
Emotions and Emotional Communication in Infants

Edward Z. Tronick

University of Massachusetts, Amherst

ABSTRACT: *Important advances have recently been made in studying emotions in infants and the nature of emotional communication between infants and adults. Infant emotions and emotional communications are far more organized than previously thought. Infants display a variety of discrete affective expressions that are appropriate to the nature of events and their context. They also appreciate the emotional meaning of the affective displays of caretakers. The emotional expressions of the infant and the caretaker function to allow them to mutually regulate their interactions. Indeed, it appears that a major determinant of children's development is related to the operation of this communication system. Positive development may be associated with the experience of coordinated interactions characterized by frequent reparations of interactive errors and the transformation of negative affect into positive affect, whereas negative development appears to be associated with sustained periods of interactive failure and negative affect.*

How is it that some children become sad, withdrawn, and lacking in self-esteem, whereas others become angry, unfocused, and brittlely self-assertive, whereas still others become happy, curious, affectionate, and self-confident? As clinicians, researchers, and policymakers, our goal must be to understand the processes that lead to these outcomes, not just to generate indexes of them, so that problematic and compromised developmental outcomes can be prevented and remediated. Although the nature of these processes is not yet known, an answer is taking shape on the basis of recent work on the nature of infant-caregiver emotional communication.

The emerging answer is that the infant and adult are participants in an affective communication system. A central hypothesis is that the operation of this system has a major influence on how well the infant accomplishes his or her goals, the emotions the infant experiences, and the infant's developmental outcome. If this hypothesis is correct, then the key issue is to understand how this system works. We need to explore the inextricable links among infant emotions and behavior, caregiver emotions and behavior, and the success, failure, and reparation of interactive errors that the infant experiences when striving to accomplish his or her goals. Two contrasting examples of infant-mother interaction drawn from the work of Brazelton (Brazelton, Koslowski, & Main, 1974) will serve as a base for the initial exploration of the functioning of this affective communication system.

Imagine two infant-mother pairs playing the game of peek-a-boo. In the first, the infant abruptly turns away

from his mother as the game reaches its "peek" of intensity and begins to suck on his thumb and stare into space with a dull facial expression. The mother stops playing and sits back watching her infant. After a few seconds the infant turns back to her with an interested and inviting expression. The mother moves closer, smiles, and says in a high-pitched, exaggerated voice, "Oh, now you're back!" He smiles in response and vocalizes. As they finish crawling together, the infant reinserts his thumb and looks away. The mother again waits. After a few seconds the infant turns back to her, and they greet each other with big smiles.

Imagine a second similar situation except that after this infant turns away, she does not look back at her mother. The mother waits but then leans over into the infant's line of vision while clicking her tongue to attract her attention. The infant, however, ignores the mother and continues to look away. Undaunted, the mother persists and moves her head closer to the infant. The infant grimaces and fusses while she pushes at the mother's face. Within seconds she turns even further away from her mother and continues to suck on her thumb.

I will not yet focus on the issue of who is responsible for the interactional errors in the second example. Instead, I will focus on the critical feature in each interaction: that the affective communications of each infant and mother actually change the emotional experience and behavior of the other. In both illustrations, the infants' looking away and thumb sucking convey the message that the infants need to calm down and regulate their emotional state. Each mother respects this message by waiting. Within seconds, the first infant looks back at his mother, communicating that he is ready to interact, and the mother responds by moving in closer with a smile, which her infant returns. Their smiles communicate their positive evaluations of what they are doing. In the second illustration, the mother waits but then disregards the infant's message and makes a vigorous attempt to solicit the infant's attention. The mother comes in closer and actively signals her infant to change what she is doing and attend to her. The infant responds by sharply turning away with strong negative affect, communicating to her mother that *she* should change what she is doing. The mother, however, ignores this message, and the infant becomes even more affectively negative as she tries to cope with her mother's continuing intrusiveness.

Now imagine that these episodes are prototypical for each dyad. That is, the first dyad routinely experiences reciprocal positive exchanges in which interactive errors are readily repaired, whereas the second dyad experiences repeated conflictual negative exchanges. There is no need

to overcharacterize these interactions. Certainly the first dyad experiences some conflictual interactions, and the second some reciprocal positive interactions. Given the difference in the balance of positive and negative exchanges in the two, however, it is hypothesized that the first infant will develop a tendency to look at his mother more, exhibit more positive affect, and experience less distress when he experiences stress than the second infant. The second infant, by contrast, will be more withdrawn and will exhibit more sadness. There is evidence to support this prediction (as I will show later), but I first will examine some of the theoretical assumptions underlying this hypothesis.

Emotions, Goals, Other- and Self-Directed Regulatory Behaviors

To begin with, infants, like all other creatures, have a multiplicity of goals (Bowlby, 1982; Trevarthen, 1974). These include goals for engaging the social and inanimate environments (e.g., interacting with others, maintaining proximity to the caretaker, engaging in interactions characterized by mutual delight and reciprocity, and acting on objects) and internal goals (e.g., maintaining homeostasis, establishing a feeling of security, experiencing positive emotions, and controlling negative emotions). To accomplish these goals, infants process information about their current state in relation to their goal. They evaluate whether they are succeeding or failing and then use that evaluation to guide actions aimed at accomplishing their goal or redirecting their efforts to other goals (Tronick, 1980). For instance, the first infant in the earlier example fulfills his interactive goal by affectively signaling his mother when he is ready to interact by looking at her and smiling. He also fulfills his goal to control his emotional state by turning away and sucking on his thumb. Thus, the infant is active, not passive.

Emotions play a critical part in this evaluative process. An evaluation by the infant that the goal is being accomplished results in a positive emotional state—joy or interest—motivating further engagement (e.g., the first infant smiles and continues to look at his mother). When the infant's evaluation is that the goal is not being accomplished, the infant experiences negative emotions. More specifically, if the infant's evaluation is that the obstacle blocking the achievement of the goal can be overcome, an emotional state of anger results, and the infant is motivated to try to remove the obstacle (e.g., the second infant has an angry facial expression and pushes her mother away). However, an evaluation that the obstacle cannot be overcome results in sadness and disengagement (e.g., the second infant eventually withdraws). Thus emo-

tions motivate and organize the infant's behavior rather than disrupt it (Campos, Barrett, Lamb, Goldsmith, & Sternberg, 1983; Izard, 1978).

Obviously, infants are not born fully equipped to accomplish these goals on their own. Infants' capacities are immature, limited, and poorly coordinated. Moreover, disruptions of infants' ongoing activities come from both inside and outside (e.g., from internal physiological states, such as hunger and uncontrolled affect, as well as from external obstacles). Given these limitations and disruptions, why don't infants typically fail to achieve their goals and continuously experience negative emotions?

To oversimplify, the answer is that the infant is part of an affective communication system in which the infant's goal-directed strivings are aided and supplemented by the capacities of the caretaker. An infant's affective displays function as messages that specify the infant's evaluation of whether he or she is succeeding in achieving a goal. The caretaker "reads" this message and uses it to guide his or her actions for facilitating the infant's strivings. Gianino and Tronick (1988) have labeled these affective displays *other-directed regulatory behaviors* to capture their function of regulating the behavior of the infant's partner.

Consider the following example, in which the infant's goal is to get a just-out-of-reach object. The six-month-old infant stretches his hands out toward the object. Because he cannot get hold of it, he becomes angry and distressed. He looks away for a moment and sucks on his thumb. Calmer, he looks back at the object and reaches for it once more. But this attempt fails too, and he gets angry again. The caretaker watches for a moment, then soothingly talks to him. The infant calms down and with a facial expression of interest gazes at the object and makes another attempt to reach for it. The caretaker brings the object just within the infant's reach. The infant successfully grasps the object, explores it, and smiles. In this illustration, the caretaker reads the infant's affective displays, uses this information to facilitate the infant's goal-directed activities, and helps to change the infant's emotional state. More specifically, the caretaker is responsible for the reparation of the infant's failure into success and the simultaneous transformation of his negative emotion into a positive emotion (Gianino & Tronick, 1988).

There is a second important feature to this illustration. The infant is not solely dependent on the caretaker to control the negative affect he experiences. He has several coping behaviors available: looking away, self-comforting, and even self-stimulation. These behaviors control the infant's negative affect by shifting his or her attention away from a disturbing event or substituting positive for negative stimulation (Rothbart & Derryberry, 1984). For example, looking away reduces infants' heart rates during stress, and thumb sucking can calm distressed infants.

Gianino and Tronick (1988) have labeled these coping behaviors *self-directed regulatory behaviors*, suggesting that they function to control and change the infant's own affective state (Beebe & Stern, 1977). When successful, these behaviors, like the infant's other-directed regulatory

Preparation of this article was supported in part by a grant from the National Science Foundation (BNS 85-06987) and the Pampers Infant-Parent Research Scholars Award. My colleague A. Gianino is responsible for many of the formulations in this article. I also want to thank K. Weinberg for her help.

Correspondence concerning this article should be addressed to Edward Z. Tronick, Child Development Unit, Children's Hospital Medical Center, 300 Longwood Ave., Boston, MA 02115.

behaviors, shift the infant's negative emotional state to a more positive emotional state so he or she can pursue goal-directed engagements with people and objects. In the aforementioned example, the infant attempted to reach the object again only after calming himself down by looking away and sucking on his thumb.

Clearly, the distinction between self-directed and other-directed behavior is not hard and fast. Self-directed behavior can function as communication, conveying the infant's evaluation of success or failure and his or her emotional state to a caregiver. The caregiver may then act on this communication to aid the infant's accomplishment of internal and external goals. This also occurred in the illustration.

Other-directed and self-directed regulatory behaviors are part of the infant's normal repertoire for coping with sadness, uncontrolled anger, and the extremes of positive affect, which can turn into distress. They enable the infant to control the potential disruptive effects of these emotions and their extremes on his or her goal-directed activities. These coping behaviors make it possible for the infant to accomplish the dual simultaneous tasks of controlling his or her emotional state while interacting with people or acting on the inanimate world.

Some of the most dramatic effects of regulatory behaviors on infant emotions are seen when the mother's behavior is manipulated so that the infant is prevented from successfully achieving the goal for reciprocal interaction. Such manipulations may involve distorting the mother's affective behavior by instructing her to act in an unresponsive manner (that is, remaining still-faced while looking at her infant) or to behave in a disruptive manner (that is, interacting in an emotionally flat and withdrawn fashion, which simulates the disengagement of some depressed mothers; Cohn & Tronick, 1983; Tronick, 1980).

Confronted by these manipulations, most three-month-old infants initially signal to their mothers with facial expressions, vocalizations, and gestures in an attempt to get their mothers to resume their normal behavior. The infants' message is that their mothers should change what they are doing. When these other-directed behaviors fail to achieve that goal, the infants express negative emotions and use self-directed regulatory behaviors in an attempt to control their emotional responses. They look away and self-comfort. These reactions occur even when the mothers are still-faced for only a few seconds. Moreover, the infants' negative affect and utilization of self-directed regulatory behaviors do not end simply upon the resumption of normal behavior by their mothers. Rather, there is a continuation of the infants' negative mood and reduction in visual regard of their mothers for the next few minutes. This finding suggests that even three-month-old infants are not simply under the control of the immediate stimulus situation but that events have lasting effects, that is, they are internally represented. These effects will be related to defensive behavior and psychopathology later in this article. For now, I will focus on the implication from these studies that infant

emotions are specific and meaningful reactions to the infant's active processing and appreciation of the mother's and others' affective behavior.

The Organized Nature of Infant Emotions

Two-month-old infants make a fundamental distinction between people and objects (Brazelton et al., 1974; Trevarthen, 1974). Prereaching infants presented with an object look intently at it, sit up straight, remain relatively still, and punctuate their fixed gaze with swiping movements and brief glances away. Presented with people, infants' posture is more relaxed, and their movements are smoother. They become active at a slower pace and then look away for longer periods of time than they do with objects. Furthermore, infants give full greeting responses to people but not to objects. Simply stated, infants communicate with people and act instrumentally on objects.

Young infants can also discriminate the facial expressions of others (Malatesta & Izard, 1984). For example, infants look more at facial expressions of joy than anger. More significantly, it appears that the emotional content of different maternal emotional expressions are appreciated by infants (i.e., they lead to different infant emotions). When newborns are in a quiet, alert state, looking at them and gently talking to them can produce a smile. Wolff (1963) described how the infant's smile is first regularly elicited by a vocalization and then by the face. Recent research suggests that 10-week-old infants react to maternal facial and vocal displays of anger with anger but have fewer angry responses when their mothers pose sadness (Lelwica & Haviland, 1983). Moreover, infant reactions are even influenced by their appreciation of the context surrounding the event (for example, a mother wearing a mask elicits laughter, whereas a stranger wearing the same mask elicits distress and fear, see Sroufe, 1979).

Campos and his colleagues (Campos et al., 1983) made a classic observation of how 10-month-old infants appreciate (i.e., appraise; Bowlby, 1982) the affective expressions of others and modify their own actions on the basis of that appreciation. They found that when 10-month-old infants are exploring the surface of the visual cliff (i.e., an apparatus that presents an apparent but not real drop-off), they will look to their mothers when they come to the "drop-off" if the apparent depth is ambiguous as to its "danger." When their mothers pose a fearful or angry face, most infants will not cross. But when their mothers pose a joyful face, most infants will cross. Infants react similarly to maternal vocalizations conveying fear or joy. Interestingly, the expressions and vocalizations of other adults have a similar effect. It is remarkable that infants actively seek out affective information from another person not only to supplement their information about the event but even to override their own appreciation and perception of the event. Clearly, the emotional state of others is of fundamental importance to the infant's emotional state. And carefully note that this importance is not the result of passive processes such as mirroring. Rather, it results from the infant's active use of another's

emotional expression in forming his or her appreciation of an event and using it to guide action.

Infants are well equipped to convey their appreciations and their emotional states. Young infants make nearly all the muscle movements that are used by adults to express the primary emotions (Ekman & Oster, 1979). Izard (1978) has identified facial expressions of interest, joy, disgust, surprise, and distress in young infants. Weinberg (1988) and Hamilton (1988) have identified facial expressions of sadness and anger in three- to six-month-olds. Furthermore, a quite dramatic phenomenon is that newborns can imitate the components of the facial expressions of surprise, fear, and sadness (Field, Woodson, Cohen, Garcia, & Greenberg, 1983). Although these findings on imitation are controversial, they provide evidence of infants' ability to discriminate facial expressions and their ability to express that discrimination in differentiated ways. Hand postures and variations in motor tone are also indicative of infant affective behavioral states, as are variations of infant vocalizations (Fogel & Hannan, 1985; Papousek & Papousek, 1987).

Far less work is available on the relations among different expressive systems. However, Weinberg (1989) has found that in normal interactions, specific facial expressions are related to specific behaviors. In six-month-olds, for example, facial expressions of joy are more likely to occur when the infant is looking at the mother, positively vocalizing, and using gestural signals, whereas facial expressions of sadness occur when the infant is looking away and fussing, but not crying. These data demonstrate well the organized quality of the infant's affective system.

Varied and differentiated as the infant's affective repertoire is, it may still be underestimated. The variety and subtlety of facial expressions still elude our categorical schemes. How many types of smiles are there? How many forms are there of what we broadly label distress?

Moreover, past research has focused too much on facial expressions and not enough on gestures, postures, and vocalizations and their relations. Most critically, researchers need to put the infant in situations that evoke infant goals, evaluations, and strivings in order to elicit the infant's full affective repertoire. If this is not done, then the repertoire will not be available for observation. In these situations, researchers also must carefully consider moods rather than just the brief affective expressions they have concentrated on in the past. Recurrent moods, or what Emde (1983) has referred to as the infant's affective core, are critical to infant functioning because they systematically modify the infant's experience of events and bias the infant's response to them.

Regardless of what the infant's affective repertoire is eventually discovered to be, it is well established that parents are acutely sensitive to their infant's emotional expressions and behavior. Parents attend to their infant's direction of gaze and modify their behavior on the basis of it. They maintain a somewhat distant (40 cm) observational distance when their infant is looking at something other than themselves, but they move to a dialogic distance of about 22.5 cm when their infant looks at them

(Papousek & Papousek, 1987). Parents also "frame" their infant's gaze by looking at their infant until the infant looks away from them (Kaye & Fogel, 1980). Cohn and Tronick (1987) have found that when the infant looks away, parents use facial expressions, vocalizations, and gestures to solicit their infant's attention back to themselves, but that when eye-to-eye contact is established, parents change their affective behavior. For instance, parents often give an initial greeting in which they tilt their head slightly back, raise their eyebrows, and open their eyes and mouth wide (Papousek & Papousek, 1987).

Emde (1983) has found that parents categorize infant facial expressions along three dimensions: (a) hedonic tone, from positive to negative affect; (b) activation, from sleep to excitement; and (c) orientation, from internal to external (i.e., sleepy or bored to interested or curious). Most mothers also discriminate the discrete emotions of anger, fear, surprise, joy, interest, and sadness in their one-month-old infants. The mothers use facial, vocal, and behavioral expressions to make their judgments. Malatesta (Malatesta & Izard, 1984) found further specificity in parental responses to infants' facial expressions of emotion. Mothers respond with contingent imitation to their infants' more fully formed categorical emotional expressions (e.g., anger and joy) than to the more "random" facial movements (e.g., twitches or half smiles). Moreover, infant expressions of sadness and anger produce affective responses of sadness or anger in their mothers.

In sum, parents and other adults appear to operate on the assumption that a child has better information about what he or she wants than they do. Consequently, they attend to and act on a wide range of affective behaviors to aid the child's accomplishment of his or her goals.

Normal and Abnormal Infant-Adult Affective Communication

Infant and adult affective communicative capacities make possible mutually coordinated infant-adult interactions. After a decade of controversy, it is now well established that the face-to-face interactions of infants and adults starting as young as three months are bidirectional (i.e., mutually regulated) rather than just being the product of adult social skills. That is, infants modify their affective displays and behaviors on the basis of their appreciation of their mothers' affective displays and behavior (Cohn & Tronick, 1987; Lester, Hoffman, & Brazelton, 1985). For instance, infant smiles and vocalizations are contingent on specific maternal affective turn-taking signals (Cohn & Tronick, 1987). Of course, adults make similar modifications.

This coordination has led to characterizations of the mother-infant interaction as typically being reciprocal, synchronous, or coherent. These terms and others like them are attempts to capture the quality of the interaction when it is going well. Methods of assessment have been developed on the basis of this type of characterization, that is, a "good interaction" is a coordinated interaction.

However, such terms overcharacterize just how well the interaction typically goes. Coordination, regardless of infant age during the first year, is found only about 30% or less of the time in face-to-face interactions, and the transitions from coordinated to miscoordinated states and back to coordinated states occur about once every three to five seconds (Tronick & Cohn, 1989). Thus, a more accurate characterization of the normal interaction, and a better basis for assessment, is that it frequently moves from affectively positive, mutually coordinated states to affectively negative, miscoordinated states and back again on a frequent basis. But if this is the characterization of normal interaction, what is the characterization of abnormal interaction?

I (Tronick, 1980) have summarized several descriptions of infants who chronically experienced miscoordinated interactions. These infants repeatedly engaged in self-directed regulatory behaviors (e.g., they turned away, had dull-looking eyes, lost postural control, orally self-comforted, rocked, and self-clasped). These cases were extreme, but in examining a more typical population of mothers with high levels of depressive symptomatology for depression, Cohn and I (Cohn & Tronick, in press) have found that not only are the interactions of these mothers and their infants disturbed in ways similar to that seen in the extreme cases but that the affective and regulatory reactions of the infants are related to the affect and behavior of their depressed mothers.

In general, during these interactions there are few periods when infant and mother are mutually positive, and only a few of the interactions evidence any contingency between the infant's and mother's affective behavior. As a group, the depressed mothers look away from their infants more, are angrier and more intrusive, and display less positive affect than normal mothers. Cohn and Tronick (in press) found that seven-month-old infants of the most disengaged mothers show the greatest amounts of protest, that the infants of the most intrusive mothers look away the most, and that the infants of the most positive mothers, little as that is, express more positive affect. Similarly, Hamilton (1989) found that three-month-old infants' affective expressions are strongly related to maternal reports of their own affect. Three-month-old infants whose mothers reported more anger expressed more anger, whereas infants of mothers who reported more sadness expressed more distress.

My interpretation is that depressed mothers, in different ways for different mothers, fail to appropriately facilitate their infant's goal-directed activities. Their interactive behaviors and affect are poorly timed or often intrusive. Their affective displays are negative (e.g., anger, sadness, irritability), conveying the message that the infant should change what he or she is doing. This message and way of interacting is an obstacle to successful interaction, precludes the infant's achievement of his or her interactive goal, and leads to a predominance of negative affect and self-directed regulatory behavior by the infant. Thus, a general characterization of abnormal interactions is that the participants are stuck in affectively negative mis-

coordinated interactive states, and their messages calling for change are disregarded.

Now let me return to my opening question: How is it that some children become happy and curious, whereas others become sad and withdrawn, and still others become angry and unfocused? My answer is that these different outcomes are related to the working of the affective communication system in which the infant participates, especially to the balance of the child's experience of success or failure during his or her social-emotional interactions. Gianino and I (Gianino & Tronick, 1988) think of the normal, often-occurring, miscoordinated interactive state as an *interactive error*, and the transition from this miscoordinated state to a coordinated state as an *interactive repair*. The achievement of a coordinated state successfully fulfills the infant's interactive goal and engenders positive affect, whereas an interactive error fails to fulfill that goal and engenders negative affect.

In normal interactions, the infant experiences periods of interactive success and interactive error and frequent reparations of those errors. Emotionally, the infant experiences periods of positive affect and negative affect and frequent transformations of negative to positive affect; hence, experiences of negative emotion are brief. In abnormal interactions, the infant experiences prolonged periods of interactive failure and negative affect, few interactive repairs, and few transformations of negative to positive affect.

Gianino and I (Gianino & Tronick, 1988) have argued that the experience of success and reparation of interactive errors and negative affect that typifies normal interactions has several developmentally enhancing effects that lead to positive outcomes. The experience of interactive reparation and the transformation of negative affect into positive affect allow the infant to elaborate his or her other-directed affective communicative and self-directed regulatory capacities and to use them more effectively, that is, to be able to maintain engagement with the external environment in the face of stress. With the accumulation and reiteration of success and reparation, the infant establishes a positive affective core, with clearer boundaries between self and other (Emde, 1983). From this experience, the infant develops a representation of himself or herself as effective, of his or her interactions as positive and reparable, and of the caretaker as reliable and trustworthy.

In some initial work on normal interactions, Gianino and I (Gianino & Tronick, 1988) found that infants who experience more repairs during normal interactions are more likely to attempt to solicit their mothers' normal behavior when their mothers are acting in a disturbing, stressful manner (i.e., still-faced). These infants, on the basis of their experience of normal interactions, have a representation of the interaction as reparable and of themselves as effective in making that repair. Infants who experience fewer repairs are less likely to solicit their mothers and more likely to turn away and become distressed. In addition, infants who exhibit specific affective tendencies, such as smiling or distress, to this stressful

behavior by their mothers at a first laboratory visit exhibit similar affective tendencies on a second visit two weeks later. Stability across visits was also found for such self-directed regulatory behaviors as self-comforting. Six-month-olds are already establishing an affective coping style and a representation of self and other.

By contrast, in abnormal interactions the chronic experience of failure, nonreparation, and negative affect has several detrimental effects on developmental outcome. The infant establishes a self-directed style of regulatory behavior (i.e., turning away, escaping, becoming perceptually unavailable) to control negative affect and its disruptive effects on goal-directed behavior. Indeed, regulation of negative affect becomes the infant's primary goal and preempts other possible goals. This self-directed style of regulatory behavior precludes the infant's involvement with objects, potentially compromising cognitive development, and distorts the infant's interactions with other people. With the reiteration and accumulation of failure and nonreparation, the infant develops a representation of himself or herself as ineffective and of the caretaker as unreliable.

I (Tronick, 1980) have found that those infants who chronically experienced miscoordinated interactions disengaged from their mothers and the inanimate environment and distorted their interactions with other people. Similar effects are seen in the infants of depressed mothers: They have more negative interactions with unfamiliar adults, and those infants who are more negative during face-to-face interactions are also more negative in other situations (Tronick & Field, 1986). Of course, an infant could completely give up the goal of engaging his or her mother. However, the young infant may not be able to give up this goal, and even if he or she could, the consequences might be even more severe (Bowlby, 1982).

From this perspective, the pathways leading to the varieties of normalcy and psychopathology derive from the divergent experiences infants have with success, reparation of failure, and the transformation of negative emotions to positive emotions. Typically, there is no single traumatic juncture or special moment separating these pathways, only the slowly accumulated interactive and affective experiences with different people and events in different contexts that shape the regulatory processes and representations of the infant over time.

A major pathway leading to the variety of normal individual outcomes, one that is often disregarded, is the difference in emotional experience of individuals due to exposure to different cultural practices of socializing affect and behavior. For example, among the Gusii of Kenya, a people with strict rules about who may look at whom during face-to-face interactions, a mother is likely to look away from her infant at just that moment when the infant gets most affectively positive. In response, the infant's affect becomes more neutral, and he or she may look away. American mothers, at least the ones we study in our laboratories, almost never look away from their infants but, rather, get quite excited themselves. In response, American infants get even more excited and positive. Thus,

Gusii infants internalize one set of interactive experiences and American infants another.

Framed by cultural bounds, the most important cause of the varieties of normal outcome are the strikingly different experiences individuals have with affective communication, interactive success, and emotional reparation during their reiterated daily exchanges with others. For instance, Cohn and I (Tronick & Cohn, 1989) have found large individual differences in the ability of mother-infant pairs to maintain coordinated interactive states. In addition, Cohn and I reported that mother-son pairs are in well-coordinated states about 50% more of the time than mother-daughter pairs at six and nine months. These differences have important consequences for the emotional responsiveness and the formation of the self in individual males and females.

There are many pathways to psychopathology. From the perspective of mutual regulation, psychopathology is likely to arise in situations where there is persistent and chronic interactive failure. In these situations the infant is forced to disengage from people and things because the infant has to devote too much regulatory capacity to controlling the negative affect he or she is experiencing (Main, 1981). Eventually and paradoxically, to the extent that these self-directed regulatory behaviors are successful in controlling the negative affect and containing its disruptive effects, the infant begins to deploy them automatically, inflexibly, and indiscriminately. Thus, what were normal self-regulatory behaviors become pathological or "defensive" because they are used to preclude the anticipated experience of negative affect, even in situations where negative affect might not occur. The infant gives up attempting to appreciate the nature of the immediate situation and instead approaches new situations already withdrawn and biased to act inappropriately. This severely constricts the infant's engagement with the world, future options, and even autonomy and may lead to failure-to-thrive, depression, and other forms of infant psychopathology.

But of course one must be cautious. Pathology is not necessarily the outcome of abnormal interactive experiences; indeed, some effects may be positive. For example, the infant of a depressed mother might become exceedingly sensitive to her emotional state in order to read her better and to better regulate the interaction. Such sensitivity may be useful when the infant interacts with others. Moreover, experience with poorly coordinated interactions is likely to have different effects at different developmental points. For example, experience with a depressed mother will have one effect during the infant's first months of life, when the mother's behavior may disrupt her infant's early emotional experience, and a different effect at the end of the first year, when depressed behavior will be more likely to disrupt the infant's newly emerging forms of autonomy.

This account has focused on the caretaker as the critical factor affecting, especially disrupting, the affective communication system. But the infant is an agent as well. Although the infant's capacities are impressive, they are

still limited, so that the infant is not always able to play his or her role in the interaction effectively. Furthermore, individual differences in temperament make different infants quite different interactive partners. In the opening examples, the first infant might be temperamentally more active and better able to control affect, whereas the second infant might be more sensitive to stimulation and more inhibited. These sorts of differences place different demands on interactive partners, make infants differentially reactive, and lead to different outcomes.

More generally and critically, many factors affect the child's developmental outcome. Even a partial list would include prematurity, malnutrition, illness, the infant's other interactive experiences, and factors such as social support, stress, and self-esteem that affect the mother's behavior with her infant. Indeed the list is a long one, but the principle is that any factor, no matter how distant, that consistently modifies the infant's affective experience modifies the infant's outcome to some degree.

Conclusion

This perspective on affective communication can be extended to the older child. The older child experiences new emotions—shame and guilt to name two—and has a more structured self to be affected by success and failure (Lewis, 1987). The older child also moves on to more complex and demanding tasks with people, objects, and ideas. These tasks place new demands on the child's ability to control his or her affect and on the caretaker to supplement the child's capacities. Problems children have with tantrums, impulse control, and conduct disorders, and even the risk-taking of adolescents, may be viewed as arising out of children's experiences with mutual regulation and their ability to self-regulate.

The regulation of emotions, self and other, interactive success, and affective reparation are in fact lifetime issues (Stern, 1985). How adults manage these functions is determined in their current circumstances by their regulatory style and their conscious and unconscious representation of their past. Given the transformational nature of development, it would be foolish to assert that the infant's regulatory style and representations determine those of the adult, but it would be equally foolish to assert that they are without long-term influence. Certainly the way in which the adult-as-child regulated and represented the circumstances and the emotions he or she experienced accrue to the adult.

Thus, the infant, the child, and the adult act on the world, regulate emotional states, and communicate affectively. And for all of them the working of the communicative process—its degree of interactive coordination and affective reparation—is what is critical to their outcome. Of course we need to know more. To do that we need to look in great detail at the daily reiterated workings of this emotional communication system. This will take a major effort and commitment. Indeed the time may have arrived for researchers to “reinvent” the systematic study of the development of individuals looked at one at a time. However, intervention need not wait for that full

understanding. We already know that many interventions—from close-up ones such as interactive coaching, parental therapy, respite care for the child and parent, and daycare, to more distant ones such as prenatal care, health care, and jobs—will modify the child's experience and lead to positive developmental outcomes. We should put them in place.

REFERENCES

- Beebe, B., & Stern, D. (1977). Engagement–disengagement and early object experience. In M. Freedman & S. Grenel (Eds.), *Communicative structures and psychic structures* (pp. 33–55). New York: Plenum Press.
- Bowlby, J. (1982). *Attachment and loss: Vol. 1 Attachment* (2nd ed.). New York: Basic Books.
- Brazelton, T. B., Koslowski, B., & Main, M. (1974). The origins of reciprocity: The early mother–infant interaction. In M. Lewis & L. A. Rosenblum (Eds.), *The effect of the infant on its caregiver* (pp. 49–76). New York: Wiley-Interscience.
- Campos, J., Barrett, K., Lamb, M., Goldsmith, H., & Sternberg, C. (1983). Socioemotional development. In P. H. Mussen (Ed.), *Handbook of child psychology: Vol. 2. Infancy and developmental psychology* (pp. 783–915). New York: Wiley.
- Cohn, J. F., & Tronick, E. Z. (1983). Three-month-old infants' reaction to simulated maternal depression. *Child Development*, *54*, 185–193.
- Cohn, J. F., & Tronick, E. Z. (1987). Mother–infant face-to-face interaction: The sequence of dyadic states at 3, 6, and 9 months. *Developmental Psychology*, *23*, 68–77.
- Cohn, J., & Tronick, E. Z. (in press). Specificity of infants' response to mothers' affective behavior. *Journal of the American Academy of Child and Adolescent Psychiatry*.
- Ekman, P., & Oster, H. (1979). Facial expressions of emotions. *Annual Review of Psychology*, *30*, 527–554.
- Emde, R. (1983). The pre-representational self and its affective core. *The Psychoanalytic Study of the Child*, *38*, 165–192.
- Field, T., Woodson, R., Cohen, D., Garcia, R., & Greenberg, R. (1983). Discrimination and imitation of facial expressions by term and preterm neonates. *Infant Behavior and Development*, *6*, 485–490.
- Fogel, A., & Hannan, E. T. (1985). Manual actions of nine- to fifteen-week-old human infants during face-to-face interaction with their mothers. *Child Development*, *56*, 1271–1279.
- Gianino, A., & Tronick, E. Z. (1988). The mutual regulation model: The infant's self and interactive regulation coping and defense. In T. Field, P. McCabe, & N. Schneiderman (Eds.), *Stress and coping* (pp. 47–68). Hillsdale, NJ: Erlbaum.
- Hamilton, P. (1989). *The interaction of depressed mothers and their 3 month old infants*. Unpublished doctoral dissertation, Boston University.
- Izard, C. (1978). Emotions as motivations: An evolutionary–developmental perspective. In H. E. Howe, Jr. (Ed.), *Nebraska Symposium on Motivation* (Vol. 26, pp. 163–199). Lincoln: University of Nebraska Press.
- Kaye, K., & Fogel, A. (1980). The temporal structure of face-to-face communication between mothers and infants. *Developmental Psychology*, *16*, 454–464.
- Lelwica, M., & Haviland, J. (1983, April). *Ten-week-old infants' reactions to mothers' emotional expressions*. Paper presented at the biennial meeting of the Society for Research in Child Development, Detroit.
- Lester, B., Hoffman, J., & Brazelton, T. B. (1985). The structure of mother–infant interaction in term and preterm infants. *Child Development*, *56*, 15–27.
- Lewis, M. (1987). Social development in infancy and early childhood. In J. D. Osofsky (Ed.), *Handbook of infant development* (2nd ed., pp. 419–555). New York: Wiley.
- Main, M. (1981). Avoidance in the service of attachment: A working paper. In K. Immelmann, G. Barlow, M. Main, & L. Petrinoich (Eds.), *Behavioral development: The Bielefeld Interdisciplinary Project* (pp. 651–693). New York: Cambridge University Press.
- Malatesta, C. A., & Izard, C. E. (1984). The ontogenesis of human social signals: From biological imperative to symbol utilization. In N. A.

- Fox & R. J. Davidson (Eds.), *The psychobiology of affective development* (pp. 161–206). Hillsdale, NJ: Erlbaum.
- Papousek, H., & Papousek, M. (1987). Intuitive parenting: A didactic counterpart to the infant's precocity in integrative capacities. In J. D. Osofsky (Ed.), *Handbook of infant development* (2nd ed., pp. 669–720). New York: Wiley.
- Rothbart, M., & Derryberry, D. (1984). Emotion, attention and temperament. In C. Izard, J. Kagan, & R. Zajonc (Eds.), *Emotion, cognition and behavior* (pp. 133–156). New York: Cambridge University Press.
- Sroufe, L. (1979). The coherence of individual development: Early care, attachment, and subsequent developmental issues. *American Psychologist*, 34, 834–841.
- Stern, D. N. (1985). *The interpersonal world of the infant. A view from psychoanalysis and developmental psychology*. New York: Basic Books.
- Trevarthen, C. (1974). Conversations with a two-month-old. *New Scientist*, 896, 230–235.
- Tronick, E. (1980). On the primacy of social skills. In D. B. Sawin, L. O. Walker, & J. H. Penticuff (Eds.), *The exceptional infant. Psychosocial risks in infant environment transactions* (pp. 144–158). New York: Brunner/Mazel.
- Tronick, E. Z., & Cohn, J. F. (1989). Infant–mother face-to-face interaction: Age and gender differences in coordination and the occurrence of miscoordination. *Child Development*, 60, 85–92.
- Tronick, E. Z., & Field, T. (1986). *Maternal depression and infant disturbance: New directions for child development* (Vol. 34). London: Jossey-Bass.
- Weinberg, K. (1989). *The relation between facial expressions of emotion and behavior in 6 month old infants*. Unpublished master's thesis, University of Massachusetts, Amherst.
- Wolff, P. (1963). Observations on the early development of smiling. In B. M. Foss (Ed.), *Determinants of infant behaviour* (pp. 113–138). London: Methuen.