Infants' Meaning-Making and the Development of Mental Health Problems

Ed Tronick — *University of Massachusetts Boston, Children's Hospital Boston, and Harvard Medical School*

Marjorie Beeghly — *Wayne State University, Children's Hospital Boston, and Harvard Medical School*

We argue that infant meaning-making processes are a central mechanism governing both typical and pathological outcomes. Infants, as open dynamic systems, must constantly garner information to increase their complexity and coherence. They fulfill this demand by making nonverbal "meaning"—affects, movements, representations—about themselves in relation to the world and themselves into a "biopsychosocial state of consciousness," which shapes their ongoing engagement with the world. We focus on the operation of the infant–adult communication system, a dyadic, mutually regulated system that scaffolds infants' engagement with the world of people, things, and themselves, and consequently their meaning-making. We argue that infant mental health problems emerge when the meanings infants make in the moment, which increase their complexity and coherence and may be adaptive in the short run, selectively limit their subsequent engagement with the world and, in turn, the growth of their state of consciousness in the long run. When chronic and iterative, these altered meanings can interfere with infants' successful development and heighten their vulnerability to pathological outcomes. Cultural variations in meaning-making and implications for clinical practice are discussed.

Keywords: infant mental health, meaning-making, maternal depression, mutual regulation, psychopathology

How do infants develop mental health problems? Classical theorists such as James (1890), Freud (1923), and Watson (1928) would have scoffed at this question. James's infant lived in a world characterized by "blooming buzzing confusion" (James, 1890, p. 488), and Freud's infant was either in a state of tension seeking release or quiescence. Neither of their infants could make meaning about their world. They lacked emotions, organized behaviors, or ways of being in the world or with others and had no way of regulating their own reactions or actively affecting those of another person. Watson went so far as to suggest that infants' mental life was a figment of the adult imagination, and even adults were mindless. In these historical views, infants could not have mental health problems because they had no mental life. But these classical theorists were, well, colossally wrong: wrong only in the way colossal thinkers can be.

We now know that infants and young children have a stunning array of biopsychosocial competencies. Even young infants have rudimentary intentions and organized and motivating emotions and are able to react to the meanings of others' intentions and emotions (Brazelton, 1992; Lavelli & Fogel, 2005; Reddy, 2008; Trevarthen, Aitken, Vandekerckhove, Delafield-Butt, & Nagy, 2006; Tronick, 2007). With these biopsychosocial competencies, infants make meaning about their relation to the world of people and things and about themselves. Of course, their meaning-making is nonsymbolic and radically different from the representational meaning made by older children and adults, but it is meaning nonetheless.

Unfortunately, in ways unique to infants, their meaning-making may go wrong and may lead down aberrant developmental pathways. Some infants may come to make meaning of themselves as helpless and hopeless, and they may become apathetic, depressed, and withdrawn. Others seem to feel threatened by the world and may become hypervigilant and anxious or hyperactive and perseverative. Still others develop rigid or dysregulated patterns of self-regulatory behavior or have difficulty making sense of themselves and others (e.g., those with autism spectrum disorders; Fonagy, 1999; Hobson, 2002). When these aberrant or atypical forms of meaning-making persist, they can distort how infants master age-appropriate developmental tasks, such as developing self-regulation, forming attachments with caregivers, or establishing autonomy. Ultimately, the aberrant meanings amplify and heighten infants' vulnerability to pathological outcomes (Beeghly &

Ed Tronick

Tronick, 1994; Cicchetti & Barnett, 1991; Hill-Soderlund & Braungart-Rieker, 2008; Sroufe, 2009).

In this article, we first provide an open systems perspective on infants' meaning-making in the context of the infant–adult communication system using examples from research on infant social development. Meaning-making is a fundamental developmental process, and in our view, a perspective from typical development (including a focus on individual differences and cultural variations in meaning-making) is needed for a clearer understanding of how development can become derailed and generate infant mental health problems. With the framework of typical development established, we then elaborate how the chronic and iterative meanings infants and caregivers cocreate can lead to maladaptive child outcomes, using illustrations from the literature on maternal depression. Thus, in our view, both typical and aberrant development can be understood from a singular open systems perspective on meaning-making. Clinical implications stemming from this perspective are then discussed.

Open System Dynamics of Meaning-Making

Underlying our argument is the view that infants and their engagement with the world are best understood from the perspective of open dynamic systems. Infants as dynamic systems are made up of multiple subsystems (e.g., brain, physiologic processes, and behavior) that continuously interact with each other and the external world in a circular causal fashion (Fogel, 2006; Greenspan, 2008; Prigogine & Stengers, 1984; Seligman, 2005; Smith & Thelen, 2003). Moreover, infants' ongoing engagement with the external and internal worlds contributes to the representations (meanings) they create of their experiences, and, in turn,

these meanings are shaped by those engagements (Tronick et al., 1998). These self-organizing processes, via positive and negative feedback, also lead to the emergence of new systemic properties, including new developmental capacities, such as the ability to walk or use language, which in turn create new meanings.

According to Prigogine (Prigogine & Stengers, 1984), a broad general principle governs the operation of open systems, namely, that open systems must acquire resources—energy and information—to maintain the complexity and coherence of their organization. In developing systems, such as human infants, sufficient resources must be obtained to enable them to increase their coherence and complexity and to self-organize new capacities. For instance, in the course of their ongoing engagement with caregivers, infants create new meanings about those experiences (e.g., internal working models; Bretherton & Munholland, 1999), which contribute to their greater complexity and coherence as systems. Most infants have reliable, responsive caregivers and develop secure working models of their relationship with them (De Wolff & van IJzendoorn, 1997). These secure-base "meanings" enhance the likelihood that infants will acquire more resources from their exchanges with their caregivers in the short run, and these growth-promoting interactions will, in turn, contribute to resilient outcomes in the long run. In contrast, infants with harsh, unresponsive caregivers may learn to minimize their engagement with the caregiver in order to safely maintain proximity with her (Cicchetti & Barnett, 1991). Although this avoidant behavioral style may be adaptive in the short run, it may increase the risk of long-term maladaptive outcomes, such as a tendency to form insecure attachment relationships with others in later life (Fraley & Shaver, 2000). A metaphor may help in seeing the dynamics of this process. Rain drops (moment-by-moment meanings) sculpt a landscape (form a state of consciousness). The sculpted pathways (chronic meanings) constrain where the rain can flow, yet at the same time the pathways continue to be shaped by the rain (new meanings; Granic & Patterson, 2006).

Just as acquiring nutrients supports infants' physical growth, we hypothesize that acquiring information, or engaging in what Bruner (1990) called *acts of meaning* (e.g., the multilayered levels of feeling, perceiving, thinking, reaching, looking, and smelling), supports infants' mental growth. Engaging in acts of meaning is sui generis for infants, as it is for all humans. When infants are successful in making new meanings, what Kaufman (1995) referred to as achieving "self-organized criticality," a new biopsychosocial state of consciousness emerges that contains more information and is more complex and coherent than it was previously. Consequently, infants as systems become more flexible and better able to reorganize when challenged by perturbations. Although infants are always trying to make coherent meaning, variations in the environment in combination with their own unique internal characteristics can make infants' meaning-making difficult. Even with brief or minor perturbations in caregiving or the environment, infants can enter a state of disequilibrium that may be dis-

**Marjorie
Beeghly**

organizing, and the disorganization in and of itself may further undermine their meaning-making ability in the moment. In systems terminology, such infants lose complexity and information. If the perturbation is prolonged and chronic (e.g., imagine an infant trying to make meaning of a caregiver whose moods rapidly swing between positive and negative affect), infants as systems become less stable and flexible (dissipate) and may be more vulnerable to the effects of later perturbations.

An illustration of the concept of dissipation comes from thermodynamics. To remain boiling, water requires a constant input of heat energy. When the heat is withdrawn, the water (steam) changes back into a liquid state—that is, the steam state dissipates. Just so, caregivers who soothe a crying infant who is unable to self-soothe can promote a more complex and coherent state of consciousness on the part of the infant. Conversely, withdrawing the soothing can lead to prolonged distress and a dissipation of a coherent state in the infant. If the resulting experience of dysregulation is brief and quickly repaired, it may be growth-promoting because infants may make nonsymbolic meanings that they and their caregivers are competent to repair ruptured interactions. A different "meaning" may result from the experience of chronic or prolonged perturbations in the infant–caregiver interaction. An extreme example comes from institutionalized children who experience social deprivation. Despite adequate care, the chronic lack of a consistent caregiver and appropriate social interactions—a lack of opportunity for *dyadic* meaning-making—can lead to a prolonged state of dysregulation and associated negative self-representations such as "My actions do not work in getting me help" or "I am helpless." In turn, these experiences of deprivation can lead to altered brain development, compromised socioemotional functioning, stunted mental growth, and even death (Nelson, Zeanah, & Fox, 2007).

To avoid organizational dissipation, a system selects resources (i.e., information available in the moment) to maximize its complexity and coherence (Fogel, 2006; Smith & Thelen, 2003). These resources may be garnered by the system operating on its own (e.g., self-soothing) or joining with another system to form a larger system (e.g., being soothed by a caregiver). Joining together may be an especially effective resource-acquisition mode because the larger dyadic system may be able to garner more resources than either system could accomplish on its own (Tronick, 2005). Institutionalized infants, who have no person to join with, are forced to engage in self-organized, solitary meaning-making. While they are capable of solitary meaning-making, like all infants their capacity for self-organized, coherent meaning-making is limited; they cannot sustain it for long periods. Without the provision of external resources, their ability to self-regulate attentional and affective states diminishes and their capacity for meaning-making flounders, resulting in dissipation of the coherence of their biopsychosocial state of consciousness (Bernier, Carlson, & Whipple, 2010; Tronick, 2005). Moreover, the ability of institutionalized infants to make meaning with others may be compromised, even when others become available to them later in life (e.g., through adoption; Nelson et al., 2007).

A critical and potentially insidious feature of meaning-making that maximizes organization in the moment is that it is not always adaptive in the long run (i.e., it is blind to later consequences). Imagine the bending of a tree branch to catch the sunlight, which increases the tree's resources but also makes it vulnerable to wind damage in storms. Similarly, infants with hovering, overly supportive caregivers may not learn to self-regulate effectively and so may become especially vulnerable to stress when left briefly without caregiver support (Beebe et al., 2010; Bernier et al., 2010). Alternatively, infants who avoid an overly intrusive parent may reap short-term relief, but their avoidant strategy in the long run may cause them to miss out on other growth-promoting social engagements, with potential detrimental long-term developmental consequences (Beeghly & Cicchetti, 1994; Sroufe, 2009; Tamis-LeMonda, Bornstein, Baumwell, & Damast, 1996).

An Example of the Dynamics of Meaning-Making

To illustrate the dynamics of meaning-making, let us present a microanalytic glimpse of a mother and her six-month-old infant interacting (see Figure 1). The mother bends down to nuzzle the infant with her hair. The baby tightly grabs her hair and won't let go when she tries to disengage herself. The mother vocalizes in genuine pain ("Ow!") and pulls back with an angry, bared-tooth facial expression. Although the mother's vocal and facial display of anger lasts less than half a second, the infant immediately responds in a defensive fashion. He brings his hands up in front of his face and turns away. His reaction is reminiscent of the defensive ducking behaviors infants exhibit to loom-

Figure 1
Mother and Infant Interaction

Note. Left to right: The infant pulls the mother's hair. When the mother disengages, the infant holds on, and the mother responds with an angry facial expression and vocalization. The infant reacts defensively. After some seconds, they both repair the interaction. Copyright 2007 by Ed Tronick. Reprinted with permission.

ing objects (Schmuckler & Li, 1998). The mother's angry display is not just an interesting or novel display or one with no significance; rather, it has meaning for the infant. The infant appears to be apprehending danger. The mother immediately perceives the meaning of her infant's change in behavior and quickly changes what she is doing. She uses soothing, cajoling actions and vocalizations to try to repair the interactive rupture. At first, the infant stays behind his hands; then he tentatively peeks out at her. Gradually, over the next 30 to 40 seconds, he begins to smile, and then he smiles and looks at her, until they return to a state of mutual positive engagement.

Over the course of this brief interactive exchange, meanings are continuously made by both the infant and the mother, starting with the initial threat of the mother's anger display. Notably, the sense of threat lingers for the infant even after the mother's facial expression has changed back to a positive one. This dyad was able to repair the rupture quickly and re-coordinate their intentions to play with one another. However, with another dyad, one can imagine that this repair process might not have succeeded, and the infant's sense of threat could have remained. The failure to repair, in turn, might have led to further disruptions, which could generate new meanings for both mother and infant (e.g., that their interactive disruptions and perhaps the threat cannot be repaired). Were these failures to become chronic, the infant might come to mistrust the world, taking himself or herself down a pathway toward maladaptation (Erikson, 1950; Sroufe, 2009).

Infants' Nonsymbolic Meaning-Making

Infants' task of making meaning of themselves in the world is prodigious and difficult, yet they must do it; otherwise, they would simply not function or survive. Edelman (1987) argued that children have to label an unlabeled world so that they can act on it, yet nonsymbolic infants do not come into the world with explicit forms of meaning-making, such as language or symbols.

But *how* do infants make meaning? Infants' meaning-making must be conceptualized differently from the way we think of it in older children and adults. Piaget (1954) revolutionized our thinking about infants' meaning-making by demonstrating that, rather than categorizing objects as older children do, infants make meaning of an object from what they can *do* to it. There are no spoons or toys, but things that are "bangable," "mouthable," or "throwable." The meaning is sensorimotor, perhaps akin to what is meant by muscle or procedural memory in adults. Stechler and Latz (1966) suggested that infants also make sensori-*affective* meanings. A large, noisy toy or an unfamiliar adult is neither a toy nor an adult to infants but rather something to be avoided; its meaning *is* fearfulness. Although it is challenging for adults to think about sensorimotor or sensoriaffective processes as forms of meaning, adults, too, experience these kinds of meanings. Picture an adult alone in a dark, shadow-filled, unknown city, feeling fear and an urge to escape. This sensoriaffective meaning exists side by side with other explicit meanings conveyed in words, such as reassurances from friends that the city is completely safe.

More generally, the meaning-making of infants can be viewed as a dynamic *biopsychosocial* process involving the interplay of multiple systems at multiple levels of organization acting in a causally circular manner (Gottlieb & Halpern, 2008; Sameroff, 2000). There is a vast and complex array of biopsychosocial meaning-making processes. These include motor actions, emotions, reactivity levels and thresholds, moods, mirror neurons, cortical processes, and processes such as the dampening of the hypothalamic–pituitary–adrenal axis and the kindling effect of trauma on neuronal groups (Haglund, Nestadt, Cooper, Southwick, & Charney, 2007; Hofer, 2006). All of these processes influence how infants make meaning of themselves and the world. There also is no singular meaning but an ongoing and layered flow of meaning. These meanings make up what we call a "core biopsychosocial state of consciousness" for the infant (Damasio, 2000), a unique organization of multiple and interacting physiologic, brain, and behavioral processes that create a polysemic (multiple-meaning) sense of what is happening now and alter the nature of possible future meanings. In the hair-pulling example, the infant's meaning about the mother's anger display changes from danger (sympathetic arousal, parasympathetic dysregulation, and activation of the amygdala) to a partial recovery of positive engagement (parasympathetic control) but with a lingering sense that something is still awry (higher sympathetic arousal, ongoing amygdala activation). Adults, too, experience a flow of meanings during a car

accident. The adult might first experience a reflexive avoiding and calmness, checking on the passengers, then fearfulness, cardiac acceleration, and a flood of adrenalin, and then either relief or persistence in reactivity.

Cold Dynamics and Hot Mental Life

The anger example and simply observing how infants actively engage their world raise a question about our dynamic systems perspective. Dynamic systems theory is a "cold" theory that uses the metric of nonlinear equations to measure the expansion and dissipation of complexity and coherence in any kind of system. But infants' mental life is "hot." We hypothesize that succeeding to expand information as a system, or failing to do so and dissipating, has *experiential* as well as behavioral consequences for infants, which have implications for the development of resilience and mental health problems.

Infants' success in making new meanings and expanding states of consciousness brings with it *feelings* of well-being, pleasure, and joy and leads to positive engagement with the world. A sense of wholeness and continuity develops. A particularly powerful experiential consequence of cocreating states of shared meanings with another person—a dyadic state of consciousness—is to *feel* connected and in relationship with that person (Kochanska, 2002; Tronick et al., 1998). These are feelings of attachment, or what Fosha (2000) called *relational* affects (e.g., *feeling* "in sync" with the other). Thus, forming a dyadic state of consciousness is a major constitutive process for forming and growing relationships. As in the expression "neurons that fire together wire together," individuals who create something new together connect to each other. In contrast, when infants have difficulty gaining meaning in the context of relationships with others, the complexity of their biopsychosocial state of consciousness is reduced. Such infants exhibit affective and behavioral reactions that are consistent with sadness and/or anger, withdrawal, and disengagement. Also, they likely experience anxiety and fear because as they lose organization, they become dysregulated and their sense of self becomes threatened. Thus, infants will seek feelings of expansion and connection and avoid anxious, fearful feelings associated with dissipation (Ham & Tronick, 2009; Hofer, 2006; Kaufman, 1995; Sander, 2004).

In putting forward this hypothesis about fulfilling cold principles with hot experiences, we are aware that we are moving into uncharted phenomenological spaces and that some readers may object. We know we are personifying what infants do and experience, and embedding their actions with meaning and intentions—what Freeman (2000) referred to as actualizations of meaning. Since infants have no speech and their state of consciousness is unlike ours, we cannot be certain about their experience or their exact meaning or intent. Also, we have to use words to capture what is a non-language-based phenomenon. We cannot ask infants what they mean but can only infer meaning from the infants' behavior. But their behavior leads to compelling inferences. Nonetheless, some readers may object. However, we believe such a perspective psychologically instan-

tiates dynamic systems, speaks to the centrality of meaning for human development, and at the very least is clinically useful.

For instance, many behaviorally based empirical studies have indicated that even young infants display a wide array of understandings about the object and social world, suggesting that they are capable of at least rudimentary forms of mental representation and have expectations about their world (Berk, 2010). Infants' awareness of object permanence has been demonstrated during the first months of life using violation-of-expectation and object-tracking methods (see Baillargeon, 2004). Young infants also exhibit emergent categorization, analogical problem solving, and deferred imitation skills (e.g., Barr, Marrott, & Rovee-Collier, 2003; Spelke & Kinzler, 2007). Similarly, from research on early parent–infant interactions, three- to four-month-old infants exhibit exquisite sensitivity to the structure and timing of face-to-face exchanges. When they gaze, smile, or vocalize, they appear to expect their social partner to respond in kind (Markova & Legerstee, 2006). They also begin to view others as being "like me," an awareness thought to lay the foundation for understanding others' thoughts and feelings (Gergely & Watson, 1996; Meltzoff, 2007).

In the hair-pulling example, the infant's ducking away behind upheld hands followed the mother's anger expression closely in time, leading to the inference that the meaning made by the infant is something like "danger." This example is consistent with research findings showing that infants have organized behaviors that are linked in predictable ways to stimulating events, including emotional expressions of face, voice, gaze, and psychophysiology (Cohn & Tronick, 1989; Field, 1995; Mesman, van IJzendoorn, & Bakermans-Kranenburg, 2009). The next question to be addressed is the following: How does this dynamically organized system of meaning-making work?

The Mutual Regulation Model: Dyadic Meaning-Making and Reparation

In our view, the infant–adult meaning-making system is a dyadic, mutually regulated communicative system in which there is an exchange of each individual's meanings, intentions, and relational goals—what we call the mutual regulation model (Beeghly & Tronick, 1994; Tronick, 1989; see also Beebe et al., 2010; Fogel, 2006). In early work, researchers were so impressed by findings of orderliness in infant–mother interactions that they adopted a Fred-and-Ginger model of dyadic synchrony as one reflecting optimal functioning (Brazelton, Koslowski, & Main, 1974; Stern, 1985; Trevarthen, 1993). They also argued that the canonical mother–infant interaction was characterized by low levels of anger, sadness, or distress, long periods of mutual gazing and vocalizing, and a high proportion of shared positive affect expressed by big smiles. While this synchrony model is lovely and romantic, subsequent microanalytic research on infant–parent *en face* interaction has provided little support for this view (Beebe et al., 2008; Tronick, 1989; Tronick & Cohn, 1989).
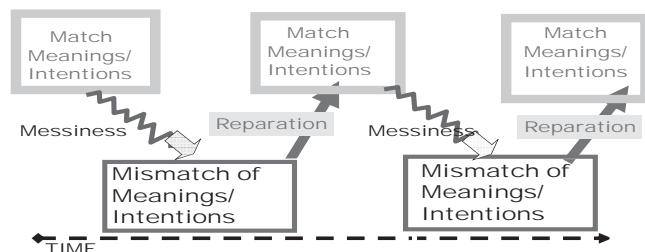
Note. Copyright 2007 by Ed Tronick. Reprinted with permission.

Unlike Fred and Ginger's dance, the interactive dance between infants and caregivers is more like the way most of us dance. Our dancing is hardly perfect; there are missteps, apologies, tries, retries, match ups, and missteps again. In systems terminology, the typical interaction is *messy*: It moves from matching (coordinated, synchronous) states of shared meanings and intentionality to mismatched (miscoordinated, dyssynchronous) states and back to matching intentional states via an active, jointly carried out reparatory process (Tronick, 2008; Tronick et al., 1998). This general lack of coordination—messiness—suggests that infants and caregivers do not share similar intentions most of the time during *en face* interactions (e.g., the caregiver looks at the infant while the infant looks away) and that they cannot continuously coordinate their engagement states.

What accounts for all this interactive messiness? There are many possible reasons for it, such as each partner's midstream waning of attention or changing of intentions, the rapidity of the exchange in tenths of seconds, and the immaturity of the infant (Tronick, 1989, 2005). Whatever the reasons, messiness is an inherent quality of infant–caregiver interactions, and therefore the task of creating shared meanings is a daunting one for infants, children, and adults alike.

Video microanalysis has demonstrated that infant–caregiver dyads typically repair interactive mismatches rapidly via cocreative processes, with implications for shared meaning-making (see Figure 2). In one study (Gianino & Tronick, 1988), mother–infant mismatches were repaired 70% of the time in the next interactive step, with new reparations occurring about every three to five seconds. In turn, the newly formed dyadic matches were followed by the reemergence of mismatches, which were followed by reparation of mismatches to matches and, we hypothesize, the formation of new meanings. Notably, periods of dyadic matching are associated with infants' positive affect and engagement, whereas dyadic mismatches are associated with infants' negative affect and dysregulation (Tronick, 1989).

Functions of Reparation

From a systems perspective, we argue that dyads' ability to repair interactive errors is essential for growth; indeed, it is the fundament of new meanings. Two examples of the process of reparation are offered in this vein: learning how to play interactive games like peek-a-boo and acquiring culturally appropriate ways of being together. Both are purely social, and both are "arbitrary."

An infant learning to play peek-a-boo engages in a bootstrapping, bit-by-bit reparatory process of changing interactive errors (failing to respond, looking away too soon, or only looking) into a coordinated sequence of game states that, over time, come to resemble the canonical form of the game—a form known to the adult (Bruner, 1990). For the infant, new information is available in how he or she and the adult play bits of the game (look now, hide your face, look again), and over time, the "correct" (i.e., coordinated) bits are selected and incorporated because they increase the infant's complexity. In essence, with time and reiteration, selected meanings accumulate, and the peek-a-boo game is incorporated by the infant into his or her state of consciousness. In turn, incorporating new information affects what meanings are likely to be selected next as the infant moves forward in time (e.g., look away, then duck, now peek).

Beyond games, infants have the difficult task of making sense of their world in its unique cultural context, a world in which labeling of the world is historical, arbitrary, subtle, and highly contextualized (LeVine, 1990). Infants are born into a historical and cultural world to which they are not preadapted and which they cannot anticipate. In this world, infants need to learn culturally specific ways of being with others, a form of implicit relational knowledge (Tronick et al., 1998) that likely demands the totality of infants' biopsychosocial meaning-making processes. We present only one example to make the point, but the reader is encouraged to keep in mind that there are a myriad of examples and to realize just how radically different states of consciousness and ways of being are for individuals in different cultures (e.g., LeVine, 1990).

Among the Gusii, an agricultural community in southwestern Kenya, the mutual greeting between mothers and infants differs markedly from the exuberant greetings of their North American counterparts (LeVine, 1990). Gusii mother–infant greetings may or may not involve eye contact, and the dyad's affect interchange is likely to be sober. As part of a cross-cultural study (LeVine, 1990; Tronick, 2005), Gusii mothers were asked to engage in face-to-face play with their infants, an activity in which they typically do not partake. Video microanalyses of their interactions revealed that the mothers looked away from their infants just as their infants made eye-to-eye contact and smiled, exactly the opposite pattern from that seen in most interactions of Western mothers and their infants. In response, the infants looked away and their smiles vanished; they actually seemed to deflate. The infants' initial gaze and smile conveyed "I want to interact" but was mismatched by the mothers' nonverbally expressed intent, "I don't" or more accurately "Not that way."

Why do the mothers in this community turn away in this way? Gusii mothers do not tend to reciprocate their infants' big smiles because their greeting is already

sculpted into a culture-specific form that precludes such exuberance; direct gaze and high levels of affect violate cultural norms. The mismatch of dyadic coordination suggests that a dyadic state is not created in that moment, and the infants' turning away suggests that their experience is negative, perhaps reflecting some dissipation of complexity. But then how do mother–infant pairs in this community become coordinated, and what does their coordination look like? Our sense is that infants and caregivers have to discover and cocreate a form of greeting that conforms to culturally appropriate ("natural") ways of greeting. As with infants learning social games, Gusii infants achieve the culturally appropriate Gusii greeting in a bootstrapping bit-by-bit process in a dyadic context. Gradually, infants come to shorten their looks and limit their affective expressions. In turn, their mothers respond reciprocally. With iteration, the infants select a set of behaviors with meanings that conform to the sober Gusii greeting, and in making that selection, a uniquely typical cultural state is formed. While exhibiting the Gusii greeting may lead to less complexity in Gusii infants in the short run compared with other possible but unavailable and unallowable patterns, the sober greeting pattern builds complexity in the long run because it allows Gusii infants to engage with adults in culturally appropriate ways.

We might note that were a North American mother to turn away like Gusii mothers, American clinicians would likely raise concerns about the mother and the mother–infant relationship. We can only guess what a Gusii clinician would think of a Gusii mother engaging in an American-style exuberant greeting, but no doubt the Gusii clinician also would see it as pathological. But the point is that despite the remarkable differences between the Gusii and Western greetings, both are assembled dyadically via reiterated, complexity-governed selective processes of reparation. Over time, this selective process brings greater complexity and coherence to the dyadic state, and each pattern is growth promoting for infants within their own cultural context.

Thus, dyads' successful reparatory processes have positive growth-promoting effects. We hypothesize that developing a successful reparatory history with a specific person via iterated interchanges such as those in peek-a-boo games leads to an implicit knowing by infants that "we can repair mismatches." In turn, this contributes to an attendant sense of trust and eventually to a secure attachment relationship with that person (e.g., Cohn, Campbell, & Ross, 1991). With the accumulation of successful reparations, infants come to an implicit knowing that their dysregulated emotional state and sense that "something is wrong" can be transformed into a positive state and concomitant feeling that "things are right" (Harrison, 2003). This process likely contributes to infants' emergent sense of agency and mastery (Brazelton, 1992).

Moreover, out of the iterated moment-by-moment experiences of positive affect, infants develop a positive mood or an affective core conveying a general sense of well-being (Emde, 1983; Kochanska, 2002; Tronick, 2005). This positive affective core enables the infant to come to new situations with positive feelings about a yet-to-be-known situation and builds a kind of robustness or resilience. In this way, infants' moods are Janus-like because they carry the past into the present while simultaneously biasing expectations about the meaning of the yet-to-be-experienced future. Thus, infants' moods are also memorial processes, although they are not coded with words or symbols and do not involve implicit or explicit cognitive processes (Tronick, 2002). We hypothesize that these processes may be critical to the emerging organization of infants' biopsychosocial state of consciousness.

Failed Reparations: Illustrations From Research With the Still-Face Paradigm

Failed reparations have problematic effects. Acute effects of reparatory failure can be observed during the still-face paradigm (Adamson & Frick, 2003), an experimental procedure used primarily but not exclusively among Western infant–caregiver dyads in which the process of dyadic meaning-making is perturbed. Following an episode of typical social interaction, the adult partner is asked to adopt a neutral poker face and look at the infant while refraining from talking or touching the infant. The still-faced adult fails to engage in her usual interactive behavior or carry out her regulatory role with the infant, thus creating a prolonged dyadic mismatch. A reunion episode follows the still-face, during which the caregiver resumes her normal interactive behavior and reparation is again possible (Tronick, 2007).

The effect of the adult's still-face on infants and young children is dramatic and well described (Mesman et al., 2009; Weinberg, Beeghly, Olson, & Tronick, 2008). Nonverbal infants react to the still-face with solicitations, with anger and distress, and with sadness and withdrawal, whereas verbal toddlers ask "What are you doing?" and demand that their mothers "Talk to me." During the reunion episode following the still-face, children exhibit a carryover of negative affect and a rebound of positive affect, and they display both approach and avoidant behaviors as the dyad attempts to repair the mismatch (Mesman et al., 2009; Weinberg et al., 2008). Adults in simulations of the still-face show similar reactions, even though they are aware of the simulation (Tronick, 2005). We hypothesize that developing a failed reparatory history with a specific person leads to an implicit knowing by infants that "we can't repair mismatches." This sense of failure may lead to an insecure attachment relationship with that person and may undermine infants' trust in others (Cohn et al., 1991; Tronick, Cohn, & Shea, 1986).

Critically, the reparation processes cocreated by different dyads are unique, because they are cocreated by different individuals in different contexts. Over time, these processes may lead to relationship-specific features for different dyads and, ultimately, to variable child outcomes. To use the rain metaphor, the dyadic reparation process creates a unique "psychic landscape." External and/or endogenous factors may contribute to this uniqueness. For instance, infants respond differently to their mothers than to their fathers (see, e.g., Aksan, Kochanska, & Ortmann,

2006; Feldman, 2003; Parke, 2000), and over time, mother–infant and father–infant dyads develop different ways of being together. Similarly, although the literature is less consistent (Mesman et al., 2009), female and male infants may respond differently to interactive stressors, such as a maternal still-face perturbation (Tronick & Cohn, 1989), and fathers and mothers may have different socialization goals for their male infants than for their female infants (Golombok & Fivush, 1994). Different ways of being together may also be cocreated for individual dyads when infants have difficult temperaments compared with easy temperaments, when parents have inadequate social support or must cope with multiple stressors (Greenspan, 2008; Sameroff, 2000), or when parents live in different cultural contexts (LeVine et al., 2008). Although we cannot catalog the effects of all the factors that affect the generation of unique dyadic features and outcomes, the rule may be that any factor that affects the infant, the adult, and their ongoing interchanges and meaning-making will lead to uniqueness and individual differences.

A note of emphasis is in order. Although we are taking a strongly relational approach in our argument, we, along with others (Beebe et al., 2010; Fogel, 2006), do not see these meaning-making processes as solely dyadic. Even when meanings are generated in interactive contexts, they have to be acted on by endogenous self-organized processes. The self-organized processes, in turn, may amplify or diminish them and play a major role in getting meanings "in" the infant, that is, in the infant's internalizing or assimilating the meanings (Smith & Thelen, 2003). Additionally, self-organizing processes in and of themselves can create new characteristics (Kaufman, 1995; Modell, 1993; Sander, 2004). For instance, infants with a positive affective core may be more likely to explore and consequently more likely to discover new meanings about themselves in the world, which may further strengthen their positive affective core and amplify their tendency to explore (Emde, 1983; Tronick, 2005, 2007). In contrast, when these self-organized processes fail, infants may move into growth-limiting trajectories, and if such failures are chronic, their development can derail.

Although our focus here is on infancy, dyadic reparation is a dynamic process relevant throughout the life span. Similar to Gottman and Driver's (2005) perspective on adult couples, the experience of reparation in adult relationships (e.g., recovering from an argument) is foundational to robust relationships, in contrast to experiencing consistently smooth getting along per se. It also is a key piece in building a strong therapeutic alliance in the clinician–patient relationship (Tronick et al., 1998).

The Emergence of Mental Health Problems

We now return to the question of how infants develop mental health problems. In our view, mental health problems are *cocreated* from self-organizing processes that ensue when dyadic reparatory processes during social interactions and their associated meanings go awry. Such interactions are chronically characterized by prolonged mismatches, unsuccessful reparation, and a general failure to reestablish positive dyadic states (Tronick et al., 1998). Although these processes may lead to increments of complexity in the moment, eventually they fashion dyadic ways of being together that limit or preclude future opportunities for infants to form positive dyadic states and to expand their state of consciousness.

An illustration of derailing regulatory processes comes from research on the interaction patterns of infants whose mothers have high levels of depressive symptoms (Carter, Garrity-Rokous, Chazan-Cohen, Little, & Briggs-Gowan, 2001; Murray & Cooper, 1997; Weinberg, Olson, Beeghly, & Tronick, 2006). From a systems perspective, one can view maternal depression as a communicable condition in the sense that it is associated with a host of emotional, cognitive, and behavioral problems that seem to be transmitted from caregiver to offspring over the life span (Cicchetti & Toth, 1998; Murray & Cooper, 1997; Reck et al., 2004). Longitudinal studies have shown that mothers with a high level of depressive symptoms early in the postpartum year are likely to continue to have symptoms over the next several years (Beeghly et al., 2002), and the severity and chronicity of their symptoms are exacerbated by stress-inducing social risk factors, such as poverty or single parenthood (Beeghly et al., 2003). Consequently, infants of depressed mothers are likely to be chronically exposed to negative maternal mood states and associated dyadic ways of being together that communicate a sense of helplessness and hopelessness. Infants and caregivers in this population may also share a genetic diathesis and associated epigenetic processes, which may further contribute to their vulnerability (Cicchetti & Toth, 1998).

Although specific outcomes vary, given the way in which chronic dyadic communicative patterns became established in different dyads, research has shown that infants of depressed parents are more likely to experience sustained periods of negative affect during infant–parent interaction than infants of nondepressed parents (Carter et al., 2001; Weinberg et al., 2006). Boys of depressed mothers appear to be especially vulnerable to the effects of maternal depression (Weinberg et al., 2006). Field (1998) showed that infants of depressed mothers engage in more negative patterns of interactions with a sensitive nonmaternal adult and may even induce a negative affect state in that adult. Beebe et al. (2008) found that mother–infant contingency patterns are altered by maternal depression when infants are as young as four months of age, although the specific effects of depression status vary depending on the specific communication channel (e.g., touch, vocalization). Others have reported that infants of depressed mothers explore the inanimate environment less avidly than do infants of nondepressed mothers (Murray & Cooper, 1997). From a dynamic systems perspective, these depression-related differences in engagement are likely to lead to negative representations of the self and the mother–child relationship and to long-term developmental compromises, because the effects of initial compromises self-amplify, cu-

mulate, and become stabilized by negative feedback (Gelfand & Teti, 1990; Granic & Patterson, 2006).

The question arises as to why infants of depressed mothers continue to engage with their depressed parent in a developmentally compromising fashion, as their way of being together in the moment comes to restrict their subsequent growth and development. We argue that the selective process of meaning-making for infants of depressed mothers is not unlike that observed when infants learn games like peek-a-boo or adopt culturally specific behaviors, such as the Gusii greeting. During peek-a-boo games, young infants incrementally increase complexity moment by moment during the game. Over time, participation in peek-a-boo games affords increasing complexity, because more mature infants can play the game in a more reciprocal manner. With increasing developmental maturity, however, infants cease to be interested in peek-a-boo games because such games no longer increase complexity. Similarly, Gusii infants as open systems also have to find ways during social interactions with others to increase the complexity of their states of consciousness and avoid dissipation. Although cultural constraints restrict Gusii infants and mothers from engaging in exuberant face-to-face exchanges that lead to growth in other societies, Gusii mother–infant pairs find other culturally appropriate ways to interact that lead to incremental growth of complexity (e.g., Gusii forms of exchange). Thus, the limitation of systems growth in the short run is overcome and fulfills the principle of increasing complexity in the long run.

For similar reasons, infants of depressed mothers have to interact with their mothers, even if their interactions are characterized by negative affect, mismatches, and ineffective reparations. The alternative of not engaging with their mothers at all is a nonviable option. Severe or chronic social disengagement is a psychic disaster because infants' self-organizing processes are limited, and eventually they will lose organization and dissipate (Nelson et al., 2007; Spitz, 1946). In making these comparisons, we are not asserting the "normalcy" of interactions between depressed mothers and their infants but rather that the process of meaning-making during infant–caregiver interaction is similar in different contexts, be they social games, cultural interactions, or depressed exchanges. In each case, a context for growth is restricted in the moment, and that restriction has different long-term consequences for future health or pathological growth.

As open systems, infants of depressed mothers select an assemblage of meanings from those available that increase the complexity and coherence of the meaning being made *in the moment*. The infants may learn that "we can be sad together" or face the dissipating alternative of infrequent or conflicted interactions. By cocreating this sad meaning, the infants and mothers can stay engaged, with some resulting increment in the complexity of infants' biopsychosocial state of consciousness. Over time, these dyads' sad way of being together may become stabilized as their characteristic way of being together (Beebe et al., 2008; see also Campbell & Cohn, 1991; Field, 1995; Murray & Cooper, 1997). Although these states of conscious-ness can be coherent and complexity-enhancing in the moment and over the short run, the interaction with the depressed parent becomes increasingly constricted and rigid in the long run. In turn, the quality of engagement achieved by infants or children with their depressed care-givers becomes more limited and limiting (Beebe et al., 2008; Campbell & Cohn, 1991; Field, 1995, 1998; Murray & Cooper, 1997).

In essence, it is necessary to recognize that the process of selecting meanings that are incorporated into a state of consciousness or organized into a way of being together is not always adaptive (i.e., the process is blind to long-term consequences). That is, meaning-making simply operates to maximize complexity by selecting what better fits together from what is available *now*. It operates even if the long-run costs are extremely high because, in the moment, the alternative is to dissipate and to lose coherence and complexity about the world—a loss open systems must avoid (Prigogine & Stengers, 1984; Tronick, 2005).

Blind selection for complexity and coherence in the moment helps to clarify a phenomenon that is difficult to explain with traditional psychodynamic or behaviorist models. Just as infant rhesus macaques become attached to neglectful or rejecting parents and human adults are often unable to leave abusive partners, human infants and children are likely to form attachments to abusive parents, even if those attachments are insecure in quality. Yet research suggests that parental maltreatment is linked to long-term negative consequences, such as disorganized attachment and atypical self-development (Beeghly & Cicchetti, 1994; Cicchetti & Barnett, 1991; van IJzendoorn, Schuengel, & Bakermans-Kranenburg, 1999). So what keeps these children in the relationship? Bowlby (1980) argued that attachment is a biobehavioral system rooted in evolutionary history that promotes survival, and he and others have posited that felt security is the critical emotion underlying attachment and well-being (Cummings, 1995).

It is difficult to imagine how maltreating parents could enhance their infant's survival or how they could promote felt security in their infants. Our view is that, like infants of depressed parents, infants of abusing or neglectful parents face a dilemma. To avoid the toxic caregiver, infants can either withdraw and self-regulate (a choice that will eventually lead to diminishing complexity and compromised growth as a system, potentially dysfunctional patterns of engagement with others, psychopathology, and dissipation as a system) or maintain their presence in the dysfunctional relationship and gain whatever complexity from it is possible, at whatever cost in the long run. The latter is the only viable choice (the lesser of two evils), and although limited, such infants can in this way develop a core sense of themselves, the parent, and their relationship even if these representations are negative and lead to future maladaptive and even psychopathological outcomes (Sroufe, 2009).

Clinical Implications and Summary

The study of the dynamics of meaning-making sheds light on how infants may develop either resilient or maladaptive outcomes during infancy and early childhood. As such, it

brings to mind several clinical implications. For infants and mothers in therapy, this perspective highlights the importance of studying dyadic communicative processes (i.e., their chronic iterated interactive processes) such as matching, mismatching, and reparation that go on moment by moment as central mechanisms that generate the full range of typical and atypical development (Beebe et al., 2008, 2010; Tronick et al., 1998). These processes become the constraints that further shape moment-by-moment experience as development proceeds. As contrasted with approaches that concentrate on trauma as a primary mechanism generating mental health problems, we have argued that a more intense focus on the life of infants and parents *as it is lived*—in its most quotidian moments—is warranted. While not denying trauma's effects, this perspective views trauma as an interruption and distortion of meaning-making and the selection of meanings in the moment. Trauma creates fixed meanings that limit the expansion of complexity in dyadic open systems, and we believe it actually may impair meaning-making processes per se. Moreover, trauma's toxic effects on young children are amplified over time because those effects distort and preclude other typical meaning-making processes that are foundational to positive developmental outcomes (Osofsky, 1995; Pollak, Cicchetti, Hornung, & Reed, 2000).

By focusing on the chronic, moment-to-moment social experiences of infants and caregivers, this approach demands that treatments for infants *must* involve caregivers and that caregivers, too, must change their ways of being together with their infants. In interventions with infants, therefore, caregivers must actively scaffold their infants' intentions and meaning-making and simultaneously make new meanings with them in order to induce change. This approach is likely to succeed if it is begun early and reiterated often, because infants are developing systems and therefore especially open to change (Gottlieb & Halpern, 2008; Sander, 2004). Anna Freud recognized this when she wrote that the goal of therapy was to get children back on their developmental pathway (Freud, 1974). Change with adult patients is more difficult because so much of their organization is already fixed, and undoing organization generates anxiety and resistance (Sander, 2004).

In some cases, having infants develop a therapeutic relationship with a person other than the disturbed caregiver may protect them because it enables them to develop ways of being with others that not only are generative for future relations with others but also, reciprocally, may help induce change in their caregiver(s). That is, infants as open systems can serve a therapeutic function with their caregivers (Field, 1998), and the exchange can self-amplify into a virtuous (as opposed to vicious) therapeutic cycle. We believe that caregivers also need to be in their own therapy in order to have them change the meanings that maintain the distortions of their interactions with their young children. In other therapeutic contexts (with the exception of family therapy), a therapist who works with a couple and also individually with one or each of the members of the couple might be seen as engaging in a boundary violation, with its many attendant problems. However, in infant mental health work, such multipatient system work may be extremely effective in scaffolding the process of change.

Meanings come in a multitude of different (polymorphic) forms, and we have not identified all the ways that infants and caregivers come to form different individual and shared meanings or all the ways these meanings can be changed. An implication is that infant mental health therapies that rely solely on one form of meaning-making (e.g., dyadic, cognitive, or body therapies), be they parent- or infant- or relationship-focused, may have only limited success because they may be able to "remake" only some of the forms of meaning made at other levels. The multifaceted nature of infants' meaning-making suggests that a wide variety of infant therapies would be useful, such as touch, massage, holding, playing alone and with others, reverie, mindfulness and other states, and psychophysiologic interventions (Field, 2003; Ham & Tronick, 2009; P. Ogden, Minton, & Pain, 2006; T. Ogden, 1997; Siegel, 2010). Multiple ways of working with infant–caregiver dyads are also needed, and perhaps the same holds for adult therapy as well.

Moreover, clinicians working with at-risk infant–caregiver dyads need to recognize and tolerate the messiness around negative states that is generated in typical interactions, what Brazelton (1992) in his *Touchpoints* model called "valuing disorganization." Such tolerance is not always easy or comfortable because it induces a loss of complexity in the system (dissipation). It may also increase anxiety in both the patient and therapist, perhaps resulting in problematic actions aimed at controlling the therapist's anxiety. However, when viewing the infant–caregiver dyad as an open system, therapists must allow for interactive disorganization (messiness) and sometimes even induce it to overcome rigid patterns. They then need to actively support caregivers' and infants' attempts to cocreate mutual strategies to modulate and repair their negative affective states during social interaction and to cocreate new meanings. Then, as new and more complex meanings form, infants and caregivers (and therapists) can gain increasing confidence in their coping capacities and in others' reliability, which can amplify the possibility of change. Our focus on the dynamic moment-to-moment interchanges between infant and caregiver highlights the concept that every infant–caregiver relationship is unique, and therefore treatment plans should not be overly formulaic or rigid but rather should focus on individual differences. Taking this perspective in therapy may ultimately lead to our generating dynamic nonlinear techniques for inducing change.

An important advantage of this perspective is the recognition that the process of making sense out of the world is a lifelong transactional process, not a developmental perspective in which early experience or genetics alone rigidly determine later outcomes (Kagan, 1998). Rather, although the past does constrain the future, over the life span there is always the possibility of creating new meanings of self and the world that are age possible and polymorphic in character. Both in the moment and over time, these meanings become increasingly coherent and complex and, at the same time, constrained by the past. Even more

vital is the need to recognize that no connection between individuals is perfect; yet out of all this imperfection, dyadic reparatory processes generate unique meanings, and new connections emerge. Such is the wonder of the human condition: the emergence of new ways of being together and new meanings in relation to the world and to one's self.

REFERENCES

Adamson, L. B., & Frick, J. E. (2003). The still-face: A history of a shared experimental paradigm. *Infancy, 4,* 451–473. doi:10.1207/S15327078IN0404_01

Aksan, N., Kochanska, G., & Ortmann, M. R. (2006). Mutually responsive orientation between parents and their young children: Toward methodological advances in the science of relationships. *Developmental Psychology, 42,* 833–848. doi:10.1037/0012-1649.42.5.833

Baillargeon, R. (2004). Infants' reasoning about hidden objects: Evidence for event-general and event-specific expectations. *Developmental Science, 7,* 391–414. doi:10.1111/j.1467-7687.2004.00357.x

Barr, R. G., Marrott, H., & Rovee-Collier, C. (2003). The role of sensory preconditioning in memory retrieval by preverbal infants. *Learning & Behavior, 31,* 111–123.

Beebe, B., Jaffe, J., Buck, K., Chen, H., Cohen, P., Feldstein, S., & Andrews, H. (2008). Six-week postpartum maternal depressive symptoms and 4-month mother-infant self- and interactive contingency. *Infant Mental Health Journal, 29,* 442–471. doi:10.1002/imhj.20191

Beebe, B., Jaffe, J., Markese, S., Buck, K., Chen, H., Cohen, P., . . . Feldstein, S. (2010). The origins of 12-month attachment: A microanalysis of 4-month mother-infant interaction. *Attachment & Human Development, 12,* 3–141. doi:10.1080/14616730903338985

Beeghly, M., & Cicchetti, D. (1994). Child maltreatment, attachment, and the self system: Emergence of an internal state lexicon in toddlers at high social risk. *Development and Psychopathology, 6,* 5–30. doi:10.1017/S095457940000585X

Beeghly, M., Olson, K. L., Weinberg, M. K., Pierre, S. C., Downey, N., & Tronick, E. Z. (2003). Prevalence, stability, and socio-demographic correlates of depressive symptoms in Black mothers during the first 18 months postpartum. *Maternal and Child Health Journal, 7,* 157–168. doi:10.1023/A:1025132320321

Beeghly, M., & Tronick, E. Z. (1994). Effects of prenatal exposure to cocaine in early infancy: Toxic effects on the process of mutual regulation. *Infant Mental Health Journal, 15,* 158–175. doi:10.1002/1097-0355(199422)15:2<158::AID-IMHJ2280150207>3.0.CO;2-7

Beeghly, M., Weinberg, M. K., Olson, K. L., Kernan, H., Riley, J. M., & Tronick, E. Z. (2002). Stability and change in level of maternal depressive symptomatology during the first postpartum year. *Journal of Affective Disorders, 71,* 169–180. doi:10.1016/S0165-0327(01)00409-8

Berk, L. E. (2010). *Exploring lifespan development* (2nd ed.). Boston, MA: Allyn & Bacon.

Bernier, A., Carlson, S. M., & Whipple, N. (2010). From external regulation to self-regulation: Early parenting precursors of young children's executive functioning. *Child Development, 81,* 326–339. doi:10.1111/j.1467-8624.2009.01397.x

Bowlby, J. (1980). *Attachment and loss: Vol. 1. Attachment.* New York, NY: Basic Books.

Brazelton, T. B. (1992). *Touchpoints: Your child's emotional and behavioral development.* Reading, MA: Addison-Wesley.

Brazelton, T. B., Koslowski, B., & Main, M. (1974). The origins of reciprocity: The early mother-infant interaction. In M. Lewis & L. A. Rosenblum (Eds.), *The effect of the infant on its caregiver* (pp. 49–76). New York, NY: Wiley.

Bretherton, I., & Munholland, K. A. (1999). Internal working models in attachment relationships: A construct revisited. In J. Cassidy & P. R. Shaver (Eds.), *Handbook of attachment: Theory, research, and clinical applications* (pp. 89–111). New York, NY: Guilford Press.

Bruner, J. (1990). *Acts of meaning.* Cambridge, MA: Harvard University Press.

Campbell, S. B., & Cohn, J. F. (1991). Prevalence and correlates of postpartum depression in first-time mothers. *Journal of Abnormal Psychology, 100,* 594–599. doi:10.1037/0021-843X.100.4.594

Carter, A. S., Garrity-Rokous, F. E., Chazan-Cohen, R., Little, C., & Briggs-Gowan, M. J. (2001). Maternal depression and comorbidity. *Journal of the American Academy of Child & Adolescent Psychiatry, 40,* 18–26. doi:10.1097/00004583-200101000-00012

Cicchetti, D., & Barnett, D. (1991). Attachment organization in maltreated preschoolers. *Development and Psychopathology, 3,* 397–411. doi:10.1017/S0954579400007598

Cicchetti, D., & Toth, S. L. (1998). The development of depression in children and adolescents. *American Psychologist, 53,* 221–241. doi:10.1037/0003-066X.53.2.221

Cohn, J. F., Campbell, S. B., & Ross, S. (1991). Infant response in the still-face paradigm at 6 months predicts avoidant and secure attachment at 12 months. *Development and Psychopathology, 3,* 367–376. doi:10.1017/S0954579400007574

Cohn, J. F., & Tronick, E. Z. (1989). Specificity of infants' response to mothers' affective behavior. *Journal of the American Academy of Child & Adolescent Psychiatry, 28,* 242–248. doi:10.1097/00004583-198903000-00016

Cummings, E. M. (1995). Security, emotionality, and parental depression: A commentary. *Developmental Psychology, 31,* 425–427. doi:10.1037/0012-1649.31.3.425

Damasio, A. (2000). *The feeling of what happens.* London, England: Vintage Press.

De Wolff, M. S., & van IJzendoorn, M. H. (1997). Sensitivity and attachment: A meta-analysis on parental antecedents of infant attachment. *Child Development, 68,* 571–591. doi:10.2307/1132107

Edelman, G. M. (1987). *Neural Darwinism: The theory of neuronal group selection.* New York, NY: Basic Books.

Emde, R. N. (1983). The prerepresentational self and its affective core. In A. Freud, H. Hartmann, & E. Kris (Eds.), *The psychoanalytic study of the child* (pp. 165–192). New Haven, CT: Yale University Press.

Erikson, E. H. (1950). *Childhood and society.* New York, NY: Norton.

Feldman, R. (2003). Infant–mother and infant–father synchrony: The co-regulation of positive arousal. *Infant Mental Health Journal, 24,* 1–23. doi:10.1002/imhj.10041

Field, T. (1995). Infants of depressed mothers. *Infant Behavior and Development, 18,* 1–13. doi:10.1016/0163-6383(95)90003-9

Field, T. (1998). Maternal depression effects on infants and early intervention. *Preventive Medicine, 27,* 200–203. doi:10.1006/pmed.1998.0293

Field, T. (2003). *Touch.* New York, NY: Bradford Books.

Fogel, A. (2006). Dynamic systems research on interindividual communication: The transformation of meaning-making. *Journal of Developmental Processes, 1,* 7–30.

Fonagy, P. (1999). Psychoanalytic theory from the viewpoint of attachment theory and research. In J. Cassidy & P. R. Shaver (Eds.), *Handbook of attachment: Theory, research, and clinical applications* (pp. 595–624). New York, NY: Guilford Press.

Fosha, D. (2000). *The transforming power of affect.* New York, NY: Basic Books.

Fraley, R. C., & Shaver, P. R. (2000). Adult romantic attachment: Theoretical developments, emerging controversies, and unanswered questions. *Review of General Psychology, 4,* 132–154. doi:10.1037/1089-2680.4.2.132

Freeman, W. J. (2000). *How brains make up their minds.* New York, NY: Columbia University Press.

Freud, A. (1974). *Normality and pathology in childhood: Assessments of development* (Vol. 6). New York, NY: International Universities Press.

Freud, S. (1923). *The ego and the id.* New York, NY: Norton.

Gelfand, D. M., & Teti, D. M. (1990). The effects of maternal depression on children. *Clinical Psychology Review, 10,* 329–353. doi:10.1016/0272-7358(90)90065-I

Gergely, G., & Watson, J. S. (1996). The social biofeedback theory of parental affect-mirroring: The development of emotional self-awareness and self-control in infancy. *International Journal of Psychoanalysis, 77,* 1181–1212.

Gianino, A., & Tronick, E. Z. (1988). The mutual regulation model: The infant's self and interactive regulation, coping, and defensive capacities. In T. Field, P. McCabe, & N. Schneiderman (Eds.), *Stress and coping* (pp. 47–68). Hillsdale, NJ: Erlbaum.

Golombok, S., & Fivush, R. (1994). *Gender differences.* New York, NY: Cambridge University Press.

Gottlieb, G., & Halpern, C. T. (2008). Individual development as a system

of co-actions: Implications for research and policy. In A. Fogel, B. J. King, & S. G. Shanker (Eds.), *Human development in the 21st century* (pp. 41–47). New York, NY: Cambridge University Press.

Gottman, J. M., & Driver, J. L. (2005). Dysfunctional marital conflict and everyday marital interaction. *Journal of Divorce & Remarriage, 43*(3–4), 63–77. doi:10.1300/J087v43n03_04

Granic, I., & Patterson, G. R. (2006). Toward a comprehensive model of antisocial development: A dynamic systems approach. *Psychological Review, 113,* 101–131. doi:10.1037/0033-295X.113.1.101

Greenspan, S. I. (2008). A dynamic developmental model of mental health and mental illness. In A. Fogel, B. J. King, & S. G. Shanker (Eds.), *Human development in the 21st century: Visionary ideas from systems scientists* (pp. 157–175). New York, NY: Cambridge University Press.

Haglund, M. E., Nestadt, P. S., Cooper, N. S., Southwick, S. M., & Charney, D. S. (2007). Psychobiological mechanisms of resilience: Relevance to prevention and treatment of stress-related psychopathology. *Development and Psychopathology, 19,* 889–920. doi:10.1017/S0954579407000430

Ham, J., & Tronick, E. Z. (2009). Relational psychophysiology: Lessons from mother-infant physiology research on dyadically expanded states of consciousness. *Psychotherapy Research, 19,* 619–632.

Harrison, A. M. (2003). Change in psychoanalysis: Getting from A to B. *Journal of the American Psychoanalytic Association, 51,* 221–256. doi:10.1177/00030651030510011201

Hill-Soderlund, A. L., & Braungart-Rieker, J. M. (2008). Early individual differences in temperamental reactivity and regulation: Implications for effortful control in early childhood. *Infant Behavior and Development, 31,* 386–397. doi:10.1016/j.infbeh.2007.12.007

Hobson, P. (2002). *The cradle of thought.* London, England: Macmillan.

Hofer, M. A. (2006). Psychobiological roots of early attachment. *Current Directions in Psychological Sciences, 15,* 84–88. doi:10.1111/j.0963-7214.2006.00412.x

James, W. (1890). *The principles of psychology.* New York, NY: Henry Holt.

Kagan, J. (1998). *Three seductive ideas.* Cambridge, MA: Harvard University Press.

Kaufman, S. (1995). *At home in the universe. The search for the laws of self-organization and complexity.* New York, NY: Oxford University Press.

Kochanska, G. (2002). Mutually responsive orientation between mothers and their young children: A context for the early development of conscience. *Current Directions in Psychological Science, 11*(6), 191–195.

Lavelli, M., & Fogel, A. (2005). Developmental changes in the relationship between the infant's attention and emotion during early face-to-face communication: The 2-month transition. *Developmental Psychology, 41,* 265–280.

LeVine, R. A. (1990). Enculturation: A biosocial perspective on the development of self. In D. Cicchetti & M. Beeghly (Eds.), *The self in transition: Infancy to childhood* (pp. 99–117). Chicago, IL: University of Chicago Press.

LeVine, R. A., Dixon, S., LeVine, S. E., Richman, A., Keefer, C. H., Leiderman, P. H., & Brazelton, T. B. (2008). The comparative study of parenting. In R. A. LeVine & R. S. New (Eds.), *Anthropology and child development* (pp. 55–65). Malden, MA: Blackwell.

Markova, G., & Legerstee, M. (2006). Contingency, imitation, and affect sharing: Foundations of infants' social awareness. *Developmental Psychology, 42,* 132–141. doi:10.1037/0012-1649.42.1.132

Meltzoff, A. N. (2007). "Like me": A foundation for social cognition. *Developmental Science, 10,* 126–134. doi:10.1111/j.1467-7687.2007.00574.x

Mesman, J., van IJzendoorn, M. H., & Bakermans-Kranenburg, M. (2009). The many faces of the still-face paradigm: A review and meta-analysis. *Developmental Review, 29,* 120–162. doi:10.1016/j.dr.2009.02.001

Modell, A. (1993). *The private self.* Cambridge, MA: Harvard University Press.

Murray, L., & Cooper, P. (Eds.). (1997). *Postpartum depression and child development.* New York, NY: Guilford Press.

Nelson, C. A., Zeanah, C. H., & Fox, N. A. (2007). The effects of early deprivation on brain-behavioral development: The Bucharest Early Intervention Project. In D. Romer & E. F. Walker (Eds.), *Adolescent psychopathology and the developing brain: Integrating brain and pre-*

vention science (pp. 197–215). New York, NY: Oxford University Press.

Ogden, P., Minton, K., & Pain, C. (2006). *Trauma and the body: A sensorimotor approach to psychotherapy.* New York, NY: Norton.

Ogden, T. (1997). *Reverie and interpretation: Sensing something human.* Lanham, MD: Rowman & Littlefield.

Osofsky, J. D. (1995). The effect of exposure to violence on young children. *American Psychologist, 50,* 782–788. doi:10.1037/0003-066X.50.9.782

Parke, R. D. (2000). Father involvement: A developmental psychological perspective. *Marriage & Family Review, 29*(2), 43–58. doi:10.1300/J002v29n02_04

Piaget, J. (1954). *The construction of reality in the child* (8th ed.). New York, NY: Basic Books.

Pollak, S. D., Cicchetti, D., Hornung, K., & Reed, A. (2000). Recognizing emotion in faces: Developmental effects of child abuse and neglect. *Developmental Psychology, 36,* 679–688. doi:10.1037/0012-1649.36.5.679

Prigogine, I., & Stengers, I. (1984). *Order out of chaos: Man's new dialogue with nature.* Toronto, Ontario, Canada: Bantam New Age Books.

Reck, C., Hunt, A., Weiss, R., Noon, A., Moehler, E., Downing, G., . . . Tronick, E. Z. (2004). Interactive regulation of affect in postpartum depressed mothers and their infants: An overview. *Psychopathology, 37,* 272–280. doi:10.1159/000081983

Reddy, V. (2008). *How infants know minds.* Cambridge, MA: Harvard University Press.

Sameroff, A. J. (2000). Developmental systems and psychopathology. *Development and Psychopathology, 12,* 297–312. doi:10.1017/S0954579400003035

Sander, L. (2004). *Living systems, evolving consciousness, and the emerging person.* New York, NY: Analytic Press.

Schmuckler, M. A., & Li, N. S. (1998). Looming responses to obstacles and apertures: The role of accretion and deletion of background texture. *Psychological Science, 9,* 49–52. doi:10.1111/1467-9280.00009

Seligman, S. (2005). Dynamic systems theories as a metaframework for psychoanalysis. *Psychoanalytic Dialogues, 15,* 285–319. doi:10.1080/10481881509348832

Siegel, D. (2010). *Mindsight: The new science of transformation.* New York, NY: Norton.

Smith, L. B., & Thelen, E. (2003). Development as a dynamic system. *Trends in Cognitive Sciences, 7,* 343–348. doi:10.1016/S1364-6613(03)00156-6

Spelke, E. S., & Kinzler, K. D. (2007). Core knowledge. *Developmental Science, 10,* 89–96. doi:10.1111/j.1467-7687.2007.00569.x

Spitz, R. (1946). Anaclitic depression. *Psychoanalytic Study of the Child, 2,* 113–117.

Sroufe, L. A. (2009). The concept of development in developmental psychopathology. *Child Development Perspectives, 3,* 178–183. doi:10.1111/j.1750-8606.2009.00103.x

Stechler, G., & Latz, E. (1966). Some observations on attention and arousal in the human infant. *Journal of the American Academy of Child Psychiatry, 5,* 517–525. doi:10.1016/S0002-7138(09)62098-7

Stern, D. N. (1985). *The interpersonal world of the infant.* New York, NY: Basic Books.

Tamis-LeMonda, C. S., Bornstein, M. H., Baumwell, L., & Damast, A. M. (1996). Responsive parenting in the second year: Specific influences on children's language and play. *Early Development and Parenting, 5,* 173–183. doi:10.1002/(SICI)1099-0917(199612)5:4<173::AID-EDP131>3.0.CO;2-V

Trevarthen, C. (1993). The function of emotions in early infant communication and development. In J. Nadel & L. Camaioni (Eds.), *New perspectives in early communicative development* (pp. 48–81). London, England: Routledge.

Trevarthen, C., Aitken, K. J., Vandekerckhove, M. M., Delafield-Butt, J., & Nagy, E. (2006). Collaborative regulations of vitality in early childhood: Stress in intimate relationships and postnatal psychopathology. In D. Cicchetti & D. J. Cohen (Eds.), *Developmental psychopathology: Vol. 2. Development neuroscience* (pp. 65–126). New York, NY: Wiley.

Tronick, E. Z. (1989). Emotions and emotional communication in infants. *American Psychologist, 44,* 112–119. doi:10.1037/0003-066X.44.2.112

Tronick, E. Z. (2002). A model of infant mood states and Sandarian

affective waves. *Psychoanalytic Dialogues, 12,* 73–99. doi:10.1080/10481881209348656

Tronick, E. Z. (2005). Why is connection with others so critical? The formation of dyadic states of consciousness and the expansion of individuals' states of consciousness: Coherence governed selection and the co-creation of meaning out of messy meaning making. In J. Nadel & D. Muir (Eds.), *Emotional development: Recent research advances* (pp. 293–315). Oxford, England: Oxford University Press.

Tronick, E. Z. (2007). *The neurobehavioral and social-emotional development of infants and children.* New York, NY: Norton.

Tronick, E. (2008). Multilevel meaning making and dyadic expansion of consciousness theory: The emotional and the polymorphic polysemic flow of meaning. In D. Fosha, D. J. Siegel, & M. Solomon (Eds.), *The healing power of emotion: Affective neuroscience, development, and clinical practice* (pp. 86–110). New York, NY: Norton.

Tronick, E. Z., Brushweiller-Stern, N., Harrison, A. M., Lyons-Ruth, K., Morgan, A. C., Nahum, J. P., . . . Stern, D. N. (1998). Dyadically expanded states of consciousness and the process of therapeutic change. *Infant Mental Health Journal, 19,* 290–299.

Tronick, E. Z., & Cohn, J. F. (1989). Infant-mother face-to-face interaction: Age and gender differences in coordination and the occurrence of miscoordination. *Child Development, 60,* 85–92. doi:10.2307/1131074

Tronick, E. Z., Cohn, J., & Shea, E. (1986). The transfer of affect between mothers and infants. In T. B. Brazelton & M. W. Yogman (Eds.), *Affective development in infancy* (pp. 11–25). Norwood, NJ: Ablex.

van IJzendoorn, M. H., Schuengel, C., & Bakermans-Kranenburg, M. J. (1999). Disorganized attachment in early childhood: Meta-analysis of precursors, concomitants, and sequelae. *Development and Psychopathology, 11,* 225–249. doi:10.1017/S0954579499002035

Watson, J. B. (1928). *Psychological care of infant and child.* New York, NY: Norton.

Weinberg, M. K., Beeghly, M., Olson, K. L., & Tronick, E. Z. (2008). A still-face paradigm for young children: 2½ year-olds' reactions to maternal unavailability during the still-face. *Journal of Developmental Processes, 3*(1), 4–21.

Weinberg, M. K., Olson, K. L., Beeghly, M., & Tronick, E. Z. (2006). Making up is hard to do, especially for mothers with high levels of depressive symptoms and their infant sons. *Journal of Child Psychology and Psychiatry, 47,* 670–683. doi:10.1111/j.1469-7610.2005.01545.x