

# Positive and Negative: Infant Facial Expressions and Emotions

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## Abstract

One path to understanding emotional processes and their development is the investigation of early facial expressions. Converging evidence suggests that although all infant smiles index positive emotion, some smiles are more positive than others. The evidence stems both from the situations in which infants produce different facial expressions and from naive observers' ratings of the emotional intensity of the expressions. The observers' ratings also suggest that similar facial actions—such as cheek raising—lead smiles to be perceived as more positive and lead negative expressions (cry-faces) to be perceived as more negative. One explanation for this parsimony is that certain facial actions are associated with the intensification of both positive and negative emotions.

## Keywords

emotion; facial expression; infancy; joy; distress

Extreme expressions—from the fierce grimace to the cresting smile—characterize early human life. These expressions often elicit strong emotions in persons close to an infant and play a role in forming interactive patterns that influence later development. But our understanding of the link between infants' facial expressions and their emotional experience is limited be-

cause infants cannot use words to tell us directly about their emotions. In this article, I report on new attempts to understand infants' facial expressions by investigating both the situations in which different types of expressions take place and naive observers' ratings of the emotional intensity of those expressions. I conclude by describing innovative techniques that promise to illuminate long-standing issues in the communication of emotion.

## A DOMINANT THEORY AND ITS VICISSITUDES

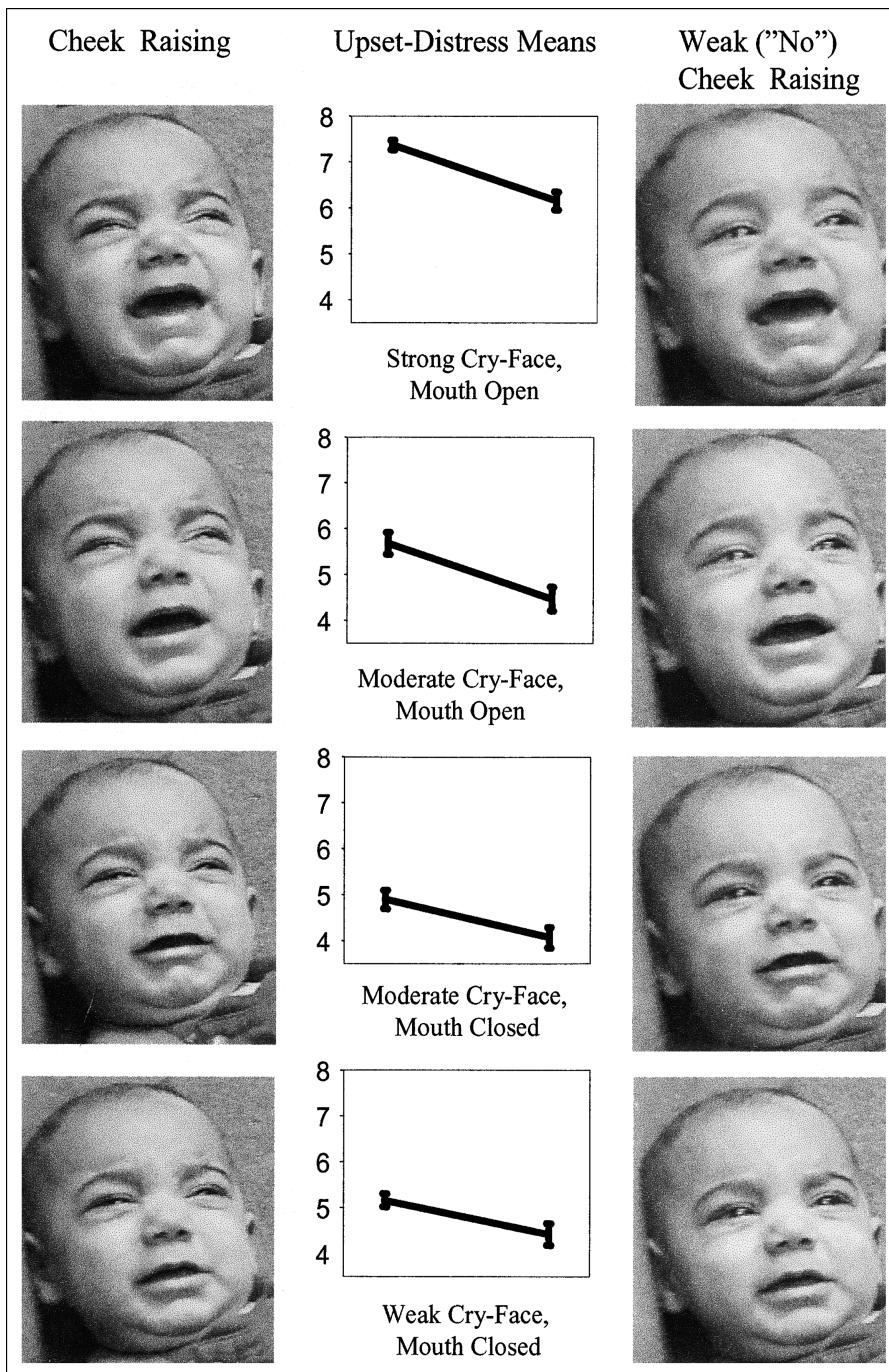
One dominant theory holds that there are a relatively small number of basic, discrete emotions, such as joy and anger (Ekman, 1994). Each involves a distinct emotion program that produces a prototypic feeling state and facial expression. Infancy provides crucial information about the relationship between emotion and facial expression because infants are not affected by social rules concerning when it is appropriate and not appropriate to smile or show other expressions. Do infants typically display discrete expressions of positive and negative emotion as predicted?

It is difficult to elicit discrete negative expressions, such as expressions of anger, distress, and sadness, in infants. Blends of these expressions are common (Matias & Cohn, 1993), and infants tend to cycle through anger and distress expressions during a single crying bout (Camras, 1992). In fact, the cry-face is the most common infant

reaction to all negative situations. In the cry-face, the brows are lowered and the lip corners are pulled to the side; there is a variable degree of mouth opening and cheek raising (Oster, 2000; see Fig. 1). The cry-face incorporates features of both anger and distress expressions and may index a shared core of negative emotionality. Naive judges, for example, rate discrete anger and distress expressions (variants of the cry-face) as showing high levels of both anger and distress (Oster, Hegley, & Nagel, 1992).

Smiles, in contrast, are easily recognized by naive judges as discrete expressions of joy in infancy and beyond. However, adults sometimes smile in unpleasant situations or simply in response to social interchange. The dominant theory has addressed this inconsistency by postulating a distinction between joyful and nonjoyful types of smiling (Ekman, 1994). Cheek-raise, or Duchenne, smiles, in which the muscle around the eye contracts, lifting the cheeks high, are thought to be felt expressions of joy (left-hand column of Fig. 2). Smiles without cheek raising are thought to be nonemotional signals used to lubricate social interactions and mask negative feeling (right-hand column of Fig. 2).

The distinction between different types of smiling is supported by a study in which adults showed more cheek-raise smiling while viewing amusing films than while viewing gruesome films, and the quantity of cheek-raise smiling was associated with self-reported positive emotion (Ekman, Davidson, & Friesen, 1990). Smiles without cheek raising, by contrast, did not tend to occur during the amusing film, nor were they associated with self-reported positive emotion. Even among 10-month-old infants, cheek-raise Duchenne smiles tended to occur in reaction to mother's smiling approach, and



**Fig. 1.** Mean upset-distress ratings (on a scale from 0 to 8) and their standard errors for each pair of cry-faces. The cry-faces on the left involve cheek raising, and the cry-faces on the right involve only very weak cheek raising. The expressions in each horizontal pair were created with the identical cry-face mouth. In each column, the mouth is open in the top two cry-faces and closed in the bottom two. Pairs of expressions also differ in the strength of the cry-faces portrayed.

smiles without cheek raises tended to occur in reaction to the approach of an impassive stranger (Fox & Davidson, 1988).

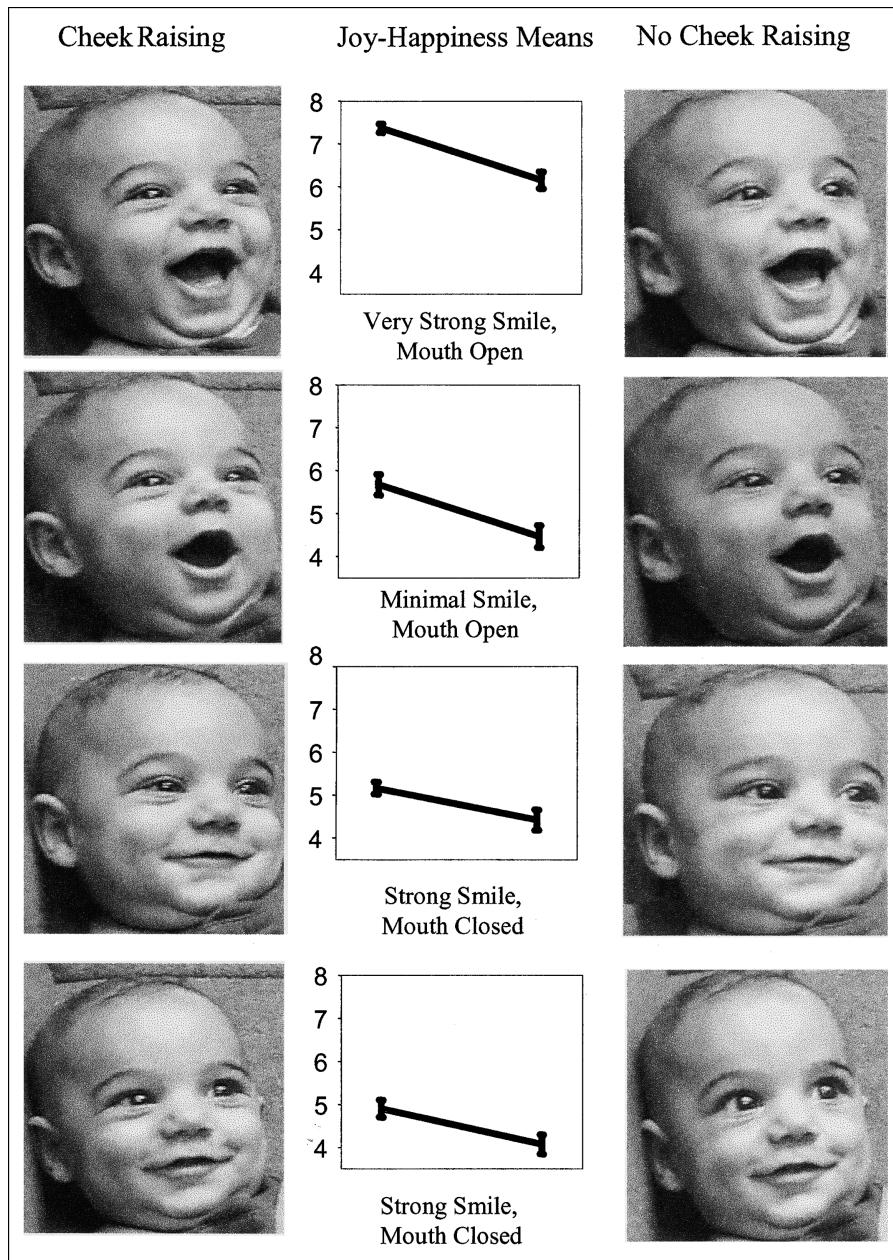
Research with 1- to 6-month-old infants showed, however, that smiles with and without cheek raising are related (Messinger, Fogel, & Dickson, 1999).

A rise or fall in an infant's cheek-raise smiling during a given interaction with his or her mother tended to be mirrored by a rise or fall in the infant's smiling without cheek raising. Most tellingly, individual smiles with cheek raising tended to be preceded by smiles without cheek raising. This suggests that infants frequently begin a smile without cheek raising that involves a constrained degree of positive emotion, and that this emotion then intensifies, and is reflected in a more positive smile with cheek raising.

The dominant theoretical perspective has not countenanced the suggestion that smiles with and without cheek raising are distinguished only by quantitative differences in the intensity of positive emotion. In focusing on cheek-raise smiling as a unique index of positive emotion, the theory has also neglected the emotional significance of open-mouth (play) smiling in which the jaw is dropped (upper half of Fig. 2). Open-mouth smiling is common and tends to occur with cheek-raise smiling (upper left-hand quadrant of Fig. 2), especially during social games. Is there, then, a single discrete expression of joy?

#### DIFFERENT SMILES ARE PRODUCED IN DIFFERENT SITUATIONS

The situations in which young infants smile suggest that all smiles are emotionally positive, but specific types of smiling are more positive than others (Messinger, Fogel, & Dickson, 2001). If only cheek-raise smiling is joyful, smiling alone—which does not involve cheek raising or mouth opening—should not occur in periods of interaction expected to elicit positive emotion. A recent study, however, found that smiling alone, expressed as a proportion of time without smiling,



**Fig. 2.** Mean joy-happiness ratings (on a scale from 0 to 8) and their standard errors for each pair of smiles. The smiles on the left are cheek-raise (Duchenne) smiles, and the smiles on the right are not. The expressions in each horizontal pair were created with the identical smiling mouth. In each column, the top two smiles are open-mouth smiles, and the bottom two are not. Pairs of expressions also differ in the strength of the smiles portrayed.

tended to occur both when infants were gazing at their mothers' faces and when their mothers were smiling (Fig. 3). Smiling alone, then, appeared to be involved both in visual engagement with mother (gazing) and in sharing positive affect (mutual smiling; Messinger et al., 2001).

If even smiling alone tended to occur in positive periods of interaction, when did other types of smiling occur? Cheek-raise and open-mouth smiling were each expressed as proportions of time smiling alone to answer this question. Infants engaged in more

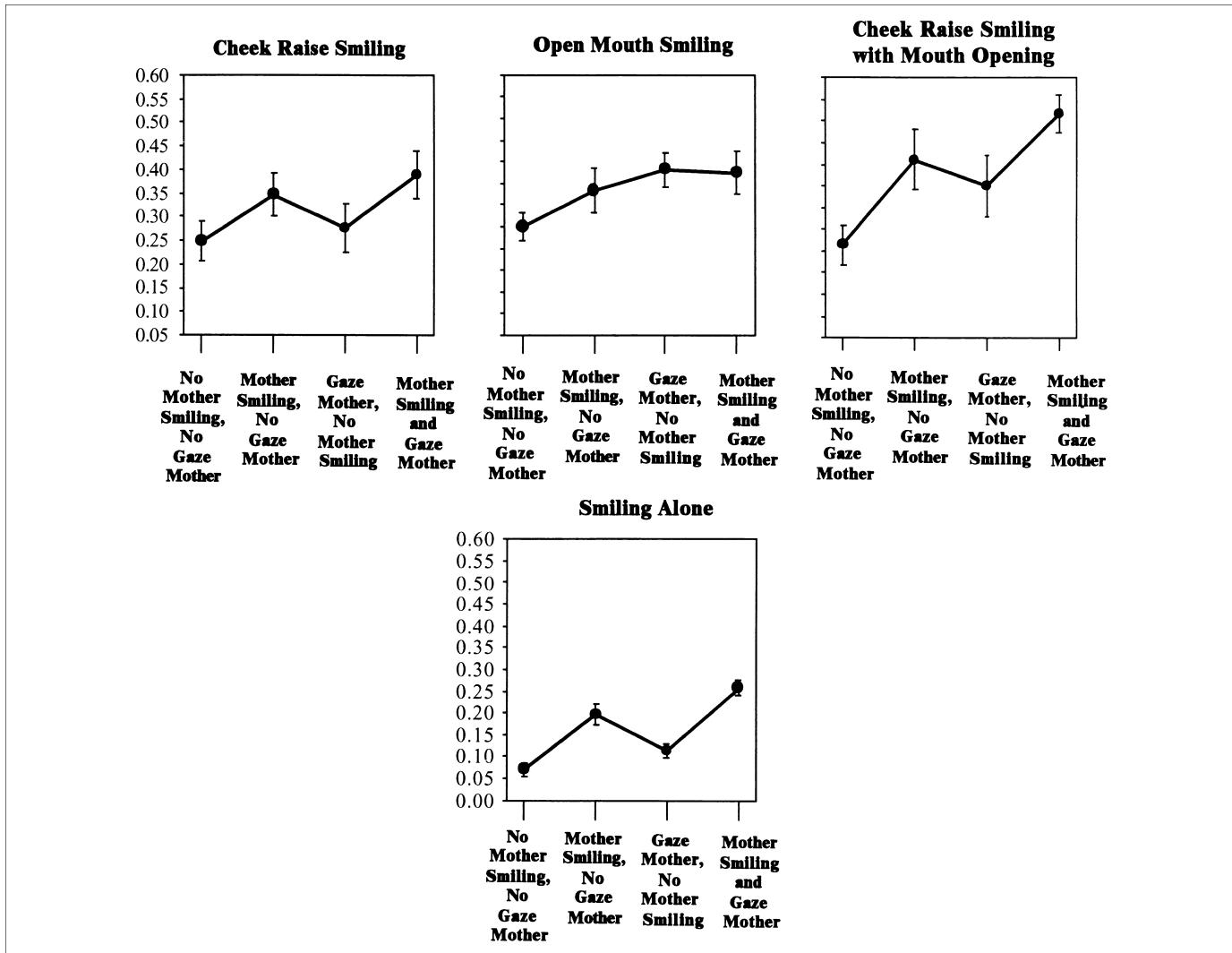
cheek-raise smiling when their mothers were smiling rather than not smiling. They engaged in more open-mouth smiling when gazing at than away from their mothers' faces. Infants engaged in more combined open-mouth cheek-raise smiling than smiling alone both when their mothers were smiling and when they were gazing at their mothers (Fig. 3).

Different types of smiling appear to involve the intensification of different positive processes that are present to a lesser degree in smiling alone (Messinger et al., 2001). Cheek-raise smiling was especially associated with the reciprocation of positive affect, whereas open-mouth smiling was especially associated with visual engagement. Between 1 and 6 months of age, infants' open-mouth cheek-raise smiling became more prevalent when the infants were gazing at their mothers' faces while the mothers were smiling. This suggests that as infants develop, they become increasingly likely to use open-mouth cheek-raise smiling to participate in peak positive interchanges in which joy is shared during mutual engagement (Fogel, Nelson-Goens, Hsu, & Shapiro, 2000).

These results suggest that there is no single smile of joy in infancy. Instead, all smiles are linked to positive social processes, and different types of smiling appear to be specialized for different types of positive interchanges. One interpretation is that all smiles are positive but that some smiles are more positive than others. Do the ratings of naive observers support this inference?

### ADULT PERCEPTIONS OF INFANTS' SMILES AND CRY-FACES

My colleagues and I recently designed a study to investigate whether all smiles are perceived as



**Fig. 3.** Infant smiles as a function of whether the mother was smiling and whether the infant was gazing at the mother. In the bottom graph, smiling alone is expressed as a proportion of time smiling alone plus time without smiling. In each of the three graphs at the top, the indicated smiling type is expressed as a proportion of that smiling type plus smiling alone. Standard error bars surround each mean. From "All Smiles Are Positive, but Some Smiles Are More Positive Than Others," by D.S. Messinger, A. Fogel, and K.L. Dickson, 2001, *Developmental Psychology*, 37, p. 647. Copyright 2001 by the American Psychological Association. Adapted with permission.

positive and whether smiles with cheek raising and smiles with mouth opening are perceived as more positive than smiles without those features. The study included a parallel investigation of negative perceptions of cry-faces, because there is circumstantial evidence that cry-face expressions involving cheek raising and mouth opening are associated with more intense negative emotion than cry-faces without those features (Fox & Davidson, 1988).

For the rating study, a photo-editor was used to create identical pairs of smiles and pairs of cry-faces that differed only in cheek raising (see Figs. 1 and 2).<sup>2</sup> Different pairs showed different degrees of mouth opening and strength of the underlying expression. Each smile and cry-face was shown, in a randomized order, with a comparison neutral expression to 50 undergraduate participants who rated the happiness and joy (positive

emotion) they perceived in the different types of smiles and the distress and upset (negative emotion) they perceived in the cry-faces.

All smiles were perceived as more emotionally positive than the comparison neutral expression. All cry-faces were perceived as more emotionally negative than the comparison neutral expression. Even smiles and cry-faces involving neither cheek raising nor mouth opening (see the lower right-hand

quadrants in Figs. 1 and 2) were perceived, respectively, as more positive and more negative than neutral expressions. These results suggest that all types of infant smiling communicate joy and that all cry-faces communicate distress. What features of the expressions, then, were associated with perceptions of more intense positive and negative emotion?

Smiles with cheek raising (Duchenne smiles) were perceived as more emotionally positive than smiles without cheek raising. Cry-faces with cheek raising (and forehead knotting) were perceived as more emotionally negative than cry-faces without. (See the graphs in Figs. 1 and 2.) Mouth opening was also associated with ratings of greater emotional intensity for both smiles and cry-faces. Smiles with mouth opening were perceived as more positive than smiles without. Cry-faces with mouth opening were perceived as more negative than cry-faces without. The cry-faces with mouth opening also tended to be stronger than cry-faces without mouth opening. In fact, stronger smiles and cry-faces were also both perceived as more emotionally intense than weaker versions of these expressions. The relative heights of the graphed lines in Figures 1 and 2 illustrate these differences.

### EXPRESSION FAMILIES— EMOTION FAMILIES

The ratings study paralleled earlier findings in indicating that all smiles are perceived positively, but some more positively than others. Similarly, all cry-faces were perceived negatively, but some more negatively than others. It may be that different types of smiles are dynamically related members of a family of expressions, as are different types of cry-faces. The smile and cry-face expression families are linked to corresponding emotion

families, each of which is distinguished by a common motivational orientation to the environment. Different types of smiles play a role in a family of related positive emotions distinguished by a desire to continue pleasant experience. Different cry-faces play a role in a family of related negative emotions distinguished by a desire to stop unpleasant experience.

Specific features of these facial expressions provide clues to distinguishing the qualities of related emotions within emotion families. Continued research on the situations in which cry-faces and smiles occur, as well as additional rating studies using larger samples of infants with more diverse samples of expressions, are necessary. It nevertheless appears likely that similar facial features are markers of both emotionally intense positive and emotionally intense negative expressions. What would account for this parsimony?

Intensity, arousal, and attention dimensions might distinguish different types of smiles and cry-faces. It makes sense that stronger facial expressions are especially emotionally intense. If a given feeling is associated with the contraction of certain muscles, it is not surprising that more intense instances of the feeling would be associated with stronger contraction of those muscles. Mouth opening may be associated with increased arousal in both smiles and cry-faces. For smiles, the arousal is often socially elicited, and the smiles appear to have an unconstrained, immediate quality. In cry-faces, mouth opening may be more directly linked to the arousal associated with crying. Cheek raising, in contrast, reduces the visual field and may be linked to a feeling—and the object of that feeling—becoming more focal. In smiles, cheek raising may be tied to a rising tide of pleasure. This may typically occur when sharing a positive experience and so commu-

nicate one's involvement in that experience to a partner. In cry-faces, the strengthening of cheek raising may be linked to the transition from anger to distress, in which feelings of trying to overcome an obstacle change to feelings of being overwhelmed by discomfort.

### NEW DIRECTIONS

Several enduring questions remain unresolved. Is there a one-to-one correspondence between infants' emotional feeling and expression? Specific types of infant smiling tend to occur in specific situations, but do not typically predominate in those situations. Cry-faces—not expressions of discrete negative emotions—are infants' most likely reaction to all negative situations. These findings suggest that infants' feelings are usually but not always elicited in the expected situations. It may also be the case that infants' feelings and facial expressions are themselves probabilistically associated. It is likely that facial expressions influence as well as express feeling and that these emotional processes are themselves intimately tied to participation in ongoing interactions. Two new tools may help researchers deepen their understanding of the reciprocal influence of expressions, feelings, and interactive situations.

New software should allow precise quantitative measurement of facial action in time (Cohn, Zlochower, Lien, & Kanade, 1999). This may shed light on how expressions change during an ongoing interaction, becoming weaker and stronger, and involving more and less cheek raising and mouth opening before they fade. As a start, such software might confirm that strong smiles and cry-faces tend to co-occur with both cheek raising and mouth opening, creat-

ing particularly intense composite expressions. These expressions might be particularly salient to nonexpert observers and so might be economical indices of temperament and of emotion regulation in both normally developing and at-risk infants.

New simulation software promises to illuminate how facial expressions are patterned in time with other expressive actions such as vocalizations and gazes at a partner. Studies using this software indicate that infants embed vocalizations within the course of ongoing smiles and cry-faces (Yale, Messinger, Cobo-Lewis, Oller, & Eilers, 1999). Infants may be calling attention to their emotional expressions, as the facial expressions tend to begin during a gaze at mother. Infants' expressive actions influence and are influenced by similar expressive actions on the part of caregivers. Using simulation software to investigate how infants and caregivers coordinate their actions in time will illuminate the interpersonal contexts that are simultaneously a primary context in which infant emotion occurs and part of an emotional process occurring between two partners.

What about development beyond infancy? There appear to be similarities between infants' and adults' smiles, though their smiles without cheek raising appear to have different functions. Adults also appear to be more inclined than infants to express negative emotion discretely (e.g., using different expressions for anger and sadness) rather than through cry-faces. How and when do such differences between infants and

adults arise? Detailed descriptions of emotional expression will be an important path to understanding continuity and development in emotional functioning through the life span.

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### Notes

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2. We created each pair by pasting identical lower portions of an expression (from the cheekbones down) over one expression with and one expression without cheek raising. However, even the cry-faces classified as lacking cheek

raising involved a weak level of this action, so there was a bias against finding an effect of cheek raising. Mouth opening was defined as dropping of the jaw. Stronger smiles involved stronger lip-corner raising. Stronger cry-faces involved stronger sideways lip-corner pulling and the presence of chin raising. Anatomically based descriptions of the stimuli and details of the statistical analyses and procedure are available from the author.

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