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UNIVERSAL FACIAL EXPRESSIONS OF EMOTION: AN OLD CONTROVERSY AND NEW FINDINGS

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More than a century ago, Darwin published his work *The Expression of the Emotions in Man and Animals* (1872), 13 years after his revolutionary *The Origin of the Species* (1859). Darwin claimed that we cannot understand human emotional expression without understanding the expressions of animals; for, he argued, our emotional expressions are in large part determined by our evolution.

Amazingly, Darwin's book had very little influence up until 20 years ago. The empirical research on facial expressions of emotion following Darwin's expression book was quite episodic. A number of recent trends, however, have contributed to the resurgence of interest in facial expression in the last 20 years. These include the work of Tomkins (1962, 1963), who provided a theoretical rationale for studying the face as a means for learning about personality and emotion; the application of ethological methods and concepts to human behavior, with emphasis placed on the biological bases of behavior and commonalities in social behavior across cultures; developmental psychologists' investi-

gation of attachment, mother-infant interaction, and the development of emotion; and new methods for measuring the face. These trends have generated research that indicates there are universals in facial expressions of emotion. Before describing that evidence, the cultural specificity view of facial expressions of emotion, which dominated the field up until recently, is first discussed.

THE CULTURE-SPECIFIC VIEWPOINT

A. Theorists

Three theorists were extremely influential in anthropology and psychology for a number of decades, arguing that the information signaled by facial expressions is specific to each culture. None provided much evidence, but their views merit consideration both for historical reasons and to elucidate certain theoretical issues they ignored that are relevant to understanding the signal value of facial expressions.

"What is shown on the face is written there by culture." Klineberg claimed he never made that statement, although it was attributed to him. He did argue, in a more tentative way, for that view. Commenting on an anthropologist's account of how people arriving in a village wore a fierce look rather than a smile, Klineberg (1940) said:

Not only may joy be expressed without a smile, but in addition the smile may be used in a variety of situations a smile may mean contempt, incredulity, affection ... [quoting from Lafacadio Hearn's observation of the Japanese] Samurai women were required, like the women of Sparta, to show signs of joy on hearing that their husbands or sons had fallen in battle. (pp. 194f).

Birdwhistell (1970), an anthropologist with training in linguistics, dance, and dance notation, was another influential advocate of this view. He claimed that facial expressions are part of what he termed *kinesics*, which can best be viewed as another language, with the same type of units and organization as spoken language.

Early in my research on human body motion, influenced by Darwin and by my own preoccupation with human universals, I attempted to study the human smile. Not only did I find that a number of my subjects "smiled" when they were subjected to what seemed to be a positive environment but some "smiled" in an aversive one (p. 29f). This search for universals was culture bound. There are probably no

universal symbols of emotional state. We can expect them [emotional expressions] to be learned and patterned according to the particular structure of particular societies. (p. 126)

Klineberg and Birdwhistell's observations highlight both a methodological and conceptual problem. First consider the methodological problem that is due to the use of imprecise behavioral description. The term *smile* unfortunately covers too many different facial expressions. Ekman and Friesen (1976) distinguished dozens of such smiling expressions, each of which involves the deployment of different sets of muscle actions. Each of these smiles differs in appearance, although in each the lip corners are drawn upward. The evidence to be described later about smiling shows that when different forms of smiling are distinguished, they are found to occur in quite different circumstances. Two forms of smiling occur in other than pleasant situations, another occurs when politeness is called for, another when enjoyment is experienced, and another when embarrassment is experienced.

It is confusing to call these all smiling, implying that they are a singular, unified category of behavior. When these different lip-corner-up appearances are treated by the observer as one entity, then, it will appear, as it did to Klineberg and Birdwhistell, that the smile has no common meaning. It is only by understanding the anatomy of facial action, by experience in the close description of facial behavior, that such errors in describing facial behavior can be avoided. The problem of treating smiles as a unitary category is especially acute when observations are made in real time without the opportunity to review the behavior repeatedly and at slowed motion, and when the observations are made by a single observer, so there is no capability to check on interobserver reliability. Imprecise terms such as *frown*, *grimace*, and *scowl*, like *smile*, encourage observers to miss what may be important distinctions.

The conceptual problem underlying the claims of Klineberg and Birdwhistell is their failure to consider the possibility that differences in observed facial expression may be due to culturally imposed attempts to manage universal expressions. They treated facial expression as if it is a totally involuntary system, not capable of being voluntarily controlled. Ekman and Friesen (1969) coined the phrase *display rules* to refer to such norms about who can show which emotion to whom, and when. People learn to interfere, they proposed, with facial expressions of emotion. The observation that Klineberg cited of the fierce look during a greeting could, from this vantage point, be due to a display rule to

mask the appearance of happiness. Similarly, the smiling appearance of the grieving Samurai women could be a display rule to cover any sadness or distress with the appearance of polite smiling.

It would be quite damaging to the conclusion that there are universal expressions of emotion if there were clear evidence that when people are in a negative affect situation (experiencing pain, sadness, disgust, fear, or anger), they show an expression in which the lip corners go up—but only if the following other explanations can be ruled out:

1. The subject who shows this smiling countenance does not believe that negative feelings must be masked with a simulated, deliberate smile.
2. The smile is not a comment added by the subject to signal that the negative experience can be endured (a grin-and-bear-it smile, or what Ekman and Friesen called a "miserable smile").
3. The smile incorporates the features that Ekman and Friesen have found to occur when enjoyment is experienced (see following description), as distinct from polite or masking smiles.

There is no such evidence.

LaBarre (1947) made his major argument against universality 9 years after Klineberg. He failed to distinguish facial expressions of emotion from gestures, as seen in his statement "there is no natural language of emotional gesture" (p. 55). The distinction between gesture and emotional expression is not an easy one, but it is necessary, because gestures are socially learned and culturally variable, whereas there is strong evidence that facial expressions of emotion are not. Ekman and Friesen (1969) subdivided gestures into what they termed *illustrators*, movements that punctuate or help to illustrate simultaneous speech, and *emblems*, a term first suggested by Efron (1941), which refers to movements that have a direct verbal translation, a dictionary definition known to all members of a culture or subculture.

Any message can be conveyed by an emblem, including factual information, commands, attitudes, and—here is the complication—feelings. The latter Ekman called *referential expressions*, expressions that refer to emotions, performed in a way that signals that the emotion is not felt when the expression is made. The message conveyed by an emotional expression is, by definition, a feeling of the moment, providing information about likely antecedent events, consequent events, and so on. Ekman (1979) gave a more complete explanation of the differences between referential and emotional expressions.

It would take us too far afield to discuss thoroughly the differences between emblems, illustrators, and conversational regulators (which collectively Ekman [1979] called *conversational signals*) as compared to emotional expressions. It is sufficient to draw attention to the fact that every facial movement is not an emotional expression. Although many conversational signals involve the hands, some do involve the face. Facial action is not dedicated solely to emotional expression. Brow raising, brow lowering, and a number of different types of actions that pull the lip corners up are among the most common conversational signals. LaBarre failed to clearly make these distinctions.

Darwin also was not completely consistent in this regard. Darwin was primarily concerned with emotional expressions, which he considered innately determined and thereby universal. Although he mentioned a few emblems that he considered universal, he acknowledged that most were culture specific. LaBarre, on the other hand, focused primarily on emblems, although he included some emotional expressions and referential expressions.

UNIVERSAL FACIAL EXPRESSIONS

In the early 1970s there were two challenges to the culture-specific view of facial expressions of emotion: a critical re-evaluation of the experiments that had supported that position (Ekman, Friesen, & Ellsworth, 1972); and, more importantly, new cross-cultural data. Izard (1971), and also Friesen and Ekman conducted similar studies of literate cultures, working independently but at the same time.

In each culture, subjects were presented with photographs of posed Caucasian facial expressions similar to those presented in Fig. 2.1. Subjects were asked to choose the emotion term that best matched the emotion shown in the photograph. Although Izard and Ekman each showed different photographs, gave the subjects somewhat different lists of emotion terms, and examined people in different cultures, 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, Ekman and Friesen also studied a visually isolated preliterate culture in New Guinea (Ekman & Friesen, 1971; Ekman,

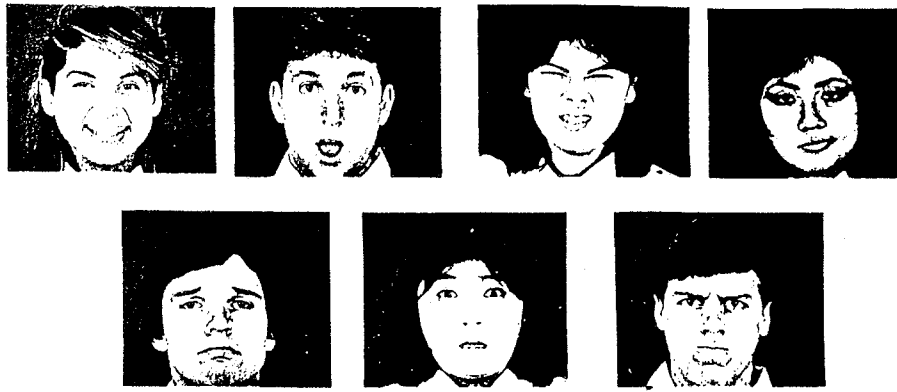


Fig. 2.1. Starting in the upper left corner and moving clockwise, the emotions posed are: happiness, surprise, disgust, contempt, anger, fear, and sadness.

Sorenson, & Friesen, 1969). They replicated their literate culture findings, as did Heider and Rosch (as reported in Ekman, 1972) a few years later in another visually isolated culture in what is now West Irian. Although surprise expressions were distinguished from anger, fear, sadness, disgust and enjoyment expressions in both preliterate cultures, surprise was not distinguished from fear expressions in one of the preliterate, visually isolated cultures. Ekman and Friesen also reversed the research design and found that when New Guineans posed facial expressions they were understandable to Western observers.

To reconcile these findings of universality with the many reports by cultural anthropologists of culture-specific facial expressions, Ekman and Friesen (1969) postulated display rules to describe what they presumed cultures teach their members about the management of expression in social contexts. Cultural variations in display rules could explain how universal expressions might be modified in social situations to create the impression of culture-specific facial expressions of emotion. They tested this idea in a study comparing the spontaneous expressions of Japanese and Americans observed in response to films evocative of fear and disgust. In each country subjects were videotaped when they were alone (and presumably no display rules should operate) and when they were with another person. As predicted, there was no difference between cultures in the expressions shown when the subjects thought they were alone. When an authority figure was present, however, the Japanese masked negative expressions with the semblance of smile more than the Americans.

Ekman, Friesen, and Izard interpreted the evidence as showing universal facial expressions as posited by Tomkins, Plutchik (1962), and (much earlier), by Darwin (1872). Consistent with this evolutionary view of expression were other reports of similarities in expression in other primates and early appearance developmentally. Recently, there have been challenges to the claim of universality in facial expressions of emotion. Lutz and G. M. White (1986) cited anthropologists who regarded 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 or protected against the potential for bias or error when the information is obtained by the single observer who formulated the hypothesis under study. There are no replicated findings, with safeguards against bias and data on interobserver reliability, that a facial expression signifies entirely different emotions in two cultures.

Ortony and T. J. Turner (1990) provided a different challenge, speculating that it is only the components of expressions and not the full emotional expressions that are universal. However, there is no evidence to support their contention, and their claims contradict what is known about the muscular basis for facial expression (Ekman, 1992). Their challenge to the evidence on universals in expression was born out of their desire to reject the theoretical position that there are any emotions that should be considered basic. Their stance required them also to dismiss developmental, phylogenetic, and physiological evidence consistent with an evolutionary view of facial expressions of emotion.

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

A number of empirical questions remain about universals in facial expression. We do not know how many expressions for each emotion are universal, for no one has systematically explored a variety of ex-

pressions for each emotion in multiple cultures. Nor is there certain knowledge about whether there are other emotions that have universal expressions. There is some evidence, but it is contradictory, for universal facial expressions for contempt, interest, shame, and guilt. Little is also known about cross-cultural differences in display rules, as a function of gender, role, age, and social context (but see recent work by Matsumoto, 1990).

FACIAL ACTION GENERATES EMOTION PHYSIOLOGY

Most emotion theorists emphasize the involuntary nature of emotional experience, ignoring those instances in which 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 is generated centrally when an emotion is called forth by an event, memory, image, and so on.

A new role for facial expression was found in the collaboration between Ekman, Friesen and Levenson of the University of California at Berkeley (Ekman, Levenson, & Friesen, 1983). Voluntarily performing certain facial muscular actions generated involuntary changes in autonomic nervous system (ANS) activity (for review, see Levenson, 1994). Subjects were not asked to pose emotions, but instead to follow muscle-by-muscle instructions to configure their face into one of the expressions that had been found to be universal. For example, rather than ask a subject to pose anger, instructions stated: "Pull your eyebrows down and together, raise your upper eyelid and tighten your lower eyelid, narrow your lips and press them together." There was greater heart rate acceleration and increased skin conductance when subjects made the expressions for negative emotions (anger, disgust, and fear) as compared to the positive emotion of happiness. There was greater heart rate acceleration when subjects made the expression for anger, fear and sadness as compared to disgust, and increased finger temperature in anger as compared to fear.

This work has since been replicated in three more experiments (Levenson, Carstensen, Friesen, & Ekman, 1991; Levenson, Ekman, & Friesen, 1990), and a number of a possible artifacts that could have been responsible for this phenomenon have been ruled out: It occurs

when subjects cannot see their own faces or the face of the person giving the instructions; it is not an artifact of somatic muscle activity; and, it is not due to differences in the difficulty of making the different facial configurations. The finding that voluntary facial action generates different patterns of ANS activity was also replicated in an older population (Levenson et al., 1991). Recently an experiment was conducted in another culture to determine whether these findings are specific to Americans, or are more general. A cultural group was selected—the Minangkabau of Sumatra—who differ from Western societies in language, religion (fundamentalist Moslem), and social organization (they are matrilineal, with inheritance through the mother's side of the family). The findings replicated (Levenson, Ekman, Heider, & Friesen, 1992) suggesting that this phenomenon may be pancultural.

There are several issues that are relevant to the fact that voluntary facial action generated physiological changes. The nature of the physiological changes themselves and their likely functions have been discussed elsewhere (Ekman, 1984; Ekman et al., 1983; Levenson et al., 1990). First is the consideration of whether these voluntary facial muscular performances generate emotion or only the physiology of emotion. The problem in answering this question is what to use as the criterion for emotion. Ekman and Levenson could not use either the face, which generated the response, nor the physiological changes that occurred when the facial actions were made because they wanted to know whether an emotion was experienced when these physiological changes were generated. Instead they had to rely on self-report, which is notoriously vulnerable to demand characteristics. They tried to minimize that by asking an open-ended question, and by also including in that question a probe about any physical sensations or memories. Few sensations or memories were reported, whereas on 78% of the trials, the subjects reported feeling an emotion. When subjects reported actually feeling the emotion associated with the expression they made, the ANS distinctions among the negative emotions were more pronounced. Clearly, considerably more research is needed to be certain that people actually are experiencing emotions in this task. Different self-report procedures should be used, perhaps also with manipulations about expectations, to learn how subjects construe the physiological changes that occur when they make the facial muscular actions.

A question can also be raised about whether the changes in ANS activity generated when subjects make the different facial expressions are unique to this specific task or would occur when emotion is brought

about by more usual means. This raises the general question about whether ANS patterning is emotion specific or context specific (see a recent discussion by Stemmler, 1989). Ekman (1984) has proposed that the changes in both physiology and expression are emotion specific, but the results on this issue in the first study (Ekman et al., 1983) were not clear cut. They found both similarities and differences in the specific ANS patterns generated by the voluntary facial action task and by a task in which subjects were instructed to relive past emotional experience. Recently Ekman and Levenson (Levenson et al., 1991) obtained more consistent results, finding the same distinctions among negative emotions in ANS activity in both the voluntary facial action task and in the relived emotion task. Work now in progress is comparing the ANS activity that occurs with these two tasks and a task in which emotions are aroused by viewing short motion picture films.

The same question—are any observed patterns of activity emotion specific or task specific—can be asked about any emotional response, not just ANS physiology. Although there has been no specific study aimed at answering this question for facial activity, there is considerable evidence suggesting that the facial configuration (the specific pattern of facial muscular activity) is more emotion specific than task specific, whereas attempts to control the expression, the timing of the configurational changes, and the extent of activity all reflect the specifics of how the emotion was brought about. In work in progress, Ekman and Levenson are directly examining this issue for the face as well.

Before turning to the question of how voluntarily making different facial configurations generates different patterns of physiology, the focus is broadened to consider central nervous system (CNS) as well as ANS physiology, drawing on new findings in a collaboration between Ekman and Davidson, from the University of Wisconsin. Exactly the same task was employed, in which subjects followed muscle-by-muscle instructions to create different facial configurations. R. J. Davidson and his colleagues measured left and right frontal, temporal, and parietal electroencephalogram (EEG) activity. Different patterns of EEG activity occurred when subjects made the muscular movements that had been found universally for the emotions of happiness, anger, fear, sadness, and disgust. These findings await replication.

There are three quite different explanations of how voluntary facial action generates emotion-specific physiology. The first explanation posits a central, hard-wired connection between the motor cortex and other areas of the brain involved in directing the physiological changes

that occur during emotion. Usually when emotions are aroused by the perception of a social event, a set of central commands produce patterned emotion-specific changes in multiple systems, including (but not limited to) such peripheral systems as facial expressions, vocalizations, skeletal muscular settings, and ANS activity. When there is no emotion operative, as in the described experiments, but one set of those commands is generated deliberately, the established emotion networks transmit the same patterned information, thereby generating the other emotion-specific response changes. The initiating actions need not be a facial expression; emotion-specific vocalizations, or respiratory patterns, for example, should do just as well.

A second group of alternative explanations could propose that any connection between expression and physiological change is learned and not hard-wired. The extreme version of this viewpoint sees emotions as totally socially constructed, and has no reason to expect that there always will be both an expression and a unique pattern of physiology in every emotion, let alone any connection between the two. Emotion-specific ANS activity might only be learned in those cultures that teach their members specific adaptive behaviors for an emotion, and there would be no reason for every culture to do so, or if they did, to teach the same adaptive pattern. If anger exists in two cultures, and it certainly need not in every culture, there would be no necessary reason that anger would be associated with fighting and the physiology that subserves such actions in any two cultures. Nor would there be any reason for expressions to be learned and associated with any physiology. Levenson and Ekman's findings (Levenson et al., 1991) of the same emotion-specific ANS physiology, and the capability for voluntary facial action to generate that activity, in a Moslem, matrilineal, Indonesian culture challenge such a radical social constructivist view. A more moderate social learning position, which allowed for universals in both expression and in physiology, might still claim that the link between the two is learned and not hard-wired, established through repeated co-occurrence.

A third set of alternative explanations emphasizes peripheral feedback from the facial actions themselves, rather than a central connection between the brain areas that direct those facial movements and other brain areas. This view includes variations in terms of whether it is feedback from the muscles, skin, or temperature changes and whether it is hard-wired or requires learning. This explanation is consistent with the views of Izard, Laird, Tomkins, and Zajonc.

For now, there is no clear empirical basis for a definitive choice among these explanations. Studies of people with facial paralysis who have no possibility of peripheral facial action or feedback will hopefully challenge that explanation. If there is a direct central connection, and if these people know how to deliberately and accurately make their facial muscles contract, then the patterned changes in their physiology should be observed, even though no facial action occurs. That study is not yet complete, and the results may be ambiguous. The findings may be negative not because the mechanism is not a central one, but because these patients may not be able to follow the instructions to attempt to contract specific facial muscles. We have no way to verify, as we can with normal subjects, that they actually produced the required facial muscle configuration.

THE SMILE OF ENJOYMENT

Failing to recognize that there are different types of smiling that may have different meanings has confused both psychologists and anthropologists. The appearance of smiling of some form in unpleasant circumstances led anthropologists such as Birdwhistell (1970) and LaBarre (1947) to proclaim that facial expressions are culture specific. Within psychology, the conclusion that facial expressions do not provide much accurate information about emotion—the position taken in W. A. Hunt's (1941) and Bruner and Tagiuri's (1954) influential literature reviews—relied heavily on experiments in which subjects smiled in unpleasant circumstances. The classic study by Landis (1924) found that subjects smiled as often when observing a rat being decapitated as when listening to music.

More recently, studies of interpersonal deception have obtained contradictory findings on smiling (see review by M. G. Frank, Ekman, & Friesen, 1993). The confusion might have been avoided if scientists in this century had read the French neuroanatomist Duchenne de Boulogne, who wrote in 1862. Although this work was not translated into English until recently (Duchenne, 1990), Darwin had 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: zygomatic major, which pulls the lip corners up obliquely, and orbicularis oculi, which orbits the eye pulling the skin from the cheeks and fore-

head toward the eyeball. "The first [zygomatic 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). "[This muscle] 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).

Duchenne's observation is consistent with the finding that most people cannot voluntarily contract the outer portion of the muscle that orbits the eye, and would therefore not be able to include this action when they deliberately smile (Ekman, Roper, & J. C. Hager, 1980). Duchenne had not distinguished between the inner and outer part of the orbicularis oculi muscle, but Ekman and colleagues found that most people can voluntarily contract the inner portion of the orbicularis oculi muscle. They therefore modified Duchenne's formulation considering just the actions of the outer part of this muscle crucial for distinguishing the smile of enjoyment from other forms of smiling.

Ekman and Friesen (1982) also suggested that enjoyment smiles could be distinguished from other forms of smiling by the presence of certain other muscles, and by the symmetry and the timing of the smile. Ekman (1985) described some 18 different forms of smiling. He defined enjoyment smiles as those smiles associated with pleasure, relief, amusement, etc. Nonenjoyment smiles include masking smiles (in which the smile at least partially covers muscular movements associated with another emotion), false smiles (smiles intended to mislead another into believing enjoyment is felt when it is not), miserable smiles (grin and bear it smiles), and so on.

Although there has been some empirical support for each of the proposed markers that distinguish enjoyment from other smiling (e.g., Ekman, Friesen, & O'Sullivan, 1988, on other muscular differences; Ekman, J. C. Hager, & Friesen, 1981; J. C. Hager & Ekman, 1985, on symmetry; Hess & Kleck, 1990, on timing), the largest number of studies have examined Duchenne's observation. In all of these studies, the smile with contraction of the outer portion of the orbicularis oculi muscle (which in his honor Ekman called Duchenne's smile), is compared with other kinds of smiling which do not include that muscular action. Three types of evidence support Duchenne's distinction.

Social Context. Ekman et al. (1988) found more Duchenne smiles when subjects truthfully described pleasant feelings than when they followed instructions to claim to be feeling pleasant when they

were actually watching very gruesome surgical films. In another study (Ekman, R. J. Davidson, & Friesen, 1990) in which people were not asked to deceive but simply watched emotion-inducing films alone, there were more Duchenne smiles when they watched pleasant as compared to unpleasant films, but no difference in how often other kinds of smiling occurred. Ten-month-old infants showed more Duchenne smiles when approached by their mother and more of other kinds of smiling when approached by a stranger (N. A. Fox & R. J. Davidson, 1988). Five- to seven-year-old children showed more Duchenne smiles when they succeeded and more other kinds of smiling when they failed in a game (K. Schneider, 1987). Psychiatrically depressed patients showed more Duchenne smiles at time of discharge from a hospital as compared to time of admission, with no difference in other kinds of smiling (Matsumoto, 1987). Similarly, there was more Duchenne smiling in late as compared to early psychotherapy sessions, but only among patients who had improved (F. Steiner, 1986).

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, & Wagner, 1989). Mothers who were referred to a clinic by the courts because they had abused their child showed less Duchenne smiles when interacting with a child than a control group of mothers who had evidenced no child abuse (Bugental, Blue, & J. Lewis, 1990). Levenson and Gottman found that happily married couples showed more Duchenne smiles than unhappily married couples, but there was no difference in other kinds of smiling (Levenson, 1989).

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, not other kinds of smiling, 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 to other smiles. The study of 10-month-old infants (N. A. Fox & R. J. Davidson, 1988) also found differences in regional brain activity when the infants showed Duchenne as compared to non-Duchenne smiles. In Ekman's recent unpublished study with R. J. Davidson, different patterns of regional brain

activity were found when subjects deliberately performed a Duchenne smile as compared to a nonDuchenne smile.

This is a remarkable convergence of evidence supporting the distinction between Duchenne and other kinds of smiling. No account should be taken of studies that claim to show smiles are unrelated to emotion (e.g., Fridlund, 1991), which 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 nonenjoyment smiles when they viewed a series of smiles (M. G. Frank, Ekman, & Friesen, 1993). 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 (Ekman, O'Sullivan, Friesen, & Scherer, 1991).

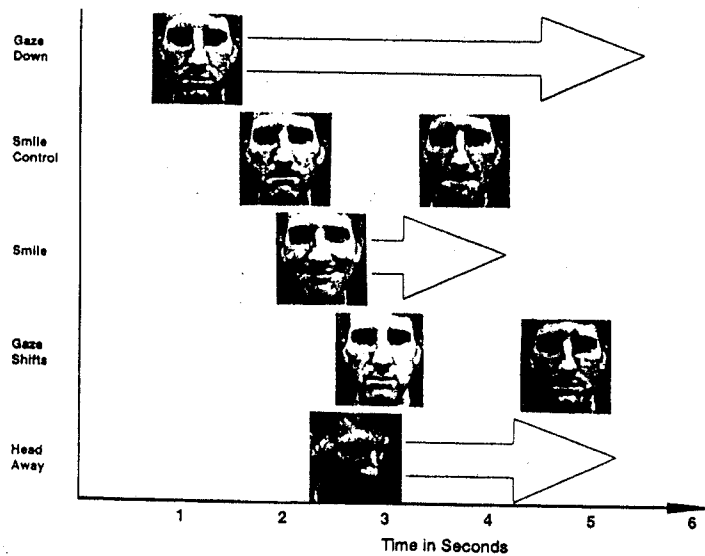


Fig. 2.2. Component actions of the expressions of embarrassment.

One of the questions remaining about smiles is whether the different positive emotions (e.g., amusement, contentment, relief, etc.) have distinctive forms of smiling or if the variety of positive emotions share one signal and can be inferred only from other behavioral or contextual cues. A similar question can be raised about whether various forms of nonenjoyment smiles (compliance, embarrassment, grin-and-bear-it, etc.) are marked in the smile itself. Recent research on the facial ex-

pression of embarrassment (Keltner, 1995) has found that when people report embarrassment, they show a consistent pattern of behavior distinct from that of amusement. The separate actions of this response are represented in Fig. 2.2.

When embarrassed, people look down with a latency of .7 seconds, then smile and simultaneously attempt to control the smile with facial actions that are antagonistic to the upward pull of the zygomatic muscle, and then turn their head away and touch their face. Follow-up studies have shown that observers are able to discriminate videotaped expressions of spontaneous embarrassment and amusement, and they are able to do so when the same facial actions are posed in still photographs. This suggests that an important part of the embarrassment signal is the sequential unfolding of its component actions.

The same emphasis on dynamic and morphological markers that was useful in differentiating different kinds of smiles should also be useful for distinguishing actual instances of each of the negative emotions from deliberate performances of those emotions. In each case, the actual negative emotional expression will include muscular elements that are difficult for most people to perform voluntarily. For example, most people cannot voluntarily contract the portion of the muscle in the lips that narrows the lip margin, and the absence of this muscular action should differentiate the deliberately performed from the actual expression of anger.

FACIAL MEASUREMENT

There are two different approaches for measuring facial expressions in muscular or anatomical terms. In one technique, human coders learn to recognize visually distinct facial actions that can singly or in combination account for all facial movement. The Facial Action Coding System (FACS; Ekman & Friesen, 1976, 1978) allows for the scoring of any observed facial movement. Izard (1979) developed a similar scoring system, but it includes only those facial movements that Izard believed relevant to emotion.

The other method is facial electromyography (EMG), in which surface electrodes placed over different regions of the face measure electrical discharge from contracting muscular tissue through the skin. The EMG signal lends itself to immediate recording, is not labor intensive, and is sensitive to slight muscular movements that may not be visible

even to the trained eye. One drawback is that EMG is highly obtrusive; the application of surface electrodes makes subjects aware of the facial measurement. Another drawback is that the recording selectivity of facial EMG is not muscle specific, but rather regionally specific, and it is not yet certain whether EMG allows the differentiation of as many different emotions as can be done with measurement that relies on observer scoring of visible muscular actions. The first method—scoring observed facial movements in muscular terms—remedies these problems. It is precise, able to specify which muscles were active, and FACS allows measurement of any movement, not just an a priori set predetermined by the placement of EMG leads. The visible movement scoring techniques are also unobtrusive, performed from videotape records without intruding on the subject. The disadvantage of this approach is that it is labor intensive and insensitive to very slight changes in muscle tonus.

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