

# Chapter Sixteen

## *Principles of Emotion and its Development in Infancy*

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### Overview

The field of emotional development has made considerable theoretical and empirical strides over the last 30 years. From these advances, we lay out some basic principles that characterize what is known about emotion and its development. Adopting a functionalist perspective, we review what emotions are and how they develop, highlighting many of the factors involved in their development and the processes by which this development occurs. The chapter is organized around the following five topics: (1) the nature of the emotion process and the properties that comprise it; (2) the role evolution may play in emotional development; (3) the developmental processes of differentiation and integration that organize some aspects of development; (4) the role of cognitive factors in emotional development; and (5) the importance of conceptualizing emotional development as a multicomponent process.

### A Perspective on the Nature of Emotion

#### *False Starts in the Study of Emotion*

Select any treatment of emotion and chances are that it begins with an apology. Emotion, the readings will say, is difficult to define and to dissociate from other mental and behavioral phenomena, including cognition, motivation, and social interaction. Chances are, too, that the treatment will begin with citation from a dictionary. Typically, such cita-

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tions beg the question of what emotion is ("an affective state of consciousness in which joy, sorrow, fear, hate, and the like are experienced as distinguished from cognition or volition"). They in turn rely on criteria not specific to emotion, such as increased heartbeat, respiration, muscular tension, and the like – states that are evident in exercise as well as emotion. Moreover, all too often they characterize emotion as a disruptive and disorganizing phenomenon.

To the extent that such dictionary definitions capture common usage, and to the extent that common usage dictates starting points for studying emotion, it is not surprising that the study of emotion and emotional development has had a fitful and contentious history. The problem in the study of emotion rests not with the concept of emotion, but with the conception of emotion implicit in definition by common usage. For us, emotion is *not* (or at least, not just) an intrapsychic state of consciousness; it is *not* something that can be defined by pointing to physiological, or for that matter, any other reaction; and it is *not* (or not necessarily) disruptive and disorganizing.

Emotion is not just a feeling state because it powerfully affects both one's own behavior and the behavior of others. In fact, we can have emotions without feelings (Lazarus, 1991), our feelings often follow an emotion episode (Frijda, 1986; James, 1892/1963), and feelings may play no causal role in emotion (Bowlby, 1973; Ryle, 1949). While feelings are a crucial facet of emotion, they are not its core; they are not what determines everything else about the emotion process.

Emotion is not physiological arousal because any physiological response can be shown to change in states in which there is no emotion (for example, even in meaningless motoric activity). After a century of searching, no one has yet convincingly demonstrated the existence of "autonomic signatures" of emotion – those physiological patterns that are found in one emotional state but not in another (see Cacioppo, Klein, Berntson, & Hatfield, 1993). Even those reactions that are occasionally reported across a variety of eliciting circumstances (e.g., Ekman, 1999a,b) tend to be related to discrete emotions weakly and inconsistently (Boiten, 1996; Ekman, Levenson, & Friesen, 1983; Levenson, 1992; Levenson, Ekman, Heider, & Friesen, 1992; Stemmler, 1989).

Facial or other expressions cannot serve as a criterion for emotion either. Although most textbooks tout the universality of facial expressions for emotions such as anger, fear, joy, sadness, surprise, and disgust, such impressive reports come from studies of *recognition* of facial expressions, not from studies of *production* of facial expressions, where the findings are rarely robust. The facial expressions of infants or adults undergoing emotions in real-life settings are not strongly related to the states that they are supposed to express; often, facial expressions are rarely or never seen when they should be. Such is the case for the facial expression of fear, which is seldom seen in situations that provoke intense fear states, including fear of heights, of looming objects, and of strangers (Campos, 1985; Camras et al., 1998; Hiatt, Campos, & Emde, 1979).

Finally, emotions need not disorganize, contrary to many theoreticians' proposals (e.g., Goleman, 1995; Hebb, 1949; Leeper, 1948; Mandler, 1975, 1979). By their very nature, emotions can be organizing and adaptive. They are designed to help the individual adapt to problems that emerge in his or her transactions with the world, and they organize both intrapersonal and social processes. Positive and negative emotions can help overcome problems, encourage engagement with the world, and structure one's perceptions and thoughts. Without properly sharing emotions with a caregiver, and without obtaining

emotional security from that person, one could never arrive at the favorable and harmonious relationship called "secure attachment" (Sroufe & Waters, 1977). Furthermore, emotions presumed to be "disruptive," such as anger and fear, can motivate successful undertakings by overcoming inhibitions and bringing about successful coping. To define emotion by reference to presumably disruptive characteristics seems limiting, misleading, and inaccurate.

### *An Alternative Conceptualization of Emotion*

How does one conceptualize emotion fruitfully? Our attempt will begin with a different starting point than that of common usage. We will delineate what we believe are the major features of emotions that differentiate them from the nonemotional, and also present a set of general criteria for differentiating one emotion from the other. In the process, we will set a frame for explaining major aspects of emotional development in infancy. The discussion of what follows draws heavily from prior writings by Campos, Barrett, Lamb, Goldsmith, and Stenberg (1983), Barrett and Campos (1987), Frijda (1986), and Lazarus (1991, in press). These writings constitute the basis for what is called the functionalist approach to emotion.

William James (1892/1963) began his famous chapter on emotion in his textbook, *Principles of Psychology*, by stating that emotions end at the periphery of the body and do not proceed beyond. In so doing, James, who was trying to explain the origin of feeling states, epitomized the approach to emotion that emphasizes its intrapersonal, intrapsychic, and self-centered bases. In contrast to James, we believe that emotions reach out to the social and physical world. We believe that emotions are *relational* – their origin results from the impact of events on what the person is trying to do. Emotions come about neither from the self nor from the environment but from the fusion of external event and internal intent. Far from ending at the periphery of the body, emotions broadcast to the outside world. They communicate (intentionally or otherwise) powerful messages and consequently regulate the behavior of others. Viewed in this light, emotions are not intrapsychic but transactional, integrating the real or imagined physical and social world to the person's strivings. Emotions are thus intimately tied to adaptation. When self and world clash, creating problems which require steps to address, negative emotions such as anger and fear occur. When self and world suddenly coordinate effectively, creating smooth progress to a goal, positive emotions, such as joy, relief, love, triumph, etc., are generated.

### *A working definition of emotion*

In effect, *emotions are the processes by which an individual attempts to establish, change, or maintain his or her relation to the environment on matters of significance to the person.* The attempt can be overt, as when an individual actively engages in transactions with the world, or covert, as when the person is merely in a state of action readiness for dealing with the world (Campos & Barrett, 1984; Frijda, 1986). Emotions are thus not identified, as they are in dictionary definitions, with any particular feeling, nor with any individual facial or vocal or other expression, or even with any specific instrumental

behavior. Emotions can best be identified by seeing the adaptive function that a particular behavior or set of behaviors appears to serve as the person deals with his or her relation to the world. Specific behaviors acquire their emotional meaning only in terms of the role they play in person-environment transactions. A smile, therefore, can serve many masters, as Kagan (1971) stated; in context, it can as readily be in the service of scorn as of joy.

### *What Makes Our Interaction with the World Emotional?*

#### *Emotion and significance*

Not all attempts by a person to change his or her relation to the environment are emotional. Perhaps the most unambiguous feature distinguishing emotion from the non-emotional is *personal significance* – that is, the value, importance, or relevance of the transaction for the person. Transactions that have value are emotional; those without value are not. Put another way, what is potentially damaging or beneficial to oneself is emotional; what is routine is not.

The notion of significance is at the core of contemporary theories of emotion. Usually, for most of these theories, what makes an event significant, and hence emotional, is the relevance of the event for the attainment of one's goals. For Lazarus (1991), the generation of emotion begins with the issue of whether an event is congruent or incongruent with one's goals. As Frijda (1986) suggests, emotions "serve concern satisfaction; they do so by monitoring the relevance of events and by modulating or instigating action accordingly" (p. 475). Extrapolating from Lazarus and Frijda, we believe that emotions typically begin the moment that an event is related to one's goals, change when the goal is attained or is relinquished once and for all, and end when the significance of the transaction abates. When viewed in this light, emotions can be brief or enduring; unlike conceptualizations linking emotion to facial expressions, emotions are not necessarily succinct or micromomentary (as Ekman, 1999b, proposes).

The link between emotion and the goals (motivations, intentions, concerns) of an individual is thus an intimate one. However, there are other ways besides goal relevance by which events become significant. One of these is social signals. Such signals from others – their smiles, growls, coos, scowls, laughs, stares, sneers, etc. – have an impact on one's actions, and give those actions a value previously lacking. Social signals also can change the existing significance of an event or action, from aversive to engaging, or the reverse. As such, these signals communicate emotional significance in a process that pervades the entire life span.

The social signals of others can, under certain circumstances, generate a like emotional state in the perceiver of those signals, a process called affect contagion (Hatfield, Cacioppo, & Rapson, 1994). One form of affect contagion is present at birth: the empathic distress reaction of infants. Newborn infants cry in response to the cries of other newborns, but not in response to their own cry or to acoustically similar sounds of equal loudness and duration like white noise (Dondi, Simion, & Caltran, 1999; Martin & Clark, 1982; Sagi & Hoffman, 1976; Simner, 1971). By 10 weeks, affect contagion



responses have broadened; at this age, infants may respond to positive emotions with positive reactions, to anger signals with anger-like expressions, and to sad displays somewhat more diffusely with mouthing and tonguing, when such signals are jointly conveyed through face and voice (Haviland & Lelwicks, 1987).

Emotional communication via social signaling may be a necessary component for the generation of somewhat later-appearing emotions such as shame, guilt, and pride (Barrett & Campos, 1987). Shame, for instance, requires that the shamed individual detect disappointment, anger, sadness, or otherwise disapproving emotional communication from a significant other. Pride, too, involves expected praise in the form of exuberant paralinguistic and gestural communications from another. Guilt requires the perception of the emotional signals of sadness, pain, fear, or suffering one's actions have caused in another. Whatever cognitive factors are involved in addition, emotional signals seem a prerequisite for generating these later-appearing emotions, sometimes called "self-conscious" emotions (Fischer & Tangney, 1995; M. Lewis, 1993), but which we believe are more appropriately called "other-conscious" emotions (after J. S. Watson, personal communication, 1999).

### *How Are Emotions Generated and Manifested?*

The significance of one's transaction with the world assumes different forms depending on the nature of relation between person and event. Emotions like joy or relief arise from congruence between a person's strivings and events, resulting in active attempts to maintain such congruence. Emotions like anger and sadness arise when incongruence marks person-event relations. Both anger and sadness involve frustrating encounters with an obstacle to goal attainment, but in anger the possibility of overcoming the obstacle – and hence the incongruence – exists. When goal restoration is deemed unattainable, sadness ensues.

Some events go beyond simple goal congruence or incongruence. In fear, for example, the relation of an event to one's goals involves a particular goal – that of personal security; the event is a threat to one's safety, well-being, or status. In shame, on the other hand, the event involves the person behaving in the world under the watchful eye of a significant other and is related to concern that one's action will elicit rebuke from the other (Mead, 1934). In pride, a person not only solves a problem but also obtains the approval of others; joy at mastery transforms into something quite different by the meaning and desirability of the praise of others.

Whatever the specific nature of exchange between person and event, it is at the level of relation between the two that the emotion process resides (Frijda, 1986; Lazarus, 1991). Preciously few if any events have intrinsic capacity to generate emotion. Even social signals, which otherwise have such power to create like emotion in the perceiver, can produce very different effects depending on the context in which the perceiver is embedded. A cheery smile and enthusiastic pickup gesture, for example, can be unpleasant to a tired and overstimulated infant (Stern, 1971, 1977). The cry of a peer, potent for the newborn, rarely promotes empathic distress by 6 months of age (Hay, Nash, & Pedersen, 1981). At a minimum events must be considered in the context of a person's

show sadness at losses if they are not irrevocable. Our action tendency potential helps regulate the impact of a stimulus on our strivings and goals. The emotion process is not a linear one but a complex loop that involves both feedback (the response mitigating the effect of a stimulus) and feedforward effects (the response creating a future state in which the stimulus has a different impact).

The specific emotional behavior that comprises action tendencies takes two forms. Note that both kinds of behavior are relational – serving to create, maintain, or change the relation of the person to the environment. Both are intrinsically functional. One kind of behavior is called by common usage “expressive.” “Expressions” are designed to change the relation of the person to the environment, but not by affecting the environment directly. Rather, they do so by recruiting the intervention of another, such as by social signaling. Examples of expressions are smiles, scowls, frowns, and sneers in the facial realm; screams, groans, and squeals in the vocal domain; and cringing, cowering, snuggling, and puffing up in the gestural domain. None of these reactions will make a frightening encounter go away, or a frustrating one become less so. The relational impact of expressions is largely tied in with their potential to affect others. The smile may communicate to someone else “keep up what you are doing”; the cry can command “change my situation”; a grimace may imply “I am about to attack”; weeping may suggest “come provide succorance.” Viewed in this way, the term “expressive” is not apt. The importance of expressive behaviors comes about not so much from their serving as readouts of internal states, as means of telling another what one’s “feelings” are (Planalp, 1999), but from influencing how the other behaves, and forecasting what the “expressing” person will do next. Although we will continue to use the term “expression” because so much research uses that term, we much prefer avoiding the term, and using the more apt designation “social signal.”

The second kind of emotional behavior is called “instrumental.” In contrast to expressions, these actions affect the world directly. Instrumental behaviors are designed to remove us from a threat (e.g., by running away or freezing). They allow us to displace or eliminate obstacles (e.g., by attack or effortfully pushing the obstacle aside). And they help us avoid social contact when we have engaged in a disapproving act (e.g., by leaving the field, by avoiding social communication with the disapproving other, or by distracting the other from our transgression).

### *Emotion regulation*

Heretofore, we have emphasized the role that emotions play in regulating the relation between the person and the environment. However, emotions are also *regulated*. That is, a given emotion is often attenuated, accentuated, or transformed into a completely different emotion (although the latter probably occurs only after the period of infancy). Research that deals with emotions as regulated falls under the rubric of emotion regulation.

Emotion regulation operates at several levels in the emotion process. Campos, Mumme, Kermoian, and Campos (1994) analyzed the various mechanisms of such regulation in terms of three processes: (1) the control of perceptual input; (2) changing the meaning of the person–environment relation; and (3) inhibiting or amplifying

responses. An example of control over perceptual input is "niche-picking" – the selection of environments in which a problem is not likely to arise. Infants show such tendencies when they avoid social contact with others, when they retreat in private after an unannounced bowel movement, and when they show "avoidant-attachment" behavior to a caregiver whose interactions with the child have been insensitive. In contrast to the first process, little, if any, empirical evidence exists to indicate that infants are capable of changing the meaning of the person–environment relation. It is probably not until the preschool years that a child has the capacity to regulate his or her emotions using this process. Finally, infants develop the ability to inhibit and amplify their emotional displays. We see the latter when infants, for instance, cry louder than is typical to gain the attention of their caregiver in another distant room and smile broadly at important people in their environment. We see the former when infants inhibit their crying behavior to gain succor from mothers who are unlikely to pick up their infants during crying episodes.

## **Evolutionary Processes in Emotional Development**

As we have discussed, emotions are processes that typically arise when an individual faces a problem, with the nature of the problem determining the quality of the emotion. Emotions are thus inseparable from attempts at adaptation; they are designed to help the person create a better fit with his or her environment. The term adaptation has two meanings. One refers to successful dealings with the environment in the here-and-now and is the cornerstone of the "functionalist" theory of emotions (Barrett & Campos, 1987; Campos & Barrett, 1984; Frijda, 1986; Lazarus, 1991). The second meaning refers to evolutionary value, to the fit of an individual in the past history of the species with the so-called "environment of evolutionary adaptedness," and is foundational to the "evolutionary psychology" of emotions (Cosmides & Toobey, 2000). Our approach in this chapter is a functionalist, not an evolutionary, one. We emphasize ontogeny, not phylogeny. Nevertheless, evolutionary factors may serve as primitives or starting points for an explanation of emotional development. So, a functionalist theory of emotion must make some educated guesses about the contribution of evolution in the human infant's emotional makeup.

It is very difficult to infer the operation of evolutionary factors in emotion (Haig & Durrant, 2000; Ketelaar & Ellis, 2000). In general, we can infer an evolutionary role in emotion when as many as possible of the following criteria are met: (1) universality of manifestation across cultures; (2) presence very early in ontogeny; (3) presence later in ontogeny in the absence of experience (e.g., the smile in blind infants); (4) evidence for underlying brain organization and circuitry that make possible a phenomenon when such brain circuits do not depend upon experience for their organization; and (5) apparent adaptive value in the sense that appropriate responding to certain situations results in the person surviving to pass along his or her genes. Using some of these criteria as a guide, and operating under the assumption that human evolution has been made possible largely by the development of flexibility rather than rigidity of responding, we will describe a

number of ways in which we believe that evolutionary processes could play a role in explaining emotional development.

When we look at humans in their environments, certain relational commonalities emerge that universally capture emotional functioning. As we noted in the introduction, each emotion is marked by an abstract relational meaning structure: when we encounter an obstacle to our goals and have no means of overcoming the obstacle, sadness results, but when events match our goals, then we experience happiness. Such abstract patterns appear to be evident in all cultures (Kitayama & Markus, 1994; Mesquita & Frijda, 1992; Wallbott & Scherer, 1988), and such universality suggests the potential for an evolutionary origin to these patterns. The potential role of evolution in these patterns, however, does not likely extend to specific event–emotion linkages. For example, in some cultures eating insects is considered a delicacy; in others, it is repulsive. Although what is repulsive differs across cultures, disgust is nonetheless universal, so long as the event–person relation involves an appreciation of contamination and a rejection of oral incorporation (Rozin & Fallon, 1987).

Universality thus characterizes emotions at an abstract level of person–event transaction. However, specific events, actions, goals, and evaluations involved in the emotion process are flexible and intimately linked to culture and ontogenetic experience rather than to evolutionary factors *per se*. In this respect, the role of evolution in emotion is analogous to the role of evolution in language. No one will question that language has evolved and is adaptive. Yet no one will say that we have evolved to speak French, English, or Swahili. The words used for environmental referents and the specific pronunciation of those words are simply too different across cultures, and too malleable across historical time, to have evolved. Thus, we are evolutionarily capable of fear, and such fear emerges when we perceive threat; but there are not necessarily any specific events that constitute threat across all cultures, and there are not necessarily any specific behaviors humans employ to universally deal with threat.

Nonetheless, there are some specific aspects of the emotion process for which evolutionary factors seem to play a role. In what follows we will review evolutionary influence at the level of emotional responses, emotional evaluations of stimuli and events, and at the level of a fundamental process that helps humans early in development to attach specific emotional meaning to the world: motor mimicry.

### *Evolution and Emotional Response Patterns*

Behavioral flexibility is not limitless. Even if one does not always or generally see an anger face when someone is expressing anger, it seems very likely that *elements* of such a facial display are *more likely* in a state of anger than elements of a facial display communicating sadness or joy. Such constraints on response were alluded to by Darwin (1872/1965) in his principle of serviceable associated habits. This principle states that we show certain facial movements and not others when in a given emotional state because such movements in the past served very specific adaptive functions. In anger, for instance, the narrowing of the eyes and elevation of the cheek served a protective function of minimizing the surface of the eye that could be injured in potential combat. The baring of teeth was

adaptive as a preparation for biting in attack. The fixed stare was adaptive in keeping prey or adversaries in view for the purpose of monitoring their behavior. Over evolutionary time, as a function of their likely adaptive value, these responses gradually became readily shown in states of anger. Similar considerations apply to the serviceable habits in other emotions as well, including fear, disgust, and joy.

Evolutionary constraints thus may affect the relative place in a response hierarchy where a particular behavior is found – i.e., how easily the response is shown. What has evolved may be the constraints on behavior (and these constraints appear not to be very strong), but possibly not the patterned “emotional behaviors” themselves. We know of no evidence nor speculation as to why each individual “serviceable associated habit” has to be elicited in concert with every other such habit to make a patterned “fear face.” Thus, we propose that evolutionary factors may organize parts of emotional displays, but probably not wholes.

### *Evolution and Biological Preparedness for Learning*

Since events do not have intrinsic, biologically determined meaning structures of their own, we propose that experiential and learning factors must play a role in the capacity of a stimulus to generate emotion. However, we do believe that evolution can play a critical role in learning. There is now abundant evidence that evolutionary factors affect learning by influencing how quickly a stimulus is linked to emotion, how enduring the learning is, and how strong is the emotion that occurs following an encounter between a person and an event. The fact that some emotions can be learned more quickly and retained in more enduring fashion to certain stimuli but not others is called “biological preparedness for learning.” We propose such preparedness as another way in which evolution plays a role in emotional development. It is a means of ensuring flexibility of behavior while simultaneously constraining flexibility to some degree.

In infancy, biological preparedness for learning was demonstrated as long ago as 1930 by C. W. Valentine. He presented his year-old offspring with stimuli that he reported differentially were conditioned to the sound of a loud whistle. One stimulus he presented, for instance, was a caterpillar – a wiggly and furry creature that initially elicited no aversion by the infant. However, as soon as the insect was shown to his daughter and then followed by a loud whistle, she began to tremble and to move away from it. By contrast, when Valentine showed the baby a pair of opera glasses followed by the same loud whistle, the baby startled to the whistle but did not avoid the glasses as she did the caterpillar. Valentine concluded that, while fear of the specific stimuli was not innate, the reaction to certain types of stimuli represented a fear “lurking to come out” with the proper experiential provocation.

More recently, and in much better-controlled studies, Cook and Mineka (1990; Mineka & Cook, 1993) demonstrated how laboratory-reared monkeys who had never been exposed to a snake or to a flower, and who initially showed no wariness to either stimulus, quickly learned lasting avoidance responses to the snake but not to the flower. Like Valentine, Cook and Mineka concluded that organisms are not innately afraid of

stimuli, but are prepared to learn to be wary of stimuli likely to indicate dangerous properties in the environment of evolutionary adaptedness.

Lest it seem that biological preparedness for learning is limited to insects and snake-like stimuli, it should be noted that similar preparedness has been demonstrated for taste stimuli (when these are associated with subsequent nausea but not shock; Garcia & Koelling, 1966), for fear and joy faces (when used to signal electric shock, fear faces produce physiological responses much more resistant to extinction than do joy faces; Ohman, 1993), and for appetitive responses such as learning to suck for sugary substances (Lipsitt, 1986). Similarly, Walden and Passaretti (1996) reported that 18-month-old infants seem prepared to associate maternal messages specifying positive emotion and security to mechanical stimuli, but not to snake-like stimuli. In sum, preparedness for learning emotional meanings, although relatively underinvestigated, seems to be a robust finding. It clearly is a principle with vast implications for understanding emotional development and the role of the ecology within which the child is developing.

### *Evolution and Part-Whole Phenomena*

A third way in which evolutionary factors may organize emotion in the infant and young child is through the close link between relatively simple *featural* parameters of stimulation and the generation of aspects of emotion. There has been a tendency in early ethological studies to draw too rich an interpretation of what elicits emotional behavior in animals and infants. The tendency is to attribute to a whole stimulus – to a pattern or Gestalt – effects that are in fact due to a stimulus feature or element embedded in the pattern. We propose instead that certain parameters of stimulation – certain stimulus features – have the capacity to elicit aspects of emotional response, and that such a capacity is the outcome of evolution. However, we are skeptical that evolution typically leaves behind sensitivity to more patterned and higher-order variables of stimulation.

Consider this classic study in ethology. Tinbergen (1948, 1951) studied the scurrying fear-like reactions of goslings when a particular display was presented to them. The display consisted of a long neck, an oval expansion that looks like the wings of a bird, then a short extension. The design is such that, if moved in one direction, the leading edge of the display had the long-necked shape of a goose. If moved in the opposite direction, the leading edge had the short-necked shape of a hawk. Tinbergen observed that the goslings scurried when exposed to the overhead movement of the hawk-like shape, and showed no such behavior when exposed to the overhead movement of the goose-like shape. He inferred that the hawk-like stimulus fit a biologically adapted template that facilitated avoidance, and hence survival.

Subsequent studies by several researchers (reviewed in Schneirla, 1965, and Gould, 1982) have confirmed the phenomenon Tinbergen described, but disconfirmed the interpretation. Instead of using the hawk–goose display, Goethe (cited in Schneirla, 1965) used a dark triangle, the base of which was presented vertically, such that when moved in one direction, the base of the triangle appeared first, and when moved in the opposite direction, the apex appeared first. Although this stimulus lacked any fit to an evolutionarily derived template of a potential predator, the base-appearing-first presentation led to



scurrying in the goslings studied; but the apex-appearing-first display did not. Schneirla (1965) proposed that the scurrying-inducing element was the rate of change of stimulation, not the hawk or goose shape of the stimulus. When the rate of change is abrupt (as in the short-necked hawk stimulus or the base of the triangle), scurrying occurs. When the rate of change is gradual (as in the goose neck or the apex of the triangle), scurrying is lacking. Schneirla thus concluded that the goslings were sensitive to the relatively simple parameter of rate of change of stimulation, and not to the complex Gestalt of goose or hawk.

There are many instances of apparently preadapted reactions of human infants to relatively simple features of stimulation. At one time, it was thought that the heartbeat sound had an innate capacity to soothe infants because of the imprinting of heartbeat sounds to the infant while the infant was in the womb (Salk, 1962). In point of fact, heartbeat sounds do soothe infants, but not because they are heartbeat sounds. Brackbill, Adams, Crowell, and Gray (1966) showed that it was the rhythmicity of stimulation in the heartbeat sound that soothed, not the quality of the heartbeat itself. As with the hawk–goose phenomenon, a relation reliably demonstrated across studies has been shown to be the consequence of a feature embedded within a complex display, not the complex display itself. Such may also be the case for the empathic distress response of neonates to another neonate's cry; neonates may be sensitive to specific acoustic parameters of another's cry, but not to the cry as a whole.

At this writing, there is considerable interest in identifying whether the human being's reaction to music is innate, or acquired through acculturation and experience (Sloboda, 1986). Music is an excellent example of a complex event with features – especially rise time, loudness, tempo, and rising and falling acoustic contour patterns – that are likely to affect the arousal component of emotion. However, whether a complex organization of notes has the intrinsic capacity to go beyond arousal to elicit discrete emotions like fear, sadness, joy, etc., in the absence of experience or expectation, remains to be demonstrated (Meyer, 1957). One of the best studied of the features that can generate arousal is loudness. When presented with an acoustic stimulus of low intensity (e.g., less than 75 dB), infants characteristically show a heart-rate deceleration and the slowing of bodily activity characteristic of orienting. When the acoustic stimulus is of high intensity (e.g., 90 dB), the infant shows cardiac acceleration, jerky bodily movement, and other signs of a defensive response (Hatton, Berg, & Graham, 1970). Although less studied than loudness, intonational contours seem to have a bearing on emotion, with rising contours arousing, and descending contours soothing, the infant (Fernald, 1992). Studies of infants' emotional reactions to music similarly show clear reaction to tempo, loudness, and pitch; the reactions of infants to more complex aspects of musical composition remain to be demonstrated (Sullivan, Gentile, & Pick, 1998).

### *Co-evolution of Reception and Action*

The vast majority of researchers, from Darwin (1872/1965) to the present, have focused the bulk of their theoretical and empirical attention on the role that evolution plays in organisms' emotional expressions, especially facial expressions (e.g., Ekman, 1972;

Tomkins, 1962, 1963; for an exception see Fridlund, 1997). However, if emotions are relational and if they have signal value for others, then the recipient is indispensable to the emotion process. Typically, emotional displays are only effective in a social context if they are perceived and acted upon by another (Fridlund, 1997). From this viewpoint, evolution must necessarily play a role not only in the production of expressions, but also in the reception of others' emotional displays. This issue raises the question of whether there is a process, or a set of processes, by which the expressive responses of the human and the perception of those responses when made by others can be unified. We believe that there is such a process, and propose that motor mimicry, and feedback to the brain from the motor behavior, is the best candidate for explaining the co-evolution of response and reception. Two lines of empirical work suggest that phylogeny may contribute to organisms' sensitivities to others' emotional displays and influence subsequent action in response to such displays. The first line of evidence comes from work on human infants and the second from rhesus monkeys.

Researchers have demonstrated that infants, in their first days and even first hours of life, can imitate certain facial displays such as tongue protrusions and pursed lips (e.g., Meltzoff & Moore, 1977, 1983), although not robustly and not always replicably (Anisfeld, 1991; Anisfeld et al., 2001). Over the first few months of life, imitation becomes increasingly prominent in the life of the infant (Uzgiris & Hunt, 1975). Many researchers have interpreted the existence of imitation as a "meeting of the minds" between modeler and caregiver (e.g., Gopnik & Meltzoff, 1997), such that the infant can feel what the modeler is feeling (e.g., joy when seeing a smile). From both an evolutionary and a functionalist perspective on emotions, what is important is not that the infant feels a like emotion, but that the infant can predict the future behavior of the emoting person (Fridlund, 1997). Regardless of which stance one takes on the issue of feeling, some (e.g., Hoffman, 2000) have pointed out that motor mimicry and imitation form the basis for empathy and ultimately prosocial and moral development. Taken from this perspective, neonatal imitation may be a phylogenetically mediated mechanism and precursor to forecasting others' behaviors that has ready adaptive value for the infant and that enables the human to be integrated into the social fabric of the group.

The mechanism of imitation has important implications for explaining what otherwise seems to be a contradiction in the proposal that evolution works by recruiting simple featural elements, and not complex patterns of perception. An important study has shown that rhesus monkeys less than 2 months of age respond appropriately to the social signals of conspecifics even when reared in the absence of social experience. For instance, infant rhesus monkeys show marked avoidance reactions to the presentation of a staring, immobile face; on the other hand, the same monkeys approach a figure engaging in lipsmacking behavior (Kenney, Mason, & Hill, 1979).

At first scrutiny, this study suggests that infant rhesus monkeys show innate reactions to complex social signals, with obvious evolutionary adaptive value by permitting the monkey to react appropriately to other monkeys almost from the beginning of life. However, we think that the evolutionarily based tendency toward motor mimicry may account for these findings, if a staring figure creates through response matching a momentary state of immobility and this immobility feeds information to the brain that is assimilated into representations of prior aggressive actions by the perceiver. Such feed-

back, then, would generate a "meaning" to the perception of a stare and lead to the assumption of avoidance responses. Similarly, perception of lipsmacking may result in reproduction in some way of lipsmacks by the perceiver monkey. If the feedback to the brain from such imitative lipsmacks is assimilated to actions such as feeding, the "meaning" of the lipsmack would then be positive and result in approach behaviors.

Motor mimicry is a fundamental axiom of behavior, evident in the human and non-human primate in very early life without social learning. Such mimicry is an important building block for generating complex emotional meanings, such as those so critically provided to conspecifics by social signals.

### **Differentiation and Integration Processes in Emotional Development**

Evolution both prepares the infant for various organism–environment transactions that result in emotions and establishes very general constraints on the manifestation of emotions. However, evolutionary factors offer relatively limited insight into the actual changes that take place as emotion develops. As a result, the nature and course of emotional organization in infancy and beyond is specifically discovered through an examination of ontogenesis.

Infants' emotional lives change remarkably over the first 2 years of life. New emotions appear on the developmental landscape, and existing emotions undergo change in their own right. In the first few months, for example, the young infant shows neither shame nor pride, but by the end of the second year, these emotions are an active part of the infant's affective repertoire. Newborns do not smile in response to external events. By 2 months, however, infants not only smile to the outside world but do so especially to faces and voices of other human beings. Saying "no" to a 20-month-old may provoke a temper tantrum, but for a 6-month-old the word holds little meaning. When 4-month-olds are threatened by a looming stimulus, they will turn their heads away or raise their arms defensively; despite some reports to the contrary, newborns are not likely to do so.

What, then, are the starting points in the ontogenesis of emotion? One very widespread view, accepted by many cognitive and psychoanalytic theorists, is that the newborn is capable of manifesting only one emotion – a diffuse state of excitement, perhaps "tinged with unpleasure" (Bridges, 1932; Spitz, 1965). At about 4 weeks of age, the emotion of distress, characterized by a more clearly negative expressiveness, differentiates out of excitement. At 6 weeks, the emotion of joy branches off from excitement, characterized by the social smile directed principally to any face-like stimulus that consists of two adjacent eye-like dots, and a nodding oval contour. At 4 months, anger differentiates out of distress, at 6 months, disgust springs off from anger, and at 8 months, fear becomes evident. According to Bridges (1932) and others, this differentiation of discrete emotions from an originally diffuse arousal state constitutes a basic principle of emotional development.

Variants of Bridges's differentiation view persist to this day. Most recently, Camras (1992; see also Oster, Hegley, & Nagel, 1992) characterized certain facial and behavioral expressions of emotion as undifferentiated. Specifically, she reported that infant facial

patterns of distress—pain, anger, and sadness – patterns often interpreted as reflecting discrete emotional states (e.g., Izard, 1991) – frequently co-occur under a variety of contexts designed to elicit only anger, only sadness, or only distress. Given these observations, Camras argued that anger and sadness expressions in the first year simply reflect intensity differences in a highly undifferentiated “unhappiness” or distress reaction that builds up over time in response to aversive events. “Anger” facial expressions thus correspond not to anger as a qualitatively distinct state but to intense distress, just as “sadness” facial expressions reflect mild distress. Going beyond Bridges, Camras (1992) has proposed that these emotional expressions remain relatively undifferentiated even into the second year of life.

Although differentiation as a process certainly characterizes many aspects of emotional development, emotional organization as a whole seems far more articulated than many differentiation accounts suggest. The work of Weinberg and Tronick (1994), for example, has revealed a number of distinct positive and negative affect patterns in the repertoire of 6-month-olds. Infants in their research were studied during an initial face-to-face play interaction with their mothers, followed by a period in which their mothers looked at but did not respond to their infants, and a subsequent “reunion” period in which mothers reestablished dyadic play interaction. Examining patterns of coherence across different modes of expressive and instrumental actions – such as facial displays, vocalizations, gestures, postural orientation, and gaze behavior – Weinberg and Tronick reported the presence of four distinct affect configurations, each specific to certain periods of the interaction context. A “Social Engagement” configuration, specific to the context of initial play interaction and the reunion, involved infant facial expressions of joy and positive vocalizations coupled with gazing at the mother and the mouthing of hands or feet. During the period of maternal unresponsiveness, infants exhibited an “Object Engagement” configuration, involving gazing at and the mouthing of objects, general scanning activity of the room, and facial expressions of interest. Infants also demonstrated during this period distinct organizations of “Passive Withdrawal” – involving fussy vocalizations, sad facial expressions, and indicators of stress such as hiccupping and spitting up – and “Active Protest” – involving angry expressions, scanning behavior, crying, attempts to escape, as well as fussy vocalizations and stress indicators – which carried over into the reunion period of interaction as well.

Each of the configurations Weinberg and Tronick (1994) identified serves a specific function with respect to the infant's relation to the world. As their labels suggest, Social Engagement functions to establish and maintain contact with social others, Object Engagement focuses the infant on object exploration, Passive Withdrawal serves to disengage or withdraw the infant from interaction, and Active Protest functions to engage the infant in efforts to eliminate an obstacle.

If we approach the study of younger infants from this functionalist standpoint, we see evidence not for an undifferentiated state of excitement or distress but for more specific emotion systems (Sroufe, 1979, 1996). Under conditions of loss of support, the neonate will typically startle and draw his or her arms around the chest in what functions as a protective embrace (Peiper, 1963). This pattern of response contrasts sharply with the head withdrawal, arm-flailing, and pushing behavior we see in neonates whose nostrils have been inadvertently occluded during breastfeeding; these infants do not clasp in protective fashion but instead implement actions that function, however crudely, as a defen-

sive attack on the condition of respiratory occlusion (Gunther, 1961; Lipsitt, 1976). Yet another functionally distinct pattern of behavior surfaces when neonates encounter bitter-tasting substances; in this context, the infant retracts his or her lips and often extends his or her tongue in a facial action that functions to reject or orally discharge the offending substance (Steiner, 1979). In each of these cases, we see patterns of behavior that, when considered in relation to specific events, serve distinct functions of protection, obstacle removal, and rejection. Even the neonate, therefore, has an action repertoire sufficiently differentiated to deal with distinct forms of aversive stimulation.

Like Sroufe (1979, 1996), we argue for the presence of some distinct, precursor emotion organizations in the neonatal period, rather than for nothing but undifferentiated arousal. However, this in no way undermines the importance of a process like differentiation for the characterization of emotional development. Processes of differentiation transform aspects of the emotion process, such as facial expressions, instrumental actions, and evaluations, from more global, homogeneous organizations to specific, increasingly heterogeneous ones, but they do so with respect to distinct, protoemotion systems (Sroufe, 1996). An example from Buhler (1930) aptly demonstrates the differentiation process with respect to the protoanger system evident in the neonate. Buhler observed that young infants, when having their noses wiped, responded with undirected, whole-body movement; their arms and legs would move wildly without necessarily contacting the hand of the individual wiping their noses. Later in development, infants increasingly coordinated their arm movements to push aside the hand and resist having their noses wiped. By 8 months, infants began to prepare for nose wiping by swiping at the hand before it could reach their noses. Thus, in this example, the relational meaning of infants' action in the context of nose wiping – obstacle removal – provides a continuity in the organization of infant–environment transactions, but the specific properties of infant action in relation to an obstacle undergo increasing differentiation with development.

Differentiation is itself part of a larger process. Each differentiation in a system is accompanied by an integration or coordination of differentiated material. As differentiation serves to render systems less homogeneous and diffuse, integration establishes in differentiated systems new, more cohesive and stable organizations. These two processes routinely complement one another. Thus, the increasing specificity of infants' action in response to having their noses wiped constitutes both a differentiation from the more global whole-body reaction of the young infant and an integration/coordination of more specific action with specific targets of that action (i.e., the hand wiping the nose). Differentiation and integration imply one another, and the combined process constitutes a fundamental means of characterizing much of the change that occurs in emotional development. In the next two segments, we highlight the differentiation/integration process as it applies to perceptual processes and action components of infant emotional development.

### *Perceptual Differentiation/Integration in Early Emotional Development*

Recall that emotions do not involve stimuli or "emotion elicitors" at the input end – at the initiation of the emotional process. We prefer to use the term "engagement" to refer



to the process whereby person and event are unified into an affectively meaningful unit. To engage in the world, the individual must have adequate sensory capacities. At birth, those capacities can be extraordinarily limited, thereby minimizing the likelihood of engagement and hence emotional responding.

Take the social smile, for instance. The social smile is a response the infant begins to show between 4 and 6 weeks of age, first to auditory stimuli and then to visual ones (Wolff, 1987). This event is powerful for parents and bystanders alike to witness, and devastating when it is manifested abnormally (as with Down's syndrome infants; see Emde, Katz, & Thorpe, 1978). What brings about the social smile?

In all likelihood, the social smile, at least when construed in terms of visual engagement, is the result of major perceptual differentiation processes occurring in the infant's visual system. Newborns have a strong tendency to scan contours. This tendency is so strong that when they scan a face, the scan typically does not reach the interior of the face; rather, it stops at the high-contrast hairline of the face or the edge of the head. At around 6 weeks of age, the infant, possibly as a result of habituation processes, reduces the tendency to scan exterior contours and begins to scan the inside of the face, especially the eyes (Haith, Bergman, & Moore, 1977). We know that the smile can be elicited "artificially" by a cardboard containing an oval, two dark dots, and a hairline, presented in nodding fashion to the infant at the age of onset of the social smile (Spitz, 1965). This display is the event that engages the infant, that is assimilated to the experiences of being held and fed by the mother, and that brings about the social smile. Any process that minimizes the chance of the newborn shifting from scanning exterior contours to interior ones will, we predict, slow down the manifestation of the social smile to faces. Any process that accelerates the shift will similarly accelerate the social smile. (Note the role of both experience and biological preparedness for learning in this interpretation of social smiling to faces.)

The process of perceptual differentiation does not end with the onset of social smiling. As discussed, 2-month-olds begin to scan the internal features of the face but focus primarily on the eyes, especially when they view a talking face (Haith et al., 1977). Consequently, infants at this age may not be as sensitive to emotional information conveyed through other features of the face, such as the mouth. Between 4 and 5 months, however, infants expand their scanning of the face to routinely include multiple features, such as mouth and nose as well as eyes (Caron, Caron, Caldwell, & Weiss, 1973). As infants begin to process more features of the face, they in turn begin to integrate those features to establish the prototypical facial Gestalts of emotional expressions that adults readily recognize (Nelson, 1987). By 7 months, infants distinguish between some facial displays of positive (e.g., happiness) and negative (e.g., anger) emotions as well as among some facial displays of the same valence, such as sadness vs. anger or happiness vs. surprise (Ludemann & Nelson, 1988; Nelson, 1987; Soken & Pick, 1999). Thus, through processes of differentiation and integration, infants gradually forge sensitivities to many different social signals conveyed as facial displays.

There are many other instances of perceptual differentiation related to emotion. Among these is the differentiation of mother from stranger through the use of vision. For the infant to engage with the mother visually, he or she must be able to see her relatively clearly, especially from a variety of distances. This process of seeing persons clearly from



a distance develops remarkably slowly in the first 6 months of life (Banks & Salapatek, 1983; Kellman & Banks, 1998). The vision of the young child is extraordinarily smudgy and indistinct. Although there may be special orientations and distances under which infants in the first couple of months can see relatively clearly, and so can tell who is the mother and who is not, it is likely that such discriminations will be limited and context-bound. Not until the infant's visual resolution approaches more adult-like levels, beginning around 6 months (Banks & Salapatek, 1983), will the infant be able to identify the mother and establish an integrated, coherent scheme of her across a wide variety of situations. Consequently, the development of the child's attachment to the mother, especially either proximity-seeking or signaling to her across large distances (Bowlby, 1969), may need to await perceptual developments that do not become relatively well developed until 5 months or later. These considerations make it clear that differentiation and integration processes play an important role in emotional development.

### *Response Differentiation/Integration in Early Emotional Development*

Differentiation/integration processes apply not just to the evaluation side of the emotion process but also to the "response" side. We have already cited evidence from Buhler (1930) for a progressive differentiation and coordination of instrumental responding to events of restraint. Work by Stenberg and Campos (1990) on the development of anger-expressive patterning in 1-, 4-, and 7-month-old infants further underscores the presence of differentiation/integration processes in emotional development. In their study, anger was generated by gently holding the infant's arms but preventing them from readily moving, and the infant's facial and vocal expressions, as well as their instrumental behaviors, were recorded. The study yielded three important findings.

First, infants showed intense negativity in emotional reaction at every age tested. Facially, their reactions became coordinated into an anger-like pattern between 1 and 4 months of age. More specifically, infants' facial displays showed few components related to fear, disgust, sadness, or other negative emotions. At 1 month, the components shown were mostly, though not exclusively, those associated with anger; the infants lowered their brows and drew them together and they elevated their cheeks. However, they also showed two facial components that indicated incomplete, partially diffuse organization of facial movements. In one, they closed their eyes rather than narrowed them (as would be expected in an anger encounter), displaying a more general distress pattern. In the second, they stuck their tongues out rather than pulling the corners of the mouth back. Although they also vocalized negatively, 1-month-olds did not specifically target their expressions at anything relevant in the environment, looking instead all over the room in a relatively diffuse manner.

Second, by 4 months, infants' facial actions were more organized, with the eyes showing the expectable narrowing (rather than closing), and the oral region the prototypical pulled-back appearance. Moreover, the infants directed their facial movements toward the site of the frustration – the hands of the experimenter holding the infants' arms – suggesting that the emotional state had a target or an aim. The voice, too, showed greater coordination with the face. It was as if the facial movements were in the service

of vocalizing, because in general the vocalizations that were observed followed rather than preceded the facial patterning.

Third, at 7 months, a major reorganization took place not in the face or the voice, but in the targeting component of the emotion. The infants directed their expressions both to the frustrating experimenter as well as to the mother (who was a bystander in the testing procedure). Indeed, they vocalized only when looking at the person frustrating their movements, or at their bystander mothers.

There have not been many other studies that complement the picture Stenberg and Campos (1990) provide for progressive response organization and integration. Nevertheless, there are analogs in the development of the smile in the first few weeks of life. Infants' endogenous smiles are low intensity and involve simply turning up the corners of the mouth (Emde & Koenig, 1969). Infants' first waking smiles are of a slightly larger magnitude but still only involve turning up of the mouth corners (Emde, Gaensbauer, & Harmon, 1976; Wolff, 1987). Both smiling forms are due to the contraction of a single muscle (Ekman & Oster, 1979). By the end of the third week, however, infants' smiles begin to recruit other muscles and increasingly involve a brightening and crinkling of the eyes in conjunction with the contraction of the mouth corners to produce a full "grin" (Wolff, 1987).

Infants' emotional expressions (including facial and vocal, and possibly gestural and tactile), as well as instrumental behaviors, thus become more differentiated and articulated in the course of development. Ultimately, infants' increasingly articulated expressive and instrumental responses allow them to better achieve their goals and strivings in the world. As general processes, differentiation and integration offer a systematic way of outlining the course of emotional development, both in infancy and later in life. We now turn to more specific elements of the emotion process that organize its development.

## Cognitive Factors in Emotional Development

The study of emotion in the last 30 years has revolved to a large extent around the role that cognitive factors play in the generation of emotion (Lazarus, 1991). The role of cognition in emotion involves those aspects of emotion generation that are not immediately available in the stimulus array, in which processes such as memory, expectancy, belief, schemes, problem solving, and symbol systems structure a person's attempts to make sense of the world. Although cognition does not generate emotion by itself, without its linkage to something that makes it significant, it is nevertheless important to ask, "What role do cognitive factors play in the generation and development of infant emotion?"

### *Specific Cognitive Organizations and Emotional Development*

#### *Linking stages of sensorimotor intelligence to emotional development*

Anyone who has observed infants will notice a major transition in the second half of their first year. At this time, infants begin to show wariness and distress both in the presence

of strangers and in the absence of their primary caregivers. These robust phenomena are the starting points for many accounts which highlight the role of specific cognitive advances in the emergence of certain emotions. Some psychoanalytic theorists, for example, view stranger and separation distress as an outgrowth of the infant's emergent ability to mentally represent the mother – a representation that allows infants to notice discrepancies between mother and strangers and to keep the mother in mind even during her absence (Decarie, 1965; Spitz, 1965). Tests of this proposal have often relied on Piaget's (1954) developmental account of object permanence – the infant's understanding that people and objects exist independent of the infant's own perception and action. Specifically, the emergence of Stage 4 object permanence, in which infants begin to search for objects that are no longer visually present, occurs around the same time as stranger and separation distress appear in development. However, no evidence to date supports a relation between Stage 4 object permanence and either stranger or separation distress (Campos et al., 1983; Campos & Stenberg, 1981).

More empirically promising is the relation between development in self-awareness (an index of Stage 6 sensorimotor intelligence) and the emergence of embarrassment (M. Lewis, 1995). Between 15 and 18 months, infants whose noses have been marked with rouge demonstrate face and nose touching when they are placed in front of a mirror, indicative of mirror self-recognition. Prior to 15 months, infants in such a situation interact with the mirror itself but do not act as if they recognize themselves in it (M. Lewis & Brooks-Gunn, 1979). M. Lewis and his colleagues suggest that the emergence of mirror self-recognition indexes the acquisition of an objective self-awareness, in which infants begin to *consciously* reflect on themselves as individuals with a distinct identity. This acquisition must be in place, according to M. Lewis (1995), for infants to experience embarrassment. There is, in fact, a link between the development of objective self-awareness, indexed by mirror self-recognition, and the subsequent emergence of embarrassment (M. Lewis, Sullivan, Stanger, & Weiss, 1989).

Although evidence for links between specific sensorimotor intellectual advances and emotional development remains limited, no one can doubt the importance of cognitive organization in emotion. Clearly an understanding of absence plays a role in the developmental emergence of separation distress. We must keep in mind, however, the developmental nature of cognition in infancy. Piaget's object permanence involves six distinct stages of organization, each of which reflects the gradual consolidation of an understanding that self and other are distinct, integrated entities. Stage 4 object permanence elaborates on previous stages of object permanence; we cannot, as a result, isolate it as *the* point when infants begin to view their mothers as independent, integrated entities. Self-awareness, similarly, does not emerge fully formed with the arrival of mirror self-recognition but develops from previous forms.

If cognitive development is gradual and does not emerge fully formed, then it may be possible to observe less than fully formed manifestations of the emotion at earlier ages than the normative as well. That is precisely the case with separation distress, stranger distress, and embarrassment. Many mothers report a period of early stranger distress in infants between 3 and 6 months – a reaction that is not as strong, as consistent, or as independent of context as the reaction will be later. Similarly, some observers, such as Stayton, Ainsworth, and Main (1973), report a spurt in negative reactions to separation

at 5 months of age, but these reactions are observed principally in the home setting. Finally, M. Lewis et al. (1989) report that a substantial minority of infants who do *not* yet show mirror self-recognition nevertheless react with embarrassment.

### *Cognition in context: The role of ecological factors in cognition–emotion relations*

As we have noted, cognitive factors by themselves are not sufficient to generate emotion. Like shame, embarrassment involves not simply an objective self-awareness but a sense of being “under the watchful eye of the other” (Mead, 1934). The child in an embarrassing transaction must expect either a negative social signal for what he or she has done, or the absence of an expected positive signal. Most research on emotional development does not consider the importance of the child’s embeddedness in a specific ecology that, when combined with minimal cognitive developments, results in emotion. Similar considerations apply to separation and stranger distress. Separation from the mother is rare for the Japanese infant; when it occurs, it results in a far more intense reaction in the Japanese infant than in German infants, whose parents frequently leave them alone (Grossmann, Grossmann, Huber, & Wartner, 1981; Miyake, Chen, & Campos, 1985). Sadness, another emotion linked to the development of representation and thought to “emerge” at 6 months or so (Spitz, 1965), can be observed at much earlier ages if the circumstances facilitate its manifestation (such as being reared in abusive and neglectful situations; Gaensbauer, 1980).

### *General Cognitive Processes and Emotional Development*

#### *Memory and discrepancy from the familiar in the first 6 months*

More general cognitive processes such as memory and expectancy have also been implicated in emotional development. One such process involving memory development is the principle of discrepancy from the familiar (e.g., Hebb, 1946). Such discrepancy from the familiar is a crucial ingredient for all emotional processes as it signals noteworthy change in the person’s relation to his or her environment. An infant’s interest and arousal in the context of a novel event vary systematically with the degree of that event’s discrepancy from the infant’s past; this fundamental principle holds from the newborn period and beyond (Friedman, Bruno, & Vietze, 1974; McCall & Kagan, 1967). Repeated presentations of a stimulus (e.g., a vertical arrow) produce a waning of interest in infants – they habituate to the stimulus – and once familiarity is established, additional presentations will fail to reinvigorate infant attention. Presentation of a new stimulus (e.g., a diagonal arrow) will revive infant attention and arousal but only up to a point; with sufficient magnitudes of stimulus discrepancy (e.g., a horizontal arrow following familiarization with a vertical arrow), infant attention remains low.

The discrepancy principle has been extended beyond arousal to specific valenced emotions as well (Hebb, 1949; McCall & McGhee, 1977). Stimuli or events that moderately diverge from an infant’s past experience, that require some degree of effort to incorporate into memory (“effortful assimilation”), but that nonetheless ultimately comply with

memory, are said to result in positive emotion such as joy (Kagan, 1971). Events that actively conflict with infant memory – familiar in some respects but discrepant enough to prove incompatible with past experience – produce negative emotion such as fear, whereas highly familiar events that readily match memory provoke much less interest and even boredom from the infant (McCall & McGhee, 1977).

How does the discrepancy principle affect emotional *development*? In infancy, discrepancy from the familiar follows a two-step developmental sequence. In the infant's first 6 to 8 months, discrepancy takes the form of basic event recognition. Infants simply assess an event as matching or not matching their previous experience; in effect, their processing maps onto the question, "Have I encountered this event before or not?" (Schaffer, 1974). Instructive in this regard is work linking discrepancy to smiling via effortful assimilation. Seven-month-olds, who were habituated to a standard stimulus, smiled most and cried least when subsequently presented with a stimulus moderately discrepant from the standard (Hopkins, Zelazo, Jacobson, & Kagan, 1976). In work by Zelazo and Komer (1971), infants as young as 3 months smiled most midway through a series of repeated stimulus presentations, presumably at a point between initial unfamiliarity and well-established familiarity. The emergence of social smiling can thus be explained as evidence for infants' initial consolidation of memory for faces in general.

Similarly, the emergence of infant distress to an unresponsive, expressionless mother supports a discrepancy framework of explanation. Beginning around 3 months, infants cry and protest when their mothers simulate depression during face-to-face interaction (Cohn & Tronick, 1983). Around this time, infants begin to demonstrate marked sensitivity to routines and specific contingencies in dyadic interaction, suggesting that between 2 and 4 months infants establish expectations for how primary caretakers should interact with them (Rochat, Querido, & Striano, 1999). Thus, by 3 months of age, a stiff-faced, unresponsive mother conflicts with most infants' past experience, thereby generating negative affect.

### *Discrepancy from the familiar: The emergence of stranger anxiety*

Between 7 and 9 months, infants move beyond mere recognition in memory to rudimentary levels of recall (Meltzoff, 1988; Schaffer, 1974). Infants' processing of discrepancy consequently assumes a new form and establishes the basis for stranger distress. We previously reported that infants as young as 3 months show a muted form of stranger distress; at this time, infants recognize strangers as unfamiliar (Bronson, 1972). Between 7 and 9 months, however, infants no longer rate a stranger as simply unfamiliar but as *different from* their mothers, in effect asking the question "How does this event compare or relate to my other experiences?" (Schaffer, 1974). Kagan (1974) calls this new process "activation of hypotheses," in which infants actively scan their memory for the purpose of relating multiple representations to discrepant events. In general, the transition in discrepancy processing from recognition of familiarity to active comparison of events with stored memories reflects a shift from sequential to simultaneous processing. In the first 6 months, infants process events in isolation of other events and never contrast the processing of a current event with other event representations in their memory store. But after 6 months, simultaneous processing becomes evident, in which infants



compare/contrast discrepant events with stored representations of similar but different events (Schaffer, 1974).

### *Insufficiency of discrepancy in explaining emotional development*

Discrepancy processes play a critical role in emotion for infants and adults alike. Mismatches between events and our expectations – derived from past experience – render us attentive, increase our arousal, and prime us for meaningful interaction with the world. Discrepancy processes, however, are insufficient for explaining either the generation of specific emotions or emotional development in general. For example, the same event for the same infant can generate markedly different emotions depending on various contextual factors. Ten-month-olds, when presented with their mothers wearing a mask, invariably smile and frequently laugh when the presentation occurs at home, but show much less positive affect to the same event conducted in the lab; similarly, a stranger's approach elicits greater heart-rate acceleration in the lab than in the infant's home (Sroufe, Waters, & Matas, 1974). These results and others like them suggest that the specific quality of an infant's emotion depends on much more than an event and its discrepancy from past experience. Discrepancy affects emotional arousal levels and consequently the intensity of emotional responses and experience, but something more is needed to account for specific, valenced emotions such as fear and joy (M. Lewis & Goldberg, 1969; Sroufe, Waters, & Matas, 1974; Stechler & Carpenter, 1967).

What is needed, in fact, is a way to turn "cold" cognitive processes – like discrepancy – and structures – like object permanence and objective self-awareness – into "hot" cognitions, cognitions that *evaluate* events and as a result render events significant and emotion-relevant (Campos & Barrett, 1984; Sroufe, 1996). One such candidate is the process of appraisal, to which we now turn.

### *Appraisal Processes and Emotional Development*

Sroufe's emphasis on the context of events in generating emotion underscores the need to embed general cognitive processes such as discrepancy from the familiar in a larger organizational framework. With the notion of appraisal, researchers have specifically begun to view cognition's influence on emotion within a larger motivational context. Appraisal represents a special form of cognition that involves the infant's evaluation of an event in terms of its significance or relevance for his or her goals and concerns (Campos & Barrett, 1984). As such, appraisal is an integral part of the emotion process and is not considered a purely cognitive process but a cognitive-motivational process (Barrett & Campos, 1987; Mascolo & Fischer, 1995; Mascolo & Harkins, 1998).

The cognitive transition from sequential to simultaneous processing gains new meaning when we embed it in significant transactions between the infant and the world. Between 6 and 9 months, infants' affective exchanges with their caregivers extend beyond the realm of dyadic interaction to triadic interaction, a process termed "secondary inter-subjectivity" (Trevvarthen & Hubley, 1978). In effect, infants begin to share emotion with their caregivers *about* a third event – such as an object in the environment or another



person – and to understand that others' emotional displays and gaze patterns can refer to people and events outside the caregiver–infant dyad (Bates, 1979). This shift in emotional communication relies on the emergence of simultaneous processing – infants must appreciate the emotion communicated by the caregiver in simultaneous relation to a distinct event or person – but is not reducible to purely cognitive processes, for secondary intersubjectivity is ultimately about a new form of affective sharing in infancy.

*Social referencing: An example of appraisal in infancy*

Social referencing, a fundamental appraisal process, is perhaps the emotional cornerstone of secondary intersubjectivity. Infants who social reference use the facial, vocal, and gestural affective displays of others to evaluate ambiguous events and to regulate subsequent action in relation to those events (Campos & Stenberg, 1981). This process relies on the infant's being able to relate the valenced meaning conveyed by a social other to an event whose meaning is not clear cut – such as the presence of a novel toy, the approach of a stranger, or the drop-off of a support surface on the visual cliff. Infants as young as 9 months do indeed relate the general positive or negative affective meaning conveyed by social others to ambiguous people/events and adjust their responses to the person/event accordingly. If, for example, a mother displays fear in relation to the drop-off edge of the visual cliff, infants rarely cross the cliff to their mothers, but in the context of a happy display from the mother, infants readily cross (Sorce, Emde, Campos, & Klinnert, 1985); similarly, infants respond much more positively to a stranger's approach or to a strange toy when their mothers react to the event with smiles and positive vocalizations (Boccia & Campos, 1989; Feinman & Lewis, 1983; Mumme, Fernald, & Herrera, 1996).

The process of social referencing tailors the cognitive emergence of simultaneous processing to the emotion system proper; it involves evaluations of situations that directly affect infants' goals and strivings and makes use of expressive behavior via the face, voice, and gesture. In investigations of the development of pride, shame, and guilt, Mascolo and Fischer (1995) also address cognitive factors from the standpoint of appraisal. Pride appraisals, for example, involve self-evaluations of *responsibility* for acting in ways that garner social approval (Mascolo & Harkins, 1998). Pride appraisals originate, according to Mascolo and his colleagues, in the infant's detection of contingencies between his or her action and its effects. Infants as young as 2 months smile when their actions affect outcomes in the world. At the end of the first year, infants begin to establish more complex action–effect contingencies by enjoying both the immediate effects of their action and the positive reactions from social others to their action. Toward the end of the second year, infants begin to reflect on their action as a product of their own agency (Mascolo & Fischer, 1995). Although this and other appraisal sequences for shame and guilt take root in general forms of infant cognitive development, the appraisal component itself involves specific forms of cognition, such as notions of responsibility and evaluations of social approval, that intimately relate to the strivings of the infant.

*Stranger and separation reactions as disruptions of expectations about communication*

Cognitive advances in object permanence and self-awareness as well as cognitive processes such as memory and expectancy have been theoretically and empirically linked to emo-

tional development in infancy. But none of these factors holds inherent meaning for the emotional life of the infant; as a result, we must approach cognitive factors from the standpoint of relational meaning patterns in emotion and ultimately embed "cold" cognitions within a motivational context of the infant's goals and strivings. Such a consideration sheds new light on the very phenomena that have inspired traditional cognitive explanations in emotional development: stranger and separation distress. Factors such as memory and expectancy may indeed play a role in these developments, but to fully understand that role, we must reconceptualize these factors from the standpoint of significance in the infant's life.

To this end, separation and stranger distress may emerge as a consequence of specific expectations infants have for how social others should behave when communicating with them (Bower, 1977). With the emergence of primary intersubjectivity at 2 to 3 months, infants and their primary caregivers gradually co-construct unique modes of communicating and sharing emotion with one another, consisting of specific and routinized sequences of facial signaling, vocalizing, gesturing, body orientation, and tactile contact. These communication modes have powerful regulatory effects on infant arousal levels and emotional state (Tronick, 1989). Eventually, infants come to expect these specific forms of communication in the context of social interaction. Infants for whom these expectations are consolidated will encounter a rather dramatic violation of expectancy when a stranger interacts with them; similarly, when separated from the primary caregiver, these same infants will be without an important source of emotional regulation via the loss of a significant communicational partner. By couching the emergence of stranger and separation distress in the context of infant-caregiver communication patterns and their regulatory consequences, we can see why, for example, infants are most likely to react with distress when a stranger tries to interact with them but rarely ever show distress to the mere presence of a stranger (Schaffer, 1971).

## Multiple Component Processes and Emotional Development

### *The Importance of Context in Emotion and Its Development*

Appraisal processes in emotional development highlight the importance of embedding one component of the emotion process – cognition – within a context of other components – goals and strivings. Equally important is the consideration of *physical* and *social contexts* when studying the emotion process and its development. Context is crucial as a factor that affects the manifestation of emotion in a specific emotional transaction, and also as a catalyst that helps to organize the development of emotion. We will illustrate these points in this section of the chapter.

The word "context" is usually taken to mean the presence or absence of some environmental factor in relation to a person's behavior. For example, an infant's reaction to a stranger will be rather different depending upon whether the mother is or is not present in the testing room. The mother's presence is thus a contextual factor in stranger distress (see Sroufe et al., 1974). However, for us, context involves much more than just modu-

lation of emotional responding. In a relational approach to emotion, context refers to the broad social, economic, and historical *ecology* within which the infant is developing, and it simultaneously refers to the *appropriateness of the fit* of the infant into that ecological niche. Viewed in this way, not only does the infant develop, but so too does the environment. The concepts of harmony, discord, and reciprocity between the infant's behavior and that of caregivers are thus crucial for understanding developmental transitions in emotion.

### *Examples of the role of context in real-time interaction*

The work of Fogel and his colleagues illustrates the importance of one aspect of context – the type of behavior of the mother and the type of games she plays with her infant – for the organization of infant's expressive behavior during dyadic interaction. Fogel's work demonstrates how specific factors in the play of caregiver and infant shape the forms that infant smiling behavior assumes (Dickson, Walker, & Fogel, 1997). Twelve-month-olds' smiles in the play context of book reading typically consist only of lip-corner raises. During physical play, open-mouth smiling prevails, and when caregivers vocalize with their infants, infant smiling includes both lip-corner raises and contraction of the muscles surrounding the eyes. Fogel's work thus advances our understanding of the way that parents' behavior can help to organize infants' expressive behavior.

### *Context and the parent-child system*

Context can have an impact broader than the organization of emotional expression (Sander, 1964). Emotional development does not take place in a social vacuum: the infant's development is indissociably tied in with developmental tasks the baby and the mother jointly face. How these developmental tasks are resolved can profoundly affect personality development.

Sander proposes five developmental tasks that mothers and infants jointly face in the first two years of life. One concerns coordination of patterns of feeding, quieting, sleep, and arousal regulation (birth to 3 months). A second deals with newly emerged smiling and vocalization patterns (4–6 months). A third revolves around the child's new initiative skills (7–9 months). A fourth involves issues relating to the establishment of the mother as the principal attachment figure (10–12 months). And the fifth centers on the emergence of the infant's self-assertion (15 to 20 months of age). Posing context as Sander does in terms of broad patterns in parent-child interactions is very valuable. For example, it shows how mothers can react very differently to the way a baby develops emotionally. A mother who is very happy dealing with a dependent and relatively helpless infant (Phases 1 and 2) may become saddened, upset, and less sensitive toward the infant when the infant becomes increasingly autonomous (Phase 3). If so, the mother may inadvertently create a context in which the child's *fit* with her behavior shifts from harmonious to disruptive. (The reverse can also be true, if the mother values the newfound autonomy of her baby and moves away from disliking the baby as helpless to seeing the baby as more grown up.) A similar consideration applies to the role of the father. A father who has enjoyed playing with his baby in Phase 3 may be disturbed when he sees the baby

making the mother his or her first love in Phase 4. Sander has shown (1962, 1964) how interactional failures in the parents' and the child's navigation of these developmental tasks can result in personality disorders later on. In sum, one must take into account the context – the appropriateness of fit between baby and parents – to understand normal and deviant emotional development.

### *Context and Beyond: The Multicomponential Nature of Emotional Development*

Recognizing the critical role context plays in the emotion process underscores the need to view emotional development as a multicomponent process, comprised of elements such as action and action tendency, goals and concerns, physiological, appraisal, and experiential feeling components, as well as social and physical context components. Just as no one component serves as criterion for emotion in its mature form, no one component of the emotion process serves as criterion for either a given developmental level of organization in emotion or a transition between levels of organization in development. Thus, characterizing the emotional life of a 4-month-old – as distinct from an 8-month-old – requires more than simply knowing the child's appraisal skills, because event appraisals necessarily depend on the actions available to the infant for engaging the event (Campos et al., 1994). We must also know the action repertoire available to the 4-month-old. But this is only half the picture, for we must also know about the world in which the 4-month-old resides, the social and physical contexts in which the infant is embedded. Our evaluations of and actions on the world are both an outgrowth and organizer of our transactions with the world.

If the emotion process consists of multiple, interrelated components, then emotional development stems from systematic changes in the interactions among these components (Fogel et al., 1992). Both individual developments of particular components themselves and interactions among components establish organizational changes in emotion; to understand emotional development, therefore, requires an assessment of how the components of emotion interact to produce behavior at different levels of developmental organization, from birth forward (M. D. Lewis, 2000; M. D. Lewis & Granic, 1999; Mascolo & Griffin, 1998).

Change in one component of emotion may destabilize the system, but establishment of a new developmental organization in emotion requires consideration of all its components in interaction with one another. As a result, physical and social contextual factors are as important as intrapersonal factors such as appraisal in conceptualizing emotion, both in its real-time unfolding and in its developmental organizations. As active, self-organizing processes, emotions take root directly in activity geared toward adaptation in the world. Emotions, in brief, develop through person–environment transactions (Campos et al., 1994; Griffin & Mascolo, 1998; Thompson, 1993). We now illustrate these fundamental principles by detailing how a major transition in person–environment relations – the onset of crawling – incites sweeping reorganization in emotion and how the actual process of reorganization derives from new interactions among various elements of the emotion system.

*Locomotor experience and emotional development*

Crawling and the experience it generates affect the emotional life of the infant in profound ways. With the onset of crawling, infants have at their disposal a new means of acting on the world and adapting to the world. In the literature on infant attachment, crawling has long been considered an important step for the emergence of specific attachments to caregivers; using the caregiver as a secure base from which to explore the world intimately depends on the availability of independent movement for the infant (Ainsworth, Blehar, Waters, & Wall, 1978; Bowlby, 1969). Through crawling and the newfound autonomy it provides, infants can not only entertain new goals but also more fully explore existing goals. The crawling infant furthermore affects the social system in which he or she is embedded. Caregivers must regulate the infant's newfound opportunities for exploration to ensure their infants' safety, which in turn impacts communication patterns between caregiver and infant.

Caregivers, in fact, report major increases in their infants' displays of anger and temper tantrums following crawling onset (Campos, Kermoian, & Zumbahlen, 1992). Once infants begin to crawl, caregivers themselves target more positive affect toward infant exploration and the discovery of new events and situations. At the same time, caregivers begin to assign a more sophisticated intentionality to their infants and treat them as more responsible for their actions. This change, coupled with the increased chance for a mobile infant to encounter dangerous situations, produces a substantial increase in parental targeting of fear and anger to their infants once crawling begins (Campos, Bertenthal, & Kermoian, 1992; Zumbahlen & Crawley, 1996).

In short, the onset of crawling, a basic action component of the process of relating to the world, prompts the need for fundamental reorganization in the infant's emotional life, both at the level of infant affectivity and at the level of the emotional climate in which the infant resides. Once infants begin to crawl, their goals, evaluations, expectations, and interactions with others undergo major transition in conjunction with the new adaptive demands they face. The organization of the infant's emotional life consequently assumes new forms as various components of the emotion process reestablish stable interaction with one another. One of these new forms is the emergence of wariness of heights. In what follows, we outline an account for this new form of fear in infancy that vividly instantiates the need to view emotional development as a self-organizing, multicomponent system. The account demonstrates how crawling experience prompts a reorganization in the way infants register self-motion by providing new opportunities for infants to relate what their eyes tell them is their motion with what their body feels is their motion. This reorganization, in turn, affects how infants control their posture and ultimately generates expectations about the information available for self-motion detection. It is under conditions which violate these expectations that fear is aroused.

*The emergence of wariness of heights: An example*

It is well established that experience with self-produced locomotion, either through crawling or through the use of a "walker," gives rise to wariness of heights (Campos, Bertenthal et al., 1992; Campos, Hiatt, Ramsay, Henderson, & Svejda, 1978). How



crawling experience ultimately engenders fear of heights, however, remains open to speculation. We present here an account for wariness of heights that relies on work done with adults on height vertigo. Brandt and his colleagues have demonstrated that height vertigo derives from conflict in information available for determining self-motion (Brandt, Arnold, Bles, & Kapteyn, 1980; Brandt, Bles, Arnold, & Kapteyn, 1979). Extensive evidence suggests that as adults, we use both visual information and information derived from the vestibular system to judge our movement in the world and that we rely on what we see to maintain our posture and balance, as is evident when we shut our eyes while standing (e.g., Dichgans & Brandt, 1978; Lee & Lishman, 1975; Lishman & Lee, 1973). Brandt and his colleagues argue that adults implicitly expect what they see to correspond to their internally derived sensations of motion. Such a correspondence is violated under conditions likely to produce height vertigo. When we stand at the edge of a cliff, our normal body sway tells us, via the vestibular system, that we are moving, but our eyes tell us next to nothing about our body sway because normally available optical textures in our surround – such as the ground stretching out in front of us – are largely absent. They are too far away to be noticed or to be effective. To overcome the conflict, adults typically increase their postural sway to generate motion in their visual surround, but this ultimately results in greater postural instability and height vertigo.

We have extended this argument to the emergence of wariness of heights in infancy by suggesting that experience with crawling sets in motion processes that ultimately establish infant expectations of specific correspondence between visual and vestibular sources of self-motion information (e.g., Bertenthal & Campos, 1990; Campos, Kermoian, & Witherington, 1996). First, with experience in crawling, infants demonstrate a new sensitivity to certain forms of visual motion information for controlling their posture (Higgins, Campos, & Kermoian, 1996). Specifically, crawling infants begin to use patterned visual information available in their peripheral visual field to determine self-motion.

Second, crawling experience establishes specific correspondences between visual and vestibular information for self-motion. When infants are passively moved, nothing compels them to look in their direction of motion; as a result, they will not consistently generate the visual information in the peripheral visual field that accompanies forward motion. Crawling infants, on the other hand, typically look in their direction of motion and consequently experience specific, correlated information about their movement from both the visual and vestibular systems.

Third, crawling infants form expectations about this correlated input. In fact, crawling infants rely more than ever on information for self-motion because their newly established mobility carries with it increased encounters with postural instability. The specific expectations infants establish for correlated input are in the service of maintaining postural stability and are as a result imbued with affective significance for the infant. Loss of support and the vestibular input accompanying it are a significant source of negative emotion throughout development (Campos & Bertenthal, 1989; Jersild, 1946).

Thus, crawling experience lays the foundation for systematic changes in perception, action, and cognition which in turn organize a new form of fear in context: wariness of heights. We, in fact, have preliminary evidence to suggest that increases in infants' sensitivity to peripheral visual information for controlling body posture directly map



onto demonstrations of wariness of heights (Witherington, Kermoian, & Campos, 2001). Such evidence underscores both the potential for this specific account and the need for accounts in general that treat emotion and its development as a complex, multicomponent process.

## Conclusion

Emotions are multifaceted processes, and explaining their development requires a multifaceted approach. Emotion as a process is comprised of many components – both intra- and extraorganismic – all of which contribute to its organization at any given time and to transformations in its organization across development. Characterizing emotion in terms of its components and their interactions affords us insight into the nature of the developmental process itself. We fully capture emotional development, in turn, when we derive from this multicomponential analysis a synthetic rendering of person–environment relations across development. Such a synthesis as yet eludes the study of emotion in any period of development. Still, by treating emotion in relational terms, as the outgrowth of evaluations and actions in physical and social contexts, we know where to tap critical transition points in emotional development. It is at points in development when the person's relation to his or her environment is fundamentally altered that we know the person's emotional life will reorganize. For the infant, motoric changes should serve as major transition points in emotional development. We have already outlined the important emotional changes that arrive with crawling experience. Other motoric transitions, such as the emergence of smooth-pursuit eye tracking, visually guided reaching and grasping, independent sitting, standing and walking, all potentially mark major reorganizations in the infant's emotional stance toward the world. Notwithstanding work on infant crawling, relatively little research to date has mined the potential of these important developmental transitions (Biringen, Emde, Campos, & Appelbaum, 1995; M. D. Lewis, 1993; Witherington, 1999).

With each motoric transition, infants establish more effective means of meaningfully interacting with the social and physical world. New means of action fundamentally alter the manner in which infants implement their existing goals/strivings and establish for the infant new sets of goals, as well. In essence, emotional development in infancy revolves around systematic changes in the way infants *regulate* their goal-directed activity, their significant engagement with the people and things that surround them. At every point in development, then, emotion can be viewed from the standpoint of its regulatory effects on person–environment relations. Emotional development is *not* about trying to control our emotions *per se*, as the literature sometimes suggests. The emotion system is *inherently regulatory*, and to study it we must look at the functional relations between person and environment. We must establish what the person is trying to do to understand anything about his or her emotional stance toward the world. It is at this level – the level of infants regulating their relation to the world – that the fundamental and most significant properties of infant emotional development will be discovered.

## References

- Ainsworth, M., Blehar, M., Waters, E., & Wall, S. (1978). *Patterns of attachment: A psychological study of the Strange Situation*. Hillsdale, NJ: Erlbaum.
- Anisfeld, M. (1991). Neonatal imitation. *Developmental Review*, 11, 60–97.
- Anisfeld, M., Turkewitz, G., Rose, S. A., Rosenberg, F. R., Sheiber, F. J., Couturier-Fagan, D. A., Ger, J. S., & Sommer, I. (2001). No compelling evidence that newborns imitate oral gestures. *Infancy*, 2, 111–122.
- Banks, M. S., & Salapatek, P. (1983). Infant visual perception. In P. H. Mussen (Series Ed.) & M. Haith & J. J. Campos (Vol. Eds.), *Handbook of child psychology: Vol. 2. Infancy and developmental psychobiology* (4th ed., pp. 435–571). New York: Wiley.
- Barrett, K. C. (1998). A functionalist perspective to the development of emotions. In M. F. Mascolo & S. Griffin (Eds.), *What develops in emotional development?* (pp. 109–133). New York: Plenum Press.
- Barrett, K. C., & Campos, J. J. (1987). Perspectives on emotional development: II. A functionalist approach to emotions. In J. D. Osofsky (Ed.), *Handbook of infant development* (2nd ed., pp. 555–578). New York: Wiley.
- Bates, E. (1979). Intentions, conventions, and symbols. In E. Bates, L. Benigni, I. Bretherton, L. Camaioni, & V. Volterra (Eds.), *The emergence of symbols: Cognition and communication in infancy* (pp. 33–68). New York: Academic Press.
- Bertenthal, B., & Campos, J. J. (1990). A systems approach to the organizing effects of self-produced locomotion during infancy. In C. Rovee-Collier & L. P. Lipsitt (Eds.), *Advances in infancy research* (Vol. 6, pp. 1–60). Norwood, NJ: Ablex.
- Biringen, Z., Emde, R. N., Campos, J. J., & Appelbaum, M. I. (1995). Affective reorganization in the infant, the mother, and the dyad: The role of upright locomotion and its timing. *Child Development*, 66, 499–514.
- Boccia, M., & Campos, J. J. (1989). Maternal emotional signals, social referencing, and infants' reactions to strangers. In N. Eisenberg (Ed.), *New directions for child development* (Vol. 44, pp. 25–49). San Francisco: Jossey-Bass.
- Boiten, F. (1996). Autonomic response patterns during voluntary facial action. *Psychophysiology*, 33, 123–131.
- Bower, T. G. R. (1977). *A primer of infant development*. San Francisco: W. H. Freeman.
- Bowlby, J. (1969). *Attachment and loss: Vol. 1. Attachment*. New York: Basic Books.
- Bowlby, J. (1973). *Attachment and loss: Vol. 2. Separation*. New York: Basic Books.
- Brackbill, Y., Adams, G., Crowell, D., & Gray, M. (1966). Arousal level in neonates and preschool children under continuous auditory stimulation. *Journal of Experimental Child Psychology*, 4, 178–188.
- Brandt, T., Arnold, F., Bles, W., & Kapteyn, T. S. (1980). The mechanism of physiological height vertigo I. Theoretical approach and psychophysics. *Acta Otolaryngologica*, 89, 513–523.
- Brandt, T., Bles, W., Arnold, F., & Kapteyn, T. S. (1979). Height vertigo and human posture. *Advances in Oto-Rhino-Laryngology*, 25, 88–92.
- Bridges, K. (1932). Emotional development in early infancy. *Child Development*, 3, 324–341.
- Bronson, G. W. (1972). Infants' reactions to unfamiliar persons and novel objects. *Monographs of the Society for Research in Child Development*, 37 (3, Serial No. 148).
- Buhler, C. (1930). *The first year of life*. New York: Day Press.
- Cacioppo, J. T., Klein, D. J., Berntson, G. G., & Hatfield, E. (1993). The psychophysiology of emotion. In M. Lewis & J. M. Haviland (Eds.), *Handbook of emotions* (pp. 119–142). New York: Guilford Press.

- Campos, J. J. (1985, August). *Current issues in the study of emotion and emotional development*. Paper presented at a symposium on cognition-emotion relations at the meetings of the American Psychological Association, Los Angeles, CA.
- Campos, J. J., & Barrett, K. C. (1984). Toward a new understanding of emotions and their development. In C. E. Izard, J. Kagan, & R. B. Zajonc (Eds.), *Emotions, cognition, and behavior* (pp. 229-263). Cambridge: Cambridge University Press.
- Campos, J. J., Barrett, K. C., Lamb, M. E., Goldsmith, H. H., & Stenberg, C. (1983). Socio-emotional development. In P. H. Mussen (Series Ed.) & M. Haith & J. J. Campos (Vol. Eds.), *Handbook of child psychology: Vol. 2. Infancy and developmental psychobiology* (4th ed., pp. 783-915). New York: Wiley.
- Campos, J. J., & Bertenthal, B. I. (1989). Locomotion and psychological development in infancy. In F. Morrison, C. Lord, & D. Keating (Eds.), *Applied developmental psychology* (Vol. 3, pp. 229-258). New York: Academic Press.
- Campos, J. J., Bertenthal, B. I., & Kermoian, R. (1992). Early experience and emotional development: The emergence of wariness of heights. *Psychological Science*, 3, 61-64.
- Campos, J. J., Hiatt, S., Ramsay, D., Henderson, C., & Svejda, M. (1978). The emergence of fear on the visual cliff. In M. Lewis & L. Rosenblum (Eds.), *The development of affect* (pp. 149-182). New York: Plenum Press.
- Campos, J. J., Kermoian, R., & Witherington, D. (1996). An epigenetic perspective on emotional development. In R. D. Kavanaugh, B. Zimmerberg, & S. Fein (Eds.), *Emotion: Interdisciplinary perspectives* (pp. 119-138). Mahwah, NJ: Erlbaum.
- Campos, J. J., Kermoian, R., & Zumbahlen, M. (1992). Socioemotional transformations in the family system following infant crawling onset. In N. Eisenberg & R. A. Fabes (Eds.), *New directions for child development: Emotion and its regulation in early development* (Vol. 55, pp. 25-40). San Francisco: Jossey-Bass.
- Campos, J. J., Mumme, D. L., Kermoian, R., & Campos, R. G. (1994). A functionalist perspective on the nature of emotion. In N. Fox (Ed.), *The development of emotion regulation: Biological and behavioral considerations* (pp. 284-303). *Monographs of the Society for Research in Child Development*, 59 (2-3, Serial No. 240).
- Campos, J. J., & Stenberg, C. R. (1981). Perception, appraisal, and emotion: The onset of social referencing. In M. E. Lamb & L. R. Sherrod (Eds.), *Infant social cognition: Empirical and theoretical considerations* (pp. 273-314). Hillsdale, NJ: Erlbaum.
- Camras, L. A. (1992). Expressive development and basic emotions. *Cognition and Emotion*, 6, 269-283.
- Camras, L. A., Oster, H., Campos, J., Campos, R., Ujiie, T., Miyake, K., Wang, L., & Meng, Z. (1998). Production of emotional facial expressions in European American, Japanese, and Chinese infants. *Developmental Psychology*, 34, 616-628.
- Caron, A. J., Caron, R. F., Caldwell, R. C., & Weiss, S. J. (1973). Infant perception of the structural properties of the face. *Developmental Psychology*, 9, 385-399.
- Cohn, J. F., & Tronick, E. Z. (1983). Three-month-old infants' reaction to simulated maternal depression. *Child Development*, 54, 185-193.
- Cook, M., & Mineka, S. (1990). Selective associations in the observational conditioning of fear in rhesus monkeys. *Journal of Experimental Psychology: Animal Behavior Processes*, 16, 372-389.
- Cosmides, L., & Toobey, J. (2000). Evolutionary psychology and the emotions. In M. Lewis & J. M. Haviland-Jones (Eds.), *Handbook of emotions* (2nd ed., pp. 91-115). New York: Guilford Press.
- Darwin, C. (1965). *The expression of the emotions in man and animals*. Chicago: University of Chicago Press. (Original work published 1872)

- Decarie, T. (1965). *Intelligence and affectivity in early childhood*. New York: International Universities Press.
- Dichgans, J., & Brandt, T. (1978). Visual-vestibular interactions: Effects on self-motion and postural control. In R. Held, H. W. Leibowitz, & H. L. Teuber (Eds.), *Handbook of sensory physiology* (Vol. 8, pp. 755-804). Heidelberg: Springer.
- Dickson, K. L., Walker, H., & Fogel, A. (1997). The relationship between smile type and play type during parent-infant play. *Developmental Psychology*, 33, 925-933.
- Dondi, M., Simion, F., & Caltran, G. (1999). Can newborns discriminate between their own cry and the cry of another newborn infant? *Developmental Psychology*, 35, 418-426.
- Ekman, P. (1972). Universals and cultural differences in facial expressions of emotion. In J. Cole (Ed.), *Nebraska symposium on motivation* (pp. 207-283). Lincoln, NE: University of Nebraska Press.
- Ekman, P. (1999a). Basic emotions. In T. Dalgleish & M. Power (Eds.), *Handbook of cognition and emotion* (pp. 45-60). New York: Wiley.
- Ekman, P. (1999b). Facial expressions. In T. Dalgleish & M. Power (Eds.), *Handbook of cognition and emotion* (pp. 301-320). New York: Wiley.
- Ekman, P. W., Levenson, R. W., & Friesen, W. V. (1983). Autonomic nervous system activity distinguishes among emotions. *Science*, 221, 1208-1210.
- Ekman, P., & Oster, H. (1979). Facial expressions of emotion. *Annual Review of Psychology*, 30, 527-554.
- Emde, R. N., Gaensbauer, T., & Harmon, R. J. (1976). Emotional expression in infancy: A bio-behavioral study. *Psychological Issues Monograph Series*, 10(37), 1-198.
- Emde, R. N., Katz, E. L., & Thorpe, J. K. (1978). Emotional expression in infancy: II. Early deviations in Down's syndrome. In M. Lewis & L. A. Rosenblum (Eds.), *The development of affect* (pp. 351-360). New York: Plenum Press.
- Emde, R. N., & Koenig, K. (1969). Neonatal smiling and rapid eye movement states. *Journal of American Academic Child Psychiatry*, 8, 57-67.
- Feinman, S., & Lewis, M. (1983). Social referencing at ten months: A second-order effect on infants' responses to strangers. *Child Development*, 54, 878-887.
- Fernald, A. (1992). Meaningful melodies in mothers' speech to infants. In H. Papoušek, U. Jürgens, & M. Papoušek (Eds.), *Nonverbal vocal communication: Comparative and developmental approaches* (pp. 262-282). Cambridge: Cambridge University Press.
- Fischer, K. W., & Tangney, J. P. (1995). Self-conscious emotions and the affect revolution: Framework and overview. In J. P. Tangney & K. W. Fischer (Eds.), *Self-conscious emotions: The psychology of shame, guilt, embarrassment, and pride* (pp. 3-22). New York: Guilford Press.
- Fogel, A., Nwokah, E., Dedo, J. Y., Messinger, D., Dickson, K. L., Matusov, E., & Holt, S. A. (1992). Social process theory of emotion: A dynamic systems approach. *Social Development*, 1, 122-142.
- Fridlund, A. J. (1997). The new ethology of human facial expressions. In J. A. Russell & J. M. Fernandez-Dols (Eds.), *The psychology of facial expression* (pp. 103-129). Cambridge: Cambridge University Press.
- Friedman, S., Bruno, L. A., & Vietze, P. (1974). Newborn habituation to visual stimuli: A sex difference in novelty detection. *Journal of Experimental Child Psychology*, 18, 242-251.
- Frijda, N. (1986). *The emotions*. Cambridge: Cambridge University Press.
- Gaensbauer, T. J. (1980). Anaclitic depression in a three-and-one-half-month-old child. *American Journal of Psychiatry*, 137, 841-842.
- Garcia, J., & Koelling, R. A. (1966). Relation of cue to consequence in avoidance learning. *Psychonomic Science*, 4, 123-124.

- Goethe, F. (1940). Beobachtungen und Versuche über angeborene Schreckreaktionen junger Auerhühner (*Tetrao u. urogallus* L.). *Zeitschrift Tierpsychologie*, 4, 165–167.
- Goleman, D. (1995). *Emotional intelligence*. New York: Bantam Books.
- Gopnik, A., & Meltzoff, A. N. (1997). *Words, thoughts, and theories*. Cambridge, MA: MIT Press.
- Gould, J. L. (1982). *Ethology: The mechanisms and evolution of behavior*. New York: W. W. Norton.
- Griffin, S., & Mascolo, M. F. (1998). On the nature, development, and functions of emotions. In M. F. Mascolo & S. Griffin (Eds.), *What develops in emotional development?* (pp. 3–27). New York: Plenum Press.
- Grossmann, K. E., Grossmann, K., Huber, F., & Wartner, U. (1981). German children's behavior towards their mothers at 12 months and their fathers at 18 months in Ainsworth's Strange Situation. *International Journal of Behavioral Development*, 4, 157–181.
- Gunther, M. (1961). Infant behavior at the breast. In B. Foss (Ed.), *Determinants of infant behavior* (Vol. 1, pp. 37–44). London: Methuen.
- Haig, B., & Durrant, R. (2000). Theory evaluation in evolutionary psychology. *Psychological Inquiry*, 11, 34–38.
- Haith, M. M., Bergman, T., & Moore, M. J. (1977). Eye contact and face scanning in early infancy. *Science*, 198, 853–855.
- Hatfield, E., Cacioppo, J., & Rapson, R. (1994). *Emotional contagion*. New York: Cambridge University Press.
- Hatton, H. M., Berg, W. K., & Graham, F. K. (1970). Effects of acoustic rise time on heart rate response. *Psychonomic Science*, 19, 101–103.
- Haviland, J. M., & Lelwica, M. (1987). The induced affect response: 10-week-old infants' responses to three emotion expressions. *Developmental Psychology*, 23, 97–104.
- Hay, D. F., Nash, A., & Pedersen, J. (1981). Responses of six-month-olds to the distress of their peers. *Child Development*, 52, 1071–1075.
- Hebb, D. O. (1946). On the nature of fear. *Psychological Review*, 53, 88–106.
- Hebb, D. O. (1949). *The organization of behavior: A neuropsychological theory*. New York: Wiley.
- Hiatt, S. W., Campos, J. J., & Emde, R. N. (1979). Facial patterning and infant emotional expression: Happiness, surprise, and fear. *Child Development*, 50, 1020–1035.
- Higgins, C. I., Campos, J. J., & Kermoian, R. (1996). Effect of self-produced locomotion on infant postural compensation to optic flow. *Developmental Psychology*, 32, 836–841.
- Hoffman, M. L. (2000). *Empathy and moral development: Implications for caring and justice*. Cambridge: Cambridge University Press.
- Hopkins, J. R., Zelazo, P. R., Jacobson, S. W., & Kagan, J. (1976). Infant reactivity to stimulus–schema discrepancy. *Genetic Psychology Monographs*, 93, 27–62.
- Izard, C. E. (1991). *The psychology of emotions*. New York: Plenum Press.
- James, W. (1963). *Psychology*. Greenwich, CT: Fawcett Publications. (Original work published 1892)
- Jersild, A. T. (1946). Emotional development. In L. Carmichael (Ed.), *Manual of child psychology* (pp. 752–790). New York: Wiley.
- Kagan, J. (1971). *Change and continuity in infancy*. New York: Wiley.
- Kagan, J. (1974). Discrepancy, temperament, and infant distress. In M. Lewis & L. A. Rosenblum (Eds.), *The origins of fear* (pp. 229–248). New York: Wiley.
- Kellman, P. J., & Banks, M. S. (1998). Infant visual perception. In W. Damon (Series Ed.) & D. Kuhn & R. S. Siegler (Vol. Eds.), *Handbook of child psychology: Vol. 2. Cognition, perception, and language* (5th ed., pp. 103–146). New York: Wiley.
- Kenney, M., Mason, W., & Hill, S. (1979). Effects of age, objects, and visual experience on affective responses of rhesus monkeys to strangers. *Developmental Psychology*, 15, 176–184.



- Ketelaar, T., & Ellis, B. J. (2000). Are evolutionary explanations unfalsifiable? Evolutionary psychology and the Lakatosian philosophy of science. *Psychological Inquiry*, 11, 1–21.
- Kitayama, S., & Markus, H. R. (1994). *Emotion and culture*. Washington, DC: American Psychological Association.
- Lazarus, R. S. (1991). *Emotion and adaptation*. New York: Oxford University Press.
- Lazarus, R. S. (in press). Relational meaning and discrete emotions. In K. R. Scherer, A. Schorr, & T. Johnstone (Eds.), *Appraisal processes in emotion: Theory, methods, research*. Cambridge: Cambridge University Press.
- Lee, D. N., & Lishman, J. R. (1975). Visual proprioceptive control of stance. *Journal of Human Movement Studies*, 1, 87–95.
- Leeper, R. W. (1948). A motivational theory of emotion to replace "emotion as a disorganized response." *Psychological Review*, 55, 5–21.
- Levenson, R. W. (1992). Autonomic nervous system differences among emotions. *Psychological Science*, 3, 23–27.
- Levenson, R. W., Ekman, P., Heider, K., & Friesen, W. V. (1992). Emotion and autonomic nervous system activity in the Mingangkabau of West Sumatra. *Journal of Personality and Social Psychology*, 62, 972–988.
- Lewis, M. (1993). The emergence of human emotions. In M. Lewis & J. M. Haviland (Eds.), *Handbook of emotions* (pp. 223–235). New York: Guilford Press.
- Lewis, M. (1995). Embarrassment: The emotion of self-exposure and evaluation. In J. P. Tangney & K. W. Fischer (Eds.), *Self-conscious emotions: The psychology of shame, guilt, embarrassment, and pride* (pp. 198–218). New York: Guilford Press.
- Lewis, M., & Brooks-Gunn, J. (1979). *Social cognition and the acquisition of self*. New York: Plenum Press.
- Lewis, M., & Goldberg, S. (1969). The acquisition and violation of expectancy: An experimental paradigm. *Journal of Experimental Child Psychology*, 7, 70–80.
- Lewis, M., Sullivan, M. W., Stanger, C., & Weiss, M. (1989). Self-development and self-conscious emotions. *Child Development*, 60, 146–156.
- Lewis, M. D. (1993). Emotion–cognition interactions in early infant development. *Cognition and Emotion*, 7, 145–170.
- Lewis, M. D. (2000). Emotional self-organization at three time scales. In M. D. Lewis & I. Granic (Eds.), *Emotion, development, and self-organization: Dynamic systems approaches to emotional development* (pp. 37–69). Cambridge: Cambridge University Press.
- Lewis, M. D., & Granic, I. (1999). Self-organization of cognition–emotion interactions. In T. Dalgleish & M. Power (Eds.), *Handbook of cognition and emotion* (pp. 683–701). New York: Wiley.
- Lipsitt, L. P. (1976). Developmental psychobiology comes of age: A discussion. In L. P. Lipsitt (Ed.), *Developmental psychobiology: The significance of infancy* (pp. 109–127). Hillsdale, NJ: Erlbaum.
- Lipsitt, L. P. (1986). Toward understanding the hedonic nature of infancy. In L. P. Lipsitt & J. H. Cantor (Eds.), *Experimental child psychologist: Essays and experiments in honor of Charles C. Spiker* (pp. 97–109). Hillsdale, NJ: Erlbaum.
- Lishman, J. R., & Lee, D. N. (1973). The autonomy of visual kinaesthesia. *Perception*, 2, 287–294.
- Ludemann, P. M., & Nelson, C. A. (1988). Categorical representation of facial expressions by 7-month-old infants. *Developmental Psychology*, 24, 492–501.
- Mandler, G. (1975). *Mind and emotion*. New York: Wiley.
- Mandler, G. (1979). Emotion. In E. Hearst (Ed.), *The first century of experimental psychology* (pp. 275–322). Hillsdale, NJ: Erlbaum.
- Martin, G. B., & Clark, R. D. (1982). Distress crying in neonates: Species and peer specificity. *Developmental Psychology*, 18, 3–9.

- Mascolo, M. F., & Fischer, K. W. (1995). Developmental transformations in appraisals for pride, shame, and guilt. In J. P. Tangney & K. W. Fischer (Eds.), *Self-conscious emotions: The psychology of shame, guilt, embarrassment, and pride* (pp. 64–113). New York: Guilford Press.
- Mascolo, M. F., & Griffin, S. (1998). Alternative trajectories in the development of anger-related appraisals. In M. F. Mascolo & S. Griffin (Eds.), *What develops in emotional development?* (pp. 219–249). New York: Plenum Press.
- Mascolo, M. F., & Harkins, D. (1998). Toward a component systems approach to emotional development. In M. F. Mascolo & S. Griffin (Eds.), *What develops in emotional development?* (pp. 189–217). New York: Plenum Press.
- McCall, R. B., & Kagan, J. (1967). Stimulus–schema discrepancy and attention in the infant. *Journal of Experimental Child Psychology*, 5, 381–390.
- McCall, R. B., & McGhee, P. E. (1977). The discrepancy hypothesis of attention and affect in infants. In I. C. Uzgiris & F. Weizmann (Eds.), *The structuring of experience* (pp. 179–210). New York: Plenum Press.
- Mead, G. (1934). *Mind, self, and society: From the standpoint of a social behaviorist*. Chicago: University of Chicago Press.
- Meltzoff, A. N. (1988). Infant imitation and memory: Nine-month-olds in immediate and deferred tests. *Child Development*, 59, 217–225.
- Meltzoff, A. N., & Moore, M. K. (1977). Imitation of facial and manual gestures by human neonates. *Science*, 198, 75–78.
- Meltzoff, A. N., & Moore, M. K. (1983). Newborn infants imitate adult facial gestures. *Child Development*, 54, 702–709.
- Mesquita, B., & Frijda, N. (1992). Cultural variations in emotions: A review. *Psychological Bulletin*, 112, 179–204.
- Meyer, L. B. (1957). *Emotion and meaning in music*. Chicago: University of Chicago Press.
- Mineka, S., & Cook, M. (1993). Mechanisms involved in the observational conditioning of fear. *Journal of Experimental Psychology: General*, 122, 23–38.
- Miyake, K., Chen, S. J., & Campos, J. J. (1985). Infant temperament, mothers' mode of interaction, and attachment in Japan: An interim report. In I. Bretherton & E. Waters (Eds.), *Growing points of attachment theory and research* (pp. 276–297). *Monographs of the Society for Research in Child Development*, 50 (1–2, Serial No. 209).
- Mumme, D. L., Fernald, A., & Herrera, C. (1996). Infants' responses to facial and vocal emotional signals in a social referencing paradigm. *Child Development*, 67, 3219–3237.
- Nelson, C. A. (1987). The recognition of facial expressions in the first two years of life: Mechanisms of development. *Child Development*, 58, 889–909.
- Ohman, A. (1993). Stimulus prepotency and fear learning: Data and theory. In N. Birbaumer & A. Ohman (Eds.), *The structure of emotion: Psychophysiological, cognitive and clinical aspects* (pp. 218–239). Gottingen: Hogrefe & Huber.
- Oster, H., Hegley, D., & Nagel, L. (1992). Adult judgments and fine-grained analysis of infant facial expressions. *Developmental Psychology*, 28, 1115–1131.
- Peiper, A. (1963). *Cerebral function in infancy and childhood*. New York: Consultants Bureau.
- Piaget, J. (1954). *The construction of reality in the child*. New York: Basic Books.
- Planalp, S. (1999). *Communicating emotion: Social, moral, and cultural processes*. Cambridge: Cambridge University Press.
- Rochat, P., Querido, J. G., & Striano, T. (1999). Emerging sensitivity to the timing and structure of protoconversation in early infancy. *Developmental Psychology*, 35, 950–957.
- Rozin, P., & Fallon, A. E. (1987). A perspective on disgust. *Psychological Review*, 94, 23–41.
- Ryle, G. (1949). *The concept of mind*. Harmondsworth: Penguin.

- Sagi, A., & Hoffman, M. L. (1976). Empathic distress in the newborn. *Developmental Psychology*, 12, 175-176.
- Salk, L. (1962). Mother's heartbeat as an imprinting stimulus. *Transactions of the New York Academy of Science*, 24, 753-763.
- Sander, L. (1962). Issues in mother-child interaction. *Journal of the American Academy of Child Psychiatry*, 1, 141-166.
- Sander, L. (1964). Adaptive relationships in early mother-child interaction. *Journal of the American Academy of Child Psychiatry*, 3, 231-264.
- Schaffer, H. R. (1971). *The growth of sociability*. Baltimore: Penguin.
- Schaffer, H. R. (1974). Cognitive components of the infant's response to strangers. In M. Lewis & L. A. Rosenblum (Eds.), *The origins of fear* (pp. 11-24). New York: Wiley.
- Schneirla, T. C. (1965). Aspects of stimulation and organization in approach/withdrawal processes underlying vertebrate behavioral development. In D. S. Lehrman, R. A. Hinde, & E. Shaw (Eds.), *Advances in the study of behavior* (Vol. 1, pp. 1-74). New York: Academic Press.
- Simner, M. L. (1971). Newborn's response to the cry of another infant. *Developmental Psychology*, 5, 136-150.
- Sloboda, J. (1986). *The musical mind: The cognitive psychology of music*. Oxford: Clarendon Press.
- Soken, N. H., & Pick, A. D. (1999). Infants' perception of dynamic affective expressions: Do infants distinguish specific expressions? *Child Development*, 70, 1275-1282.
- Sorce, J. F., Emde, R. N., Campos, J. J., & Klinnert, M. D. (1985). Maternal emotional signaling: Its effect on the visual cliff behavior of 1-year-olds. *Developmental Psychology*, 21, 195-200.
- Spitz, R. (1965). *The first year of life*. New York: International Universities Press.
- Sroufe, L. A. (1979). Socioemotional development. In J. D. Osofsky (Ed.), *Handbook of infant development* (pp. 462-516). New York: Wiley.
- Sroufe, L. A. (1996). *Emotional development: The organization of emotional life in the early years*. Cambridge: Cambridge University Press.
- Sroufe, L. A., & Waters, E. (1977). Attachment as an organizational construct. *Child Development*, 48, 1184-1199.
- Sroufe, L. A., Waters, E., & Matas, L. (1974). Contextual determinants of infant affective response. In M. Lewis & L. A. Rosenblum (Eds.), *The origins of fear* (pp. 49-72). New York: Wiley.
- Stayton, D. J., Ainsworth, M. D. S., & Main, M. B. (1973). Development of separation behavior in the first year of life: Protest, following, and greeting. *Developmental Psychology*, 9, 213-225.
- Stechler, G., & Carpenter, G. (1967). A viewpoint on early affective development. In J. Hellmuth (Ed.), *The exceptional infant* (Vol. 1, pp. 163-190). Seattle, WA: Special Child Publications.
- Steiner, J. E. (1979). Human facial expressions in response to taste and smell stimulation. In H. W. Reese & L. P. Lipsitt (Eds.), *Advances in child development and behavior* (Vol. 13, pp. 257-295). New York: Academic Press.
- Stemmler, G. (1989). The autonomic differentiation of emotions revisited: Convergent and discriminant validation. *Psychophysiology*, 26, 617-642.
- Stenberg, C. R., & Campos, J. J. (1990). The development of anger expressions in infancy. In N. L. Stein, B. Leventhal, & T. Trabasso (Eds.), *Psychological and biological approaches to emotion* (pp. 297-310). Hillsdale, NJ: Erlbaum.
- Stern, D. (1971). A microanalysis of mother-infant interaction: Behavior regulating social contact between a mother and her 3-and-a-half-month-old twins. *Journal of the American Academy of Child Psychiatry*, 10, 501-517.
- Stern, D. (1977). *The first relationship: Infant and mother*. Cambridge, MA: Harvard University Press.

- Sullivan, S. F., Gentile, D. A., & Pick, A. D. (1998, April). *The perception of emotion in music by eight-month-old infants*. Poster presented at the meetings of the International Conference on Infant Studies, Atlanta, GA.
- Thompson, R. A. (1993). Socioemotional development: Enduring issues and new challenges. *Developmental Review, 13*, 372-402.
- Tinbergen, N. (1948). Social releasers and the experimental method required for their study. *Wilson Bulletin, 60*, 6-52.
- Tinbergen, N. (1951). *The study of instinct*. Oxford: Clarendon Press.
- Tomkins, S. S. (1962). *Affect, imagery, consciousness: The positive affects*. New York: Springer Verlag.
- Tomkins, S. S. (1963). *Affect, imagery, consciousness: The negative affects*. New York: Springer Verlag.
- Trevarthen, C., & Hubley, P. (1978). Secondary intersubjectivity: Confidence, confiders, and acts of meaning in the first year of life. In A. Lock (Ed.), *Action, gesture, and symbol: The emergence of language* (pp. 183-229). New York: Academic Press.
- Tronick, E. (1989). Emotions and emotional communication in infants. *American Psychologist, 44*, 112-119.
- Uzgiris, I. C., & Hunt, J. McV. (1975). *Assessment in infancy: Ordinal scales of psychological development*. Urbana, IL: University of Illinois Press.
- Valentine, C. W. (1930). The innate bases of fear. *Journal of Genetic Psychology, 37*, 394-420.
- Walden, T., & Passaretti, C. (1996, April). "I don't care what you say, I am not touching that snake": *Biologically relevant fear and infant social referencing*. Paper presented at the meetings of the International Society for Infant Studies, Providence, RI.
- Wallbott, H. G., & Scherer, K. R. (1988). How universal and specific is emotional experience? Evidence from 21 countries and five continents. In K. R. Scherer (Ed.), *Facets of emotion: Recent research* (pp. 31-56). Hillsdale, NJ: Erlbaum.
- Weinberg, M. K., & Tronick, E. Z. (1994). Beyond the face: An empirical study of infant affective configurations of facial, vocal, gestural, and regulatory behaviors. *Child Development, 65*, 1503-1515.
- Witherington, D. C. (1999). Visually-guided reaching and the development of anger in infancy (Doctoral dissertation, University of California, Berkeley, 1998). *Dissertation Abstracts International: Section B: The Sciences & Engineering, 59*(8-B), 4514.
- Witherington, D. C., Kermoian, R., & Campos, J. J. (2001). *Visual proprioception and the developmental emergence of wariness of heights*. Manuscript submitted for publication.
- Wolff, P. H. (1987). *The development of behavioral states and the expression of emotions in early infancy*. Chicago: University of Chicago Press.
- Zelazo, P., & Komer, M. (1971). Infant smiling to non-social stimuli and the recognition hypothesis. *Child Development, 42*, 1327-1339.
- Zumbahlen, M., & Crawley, A. (1996, April). *Infants' early referential behavior in prohibition contexts: The emergence of social referencing?* Paper presented at the meetings of the International Conference on Infant Studies, Providence, RI.