22

FACIAL EXPRESSION OF EMOTION

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The study of facial expression of emotion has long been the focus of theoretical controversy and empirical research (e.g., Allport, 1924; Birdwhistell, 1963; Coleman, 1949; Darwin, 1872/1998; Ekman, 1973, 1994; Fridlund, 1991; Hunt, 1941; Landis, 1924; Mead, 1975; Munn, 1940; Osgood, 1966; Russell, 1994; Schlosberg, 1954; Woodworth, 1938). In studies of facial expression, researchers have addressed how emotions develop, to what extent the information they convey is best captured verbally by discrete categories or scalar dimensions, whether emotions have distinct biological substrates, and the extent to which facial expressions of emotion are universal and how they vary across cultures. In this chapter, we first briefly review the history of the study of facial expression, highlighting the ebb and flow of theory on the aforementioned issues. We then review evidence relevant to three long-standing questions in the field: Are facial expressions accurate indicators of emotion? In which respects are facial expressions of emotion universal and in which ways are they culturally specific? And are the states signaled or represented by facial expressions of emotion best viewed as discrete systems or dimension-based entities? We conclude by highlighting more recent developments in the study of facial expression, focusing on how facial expressions shape social interaction and how individual variations in facial expression relate to personality and psychopathology.

History of the Study of Facial Expression of Emotion

The contemporary study of facial expression was profoundly shaped by Darwin's *Expression of Emotions in Man and Animals* (1872/1998). In this book, Darwin described distinct facial expressions of different emotions, thus setting the stage for discrete theories of emotion (e.g., Ekman, 1993). He also described the likely meaning of individual muscle actions (e.g., the furrowed brow), an intellectual foray that in part inspired componential theories of facial expression (Smith & Scott, 1997). He described similarities between human expressions and those of other species—an emphasis that guides research to this day (see chapter 24, this volume). And he argued that facial expressions were universal, and even obtained data from informants in different countries and within England, and analyzed observers' responses to different expressions. Although Darwin's influence is clear today, it would be almost 100 years before psychologists would conduct research to explore Darwin's insights.

For several decades, views of facial expression alternative to those advocated by Darwin prevailed. Floyd Allport (1924) proposed an alternative to Darwin's account of universality: species constant learning. Other early theorists focused on the structure of the language used to describe the information conveyed by facial expressions of emotion. Woodworth (1938) proposed a set of six emotion

categories to bring order to the variety of responses observers gave when judging the emotion shown in expressions. Schlosberg (1954) proposed three dimensions that underlie categorical judgments. In an influential review, Bruner and Tagiuri (1954) concluded that facial expression did not provide much accurate information, and the study of facial expression was dormant.

Beginning in the early 1960s, three developments provided impetus for a renaissance of interest in facial expression. First, Plutchik (1962) and Tomkins (1962, 1963) offered evolutionary accounts of facial expression of emotion. Second, independently conducted cross-cultural studies by Ekman and his collaborators and by Izard strongly suggested universality in interpreting facial expressions of emotion (Ekman & Friesen, 1971; Ekman, Sorenson, & Friesen, 1969; Izard, 1977). These findings countered prevailing ideas of cultural relativism, and directed researchers to consider the functions facial expressions serve. Finally, researchers developed anatomically based coding systems to measure facial expression (Ekman & Friesen, 1978; Izard, 1977). These systems avoided the problems associated with relying on observers' inferences about emotion based on expressive behavior, and were less intrusive and more comprehensive than EMG methods of measuring facial activity (see Ekman & Rosenberg, 1997, for a sample of diverse studies measuring facial activity).

These conceptual and methodological advances have inspired vast literatures on facial expression (for reviews, see Ekman & Oster, 1979; Keltner & Kring, 1998). This evidence allows us to arrive at more informed positions regarding long-standing questions about facial expression. The first that we address in this review may be the most basic question in the literature: Are facial expressions reliable indicators of emotion?

Facial Expressions as Accurate Indicators of Emotion

Do facial expressions convey information about emotion? Research on facial expression has seen the pendulum swing between polar responses to this question. Until the late 1960s it was widely assumed that facial expressions were not systematically associated with specific events or subjective experience, and as a consequence conveyed little information to others. In supporting this claim, researchers noted numerous instances in which facial expression did not correspond to the emotional meaning of preceding events. Individuals smiled at the decapitation of a rat (Landis, 1924) or at the news of their husband's death (for review of this position, see Ekman, 1973). Facial expressions were assumed to be like the phonemes of a language: the units of communication were attached to specific events and experiences in context- and culture-specific ways.

The writings of Tomkins, Ekman, and Izard pointed to a different hypothesis. They argued that humans have evolved distinct facial expressions that accompany the experience of emotion and convey that experience to others. The benefits of having reliable expressions of emotion are numerous: Most generally, facial expressions coordinate interactions between individuals as they respond to the challenges (e.g., threats, injustice) and opportunities (e.g., formation of bonds, pursuit of resources) in their social environment. As we shall see, this view prevailed for several decades, but has more recently been challenged by advocates of the view that emotions may not necessarily be marked by distinct and recognizable facial expressions (e.g., Fernandez-Dols & Ruiz-Belda, 1997; Fridlund, 1991; and see reply to these challenges in Ekman, 1999).

These contrasting positions can be assessed by addressing the extent to which, if at all, facial expressions relate to other markers of emotion, including emotion-related experience, physiology, appraisal, or action tendencies. Researchers have approached this question from different theoretical perspectives. Discrete emotion theorists have looked at how prototypical facial displays of emotion relate to different indices of emotion. This view has guided much of the research that we review here. Componential theorists (e.g., Ortony & Turner, 1990; Smith & Scott, 1997) have looked at how components of facial expressions (e.g., the furrowed brow or pressed lips) relate to components of emotional response (e.g., specific appraisals). These perspectives work at different yet complementary levels of analysis. The studies they have inspired suggest that facial expression is not a noisy system but instead provides information about an individual's emotion.

Correspondence Between Facial Expressions and the Experience of Emotion

The most concerted attempt to link facial expression to emotion has focused on self-reports of subjective emotion. This kind of study must overcome numerous difficulties (Davidson, Ekman, Saron, Senulis, & Friesen, 1990; Rosenberg & Ekman, 1994). Emotion must be reliably elicited and measured. The measurement of subjective emotion should occur in temporal proximity to the occurrence of facial expression. Researchers should compare the subjective correlates of closely related facial expressions (e.g., anger and disgust). And numerous methodological practices that increase the strength of potential correlations between facial expression and self-reported emotion, such as within-subjects design, should be considered (e.g., Ruch, 1995).

Notwithstanding these difficulties, several relevant studies have now documented consistent relations between facial expression and other markers of emotion. An

early review of 11 studies of contrasting methods indicated that the effect size of the relation between facial expression and experience was small to moderate, but consistently significant across studies (Matsumoto, 1987). Studies using precise facial coding systems have consistently found relations between facial expression and reports about the subjective experience of emotion. In one study, subjects' facial expressions of disgust and smiling in response to viewing evocative films correlated with subsequent self-reports of emotion (Ekman, Friesen, & Ancoli, 1980). Duchenne smiles, which involve the raising of the cheeks, but not non-Duchenne smiles, have been shown to relate to the experience of positive emotion in young and old adults (e.g., Frank, Ekman, & Friesen, 1993; Hess, Banse, & Kappas, 1995; Keltner & Bonanno, 1997; Smith, 1995). The unique facial actions of embarrassment and amusement (e.g., gaze aversion and smile controls versus the open-mouthed smile) related in distinct ways to self-reports of these emotions (Keltner, 1995). Spontaneous laughter and smiling were found to have some distinct experiential correlates (Keltner & Bonanno, 1997). Reviews of the humor and laughter literature find that the intensity of laughter or smiling correlates between .3 and .4 with self-reports of the funniness of the humorous stimuli (McGhee, 1977; Ruch, 1995). There are certain emotions for which the jury is still out, such as fear and sadness. Nevertheless, relevant studies consistently indicate that facial expressions relate to the experience of emotion. These findings are all the more impressive when one considers the logical upper limits of the strength of correlations between measures coming from such different sources and the limitations in the adequacy of attempts to report in words on subjective experiences.

Correspondence Between Facial Expression and Other Markers of Emotion

Other studies, fewer in number, have ascertained whether facial expressions of emotion relate to other markers of emotion. Select studies suggest that different facial expressions are associated with different autonomic responses; thus, following instructions to voluntarily contract the facial muscles into configurations theoretically presumed to characterize anger, fear, disgust, and sadness produce different patterns of autonomic activity (Ekman, Levenson, & Friesen, 1983; chapter 11, this volume; Levenson, Ekman, & Friesen, 1990). For example, the anger configuration triggers elevated heart rate and increased blood flow to the periphery; posing disgust triggers reduced heart rate. Of course, these findings pose the question of whether spontaneous expressions of emotion will likewise relate to distinct autonomic responses. Some evidence suggests the answer may be affirmative. Anger displays have been shown to relate to the incidence of ischemia in patients with coronary artery disease (see Rosenberg et al., 1998). The oblique eyebrows and pressed lips of sympathy correlated with reduced heart rate, whereas prior wince of pain related to elevated heart rate (Eisenberg et al., 1989).

Still other studies have linked facial expression to other components of emotional response, including emotion-specific central nervous system activity, environmental events, and cognitive appraisals. Spontaneous Duchenne smiles have been shown to relate to left anterior activity (e.g., Davidson et al., 1990; Ekman, Davidson, & Friesen, 1990), whether someone is truthfully or dishonestly describing positive feelings (Ekman, Friesen & O'Sullivan, 1988), to whether an infant is approached by its mother or a stranger (Davidson & Fox, 1989), and whether patients are improving as a result of treatment (Ekman, Matsumoto, & Friesen, 1997). Other evidence suggests that patients with right-hemisphere damage are impaired in the production of facial expressions of emotion, particularly for positive emotion (Borod, Koff, Lorch, & Nicholas, 1986). Smith has shown that individuals imagining situations high in perceived obstacles to goals were more likely to show furrowed eyebrows (Smith, 1989; Smith & Scott, 1997). A recent study found that bereaved adults' facial expressions of anger and sadness while discussing their deceased spouses tended to co-occur with distinct appraisal themes (justice and loss) coded from participants' spontaneous discourse (Bonanno & Keltner, 2000). And one study suggests that facial expressions may be associated with specific patterns of thought: Posing facial expressions of anger was associated with the tendency to attribute social events to others' actions, whereas posing facial sadness was associated with the tendency to attribute the same events to situational causes (Keltner, Ellsworth, & Edwards, 1993).

This literature lends support to the general position that facial expressions relate to the different responses that are part of the "emotion package." For advocates of the discrete perspective, it is clear that more basic research is needed on the many states considered to be discrete emotions (e.g., there is little evidence linking facial expressions of sadness to distinct markers of emotion). It will also be important to link spontaneous facial expressions (many critical studies have focused on posed expressions) and responses other than self-report. For advocates of the componential view of facial expression, the charge is quite similar, although even more pronounced: Researchers need to document, as Smith has done, whether the different components of emotion relate in systematic ways to different facial actions.

Challenges to the View That Facial Expressions Communicate Information About Emotion

Several theorists have recently challenged the view that facial expression conveys information about emotion (e.g.,

Fernandez-Dols & Ruiz-Belda, 1997). These challenges center on two widespread assumptions. The first is that facial expressions correlate with emotional experience. For example, Fridlund has argued that facial expressions (or displays) evolved to signal social intentions rather than private feeling. In fact, Fridlund argues, it may often be advantageous to deceive others about one's emotions, and to signal intentions without experiencing emotion.

Before turning to Fridlund's empirical evidence, it is important to remember that there is a vast repertoire of facial actions (e.g., eyebrow flashes, referential displays, back channel responses) that do not necessarily relate to emotion (e.g., Bavelas & Chovil, 1997; Ekman, 1979). There are certain to be facial actions, as Fridlund contends, that convey information in the absence of emotional experience. It is also likely that emotional experience is associated with social intentions (Frijda, 1986), and some have even argued that social intentions are more credible when accompanied by emotional experience (e.g., see Frank, 1988).

In several empirical studies, Fridlund has addressed whether facial expressions vary more as a function of social audience (which heightens the need to convey social intentions) or of private experience. In these studies, participants are led to experience an emotion (through imagery or by watching an evocative videotape) when they are alone, with others, or when imagining others are present (Fridlund, 1991; Fridlund, Kenworthy, & Jaffey, 1992). Facial expression is measured with EMG. These studies have shown that: (1) participants' self-reports of happiness do not correlate with measures of smiling behavior; and (2) greater smiling is observed when participants are in more social situations (and by implication, disposed to signal social intentions). Other authors have similarly observed that facial expression appears to be more tailored to the communicative demands than to the hedonic implications of the context. Kraut and Johnston (1979) found that participants smiled more when: (1) facing their friends after bowling a strike as opposed to when facing the pins just after having bowled the strike; (2) at a hockey game when engaged with their friends rather than when their team did well; and (3) talking to someone in the rain, rather than when alone in the sunshine. In a similar vein, during the awards ceremony, Olympic gold medal winners smiled more when interacting with others than when standing on the podium (Fernandez-Dolz & Ruiz-Belda, 1995).

Although provocative, these studies suffer from certain limitations. In the Fridlund studies, Duchenne or enjoyment smiles (which involve the *orbicularis oculi* muscle and are associated with pleasure) were not differentiated from non-Duchenne or polite smiles (for distinctions, see Frank, Ekman, & Friesen, 1993; Keltner & Bonanno, 1997). One might have observed robust correlations between Duchenne smiles and self-reports of happiness, but not for the non-Duchenne smiles. Measures of emotional experience were not gathered in the studies of bowlers, hockey fans, and gold medal winners, so we simply cannot make inferences about the emotional meaning of the events (e.g., gold medal winners may have been more awestruck, grateful, or wistful than happy while on the podium). These studies also suffer from a theoretical dualism that opposes emotion to communication, and fails to consider the evolutionary view that since emotions evolved to deal with the most important social interactions (mating, dealing with competitors, child care, etc.), we should expect emotions to be highly evident in social situations. Although these studies inspired a literature on the influences of social context upon facial expression, which we review later, they appear to do little to undermine the notion that facial expressions of emotion are reliably associated with specific emotional experiences.

A second challenge has centered on whether prototypical facial expressions of emotion are associated with theoretically relevant events. There is a good deal of research identifying the prototypical elicitors of emotion (e.g., Lazarus, 1991; Shaver, Schwartz, Kirson, & O'Connor, 1987), and one would certainly expect from the writings of Ekman, Izard, and others that facial expressions of emotion would follow prototypical elicitors of emotion (e.g., injustice, loss, violations of bodily integrity, rewards). The evidence for these claims is less substantial than one would imagine, in large part due to the difficulty of finding elicitors that will evoke the same relatively pure emotional state in most people. It is known that Duchenne smiles are associated with positive events, such as positive film clips and the approach from intimate others (see Keltner & Ekman, 1996, for review). Failure tends to produce shame-related gaze aversion and head movements down (Keltner & Harker, 1998). And in one study of bereaved participants, the dominant facial response to discussions of their deceased partner was sadness (Bonanno & Keltner, 1997). Clearly, more systematic work is needed to link specific events to distinct facial expressions of emotion. This work must avoid assuming that events will be appraised in the same way by all people. Progress will be made when, instead of trying to link emotions to events, emotions are linked to appraisals of events.

Others have taken a more critical view on this issue, suggesting that the prototypical facial expressions are not associated with prototypical elicitors of emotion. In extending this critique to theorizing about the development of facial expression, Camras has made two important observations (Camras, Lambrecht, & Michel, 1996). First, in experimental contexts in which one would expect infants and young children to show surprise (such as violations of object permanence), they in fact do not. Second, children often show facial expressions of surprise in rather unexpected contexts, as when they reach for desirable objects.

Future Issues

The evidence suggests that there are links between facial expressions and emotional experience, physiology, and certain elicitors. Certain individual facial actions also seem to be associated with theoretically relevant appraisal themes. We have noted that the evidence is still incomplete, and there remain facial expressions and individual facial actions in need of study, as well as different markers of emotion. As the field progresses, we will move beyond more simple questions, such as whether facial expression is an indicator of emotion, to more nuanced questions. Are there indeed prototypical and less prototypical facial expressions of emotion, as evident in differing degrees of association with other markers of emotion? Are there indeed "reliable muscle" actions for each category of emotion, which are most strongly associated with the different markers of emotion (e.g., Ekman, 1993)? And how do the different facial actions within an emotion category relate to different markers of emotion? Answers to these questions may lead to a productive rapprochement between the discrete and componential views of facial expression.

University and Cultural Variation in Facial Expressions of Emotion

Whether or not people of different cultures express emotion similarly is of central importance to those who believe that facial expressions evolved and are part of universal human nature (see Brown, 1991; Ekman, 1973). This sort of evidence is just as vital to those who study how emotions are shaped by cultural values and practices.

The search for universals in facial expression has a long and storied history (Darwin, 1872/1998; Ekman, 1973, 1998). Consistent with his zeitgeist, Darwin believed that facial expressions of emotion were universal, and distributed questionnaires to missionaries in different parts of the world, querying whether their observations led them to conclude that people in those faraway cultures expressed emotion in similar ways (Darwin, 1872/1998). No informant described a facial expression that was not identifiable from his Victorian perspective (although these informants may simply not have noticed, remembered, or been able to describe facial expressions that differed from their conceptions of emotion or facial expression).

A universalist view of facial expression, however, would be short-lived. In the 1930s, 40s, and 50s, social scientists, most notably Klineberg (1940), La Barre (1947), and Birdwhistell (1970), claimed that people in different cultures express emotions differently in the face. Their claims were based on faulty observational research, imprecise definitions of facial expressions, and failures by most to consider the role of display rules governing the expression of emotion. Nevertheless, they guided an initial wave of research on cultural specificity in the interpretation of emotion (reviewed in Ekman, 1973). Since then, numerous studies have been conducted, addressing whether individuals from different cultures: (1) show similar facial expressions when experiencing similar emotions and (2) judge facial expressions in similar ways. These studies suggest pretty strongly that facial expressions of emotion, at least in the eye of the beholder, are universal. This literature just as clearly hints at ways in which the meaning of facial expressions of emotion may vary across cultures in systematic ways.

Universality of Facial Behavior

Perhaps most striking in the literature on facial expression is the paucity of evidence concerning whether, across cultures, individuals show similar facial expressions when experiencing emotion. The methodological difficulties of this work are obvious, as noted in a previous section. Cross-cultural studies of actual emotional behavior require cross-cultural equivalence in the meaning of emotional stimuli and the relative absence of the influence of culturally based display rules (Ekman, 1973).

A first study documented that when videotaped without awareness, Japanese and American students showed remarkably similar negative facial expressions while viewing a stress-inducing film (Ekman, 1973). More recently, it was found that 5- and 12-month-old Japanese and American infants responded with similar facial, postural, and vocal expressions of anger in response to a nonpainful arm restraint (Camras, Oster, Campos, Miyake, & Bradshaw, 1992). Ethological research, although not having safeguards against a single observer's possible bias, has shown that people in different cultures display similar facial expressions, such as laughter, embarrassment, or anger, during play, flirtation, or fighting (e.g., Eibl-Eibesfeldt, 1989). Clearly, more basic research documenting the nature of facial expression in different emotional contexts, when subjects are appraising events in a similar fashion, is sorely needed.

In other studies, like those Darwin himself conducted, researchers have gathered people's descriptions of facial expressions associated with different emotions. Although self-reports of behavior are clearly subject to a variety of biases, this evidence could be used to address the universality of facial expression. For example, across cultures people are in high agreement that embarrassment is expressed in a nervous smile and gaze aversion (reviewed in Keltner & Buswell, 1997). Other studies that have systematically gathered individuals' descriptions of expressive behavior across cultures (e.g., Scherer & Wallbott, 1994) could be similarly synthesized.

Finally, one study has examined the relations between facial expression and other markers of emotion across cultures. In this study, participants in the United States and

the Minangkabau—a matrilineal, Muslim culture in Indonesia—configured their faces into the expressions of different emotions, during which time their autonomic physiology was recorded (Levenson, Ekman, Heider, & Friesen, 1992). Importantly, deliberately making the same set of facial movements produced similar autonomic responses in the two cultures, in the case of anger, disgust, and fear, pointing to universal links between facial action and emotion-specific autonomic physiology.

Universality in Judgments of Facial Expressions of Emotion

Beginning with Ekman's initial work with the preliterate, isolated Fore of New Guinea, and Izard's work with a number of literate cultures, judgment studies have addressed whether people who speak different languages and adhere to different values and beliefs interpret facial expressions of emotion in similar ways (for reviews, see Ekman, 1998; Izard, 1977; Russell, 1994). Conducted in dozens of cultures, these studies have typically presented participants with photographs of prototypical facial expressions of emotion and asked them to label the expressions with a word from a list of emotion terms. These studies reveal that across cultures people judge facial expressions of emotion with levels of agreement that exceed chance, typically achieving agreement rates between 60 and 80% (when chance levels vary between 17 and 50%). These results have led theorists of differing theoretical persuasions to conclude that people across cultures judge facial expressions of anger, contempt, disgust, fear, sadness, and surprise in similar ways (Ekman, 1994; Haidt & Keltner, 1999; Russell, 1994).

These widely cited judgment studies have been critiqued in several ways (Fridlund, 1991; Russell, 1994). A first critique pertains to the fact that researchers provided the terms with which participants labeled the facial expressions. Perhaps if asked to label the facial expressions in their own words, members of different cultures would not agree, and in fact would choose different terms that reflect culture-specific concepts. A recent study in the United States and rural India (Haidt & Keltner, 1999), however, suggests otherwise. In this study, participants were allowed to label photos of 14 different expressions in their own words. Individuals from the United States and India spontaneously used similar concepts in labeling facial expressions of anger, disgust, fear, happiness, sadness, surprise, and embarrassment (see also Izard, 1977).

The forced choice, within-subject methods of these studies have been critiqued (e.g., Fridlund, 1992a; Russell, 1994; see responses of Ekman, 1994; Izard, 1994). Specifically, it has been argued that the forced-choice format may inflate artifactual agreement across cultures in the interpretation of facial expression. Recent work strongly suggests that this is not the case (Frank, in press). Specifically, in these studies participants were presented with the usual facial expressions and terms, but they were also given options such as "none of the above" or they were given additional response options. These techniques reduced the forced-choice nature of the judgment task, but they did not reduce agreement in judging facial expression. Also, Rosenberg and Ekman (1994) found that free-response formats produced the same results as fixed-response formats for judgments of facial expressions of anger, fear, disgust, sadness, surprise, and happiness.

Another critique of traditional judgment studies is that they used posed rather than spontaneous facial expressions of emotion as stimuli. The posed stimuli, furthermore, were prototypical displays of emotion (although theoretically derived). Perhaps observers would agree less in judging spontaneous displays of naturally occurring emotion. A recent study, however, suggests that observers are just as adept at judging spontaneous displays of emotion (Keltner, 1995). In that study (Study 5), observers were quite accurate in judging the spontaneous displays of amusement (i.e, laughter), anger, disgust, embarrassment, and shame (see Study 5; Keltner, 1995). The dynamic cues that accompany spontaneous facial expressions (e.g., movements of the head and eyes) may actually enhance agreement in judging some facial expressions.

These more recent studies suggest that the universality thesis stands the test of time and scientific challenge. The universality of facial expression, it is important to note, by no means implies universality in other components of emotion. Facial expressions of emotion may be the most universal of the different facets of emotion because of their central role in meeting different social problems that have been observed in different cultures, such as forming attachments, negotiating status, or apologizing for transgressions (Ekman, 1992a; Keltner & Kring, 1998). Other facets of emotion, such as the descriptions people give to the private feeling of emotion, may demonstrate more cultural variation.

Cultural- and Context-Related Variation in Facial Expression

The universality thesis holds that across cultures humans have evolved similar facial expressions of emotion and tendencies to interpret those facial expressions. An alternative to this view holds that facial expressions are shaped by cultural values and concepts regarding emotion (e.g., Gordon, 1989). Members of different cultures learn to express emotions in different ways, and interpret those expressions through the lens of their cultures. There are at least two variants of this constructivist analysis.

The stronger version holds that there will be great cross-cultural variation in facial expression. A review of the ethnographic literature would evince numerous observations that are consistent with this thesis. The Utku of

the Arctic were claimed never to express anger in the face (Briggs, 1960). In many cultures laughter is pervasive at funerals (Bonanno & Kaltmann, 1999). Given the ambiguity of terms like "laughter," these claims are problematic. Later we assess the current state of knowledge about how facial expression varies across culture.

A weaker version of social constructivism holds that the same stimulus will produce different facial expressions depending on the nature of the social context—for example, whether one is of low or high status or among familiar others or strangers. This sort of evidence does not challenge universalist claims, for features of the social context guide emotion-eliciting appraisals and display rules in ways that may be quite similar across cultures. Later we review how facial expression does vary according to social context.

Culture and Context and Facial Expression

Only a few studies have examined whether members of different cultures vary in their expressive behavior. Members of different cultures are likely to vary in the latency of their facial expressions of emotion; for example, American infants responded with anger more quickly than Japanese infants (Camras et al., 1992). Cultures may also differ in the range of expressions used to convey a particular emotion. For example, although individuals from India and the United States agreed in their interpretation of a prototypical embarrassment display, only individuals from India indicated that a tongue bite expression—a Southeast Asian display of self-conscious emotion—expressed embarrassment (Haidt & Keltner, 1999). Cultures may vary most in the meaning of these iconic displays of emotion (see Ekman & Friesen, 1982, for related discussion on cultural variation in emblems). And in still the only study to show the operation of different display rules in different cultures, Ekman (1973) showed cultural differences in the control of facial expression. When an authority figure was present, Japanese individuals more than Americans masked negative emotional expressions in response to watching an unpleasant film, with a smile, although they had shown nearly identical facial expressions when watching such films alone.

The studies of how social context shapes facial expression are more numerous and converge on certain conclusions. First, facial expressions appear to be more intense, or mark emotion more reliably, when among familiar others as opposed to strangers. For example, observers were better able to judge the emotions (Wagner & Smith, 1991) or content of stimuli (Buck, Losow, Murphy, & Costanzo, 1992) from observations of the expressive behavior of women who had been exposed to evocative stimuli in the presence of friends as opposed to strangers. In another study, being in the presence of a friend enhanced the expressive behavior of female participants as they viewed films of slapstick comedy (Hess et al., 1995).

Social status also influences the quality and coherence of emotional expression. Thus, in a study of teasing interactions, low-status members were more likely to display embarrassment and fear, whereas high-status members were more likely to display anger and contempt (Keltner, Young, Heerey, Oemig, & Monarch, 1998). Hecht and La France and colleagues have shown that high-power individuals are more likely to show Duchenne smiles associated with pleasure, whereas low-power individuals were more likely to show non-Duchenne, polite smiles (Hecht & LaFrance, 1998). Perhaps more important, high-power individuals' self-reports of pleasure were significantly correlated with their Duchenne smiles, whereas this correlation was not significant for the low-power participants.

Culture and Context in the Interpretation of Facial Expression

There is quite a rich literature indicating how members of different cultures interpret facial expressions through the epistemological lens of culture. First, individuals from different cultures differ in the emotional intensity that they attribute to facial expressions of emotion (Matsumoto & Ekman, 1989). In a first study to address this issue, Japanese participants attributed more intense emotion than Americans to all facial expressions of emotion posed by Caucasian and Japanese individuals, except expressions of disgust (Matsumoto & Ekman, 1989). Interestingly, members of the two cultures differed in which facial expression they judged to be expressing the most intense emotion: For the Japanese participants, it was the disgust expression; for the American participants, it was the happiness and anger expressions. In recent work, Matsumoto and colleagues have explored how culturally relevant variables, such as power distance and individualism, account for cultural differences in the intensity of emotion attributed to facial expression (e.g., Matsumoto & Kudoh, 1993).

Second, individuals from different cultures vary in the inferences they draw from facial expressions of emotion. For example, American, as compared to Japanese, college students were more likely to infer that an individual displaying a Duchenne smile was highly sociable (Matsumoto & Kudoh, 1993), consistent with the tendency for Americans to make dispositional inferences from social behavior. One might also expect cultures that somaticize emotional experience (e.g., Russell, 1991b) to be more likely to infer somatic responses associated with facial expressions. Other such cross-cultural predictions could be derived from the literature on emotion and culture (e.g., Frijda & Mesquita, 1992; Markus & Kitayama, 1991; Mesquita & Frijda, 1992).

Third, recent studies lend credence to ethnographic examples that strikingly different events elicit similar facial

expression in different cultures. For example, in one study it was found that Japanese students indicated that it was more appropriate to show negative facial expressions to outgroup members (Matsumoto, 1990). American students, in contrast, indicated that it was more appropriate to display negative emotion to ingroup members. People from India were more likely to mention affiliation in explaining photographs of a Duchenne smile, whereas Americans were more likely to mention individual achievement (Haidt & Keltner, 1999), consistent with claims about independent and interdependent cultures (Markus & Kitayama, 1991).

Future Issues

The field has made progress in addressing the extent to which facial expressions are universal and how they vary across cultures. People from radically different cultures appear to categorize a limited set of facial expressions in fairly similar ways. But members of different cultures vary in the inferences they draw from facial expression, and this issue is ripe for theoretical expansion. Once again there is a striking shortage of evidence concerning how individuals from different cultures vary, and how they are similar, in their actual facial expression.

Dimensions or Discrete Emotions

A central question in the field of emotion is whether emotions are better thought of as discrete systems or interrelated entities that differ along global dimensions, such as valence, activity, or approach and withdrawal (Ekman, Friesen, & Ellsworth, 1982; Lang, 1995; Russell, 1997; Schlosberg, 1954). Most discrete emotion theorists take an evolutionary approach and posit that each discrete emotion has a different adaptive function that should be served by fundamentally distinct responses. A dimensional approach argues that emotions are not discrete and separate, but better measured and conceptualized as differing only in degree on one or another dimension (usually, two or three dimensions are invoked to explain similiarities and differences in emotion). The dimensional perspective is more common among those who view emotions as being socially learned and culturally variable. It is also more common among those who focus on verbal representation of emotion, while the categorical approach is more popular among those focused on emotional responses or physiology. Four recent developments in the study of facial expression suggest that facial expressions are fruitfully thought of as discrete systems.

Categorical Judgment Studies

Categorical judgment studies have addressed whether the perception of facial expressions of emotion is categorical or dimension based (e.g., Etcoff & Magee, 1992). Studies of the categorical perception of colors and sounds find that within-category distinctions are more difficult to make than between-category discriminations (reviewed in Etcoff & Magee, 1992). On the boundary of two categories, accuracy in discrimination rises. In the studies of the perception of facial expression, continua of facial expressions were computer generated, with each continuum defined by two endpoints that were prototypical facial expressions of emotion (e.g., anger and fear). The remaining stimuli between the endpoints included facial expressions that varied by equal physical differences. For all possible pairs within a continuum, participants were presented with two target stimuli and then a third stimuli that was identical to one of the first two stimuli, and asked to indicate which stimulus the third stimulus resembled.

If facial expressions are perceived categorically, one would expect discriminations between faces within a category to be less accurate than between pairs of faces between categories that differed by an equal physical amounts (i.e., a categorical boundary effect). Indeed, the evidence using computer-generated drawings of facial expressions (Etcoff & Magee, 1992) as well as computer-morphed photographs of facial expressions of emotion (Young et al., in press) has yielded boundary effects. There appear to be discrete boundaries between the facial expressions of emotion, much as there are perceived boundaries between different hues or sounds.

Neuropsychological Evidence: fMRI, Lesion, and Disease Studies

Studies of the central nervous system correlates of facial expressions also bear upon the dimensionality versus discrete issue. Dimensional theorists have proposed that valence is primary in determining the perception of facial expression (e.g., Russell, 1997), implying that the same brain region might primarily be involved in the perception of different facial expressions of negative emotion. Similarly, other theorists have proposed that emotional face processing, regardless of valence, is localized to particular brain regions. For example, the right hemisphere has often been implicated in emotional face processing (Adolphs, Damasio, Tranel, Cooper, & Damasio, 2000; Borod, 1992; Ross, 1981). However, evidence for this position has been equivocal. Some studies have found that individuals are better at perceiving emotional faces presented in their left hemifield (controlled by the right hemisphere) and that patients with right-hemisphere damage are impaired at identifying negative emotional expressions (e.g., Borod, 1992; Borod et al., 1986). In contrast, other studies have shown that patients with left-hemisphere damage, in comparison to patients with right-hemisphere damage and normal controls, show selective impairments for perceiv-

ing emotional expression (e.g., Young, Newcombe, de Haan, Small, & Hay, 1993).

Another putative area for generalized emotional face processing is the orbitofrontal cortex (e.g., Hornak, Rolls, & Wade, 1996; Rolls, 2000). Two sources of evidence support this position. First, patient research has found that orbitofrontal damage is associated with impairment for identifying emotional expressions (Hornak et al., 1996). Other clinical populations that implicate the frontal cortex show impairment on emotional face perception, such as patients with autism (Celani, Battacchi, & Arcidiacano, 1999) and frontotemporal dementia (Lavenu, Pasquier, Lebert, Petit, & Van der Linden, 1999). Second, a PET study has found that the orbitofrontal cortex (BA 47) activates in response to emotional faces in comparison to neutral faces (Sprengelmeyer, Rausch, Eysel, & Przuntek, 1998).

Discrete theorists have argued that the experience and perception of different facial expressions of emotion involve distinct central nervous system regions (e.g., Ekman, 1992a; Izard, 1993). Two kinds of evidence suggest that distinct brain regions activate in the process of perceiving different negative emotions.

First, one class of studies has presented photographs of facial expressions of emotion and, typically with the use of fMRI or PET, ascertained that the perception of different facial expressions elicits activity in different brain regions when compared to neutral faces. The perception of fearful facial expressions activates regions in the left amygdala (Breiter et al., 1996; Phillips et al., 1997), even when the presentation of fearful facial expressions is masked by the presentation of an immediately ensuing neutral expression (Whalen et al., 1998). The perception of sad faces activates the left amygdala and right temporal lobe, whereas the perception of anger faces activates the right orbitofrontal cortex and cingulate cortex (Blair, Morris, Frith, Perrett, & Dolan, 1998; Sprengelmeyer et al., 1998). The perception of disgust faces activates the basal ganglia, anterior insula, and frontal lobes (Phillips et al., 1997; Sprengelmeyer et al., 1998).

Second, disease and lesion studies indicate that the perception of different emotions is associated with different brain regions. Specifically, bilateral lesions to the amygdala impair the ability to recognize fearful facial expressions and vocalizations but not the ability to recognize facial expressions of sadness, disgust, or happiness (Adolphs, Tranel, Damasio, & Damasio, 1994, 1995; Adolphs et al., 1999; Broks et al., 1998; Calder et al., 1996; Sprengelmeyer et al., 1999; Young, Hellawell, van de Wal, & Johnson, 1996). Individuals suffering from Huntington's disease, which affects the basal ganglia, were unable to recognize disgust expressions accurately but were accurate in judging facial expressions of other negative emotions (Sprengelmeyer et al., 1996). Even carriers of Huntington's disease were unable to recognize facial expressions of disgust (Gray, Young, Barker, Curtis, & Gibson, 1997).

These findings suggest that perception of emotional facial expressions may be associated both with general emotional processing activity (i.e., in the orbitofrontal cortex) and with activity in emotion-specific substrates. It may be that perception of emotional facial expression takes place in two or more steps. For example, specific brain areas may be involved in identifying particular emotional expressions, whereas the orbitofrontal cortex may be involved in higher order processing such as integrating facial expression information with contextual information (Sprengelmeyer et al., 1998). Future brain imaging research concerning the perception of emotional facial expression might provide a stronger test of the discrete versus dimension question by using a different study design and analysis approach. Event-related fMRI studies, in which participants are required to judge emotional expression (i.e., not gender) and in which comparisons are made between two different emotional conditions, will provide a more direct test of areas responsive to particular emotional expressions (see Blair et al., 1998; Morris et al., 1996).

Whereas these previous studies have established that the perception of different facial expressions activates different brain regions, less is known about whether the display of different facial expressions activates different brain regions. Work in progress studying multiple emotions using brain imaging techniques should provide important findings relevant to this matter (Davidson et al., 1990; Ekman, Davidson, & Friesen, 1990). Studies that have measured event-related potentials on the scalp have found that anger, happy, and fear faces elicit different event-related potentials in children as young as 7 months old (Nelson & de Haan, 1997; Pollak, Cichetti, Klorman, & Brumaghim, 1997). Finally, preliminary evidence indicates that the stimulation of a specific brain region produces laughter (Fried, Wilson, MacDonald, & Behnke, 1998). It should be noted that whereas dimensional theorists have also claimed that distinctions among negative emotions follow from higher order, effortful inferences (Russell, 1997), the perception of some negative facial expressions of emotion activates the amygdala, which is associated with relatively automatic information processing (LeDoux, 1996).

Facial Expressions of Emotion and Autonomic Physiology

Discrete theorists have proposed that different emotions, and by implication different facial expressions, are linked to relatively distinct patterns of autonomic nervous system activity. Dimensional theorists, on the other hand, expect the major dimensions of emotion meaning, most notably valence and arousal, to organize the connections between

facial expression and autonomic physiology (for relevant arguments, see Levenson et al., 1990).

Several kinds of studies have examined the autonomic patterns associated with different facial expressions. In the directed facial action (DFA) studies, participants were asked to follow instructions to contract specific facial muscles to produce configurations that resemble prototypical facial expressions of emotion (e.g., Ekman et al., 1983; Levenson et al., 1990). Participants' autonomic physiology was recorded as they held the prototypical facial expressions of emotion. Although methodological problems of these studies have been noted (e.g., Cacioppo, Klein, Berntson, & Hatfield, 1993), the studies indicate that facial configurations of negative emotion produce distinctions in autonomic activity. Specifically, anger, fear, and sadness all produced greater heart rate deceleration than disgust, and anger produced greater finger temperature than fear, indicative of increased vasodilation and increased blood flow to peripheral muscles (Ekman et al., 1983). These autonomic distinctions among negative emotions have been replicated across populations (Levenson et al., 1990), in young and elderly participants (Levenson, Carstensen, Friesen, & Ekman, 1991), in different cultures (Levenson et al., 1992), and in a relived emotion task (Levenson et al., 1991). A simple valence account has trouble explaining these autonomic distinctions among the facial expressions of different negative emotions.

Other studies have linked spontaneous facial expressions of emotion to distinct autonomic responses. The oblique eyebrows and concerned gaze of sympathy were associated with heart rate deceleration, whereas the facial display of distress was associated with increased heart rate (Eisenberg et al., 1989). The elevated heart rate and respiratory response of laughter appears to be different from the autonomic responses associated with facial expressions of other emotions (Ruch, 1993). Embarrassment, which has its own distinct display, is likely associated with the blush, which differs from the autonomic responses of other emotions (Shearn, Bergman, Hill, Abel, & Hinds, 1990).

Facial Expressions and Evoked Responses in Others

Consistent with the view that facial expressions evolved to elicit distinct behaviors in conspecifics (Darwin, 1872/1998; Hauser, 1996), recent evidence indicates that facial expressions evoke fairly specific responses in observers (for reviews, see Dimberg & Ohman, 1996; Keltner & Kring, 1998). Facial expressions of anger, even when presented below the observer's conscious awareness, evoked fear-related facial and autonomic responses that were distinct from the responses evoked by smiles (Esteves, Dimberg, & Ohman, 1994). Facial expressions of distress have been shown to evoke sympathy (Eisenberg et al., 1989), and embarrassment and shame displays evoke amusement and sympathy, respectively (Keltner, Young, & Buswell, 1997). Facial expressions of different negative emotions evoke different emotions in observers, which fits a discrete approach to emotion more closely than a dimensional one.

Reconciliation of Discrete and Dimensional Perspectives

We have reviewed evidence that indicates that facial expressions are perceived categorically and linked to distinct brain regions, autonomic activity, and evoked responses in others. Although this evidence lends credence to the discrete accounts of emotion, we believe that dimensional approaches are useful in many ways. For example, the discrete perspectives may best apply to the current, momentary experience of emotion; dimensional accounts may be most productively applied to emotional experience aggregated across time, and to the study of moods. It is also possible to reconcile these two approaches. For example, although the differences between emotions may seem to be categorical in nature, the differences within a category of emotion—say, between the varieties of anger—may be productively accounted for by dimensions such as intensity and unpleasantness (Ekman, 1992a; Ekman et al., 1982).

What Are the Distinct Facial Expressions of Emotion?

The preceding review raises a more general question: What are the distinct facial expressions of emotion? The literature has almost exclusively focused on seven emotions: anger, disgust, fear, happiness, sadness, surprise, and contempt, the most contested of the expressions (Ekman, O'Sullivan, & Matsumoto, 1991; Matsumoto, 1992; Russell, 1991a). This same list of emotions replicates (with slight variations) in analyses of the structure of emotion lexicon, both in the United States (e.g., Shaver et al., 1987) and other cultures (Romney, Moore, & Rusch, 1997), and also in studies of other response channels, such as the voice (chapter 28, this volume), suggesting that this parsing of emotions is valid across methods, and not as culturally biased as some have argued (Wierzbicka, 1990).

Researchers are now examining other facial expressions of emotion by additionally studying the temporal dynamics of expression, and attending to gaze, head, and postural activity. Thus, encoding studies linking expressive behavior to emotional experience have documented distinct expressions for embarrassment and shame (Keltner, 1995; Keltner & Buswell, 1997; Keltner & Harker, 1998), sympathy (Eisenberg et al., 1989), and love (Gonzaga, Keltner, Londahl, & Smith, 2001), as well as different experiential correlates of laughter and smiling (Keltner & Bonanno, 1997). Ensuing judgment studies have found that

posed displays of embarrassment, shame, amusement (laughter), and sympathy do reliably convey information about emotion but not to the same extent as the displays of the traditionally studied emotions (Haidt & Keltner, 1999; Keltner & Buswell, 1996). It should be noted that the seven emotions have what Ekman has called "snapshot" qualities in that a single moment in time at the apex of the expression is sufficient, while these other emotions require a flow of movement over time (Ekman, 1993). Finally, research has focused on the blush (Leary, Britt, Cutlip, & Templeton, 1992; Shearn et al., 1990) and the iconic tongue protrusion (Haidt & Keltner, 1999), both of which convey emotion.

Facial Expression, Social Interaction, and Individual Differences

The empirical study of facial expression has long been guided by two tendencies. The first is to study facial expressions of the individual in isolation (and how that expressive behavior relates to experience, physiology, and so on), thus neglecting how facial expressions affect others (although see Dimberg & Ohman, 1996; Keltner & Kring, 1998). The second tendency has been to focus on what is prototypical and universal in facial expression rather than how it varies across individuals. Researchers have begun to move beyond these approaches to examine systematically how facial expressions shape interactions and vary according to individuals.

Facial Expression and Social Interaction

It is widely assumed that facial expressions of emotion help contribute to more complex social interactions, from flirtation rituals to collective responses to threats (e.g., Ekman, 1992a; Eibl-Eibesfeldt, 1989; Frijda & Mesquita, 1994; Keltner & Haidt, 1999; Keltner & Kring, 1998; Lutz & White, 1986). This claim is consistent with the general assumption that the communicative behavior of sender and receiver co-evolved in reciprocal fashion (Eibl-Eibesfeldt, 1989; Hauser, 1996). From this perspective, one individual's emotional expression serves as a "social affordance" that evokes "prepared" responses in others (e.g., Ohman & Dimberg, 1978). The empirical literature suggests that facial expressions shape social interactions in at least three ways.

First, facial expressions of emotion provide observers with a rich source of information about the sender. As we have seen, facial expressions of emotion signal the sender's emotional state to receivers in brief yet fairly reliable fashion (Ekman, 1984, 1992a, 1993). Observers tend to make more complex inferences based on the observation of facial expressions. Thus, select studies indicate that emotional displays also communicate the sender's social intentions—for example, whether to strike or flee, offer comfort or play (e.g., Fridlund, 1992; Haidt & Keltner, 1999). Facial expressions of emotion signal characteristics of the sender and receiver's relationship, including the extent to which it is defined by dominance and affiliation. For example, displays of anger communicate the sender's relative dominance (Knutson, 1996), whereas displays of embarrassment communicate the sender's relative submissiveness and inclination to affiliate (Keltner, 1995). Finally, facial expressions convey important information about objects and events in the environment. For example, observer monkeys who viewed model monkeys' fearful, avoidant behavior, including their facial displays, in response to snakes or toy snakes, rapidly acquire the model monkeys' fear of the real and toy snakes, even after just one observation of the model monkey (e.g., Mineka, Davidson, Cook, & Keir, 1984; Mineka & Cook, 1993). In humans, studies show that social referencing—parents' facial and vocal displays of positive emotion or fear—will determine whether their infants will walk across a visual cliff (Sorce, Emde, Campos, & Klinnert, 1985) or play in a novel context or respond to a stranger with positive emotion (Klinnert, Emde, Butterfield, & Campos, 1986; Walden & Ogan, 1988).

Second, facial expressions of emotion also evoke emotions in others. Thus, Ohman and Dimberg have documented how displays of anger evoke fear in observers, even when the faces were "masked" by a neutral face presented immediately following the presentation of the anger face, and presumably not consciously represented by the observer (reviewed in Dimberg & Ohman, 1996). Overt displays of distress, including facial displays, evoke concern and overt attempts to help beginning as early as 8 months (Zahn-Waxler, Radke-Yarrow, Wagner, & Chapman, 1992), and in adults, a pattern of sympathy-related expressive and physiological response predicts helping behavior (Eisenberg et al., 1989). Facial expressions of embarrassment evoke amusement and sympathy, which produce increased liking of the individual and, when relevant, more forgiveness (reviewed in Keltner & Buswell, 1997).

Finally, facial expressions of emotion provide incentives for others' social behavior (e.g., Klinnert et al., 1986). Displays of positive emotion by both parents and children reward desired behaviors (e.g., Tronick, 1989). For instance, as infants carry out intentional behaviors with the assistance of their parents—for example, when reaching for an object—they will smile when their parents engage in behavior that facilitates their own goal-directed behavior, and show signs of distress when the parents do not act in such fashion (Tronick, 1989). Other studies have shown that parents use positive emotional displays to direct the attention of their infants (Cohn & Tronick, 1987). In this same vein, parental laughter may facilitate learning by rewarding appropriate behavior in infants and children (Rothbart, 1973). Laughs occur almost exclusively at the

end of the utterance (Provine, 1993), which may serve as a reward for preceding social behavior.

This sort of research strongly reveals how facial expressions are more than just markers of internal states. And they are more than simply signals divorced from internal states (e.g., Fridlund, 1992a). Instead, these findings support the view that facial expressions evolved to provide information to others about what the person showing the expression is preparing to do next, and this signal is likely to influence the perceiver's behavior (for further explanation of this view, see Eibl-Eibesfeldt, 1989; Ekman, 1999). This research suggests that humans have evolved systematic responses to each other's emotions (e.g., sympathy in response to distress; fear in response to anger). It is these coordinated emotional responses between sender and receiver that may prove to be the appropriate unit of analysis for those interested in understanding how facial expressions shape social interactions and relationships.

Individual Differences in Facial Expressions of Emotion

Notwithstanding the conceptual and methodological promises of studying individual differences in facial expressions (Keltner, 1996), it is only recently that this issue has attracted the attention of empirical researchers. We trace this oversight to two historical trends. First, the early researchers of expressive behavior, such as Wolff (1943), focused on individual differences in a variety of expressive behaviors, such as gait, signature, or posture, but they did not consider facial expression. The study of the face may have been tainted by the pitfalls and ill repute of the study of physiognomy (Ekman, 1978). Second, early researchers have concentrated on universal, prototypical facial expressions, thus ignoring individual variation in facial expression.

Recent studies, however, have begun to illuminate how personality traits and psychological disorders relate to facial expressions of emotion (for reviews, see Keltner, 1996; Keltner & Kring, 1998). This literature is motivated by the idea that individual differences in emotion are central to the structure, process, and development of personality traits (e.g., Malatesta, 1990; Moskowitz & Cote, 1995; Pervin, 1993) and psychological disorders (e.g., Kring & Bachorowski, 1999). The accompanying empirical literature is in its nascent state, but is already beginning to shed light on important questions in the study of personality and psychopathology.

The Structure and Organization of Traits and Disorders

At the most descriptive level, studies of facial expression can illuminate the structure of personality traits and emotional disorders and how they differ from one another. For example, the finding that extraversion and neuroticism relate to facial expressions and self-reports of positive and negative emotion, respectively (Keltner, 1996; Larsen & Ketelaar, 1991; Watson & Clark, 1992), suggests that these two traits have an emotional core. In the realm of emotional disorder, internalizing and externalizing disorders overlap a great deal in terms of subjective dysphoria and distress, yet one study of adolescent males found externalizers to be particularly prone to express anger and internalizers fear (Keltner, Moffitt, & Stouthamer-Loeber, 1995). Here, the study of facial expression points to important distinctions among disorders that might be masked with the use of other methods, such as self-report.

In other studies, researchers have begun to examine the organization of emotion within particular traits and disorders. This research moves beyond simply characterizing the emotional profile of one particular trait or disorder, and starts to reveal the extent to which different processes (e.g., expressive behavior, subjective experience, physiological response) are organized within individuals. The most well-developed product of this line of inquiry is the literature on schizophrenia. Schizophrenic patients have been found to be less facially expressive than nonpatients in response to emotional films (Berenbaum & Oltmanns, 1992; Kring, Kerr, Smith, & Neale, 1993; Kring & Neale, 1996; Mattes, Schneider, Heimann, & Birbaumer, 1995), cartoons (Dworkin, Clark, Amador, & Gorman, 1996), and during social interactions (Krause, Steimer, Sanger-Alt, & Wagner, 1989; Mattes et al., 1995), but report experiencing *the same* or greater amount of emotion and exhibit the same or greater amount of skin conductance reactivity as nonpatients (Kring & Neale, 1996). Importantly, this research not only shows that schizophrenics display a disjunction between expression and experience; it also dispels certain misconceptions about the emotional nature of certain disorders—for example, that schizophrenics experience flat affect—that prevailed until researchers began to look at the face.

Facial Expression as an Interface Between Individual Difference and the Social Environment

A central insight in recent years in the study of individual differences is that people select and create social environments that call forth and reinforce their underlying traits and dispositions (Caspi & Bem, 1990; Scarr & McCartney, 1983). For example, hostile children tend to have a pattern of hostile intimate relations and work interactions (e.g., Caspi, Elder, & Bem, 1987) that is certain to enhance the consistency and stability of their hostility. This line of thought raises the question of how internal traits (or disorders) shape the environment. One obvious possibility is facial expression.

More specifically, guided by what is known about facial expression and social interaction (see preceding section), research can begin to document how traits and disorders relate to specific styles of interaction and relationships, thus producing and perpetuating those individual differences (Keltner & Kring, 1998). For example, in one recent study it was found that women who expressed more positive emotion in college yearbook photos were more likely to enter into satisfying marriages several years later and become more competent, less prone to negative emotion, and more satisfied with their lives (Harker & Keltner, 2001). One inference from these findings is that the tendency to express positive emotion in the face (and other channels as well) creates more harmonious social relationships, which in turn fosters personal growth and well-being. Turning to the study of emotional disorders, it has been documented that depressed patients exhibit limited facial expressions, particularly expressions of positive emotions (Berenbaum & Oltmanns, 1992; Ekman & Friesen, 1974; Ekman et al., 1997; Jones & Pansa, 1979; Ulrich & Harms, 1985; Waxer, 1974). Again, one might expect this expressive tendency to have pronounced effects upon the quality of social interactions and relationships, which in turn would turn increase the likelihood of prolonged and severe depression.

Charting the Development of Personality and Psychopathology

One of the great advantages of the study of facial expression is that it can be gathered unobtrusively from the first to the last moment of life. This gives researchers the great opportunity to chart the development of different traits and disorders in ways that are not possible with self-report methods. For example, it is known that infants vary in their expressive behavior starting as early as 7 months (Izard, Hembree, & Huebner, 1987). Linking these sorts of findings to the later development of personality traits has the promise of illuminating the rudiments of personality, and how it develops. To the extent that certain disorders have characteristic patterns of facial expression, researchers might improve early diagnosis and intervention. For similar reasons, facial expression can be used as a measure of progress in response to treatment (e.g., Ekman et al., 1997) and trauma, such as the loss of a spouse (Bonanno & Keltner, 1997).

Conclusions

In this review we have drawn upon classic and contemporary studies of facial expression to address three abiding questions. Is facial expression an accurate indicator of emotion? How are facial expressions universal and how do they vary across cultures? Are facial expressions of emotion best thought of as discrete systems or entities that vary along global dimensions? We have also looked at emergent studies examining how facial expression shapes social interaction, and how individuals vary in their facial expressions of emotion. Given the breadth of issues covered in the study of facial expression, we inevitably could not review important research on facial feedback (Matsumoto, 1987) and the development of facial expression (Abe & Izard, 1999; Izard et al., 1987; Lewis, 2000).

Once largely ignored, the study of facial expression is now at the center of the emergent field of affective science. The study of facial expression will continue to be germane to basic questions about emotion, culture, and communication. The topic of facial expression will present continued opportunities for the study of emotion-relevant experience and autonomic and central nervous system physiology. Finally, the study of facial expression will continue to allow researchers to seek answers to fundamental questions about human nature.

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