



The Effects of Mother's Physical and Emotional Unavailability on Emotion Regulation

Author(s): Tiffany Field

Source: *Monographs of the Society for Research in Child Development*, Vol. 59, No. 2/3, The Development of Emotion Regulation: Biological and Behavioral Considerations, (1994), pp. 208-227

Published by: Blackwell Publishing on behalf of the Society for Research in Child Development

Stable URL: <http://www.jstor.org/stable/1166147>

Accessed: 20/05/2008 10:53

Your use of the JSTOR archive indicates your acceptance of JSTOR's Terms and Conditions of Use, available at <http://www.jstor.org/page/info/about/policies/terms.jsp>. JSTOR's Terms and Conditions of Use provides, in part, that unless you have obtained prior permission, you may not download an entire issue of a journal or multiple copies of articles, and you may use content in the JSTOR archive only for your personal, non-commercial use.

Please contact the publisher regarding any further use of this work. Publisher contact information may be obtained at <http://www.jstor.org/action/showPublisher?publisherCode=black>.

Each copy of any part of a JSTOR transmission must contain the same copyright notice that appears on the screen or printed page of such transmission.

JSTOR is a not-for-profit organization founded in 1995 to build trusted digital archives for scholarship. We enable the scholarly community to preserve their work and the materials they rely upon, and to build a common research platform that promotes the discovery and use of these resources. For more information about JSTOR, please contact support@jstor.org.

THE EFFECTS OF MOTHER'S PHYSICAL AND EMOTIONAL UNAVAILABILITY ON EMOTION REGULATION

Tiffany Field

Infant emotion regulation develops in the context of early mother-infant interactions (for animal models, see also Hofer, in this volume). The mother assumes various roles in these interactions, as does the infant, and together they develop attunement. Emotion dysregulation can occur when the mother is either physically unavailable, as during early separations, or, even worse, emotionally unavailable, as, for example, if she is depressed. Physical or emotional unavailability of the mother contributes to dysregulation because the mother can no longer act as optimal stimulator and an arousal regulator for the infant.

This essay first reviews data on the mothers' and infants' roles during early interactions and how these serve to foster the development of infant emotion regulation. Data and methodologies are then reviewed for the measurement of synchrony, or attunement, during early interactions. Next, illustrations are provided of the ways in which physical unavailability—specifically, early separations due to the mother's hospitalization or her conference trips—contributes to emotion dysregulation. This is followed by illustrations of how the mother's emotional unavailability (due to her depression) contributes to emotion dysregulation. Finally, future research directions are suggested for the assessment of individual differences in the development of emotion regulation and dysregulation.

This research was supported by a National Institute of Mental Health (NIMH) Research Scientist Award (MH00331) and an NIMH research grant (MH40779) to Tiffany Field. I would like to thank all the mothers and infants who participated in these studies. Direct correspondence to Tiffany Field, Department of Pediatrics, University of Miami School of Medicine, P.O. Box 016820, Miami, FL 33101.

EMOTION REGULATION DURING EARLY INTERACTIONS

In a number of earlier papers, my colleagues and I advanced the notion that infants develop emotion regulation, or become behaviorally and physiologically organized, in the context of early mother-infant interactions (e.g., Field, 1978, 1985, 1991a). Because the infant spends most of the time with the primary caregiver, who is typically the mother, this can be considered the primary learning environment for the development of emotion regulation. Mothers' and infants' roles in accomplishing the regulation of infant behavior and physiology are discussed in Field (1978).

*Mothers' and Infants' Roles in
the Development of Infant Emotion Regulation*

As noted in Field (1978), the mother's roles in helping the infant establish behavioral and physiological organization consist of reading the infant's signals and, accordingly, providing optimal stimulation (with respect to stimulation modality, form, intensity, variability, and contingency), which in turn provides arousal modulation that permits the infant to remain behaviorally and physiologically organized. They also include the modeling of behaviors to be imitated by the infant and contingent responsiveness of the behavior (meaning that the mother typically simplifies and imitates the infant's behavior), which in turn leads to reinforcement of the infant's behaviors.

Similarly, the infant remains physiologically and behaviorally organized, alert, attentive, and receptive to stimulation; reads the mother's signals during social interactions; seeks out and approaches optimal stimulation (which depends on the infant's stimulus threshold, sleep-wake state, and ability to self-regulate independent of the parent's modulation, all of which depends on the infant's maturity and previous experience); withdraws and averts from nonoptimal stimulation; and contingently responds to the mother's behaviors (mostly via imitation). That contingent response in turn reinforces the mother's behaviors. When the mother and infant are able to assume these roles effectively during their early interactions, behavioral and physiological attunement is achieved, and the interactions appear harmonious and synchronous.

Behavioral and Physiological Attunement

Attunement is a term used to describe the phenomenon that occurs when mothers and infants appear to be coordinated behaviorally and/or are concordant physiologically during early interactions (Field, 1985). It has also been called *behavior meshing*, *affect matching*, *synchrony*, *concordance*, and *en-*

trainment, to name only a few alternate terms. Stern (1974) was one of the first to describe this phenomenon in infants, demonstrating dramatic differences in the mother-child interactions of two twins: the mother and one twin were synchronous during their interactions, whereas the other twin and the mother were unable to arrive at a mutually optimal level of stimulation. Stern suggested that mothers “infantize” their behavior so that the infant can closely match it and they can achieve synchrony together.

More recently, Stern (1983) has labeled that phenomenon *affect attunement*, noting that 48% of the mother’s behaviors consist of mirroring/echoing the infant’s visual/vocal behavior in either the same or a different modality. The criterion he used for coding attunement was whether the mother’s behavior matched the infant’s behavior on shape, intensity, contour, or temporal features (duration, beat, or rhythm). In psychoanalytic terms, Stern suggested that this phenomenon was a matching of inner states of the infant and mother.

Brazelton and his colleagues took a similar approach, plotting rhythmic cycles of the infant’s attention and the mother’s activity during mother-infant interactions (Brazelton, Koslowski, & Main, 1974). Mothers were seen to meet their infants’ needs in one of three ways: by adjusting their rhythm to the infant’s, following the baby’s gazing-away cues with increases and decreases in stimulation; by not responding to the child’s rhythm but rather continuing their own stimulation, thus reinforcing the time the infant spends looking away; or by attempting to impose their own rhythm to regulate the child’s. The sensitive timing of these behaviors was illustrated by a series of photographs taken from a similar study by our group (see Fig. 1). As in a dance, the mother and infant can be seen to be sensitively attuned to each other.

Since the publication of these early studies, a number of systems have been developed for the coding of these behaviors and of the affective quality of interactions (see Beebe, Jaffe, Feldstein, Mays, & Alson, 1985; Tronick, Als, & Brazelton, 1977). In these systems, behavioral states are scaled along an attentional/affective dimension (from negative to neutral to positive states or from disengagement to engagement) for each member of the dyad, and the data are then examined for the amount of time the mother and infant share the same behavior state. In harmonious interactions, infants and mothers appear to share and experience the same behavior states (Beebe et al., 1985); furthermore, infants and mothers seem to cycle together across these behavioral states, as if sharing interaction rhythms. Some authors have suggested that interaction rhythms are biologically based, resembling the temporal rhythms of sucking, cardiac, and respiratory rhythms (Stratton, 1982; Wolff, 1967). Others have suggested that the interactions themselves entrain the rhythms of the infant (Beebe et al., 1985; Sander, 1969).

Measurement of Attunement

The measurement of attunement has come to depend on the coding of videotapes, using laptop-computer technology for continuous coding (Guthertz & Field, 1989). This method, combined with the increasing sophistication of time-series data analysis (Gottman, 1989; Warner, 1989), has greatly facilitated the development of this research area. The assumption underlying these methods of data analysis is that synchrony occurs when a behavior cycles with another behavior in rhythm. Any behavior/physiology that occurs rhythmically can be described in terms of cycles, periods, frequencies, and amplitudes; cycles typically occur in ranges of seconds. Once each of the individual cycles has been determined, these are then examined for coherence or concordance. Synchrony is then defined as the degree of coherence or concordance between the behavioral/physiological cycles of the two individuals.

One of the simplest approaches to studying synchrony is to code the behavior streams of each individual for various behaviors or affective states; the proportion of time that both individuals are displaying the same behavior or state is then determined by the computer. Typically, the behavior states are scaled along the attentional/affective dimension of disengagement to engagement, and greater behavior state matching or sharing by the members of the dyad is considered greater synchrony.

Currently, the most popular method for assessing shared rhythmicity in interactions is cross-spectral analysis. Two time series are created by coding the behavior states of each of the two partners second by second. Spectral analysis is first performed to determine whether both individuals' behaviors are significantly cyclic, whether they fall within one basic frequency band, and whether their cyclicities overlap. Then, to demonstrate synchrony, two other functions need to be examined: first the coherence spectrum, which assesses the linear associations of the cycles; then the phase spectrum, which measures the lead-lag relation of the cycles (Gottman, Rose, & Mettetal, 1982) (according to Gottman, 1981, analysis of the coherence spectrum is required to determine whether the time series are related). Cross-spectral analysis is then applied to determine the coherence or shared variance of the two time series at different frequencies. This model is further described in the examples of dysregulation given below.

EMOTION DYSREGULATION IN EARLY INFANCY

Emotion dysregulation occurs when the mother's physical or emotional unavailability deprives the infant of her *zeitgeber*, or regulator. As I have argued earlier (Field, 1987), the mother is a modulator of the infant's opti-



a



b



c



d

FIG. 1.—A typical sequence observed during “attuned” interactions of normal infants and their mothers. *a*, The infant looks at the mother, and the mother shows an exaggerated facial expression (mock surprise). *b*, The infant and the mother smile. *c*, The infant laughs. *d*, The infant looks away. The mother ceases smiling and watches her infant. (From Field & Fogel, 1982.)

mal stimulation and arousal level, and, in optimal interactions, the mother's and the infant's attentive/affective behaviors and physiological rhythms become synchronized. If, however, the mother is physically unavailable (during early separations) or emotionally unavailable (i.e., affectively unresponsive, as, e.g., during a period of depression), the infant experiences behavioral and physiological disorganization, and the mother's and the infant's behavioral and physiological rhythms become asynchronous. This is manifested in affective disturbance and changes in the infant's motor, physiological, or biochemical activity levels, which follow from either temporary or chronic loss of an important external regulator of stimulation that the infant needs for arousal modulation.

A similar model, the mutual regulation model, has been proposed by Tronick and Giannino (1987). According to these authors, "Because of her own emotional state, [the depressed mother] fails to respond to her infant's other-directed regulatory signals, and thus fails to provide the infant with appropriate regulatory help" (p. 9). Tronick and Giannino argue that maintenance of synchrony is not important. Rather, they suggest that such circumstances lead the infant to develop skills to restore or "repair" harmony that are significant for successful early socioemotional functioning. By their reasoning, one might expect infants of depressed mothers to develop even greater skills because of their greater experience with asynchronous interactions.

Physical Unavailability:

Examples Taken from Early Separations

At around 9 months, dysregulation can be seen during separations from the mother. In our model, the dysregulating effect of the mother's physical unavailability is thought to occur because substitute caregivers are less familiar with the infant's signals, thresholds, personal preferences for stimulation, etc. They are less able to provide optimal stimulation than the mother, and, as a result, the mother's absence leads to loss of the external regulator of the infant's arousal level. Because of their lesser familiarity with the infant's stimulation preferences, substitute caregivers tend to be more arousing and have more difficulty regulating the infant's arousal level. The combined effects of missing a source of optimal stimulation and arousal regulation can lead to disorganization of physiology (as indexed by heart rate), play behavior, affect, activity level, sleep, and other vegetative functions during the separations, which sometimes extends even into the post-reunion periods.

By the end of the first year, the infant has probably mastered a number of self-regulatory behaviors that should attenuate the stress associated with

separation from the mother; examples of such skills are gaze aversion and such self-comforting behaviors as thumb sucking. In addition, the infant will have begun to develop strategies for emotion regulation that are well tailored to particular partners and/or circumstances. Arousal reducing behaviors that are effective with mothers may differ from those that are effective with fathers, nursery caregivers, or peers. Emotion regulation is fostered in different ways by different partners. Emotion dysregulation is probably most apparent in the absence of the infant's primary, most familiar caregiver.

Separations Due to Mother's Hospitalization

We have investigated mother-infant separations using the paradigm developed by Martin Reite and his colleagues to study infant pigtail and bonnet monkeys (Reite & Capitanio, 1985). These investigators surgically implanted telemetry in their infant monkeys and monitored both their behavior and their physiology during a period prior to mother-infant separations, during the separations themselves, and following the pairs' reunions. Generally, they found a period of behavioral agitation followed by a period of depression that often persisted after the mother-infant reunion. The infants moved more slowly than normal, and their play behavior was diminished; they showed sleep disturbances accompanied by increases in both heart rate and body temperature that were followed by decreases to below baseline. For several monkeys, the behaviors did not return to normal following reunion; the authors suggest that the mother continued to be unavailable to the infant in these cases, either because she was coming into estrus during the period of separation or because she needed to reestablish herself in the dominance hierarchy after her return.

In our study, the mother was separated from her infant (0–12 months), toddler (12–24 months), or preschooler (2–5 years) owing to the birth of another child (Field, 1985; Field & Reite, 1984). Similar to the data on the infant monkeys, the data on human infants showed agitated behavior and physiology during the period of the mother's hospitalization and depressed behavior and activity following the mother's return from the hospital. The latter suggests that the mother remained unavailable to the infant despite her physical presence; typically, the mothers were tired, and some experienced postpartum depression. Inevitably, the mother-infant relationship was altered by the arrival of the new sibling. Similar to the monkeys, the infants were agitated during their mothers' hospitalization, showing increases in negative affect, activity level, heart rate, night wakings, and crying. Longer than usual periods of deep sleep at this stage were interpreted as conservation withdrawal. After the mother returned, decreases were

noted in positive affect, activity level, heart rate, and active sleep, effects that are suggestive of depression. The parents also noted illnesses, clinging and aggressive behaviors, and changes in eating, toileting, and sleep patterns. The infants were clearly agitated by being separated from the mother even though they were cared for by their fathers.

The fathers may not have been as effective in modulating these infants' arousal because of their lesser experience with the child's arousal modulation needs. Heightened arousal can stimulate the sympathetic adrenergic system, resulting in agitated behavior typically associated with active coping—in this case, active attempts to recall the mother. The emergence of depression as the separation continued may relate to a number of factors. Given our assumptions about the nonoptimal quality of the father's care, the child's depression could have been a homeostatic mechanism acting to offset the sympathetic arousal or agitation arising in the absence of effective arousal modulation, or it might have resulted from inadequate amounts of stimulation. Moreover, the children may have experienced helplessness during the separation because of their failure to recall the mother and during the reunion because the arrival of the new sibling had altered the relationship.

This, of course, is the major confound of this paradigm—it does not permit assessing how much the changes in behavior are related to the separation per se and how much to the altered mother-infant relationship. Thus, in a subsequent study, we examined the effects of a separation that was not confounded by a change in relationship, namely, separation due to the mother's attending a conference (Field, 1991b).

Separations Due to Mother's Conference Trip

In this paradigm, we simply observed infants, toddlers, and preschoolers before, during, and after their mothers' conference trips (Field, 1991b). The observations for this study were conducted in a nursery school. Because the children in this study attended nursery school while those in our study on hospital separations did not, direct comparisons could not be made between the two sets of data. In particular, during our pilot testing we noted that children who remained at home during the mother's trip were more stressed during that period than those who remained in school; hence, it appears that the child's familiar peers and teachers may have served to buffer the usual separation stress. Of course, others (e.g., Cassidy, in this volume) might interpret this behavior instead as a "dampening" of negative emotion expression as in a "stiff upper lip" kind of behavior.

As can be seen in Table 1, changes in the children's behaviors indicate that they experienced stress during the mother's absence. However, as can

THE DEVELOPMENT OF EMOTION REGULATION

TABLE 1
 MEANS FOR FREE-PLAY AND SLEEP MEASURES AT BASELINE AND DURING SEPARATIONS
 FOR SINGLE AND MULTIPLE SEPARATIONS

	SINGLE SEPARATION (N = 40)		MULTIPLE SEPARATIONS (N = 40)	
	Baseline	During	Baseline	During
Activity level	14.1 ^a	19.1 ^b	14.7 ^a	16.1 ^b
Wandering aimlessly	6.1 ^a	10.5 ^b	6.4 ^a	5.8 ^b
Watching children	14.3 ^a	26.4 ^b	15.8 ^a	17.7 ^b
Cooperative play	24.8 ^a	15.5 ^b	26.8 ^a	32.4 ^b
Fantasy play	46.7 ^a	30.3 ^b	44.7 ^a	49.1 ^b
Fussiness	5.3 ^a	12.1 ^b	6.3 ^a	5.5 ^b

SOURCE.—Adapted from Field (1991b).

NOTE.—Lowercase letters across rows represent post hoc comparisons that are significantly different at $p < .05$ or less.

also be seen in Table 1, comparison of those who had experienced repeated separations with those who had experienced only a single separation suggests adjustment to repeated separation. Also, when later and earlier separations were compared, later separations were found to be less stressful. Thus, it appears that children learn to adapt to separations from their mothers when these are not accompanied by changes in relationships. It should also be noted that, in this sample of dual-career medical faculty and staff families, no differences were seen between the children’s responses to separation from mother and from father.

Hospital versus Conference Trip Separations

To permit comparisons that could not be performed with the data sets just described, we undertook another study: using the same nursery school population as before, we compared the child’s response to separation due to mother’s hospitalization for the birth of another child and to mother’s conference trips. As can be seen in Table 2, a number of significant differences emerged. *During the actual separation*, parents reported more sleep and behavior problems when the separation was due to hospitalization than when it was due to a conference trip. In addition, less smiling was noted during the play observations, and the children spent a greater proportion of their nap time in active sleep. This latter difference was interpreted as indicating conservation withdrawal; the children’s more agitated behavior during hospital as opposed to conference separations exhausted them more, and they required more sleep. *Following the return of the mother*, parents continued to report more sleep and general behavior problems following hospital as opposed to conference trip separations. During play, the post-

TABLE 2

MEANS FOR CHILDREN'S BEHAVIORS OBSERVED DURING SEPARATION AND AFTER THE MOTHER'S RETURN FROM A CONFERENCE TRIP VERSUS A HOSPITALIZATION FOR THE BIRTH OF A SIBLING ($p < .05$, $N = 20$)

OBSERVATION PERIOD	TYPE OF SEPARATION	
	Conference Trip	Hospitalization
Separation:		
Sleep problems (rating)	1.0	2.4
Behavior problems (rating)7	1.6
Smiling (% time)	7.4	2.7
Active sleep (% time)	4.3	10.8
After mother's return:		
Sleep problems (rating)6	2.4
Behavior problems (rating)8	1.6
Smiling (% time)	8.9	5.4
Positive verbal interaction (% time)	13.1	4.9
Fantasy play (% time)	38.7	23.2

hospital separation group also showed less smiling, less fantasy play, and fewer positive verbal interactions. Thus, in general, the hospital separations were significantly more stressful for the children than separations due to conference trips, probably because of the anticipated and actual disruptions and changes in the mother-child relationship.

In sum, both human and primate separation studies have demonstrated that separation from mother is associated with changes in infant affect, play behavior, activity level, heart rate, sleep and eating patterns, general health status, and functional responses of the immune system (Field, 1984b; Field & Reite, 1984; Field, Vega-Lahr, & Jagadish, 1984; Laudenslager, Reite, & Harbeck, 1982; Reite, Short, Seiler, & Pauley, 1981). In studies of monkey mother-infant separations, changes also have been noted in cortisol levels (Coe, Mendoza, Smotherman, & Levine, 1978). This particular constellation of changes is not surprising inasmuch as these functions are thought to be mediated by the hypothalamus and its extensive connections to other areas of the limbic system as well as the pituitary adrenal cortical system (Levine, 1983; McCabe & Schneiderman, 1985; Stansbury & Gunnar, in this volume). A biphasic response to separation, with an agitated period typically followed by a period of depression, has also been established in humans and other primates.

Depressed activity may be adaptive following a period of agitated behavior, particularly in the absence of the infant's primary source of arousal modulation. Furthermore, data from neuroanatomical and pharmacological studies reviewed by Kraemer (1984) suggest that the abnormal behavior of separated subjects might in part reflect the effect of social stimulation that, following deprivation, activates inputs to neural systems whose receptors

THE DEVELOPMENT OF EMOTION REGULATION

TABLE 3

MEANS PROPORTION OF TIME THAT MOTHER'S AND INFANT'S INTERACTION BEHAVIORS OCCURRED DURING THE SEPARATION AND STILL-FACE PERTURBATIONS ($N = 40$)

	PERTURBATION			
	Separation		Still Face	
	Baseline	During	Baseline	During
Smiling	8 ^b	1 ^a	10 ^a	3 ^b
Vocalizing	5 ^a	6 ^a	5 ^a	9 ^b
Motor activity	9 ^a	15 ^b	8 ^a	21 ^b
Gaze aversion	35 ^a	0 ^b	36 ^a	50 ^b
Distress brow	2 ^a	4 ^b	1 ^a	9 ^b
Crying	1 ^a	4 ^b	2 ^a	8 ^b

NOTE.—Lowercase letters across rows represent post hoc comparisons that are significantly different at $p < .05$ or less.

have become supersensitive. As implied by the term *conservation-withdrawal*, depressed activity may serve as a rest from agitation, and, thus, it may serve an adaptive function until physiological equilibrium is restored or until the mother and child become attuned to their new relationship and the latter's arousal modulation needs can again be met.

Physical versus Emotional Unavailability during Brief Perturbation Interactions

The studies that I have described indicate that infants continue to experience stress even after the mother is again physically available if she remains emotionally unavailable. Several experimental perturbations of mother-infant interactions have been tried to mimic the emotional unavailability of a mother who is involved with a new baby or, in the case of monkeys, with reestablishing herself in the dominance hierarchy. In these paradigms, the mother is asked to look depressed or to remain still faced (Stoller & Field, 1982; Tronick, Als, Adamson, Wise, & Brazelton, 1978); in both cases, the mother is affectively unresponsive, and, after attempting to reinstate a normal interaction, the infant becomes significantly distressed. Thus, we know that both physical and emotional unavailability of the mother distresses the young infant; however, no direct comparisons have been made between the infant's different responses to these two conditions. To make that comparison, we subjected 3-month-old infants to the mother's "still face" condition as well as to a brief separation.

As can be seen in Table 3, the infants became more negative and agitated during both these conditions. However, the situation in which the mother was emotionally unavailable (still face) appeared to be the more

stressful. During the perturbations, infant motor activity, gaze aversion, distressed brow, and crying occurred more often during still face than separation, perhaps because still face situations are a violation of the infant's expectations. The mother becomes suddenly unresponsive in a typically interactive situation. Emotional unavailability is more distressing to the infant than simply being left alone to rely on her own resources.

Analogous situations in the literature are the anesthetized mother rat who is unresponsive to her pup (Schanberg & Field, 1987) and depressed mothers who tend to leave their infants alone in playpens (Lyons-Ruth, Zoll, Connell, & Grunebaum, 1986). Being left alone by a depressed mother, however, may be less stressful for the infant than experiencing her as emotionally unavailable. In a comparison of home-care versus day-care infants observed in this same still face versus separation paradigm, home-care infants displayed more motor activity and distress brow behavior than day-care infants, again suggesting the buffering effects of day care on the disturbances associated with the physical and emotional unavailability of the mother (Field, Stoller, Vega-Lahr, Scafidi, & Goldstein, 1986).

*Chronic Emotional Unavailability Exemplified by
Mother's Depression*

The data on brief periods of mother's emotional and physical unavailability suggest that the effects of the former may be far more distressing than those of the latter. Although less direct, comparisons of findings obtained in our studies of mother's physical unavailability (the hospital and conference separations) and emotional unavailability (exposure to a depressed mother) also suggest that the latter is more harmful to the infant's development. Whereas the effects of physical separations (both conference and hospital) appear to be short lived, mother's depression is correlated with infant depression as early as 3 months of age (Field, 1984a), and, if the mother remains depressed at 6 months, it is related to growth and developmental delays shown at age 1 year (Field, 1985).

The basic factors involved in emotional unavailability are much the same as those involved in physical unavailability; however, there are some differences. First, although the emotionally unavailable mother's stimulation is not missing (as it is in instances of physical unavailability), this stimulation is disruptive and noncontingent. The mother's sad affect and withdrawn behavior, or angry affect and intrusive behavior, are noncontingent and hence disruptive to the flow of interaction. Dyadic sharing of behavior states is less frequent because of the mother's limited contingent responsivity and the dyads' limited mutual attentiveness. Studies reported by Cohn, Ma-

tias, Tronick, Connell, and Lyons-Ruth (1986) show that withdrawn mothers spent approximately 80% of their time disengaged from their infants and were responsive only to infant distress; intrusive mothers, on the other hand, expressed anger and irritation or handled their infants roughly more than 40% of the time. Infants of the disengaged (i.e., withdrawn) mothers protested nearly 30% of the time and watched their mothers less than 5% of the time, whereas infants exposed to the intrusive mothering style protested less than 5% of the time but spent more than 55% of their time avoiding their mothers.

Second, both physical unavailability and emotional unavailability on the part of the mother result in lack of arousal regulation for the infant. Emotional unavailability results when the mother is insensitive and unresponsive to the infant's signals rather than when she is absent. Finally, in the short run, the net effect is very much the same. The child's behavior and physiology are disorganized, but, in the case of emotional unavailability due to mother's depression, the disorganization is more prolonged. Changes in physiology (heart rate, vagal tone, and cortisol levels), in play behavior, affect, activity level, and sleep organization as well as other vegetative functions such as eating and toileting, and even immune system changes persist for the duration of the mother's depression. I have suggested that these changes occur because the infant is being deprived (in this case chronically) of an important external regulator of stimulation (the mother) and thus fails to develop or sustain arousal modulation and organized behavioral and physiological rhythms. Over brief periods, this has been demonstrated in observations of interaction rhythms.

In one study, my colleagues and I investigated shared states and rhythms during interactions between nondepressed and depressed mothers and their infants (Field, Healy, Goldstein, & Guthertz, 1990). Mother-infant interaction synchrony was assessed in 48 depressed and nondepressed pairs at the time the infants were 3 months old. The attentive/affective behavior states of both the mothers and the infants were coded on a negative to positive continuum that included anger and disengagement at one pole and attentiveness and playfulness at the other. The depressed mothers and their infants showed negative behavior states more often and positive behavior states less often than the nondepressed dyads (see Fig. 2). The depressed dyads also spent less time (40% vs. 54%) in shared behavior states.

In a second study, both the behavior states and the physiological rhythms (heart rate) of depressed and nondepressed mothers and their infants were subjected to cross-spectral analyses (Field, Healy, & LeBlanc, 1989). The data were analyzed to determine the coherence of mother-infant behavior states, the coherence of mother-infant heart rate, the within-partner (mother or infant) coherence of behavior and heart rate, and the

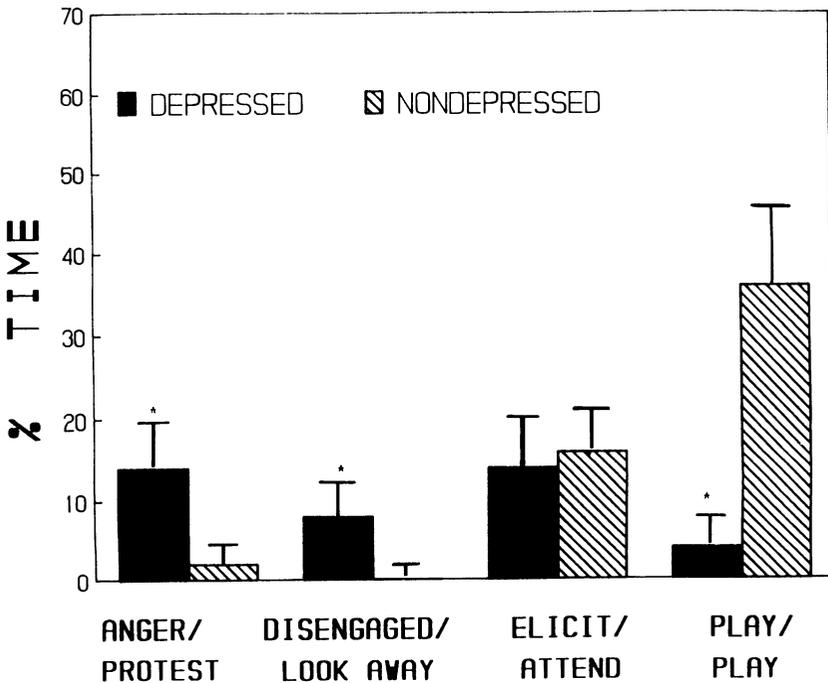


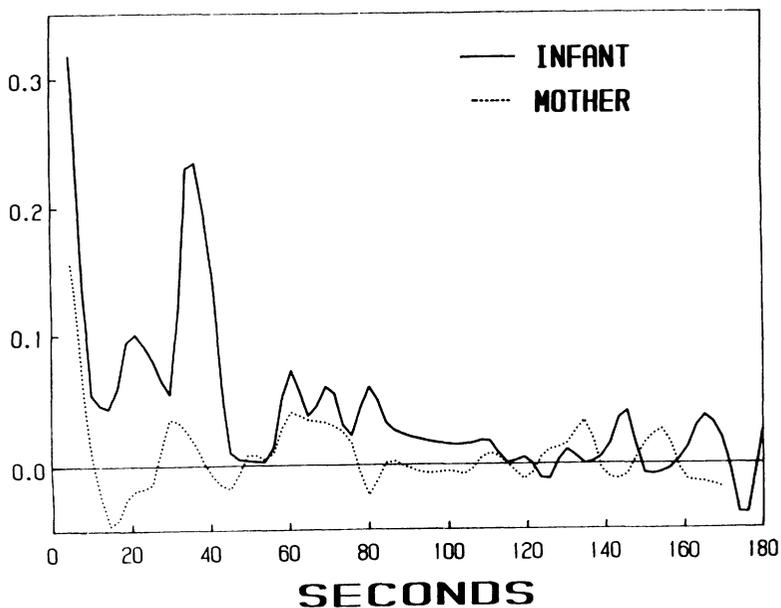
FIG. 2.—Percentage of time that mothers and infants shared behavior states. (From Field, Healy, Goldstein, & Guthertz, 1990.)

coherence of mother's behavior and infant's heart rate and of infant's behavior and mother's heart rate. These coherence values were then compared across depressed versus nondepressed mother-infant dyads to determine whether greater coherence characterized harmonious (nondepressed) than disturbed (depressed) interactions. The sharing of negative behavior states by the depressed dyads and of positive states by the nondepressed dyads was consistent with our previous findings: the coherence functions indicated that the nondepressed dyads had higher mean coherence than the depressed dyads ($M = .46$ vs. $.29$).

Models of the wave forms of these mother/infant behavior states (for the nondepressed and the depressed dyads) are displayed in Figure 3. The model wave forms illustrate the rhythmic structure of the interaction across the 3-min period as a function of the level of affective involvement. Examples of synchrony can be seen at the points where the wave forms of the mothers' and the infants' behavior-state ratings overlap.

Additional analyses also indicated greater coherence between infant's behavior and mother's heart rate for the nondepressed as opposed to the

CONTROL MOTHER/INFANT BEHAVIOR



DEPRESSED MOTHER/INFANT BEHAVIOR

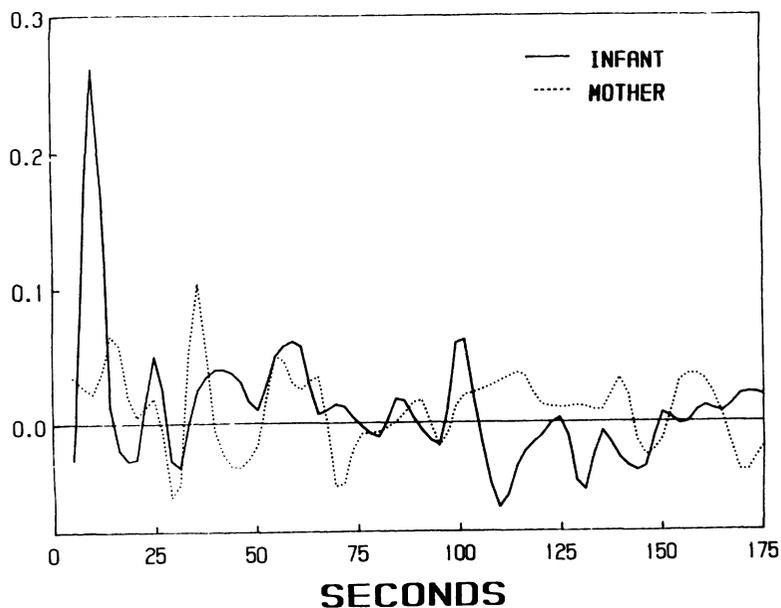


FIG. 3.—Wave forms for the nondepressed control mothers and their infants and for depressed mothers and their infants derived from averaging the sine transformed values of the frequencies in the band .03–.12 Hz ($N = 16$). (From Field, Healy, & LeBlanc, 1989.)

depressed dyads; no group differences for mother's behavior/infant's heart rate, for mother's behavior/heart rate, for infant's behavior/heart rate, or for mother's/infant's heart rate; and greater coherence across partner behavior (i.e., mother/infant) than within partner behavior and physiology (mother's behavior/heart rate or infant's behavior/heart rate).

In sum, these data converge to suggest a greater coherence between mothers' and infants' behavior in the nondepressed than in the depressed dyads. This is perhaps not surprising given that the former shared behavior states more frequently. That the nondepressed dyads also showed greater coherence between infant's behavior and mother's heart rate is also not surprising inasmuch as nondepressed mothers are noted to be more sensitive/responsive to their infants' behaviors. The heart-rate coherence values for both groups of mother/infant dyads were moderately high ($M = .46$ for the nondepressed group and $.28$ for the depressed group), suggesting that there was a mutual entrainment of physiological rhythms, not unlike that documented for therapist/patient dyads by Ax (1964) and Kaplan and Bloom (1960). As these authors suggested, correlated changes in autonomic arousal may be interpreted as evidence of empathy.

The implication here is that the depressed mothers and their infants were as empathetic as the nondepressed dyads inasmuch as their heart-rate coherence values were equivalent. However, it is possible that the high heart-rate coherence of the depressed dyads was due to their frequent sharing of negative states, which in turn attenuated the expected difference between these groups. Spending a significant portion of time in a shared angry/protesting state would be highly arousing for the depressed mother-infant dyads, just as spending time sharing a positive playful state might be highly arousing for the nondepressed dyads. If so, heart rate would be simultaneously elevated in both states, in both partners, and hence in both groups. These results suggest that both Gottman's (1989) notion that greater physiological coherence would occur in stressed dyads and Chapple's (1970) prediction that greater coherence would occur in nonstressed dyads are correct.

These, then, are some examples of the ways in which infants can become behaviorally and physiologically disorganized and interactions can become asynchronous when mothers are emotionally unavailable. As noted earlier, such early dysregulation of the infant appears to have later consequences, including growth and developmental delays at age 1 year. Seen again at preschool age, these infants are showing high internalizing and externalizing behavior scores, suggesting a predisposition to depression, conduct disorder, or co-morbidity, that is, both depression and conduct disorder (Field, Lang, Pickens, & Yando, 1994). The offspring of depressed mothers are noted to have a predisposition to later psychiatric disorders,

and the emotion dysregulation that occurs during early mother-infant interactions may be the pathway for the later disorders.

INDIVIDUAL DIFFERENCES

As in any study of any process, individual differences should be investigated once a phenomenon is established. In the case of dysregulation, individual differences might emerge as a function of several factors in addition to that of the mother being physically or emotionally unavailable. Variations in central nervous system maturity/integrity related to perinatal complications may be one such factor. Limited synchrony has been demonstrated in samples of preterm infants by Lester, Hoffman, and Brazelton (1985). These authors reported greater synchrony (coherence) in term versus preterm infant-mother dyads and in more developmentally mature dyads (5- vs. 3-month-old), suggesting that less mature, preterm infants—who are typically less responsive—achieve limited synchrony with their mothers and that mother-infant interactions become more synchronous as infants become more mature and farther removed from their perinatal complications.

Another factor may lie in differences in behavior repertoires that reflect individual differences in interaction skills, creativity, and probably intelligence. Temperament/personality differences can also play a role; these can be described in a number of different ways, including the distinction uninhibited/inhibited, as in the work of Fox and Kagan and their colleagues (see, e.g., Fox, in this volume; Kagan, in this volume), or in terms of the externalizing/internalizing typology described by Field (1987). Field reported higher thresholds in response to stimulation, slower habituation, greater behavioral reactivity, and lesser physiological reactivity for externalizing than for internalizing neonates. These characteristics would be expected to contribute to less emotion dysregulation and smoother mother-infant interactions in the case of externalizing infants.

Interactive/coping style—as in being a risk taker versus a non-risk taker (Field, 1989) or more ready to approach versus more ready to withdraw from stimulation (Fox & Davidson, 1984)—may also play a role. Differences in attitude toward stimulation are likely to lead to more or less exploratory behavior and more or less interactive behavior and hence dispose the infant to cope more actively (or less passively) with stimulation. Finally, the relative degree of mother-infant match-mismatch, synchrony, and/or empathy could also presumably lead to individual differences in the development of regulation. An example of a potentially consequential mismatch is dissimilarity in temperament between the infant and the

mother, the infant being more vocal and gregarious and the mother more withdrawn and inactive. These are only some examples of factors that can be expected to contribute to individual differences in the development of emotion dysregulation, and even these few have rarely been investigated.

SUMMARY

In summary, emotion dysregulation can develop from brief or more prolonged separations from the mother as well as from the more disturbing effects of her emotional unavailability, such as occurs when she is depressed. Harmonious interaction with the mother or the primary caregiver (attunement) is critical for the development of emotion regulation. The effects of the mother's physical unavailability were seen in studies of separations from the mother due to her hospitalization or to her conference trips. These separations affected the infants' play behaviors and sleep patterns. Comparisons between hospitalizations and conference trips, however, suggested that the infants' behaviors were more negatively affected by the hospitalizations than the conference trips. This probably related to these being hospitalizations for the birth of another baby—the infants no longer had the special, exclusive relationship with their mothers after the arrival of the new sibling. This finding highlights the critical importance of emotional availability. The mother had returned from the hospital, but, while she was no longer physically unavailable, she was now emotionally unavailable.

Emotional unavailability was investigated in an acute form by comparing two laboratory situations, the still face paradigm and the momentary leave taking. The still face had more negative effects on the infants' interaction behaviors than the physical separation.

The most extreme form of emotional unavailability, mother's depression, had the most negative effects. The disorganization or emotion dysregulation in this case is more prolonged. Changes in physiology (heart rate, vagal tone, and cortisol levels), in play behavior, affect, activity level, and sleep organization as well as other regulating functions such as eating and toileting, and even in the immune system persist for the duration of the mother's depression. My colleagues and I have suggested that these changes occur because the infant is being chronically deprived of an important external regulator of stimulation (the mother) and thus fails to develop emotion regulation or organized behavioral and physiological rhythms. Finally, individual differences were discussed, including those related to maturity (e.g., prematurity) and temperament/personality (e.g., uninhibited/inhibited or externalizing/internalizing) and those deriving from degree of mother-infant mismatch, such as dissimilar temperaments.

Further investigations are needed to determine how long the effects of

THE DEVELOPMENT OF EMOTION REGULATION

such early dysregulation endure, how they affect the infant's long-term development, how their effect differs across individuals and across development, and whether they can be modified by early intervention. Eventually, with increasing age, developing skills, and diversity of experience, infants develop individualized regulatory styles. That process, and how it is affected by the mother's physical and emotional unavailability, also requires further investigation.