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AN INVESTIGATION OF STABILITY, CHANGE, AND OBSERVED
ASSOCIATIONS DURING INFANT-MOTHER
FACE-TO-FACE INTERACTION

by
Sara Elizabeth Gable

A thesis submitted in partial fulfillment
of the requirements for the degree

of
MASTER OF SCIENCE
in
Family and Human Development

Approved:

UTAH STATE UNIVERSITY
Logan, Utah

1989

ACKNOWLEDGEMENTS

Russ Isabella provided enormous amounts of time, support, and patience during both the completion of this project and my entire graduate career at Utah State. His dedication and passion for the study of infant social development has been an inspiration to me and will surely continue to guide my personal studies. He has played an integral role in my development as a scholar and I imagine it will be a long time before I realize the full extent of his subtle yet influential mentoring.

Shelley Lindauer offered her undying faith in me during both my undergraduate and graduate studies. She is a remarkable woman and friend. I will forever benefit from the support she provided and the role model she has become.

Owen 'Siskel' Anderson and Ellen Cantrell were invaluable in coding the face-to-face data. I can't help but chuckle when I remember the fun times we had!

There are many family members and friends who also participated in the successful completion of this project. I could not have done it without their love and encouragement.

Sara Elizabeth Gable

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ABSTRACT

An Investigation of Stability, Change, and Observed
Associations during Infant-Mother
Face-to-Face Interaction

by

Sara Elizabeth Gable, Master of Science
Utah State University, 1989

Major Professor: Dr. Russell A. Isabella
Department: Family and Human Development

Researchers of social development during infancy have long viewed social competence as a reflection of the infant's experiences during early social interactions. In this context of social interaction, the infant's earliest developmental task involves the ability to regulate arousal; with continued development and the accumulation of interactional experiences, the infant takes a more active role as an initiator/elicitor of interaction. A particularly salient type of social exchange during infancy occurs when mother and infant engage in face-to-face interaction. Consequently, it was the goal of this study to examine maternal and infant behavior in the context of face-to-face interaction in order to: 1) identify those maternal behaviors that promote the infant's capacity to regulate arousal and subsequently act as a competent interactive partner; and 2) examine the extent to which early social development proceeds in a continuous manner.

Thirty-one infant-mother dyads were videotaped in two 3-minute episodes of face-to-face interaction at 1 and 4 months. The first episode involved spontaneous face-to-face interaction; the second episode involved an attention-getting manipulation of maternal behavior. Maternal and infant interactive behaviors were coded for each episode at both ages. No significant differences were found in maternal or infant behavior across episodes, thus allowing for the data to be pooled. Significant findings regarding maternal behavior included the following: maternal interactive behavior was found to remain stable across time at the individual and normative levels; maternal behavior was positively associated with infant behavior at both ages; and maternal silence during infant gaze aversion was predictive of infant regulation of arousal. Conversely, infant behavior did not remain stable across time, at either the individual or normative level, thus suggesting that infants are changing. A most revealing association was discovered between 1-month maternal physical activity and 4-month infant regulation of arousal, suggesting that maternal behavior may have long-range effects on infant social competence. Consequently, from these findings, it has been suggested that maternal intrusive behaviors (e.g., physical activity, silence during infant gaze aversion) are focal in infant regulation of arousal and subsequent interactive competence.

(119 pages)

CHAPTER I

INTRODUCTION AND STATEMENT OF THE PROBLEM

Researchers of social development during infancy have long viewed the infant's social competence as a reflection of his experiences during early interactions with mother. It is believed that these early interactions provide the potential for both the infant's mastery of the fundamental developmental tasks relevant to this period of life, and the learning of the 'rules' for coordinating one's behaviors with those of another, i.e., the rules of interpersonal behavior (Brazelton, Koslowski, & Main, 1974; Sroufe, 1979b; Stern, 1974).

In this context of social interaction, the infant's earliest developmental task involves the ability to regulate arousal; with continued development and the accumulation of interactional experiences, the infant takes a more active role as an initiator/elicitor of interaction. Given the importance of these processes of early interactions, and the prominent role attributed to the mother in assisting her infant's mastery of early developmental tasks, one would expect to observe a dimension of continuity in early social development emanating from maternal behavior displayed in the context of interaction with baby. That is, the infant's capacity to regulate arousal could be viewed as a necessary precursor to the infant's subsequent social competence,

i.e., ability to initiate and elicit interaction (Sroufe, 1979b).

A particularly salient type of social exchange during infancy occurs when mother and infant engage in face-to-face interaction, for it is during the course of such interaction that the infant is primarily responding to the amount of stimulation provided by mother while beginning to develop the capacity to regulate arousal. As the infant's capacity to regulate arousal develops, it, in turn, can be regarded as promoting further opportunities for interactions with the mother. Consequently, examination of both maternal and infant behaviors in the context of face-to-face interaction is important to: 1) identify those maternal behaviors that promote the infant's capacity to regulate arousal and subsequently act as a competent interactive partner; and 2) examine the extent to which early social development proceeds in a continuous manner.

The purpose of this study was to examine the stability and change observed during mother-infant face-to-face interaction with infants at 1 and 4 months of age, to determine which maternal behaviors displayed at 1 month facilitated optimal infant interactive behaviors at 4 months. Of particular interest was identification of specific maternal behaviors observed at 1 month that appear to promote the infant's developing capacity to regulate arousal and, consequently, perform as a competent interactive partner at 4 months. Also, it was of interest to determine which maternal behaviors, observed at 1 month, inhibited the infant's capacity to regulate arousal, resulting in less competent

interactive skills observed at 4 months.

The results of this study will contribute to the literature concerning infant social development in that they may offer information regarding the development of the capacity to regulate arousal and identify important aspects of maternal behavior in the context of interaction. Further, these results may provide evidence for the notion of continuity in early infant social development.

CHAPTER II

REVIEW OF THE LITERATURE

Background

In order to familiarize the reader with the face-to-face interaction paradigm, a brief consideration of the relevant methodology will be provided; a review of the relevant literature will follow. In general, the face-to-face interaction paradigm represents a microanalytical approach to the study of mother-infant interaction. The design and implementation of this approach is simple and useful for examining both maternal and infant behaviors observed during interaction. Quite simply, the face-to-face paradigm consists of mother and infant engaging in interaction while facing each other, their faces approximately 18 inches apart, usually within a time frame set by the researcher (e.g., two 3-minute episodes; one 10-minute episode). The value of this, however, appears much more intricate than its design and implementation in that its proponents suggest that what takes place during structured face-to-face interaction is representative of the nature of mother and infant's spontaneous, unstructured interactions.

In the context of face-to-face interaction, it is thought that mother, through the use of a natural repertoire of social stimuli is capable of providing interactional experiences that serve as the appropriate context for the facilitation of the infant's developing

capacity to regulate arousal (Stern, 1974; Trevarthen, 1974). Specifically, it is the mother who detects and gives meaning to her infant's actions through her behaviors during face-to-face interactions, thus furnishing the infant with experiences upon which to base her developing capacity for arousal regulation (Stern, 1974). Of particular importance in this regard is contingent responsivity, a characteristic of maternal behavior that provides meaning to and fabricates structure from her infant's behavior. Contingent responsivity is thought not only to characterize but to be critical to mother-infant interactional exchange.

Specifically, contingently responsive behaviors are those that: 1) immediately follow an infant behavior and thus afford the infant an opportunity to causally associate mother's response to his own behavior; 2) are appropriate in that they meet the infant's immediate needs; and 3) are accompanied by a balance of animation and modulation of maternal vocal and facial expression such that the infant is presented with interesting, dynamic, and optimally arousing stimulation (Robson, 1967). In fact, Robson asserts that the quality of the mother-infant relationship is based solely on contingent maternal behavior. While such a suggestion has yet to be supported, it has been demonstrated that maternal contingent behavior during face-to-face interaction increases the likelihood of certain infant behaviors, such as vocalizing and smiling, which may be viewed as innate releasers of tension that serve an arousal-regulating function (Brazelton et al., 1974; Sroufe, 1979a). Thus,

contingent responsivity does appear to play an important role in early social development as an essential component of maternal behavior that promotes infant regulation of arousal and subsequent social competence.

With regard to infant behaviors in the context of face-to-face interaction, a typical focus is that of behaviors thought to serve arousal-regulating functions. In studying these behaviors, researchers often employ infant heart rate as an index of internal changes, i.e., regulation of arousal, corresponding to emotional expressions, such as smiling or crying (Brazelton et al., 1974; Field, 1981; Mandler, 1975; Sroufe, 1979a; Stoller & Field, 1982). For example, during an episode of distress-free face-to-face interaction, smiling was found to diminish heart-rate acceleration, thus resulting in heart-rate deceleration and regulation of arousal (Brazelton et al., 1974; Field, 1981). In addition to smiling, the infant's control of his eye movements is viewed within this general category of arousal-regulating behaviors. In fact, it is believed that the infant's eye movements and patterns of visual attention appear to be the first intrinsic behavioral process in facilitating the regulation of arousal; gaze aversion has been linked to heart-rate deceleration in the context of mother-infant interaction (Brazelton et al., 1974; Vaughn & Sroufe, 1979). Thus, gaze alternation/aversion appears to be a manifestation of central nervous system functioning (Stern, 1974) and a necessary phase in the infant's recovering and attempting to maintain/regain

equilibrium (Brazelton et al., 1974). In this context of face-to-face interaction it is important to recognize that mother carries the major burden of responsibility for remaining cognizant of her infant's capacity for arousal and for responding contingently to her infant's arousal-regulating behaviors (e.g., smiling, gaze aversion).

If maternal contingent responsivity does not occur in the context of face-to-face interaction, infants may display behaviors indicative of overarousal. Once again, using infant heart rate as an index of internal changes provides information regarding the infant's attempts to modulate a high level of arousal. For example, Field (1981) found clear evidence of heart-rate acceleration prior to crying. More specifically, a preliminary cry-face was accompanied by heart-rate acceleration resulting in infant distress and crying. Consequently, crying, in the context of face-to-face interaction, appears to be an attempt on the infant's part to regulate overarousal (Brazelton et al., 1974).

Another aspect of interaction which is common to the face-to-face paradigm is mutual gaze--those moments when each partner is looking into the other's eyes. This particular characteristic of face-to-face interaction is thought to be a probable outcome of maternal contingent responsivity and a consequence of each member's responsivity to one another. That is, both infant and mother have the ability to elicit and hold the other's gaze through the use of the constellation of vocal and facial behaviors available to them.

If the infant smiles, coos, or is otherwise facially expressive, the likelihood of eliciting maternal attention and behavior is increased; while maternal gaze, vocal, and facial behaviors exert a strong effect on holding and eliciting infant gaze (Stern, 1974). Again, the integral role of maternal contingent responsivity is extended to the infant's capacity to regulate arousal and develop into a competent interactive partner, for it is when a balance of responsivity is achieved that the interaction is positively rewarding for both individuals, thus promoting further interaction.

On the basis of the above information, the face-to-face interaction paradigm may be viewed as a valuable tool in examining characteristics of maternal interactive behaviors as well as the infant's developing capacity to regulate arousal and his social competence as an interactive partner. The face-to-face paradigm has been shown to elicit specific aspects of maternal interactive behaviors (e.g., facial, vocal, gaze, and temporal qualities, and contingent responsivity), thus allowing for an assessment of their effectiveness in promoting the infant's social development. Perhaps more importantly, the face-to-face interaction paradigm allows for the observation of important aspects of the infant's developing self-regulation and interactive abilities, (e.g., gaze behavior, responsivity to mother, and ability to initiate and maintain interaction).

Given its value, it is not surprising that the face-to-face paradigm has been used in a wide variety of infant development

research. In general, such work tends to look not only at infant behaviors but also at the 'real' and simulated behavioral characteristics of mothers; exchanges of infant-mother dyads thought to be at risk for deficient interactions; stability and change in dyadic behaviors; and differences between structured versus natural face-to-face interactions. The literature review first addresses the most abundant literature, that of simulated and 'real' maternal behaviors; a discussion of infants at risk for deficient face-to-face interactive abilities follows.

Maternal Behaviors during Face-to-Face Interaction

A great deal of research has been conducted relating the effects of simulated maternal behavior on infant behavior during face-to-face interactions. Examples include experimental manipulations in which mothers are instructed to feign depression, present a still face, imitate their infant's behavior and/or direct attention-getting behaviors toward their infant. Perhaps the most consistent evidence from this body of research is that infant behavior is highly responsive to maternal behavior during face-to-face interaction (Cohn & Tronick, 1983; Field, 1977; Fogel, Diamond, Langhorst, & Demos, 1982; Gusella, Muir, & Tronick, 1988; Symons & Moran, 1987; Tronick, Als, & Adamson, 1979).

In one of the first such experimental manipulations, Field (1977), attempting to facilitate interaction, studied three groups of infants--high-risk premature, postmature, and full-term normal--

in a standardized face-to-face setting. At three months post-expected date of delivery, the infants were videotaped interacting with their mothers in one spontaneous and two manipulated situations. In the spontaneous situation, mothers were asked to pretend they were playing with their infants at home at the kitchen table; the manipulated interactions included an attention-getting situation where the mother was to try to keep the infant looking at her face, and an imitation situation during which the mother was asked to imitate all of her infant's behaviors as they occurred.

Results revealed that the attention-getting and imitation manipulations considerably modified face-to-face interactions by directly varying the mother's amount of activity, which in turn altered the amount of infant gaze. When the mother was instructed to keep her 3-month old's attention, she more frequently initiated conversation; when she was instructed to imitate the infant's behaviors, she decreased her activity and engaged in more contingent responsivity to her baby's behaviors. As would be predicted on the basis of the above review, infant gaze was most prevalent during the imitative interactions and least prevalent during the attention-getting interactions.

Cohn and Tronick (1983), in an investigation of 3-month-old infants' reactions to their mothers' normal and simulated-depressed expressions, videotaped infant-mother dyads in two face-to-face episodes. One episode depicted normal (i.e., "behave as you typically would") maternal vocal, facial, and physical expression;

while the other episode consisted of behavior described to the mothers as comprised of "flat, uninteresting vocal tones, expressionless faces, and a minimum of body movements and physical contact with their infants" (pg. 70).

Consistent with Field (1977), Cohn and Tronick (1983) reported that infant behavior was markedly different across the maternal expressiveness episodes--this difference was discovered in both the proportion of time spent in affect states and in the ordering of transitions among states. Infants in the depressed condition spent half of their time in protest or in a wary state whereas infants in the normal condition were rarely in protest or a wary state. Another finding of import was that the sequencing of infant affect states at 3 months was related to the quality of maternal expression. During periods of engagement, infants in the normal condition were likely to run through a well-organized sequence of three states: brief positive, monitor, and play. In contrast, infants in the depressed condition were likely to cycle in a poorly organized way among wary, protest, and look away. These findings suggest a probable inability to regulate arousal among the infants in the depressed condition, which could be viewed as an inhibitor of subsequent interactive competence.

Further evidence for the consequences of manipulated maternal actions on infants' behavior during face-to-face interaction are presented in a chapter investigating the structure of face-to-face communicative interactions in infants from 3 to 6 months. Tronick

et al. (1979) manipulated maternal behaviors during face-to-face interaction in several ways. The first manipulation had mothers slow down their rate of speech by counting aloud to their infants very, very slowly. Even though this was difficult for the mothers, the effects were extremely pronounced--the infants' smiles and vocalizations were more frequent and sustained, and in general the infants seemed to achieve a greater level of affective involvement and to maintain that level longer than was usual.

The second manipulation included having the mothers remain still-faced and then turn their heads, displaying only their profiles for the infant. In this condition, the infants were discovered to initially greet the mothers, then wait for a response; and when no response was received a new pattern emerged of the infant looking away, then glancing periodically back at the mother, apparently in the hopes of reinstating interaction. The profile condition produced different results. The infants sat and watched the mothers, cooing and calling to them while also leaning forward in the seat as if attempting to incite the mothers into interaction. These results provide evidence that at least by the age of 6 months infants are aware of their partners' communications (Tronick et al., 1979) and are capable of responding in a manner that demonstrates a degree of organization in their behavior. For example, viewing the mother's profile may have been perceived by the infant as a readiness to interact and, even though the mother did not readily interact, the infant behaved as if the mother might respond to her

attempts at any moment.

In another such manipulation of maternal behavior, Symons and Moran (1987) employed measures of both sequential dependency and individual behavior to examine the relationship among maternal and infant responsiveness, maternal activity level, and infant gaze when mothers were asked to play spontaneously, gain and hold the attention of, and imitate their 13-16-week-old infants. Mothers were observed to be more talkative, touch their infants more, display more positive affect, and act in a more animated fashion during play and attention-getting as compared with imitation. With regard to responsiveness, mothers were more behaviorally responsive during the play and imitation episodes; infants were also found to be more responsive and involved during these two conditions. Correlational analyses demonstrated that infants of mothers who were most responsive during the play and attention-getting episodes also displayed high levels of responsiveness during interaction, indicating that maternal contingent responsiveness during interaction may lead to increased infant responsiveness, thus facilitating further interaction.

In an attempt to examine the potential for lasting effects of manipulating mothers' interaction on infant behavior, Fogel et al. (1982) exposed 28 2-month-old infants to the following experimental conditions: a) normal interaction for 1.5 minutes, b) mother leaves infant alone for 1 minute, c) mother re-enters and assumes the still-face condition for 45 seconds, and d) mother resumes normal

behavior for the remaining 1.5 minutes. Two groups were randomly selected prior to testing and represented the 'look' group, whose mothers were instructed to assume the still face immediately upon returning to the room when their infants first looked at them, and the 'smile' group, whose mothers were instructed to assume the still face after their infants first smiled at them. Group assignment was predicted to either increase ('look' group), or decrease ('smile' group) the infants' tension (Sroufe, 1979a), thus influencing the type of reaction the still-face would elicit from the infant. It was expected that the arousal-regulating function served by infant smiling would possibly explain the hypothesized group differences between the 'look' group and the 'smile' group. The infant's level of arousal was anticipated to be decreased upon smiling at the mother, thus permitting the still-face manipulation to begin when the infant's level of arousal was lower, as compared to the 'look' group, whose still-face manipulation would begin when the infant's level of arousal was heightened.

With regard to experimental condition, the 2-month-old infants were found to gaze less at their mothers during the still-face episode and were found to engage in increased frequencies of pointing; infants tended to gaze away when their mothers became silent. Group differences were found in the expression of emotions, specifically wariness/distress and enjoyment. Infants in the 'smile' group tended to smile sooner than infants in the 'look' group during both the still-face and normal episodes, while infants

in the 'look' group were more likely to cry or show distress during the resumption of normal face-to-face interaction.

In further support of previous findings (Fogel et al., 1982; Tronick et al., 1979) are three studies designed to examine the effect of the still-face paradigm on 3- and 6-month-old infants. Gusella et al. (1988) carried out three different studies in order to: 1) confirm that shifts in infant behavior during the still-face condition corresponded to shifts in the mothers' interactive behavior, 2) discover if 3- and 6-month-olds would display the same changes in behavior toward the mother, during the still-faced condition, if the mother's ability to touch the infant were eliminated from the procedure, and 3) manipulate the mother's interaction during the still-face paradigm by controlling her facial and vocal characteristics through the use of a closed-circuit television system.

For Studies 1 and 2, infants and mothers were randomly assigned to a normal or still-face group. The normal group engaged in three episodes of spontaneous face-to-face interaction while the still-face groups engaged in two episodes of spontaneous interaction interrupted by one episode of still-face interaction. Study 3 differed from Studies 1 and 2 in two ways: the mothers were presented to their infants over a color television monitor and the second episode was manipulated so that the infants viewed one of the following: a still face with no voice, a still face with an interactive voice, an interactive face with no voice, or an

interactive face with an interactive voice.

Results from the first two studies suggested that 6-month-old infants are sensitive to an alteration in their mothers' facial and vocal qualities regardless of whether or not maternal touch is a component of the still-face paradigm, while the sensitivity of the 3-month olds to the still-face paradigm seemed to be dependent on the manipulation of the maternal touch component. Study 3 results also demonstrated a tendency for 6-month-old infants to react sensitively, i.e., decreased smiling and gaze behavior during the still-face episode, to changes in their mothers' behavior. Of interest is the finding that during the manipulation of maternal interactive behaviors over the television monitor, changes in mothers' facial interaction alone could produce the still-face effect, regardless of the manipulation on her interactive voice.

Collectively, these results indicate that 6-month-old infants recognize a change in their mothers' interactive behaviors during the still-face paradigm. This was clearly demonstrated by the majority of the infants adopting the pattern of decreased time spent smiling and gazing at their mothers during the still-face episode, followed by increased gaze behavior during the final, normal episode. These findings support the notion that maternal contingent responsivity leads to an increase in infant interactive behaviors during face-to-face interaction.

As is evidenced by the results reported above, the manipulation of maternal behavior during face-to-face interaction can have both

seemingly detrimental and beneficial effects on infant interactive behaviors. In general, results suggested that when maternal behaviors were manipulated to extremes with regard to level of maternal activity (e.g., attention-getting or still-face), infant gaze behavior was altered significantly, with infants spending more time gazing away from the mothers' face (Field, 1977; Fogel et al., 1982; Gusella et al., 1988). Thus it appears that infants responded to these manipulations with lower levels of interactive involvement, possibly due to their experience of either over- or under-stimulation, which in turn resulted in infants' use of their capacities to regulate arousal. When maternal behavior during face-to-face interaction was manipulated to a more 'optimal' level with regard to the infant's capacities for stimulation (e.g., imitation and very slow speech), results indicated that along with increases in maternal contingent responsivity were associated increases in infant responsiveness and involvement during interaction (Symons & Moran, 1987; Tronick et al., 1979). Consequently, further support is provided for the aforementioned notion that the infant's developing capacity to regulate arousal and subsequently act as a competent interactive partner is directly influenced by maternal contingent behavior.

The combined results are compelling in that they contribute not only to an understanding of the role of maternal contingent responsivity for infant social development, but also to a consideration of the long-term effects of naturally occurring

depressive or overactive maternal interactive behaviors on the social development of the young infant. In the following section, this latter issue will be addressed in a review of research that has employed the face-to-face interactive paradigm to investigate 'at-risk' populations comprised of infants born to mothers suffering from depression, as well as premature infants born to low SES, teenage mothers.

Infants at Risk

Maternal Depression

Tiffany Field (Field, 1984; Field et al., 1988; Field et al., 1985) has employed the standard face-to-face paradigm to investigate the relationship between postpartum depression and early infant-mother interactions. For example, Field (1984) manipulated maternal behavior across 3 interactive episodes. Episode 1 was comprised of normal, spontaneous behavior; episode 2 had mothers (both depressed and controls) acting depressed; episode 3 involved a reunion period of normal, spontaneous behavior. Across all three episodes, results revealed that 3-month-old infants of non-depressed mothers displayed more frequent positive affect, less frequent negative affect, a higher level of vocalizations, protesting, and looking wary, as compared to infants of depressed mothers. Non-depressed mothers, as compared to depressed, also displayed more positive affect, less frequent negative affect, offered more frequent vocalizations, and spent more time looking at their infants while providing

physical/tactile stimulation, across all three episodes. Perhaps most interesting, however, is that during the depressed and reunion interactive episodes, 3-month-old infants of non-depressed mothers were found to take a more active role in protesting the situation than their depressed-mother counterparts. Field (1984) hypothesizes that the behavior of infants of depressed mothers suggests a more passive coping style, as if these infants are already accustomed to a depressed style of interacting.

These findings are consistent with those of Field et al. (1985), in which, during a 10 minute episode of normal face-to-face play interaction, depressed mothers were found to express a predominantly depressed or anxious state, engage in less activity with their 4-month-old infants, express more frequent flat or tense affect, fewer infantized/imitative behaviors, less frequent contingent responsiveness, and less gameplaying during their interactions. Additionally, the infants of these depressed mothers were observed to display less optimal state ratings, more frequent squirming and back arching, fewer contented expressions, and greater levels of fussiness. It may be suggested that infants of depressed mothers appear to 'mirror' the depressed behavior of their mothers, thus resulting in less active, presumably unrewarding face-to-face interactions for both partners.

To further support the notion that infants of depressed mothers adopt depressed behavior during interactions, Field et al. (1988) determined that infants of depressed mothers generalized their

depressed behavior to interactions with non-depressed strange female adults. Specifically, these researchers reported that 3- to 6-month-old infants of depressed mothers were found to interact less competently (i.e., less physical activity and vocalizing, more fussiness, higher levels of gaze aversion) with non-depressed strangers than were infants of nondepressed mothers. And, in general, infants of depressed mothers were observed to interact with the non-depressed strangers in a manner that was highly similar to their interactions with mother. Of additional interest is the finding that the infants of depressed mothers, as compared to their non-depressed counterparts, had a more negative effect on the nondepressed strangers during the face-to-face episodes. That is, the strangers performed less optimally when interacting with infants of depressed mothers, as demonstrated by their lower interaction scores. "The infants' depressed style of interacting not only generalized to their interactions with nondepressed strangers but also seemed to elicit depressed-like behavior in the nondepressed adult" (pg. 1577).

These findings (Field et al., 1988) raise interesting questions regarding the origins of the behavior observed in infants of depressed mothers. When viewed as a consequence of the infant's capacity for regulating arousal, the limited stimulation and contingent responsivity provided by the depressed mother could be related to the less competent interactive skills of the infant. As suggested by Field et al. (1988), this type of infant interactive

deficiency could be indicative of "depression related to stimulus deprivation" (pg. 1577), leading one to infer that the infants of depressed mothers are presented with little interactive stimulation upon which to base their developing capacity to regulate arousal.

In another examination of the effects of maternal depression upon infant-mother exchange, Bettes (1988) examined the timing and intonational exaggeration of maternal vocalizations (motherese) during non-manipulated face-to-face interactions. Bettes (1988) hypothesized that maternal depression would be reflected in prosodically constrained motherese and also that depressed mothers would not modify their vocal behavior in response to infant vocalizations. Rather than videotaping, the author audiotaped the interactions in order to concentrate singularly on the vocal characteristics of the dyad. Interactions were taped in the subjects' homes, with the duration of the interaction left up to the mother. Two-minute samples of the final interactions were analyzed.

Results supported the hypotheses and reflected a general lack of contingent responsiveness for the depressed mothers, as compared to their non-depressed counterparts. Specifically, mothers evaluated as being depressed failed to alter their behavior according to the behavior of their 3- to 4-month-old infants and were also significantly slower in responding to infant vocalizations. Additionally, depressed mothers neglected to utilize the exaggerated intonational qualities that are characteristic of motherese, suggesting a lack of optimal interactive stimulation for

the infant. And finally, when depressed mothers did respond to their infants, these responses were six times more likely to be characterized by a non-exaggerated manner. That is, infants were presumably deprived of the cues characteristic of appropriate contingent responsiveness (e.g., animation and modulation of maternal vocal expressions) that typically distinguish interactions between infants and their caregivers. Infants of depressed mothers thus appear to be learning very little about the reciprocal qualities of interpersonal interaction, further supporting Field et al.'s (1988) proposition relating stimulus deprivation to an eventual deficiency in the infant's capacity for regulating arousal and subsequently acting as a competent interactive partner.

Preterm, Low SES Infants Born to Teenage Mothers

Another group of infants thought to be at risk for early interactive difficulties are preterm, low SES infants born to teenage mothers. Field (1980) hypothesized that the accumulation of these risk factors would result in mother-infant dyads experiencing the most difficult interactions. Eight different combinations of SES (low, middle), maternal age (teenage, adult), and infant birth status (preterm, term) were studied in order to test the above stated hypothesis. Mother-infant face-to-face interaction data come from assessments made when infants were 4-months old.

Main effects for the birth status of the infant suggested that preterm infants engaged in more head and gaze aversion and were less

vocal than their full-term counterparts, suggesting a possible deficiency in regulating arousal. Mothers of preterm infants were observed to be more verbal, less contingently responsive, and engaged in fewer episodes of imitative and/or exaggerated behavior and gameplaying than did mothers of full-term babies. Results demonstrating the combined effects of the risk factors illustrated that low SES teenage mothers of premature infants received lower scores on appropriateness and level of vocalizations, quality of facial expressions and gameplaying, and were observed to engage in more head and gaze aversion with their infants, thus presenting and eliciting less active interactions than the mothers in the other groups.

Collectively, the findings presented above (Bettes, 1988; Field, 1980, 1984; Field et al., 1988; Field et al., 1985) invite questions regarding the proposed continuity in social development, beginning with the infant's ability to regulate arousal. In general, it appears that depressed mothers, by failing to respond contingently to their infants' behaviors, are not fulfilling their role in assisting their infants' mastery of the task of regulation of arousal (Bettes, 1988). Relatedly, infants of depressed mothers were observed to display more negative affect, less vocalizations, more back arching, squirming and fussiness, and less contented facial expressions, thus eliciting and initiating fewer rewarding interactions with their mothers, conceivably suggesting an inability to regulate arousal (Field, 1980, 1984; Field et al., 1988; Field et

al., 1985). More importantly, with regard to the overall influence of maternal depression on infant social development, are the findings presented by Field et al. (1988) relating the interactions of infants of depressed mothers with nondepressed strangers. Specifically, these infants were observed to elicit depressed-like behaviors from strangers during face-to-face interaction, suggesting an inability to elicit mutually rewarding interactions, hence a lack of social competence. If development can be viewed as proceeding in a continuous manner, the implications of these findings are quite profound. For example, when the child begins to interact with peers, what type of interactions will the child elicit?

In attempting to assess the proposed continuity in early social development for infants at risk, many questions can be presented. For instance, does the subsequent social development of the infant, beyond the task of regulating arousal, bring about the opportunity for the potentially depressed interactive dynamics of infant-mother interactions to become more rewarding or stimulating for the infant? Obviously the communicative abilities of the infant mature, yet is this enough for interaction to change? That is, can and will the developmental changes of the infant influence the mother's interactive capabilities? A portion of the literature employing the face-to-face interactive paradigm looks specifically at the question of stability and change in the dyadic states of mother-infant face-to-face interaction behavior across early infancy.

Stability and Change in Face-to-Face Interactions

In general, research investigating stability and change in mother-infant face-to-face interaction across infancy suggests increasingly rich, spontaneous, reciprocally communicative exchanges over time (Field, Vega-Lahr, Goldstein, & Scafidi, 1987; Kaye, 1982; Kaye & Fogel, 1980). For example, Field et al. (1987) found that interaction ratings were higher--suggesting 'better' interactive exchanges--at 8 months than at 4 months, with infants smiling more, vocalizing more frequently, and demonstrating more motoric activity, suggesting that the infants and mothers are possibly gaining from their accumulation of mutual interactive experience. A finding which lends support to this notion offers that several maternal behaviors (e.g., mother smiling, mother touching), observed at 4 months were related to infant behaviors (e.g., infant gaze aversion, infant smiling) observed at 8 months. Hence, early maternal behaviors may be affecting subsequent infant behaviors, including those believed to be focal in arousal regulation (e.g., vocalizing and smiling), with a resultant meshing of infant-mother behaviors which lends itself to more rewarding interactions.

A similar 'qualitative' change in infant-mother face-to-face interaction was reported by Kaye (1982). Over a period of 20 weeks it was found that the rate of infant vocalizations and facial expressions increased, especially when the infant was attending to the mother. Additionally, it was reported that over time infants attended to mother less, but received more stimulation from her when

attending. It appears that the infants advanced from merely responding to maternal behaviors during early assessments to consequently initiating and eliciting interaction from the mother when attending to her, lending support to the notion of continuity in development as the infant moves beyond the task of regulation of arousal.

Another study by Kaye (Kaye & Fogel, 1980) provides more detail as to the temporal structure of communication which takes place during face-to-face interaction across early infancy. A finding of interest proposes that the mean proportion of time during which infants were oriented towards their mothers' faces declined with age, leading to an increase in maternal expressive behaviors during times of infant attention. Additionally, the likelihood of infant attention towards maternal expressiveness decreased over time from 6 to 26 weeks; mothers were more likely to keep their infants' attention with expressiveness at 6 weeks than at 26 weeks. Perhaps more importantly, infant responses to maternal behavior matured from being mere responses to becoming increasingly more autonomous, reciprocal, and organized.

In summary, Kaye and Fogel (1980) concluded that with the observed decline in gazing at the mother's face during face-to-face exchanges, consequent interaction becomes increasingly rich, spontaneous, and characterized by reciprocal communication during the periods of mutual gaze which do occur. Hence, these findings lend further support to the notion of continuity in early social

development evidenced in the qualitative changes observed in infants' interactive abilities. Taken together, the findings reported above (Field et al., 1987; Kaye, 1982; Kaye & Fogel, 1980) offer a strong case for observing continuity in early social development, beginning with the infant's capacity to regulate arousal and subsequently act as a competent interactive partner.

The discussion presented in the above section has offered information laying the foundation for a proposed continuity in early social development, asserting that an infant's social competence develops from his/her initial mastery of regulation of arousal. A question that has not yet been addressed, however, is the value of the face-to-face paradigm for predicting social development beyond the first year. A study of early face-to-face interaction and its relation to the infant-mother attachment relationship provides compelling information in this regard. It is necessary to point out from the outset, however, that this study (Blehar, Lieberman, & Ainsworth, 1977) differs from those reviewed to this point in that data were collected in the home, in a naturalistic setting, with the face-to-face interaction occurring spontaneously in the course of lengthy observation periods.

Predictive Value of Face-to-Face Paradigm

In a study investigating infant-mother interaction and later quality of the infant-mother attachment relationship, Blehar et al. (1977) carried out naturalistic observations throughout the infant's

first year of life to examine maternal and infant behaviors and to report on the developmental changes that took place during this period. Data employed in this particular study reflect observations of spontaneously occurring face-to-face interaction between 6 and 15 weeks of age and strange situation assessments of the infant-mother attachment relationship conducted near the infant's first birthday.

Normative findings indicate that infant behaviors changed over time, with the infants becoming more responsive; maternal behavior did not change. Similarly, individual differences in maternal behavior were stable across time, while individual differences in infant behavior were not stable. Furthermore, individual differences in interaction between mother and infant were found to be related to individual differences in the quality of the infant-mother attachment relationship assessed at 51 weeks. More specifically, infants judged to be secure in their attachment relationship with mother were found to smile and bounce more during face-to-face interactions and were also more intense in their responses and less likely to terminate interaction by averting gaze during the 6 to 15 week period. Mothers of these secure infants were, in turn, assessed as being more contingently responsive in their pacing and more often encouraging of further interaction. Conversely, infants judged to be insecurely attached to their mothers were less responsive and more negative during face-to-face interactions across the 6 to 15 week period, and were more likely to merely look at the mother and to terminate the episode by averting

their gaze. Mothers of these insecure infants more frequently initiated interaction with a quiet, passive face and often failed to respond to infant attempts to initiate interaction. These mothers were also more likely to behave in a mechanical and abrupt manner during face-to-face interaction, thus offering limited interactive stimulation to their infants.

These findings further support the notion that a degree of continuity exists in the patterns of behavior evidenced during early face-to-face interaction and the infant's subsequent social competence. For example, the final analyses (Blehar et al., 1977) employed data from 6 to 15 weeks which were found to be predictive of the quality of the infant-mother attachment relationship assessed at 51 weeks. This information causes speculation regarding the interaction data during the 36-week, between-assessment period which were not included in this study. Did the patterns of infant-mother interaction established during the first 15 weeks mature and change in a qualitative manner, for example, such as the changes described above (Field et al., 1987, Kaye, 1982; Kaye & Fogel, 1980)? It is a fascinating question and would lend itself well to research employing a full year longitudinal design of patterns of mother-infant interaction in the face-to-face paradigm and subsequent social competence.

Summary

Collectively, the findings reported in the above literature review lend credence to the notion that the micro-analytical approach to studying mother-infant interaction afforded by the face-to-face interaction paradigm is valuable for a number of reasons. First, this paradigm appears to be a useful tool for identifying those elements of maternal behavior displayed during interaction that appear important to infants' early social development--particularly the infant's capacity to regulate arousal. For example, the integral role of maternal contingent responsivity in the infant's developing capacity to regulate arousal and subsequently act as a competent interactive partner is supported throughout a majority of the literature review. A common theme found to exist in various reports is that of maternal contingent responsivity leading to infant behaviors thought to be indicative of arousal regulation and interactive competence (Cohn & Tronick, 1983; Field, 1977; Fogel et al., 1982; Gusella et al., 1988; Symons & Moran, 1987; Tronick et al., 1979). More specifically, maternal contingent responsivity was determined to promote competent infant interactive abilities, e.g., less infant gaze aversion, less negative affect, more infant smiling, more infant responsiveness to maternal behaviors (Fogel et al., 1982; Gusella et al., 1988; Symons & Moran, 1987). Thus, it could be suggested that infant social competence is directly influenced by maternal contingent responsivity.

Second, the face-to-face paradigm has resulted in the demonstration of the detrimental and beneficial effects upon infants' capacity for arousal regulation and subsequent interaction, of simulated and naturally occurring maternal behaviors. More specifically, manipulation of maternal behavior during face-to-face interaction provides additional insight into the importance of maternal behaviors thought to be especially relevant to the infant's developing social competence. In general, it was found that infant behavior is highly responsive to the manipulation of maternal behavior during face-to-face interaction (Cohn & Tronick, 1983; Field, 1977; Fogel et al., 1982; Gusella et al., 1988; Symons & Moran, 1987; Tronick et al., 1979). When maternal behavior was manipulated to one extreme, such as in the attention-getting paradigm, infant behavior changed in a manner suggestive of an inability to regulate arousal. Infants were observed to display more negative affect and less smiling and gazing at mother, possibly due to the mothers' preoccupation with maintaining their infants' attention rather than responding to infants' probable overstimulation. Manipulations of maternal behavior to the opposite extreme, such as in the imitation paradigm, demonstrated the significance of maternal contingent behavior in eliciting competent infant interactive behaviors. Infant gaze behavior and responsiveness to mother were both found to increase when mothers imitated their infants' behaviors, i.e., engaged in contingent behavior. Taken together, these findings further support the

importance of maternal contingent behavior in early infant social development and, more importantly, raise questions regarding the dynamics and consequences of dysfunctional infant-mother interaction.

Third, the use of the face-to-face paradigm has proved effective in investigating the impact of various maternal personality and demographic characteristics (e.g., maternal depression, SES, age, infant birth status) that appear to influence infant-mother interaction. When investigating the face-to-face interactions of infants and their depressed mothers, for example, a segment of the consequences of dysfunctional infant-mother interaction was discovered (Bettes, 1988; Field, 1984; Field et al., 1988; Field et al., 1985). In general, findings suggest that depressed mothers are providing their infants with less contingent responsivity and inadequate stimulation (i.e., infrequent exaggeration of facial expressions) upon which to base their developing capacities for regulation of arousal. Subsequently, infants of depressed mothers were observed to adopt a more passive coping style during interaction and to also mirror the behavior of their depressed mothers (Field et al., 1988), demonstrating less interactive competence than infants of non-depressed mothers. Not only were maternal personality characteristics found to put infants at risk for interactive deficiencies, demographic characteristics were also investigated and determined to potentially foster dysfunctional infant-mother interaction.

Field (1980) examined the combination of SES, maternal age, and infant birth status in an attempt to determine the effects of these particular risk factors on infant-mother face-to-face interaction. Her findings propose that the interactions between low SES teenage mothers and their preterm infants are less rewarding for both partners, as compared to middle SES adult mothers of full-term infants. Consequently, these infants may also be at risk for future social development, for as proposed above (Blehar et al., 1977; Field et al., 1987; Kaye, 1982; Kaye & Fogel, 1980), the face-to-face interaction paradigm may be valuable in demonstrating the continuity in early development and may also be useful in predicting subsequent social development.

The face-to-face paradigm has provided evidence for the proposed continuity in early development apparent in the qualitative changes observed over time during mother-infant face-to-face interaction. In general, investigations of infant-mother face-to-face interaction over time indicate that interactions become increasingly rich, spontaneous, and reciprocally communicative (Field et al., 1987; Kaye, 1982; Kaye & Fogel, 1980). The growth from the infant's mere responsiveness (i.e., developing capacity for regulating arousal) to reciprocity and intentionality (i.e., eliciting interaction from mother) suggests that development is continuous and represents an increasingly complex organization of behavior. In further support of this notion are Blehar et al.'s (1977) findings describing the relationship between early face-to-

face interaction and 1-year attachment quality. Findings such as these would lead one to consider that what takes place during everyday, unstructured face-to-face interactions provides much insight into the infant's developing capacity to regulate arousal and subsequently act as a competent interactive partner. Yet, as appears evident from the results of employing the structured face-to-face interaction paradigm, the same type of information can be gleaned with much less painstaking observational techniques.

In general, the basis for conducting the proposed study employing the face-to-face interaction paradigm included: 1) identifying those maternal behaviors which promote the infant's capacity to regulate arousal and subsequently act as a competent interactive partner; and 2) examining the extent to which early social development proceeds in a continuous manner. It will be of particular interest to examine the stability and change in maternal and infant interactive behaviors observed during face-to-face interaction from 1 to 4 months in order to determine which maternal behaviors promote optimal social development. For it is from the infant's initial mastery of regulation of arousal that comes the eventual ability to act as a competent interactive partner.

This study was slightly different than those reviewed above in that it combined the structured laboratory methodology with the naturalistic observation techniques described in the last study (i.e., Blehar et al., 1977). The mother-infant face-to-face interactions were videotaped while in the home, under semi-

structured conditions. That is, mothers and infants interacted while in a face-to-face position; time limits were set and maternal behavior was manipulated during one of the two interaction episodes, yet regulations on distance from the infants were not set. It was expected that these deviations from the 'classic,' structured face-to-face interaction paradigm would not provide new and unusual findings, but rather would provide further support for the previously described findings.

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CHAPTER III

METHODS

The data for this study came from a longitudinal investigation of the development of first-time mothers and their babies. The project began during the last trimester of pregnancy and culminated at the infant's first birthday. Data collection took place in both the home and the laboratory. Prenatally a home visit was made to collect relevant demographic, relationship, social support, and marital information from the mother by means of interview and questionnaires. Subsequent visits to the home, 3 conducted at 1, 4, and 9 months infant age (gestational age), involved naturalistic observations of infant-mother interaction, videotaped sessions of structured infant-mother interaction (e.g., face-to-face, free play); interviews soliciting information regarding child care, division of household labor, availability of social support, and role satisfaction; and dissemination of questionnaires relevant to marriage, personality, and adjustment to motherhood. Data collection was completed near the infant's first birthday when quality of infant-mother attachment relationships was assessed in a University laboratory using the standardized strange situation procedure (Ainsworth & Wittig, 1969). The study reported here focused only on the videotaped data of structured infant-mother face-to-face interaction collected when infants were 1 and 4 months of age. Thus, only those procedures relevant to the collection and

analysis of these data are presented below.

Subjects

Subjects for this study included 32 women and their first-born infants. As stated above, the study began during the last trimester of pregnancy and culminated at the infant's first birthday. At the time of enrollment, all women were married (range: 4 months - 8 years, mean = 2 years), expecting their first child, and living within a 30-mile radius of Logan, Utah. Seventy-five percent of the pregnancies were planned. Average age, years of education, and income upon enrollment were 23 (range: 18 - 36), 14, and \$21,000 (range: \$3 - 60,000), respectively. Eighty-four percent of the subjects are members of the Church of Jesus Christ of Latter-Day-Saints. At 1 month infant age, 8 mothers had returned to work: 1 for 40 hours per week and 7 for less than 20 hours per week. At 4 months infant age, 22 mothers had returned to work: 14 for more than 20 hours per week and 8 for less than 20 hours per week.

Gender was evenly distributed among the 32 infants, i.e., 16 boys and 16 girls. All infants, except for 2, were carried to term and delivered without complications. One infant (boy) was delivered 3 weeks prematurely while the other (girl) was diagnosed as small for gestational age (SGA). Birth weight ranged from 2495 - 4437 grams with an average weight of 3388 grams.

Design and Procedures

During the second of 3 visits to each home at both 1 and 4 months, each mother-infant dyad was videotaped in two 3-minute episodes of face-to-face interaction. Mothers were told: "We are interested in observing what takes place during your face-to-face play with your infant." For episode A, mothers were instructed to "play with your infant as you normally would"; for episode B, mothers were instructed to "keep your infant's attention, try to make him/her smile, get excited, and stay happy." The actual videotaping took place while the infants were reclining in a Sassy Bouncer (an infant seat designed to bounce up and down slightly with infant's movements) and the mothers were sitting in a chair, or kneeling on the floor, facing their infants. After filming began, mothers were free to move towards and away from their infant as they desired. That is, there were no restrictions imposed on the distance the mothers placed between themselves and their babies. Videotaping was completed using one camera equipped with a character generator which imposed a running time directly onto the videotape; taping occurred either before or after the naturalistic observation, contingent on the infant's state as decided by the mother.

Measures

Videotapes from all face-to-face interaction episodes were coded by research assistants blind to all other project data as well as the manipulation of maternal face-to-face behavior during episode

B. Scoring of the videotapes was completed using the Interaction Rating Scale (IRS: Field, 1980; see Appendix A for a copy of the IRS). The IRS (Field, 1980) is a set of three-point Likert-type scales (high ratings being optimal) that includes seven infant and ten mother ratings as follows: Infant: state, physical activity, head orientation, gaze behavior, facial expressions, vocalizations, and fussiness; Mother: state, physical activity, head orientation, gaze behavior, silence during infant gaze aversion, facial expressions, vocalizations, infantized behaviors, contingent responsiveness, and gameplaying. (See Appendix B for a coding manual developed by the author.) By summing across individual rating scales, summary scores for the face-to-face interaction episode were computed for both the mother and infant. The IRS (Field, 1980) provides a comprehensive and valuable tool for assessing infant-mother face-to-face interaction in that it focuses on both maternal and infant behaviors (e.g., maternal contingent responsiveness, infant gaze behavior) determined in the above literature review to be relevant to this type of social exchange.

Maternal and infant behaviors were coded by different persons. Behaviors as observed in episode A (i.e., non-manipulated maternal behavior) were rated for all dyads; coders then observed and coded behaviors during episode B (i.e., manipulated maternal behavior). In all cases, coding was based upon the entire 3-minutes of interaction, with one score from each scale assigned to represent the entire 3 minutes. Repeated viewing of each 3-minute episode was

often required in order to determine the score for each of the scales.

Training and Reliabilities

Two graduate assistants--one each for scoring mother and infant behavior--were trained by the author in the methods described above. Training was completed using pilot tapes of mother-infant face-to-face interaction filmed at both 1 and 4 months infant age. From these initial training sessions the 'Guidelines for Use' (Appendix B) for the IRS (Field, 1980) were developed and modified as necessary.¹ Training continued until coders reached an average level of 82% reliability before scoring of the study data began.

For the purpose of assessing inter-rater reliabilites, the author scored a total of 30% of the videotaped episodes. The range of percent agreement for mother ratings was from 66% to 100%, with an average of 84%. The range of percent agreement for infant ratings was from 75% to 92%, with an average of 82%. Agreement on discrepant ratings was reached through conference between the author and graduate assistants. Inter-rater reliabilities for individual mother and infant scales appear in Appendix A.

¹ Personal communication (1988) with Tiffany Field revealed that no coding manual exists. Thus, it was decided that development of such a manual was necessary for successful completion of this study.

CHAPTER IV

RESULTS

On the basis of the issues raised in the literature review and given the measures derived from the face-to-face paradigm, three sets of hypotheses guided the current study. These hypotheses addressed: 1) stability and change in maternal and infant interactive behaviors; 2) associations between maternal and infant interactive behaviors; and 3) exploratory predictions of infant regulation of arousal based on maternal interactive behaviors. For the first two sets of hypotheses, it is important to emphasize that maternal and infant interactive behaviors were defined as both individual rating scales ($n = 10$ for mother, 7 for infant; see Appendix A) and summary scores (i.e., summing across individual rating scales). The third and final set of hypotheses explored the feasibility of developing an infant composite score (i.e., grouping together select individual rating scales) reflecting the infant's capacity to regulate arousal, while continuing to define maternal interactive behaviors in terms of the individual rating scales and their summary score.

An issue of primary importance in defining the data set for statistical analyses was the determination of whether significant differences existed in maternal and infant interactive behaviors across episodes A and B, at both 1 and 4 months. Toward this end,

two hypotheses were examined. The first predicted significant differences in maternal interactive behaviors, from episode A (i.e., spontaneously occurring face-to-face interaction) to episode B (i.e., attention-getting paradigm) at both 1 and 4 months. The second hypothesis predicted significant differences in infant interactive behaviors from episode A to episode B at both 1 and 4 months.

In order to test these predictions, a 2 (episode) X 2 (time) repeated-measures analysis of variance (ANOVA) was performed on the individual and summary behavioral ratings for both mother and infant. Of 22 such analyses for maternal rating scales (10 individual scales and 1 summary score at each of 2 measurement periods - 1 and 4 months), 2 significant differences were found. Mean levels of 1-month maternal gameplaying differed significantly from episode A to episode B (means = 1.67 and 1.37, respectively; $F(1,26) = 6.40, p < .05$). Four-month maternal silence during infant gaze aversion differed significantly from episode A to episode B (means = 2.10 and 1.77, respectively; $F(1,30) = 5.77, p < .05$). Out of 16 univariate ANOVAs for infant ratings (7 individual rating scales and 1 summary score at each of 2 measurement periods-1 and 4 months), 2 significant differences were found. Mean levels of 1-month infant vocalizations differed significantly from episode A to episode B (means = 1.74 and 2.00, respectively; $F(1,26) = 5.14, p < .05$). Four-month infant fussiness differed significantly from episode A to episode B (means = 2.50 and 2.20, respectively; F

(1,30) = 5.48, $p < .05$). Given the low proportion of significant findings (10%) and the fact that the observed differences in interactive behaviors were not consistent across time for either mother or infant, the data were pooled, across episodes, for subsequent analyses. This data reduction was performed to increase statistical power and provide more reliable measures of infant and mother interactive behavior (Rushton, Brainerd, & Pressley, 1983). Thus, all subsequent analyses were computed and will be reported using data pooled across the non-manipulated and manipulated face-to-face interaction episodes, for both mother and infant, at both 1 and 4 months.

To create new variables representing the pooled data, means were computed to reflect maternal and infant individual ratings and summary scores across episode at each time period. For example, the measure of 1-month maternal state is comprised of the mean of the maternal state scores from episodes A and B at 1 month. Mean scores for all maternal and infant summary ratings were computed in the same fashion. It is of interest to note that two maternal ratings--head orientation and gaze behavior--were invariable across both episode and time; that is, all subjects scored 3 on these two scales for each episode at each age. In view of the fact that these ratings did not contribute unique information, they were excluded from subsequent analyses and will not be included in table information. These ratings were included in the maternal summary scores, however, for the purpose of affording comparability between

this study's global rating of maternal interactive behavior and other research employing the same instrument, i.e., the IRS (Field, 1980). Prior to reporting results of the three sets of hypotheses presented above, descriptive statistics employing the pooled data will be provided.

Descriptive Statistics

In the following section, descriptive information including means, ranges, and intercorrelations regarding maternal and infant data will be provided. This section provides the reader with important information regarding the general tendencies of, as well as variability within, this sample's interactive behaviors within the framework of the Interaction Rating Scales (Field, 1980). Additionally, reported intercorrelations provide an indication of the extent and nature of the organization of both maternal and infant behaviors.

Maternal Interactive Behaviors

Regarding the eight, 3-point, pooled individual rating scales pertaining to 1-month maternal behavior included in the present analyses and reported in Table 1, two ranged from 2.0 to 3.0; these were maternal state and infantized behavior. That is, a score of 1, the 'least optimal' rating, was never given for these scales. Two of the remaining scales had scores which ranged from 1.5 to 3.0; these were maternal facial expressions and vocalizations. The last

Table 1

Means and Ranges of 1- and 4-Month Maternal Individual Scales and Summary Scores*

Maternal Rating Scales	<u>1 Month</u> (n = 26)			<u>4 Months</u> (n = 26)		
	Mean	SD	Range	Mean	SD	Range
State	2.65	.39	2 - 3.0	2.79	.34	2 - 3.0
Physical Activity	2.06	.64	1 - 3.0	1.82	.68	1 - 3.0
Silence During Gaze Aversion	1.91	.75	1 - 3.0	1.94	.57	1 - 3.0
Facial Expressions	2.46	.48	1.5 - 3.0	2.57	.44	2 - 3.0
Vocalizations	2.24	.42	1.5 - 3.0	2.12	.28	2 - 3.0
Infantized Behavior	2.11	.25	2 - 3.0	2.27	.36	2 - 3.0
Contingent Responsivity	1.94	.53	1 - 3.0	1.93	.48	1 - 3.0
Gameplaying	1.52	.55	1 - 2.5	1.72	.53	1 - 2.5
Summary Score	22.89	2.60	19 - 28.0	23.23	2.23	19.5 - 28.0

*Table based on data pooled across episodes A and B.

4 scales--maternal physical activity, silence during infant gaze aversion, contingent responsivity, and gameplaying--ranged from 1.0 to 3.0, reflecting the full range of possible scores. The maternal summary score (summing across individual scales) for 1 month ranged from 19.0 to 28.0.

With respect to the means and ranges for 4-month maternal interactive behavior, also presented in Table 1, four of the individual rating scales ranged from 2.0 to 3.0; these were maternal state, facial expressions, vocalizations, and infantized behavior. Thus, the least optimal rating ("1") was never given for these scales. Scores for the four remaining scales--maternal physical activity, silence during infant gaze aversion, contingent responsivity, and gameplaying--reflected the full range. The maternal summary score for 4 months ranged from 19.5 to 28.0.

Intercorrelations were computed among the maternal individual rating scales at both 1 and 4 months; these are presented in Tables 2 and 3, respectively. As may be seen in Table 2, of a possible 28 intercorrelations between the 1-month individual rating scales, 17 (61%) were significant, suggesting a moderate degree of interrelation among maternal interactive behaviors. For example, maternal facial expressions were significantly correlated with maternal state, vocalizations, infantized behavior, contingent responsivity, and gameplaying. It thus appears that the IRS provides a coherent representation of maternal interactive behaviors, and this suggestion is supported by the similar findings

Table 2

Intercorrelations - Maternal Individual Scales: 1 Month (n = 27).

	State	Physical Activity	Silence During Gaze Aversion	Facial Expressions	Vocalizations	Infantized Behavior	Contingent Responsivity	Game playing
State								
Physical Activity	.24							
Silence During Gaze Aversion	.15	.29						
Facial Expressions	.60***	.16	.02					
Vocalizations	.59***	.23	.53**	.57***				
Infantized Behavior	.41*	.02	.31	.51**	.64***			
Contingent Responsivity	.42*	.21	.40*	.37*	.71***	.63***		
Gameplaying	.40*	.19	-.02	.55***	.35*	.54***	.37*	

*p < .05

**p < .01

***p < .001

Table 3

Intercorrelations - Maternal Individual Scales: 4 Months (n = 31)

	State	Physical Activity	Silence During Gaze Aversion	Facial Expressions	Vocalizations	Infantized Behavior	Contingent Responsivity	Game playing
State								
Physical Activity	.31*							
Silence During Gaze Aversion	.23	.35*						
Facial Expressions	.49**	.26	.28					
Vocalizations	.24	.40*	.44**	.25				
Infantized Behavior	.35*	.00	.25	.30*	.42**			
Contingent Responsivity	.17	.35*	.38*	.18	.66***	.44**		
Gameplaying	.42**	-.05	.05	.75***	.00	.36*	-.17	

*p < .05

**p < .01

***p < .001

for the 4-month data. Examination of Table 3 also reveals a moderate degree of intercorrelation among the 4-month maternal rating scales-- 15 (54%) were found to be significant.

Infant Interactive Behaviors

Table 4 presents the means and ranges of infant individual rating scales and summary scores for both 1 and 4 months. With regard to the seven 1-month individual infant rating scales, only one did not display the full range of possible scores. Infant physical activity ranged from 1.5 to 3.0 at 1 month. The remaining 6 scales--infant state, head orientation, gaze behavior, facial expressions, fussiness, and vocalizations--reflected the total range of possible scores. The infant summary score for 1 month ranged from 10.5 to 21.0.

At 4 months, it was once again the case that only 1 infant rating did not include the total range of possible scores; infant state ranged from 1.5 to 3.0. For physical activity, head orientation, gaze behavior, facial expressions, fussiness, and vocalizations, the total range of possible scores was represented by this sample. The infant summary score for 4 months ranged from 11.5 to 21.0.

The collection of infant interaction rating scales appears to apply well to this group of infants in that it measures the subtle differences present as early as 1 month. The full range of possible scores was reflected in this sample of infants, which is different

Table 4

Means and Ranges of 1- and 4-Month Infant Individual
Scales and Summary Scores*

Infant Rating Scales	<u>1 Month</u> (n = 26)			<u>4 Months</u> (n = 26)		
	Mean	SD	Range	Mean	SD	Range
State	2.41	.65	1 - 3.0	2.86	.35	1.5 - 3.0
Physical Activity	2.56	.53	1.5 - 3.0	2.57	.53	1 - 3.0
Head Orientation	2.09	.73	1 - 3.0	2.03	.63	1 - 3.0
Gaze Behavior	2.06	.67	1 - 3.0	2.00	.71	1 - 3.0
Facial Expressions	2.13	.47	1 - 3.0	2.45	.70	1 - 3.0
Fussiness	2.54	.57	1 - 3.0	2.34	.70	1 - 3.0
Vocalizations	1.87	.74	1 - 3.0	2.31	.56	1 - 3.0
Summary Score	15.65	2.82	10.5 - 21.0	16.55	2.75	11.5 - 21.0

*Table based on data pooled across episodes A and B.

than what was observed with the maternal interactive data.

Intercorrelations among individual infant ratings were computed for the 1- and 4-month data; these are presented in Tables 5 and 6, respectively. As revealed in Table 5, of a possible 21 intercorrelations between the 1-month individual rating scales, 11 (52%) were found to be significant. Examination of Table 6 reveals that of 21 intercorrelations at 4-months, 8 (38%) were found to be significant. The number of significant intercorrelations was lower for infant data than that reported for the maternal data, yet there was a similar degree of consistency in the nature and magnitude of significant findings. For example, head orientation and gaze behavior were significantly and positively correlated at both 1 and 4 months, as were state with gaze behavior and facial expressions, physical activity with facial expressions and fussiness, and facial expressions with fussiness. A finding of particular interest is that infant fussiness was significantly and positively correlated with head orientation and gaze behavior at 1 month, yet was not significantly and positively correlated with these individual behaviors at 4 months. This finding suggests that at 1 month, infant fussiness is associated with looking away from mother, while at 4 months this association does not exist, possibly indicating that infant fussiness manifests itself in other behaviors, e.g., physical activity and facial expressions.

Table 5

Intercorrelations - Infant Individual Scales: 1 Month (n = 27)

	State	Physical Activity	Head Orientation	Gaze Behavior	Facial Expressions	Fussiness	Vocalizations
State							
Physical Activity	.07						
Head Orientation	.18	.53**					
Gaze Behavior	.39*	.37*	.81***				
Facial Expressions	.51**	.55***	.30	.34*			
Fussiness	.27	.63***	.40*	.42*	.66***		
Vocalizations	.19	-.13	.06	.13	.21	.10	

*p < .05

**p < .01

***p < .001

Table 6

Intercorrelations - Infant Individual Scales: 4 Months (n = 31)

	State	Physical Activity	Head Orientation	Gaze Behavior	Facial Expressions	Fussiness	Vocalizations
State							
Physical Activity	-.13						
Head Orientation	.10	.17					
Gaze Behavior	.23*	.13	.90***				
Facial Expressions	.35*	.66***	.21	.30*			
Fussiness	.14	.75***	.13	.18	.85***		
Vocalizations	.28	.10	.18	.21	.34*	.19	

*p < .05

**p < .01

***p < .001

Stability and Change

Stability in Interactive Behaviors

For the sake of assessing stability in interactive behaviors, two hypotheses were tested. The first predicted that individual differences in maternal interactive behaviors would remain stable from 1 to 4 months. The second that individual differences in infant interactive behaviors would remain stable from 1 to 4 months.

In order to test the above predictions, correlations between 1- and 4-month interactive behavior scales were computed for both mother and infant. Analyses were conducted using both maternal and infant individual rating scales and summary scores. Data regarding stability are presented, along with all correlations between 1- and 4-month maternal and infant interactive behaviors, in Tables 7 and 8, respectively.

Maternal Interactive Behaviors

As observed in the diagonal of Table 7, maternal interactive behaviors were highly stable over time. For example, considering the relatively global summary score, a significant correlation between the 1- and 4-month values (.73, $p < .001$) revealed that mothers' overall constellation of observed behaviors was stable over time, indicating that mothers who displayed optimal interactive behaviors at 1 month were likely to do so at 4 months. More

Table 7

Correlations between Maternal Interactive Behavior: 1 to 4 Months (n = 26)

4 Months

	State	Physical Activity	Silence During Gaze Aversion	Facial Expressions	Vocalizations	Infantized Behavior	Contingent Responsivity	Game playing	Summary Score
1 Month									
State	.34*	.19	.31	.68***	.23	.36*	.18	.59***	.56***
Physical Activity	.47**	.04	.20	.34*	.22	.05	-.12	.51**	.32
Silence During Gaze Aversion	.25	.21	.17	.01	.23*	.28	.21	.11	.30
Facial Expressions	.35*	.36*	.44*	.71***	.20	.12	.11	.57***	.59***
Vocalizations	.31	.45**	.51**	.50**	.52**	.45**	.39	.39*	.70***
Infantized Behaviors	.31	.24	.26	.36	.20	.36*	.26	.53**	.50***
Contingent Responsivity	.31	.27	.47**	.37	.24	.40*	.39*	.36*	.56***
Gameplaying	.33*	.34	.30	.32	.16	-.03	.14	.36*	.40*
Summary Score	.53**	.40*	.50**	.59***	.41*	.35*	.28	.62***	.73***

*p < .05

**p < .01

***p < .001

specifically, 6 of the 8 individual maternal interactive behaviors were significantly correlated over the 3-month period between observations. These include maternal state, vocalizations, infantized behavior, contingent responsivity, and gameplaying. Behaviors not significantly stable over time were maternal level of physical activity and silence during infant gaze aversion. Thus, in addition to mothers' interactive behaviors being highly intercorrelated within measurement periods, the nature of their interactions relative to the group remained stable over time.

Infant Interactive Behaviors

Examination of the diagonal in Table 8 reveals that, in general, infant interactive behaviors were not very stable from 1 to 4 months. While the infant summary score (.34, $p < .05$), and two of the 7 individual rating scales (infant level of physical activity and gaze behavior) were significantly stable, the 5 remaining interactive behaviors were not. Included are infant state, head orientation, facial expressions, fussiness, and vocalizations. It thus appears that infants' early interactive behaviors are not predictive of their later behaviors.

Changes in Interactive Behaviors

For the sake of assessing changes in interactive behaviors, two hypotheses were tested. The first predicted that normative trends in maternal interactive behaviors would significantly increase

Table 8

Correlations between Infant Interactive Behavior: 1 to 4 Months (n = 26)

4 Months

	State	Physical Activity	Head Orientation	Gaze Behavior	Facial Expressions	Fussiness	Vocalizations	Summary Score
1 Month								
State	.23	.30	-.06	.04	.32	.20	-.20	.18
Physical Activity	-.19	.35*	.43*	.33	.31	.43*	.19	.45
Head Orientation	-.12	.22	.29	.24	.35*	.21	.25	.34*
Gaze Behavior	-.02	.14	.36*	.41*	.34*	.18	.19	.37*
Facial Expressions	.08	.23	.01	.10	.24	.33*	.12	.25
Fussiness	-.20	-.04	.26	.16	-.07	.07	-.17	.03
Vocalizations	.01	-.14	-.04	-.03	-.09	-.09	.28	-.03
Summary Score	-.04	.22	.27	.27	.31	.27	.15	.34*

*p < .05

**p < .01

***p < .001

across the 1 to 4 month measurement period. The second hypothesis predicted that normative trends in infant interactive behaviors would significantly increase across the 1 to 4 month measurement period.

To test these predictions, repeated-measures multivariate analysis of variance (MANOVA) tests were computed. Multivariate tests were conducted for the sake of controlling the error rate over the numerous tests conducted. Two groups of maternal interactive behaviors and two groups of infant interactive behaviors were employed in these analyses. The grouping of variables was based on previously computed intercorrelations. It was thus the case that four MANOVAs were performed: two each for mother and infant scales. The two groupings for maternal ratings were: 1) maternal facial expressions, infantized behaviors, vocalizations, and contingent responsiveness; and 2) maternal state, physical activity, silence during infant gaze aversion, and gameplaying. For infants, infant facial expressions, fussiness, physical activity, and state comprised one group; infant head orientation, gaze behavior, and vocalizations comprised the other. In all cases, univariate results for individual rating scales were examined only in the case of significant multivariate results.

Maternal Interactive Behaviors

As is evident from the multivariate results presented in Table 9, normative trends in maternal interactive behaviors remained

Table 9

Changes in Maternal Interactive Behavior from 1 to 4 Months:Multivariate and Univariate Results (n = 26)

Maternal Behaviors	1 Month		4 Months		Multivariate	Univariate
	Mean	SD	Mean	SD	F(df = 4,22)	F(df = 1,25)
<u>Group 1</u>					1.90	
Facial Expressions	2.46	.49	2.58	.44		2.74
Infantized Behavior	2.12	.26	2.29	.38		5.61*
Vocalizations	2.27	.41	2.21	.29		.68
Contingent Responsivity	1.98	.50	1.96	.51		.03
<u>Group 2</u>					1.50	
State	2.64	.39	2.78	.35		1.86
Physical Activity	2.10	.62	1.83	.65		2.46
Silence During Gaze Aversion	1.90	.74	2.02	.56		.22
Gameplaying	1.52	.56	1.73	.53		3.03
Summary Score	23.04	2.53	23.39	2.34		.96

*p < .05

**p < .01

***p < .001

unchanged across the 1- to 4-month measurement periods. Thus, even though significant differences over time were predicted in the mean scores of maternal individual ratings, findings revealed that maternal interactive behavior at the group level neither improved nor declined over the 3-month measurement period.

Infant Interactive Behaviors

Significant changes in infant interactive behaviors were observed across the 1- to 4-month measurement periods. As is reported in Table 10, multivariate tests revealed significant differences in mean levels of infant interactive behaviors (infant facial expressions, fussiness, physical activity, and state, $F(4,22) = 14.13$, $p < .001$; infant head orientation, gaze behavior, and vocalizations, $F(3,23) = 3.32$, $p < .05$), thus allowing for examination of the univariate results. Findings from the univariate tests (also in Table 10) revealed that three infant interactive behaviors significantly changed, in a positive direction, from 1 to 4 months. These included infant state (means = 2.39 and 2.90 at 1 and 4 months, respectively; $F(1,25) = 16.32$, $p < .001$), facial expressions (means = 2.12 and 2.46 at 1 and 4 months, respectively; $F(1,25) = 5.06$, $p < .05$), and vocalizations (means = 1.83 and 2.33 at 1 and 4 months, respectively; $F(1,25) = 10.83$, $p < .01$). These findings support the notion of qualitative change in infant interactive behavior over time, and suggest that infants become increasingly competent with interactional experience,

Table 10

Changes in Infant Interactive Behavior from 1 to 4 Months:Multivariate and Univariate Results (n = 26)

Infant Behaviors	1 Month		4 Months		Multivariate	Univariate
	Mean	SD	Mean	SD	F(df)	F(df = 1,25)
<u>Group 1</u>					14.13 (4, 22) ***	
Facial Expressions	2.12	.48	2.46	.75		5.06*
Fussiness	2.54	.58	2.29	.74		1.97
Physical Activity	2.58	.52	2.58	.56		.00
State	2.39	.65	2.90	.32		16.32***
<u>Group 2</u>					3.32 (3, 23) *	
Head Orientation	2.12	.74	2.14	.63		.01
Gaze Behavior	2.06	.68	2.13	.69		.28
Vocalizations	1.83	.72	2.33	.55		10.83**
Summary Score	15.62	2.89	16.83	2.87		3.51

*p < .05

**p < .01

***p < .001

as revealed in increasingly optimal, i.e., higher, scores.

Associations between Mother and Infant Behavior

Correlations were computed between maternal and infant individual rating scales and summary scores at each age of measurement to test two hypotheses concerning the associations between maternal and infant interactive behaviors. The first of these predicted that maternal and infant interactive behaviors would be significantly and positively associated at 1 month. The second that maternal and infant interactive behaviors would be significantly and positively associated at 4 months.

Associations at 1 Month

Maternal and infant interactive behaviors at 1 month were significantly correlated in a number of meaningful ways. As is evidenced in Table 11, 25% (14) of the 56 correlations were significant, including 1-month maternal and infant summary scores (.48, $p < .01$). Despite this modest number of significant correlations between maternal and infant behaviors, the nature of these associations is revealing. Of particular interest is the fact that six of the significant associations involved infant gaze behavior with maternal state, silence during infant gaze aversion, facial expressions, vocalizations, infantized behavior, and contingent responsivity. An additional four involved infant head orientation with maternal state, silence during infant gaze

Table 11

Correlations between Maternal and Infant Individual Scales: 1 Month (n = 27)

Infant

	State	Physical Activity	Head Orientation	Gaze Behavior	Facial Expressions	Fussiness	Vocalizations
<u>Maternal</u>							
State	.21	.15	.36*	.45**	.21	-.20	-.20
Physical Activity	.27	.13	.19	.28	-.06	-.29	.19
Silence During Gaze Aversion	.16	.29	.58***	.43*	.04	.05	.25
Facial Expressions	.30	.09	.23	.49**	.28	.15	.19
Vocalizations	.05	.28	.42*	.49**	.22	.04	.12
Infantized Behavior	.24	.10	.25	.36*	.28	.39*	-.17
Contingent Responsivity	.29	.12	.36*	.45**	.13	.13	.28
Gameplaying	.37*	-.14	-.08	.18	.10	-.02	.15

*p < .05

**p < .01

***p < .001

aversion, vocalizations, and contingent responsivity. Infant head orientation and gaze behavior--two presumably important aspects of infant interactive behavior--thus appear to be influenced by and/or to influence maternal interactive behaviors at 1 month.

Associations at 4 Months

Correlations involving 4-month maternal and infant interactive behaviors are presented in Table 12. Fewer correlations were found to be significant at this measurement period, yet the notion of the interrelatedness of infant head orientation and gaze behavior with maternal behavior was once again supported. Twenty-one percent (12) of the 56 associations were significant, including a significant association between maternal and infant summary scores (.32, $p < .05$). More importantly, infant head orientation and gaze behavior were found to be significantly and positively correlated with maternal silence during infant gaze aversion (.74, $p < .001$; .64, $p < .001$, respectively). Consequently, it appears on the basis of the correlations of 1- and 4-month mother and infant interactive behavior that infant head orientation and gaze behavior maintain a consistent and positive relationship with maternal silence during infant gaze aversion across the 3-month measurement period.

Predictions of 4-Month Infant Behavior

Regression analysis was employed to test the prediction that maternal interactive behavior at 1 month would be predictive of

Table 12

Correlations between Maternal and Infant Individual Scales: 4 Months (n = 31)

Infant

	State	Physical Activity	Head Orientation	Gaze Behavior	Facial Expressions	Fussiness	Vocalizations
<u>Maternal</u>							
State	.30*	.08	.15	.21	.24	.24	.00
Physical Activity	-.11	-.27	.05	.00	-.34*	-.26	-.25
Silence During Gaze Aversion	-.01	.12	.74***	.64***	-.01	.04	-.04
Facial Expressions	.28	.12	.20	.29	.31*	.30*	.02
Vocalizations	.19	-.02	.30*	.26	.13	.07	.45**
Infantized Behavior	.26	.12	.11	.13	.25	.25	.40*
Contingent Responsivity	-.06	.02	.28	.17	.09	-.01	.42**
Gameplaying	.37*	.10	.00	.16	.35*	.28	-.07

*p < .05

**p < .01

***p < .001

infant interactive behavior at 4 months after controlling for 1-month infant interactive behavior. The 4-month infant summary score served as the dependent measure; 1-month infant and 1-month maternal summary scores served as the independent variables. In order to control for 1-month infant behavior, the 1-month infant summary score was entered into the regression equation first, followed by the 1-month maternal summary score. Results of the regression analysis revealed that neither independent variable accounted for a significant amount of the variance in 4-month infant summary scores. It thus appears, at least as far as summary indices of interactive behavior are concerned, that infants' 4-month interactive behaviors are independent of their 1-month interactive behaviors as well as those of their mothers. These findings are partially in line with those reported earlier regarding few correlations between 1- and 4-month infant behavior.

In order to further examine the nature and significance of associations between 1-month maternal interactive behavior and 4-month infant interactive behavior, correlations were computed involving 1-month maternal and 4-month infant behavior ratings. As can be seen in Table 13, the 1-month maternal and 4-month infant summary scores were significantly correlated (.38, $p < .05$). Additionally, a number of significant correlations were revealed involving maternal and infant individual ratings. For example, 1-month maternal state, physical activity, and silence during infant gaze aversion were significantly correlated with 4-month infant

Table 13

Correlations between 1-Month Maternal Individual Scales and 4-Month Infant Individual Scales (n = 26)

4-Month Infant Behaviors

	State	Physical Activity	Head Orientation	Gaze Behavior	Facial Expressions	Fussiness	Vocalizations	Summary Score
<u>1-Month Maternal Behaviors</u>								
State	.28	.26	.24	.22	.50**	.43*	.08	.44*
Physical Activity	.41*	.15	.33	.42*	.38*	.29	-.07	.41*
Silence During Gaze Aversion	.15	.04	.10	.17	.36*	.18	.40*	.30
Facial Expressions	.23	-.03	.28	.24*	.02	.06	.01	.19
Vocalizations	-.02	-.09	.29	.26	.10	.13	.26	.21
Infantized Behavior	.14	-.06	-.04	.02	.08	.13	.08	.07
Contingent Responsivity	-.01	.15	.10	.12	.16	.18	-.01	.16
Gameplaying	.24	-.07	.14	.20	.03	.06	-.28	.06
Summary Score	.29	.08	.29	.37*	.34*	.28	.10	.38*

*p < .05

**p < .01

***p < .001

facial expressions. Further, 1-month maternal physical activity was significantly correlated with 4-month infant state, gaze behavior, and facial expressions. Thus, 1-month maternal level of physical activity was revealed to be particularly important in the prediction of 4-month infant interactive behavior.

Exploratory Predictions of Infant Regulation of Arousal

An area of particular interest in this study involved determining which maternal interactive behaviors facilitated the infant's developing ability to regulate arousal. Toward this end, the final set of analyses sought to test the prediction that infant interactive behaviors indicative of the capacity to regulate arousal (e.g., gaze behavior, facial expressions, vocalizations) would be predicted by both 1- and 4-month maternal interactive behaviors. In order to test the above prediction, it was necessary first to develop a composite score indicative of the infant's capacity to regulate arousal. Subsequently, the author sought to determine which maternal interactive behaviors observed during face-to-face interaction were predictive of such infant behaviors. This was accomplished in two steps: first, the infant composite score was correlated with maternal interactive behaviors; the infant composite score was then regressed onto those maternal interactive behaviors shown to be significantly correlated with it. These analyses were carried out using both the 1- and 4-month data.

Infant Composite

Based on a priori theoretical considerations and observed intercorrelations among infant individual scales, a composite score was developed that was thought to be reflective of the infant's ability to regulate arousal. Infant head orientation and gaze behavior were determined, on the basis of the above criteria, to be the best indicators of infant regulation of arousal when viewed in combination. Not only were the two scales correlated at a high magnitude, they were also consistently correlated at both 1 and 4 months (.81, $p < .001$; .90, $p < .001$, respectively). Additionally, infant gaze aversion is believed to be the first intrinsic behavioral process in facilitating regulation of arousal (Stern, 1974). These two ratings were summed at both 1 and 4 months to create two composite indices of infant regulation of arousal.

Correlations with Maternal Interactive Behaviors

Correlations between 1-month maternal individual scales and the 1-month infant composite score are presented in Table 14. As can be seen in this table, the 1-month infant regulation of arousal composite was significantly correlated to a number of 1-month maternal individual scales, thus supporting the notion that maternal interactive behaviors and infant regulation of arousal are highly interrelated aspects of face-to-face interaction. Maternal state,

Table 14

Correlations between Infant Regulation of Arousal Composite and

Maternal Individual Scales: 1 Month (n = 27)

Maternal Behaviors

	State	Physical Activity	Silence During Gaze Aversion	Facial Expressions	Vocalizations	Infantized Behavior	Contingent Responsivity	Game playing
Infant Composite (Head Orientation and Gaze Behavior)	.42*	.25	.53**	.37*	.48**	.32	.42*	.05

*p < .05

**p < .01

***p < .001

silence during infant gaze aversion, facial expressions, vocalizations, and contingent responsivity were all positively and significantly correlated with the infant composite score, suggesting that as maternal interactive behavior approaches an optimal level, so does the infant's ability to regulate arousal as measured through the 1-month composite score.

Table 15 contains the correlations involving maternal individual scales and the 4-month infant composite score. As can be seen, the number of significant correlations drops greatly from the six observed with 1-month data, yet the single significant correlation is consistent with the 1-month findings. Maternal silence during infant gaze aversion was significantly correlated with the infant composite score at both 1 and 4 months (.53, $p < .01$; .71, $p < .001$, respectively), indicating that maternal silence during infant gaze aversion was consistently related to the infant's developing capacity to regulate arousal.

Regression Analysis at 1 and 4 Months

As was outlined above, the last step in testing our final hypothesis involved determining which maternal behaviors observed during face-to-face interaction were predictive of the infant's ability to regulate arousal, as represented by the infant regulation-of-arousal composite. The regression analysis for the 1-month data was carried out using the infant composite score as the dependent variable and maternal state, silence during infant gaze

Table 15

Correlations between Infant Regulation of Arousal Composite and
Maternal Individual Scales; 4 Months (n = 31)

Maternal Behaviors

	State	Physical Activity	Silence During Gaze Aversion	Facial Expressions	Vocalizations	Infantized Behavior	Contingent Responsivity	Game playing
Infant Composite (Head Orientation and Gaze Behavior)	.19	.03	.71***	.26	.29	.12	.23	.09

*p < .05

**p < .01

***p < .001

aversion, facial expressions, vocalizations, and contingent responsiveness as independent variables. A forward-entry method was employed to determine which maternal individual rating(s) accounted for the greatest amount of variance in the infant composite score. Results are reported in Table 16, which reveals that maternal silence during infant gaze aversion and maternal facial expressions were found to account for a significant 42% of the variance in the 1-month infant composite score ($F(2,24) = 8.53, p < .01$). Maternal silence during infant gaze aversion, which was entered first into the equation, alone accounted for a significant 29% of this variance ($F(1,25) = 10.00, p < .01$).

Due to the finding that only one maternal individual scale was significantly correlated with the infant composite score at 4 months, a regression analysis was computed employing the 4-month infant regulation of arousal score as the dependent variable and 4-month maternal silence during infant gaze aversion as the independent variable. As can be seen in Table 17, the results were similar to those reported for the 1-month analysis. Maternal silence during infant gaze aversion accounted for a significant 50% of the variance in the infant composite score ($F(1,29) = 28.67, p < .001$).

After viewing the positive results generated from analyses employing the infant regulation of arousal composite and maternal behaviors, for both 1- and 4-month data, a final attempt was made to test for the nature and significance of the association between 1-

Table 16

Regression Analysis -

Infant Regulation of Arousal Composite: 1 Month

1 Month Maternal Behaviors	R	ΔR^2	(df)	F
Silence During Gaze Aversion	.53	.29	(1.25)	10.00**
Facial Expressions	.64	.13	(1.24)	5.58*
Total	.64	.42	(2.24)	8.53**

*p < .05

**p < .01

***p < .001

Table 17

Regression Analysis -

Infant Regulation Of Arousal Composite: 4 Months

4 Month Maternal Behaviors	R	R ²	(Df)	F
Silence During Gaze Aversion	.71	.50	(1,29)	28.67***

*P < .05

**P < .01

***P < .001

month maternal interactive behavior and 4-month infant interactive behavior. Correlations were computed between 1-month maternal behavior ratings and the 4-month infant regulation-of-arousal composite score. Analyses revealed that of a possible eight correlations, one was significant--1-month maternal level of physical activity with the 4-month infant regulation of arousal composite (.39, $p < .05$). One-month maternal level of physical activity, an index of physical stimulation directed towards the infant, thus appears to have significant long-range effects on the infant's ability to regulate arousal at 4 months.

CHAPTER V

DISCUSSION

This chapter will contain information relevant to the interpretation and discussion of the results reported above. First, a restatement of the overall purpose of this study will be presented, followed by a brief overview of the results. The findings will then be discussed in greater detail before providing a presentation of the strengths and limitations of this study. Finally, a concluding section will consider implications of the current work for future research.

Purpose of the Study

The general purpose of this study was to gain insight into the dynamics of infant-mother interaction and the immediate and long-range influence that interaction has on infant social development. A widely held belief among researchers of infant social development is that these early interactional experiences provide the opportunity for both the infant's mastery of the fundamental developmental tasks relevant to this period of life, and his learning of the 'rules' for coordinating one's behaviors with those of another (Brazelton et al., 1974; Stern, 1974). For it is in this context of early social interaction that the infant is faced with the primary task of regulation of arousal (Sroufe, 1979b), a

necessary precursor to the infant's subsequent social competence, i.e., ability to initiate and elicit interaction. And it is also within this context that the infant is thought to be in a position to receive 'mentoring' from an interactive partner in the negotiation of this developmental task (Sroufe, 1979b).

Overview of the Results

The current study supported its hypotheses with a few exceptions, the most obvious one involving the absence of significant differences in maternal and infant interactive behavior across the manipulated and non-manipulated episodes of face-to-face interaction. In terms of support for the study's predictions, maternal interactive behavior was found to remain stable across contexts within time, as well as across time at both the individual and normative levels. Additionally, maternal interactive behavior was associated with infant interactive behavior at both ages, and certain maternal behaviors were predictive of infant regulation of arousal, suggesting that mothers' behaviors exert both immediate and long-term influences upon the interactive competence of their infants.

In terms of support for the predictions regarding infant interactive behavior, it was determined that infant behavior remained stable across contexts within time, yet did not remain stable across time at either the individual or normative levels. Not only was change evident in terms of developmental function,

infants were also changing in terms of their performance relative to the group (i.e., rank ordering). Perhaps most revealing with regard to infant interactive behavior was the association between early maternal physical activity and later infant regulation of arousal, suggesting that maternal interactive behavior at 1 month may have relatively long ranging effects on 4-month infant interactive competence.

Discussion of the Findings

This in-depth discussion of the findings will provide conceptual interpretations of the data employing original ideas and evidence from the literature review presented in Chapter II. As was reported, there were relatively few significant differences between maternal and infant interactive behaviors from the non-manipulated to the manipulated face-to-face episodes. One possible reason for this finding is that the 3-point rating scale did not provide for enough differentiation to allow for actual differences in interactive behaviors to be scored as such. This particular manipulation of maternal behavior required that mothers gain and maintain their baby's attention, keep their baby happy and excited, and try to make their baby smile. In sum, an attempt was made to have mothers act in a manner that was potentially incongruent with what constitutes sensitive, responsive interactive behaviors in their efforts to keep their baby's attention. After questioning the virtual lack of significant differences in both maternal and infant

interactive behaviors, it appeared possible that the rating scales were not sensitive enough to pick up on subtle differences in maternal attention-getting behavior. Even though past studies have reported significant differences in maternal and infant interactive behavior in an attention-getting face-to-face paradigm (e.g., Field, 1977), might a mother who is predominantly positive and competent during spontaneous interactions with her infant continue to be scored in a manner reflective of that competency during manipulated interaction? That is, if a mother interacts with her infant in a predominantly sensitive and responsive manner, would the attention-getting paradigm afford enough of an opportunity for maternal interactive behavior to significantly change to an inconsistent mode of interaction? It seems feasible that maternal behavior could significantly change from behavior observed during spontaneous interaction, yet the changes might not be rated as such on a 3-point scale. When Field developed this measure (1980), her sample included, in part, low SES, teenage mothers of preterm infants who were found to be less competent in their interactive abilities. When taken in combination with the descriptive statistics of maternal interactive behavior representing the current sample, and the relative lack of significant differences from episode A to episode B, one could infer that the interactive behaviors displayed by low SES, teenage mothers of preterm infants were more variable in their quality than those of this sample.

A second possible reason for not finding significant

differences is that the attention-getting paradigm employed in the manipulated episode did not provide enough of an 'extreme' in manipulating maternal behavior for this sample of infant-mother dyads to bring about significant interactional differences. In this regard, however, it is important to emphasize that the purpose of this particular manipulation was to present mothers with relatively ambiguous guidelines to follow during the second episode of face-to-face interaction. It was expected that important between-episode differences would exist in some, but not all, mother-infant dyads (i.e., maternal and infant interactive behaviors). That is, due to individual differences among mothers in interpreting the instructions, it was expected that some might become more intrusive toward their infants for the sake of following instructions, whereas others would consistently adjust their own behaviors in line with their infants' signals. It may very well be the case that such differences between mothers were masked by our normative, non-significant findings. When viewing the attention-getting paradigm in the context of each mother interpreting the instructions individually, there is a margin of variability in what can actually be done during interaction. For example, some mothers may feel it necessary to increase their level of activity and vocalization, foregoing contingent responsiveness, in an attempt to keep their infant's attention, while other mothers may interpret the instructions as requiring very little variation on their typical method of interaction during spontaneous interaction.

The findings of stability of individual differences in maternal interactive behaviors across the 3-month period between measurements are similar to those of Blehar et al. (1977). These findings suggest that mothers who display optimal interactive behavior during early interactions with baby are likely to continue to display optimal interactive behavior during subsequent interactions. Conversely, mothers who display less than optimal interactive behavior during early interactions with baby appear likely to continue to display less than optimal interactive behavior.

Relatedly, examination of normative trends revealed that maternal behavior does not change significantly over time. This finding, though not in line with our predictions, is actually quite positive when taken in combination with the role of infant-mother interactional experience in early social development. Consistency in maternal behavior during early interactions can serve as a facilitator of the infant's mastery of fundamental tasks relevant to this period of life, providing the infant with predictable interactional experiences upon which to base his burgeoning social development (Stoller & Field, 1982). Additionally, mothers' behaviors were rated at a somewhat general level with the IRS. Thus, specific behaviors may very well have changed, but in terms of the more global notions of optimal vs. non-optimal interactions, no such change was evident. Thus, in summary, maternal interactive behavior remained highly stable and consistent both across context (i.e., non-manipulated vs. manipulated episodes) and across time at

both the individual and group level.

In contrast to this stable consistency in maternal behavior, infants' behaviors were not stable over time, and the nature of these behaviors changed qualitatively from 1 to 4 months. The finding that individual differences in infant behavior were not stable is also in line with Blehar et al. (1977), who reported an absence of stability in individual differences of infant interactive behavior. With regard to our sample, this finding could be due to the early age at which interactive data collection began. That is, infants at 1 month of age are to a large extent merely responding to stimulation provided during interaction. Infants at 4 months of age, on the other hand, are capable of organizing their behaviors on the basis of more than mere external stimuli. For example, Kaye (1982) reported an increase in the rate of infant vocalizations and facial expressions, and a trend toward the ability to initiate and elicit interaction from mother across the period of 6 to 26 weeks infant age. Consequently, a lack of stability in infant interactive behaviors from 1 to 4 months does not appear unusual and supports the notion that individual infants are changing in a qualitative manner. This finding also raises an important question regarding the factors influencing such change. More specifically, if, as these findings indicate, we cannot account for 4-month infant interactive behavior on the basis of infants' 1-month interactive tendencies, to what aspects of the infant's development should we turn for such understanding? As will be discussed shortly, mothers'

1-month behaviors are somewhat useful in this regard.

Normative trends in infant behavior revealed that infants became more competent interactive partners with regard to three behaviors--infant state, facial expressions, and vocalizations. These findings are in line with others which suggest that with the accumulation of interactional experience, infants demonstrate 'better' interactive abilities (Field et al., 1987; Kaye, 1982; Kaye & Fogel, 1980). Of interest for the current findings is that each of the behaviors observed to change over time--in particular, infant facial expressions and vocalizations--are focal in both arousal regulation, and elicitation and maintenance of interaction (Brazelton et al., 1974; Field, 1981; Field et al., 1987; Stern, 1974; Stoller & Field, 1982; Vaughn & Sroufe, 1979). The infants of this sample appear to be demonstrating a greater capacity for arousal regulation as well as maturity with regard to interactive ability. This study's findings therefore provide support for the notion that infant social behavior is developing in a manner indicating normative changes over time with regard to interactive competence.

Questions concerning associations between maternal and infant behavior, and predictions of infant behavior based on maternal behavior, provided interesting results with regard to the value of the various levels of measurement afforded by the IRS (Field, 1980). For example, the global ratings of 1-month maternal and infant behavior (i.e., summary scores) were not useful in predicting 4-

month infant behavior. Analyses revealed that 4-month infant summary scores were statistically independent of both 1-month maternal and infant summary scores. Yet, when correlations were computed between 1-month maternal individual ratings and 4-month infant individual ratings, significant associations, though minimal, were revealed. In particular, 1-month maternal level of physical activity was predictive of 4-month infant state, gaze behavior, and facial expressions. Further, 1-month maternal physical activity was also predictive of the 4-month infant regulation-of-arousal composite. These findings suggest that the amount of physical stimulation a mother provides when interacting with her baby at 1 month exerts a relatively long-term influence upon a number of 4-month infant behaviors thought to be focal in regulation of arousal (Brazelton et al., 1974; Field, 1981; Stern, 1974; Stoller & Field, 1982; Vaughn & Sroufe, 1979). More specifically, it can be hypothesized that when mothers physically overstimulate their infants during early interactions, the impact of this insensitivity does not appear immediately, but rather it appears later in the infant's ability to regulate arousal. Additionally, these findings demonstrate that the individual scales of the IRS may be more valuable in predicting associations between maternal and infant behavior when employed singularly or in combination (e.g., infant regulation of arousal composite) than the summary scores.

A central focus of this study was the determination of which maternal interactive behaviors were predictive of infant interactive

behavior indicative of the infant's ability to regulate arousal. As discussed earlier, 1-month maternal level of physical activity predicted 4-month infant state, gaze behavior, and facial expressions--all of which are believed to be related to the infant's arousal-regulating capacities--as well as 4-month infant regulation-of-arousal composite. Additionally, 1- and 4-month maternal silence during infant gaze aversion was determined to significantly predict 1- and 4-month infant regulation of arousal, respectively. In summary, maternal level of physical activity and silence during infant gaze aversion have surfaced as essential concurrent and predictive aspects of maternal interactive behaviors focal in promoting infant regulation of arousal.

These findings suggest that maternal intrusive behaviors, represented here by mothers' physical activity and their tendencies toward silence during infants' gaze aversion, have a negative association with infant attempts to regulate arousal through gaze aversion. The more intrusive a mother behaves, with regard to physical stimulation and responsiveness to infant gaze aversion, the more likely her infant is to spend time averting gaze rather than engaging in mutually rewarding interaction. Infant gaze aversion has been demonstrated in past studies to be a predominant method of arousal regulation during early infancy. Not only does it allow for such physiological regulation as heart-rate deceleration to occur (Field, 1981; Stoller & Field, 1982; Vaughn & Sroufe, 1979), but it also represents a necessary phase in the infant's recovering and

attempting to maintain/regain equilibrium, allowing for further interaction to occur (Brazelton et al., 1974). Thus, the mother who moderates her physical activity directed toward her infant, and remains sensitive and responsive (i.e., quiet) to her infant's needs to regulate arousal through use of gaze aversion, is providing her infant with the opportunity to master the developmental task of regulation of arousal. Perhaps more importantly, such a mother is facilitating early social development through providing the opportunity for her infant to subsequently initiate and elicit interaction.

Strengths of the Study

Before concluding this section, it is important to consider the strengths and limitations of this study. A conceptual strength of this study was the focus on face-to-face interaction to provide a 'window' into what takes place during infant-mother interaction. Proponents of this interaction paradigm have suggested that infant-mother face-to-face interactions are representative of what occurs during spontaneous, unstructured face-to-face interactions within these dyads. Thus, through incorporating the face-to-face interaction paradigm into this study of infant social development, it is expected that the research has focused upon a particularly salient 'context' of development which will thus provide important and generalizable information about infant development more generally.

A second methodological strength of this study is its longitudinal design. Observing one group of infant-mother dyads at both 1 and 4 months allowed for examination of the stability of individual differences in both maternal and infant interactive behaviors, as well as prediction from early to later measurement periods. Further, this design provided insight into the continuity which exists in early development at the individual level, as opposed to the examination of continuity through cross-sectional designs, which employ more than one age group of infant-mother dyads at one point of measurement.

Another strength of the data collection methods involved employing both a spontaneous and a manipulated episode of face-to-face interaction. This design potentially allowed for making comparisons in maternal and infant interactive functioning across the two different episodes. These comparisons may have possibly demonstrated the importance of particular maternal interactive behaviors on the interactive competence of infants across the two episodes. For example, optimal maternal contingent responsivity during the spontaneous face-to-face episode may have fostered optimal infant gaze behavior. Conversely, during the manipulated episode, if maternal contingent responsivity became less optimal, infant gaze behavior may also become less optimal, demonstrating the role of maternal contingent responsivity in fostering infant interactive competence.

The fourth and final strength of this study involved deviating

from the structured, laboratory setting to filming the interaction episodes in the home. This particular arrangement may have facilitated more 'natural' interactive behavior on the part of the mother, due to the familiarity and security of being in one's home. Further, these effects on the mother would potentially influence the manner in which her infant responded to her during the course of interaction. Subsequently, it could be hypothesized that this arrangement would produce results which are more representative of naturally occurring, unstructured infant-mother interaction.

Limitations of the Study

As discussed in the Methods chapter, this study differed from those presented in the literature review in that the face-to-face interactions were filmed in the home with one video camera. This arrangement posed an occasional problem during coding of the interaction data due to the difficulty in assigning scores to maternal and infant behaviors which required viewing the full face, as opposed to the profile. In particular, in the case of maternal and infant facial expressions, maternal infantized behavior, and infant gaze behavior, viewing the full face may have facilitated greater ease in assigning a score. It is important to note, however, that it is not necessarily appropriate to assume that all such difficulties in coding would have been eliminated by the use of two cameras.

Another limitation to this study involved our reliance upon 3-

minute videotaped sessions of face-to-face interaction as a means of addressing our research questions. Each infant-mother dyad interacted in the face-to-face setting for two, 3-minute episodes. Coding of the videotapes required employing the entire 3-minute episode for assigning a global behavior rating. The issue in question is whether three minutes of videotaped interaction provided enough of a sample to capture the nuances of maternal and infant interactive behavior in a face-to-face setting. That is, does a global rating of the entire three minutes provide a representative assessment of maternal and infant interactive behavior? When reviewing the measures of infant and mother interactive behaviors employed in past face-to-face research, a wide variety of methods is discovered. Variability exists in the amount of time infants and mothers engage in face-to-face interaction (e.g., Field et al., 1985; Fogel et al., 1982), the application of coding schemes to interaction data (e.g., measures of sequential dependency and individual behavior, Symons & Moran, 1987), and the focus of the interaction episode (e.g., the timing and intonational exaggeration of maternal vocalizations, Bettes, 1988; the manipulation of maternal facial and vocal characteristics through the use of a closed-circuit television system, Gusella et al., 1988). Thus, given the variety in methods of measuring infant-mother interactive behavior, and the fact that no one method has been shown to be more representative than the others, it appears safe to assume that the methods employed were at least as effective as other methods.

Additionally, due to the lack of significant differences between maternal and infant behavior from episode A to B, and subsequent pooling of the data across episodes, it could be stated that these grouped data of six minutes of infant-mother face-to-face interaction were more representative and reliable (Rushton, Brainerd, & Pressley, 1983).

A third limitation involves the measurement system more specifically. When the writer developed "Guidelines for Use" of the IRS (Field, 1980), it was necessary to define the 3 points of each rating scale in terms of specific, relevant behaviors observed during the face-to-face interaction episodes. It was also necessary that consistency exist within scales, and across maternal and infant scales in this regard. Toward these ends, it was decided that a score of 1 or 3 represented a predominant mode of interaction, while a score of 2 reflected either a moderate level, or a degree of inconsistency in this particular mode of interaction. The concern with this interpretation is with the score of 2, reflecting inconsistent behavior. Inconsistent behavior is highly variable and difficult to operationalize. Does inconsistent behavior reflect a perfect 1:1 ratio of 'missed' to 'not missed'? Or does it reflect a 3:7 ratio? A 3-point scale appears not to allow for quantifying the subtle individual differences in inconsistent behavior. Could a scale with more than three points capture more of the variability in what can be characterized as inconsistent behavior? This question is an important one, yet it cannot be answered with findings from

this study. However, it is important to recognize that an important distinction in the quality of maternal interactive behavior was discovered using the IRS. The 3-point scoring system employed was able to make the distinction between what has been defined as inconsistent behavior and predominantly optimal or non-optimal modes of interactive behavior. And, when viewed in combination with the overall purpose and goals of this study, and the nature of the significant results, this distinction was sufficient in testing our predictions.

Conclusions and Implications for Future Research

The significant prediction of infant regulation of arousal from maternal physical activity is very interesting in that maternal physical activity contributed virtually no unique findings to this study until across-time correlations between 1-month maternal behavior and 4-month infant behavior were computed. It was a maternal interactive behavior that was not intercorrelated with other maternal behaviors at either age, not found to remain stable across time at the individual level, nor were normative changes observed across measurement periods. Maternal physical activity revealed itself only as a significant predictor of infant interactive behavior, suggesting that its influence on early interaction may have a relatively long-ranging impact on subsequent infant interactive competence. This measure of maternal physical stimulation present during early face-to-face interaction may very

well be a highly sensitive index of maternal intrusive behavior, an interactive technique with effects that are not manifested immediately, but rather appear gradually. When viewed in the context of early interaction, maternal physical overstimulation is an interactive technique against which infants have very little safeguard beyond turning their heads and averting gaze. And it is obvious that gaze aversion is not likely to be successful in fending off a physically intrusive mother.

Is it possible that physical overstimulation present during early interaction subsequently affects infant regulation of arousal and the ability of the infant to initiate and elicit mutually rewarding interaction? It does seem likely, yet the lack of stability in the individual differences of this particular maternal interactive behavior over time suggests that maternal intrusive behavior might manifest itself in different interactive behaviors. Consequently, in light of the findings that 1- and 4-month maternal silence during infant gaze aversion significantly predicts 1- and 4-month infant regulation of arousal, this suggestion appears to be valid. Thus, it appears that maternal intrusive behavior takes on many interactive forms during infant-mother interaction, including maternal physical overstimulation and a lack of silence during infant gaze aversion, both determined to significantly influence immediate and long range infant regulation of arousal and interactive competence.

With regard to the findings of this study and implications for

future research, the next logical step in an examination of the dynamics of infant-mother interaction in a face-to-face context would include extending data collection beyond 4-months to follow up on predictions regarding maternal intrusive behaviors and their impact on infant interactive competence. Further, it would be of value to employ a more sensitive index of maternal intrusive behavior with the eventual goal of determining how this particular maternal interactive method changes across time with regard to competing issues in normative trends of infant development. And finally, an updated version of the infant regulation of arousal composite would be necessary for determining which interactive behaviors beyond infant head orientation and gaze behavior are indicative of the infant's capacity for arousal regulation.

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APPENDIXES

Appendix A

INTERACTION RATING SCALES (IRS)

Field, T. (1980). Interactions of preterm infants born to lower SES, teenage mothers. In T. Field, S. Goldberg, D. Stern, & A. Sostek (Eds.), Interactions of high-risk infants and children. New York: Academic Press.

Face-to-Face Interactions

INFANT RATINGS

- A. State Rating (86%)
 - 1. predominantly drowsy
 - 2. somewhat drowsy
 - 3. predominantly alert
- B. Physical Activity (80.5%)
 - 1. frequent squirming/arching of back
 - 2. occasional squirming/arching of back
 - 3. relaxed body with cycling of limbs toward mother
- C. Head Orientation (80.5%)
 - 1. frequent head aversion
 - 2. occasional head aversion
 - 3. rare head aversion
- D. Gaze Behavior (75%)
 - 1. seldom looks at mother
 - 2. sometimes looks at mother

3. frequently looks at mother
- E. Facial Expressions (80.5%)
1. frequent pouting or cry face
 2. bland expression
 3. occasional smiling or 'contented' expression
- F. Fussiness (92%)
1. frequent fussing or crying
 2. occasional fussing
 3. no fussing
- G. Vocalizations (80.5%)
1. no vocalizations
 2. a few vocalizations
 3. several vocalizations

*** Infant face-to-face summary score = total across scales

MOTHER RATINGS

- A. State Rating (78%)
1. predominantly depressed or anxious looking
 2. somewhat depressed or anxious looking
 3. alert and attentive
- B. Physical Activity (66%)
1. minimal activity or overly active
 2. moderate activity
 3. some activity
- C. Head Orientation (100%)
1. frequent head aversion

2. occasional head aversion
 3. infrequent head aversion
- D. Gaze Behavior (100%)
1. seldom looks at infant
 2. sometimes looks at infant
 3. constantly looks at infant
- E. Silence During Infant Gaze Aversion (81%)
1. rarely quiet when infant looking away
 2. sometimes quiet when infant looking away
 3. usually quiet when infant looking away
- F. Facial Expressions (91%)
1. flat or tense expressions
 2. alternately flat or tense and contented
 3. frequent smiling or 'contented' expression
- G. Vocalizations (94%)
1. constant, non-contingent talking or no talking
 2. moderate amount of talking or no talking
 3. contingent talking and sensitive pacing of vocalizations
- H. Infantized Behaviors (87%)
1. never imitative of infant or no simplified behaviors
 2. sometimes imitative and some simplified behaviors
 3. frequent imitative and simplified behaviors
- I. Contingent Responsivity (66%)
1. rarely responds in kind or with short latency to

infant behaviors

2. sometimes responds in kind or with short latency to
infant behaviors
3. often responds in kind or with short latency to
infant behaviors

J. Gameplaying (81%)

1. rarely plays infant, age-appropriate games
2. sometimes plays infant, age-appropriate games
3. often plays infant, age-appropriate games

*** Mother face-to-face summary score = total across scales

Appendix B

Interaction Rating Scales - Guidelines for Use

*** Developed by Sara Gable

Infant Ratings

A. State Rating

This scale refers to the state of the infant with regard to alertness vs. drowsiness. In determining the state of the infant, pay attention to certain behaviors the infant may display which would lead you to believe he/she is drowsy. For example, yawning, opening and closing eyes, rubbing eyes, little physical activity, lethargy, listlessness, could be indicators of a drowsy state. In making the distinction between predominantly drowsy and somewhat drowsy, look at intensity, occurrence, and duration of the behaviors described above. An infant who does not move and open his/her eyes for more than 50% of the episode is to be coded as predominantly drowsy while an infant who yawns occasionally and rubs at his/her eyes while displaying little physical activity would be coded as somewhat drowsy. A predominantly alert infant would be one who is actively interested in what is taking place. The predominantly alert infant does not display behaviors indicative of being drowsy. This infant is physically active and/or seems to be involved in what is taking place, remaining alert while looking at the mother and other things around the immediate area.

B. Physical Activity

This scale refers to the level of physical activity the infant displays. In assessing the level of physical activity, bear in mind the notion of relaxed cycling as representing movement which is calm and appears to be movement for the sake of movement; movement which could be viewed as playful or enjoyable and stimulating for the infant. Squirming, on the other hand, may appear to be movement which has a more immediate message, such as 'get me out of this chair and leave me alone.' It will be characterized by flailing, outstretched arms, kicking of the legs, lack of control, and may possibly be accompanied by negatively affective facial expressions. Determining whether or not the infant is arching his/her back will be somewhat difficult in that the Sassy Bouncer does not allow for easy detection of an arched back. If the back is strongly arched it will be fairly apparent while if it is only slightly arched it may be more difficult to detect. Therefore, it will be necessary to depend more heavily on the detection of activity which can be labelled as squirming.

C. Head Orientation

This scale refers to the orientation of the baby's head in reference to the mother's head/face. It assesses the orientation of the head only and does not refer to the baby's gaze.

In assigning a score, the observation of inconsistency in the baby's head orientation will be reflected in a score of 2, while a predominant orientation of the head towards or away from the mother will be reflected in a score of 3 or 1, respectively.

D. Gaze Behavior

This scale refers to the infant's propensity to gaze at and away from the mother's face. In determining a score on this scale, one must look for duration and intensity in the gaze at and gaze away episodes when they occur. It will be important to formulate a general conclusion, before assigning a score, as to whether the infant appears to enjoy and desire gazing at the mother's face.

A score of 3 will be reflective of an infant who appears to enjoy gazing at the mother's face, with periods of gazing characterized by length in duration and intensity. Babies rated as 3 will also exhibit periods of gaze aversion characterized by little duration and intensity. ***Keep in mind that every infant will look at and away from their mother's face, the variability will exist in the length of time spent in each mode; gazing at and gazing away.*** A score of 2 will be reflective of an infant who does not appear to have a preference regarding gazing at and away from the mother's face. These infants will display inconsistent gaze behavior, with periods of duration and intensity existing in both gazing at and away from the mother. Babies who earn a score of 1 will display behavior which leads the coder to believe that they do not enjoy or desire gazing at their mothers' face. The majority of the 3 minute episode will be characterized by long, intense gaze aversions.

E. Facial Expressions

This scale refers to the infants' facial expressions. In determining a score, look for interest on the infant's face. There

will be few smiles during the one month episodes so it will be important for the rater to look for 'contentment' on the infant's face. Contentment is rather difficult to operationalize, yet specific things to look for include a focused gaze, relaxed facial expressions, or expressions reflecting feelings of happiness or excitement, while a bland expression is characterized by listlessness and neutrality - there does not appear to be much of a focus in a baby displaying a bland facial expression. While the bland facial expression should predominate the 3 minute episode for the infant to receive a rating of 2, an infant who occasionally displays contentment/positive affect, intermixed with short periods of blandness or neutrality will receive a 3. An infant who displays predominantly negative affect, exhibiting pouty, fussy, whining expressions will earn a rating of 1.

F. Fussiness

This scale refers to the amount of fussiness an infant displays during the 3 minute episode. In order to record something as a fuss, the baby must make some noise/vocalization along with displaying a grimacing, pouty, negatively affective facial expression. To record something as a cry, the baby's face must turn red, or slightly red, and tears, or wet eyes, must be evident. Also, a cry will be considerably longer in duration than a simple fuss and appear to be 'coming from the gut.'

A score of 3 reflects no fussing or crying. If fussing occurs (about 1 - 5 times), as defined above, with no crying, the infant

will be rated a 2, while if there is prolonged fussing (more than 5 simple fusses) and/or any crying, the infant will receive a 1.

G. Vocalizations

This scale refers to the amount of vocalizing evident during the 3 minute episode. Vocalizations are basically noises/sounds which seem to be conveying messages. Bear in mind that they occur out of the context of fussing or crying and are more than simple grunts, burps, and sucking noises.

One Month

A score of 1 reflects no vocalizations; a score of 2 reflects 3 or fewer vocalizations, while more than 3 vocalizations will earn the infant a score of 3.

Four Months

A score of 1 reflects no vocalizations; a score of 2 reflects 5 or fewer vocalizations, while more than 5 vocalizations will earn the infant a score of 3.

Mother Ratings

A. State Rating

This scale refers to the state of the mother; the external expression of internal energy. In assessing the state rating of the mother, pay particular attention to the level of physical activity that the mother displays. A mother who is depressed would display an activity level categorized as lethargic while a mother who is anxious would display an activity level described as frantic. The mother who is alert and attentive displays an activity level which

is contingent on the baby's behavior and could be described as 'in tune' with baby, comfortable, and relaxed in reference to baby's behavior. The alert and attentive mother exhibits a wide variety of interactive techniques with baby, i.e., expressiveness, different methods of stimulating baby (vocally, physically, facially etc.). This mother can adjust to baby's state/behaviors/etc, while remaining involved and enthusiastic throughout the episode.

When trying to determine if a mother's state is anxious, identifying strange patterns of behavior directed towards baby may help, as these types of behavior could be viewed as outlets for maternal anxiety. For example: A mother who continually bounces the Sassy Bouncer, never adjusting her rhythm or level of bounce; a mother who constantly jiggles her baby's chin/cheek, never stopping or modifying her behavior in regards to b's state; a mother who plays 'Patty Cake,' manipulating her baby's arms and offering constant physical stimulation for the entire episode, never taking into account baby's responses/behavior/state or possibly baby's averted gaze.

The mother who is depressed displays behavior opposite to the anxious mother. The depressed mother exhibits listless or apathetic behavior towards baby. This mother may go so far as to rest her arms on the Sassy Bouncer or sit in one position for the entire episode, never changing her approach or actions directed towards baby. This mother may appear as though she has a very limited repertoire of techniques with which to initiate or maintain

interaction with baby.

B. Physical Activity

This scale refers to the level of physical activity and stimulation the mother directs toward baby. The level of physical activity that a mother demonstrates can run along the continuum from minimal to some to moderate to overly active. 'Some' activity is less than moderate activity and represents the optimal level that a mother can exercise in this situation. Touching the baby counts towards physical stimulation when in combination with other modes of physical stimulation, yet general touching alone does not count as more than minimal activity.

In reference to the Sassy Bouncer, the amount of bouncing that a mother initiates and maintains with baby counts as physical activity/stimulation.

C. Head Orientation

This scale refers to the extent to which the mother keeps, or does not keep, her head oriented towards baby's face/body. The head does not need to be turned completely away from the baby, it could be dropped down so that the mother is looking at herself, or it could be turned slightly to the side so that the mother's focus is directed at something other than the baby. Extent is defined by frequency (number of occurrences in a 3 minute episode): infrequent head aversion is turning the head away 3 or fewer times, with duration being very short; occasional head aversion combines turning

the head away more than three times, with duration being greater than a couple of seconds; frequent head aversion describes the mother who is unable to direct her head in the direction of the baby for the majority of the 3 minute episode - this mother spends more time looking away from the baby than looking at the baby.

With regard to context, the mother who turns her head in the same direction as the baby, as if in a contingent response aimed at looking to see where baby is looking, would not be rated as head aversion.

D. Gaze Behavior

This scale refers to the extent to which the mother keeps her gaze directed towards baby. The mother who continually gazes at her baby, only turning her gaze away in response to b's averted gaze, as in a contingent response, or in response to some external stimuli, i.e., the oven timer going off, will receive a 3 on this scale. This mother spends the majority of her time attending to the baby and when she is not attending this seems perfectly in line with the ongoing interaction. The mother who combines gazing at the baby and gazing away from the baby will receive a 2 on this scale, while the mother who spends the majority of the episode gazing away from the baby will receive a 1. Note that the score of 2 reflects an inconsistency in the mother's behavior; she spends time gazing at the baby and gazing away from the baby, yet does not seem to have any apparent reason for spending time gazing away from the baby. Her gaze aversions are not in line with the on going interaction.

***In reference to both the head orientation (C) and gaze behavior (D) ratings, be aware of the mother's general willingness to look at her baby. A mother who demonstrates a tendency to not look at her baby would receive a lower rating; for some reason this mother does not want to look at her baby and therefore consistently averts her head and gaze away from baby.

E. Silence during Infant Gaze Aversion

This scale refers to the mother's propensity to intrude on baby's periods of gaze aversion. In giving a score here, the coder must take heed to note the context of m's vocalizations/physical intrusions while the baby's gaze is averted and the proportion of infant gaze aversions during the episode to maternal vocalizations/physical intrusions. For instance, m's vocalizations may be a response to b's averted gaze and m may quiet immediately after offering her vocalization (e.g., b may become overstimulated with m's behavior and turn his/her head away from m, thus averting gaze, m may respond to b's averted gaze by lowering the pitch and tone of her voice/actions and vocalize to b in a quiet, soft tone of voice, acknowledging his/her averted gaze); she should not receive a score reflective of the m who talks continually, yet not in response to b's averted gaze, after b's gaze is averted. Physical intrusions are any observed attempts from m to regain b's attention, i.e., turning baby's head, tickling baby's body in an intrusive manner, poking around baby's neck, putting a toy near baby's face.

A mother who is generally quiet and not physically intrusive

during infant gaze aversions will receive a 3 on this scale. A mother who displays inconsistency (both vocally and physically) in her behaviors (i.e., talks while baby's gaze is averted, tickles or turns baby's head, remains quiet and watches baby, responds to b's averted gaze by also turning her head) during baby's gaze aversion will receive a 2 on this scale. A mother who receives a 1 on this scale exhibits an inability to remain non-intrusive during baby's gaze aversion. Her words/actions are consistently intrusive while baby's gaze is averted.

F. Facial Expressions

This scale refers to maternal facial expressions alone. In assessing the mother's facial expressions, the coder must take note of the level of expressiveness a mother exudes. A mother who is positively expressive and demonstrates an ability to be flexible in her facial expressions, changing her expressions contingently with b's expressions/behavior, will earn a rating of 3. A mother who exhibits inconsistency in her expressiveness, being both positively expressive and flexible, while also exuding flat, disinterested affect will earn a 2, while a mother who is predominantly flat, disinterested, and unexpressive will earn a rating of 1.

If the coder is unable to observe the mother's facial expressions during the entire episode, the tone of the mother's voice (i.e., flat, 'bored,' pleasant, tense, alternately flat and pleasant tone, unexpressive) will suffice as an appropriate substitute in scoring.

G. Vocalizations

This scale refers to the level of appropriateness and contingency demonstrated in mother's vocalizations. Contingent maternal vocalizations reflect a mother who bases her vocalizations, i.e., tone, speed, pitch, on baby's behavior, state, expressions, and movement. The notion of sensitive pacing brings to light the fact that the mother does not constantly vocalize when b's gaze is averted and that the mother may allow lapses of time between her vocalizations, as if in an effort to facilitate turn-taking in conversation. Sensitive paced vocalizations are pleasant in tone and non-intrusive, they do not work against baby's state. The mother who demonstrates these qualities in her vocalizations receives a 3 as her rating for this scale. A mother who vocalizes constantly, non-contingently, and intrusively, never taking into account b's behavior, state, or needs, would receive a 1, as would a mother who does not vocalize. A mother who demonstrates both contingent, sensitive paced vocalizations and non-contingent, intrusive vocalizations will receive a 2. Again, the notion of inconsistency in maternal behavior is reflected in the score of 2.

H. Infantized Behaviors

This scale refers to the mother's willingness to employ infantized/'simplified' behaviors during her interactions with baby. Infantized behaviors as those behaviors that a mother exhibits which are strikingly different from adult-like behaviors, i.e., exaggerated facial expressions, hi-pitched (motherese) tone of

voice, repetition of simple phrases, and imitation of baby's facial expressions, vocalizations, or body movements. Basically, simplified behaviors can be thought of as behaviors performed with the intent of gaining or maintaining baby's attention.

A score of 1 is reflective of no imitative or simplified behaviors - this score reflects a mother who never exhibits infantized behaviors during the 3 minute episode. A score of 2 reflects a mother who displays some imitation and/or some simplified behaviors during the 3 minute episode. This mother does not employ these types of behaviors to the fullest extent possible in gaining or maintaining the baby's attention; i.e., she may revert to simple commands or physical intrusion (turning the baby's head) in order to gain or maintain the baby's attention. A score of 3 on this scale reflects a mother who uses infantized behaviors frequently during the 3 minute episode; she appears comfortable using these behaviors, uses them appropriately, sensitively (e.g., does not imitate b's cries of distress) and in reference to baby's behavior; she employs them to the fullest extent appropriate in gaining and maintaining baby's attention.

I. Contingent Responsivity

This scale refers to the level, latency and appropriateness of mother's contingent responsivity. In order to determine the extent to which a mother responds contingently and with short latency to baby's behaviors, the coder must be aware of the variety of signals/cues which the baby can 'send out.' Vocalizations, body

movements, facial expressions and gaze behavior are among the potential signals/cues to which a mother can respond contingently and with short latency. It may aide the coder to employ a frequency count of maternal responses (and missed maternal responses) and the latency (amount of time which has elapsed) between the baby's cue and mother's response while scoring this scale.

A mother who never seems to pick up on baby's cues/signals and therefore never responds contingently or with short latency will receive a score of 1 on this scale. A mother who seems entirely aware of baby's signals/cues, picking up on the most subtle behaviors, responding both appropriately and contingently with short latency will receive a 3. The mother who sometimes responds contingently and with short latency and sometimes does not respond contingently and with short latency to baby's signals/cues will receive a 2. The score of 2 is considered as reflecting an inconsistency in maternal responsiveness to baby's signals/cues and could also represent the notion of maternal intrusiveness during interaction. Also, a score of 2 is reflective of the infant who offers very few (less than 3) opportunities for the mother to respond, although the mother responds both appropriately and with short latency. For a score of 3 to be given, there must be more than a few opportunities for the mother to be able to respond contingently.

The coder must be aware of the fact that an intrusive mother is one that is not entirely capable of consistent contingent

responsiveness to infant cues/signals. In general, intrusiveness places the mother in a position where she is missing infant signals/cues.

J. Gameplaying

This scale refers to the mother's use of gameplaying during interaction. When scoring this, the coder must be aware of what qualifies as age-appropriate play. First, gentle manipulation of the baby's limbs qualifies, as it stimulates the baby physically. Second, nursery rhymes, simple songs, and clicking/clucking noises qualify because they stimulate the baby's auditory senses. Third, gentle tickling of the baby's body and blowing in the baby's face qualify due to the physically stimulating nature of the actions, and lastly, employing simple toys (i.e., rattles, squeaky toys, mirrors, etc.) qualifies because of the potential visual, auditory, and object stimulation afforded to the baby. Also, a mother who sticks out her tongue at her baby or in other ways exaggerates her own facial expressions in an attempt to have baby imitate her actions or otherwise capture baby's attention is engaging in age-appropriate play. Also, there must be a conscious awareness on the mother's part of what she is doing for these actions to qualify as gameplaying.

In assessing the mother's propensity to employ age-appropriate play techniques, the coder must take note of the number of times the mother initiates play episodes, the duration of her attempts/initiations, and the appropriateness of the mother's

attempts - in reference to baby's state and the level of play initiated, i.e., it would not be entirely appropriate to initiate highly stimulating play if the baby is asleep, nor would it be appropriate to shake a rattle literally in the baby's face. With regard to duration, a single stroke of the baby's cheek or a very brief jiggle of the baby's leg would not qualify as play due to the lack of duration, unless the baby offers a response which lets the mother know that this is not what the baby wants, so the mother stops her attempts (would be scored as a contingent response).

A score of 1 reflects a mother who virtually never attempts to initiate age-appropriate games/play with the baby. A score of 2 reflects a mother who initiates gameplaying occasionally, yet does not necessarily employ appropriate techniques or gives up too soon, thus not exhibiting duration. A mother who scores a 3 initiates age-appropriate play often and does so in a manner contingent with the baby's state and behavior; she focuses on what she is doing and attempts to go for somewhat longer lengths of time; she is able to capture the baby's attention with her 'games.' A score of 3 reflects the mother who uses age-appropriate play optimally, and also the mother who overuses play, thus behaving in an intrusive manner. (Other scale ratings will reflect this mother's behavior.)

*In reference to the Sassy Bouncer - Mother's bouncing baby in the chair without any vocalizations regarding what she is doing does not count as gameplaying, while a mother who gains baby's attention or

initiates play by bouncing baby in the chair and vocalizing about what she is doing does count as gameplaying. Remember, bouncing the Sassy Bouncer does count as physical activity, scale B.