applying ethological methods and concepts to human behavior. Interested in the biological bases of behavior, human ethologists welcomed evidence of commonalities in social behavior across cultures, and they provided the first detailed "catalogs" describing naturally occurring facial behavior (Blurton Jones, 1972; Brannigan & Humphries, 1972; Grant, 1969; McGrew, 1972). Because the question of the universality of facial expression is so central to thinking about emotion and nonverbal behavior, we shall review the more recent studies in this area, thereby updating and refining the issues in this domain.

In the 1960s and 1970s, the availability of low-cost photography and videotaping encouraged several researchers to measure the ability to recognize facial expressions (O'Sullivan & Guilford, 1975; Rosenthal, Hall, DiMatteo, Rogers, & Archer, 1979). The question of what kind of information can be conveyed by the face, however, continues to be debated. For this reason, we also shall review the issues to be considered in assessing accuracy in judging facial emotional expressions.

The final topic that we shall address is the role of facial feedback in the phenomenology of emotion. The increasing interest of psychologists in issues pertaining to emotion suggested the facial feedback hypothesis as one with broad appeal.

The topics this chapter will address – facial measurement, universality, accuracy, and facial feedback – were chosen for their importance, both historically and theoretically. Nonetheless, several areas have been excluded from consideration. In recent years, developmental psychologists investigating attachment, mother–infant interaction, and the development of emotion have begun to study facial expression. Because other chapters in this book discuss developmental aspects of nonverbal behavior, it will not be addressed here.

The encoding or expression of individual facial behavior is receiving more and more attention (Rusalova, 1987), with many researchers examining encoding differences among schizophrenics (Garfield, Rogoff, & Steinberg, 1987; Morrison, Bellack, & Mueser, 1988) and brain-damaged individuals (Weddell, Trevarthan, & Miller, 1988). But we shall not review this research or that on the relationship between the face and the autonomic nervous system (Ekman, Levenson, & Friesen, 1983; Levenson, Ekman, & Friesen, in press) and the central nervous system (Davidson, Ekman, Saron, Senulis, & Friesen, 1990), as it is too far afield from the nonverbal behavior emphasis of this book.

For the same reason, research on the words used to describe facial expressions of emotion will not be reviewed. Ekman, Friesen, and Ellsworth (1972) reanalyzed many of the experiments conducted from 1914 to 1970. They found, contrary to Bruner and Tagiuri's assessment (1954), that the data yielded consistent, positive answers to fundamental questions about the language used to describe facial expression, the influence of context on judgments of facial expression, the accuracy of judgments, and similarities across cultures. More recent thinking on the language and labels used to describe facial expressions of emotion includes that of Russell and Fehr (1987) and Ekman and O'Sullivan (1988). Other reviews of facial expression research include Charlesworth and Kreutzer (1973) on infants and children; Chevalier-Skolnikoff (1973) and Redican (1975, 1982) on nonhuman primates; Izard (1977) on theories of emotion; Ekman and Oster (1979) on the face; and Fridlund, Ekman, and Oster (1987) on facial expression of emotion, including developmental and physiological aspects.

Facial measurement

Two major methodologies for studying facial expressions have been developed: the measurement of visible facial actions using facial coding systems and the measurement of electrical discharges from contracting facial muscle tissue (facial electromyography).

Measurement of visible facial action

Since Landis's report in 1924, many systems have been devised to structure and analyze the observation of facial action. Such measurement systems share the following features: (1) They are noninvasive; (2) they offer a permanent visual record (videotape or cinema) that allows slowed playback and/or multiple viewings rather than real-time observation; and (3) they rely on an observer who scores or codes behavior according to a set of predetermined categories or items. Many of these systems were not constructed as independent contributions but, rather, in the course of studying other substantive questions. Typically, the rationale for developing these systems was based on neither sound theoretical argument nor empirical data (see Ekman, 1982, for a detailed comparison of 14 major facial coding systems).

A problem encountered by all researchers trying to understand facial behavior is selecting appropriate behavioral units for dividing the ongoing, complex, and dynamic stream of facial activity. Though this issue is of prime importance, many coding systems have not considered it. As Altmann commented, "What stage in our research could be more crucial than this initial choosing of behavioral units. Upon it rests all of our subsequent records of communication interactions and any conclusions we may draw from them" (Altmann, 1968, p. 501; also see discussions by Buck, Baron, & Barrette, 1982; and Condon & Ogston, 1967a,b).

Two major approaches have been used in constructing facial coding systems: the message judgment approach and the measurement of sign vehicle approach. In the message judgment approach, facial expressions are presented in their entirety, and judgments are solicited from observers. For example, slides of psychiatric patients are shown to judges who must then classify each one as depressed, normal, or schizophrenic. Message judgment approaches either place expressions along emotion scales (e.g., Schlosberg, 1941, 1952, 1954) or in discrete emotion categories (e.g., Izard, 1971, 1972; also see the review of both scaling and categorical approaches by Ekman, Friesen & Ellsworth, 1982b).

In the measurement of sign vehicle approach, slides are examined for particular differences that might differentiate diagnostic categories. For example, depressives might raise their inner eyebrows more than schizophrenics or normals do, and the schizophrenics might show more perioral facial actions.

Both approaches to facial coding have value in certain applications, although the message judgment approach is singularly handicapped: It

is impossible in such a system to determine exactly which facial signs result in judgment differences. This liability is particularly pronounced when studying emotional behavior. But an analytic approach that specifies discrete facial actions avoids sloppy inferences regarding critical facial signs of emotion.

Facial unit selection. The choice of behavioral units in facial coding systems has been based on theory (largely ethological formulations), inductive observation, or facial anatomy.

Theory-based selection. Ekman, Friesen, and Tomkins's (1971) Facial Affect Scoring Technique (FAST) specified what they considered, on the basis of their previous research, to be the distinctive components of six universal affect expressions (77 descriptors of the hypothesized facial appearance for happiness, sadness, anger, fear, surprise, and disgust). FAST proved to be useful in studies relating subjects' facial expressions to autonomic responses, experimental conditions, and observers' judgments. But it could not be used to determine whether actions other than those specified were relevant to emotion or to study developmental changes or individual differences in the expression of emotion. No provision was made to code the intensity of the facial behaviors, and facial descriptors were specified as happening in two states, either "on" or "off."

Izard continued working with theoretically based coding systems and produced the Maximally Descriptive Facial Movement Coding System (MAX; Izard, 1979) and the System for Identifying Affect Expression by Holistic Judgment (AFFEX; Izard & Dougherty, 1980). Like FAST, MAX and AFFEX are based on early facial expression recognition studies that established that certain configurations of facial muscle groups are universally judged to be associated with particular emotions. Neither MAX nor AFFEX offers an exhaustive listing of possible facial behaviors; MAX, for example, provides only those 27 descriptors that Izard hypothesized were necessary to form judgments about seven "primary" emotions. No data are provided to show that the facial actions excluded are not part of emotional expression, and thus the "exhaustiveness" of the systems cannot be confirmed or disconfirmed using these systems. No provision is made for encoding response intensity, and like FAST, facial action is seen as either "on" or "off."

MAX and AFFEX were designed primarily for coding emotional expressions in infants. Oster and Rosenstein (1983) pointed out three diffi-

culties inherent in the use of MAX and AFFEX for this purpose. First, when scoring facial behavior one cannot distinguish between organized patterns of facial expression in infants and configurations that coincidentally match adult facial stereotypes. Second, in these systems one can classify infant expressions as "fitting" a particular adult category on the basis of only a few facial actions, occurring in just two of the three areas of the face. The omission of certain facial actions from MAX and AFFEX thus makes it impossible to verify whether infant (or even adult) expressions meeting the coding criteria are the same as their standardized adult counterparts or whether other infant expressions that do not resemble adult stereotypes constitute meaningful communicative signals. Third, and perhaps most serious, is the absence of any independent evidence that the configurations specified in MAX and AFFEX indicate the presence of the corresponding discrete emotional states in infants. This last objection likewise applies to the use of MAX and AFFEX for coding adult expressions.

Inductively based selection. Several overlapping listings of facial actions have been derived by observing spontaneous behavior in infants (Nystrom, 1974; Young & Decarie, 1977), children (Blurton Jones, 1971; Brannigan & Humphries, 1972; Grant, 1969; McGrew, 1972), and normal adults and psychiatric patients (Grant, 1969), which were reviewed in detail by Ekman (1982). The inductively based systems have been useful in generating "ethograms," or catalogs of the salient behaviors in the communications repertoire. Blurton Jones's system has been adopted with some variations by a number of developmental psychologists.

The inductively based facial coding systems cannot be considered as general-purpose facial measurement systems, as the parsing of facial actions is inconsistent – all include both simple actions and complex movements that are not subdivided into components. Behavioral units are occasionally objectively identified but are often given names laden with subjective judgments (e.g., "angry frown"). These terms only complicate inferences about the facial behavior (e.g., whether or not the frown signifies anger). Many behavioral units are vaguely described, so that investigators cannot know whether they are coding the same actions. Descriptions of actions are often not in accord with the underlying facial anatomy. For example, Birdwhistell (1970) attempted to construct a facial measurement system paralleling linguistic units, and Grant (1969) derived measurement units from their ostensible (i.e., unvalidated) "function." Static facial signs (e.g., individual, racial, or age-related differences in physiognomy) make it difficult to identify certain actions in systems in which facial behavior is described in terms of static configurations, for instance, "oblong mouth."

Anatomically based selection. Because every facial movement is the result of muscular action, any complex facial movement can be scored analytically in terms of the minimal muscle actions that collectively produced the movement. Seaford (1976) provided an excellent, detailed critique of the hazards in theoretically and inductively derived systems. In contrast, his description of a regional variation in facial expression showed the advantages of an anatomical approach.

Several investigators have attempted to derive anatomically based systems (Ermiane & Gregarian, 1978; Frois-Wittman, 1930; Fulcher, 1942; Landis, 1924; see Ekman, 1982, for analyses of these systems). Because only anatomically based coding systems offer the possibility of being comprehensive, the extant systems can be evaluated against this standard.

The comprehensiveness of any facial coding system must be assessed according to four criteria. First, all visible facial actions must be included in the system (regardless of theoretical or inductive notions about function or signal value). Second, a provision for coding the intensity of facial actions must be included, as it is particularly important to measure muscular excursions in the left versus the right side of the face and to assess intensity of emotion. Third, a provision for timing the facial actions, with regard to both stimulus situations and the patterning of the facial actions themselves, must be included in a comprehensive system. The response dynamics that must be coded include onset time, apex time, and offset time; these fine-grained dynamics have already been implicated in the discrimination between deceptive and honest expressions (Ekman & Friesen, 1982) and feigned and unfeigned smiles (Ekman, Hager, & Friesen, 1981). Fourth, the behavioral units must be clearly and operationally defined, with high interrater reliabilities and suitable validity data.

Measured according to these criteria, nearly all of the anatomically based systems fall short, as most were devised solely to measure emotion. The systems devised by Frois-Wittman (1930), Fulcher (1942), and Landis (1924) contained only limited subsets of facial actions, and they made no provision for timing actions. Ermiane & Gregarian (1978) offered a system that coded all visible facial actions, including intensity information, but did not code the timing of facial actions. Ermiane and

Gregarian also distinguished the actions of some muscles without data supporting that they operated independently in visible behavior.

Facial Action Coding System: FACS

The Facial Action Coding System (FACS) (Ekman & Friesen, 1976, 1978) was developed to fill the need for a comprehensive, general-purpose system applicable in any context, not just in emotion-related situations. As a prerequisite, Ekman and Friesen sought to discover the precise role of each facial muscle on visible facial expression. In order to do so, they resurrected Duchenne's (1862) method of inserting needle electrodes in individual facial muscles. The muscle activity elicited by electrical stimulation at the electrode tip indicated the effect of each muscle on facial appearance. The facial actions that Ekman and Friesen discerned were found to be in accord with Hjorstjo's (1970) independent anatomical studies of the appearance of single facial muscle actions.

The descriptions of facial actions comprising FACS were based not only on the resulting stimulation data but also on the determination of whether particular muscle combinations produced visibly distinguishable facial actions. Distinct muscles that produced morphologically identical facial actions were combined. But if a single muscle were found to produce two or more visibly distinct actions, two or more facial action units were designated. Ekman and Friesen derived 44 action units (AUs) that can, singly or in combination, account for all visible facial movements. All AUs can be scored according to five-point intensity ratings, and the time of the onset, apex, and offset for each AU can be coded. FACS also offers high interrater reliabilities.

FACS takes considerable time to learn and use, requiring repeated, slow-motion viewing of facial actions. Because slow-motion replay is required, FACS is not suitable for real-time coding. By its nature, FACS includes more distinctions than may be needed for any particular study, which increases the expense and tedium of measurement. However, once meaningful behavioral units are derived empirically (i.e., not from theoretical or inductive assertions), it is possible in a given study to collapse some of the elementary measurement units or to disregard subtle distinctions. This point applies especially to studies of emotion – FACS contains hypotheses about which AUs may, in fact, correlate with specific emotional states.

Although not all of the FACS emotion hypotheses have been tested, there is evidence (reviewed by Ekman, 1982) to support a number of the predictions. Studies of spontaneous emotional expression in which a subjective report was used as a validity criterion have supported predictions of the actions that signal happiness, fear, distress, and disgust. And studies using observers' attributions of emotion as a validity criterion have supported FACS predictions for these emotions as well as for surprise and anger.

EMFACS

Ekman and Friesen wanted to supplement the comprehensive FACS with a standardized alternative that measures broader, emotion-related facial actions. The result, EMFACS, considers only emotional expressions and, among those, only the AUs and AU combinations that are best supported by empirical findings or theory as emotion signals. As such, EMFACS is really a theory-based coding system, but with an important difference. Its systematic derivation from FACS permits confident statements about what was omitted. The solidity of EMFACS as a system with empirical grounding is suggested by several concurrent validation studies with FACS, which resulted in high correlations (in the +.80 range) with emotion ratings obtained with FACS and EMFACS.

Coding time with EMFACS is reduced, albeit at the expense of distinguishing subtler AUs and AU combinations, including those indicative of conversational signals. The precise temporal dynamics of the facial actions are ignored in favor of unitary demarcations of peak actions. To maintain an empirical approach to the measurement procedure, the facial actions are, like FACS, described in terms of numerical codes. The coder is also requested not to interpret the actions as emotion signals until they are later tabulated and classified according to EMFACS criteria.

Other measures of visible facial action. Perhaps the most popular measure of facial activity has been the direction of gaze; yet surprisingly this rarely has been studied in relation to emotion or facial expressions. (Exceptions were provided in research by Graham & Argyle, 1975; Lalljee, 1978; Waters, Matas, & Sroufe, 1975.) Although pupil dilation has been studied in relation to emotion, we know of no study of associated changes in facial expression. Blood flow, skin temperature, electrodermal responding, and coloration changes in the face are other measures that so far remain unexplored.

Facial electromyography

Following earlier work by Malmo and Shagass (1949) and others, the use of facial electromyography (EMG) has been advanced as a putative measure of posed expression and also of mood and emotional states that are not necessarily accompanied by overt facial action. Because facial EMG attempts to measure the activity of specific facial muscles, it can be seen as an example of the measurement of sign vehicle approach.

The use of facial EMG techniques does not relieve investigators of having to define units of measurement and to choose which facial behaviors to observe. They must decide what features of the EMG signal are salient (i.e., what constitutes the EMG "response"). Because of the cost in time and effort of using facial EMG techniques – sampling even a small proportion of facial muscles using EMG-recording electrodes requires a large number of electrodes and an inordinate amount of subject preparation – investigators must decide which facial behaviors will be important. Therefore, all facial EMG–emotion research can be seen as necessarily having a theory-based component.

To date, facial EMG techniques have been used in studies of affective imagery and affective disorder (Brown & Schwartz, 1980; Oliveau & Willmuth, 1979; Schwartz, Brown, & Ahern, 1980; Schwartz, Fair, Salt, Mandel, & Klerman, 1976a,b; Schwartz, Fair, Mandel, Salt, Mieske, & Klerman, 1978; Teasdale & Bancroft, 1977; Teasdale & Rezin, 1978), of posed facial expressions (Rusalova, Izard, & Simonov, 1975; Sumitsuji, Matsumoto, Tanaka, Kashiwagi, & Kaneko, 1967, 1977), and of social interaction and empathy (Cacioppo & Petty, 1981; Englis, Vaughan, & Lanzetta, 1981; Vaughan & Lanzetta, 1980, 1981). (For a critical review of the facial EMG–emotion literature, consult Fridlund & Izard, 1983, and Fridlund, Ekman, & Oster, 1987.)

Facial measurement and the Duchenne smile

The utility of fine-grained measurement of facial behavior has been underscored by research on smiling. Ekman (1985) distinguished 18 theoretically different kinds of smiles, including both voluntary and involuntary ones. One type of involuntary smile is what Ekman and Friesen (1982) originally termed a *felt happiness smile* but have since renamed an *enjoyment smile*. Such smiles include all smiles that occur while the person actually experiences, and presumably would report, a positive emotion. These positive emotions could arise from visual, auditory, gustatory, kinesthetic, or tactile stimulation; amusement and delight; contentment and satisfaction; beatific experiences; relief from pain, pressure, or tension; and enjoyment of another person. They proposed that these enjoyment smiles differ in morphology and timing from more deliberate, voluntary smiles such as social, polite, or masking smiles.

Ekman and Friesen's ideas about morphology were based on their studies of voluntary facial actions and the writings of the French anatomist Duchenne:

> The emotion of frank joy is expressed on the face by the combined contraction of the zygomaticus major muscle and the orbicularis oculi. The first obeys the will but that the second 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. . . . The muscle around the eye does not obey the will; it is only brought into play by a true feeling, by an agreeable emotion. Its inertia, in smiling, unmasks a false friend. (1862/1990, p. 126)

Consistent with Duchenne's description, Ekman, Roper, and Hager (1980) found that most people are unable to contract voluntarily the orbicularis oculi muscle.

Based on these findings and Duchenne's observations, Ekman and Friesen (1982) suggested that the common morphological elements in enjoyment smiles are the action of two muscles: the zygomaticus major muscle pulling the lip corners upward toward the cheek bones, and the portion of orbicularis oculi that raises the cheek and gathers the skin inward from around the eye socket (see Figure 5.1). Ekman (Ekman, Davidson, & Friesen, 1990) proposed calling smiles incorporating both of these elements *Duchenne smiles*.

Seven studies have obtained evidence for distinguishing the Duchenne or enjoyment smile from other forms of smiling. Ekman, Friesen, and Ancoli (1980) found that Duchenne smiles occurred more often than did three other types of smiles when people watched pleasant films and that only Duchenne smiles correlated with the subjective report of happiness. Ekman, Friesen, and O'Sullivan (1988) found that Duchenne smiles occurred more often when people were actually enjoying themselves, as compared with people feigning smiling to conceal negative emotions. Fox and Davidson (1988) found that 10-month-old infants' Duchenne smiles occurred more often in response to their mother's approach, whereas other types of smiling occurred more often in response to approach by a stranger. They also found that only Duchenne smiles were associated with the left-frontal EEG activation, the pattern of cerebral activity repeatedly found in positive affect. Matsumoto (1986) found

that depressed patients showed more Duchenne smiles in a discharge interview, as compared with an admission interview, but that there was no difference in the rate of other kinds of smiling.

Steiner (1986) discovers that Duchenne smiles, but not other types of smiles, increased over the course of psychotherapy in European patients who were judged to have improved. Ruch (1987) found that Duchenne smiles were sensitive to the amount of humor felt by German adults when responding to jokes or cartoons. And Schneider (1987) pointed out that in young German children Duchenne smiles revealed whether they had succeeded or failed in a game.

Ekman and Friesen (1982) also proposed that involuntary enjoyment smiles would differ from other smiles in the amount of time it takes for the smile to appear, how long it remains on the face before fading, and in the time required for the smile to disappear. Two studies have shown the utility of these measures of timing, which are, however, much more costly to obtain than is the measurement of which muscles are recruited. Bugental (1986) found that women showed more enjoyment smiles with responsive than with unresponsive children. Weiss, Blum, and Gleberman (1987) discovered that involuntary enjoyment smiles occurred more often during posthypnotically induced positive affect than in deliberately posed positive affect.

Collectively, these studies suggest that smiles should no longer be considered a single category of behavior but can be usefully distinguished by measuring their different facets. Such measurements can be made only with comprehensive coding systems such as those described.

The universality of facial expressions of emotion

Although methodological improvements provide the substrate that supports empirical knowledge, the knowledge itself is the goal. In the area of facial expressions of emotion, no issue is more important than the question of whether facial expressions of emotion are universal across all cultures or are specific to each. This question is significant because it addresses several issues: the basic similarity of human emotional experience, the biological basis for emotion, and the relationship between facial expression and emotion. The history of research on the universality of facial expressions began with social scientists who believed that such expressions were culturally determined. At least five early studies (Dickey & Knower, 1941; Triandis & Lambert, 1958; Vinacke, 1949; Vinacke & Fong, 1955; Winkelmayer, Exline, Gottheil, & Paredes, 1971)

attempted to show differences across cultures in the way that observers judge facial expressions. In fact, their findings were either ambiguous or showed similarity across literate cultures.

All five of these studies were undertaken to demonstrate that facial expressions are culturally specific, and yet they found evidence of universality. But each study had major design flaws. Most gave little thought to the necessity of sampling systematically the facial expressions studied. Rather than selecting expressions according to either theory or a representative data base, the stimuli were selected for convenience.

Researchers who have attempted to demonstrate universality have used three different research methods: (1) poses of emotion elicited from members of different cultures, (2) spontaneous expressions compared in two or more cultures, and (3) comparison of judgments of emotions made by observers in different cultures who viewed the same set of facial expressions.

Eliciting poses

Ekman and Friesen (1971) asked members of one culture to show how their face would look if they were the person in each of a number of different emotional contexts (e.g., "you feel sad because your child died," "you are angry and about to fight"). They interpreted their findings as strongly supporting the possibility of universality, as observers in another culture did far better than chance in identifying which emotional contexts the posed expressions were intended to portray. This finding had unusual relevance because the persons displaying the expressions were members of a visually isolated New Guinea culture (the South Fore). The ability of Americans to understand these New Guinean expressions could not be attributed to earlier contact between these groups or to both having learned their expressions from mass media models.

Three problems limit these findings, however. First, there has been only one such study, and it has not been repeated in another preliterate, visually isolated culture, or for that matter in a literate, non-Western, or Western culture. Second, not all six of the emotions portrayed were accurately recognized. Although anger, disgust, happiness, and sadness were distinguished from one another and from fear and surprise, the American observers could not distinguish the New Guineans' portrayals of fear and surprise. Third, the facial expressions were posed,

and so Mead (1975) argued that establishing that posed expressions are universal does not mean that spontaneous facial expressions of emotion are universal. Ekman (1977) responded that the most likely explanation of why people can readily interpret and pose facial expressions is that they had seen those same facial expressions and experienced them in everyday social life. Evidence for the spontaneous expression of emotion in different cultures is particularly germane to this argument.

Comparing spontaneous expressions

Ekman and Friesen (1971) compared spontaneous facial expressions by Japanese and American college students. They selected Japan as the comparison culture because of the widely held Western belief in Asian inscrutability. They hoped to show that this stereotype was based on display rules about masking negative affect in the presence of an authority, as suggested by their neurocultural theory of emotion (Ekman & Friesen, 1969). Male college students in Tokyo and in Berkeley, California, came into a laboratory and watched both neutral and stress-inducing films while their skin resistance and heart rate were measured. The videotapes of the facial expressions (filmed with a hidden camera unknown to the subject until after the experiment) were coded by persons who did not know which film was seen when the facial expressions occurred. A correlation greater than .90 was found between the particular facial movements shown by the Japanese and the American students (Ekman, 1973; Friesen, 1972). Virtually the same repertoire of facial movements occurred at the same points in time.

Later in the same experiment a scientist, dressed in a white coat, entered the room and sat with the subject while he watched the stress film. It was predicted that in the presence of an authority figure the display rules for managing facial behavior should operate differently in the two countries; that is, there would be more monitoring of negative facial behavior in Japan than in the United States. Facial measurements were in the predicted direction. The Japanese students showed more raised lip corners (social smiling) than did the Americans (Friesen, 1972). Slow-motion analyses of the facial expressions revealed a sequencing of facial behaviors in which a smiling movement was superimposed on the muscular action of disgust or fear. This was the first study to show how cultural differences in the management of facial expressions (display rules) can mask universal facial expressions.

Two problems, however, limit the findings from this study. Again it

is but a single study; no one has yet attempted to replicate it. The second limitation is that the stress-inducing films elicited only two negative emotions (disgust and fear), thereby not allowing determination of whether the full range of emotional expressions is universal. The next type of research met these two criticisms, studying many emotions and with many replications.

Comparing observers' judgments

Typically, in most cross-cultural facial expression studies, the people in each culture are shown still photographs of facial expressions and are asked to select a single emotion word or category from a list of words or categories. Very high agreement was found in the specific emotions attributed to facial expressions across a variety of cultures (five literate cultures, Ekman, 1972; Ekman, Sorenson, & Friesen, 1969; nine literate cultures, Izard, 1971; two literate cultures, Niit & Valsiner, 1977; and one non-Western literate culture, Boucher, 1973; Boucher & Carlson, 1980). The strength of this kind of evidence is its many replications. Unlike the first two kinds of research, this type of study has been repeated in many cultures, by different investigators, using different photographs of facial expression.

These studies have provided consistent evidence for the common recognition of at least six emotions (happiness, anger, fear, sadness, surprise, and disgust). Izard reported agreement also for shame and interest, but there is a question about whether it was facial expression or head position that was the clue to recognizing these emotions. There have been no other cross cultural studies of the facial expressions of shame and interest. Ekman and Friesen (1986) reported agreement across 10 Western and non-Western literate cultures in the identification of a specific expression for contempt (Figure 5.1). Although there is some argument about this (Izard & Hayes, 1988, and reply by Ekman & Friesen, 1988; also P. E. Ricci Bitti, personal communication, 1986), Ekman and Heider (1988) again replicated the recognition of contempt in a non-Western culture.

Six questions can be raised about such judgment studies in which the same set of faces is shown to observers in different cultures. First, establishing agreement across cultures about the recognition and labeling of an emotion does not prove that the emotion is expressed or experienced in the same way across these cultures. This objection seems highly implausible. The recognition of emotion is not a matter that is taught for-

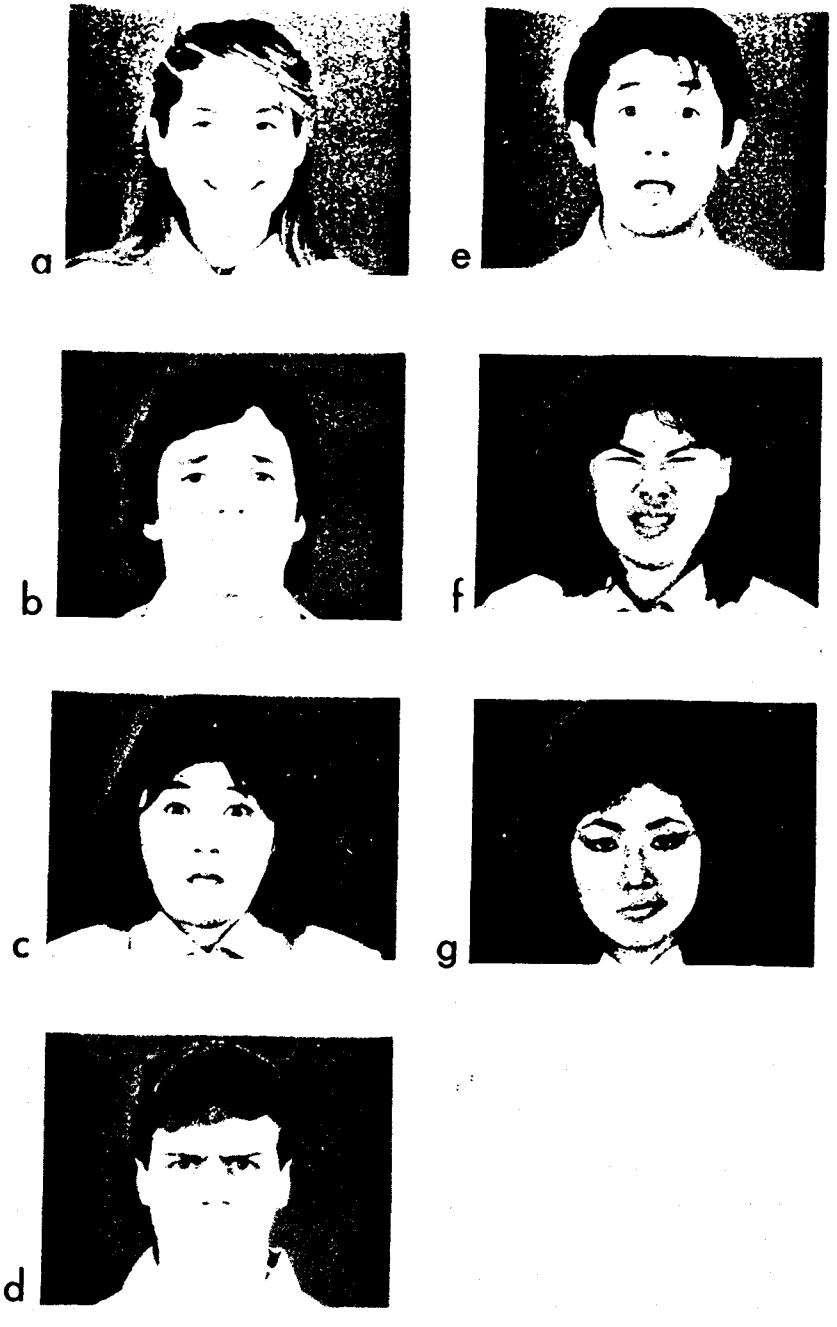

Figure 5.1. Seven basic emotions: (a) happiness, (b) sadness, (c) fear, (d) anger, (e) surprise, (f) disgust, and (g) contempt. (Matsumoto & Ekman, 1989.)

mally but presumably is learned by observing the expressions that actually do occur. (Some have suggested that the recognition of emotion is innate, but whether it is innate or learned is not relevant to this particular point.) If the expression of anger involved a slack jaw and raised brows in culture A and lowered brows and pressed lips in culture B, then the people from those cultures should disagree in their judgments of emotion when viewing photographs of these two different expressions. But this did not happen. People from different cultures agree in attributing anger to photographs showing lowered brows and pressed lips and agree in attributing surprise when the jaw is slackened and the brows are raised (Figure 5.1).

A second objection is that the observers in all these studies were responding to posed, not spontaneous, expressions. It seems far-fetched to propose that these are two unrelated sets of facial expressions, a posed set that for some reason is recognized across cultures and a spontaneous set that is culture specific. Furthermore, the posed expressions are similar in form to the expressions found in the cross-cultural studies of spontaneous expressions. Although such comparisons between spontaneous and posed behavior can be made only for disgust, fear, and happiness (because other emotions have not been elicited in cross-cultural studies of spontaneous expression), there is no reason to expect that such similarity would not be found for other emotions. In Western cultures, such similarities between posed and spontaneous expressions have also been established for anger, surprise, and sadness.

Another answer to this question about whether universality is established if the judged expressions are posed comes from the study of the spontaneous facial behavior of Japanese and American college students described earlier (Ekman, 1973; Friesen, 1972). Japanese and American observers judged whether the facial expressions of Japanese and American students were elicited by watching a stressful or a neutral film. Observers of both cultures were equally accurate whether they judged members of their own or the other culture. Moreover, persons of either culture who were judged correctly by Americans were also judged correctly by Japanese ($r > +.75$).

A third objection is that all the people who were studied shared the same visual or media culture. Perhaps they all learned to recognize emotional expressions, or even to make those expressions, by observing the same models in films, television, and photographs. This criticism is met by a judgment study in a visually isolated, preliterate New Guinea culture, the South Fore (Ekman & Friesen, 1971). (These were the same

subjects whose poses of emotion were described at the beginning of this section in regard to the evidence of universality.) The South Fore subjects had seen no movies, television, or photographs. They spoke neither English nor pidgin. They had never worked for a Caucasian or lived in a government settlement. Nearly 10% of the members of this culture were studied. For anger, happiness, sadness, disgust, and surprise (except as distinguished from fear) the faces identified with each emotion were the same as in literate cultures. Karl Heider and Eleanor Rosch were skeptical of these findings, believing that facial expressions are culture specific. In 1970, on a field trip to West Iran, they repeated this study with the Dani, a culture even more remote than the South Fore, and they obtained a nearly perfect replication of Ekman and Friesen's results (reported in Ekman, 1973).

The fourth criticism of the judgment studies is that the judgment tasks that they used might have concealed cultural differences in the perception of secondary blended emotions. Many students of emotion have noted that facial expressions may contain more than one message (Ekman & Friesen, 1969; Izard, 1971; Plutchik, 1962; Tomkins, 1963). The two emotions in a blend may be of similar strength, or one emotion may be primary and much more salient than the other secondary emotion. In earlier cross-cultural studies, the investigators presumed that the expressions they showed displayed a single emotion rather than a blend and therefore did not give those who observed the expressions an opportunity to choose more than one emotion term for each expression. Without such data, however, it is not possible to ascertain whether an expression conveys a single emotion or a blend, and if it is a blend, whether cultures agree in their judgment of the secondary emotion. Earlier evidence of cross-cultural agreement in the judgment of expressions might be limited just to the primary message and not the secondary blended emotions.

A later study by Ekman et al. (1987) resolved this problem. In this study members of 10 literate Western and non-Western cultures were shown a set of Caucasian facial expressions. Instead of being limited to selecting one emotion term or category for each expression, the observers were allowed to indicate both the presence of multiple emotions and the relative intensity of each. There was very high agreement across cultures about the secondary blended emotion signaled by an expression.

The fifth question is whether there is universality not just in which emotion is signaled by an expression but also in the intensity of the

perceived emotion. Only two cross-cultural studies (Ekman, 1972; Saha, 1973) obtained intensity judgments, and no differences among cultures were found. But not many cultures were examined in either study. Ekman et al. (1987) addressed this question as well and found cross-cultural agreement about the relative strength of expressions of the same emotion. With few exceptions, the 10 cultures they examined agreed on which of two different expressions of the same emotion was more intense.

Ekman et al. (1987), however, did uncover evidence of cultural differences in the absolute intensity level attributed to an expression. The Asian cultures (Hong Kong, Japan, Sumatra) attributed less-intense emotions to expressions than did the non-Asians. Because all the expressions shown had been of Caucasian faces, it was not possible to know whether this might be caused by the Asians' reluctance to attribute strong emotions to a foreigner. To examine this issue, Matsumoto and Ekman (1989) showed expressions of both Japanese and Americans to observers in both countries. Regardless of the culture or sex of the person they were judging, the Japanese made less intense judgments than did the Americans. Work is now in progress to investigate whether the Japanese make less intense attributions than do Americans when judging other personal characteristics apart from emotion.

Although no one study, or one kind of research, is conclusive, collectively they provide an enormous body of consistent evidence for the universality of at least some facial expressions of emotions. Although the evidence is strong for fear, anger, disgust, sadness, surprise, and happiness, there still are questions about contempt, shame, and interest. Also, there are no data on how many expressions for each emotion are universal. Nor is it known how often these universal expressions of emotion are seen in ordinary social life. And little has yet been documented about cultural differences in facial expression, except for the single study of display rules (Ekman, 1973; Friesen, 1972) discussed earlier and the recent evidence regarding differences in the judgment of emotional intensity (Ekman et al., 1987).

Despite this evidence, it could still be argued that facial expressions of emotion are culturally variable social signals and that the commonality in judgments can be attributed solely to common learning experiences. According to this interpretation, exposure to the same mass media representations of emotional expression might have taught people in each culture how to label facial expressions. But this explanation was invalidated by studies of isolated, preliterate cultures not exposed to the

mass media: the South Fore in Papua New Guinea (Ekman & Friesen, 1971), and the Dani in West Iran (Heider & Rosch, reported by Ekman, 1973). Members of these cultures chose the same facial expressions for particular emotions as did members of literate cultures.

A limitation of these cross-cultural experiments is that the facial expressions presented were not genuine but were posed by subjects instructed to show a particular emotion or to move particular facial muscles. One interpreter of this literature (Mead, 1975) suggested that universality in judgments of facial expression might be limited to just such stereotyped, posed expressions. Two experiments, however, argue against this interpretation. Winkelmayer, Exline, Gottheil, and Paredes (1978) chose motion picture samples from interviews with normal and schizophrenic individuals to see whether emotion judgments by members of different cultures would differ when spontaneous rather than posed expressions were shown. There was no overall difference among American, British, and Mexican observers. However, the Mexican observers were less accurate than the others were in judging the facial expressions of normal, but not schizophrenic, subjects. This difference had not been predicted, may have been due to language and/or culture, and has not been replicated.

The evidence strongly supports universality for six or more emotions, which represents only a small percentage of facial behavior. How accurate are people in using facial behavior to infer emotional state in an ongoing social interaction? Is the face used as a source of information in ordinary human relationships?

Accuracy in judging facial expressions of emotion

In determining the accuracy of judgments based on facial expression, a continuing problem has been deciding on a criterion, independent of the face, for establishing which emotion, if any, was experienced at the moment of facial expression. This is especially problematic considering that most facial behavior is probably not related to emotional display; rather, it appears to be punctuative, gestural, self-communicative, or parapractic (Ekman, 1977, 1979).

The problem of an independent criterion, and thus the possibility of validation, has been the greatest obstacle to research on accuracy in judging facial expressions of emotion. A common approach has been to ask subjects to describe their feelings (usually retrospectively) and to see whether their facial expressions differ when reporting emotion A

compared with emotion B. Such self-reports are error prone, however, as subjects may fail to remember, or to distinguish among, the emotions experienced, particularly if several minutes elapse before they make the report. For example, a subject who successively felt anger, disgust, and contempt while watching a film might not recall all of these reactions, their exact sequence, or their time of occurrence. This problem can be reduced by limiting self-reports to grosser distinctions (i.e., between pleasant and unpleasant feelings); however, one then cannot determine specifically the relationships between more complex facial behaviors and more differentiated affective states.

A second approach has used elicitors to arouse specific emotions, for example, affectively positive versus negative films or slides; anticipation of an electric shock versus a no-shock trial; or hostile versus friendly remarks made by a confederate. The respondents' facial expressions are then evaluated for variance attributable to the experimental conditions. Because it is unlikely that all subjects experience the same, discrete, sustained emotion during a particular condition, this approach can usually show only that different facial expressions are used in presumably pleasant and unpleasant conditions or that there are overriding commonalities in facial behavior during experimental inductions.

Attempts to predict or "postdict" other information about a subject (e.g., whether he or she has many friends) have also been used to assess accuracy (Archer & Akert, 1977; Cline, 1964). This approach implies, however, that facial expressions can provide information about enduring traits in addition to transient states. Difficulties encountered in the operational definition of traits, in addition to selecting units of facial measurement, encumber this approach.

If particular changes in vocal intensity or prosody, gross body movement, head position, or speech content were infallible indicators of particular emotions, these could serve as accuracy criteria. Unfortunately, there is no evidence that these channels impart any more accurate information about emotional states than do facial expressions. The same difficulties befall investigators who seek unambiguous benchmarks for emotion in the (peripheral) autonomic nervous system or in the central nervous system.

There is, in fact, no single infallible way to determine an individual's "true" emotional state. Multiple convergent measures should be used, such as facial, postural, and psychophysiological, to gain a more reliable indication of the emotions displayed and experienced.

Emotional information in the face

Despite these difficulties, there is evidence that facial expressions of emotion can provide accurate information about the occurrence of pleasant, as compared with unpleasant, emotional states. A reanalysis of studies from 1914 to 1970 concluded that both facial measurement and observers' judgments can accurately distinguish pleasant from unpleasant states (Ekman, Friesen, & Ellsworth, 1972, 1982a). Since then, a number of experiments have replicated these findings but have not extended them to possible distinctions among particular positive and negative emotions. There is little information pinpointing the specific facial actions that differentiate pleasant and unpleasant states. In the vast majority of studies, most investigators have used the message judgment approach, which precludes determining to which configurations the observers were responding. Those who directly measured facial expression have, in large part, failed to report the frequency of specific actions and/or the full-face conformations that provided the pertinent information.

More recent experiments using facial electromyography have produced evidence bearing on the discrimination of pleasant versus unpleasant emotional states. Schwartz, Fair, Salt, Mandel, and Klerman (1976a,b) used an affective-imagery task to induce emotions. They showed that "happy" imagery conditions were separable from negative-affect conditions, largely through the reciprocal activities in EMG sites overlying the corrugator supercilii (which lowers and draws together the brows) and zygomatic major (which raises the lip corners into a smile). Corrugator sites also tend to show EMG activity corresponding to self-reported negative-thought frequency (Teasdale & Rezin, 1978). Fridlund, Schwartz, and Fowler (1984) also reported good discrimination of "happy" from negative-affect imagery trials. In these EMG studies, the imagery trials are presumed to induce "real" emotions. That they may instead induce a type of posed expression was suggested by Ekman, Hager, and Friesen (1981) and later by Fridlund and Izard (1983).

A careful analysis of what responses are being detected in these EMG experiments has yet to be performed. Are subjects in "negative-affect" conditions just frowning more, and in "positive-affect" conditions, smiling more? Or is there other, more tonic muscular activity signifying an index of mood? No definitive data have been provided.

In addition to distinguishing positive from negative emotions, facial

expressions seem also to provide accurate information about the intensities of, and distinctions among, several specific negative and positive emotions. Surprisingly, few decoding studies have attempted to categorize seemingly spontaneous facial expressions into a range of emotional categories. Most studies either have used posed expressions as stimuli or have instructed subjects merely to classify facial expressions along a pleasant–unpleasant dimension. Only a few studies offer relevant data.

Ekman, Friesen, and Ancoli (1980) used FACS to study the spontaneous facial expressions that occurred while the subjects watched motion picture films and then reported on their subjective experience. High correlations were found for specific facial actions hypothesized to be signs of positive and negative emotions and for self-reports of the intensity of those positive and negative emotions. Facial actions that reliably distinguished reports of disgust were also isolated.

Several facial EMG studies have tried to discriminate among multiple posed emotional states. Highly patterned, multiple-site EMG activity is found with instructions to pose facial expressions of several emotions (Sumitsuji, Matsumoto, Tanaka, Kashiwagi, & Kaneko, 1967, 1977). Trained actors generate higher-amplitude, more discriminable EMG patterns than do untrained controls (Rusalova, Izard, & Simonov, 1975). Vaughan and Lanzetta (1980) employed a "vicarious classical conditioning" paradigm in which observers are exposed to a model who appears to be experiencing pain. Under these conditions, subjects generate EMG patterns congruent with emotions of "anticipation" and "pain" when models are ostensibly anticipating, and then receiving, noxious stimuli. Finally, Fridlund et al. (1984) showed reliable multivariate classifications of both posed and imagery-related trials across emotional categories of happiness, sadness, anger, and fear.

Paradoxically, the emotional information communicated by the face can be inferred from situations in which the face is used to falsify such information. Facial expressions may not only reflect emotional state but may also (1) feign emotion when none is present (e.g., the social smile), (2) attenuate or dampen the apparent intensity of any felt positive emotion (e.g., the dampening smile), and/or (3) mask the presence of a negative felt emotion with a simulated alternative emotion (e.g., the masking smile). Quite often the literature has obscured these distinctions by using the overinclusive term *deception*. In order to understand by which process the subjects are responding, it is necessary in facial deception studies to sample both facial behavior and other response systems possibly indicative of emotion. Among the dozens of recent experiments on

interpersonal deceit, few (e.g., Ekman & Friesen, 1974; Harper, Wiens, & Fujita, 1977; Lanzetta, Cartwright-Smith, & Kleck, 1976; Mehrabian, 1971; Zuckerman, DeFrank, Hall, Larrance, & Rosenthal, 1979) explicitly instructed their subjects to conceal their emotions and also obtained evidence (independent of the face) that the subjects actually experienced some emotion.

These experimental tests of the extent to which the face can be used to deceive have yielded contradictory results, which are most likely due to variations in the strength or number of emotions aroused, the subjects' motivation to deceive, and their prior practice in perpetrating such deception. However, these experiments have also differed in other ways, for example, whether the subjects knew they were being videotaped, whether the observers knew that deception might be involved, whether the observers were trained, and whether channels other than facial expression were available to the observers.

Information from the face versus other nonverbal channels

It is clear that the face provides emotional information. What is less clear is how this information compares with that obtained from the voice, speech, and body movement. A number of studies have compared observers' judgments of an event perceived via different verbal and nonverbal "channels": audiovisual, aural alone, or visual alone. Others have focused on which of several discrepant cues (delivered across channels) are remembered or acted upon. Since the initial findings by Mehrabian and Ferris (1967), most experiments have found that the face is more accurately judged, produces higher agreement, or correlates better with judgments based on full audiovisual input than does speech content or tone of voice; this difference has been termed *video primacy* (Argyle, Alkema, & Gilmour, 1971; Bugental, Kaswan, & Love, 1970; Burns & Beier, 1973; DePaulo, Rosenthal, Eisenstat, Rogers, & Finkelstein, 1978; Zaidel & Mehrabian, 1969). Video primacy is especially apparent when speech content is filtered (Zuckerman, Amidon, Bishop, & Pomerantz, 1982). The results of a few experiments have departed from the Mehrabian and Ferris (1967) findings and have suggested that the face was less important than another channel was (Berman, Shulman, & Marwit, 1976; Shapiro, 1972) or that the channel cue varied with the observer (Van de Creek & Watkins, 1972). The factors accounting for these differences in findings are not yet known.

A study by Ekman, Friesen, O'Sullivan, and Scherer (1980) found that

the relative weight given to facial expression, speech, and body cues depended on both the judgment task (e.g., rating the stimulus person's dominance, sociability, or relaxation) and the conditions in which the behavior occurred (whether subjects frankly described positive reactions to a pleasant film or tried to conceal negative feelings aroused by a stressful film). The correlation between judgments made by observers who saw the face with speech were quite low on some scales (e.g., calm–agitated) and quite high on other scales (outgoing–withdrawn).

Krauss, Apple, Morency, Wenzel, and Winton (1981) also published data on the relative weighting of verbal and nonverbal channels. Krauss and his colleagues used judgments from observers of a televised political debate and videotaped samples of interviews with college women, alone and in combination with typescripts and content-filtered speech, and they concluded that there was "no support for the widespread assumption that nonverbal channels . . . form the primary basis for the communication of affect" (Krauss et al., 1981, p. 312). As such, the Krauss et al. findings have been interpreted as corroborating those of Ekman et al. (1980) in negating video primacy. However, O'Sullivan and Ekman (1983) criticized the Krauss et al. findings because (1) no independent evidence was obtained that the videotaped expressers were emotionally aroused, (2) typescripts were selected with bias toward samples rich in verbal content, (3) face and body were not isolated for videotaped presentations, and (4) the rating scales used had low ecological validity. O'Sullivan and Ekman (1983) reemphasized that the Ekman et al. (1980) data did not negate video primacy but, rather, established its dependence on context.

Studies by Bugental and her colleagues suggested that the influence of facial expression, as compared with other sources, depends on the expresser, the perceiver, the message contained in each channel, and previous experience. Children were less influenced than were adults by a smile shown by an adult female when it was accompanied by negative words and voice tone (Bugental, Kaswan, Love, & Fox, 1970). Some experimental grounds for distrusting mothers' smiles was found in a study showing that smiling in mothers (but not fathers) was not related to the positive versus negative content of the simultaneous speech (Bugental, Love, & Gianetto, 1971). Also, mothers (but not fathers) of disturbed children produced more discrepant messages (among face, voice, and words) than did parents of nondisturbed children (Bugental, Love, & Kaswan, 1971).

The whole question of how much information is conveyed by separate

channels may have been miscast. There is no evidence that individuals in actual social interactions selectively attend to different channels, although there is speculation that this may be an individual characteristic of interest. There is no evidence that information conveyed to separate channels is merely additive. We believe that it is more likely that different channels contribute differentially depending on the trait or emotion of interest. The expression of some emotions are probably more easily expressed or inhibited in one channel than in another, and observers may prefer a particular channel when all are available but can use information from other channels if forced to do so. We shall now turn from the question of how one person knows the emotional state of another to the question of knowing our own emotional state.

Facial feedback

How can we account for the subjective experience of emotion? The debate over this issue has been dominated by theorists arguing for the primacy of either "peripheral" visceral and striate-muscle responses (James, 1884, 1890; Lange, 1885; Tomkins, 1962, 1963, 1982) or the primacy of "central" cognitive appraisal (e.g., Cannon, 1927, 1931; Lazarus, Averill, & Opton, 1970; Plutchik, 1977; Schachter & Singer, 1962).

Citing Darwin's (1872) classic work on the origins of emotional expressions, Tomkins (1962, 1963, 1982) modified and extended James's theory of emotion, positing that discrete, differentiated emotions derive from feedback from innately patterned facial expressions. Tomkins's assertions set the stage for several experiments designed to test the "facial feedback hypothesis" – that patterned proprioceptive feedback from facial muscle activity (or from integrated facial expressions) is a necessary and/or sufficient determinant of the experience of emotion (see Buck, 1980, for a detailed account of the facial feedback hypothesis and related research).

A variant of the facial feedback hypothesis, set within the framework of self-attribution theory (Bem, 1967; Schachter, 1964), postulates that we can use information from our own facial (and other) behavior to infer what we feel. Laird's original study (1974) provided a model for later facial feedback experiments: The subjects were instructed to contract particular facial muscles, producing – presumably without their awareness – a "happy" or "frowning" expression that they maintained on their faces while viewing slides or cartoons. The face manipulation had a significant, though small, effect (compared with the effect of the

slides) on their reported feelings. A subsequent series of experiments found that individual differences on the face manipulation task were related to other indices of an individual's tendency to use "self"- versus "situation"-produced cues (Duncan & Laird, 1977).

Tourangeau and Ellsworth (1979) failed to confirm the strong version of the facial feedback hypothesis, that is, that overt facial expression is both necessary and sufficient for the experience of emotion. Facial manipulations had no significant effect on self-reported emotion and only ambiguous effects on physiological responses. The study was roundly criticized. The criticisms pointed out the difficulties in testing experimentally the facial feedback hypothesis. Hager and Ekman (1981) cited three main shortcomings: (1) The specific requested movements were not valid analogs of emotional expressions; (2) other expressions besides the requested movements may have occurred; and (3) the procedures were subject to contamination by demand characteristics. Izard (1981) asserted that any role that facial feedback might play in emotional experience would be reflexive, nearly immediate, and only a few milliseconds in duration. Tomkins (1981) commented on the artificiality of the expression-manipulation procedure and on the fact that the procedure bypassed the numerous physiological systems normally involved in affect (e.g., respiration and blood flow). In response to these criticisms, Ellsworth and Tourangeau (1981) stated that their experiment disconfirmed the "necessity" version of the facial feedback hypothesis and not the "sufficiency" variant. The criticisms of the Tourangeau and Ellsworth (1979) experiment, and the authors' rebuttal, should be consulted for elaborations of these issues.

Other tests for the facial feedback hypothesis have monitored facial expressivity and other (usually physiological) indices of emotional behavior (e.g., Zuckerman, Klorman, Larrance, & Spiegel, 1981). A positive correlation between magnitudes of within-trial facial expressions and adjunctive indices of emotion is taken as supporting the hypothesis. Buck (1980) schematized the various interpretations and derivatives of the facial feedback hypothesis and the corresponding methods for testing each.

The strongest evidence for a positive link between voluntary facial expression and emotion comes from a series of experiments by Lanzetta, Kleck, and colleagues (Colby, Lanzetta, & Kleck, 1977; Kleck, Vaughan, Cartwright-Smith, Vaughan, Colby, & Lanzetta, 1976; Lanzetta, Cartwright-Smith, & Kleck, 1976), investigating the effect of overt facial expression on the intensity of emotional arousal produced by shock. At-

tempts to conceal facial signs of pain consistently led to decreases in both skin conductance and subjective ratings of pain, whereas posing the expression of intense shock significantly increased both measures of arousal. When the subjects were told that they were being observed by another person, they showed less intense facial expressions and correspondingly reduced autonomic responses and subjective ratings of pain, even though they received no instructions to inhibit their responses (Kleck et al., 1976).

These findings can be interpreted in various ways (see Lanzetta et al., 1976). Before concluding that facial feedback was directly and causally related to the observed changes in arousal, it would be necessary to rule out the possibility that some other strategy used by the subjects might have affected (or comediated) both their facial expressions and emotional experience. It is also not clear that the effect is specific to facial versus bodily signs of emotion. Nevertheless, these findings suggest that overt facial expression is often correlated with intensity of emotional arousal. Evidence that facial feedback can determine which emotion is experienced is far more tenuous.

There are ample neuromuscular pathways by which facial activity can mediate emotional experience, including exteroceptors in the superficial layers of facial skin, distention and thermoreceptors in the deeper facial skin, and possible spindle organs in facial muscle tissue sensitive to the state of contraction. The studies to date must be seen only as very weak tests of a facial feedback hypothesis. Demand characteristics and possible effects of comediating systems (cognitive or other) for both facial action and ANS measures cannot be discounted. One real test of the facial feedback hypothesis – providing subjects with "simulated" multichannel facial feedback to trigeminal afferent fibers – is technologically unfeasible at this time. Clinical evidence is probably not useful, as studies of changed emotionality in facial hemiparetics are confounded with depressive reactions secondary to disability.

Finally, the studies to date have underestimated the impact of external, social feedback, that is, the micromomentary reactions of conspecifics to an individual's facial displays. From this perspective, the visual, tactile, or auditory feedback from others' reactions may represent an additional basis for the individual's appraisal of emotion or even the principal basis, according to those who emphasize the socialization of emotion (Lewis & Michalson, 1982).

Although other nonverbal channels also communicate emotion and contribute to its experience, the face has a centrality and a universality

in this regard that compel our attention – not only as scientists but also as friends, lovers, parents, and casual observers.

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