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The Caregiver-Infant Dialogue: Examining Maternal and Infant Responsivity in a Face to-Face Interaction Sequence at 2, 4 and 6 Months of Age

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THE CAREGIVER-INFANT DIALOGUE: EXAMINING MATERNAL AND INFANT RESPONSIVITY IN A FACE-TO-FACE INTERACTION SEQUENCE AT 2,4 AND 6 MONTHS OF AGE

by

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VITA

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The author's research efforts include:

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REVIEW OF RELATED LITERATURE

The game begins. Mother and father enter the nursery where baby has signalled that they are needed. They have heard a cry, a coo, a stir of movement; some cue has told them to come in. They enter and move in close to find their infant has awakened. With eyes wide, head swaying back and forth, the woman moves in closer then draws away. Her husband joins her and together they chorus in "oohs" and "ahs" pitched lower, then higher, then lower again. What is this strange game and who are the participants? Such behavior is often characteristic of those first conversations between parent and infant. As in our example, the game is sometimes playful, while at other times parents struggle to get to know and understand their new baby. How should the cues from baby be interpreted: is he hungry, is he tired, is he wanting a cuddle or just some time to play and explore? Clear communication is sometimes difficult. Parents and their babies alike must continually adjust, interpret, and readjust to the communicative signals each partner in the interaction dialogue presents.

The relationship between children and their parents has long been a topic of interest and concern for both parents and professionals (Ainsworth, Bell, & Stauton, 1972;

Bowlby, 1969; Tronick, 1982). In an attempt to understand the complexity that confronts them, the professional seeks to delineate the dynamics and changing character of this relationship. Parents and their children are seen as functioning as an interactive system (Lewis & Rosenblum, 1977). This interactive system shared between parent and child has been described as a dialogue, a dance in which each partner contributes to the continuation or cessation of the interaction. As one partner "speaks" the other must "listen" and respond. In so doing the behavior of each is driven individually, as well as contingently by the behavior of the partner in the interactive system.

For many researchers, the process of development may be best examined within the context of the relationship shared between mother and her infant (Brazelton, Tronick, Adamson, Als, & Wise, 1975; Thoman, Acebo, Dreyer, Becker, & Freese, 1979). Every major psychological perspective suggests the heuristic value in examining this relationship and evidences support for interaction as the avenue to better understanding of parent-infant relations. In fact, the relationship established between the infant and his primary caretaker has been described as the prototypic caring and loving relationship. This notion of mother-infant interaction serving as a model for future social relationships is a recurring theme in the literature (Schaffer, 1977; Stroufe, 1978; Papousek, 1975). Freud

wrote nearly fifty years ago that the mother-infant relationship was "unique, without parallel, established unalterably for a whole lifetime as the first and strongest love-object and as the prototype of all later love-objects" (Freud, 1938). Even as the tide of behaviorism rushed across the field of psychology in the 1950's and 1960's, the mother-infant relationship continued to be of profound interest. Investigations probing this relationship came to focus upon observable behavior and paid less attention to expressed feelings. Alternatively, the infant's cognitive development was actively pursued as the avenue to interpretation of the mother-infant pair. More specifically, understanding the infant's changing emotional involvement with and cognition of his mother offered new insight into the infant's role in interaction (Sroufe & Waters, 1976). Learning theorists suggest a somewhat different picture of the relationship shared between mother and infant and argue that interaction between the infant and adult caregiver consists of many natural learning situations (Papousek, 1977). Clearly, the mother-infant relationship is important in its own right and also in serving as a base from which one might better understand the ontongeny of the parent-child relationship.

The behaviors observed between parent and infant change over time as a function of variables within each participant, as well as from changes in the character of

their interaction. Developmental, physical, psychological, and emotional characteristics of both infants and their parents will shape subsequent interaction and are fundamental to our understanding of the development of parent-child relations. In the sections that follow we will specifically address how both infant and parent contribute to the quality of interaction.

Infant Contributions to the "Dance"

Infant contributions to the interaction dance seems to present a social preadaptation for smooth mother-infant interaction (Kagan, 1979; Lamb & Easterbrooks, 1981; Schaffer, 1979). The baby brings a vast array of structural and functional characteristics that bind him to other members of the species and influence the operation of the dyad. The infant's visual system is selective, the human face produces just the right combination of captivating stimulus elements: movement, light and dark contrasts, sharp angles, 3-dimensionality (Bornstein, 1979; Cohen & Salapatek, 1975; Fagan, 1979). Similarly, the infant's auditory system is attuned to the type of sounds characteristic of the human voice (Eisenberg, 1976).

The infant's physical characteristics (cuddliness and the typology of characteristics that fit the "babyishness" ideal) are thought to influence the strength with which an infant elicits responses from his environment (Boukydis, 1981). This ability of the infant's physical appearance

to evoke responses from adults was investigated in a study of the perceived attractiveness of preterm and full-term human infants (Maier, Holmes, Slaymaker, & Reich, 1983). From pictures taken of newborns at 3 different conceptional ages (full-term, one month before term, and two months before term) composite drawings were made (one for each gestational age). College-aged subjects rated the composite drawings on the basis of overall impressions, perceived functional evaluations and judged behavioral inclinations. Physical characteristics of the composite drawings differed as a function of conceptional age with the full-term composite possessing proportionally wider eyes and rounder heads than the preterm composites. Drawings depicting the full-term characteristics evoked much more favorable responses from the adults (more likeable, attractive, cute and normal) than those of the preterm infants.

Researchers have tried to delineate what aspects of the mother-infant pair facilitate or impede the smooth functioning of the dyad. Essentially, it is agreed that the organization of these within infant variables (characteristics) influence the functioning of the mother-infant pair. This organization of infant characteristics has been investigated in a number of ways. Brazelton (1973) argues that an infant's behavior is organized in particular ways over time with the infant sleep/wake cycle or state pattern establishing this organization. The infant's regulation

of state is initially his most powerful control and response system. With the recognition of these state patterns one sees that infants behave differently and predictably in different states--specific responses no longer appear chaotic. Stern (1977) suggests that infants are born with a timing program which translates into the ability to form expectations about tempos. He argues that if this were not the case, the infant could only react to the caregiver, but not dance with her. This literature suggests that infant behavior patterns elicit responses in mom providing her with feedback information, enabling her to pattern her own behavior in an optimal way.

A more formal view of the organization of infant characteristics is offered by research probing infant temperament. Thomas and Chess (1977) argue that infant temperament, which constitutes a cluster of constructs and behaviors that characterize an infant's personality (activity level, mood, threshold for stimulation, adaptation) greatly predicts the infant's reaction to the environment, as well as the environment's reaction to a particular baby. On the basis of these categories of behavior the authors describe three different patterns: the easy child, the difficult child and the slow to warm-up child. For example, the easy child establishes an early regularity in sleeping and feeding schedules, possesses a positive approach to new stimuli (which includes a high degree of adaptability to

change) and expresses a predominantly positive mood. On the other hand, the difficult child has irregular sleeping and feeding schedules, responds negatively to new stimuli and shows intense mood expressions (frequently negative). Further, Thomas and Chess suggest that the issue of whether or not these temperamental traits remain consistent over time cannot be studied globally. They argue that one or several traits may show striking continuity from one specific age period to another, while other attributes may not. "Consistency in development will come from continuity over time in the organism and significant features of the environment. Discontinuities will result from changes in one or other which make for modification and change in development."

While appreciating the organization of infant characteristics it is the "fit" these characteristics establish with the caretaking environment that will accord or negate any preadaptation for smooth mother-infant interaction. The task of the socializing parent is not to create behavior out of nothing, but to synchronize behavior with behavior already organized in the infant. Kaye (1980) demonstrated how mothers appear to respect this temporal organization in the infant and do indeed attempt to synchronize their behavior with it. He found baby's sucking to be organized in burst-pause patterns. Mothers tended to interact with their infants in precise synchrony with this

pattern. During bursts (sucking) they were generally quiet and inactive while during pauses they jiggled, stroked and talked to the baby.

Once again we are drawn to the mother-child system as the context within which to best observe and understand the functioning of each partner. We are unable at this point to choose with certainty which infant characteristic (or cluster of characteristics) is going to be most influential in setting the tone of the relationship in a given mother-infant pair. In answering such a question we must recognize the dynamic transaction between mother and her baby. More specifically, we must appreciate the characteristics, organization and "fit" mother contributes to the interaction dance with her infant.

Mother Contributions To the "Dance"

Up to this point, the arguments presented here have primarily focussed upon the kinds of behaviors and tendencies the infant offers the caretaking environment. While we have come to recognize the infant as a capable and active partner in the interaction dance, it is mother who will primarily control the movement since she is the more competent partner (with her broader base of cognitive and affective resources). For our purposes "mother" is here defined as the role of the primary caregiver, whomever he or she might be. (Later, in our own sample of parent-infant dyads, this role is carried out by the infant's

biological mother).

The role of mother in dyadic interaction is complex. In order to act and respond appropriately mother must evaluate her infant's behavioral state, attempt to maintain it at optimum levels, and decide on the basis of the infant's attention to continue or modify her stimulation both qualitatively and quantitatively (Brazelton, 1975). In addition, she must be sensitive to the individuality her baby presents. Recall, for example, the description of infant temperament as presented by Thomas and Chess (1977). An infant who has a low threshold for stimulation presents a different picture to mother than one who seeks a higher level of stimulation. Mother must recognize and respond differently to such individual infant characteristics. Stern (1977) has extensively studied what he calls "infant elicited behaviors." This is the behavioral repertoire that moms (and even children as young as six years old) employ in their interactions with infants (Relling & Fullard, 1977). This behavioral repertoire includes facial expressions exaggerated in space and time, vocalization that is highly variable and characteristic of an imaginary dialogue, gaze that is mutual and long lasting and proxemics that deeply invade the infant's psychological bubble or envelope of space. Several authors have hypothesized the function that these infant elicited behaviors serve. Kagan (1979) feels that these behaviors contribute to the

infant's ability to form sensory representations of these expressions. Further, Kagan suggests that the slowness that characterizes these behaviors is appropriate because the infant processes information more slowly. In addition to the qualitative dimensions of mother's interaction with her infant, Tronick (1982) suggests a quantitative change in mother's behavior over time. He discusses how she is continually "upping the ante" in her interactions, aspects of the dyad once provided by mom begin to become the task and responsibility of the infant. However, such a quantitative behavioral change does not occur in a vacuum and requires that mother be sensitive to the growing competencies her infant presents.

The picture that emerges from the literature is that mother-infant interaction is a highly individual and intricate process. This is not hard to imagine given the different characteristics, behaviors and styles mothers and infants can bring to the dyad. The infant offers individual characteristics organized to "fit" with the caretaking environment. The mother offers a behavioral repertoire suited to communication with the infant and a capacity for sensitivity to the cues her baby presents. Acknowledging that both mother and infant contribute to the course of interaction, both must be considered in determining potential missteps in the interaction dance. Potentially threatening alterations in the physical, cognitive and

affective characteristics mothers and infants bring to the dyad might lead to problematic interaction patterns.

Missteps in the "Dance": The High Risk Mother-Infant Pair

It must be kept in mind that the establishment of mutuality in the mother-infant relationship is dependent upon both partners; if one or the other fails to play his role, the interaction becomes unpredictable and disintegrates. The breakdown can originate with either member of the dyad or because the fit between them is out of synchrony (Bruner, 1973; Holmes, Reich, & Pasternak, 1984; Lamb & Easterbrooks, 1981; Massie, 1982). It has been widely suggested that specific characteristics of infants and their mothers may facilitate or impede smooth interaction. One particular situation in which the interactive skills of both parents and infants are often hampered is the birth of a high risk infant. An infant's high risk status will negatively impact upon the very characteristics thought important for smooth caregiver-infant interaction (e.g., infant appearance and behavioral organization, mother sensitivity, and a capacity to respond appropriately). The population of high risk infants actually includes a broad category of infants with widely differing psychological and environmental problems. The premature infant is one segment of this high risk infant population. Often born sick and far too soon, many of these children spend their first weeks or months of life in an intensive care

nursery. The difficulties that may arise in parent-infant interaction within this population are sadly expressed in the overrepresentation of premature infants in reported cases of child abuse (Field, 1979; Goldberg, 1979; Holmes, Reich, & Pasternak, 1984). Als et al. (1979) offer some insight into the dynamics involved in parents' interaction with their premature infants:

> Parents seem biologically programmed to expect full-term normal newborn behavior. Not only are parents of preterm infants deprived of the realization of this expectation by having a premature infant, but, they are at a premature stage of development themselves, deprived of the last weeks and months of readying themselves for interaction with their infant . . . . We thus are dealing with two premature subsystems of an interactive feedback system in which both subsystems may be showing distorted behavior patterns.

Divitto and Goldberg (1979) set out to explore the social interactive consequences of prematurity. The authors postulated that harmonious social interactions would be facilitated by high levels of parent confidence and infant social competence. Further, they suggested as medical complications of the infant increased, parent confidence and infant social skills would decrease, resulting in more problematic interaction. They found that early interactions were indeed affected by premature birth, medical condition and prolonged hospitalization. Their research demonstrated that mothers of premature infants and full-term infants interact quite differently with their babies. Mothers of premature infants work harder and are more

active in carrying the "interactive burden." In so doing, these mothers seem to be compensating for their infant's relative passivity in the interaction dialogue. Often this compensation on the part of the mother continues even when her baby's behavior has become more active and organized. Recall the argument offered by Tronick (1982) where he suggests an important interactive task provided by mother is to "up the ante" in her interactions with her infant. That is, allow the infant to take increasing responsibility for the continuation or cessation of the interaction. Denying the infant this control has evidenced irritability and withdrawal on the part of the premature infant to his highly active mother (Brown & Bakerman, 1979; Field, 1977; Holmes, Reich, & Pasternak, 1984).

Earlier it was suggested that the infant's organization of behavior into a predictable sleep/wake cycle or state pattern provided the infant with a powerful control system and the caretaking environment a powerful mechanism for providing optimal care (Brazelton, 1973). Difficulties in reflexive behavior (e.g., sucking), state control (e.g., maintaining an alert state in these infants is often problematic) and the ability to respond appropriately to social stimulation are evidenced in the premature infant (Brazelton, Tronick, Adamson, Als, & Wise, 1975; Goldberg, 1979). The behavior of these infants is often described as disorganized which has obvious implications for

interaction patterns. In addition, the likelihood of the premature infant sending clear signals to the caretaking environment is sharply reduced. One clear signal to the caregiver that the infant needs attention is infant crying. Frodi (1978) found that preamture infants cry less often but that their cry is perceived as more aversive to adults than the cry of their full-term counterparts.

The premature infant has been the target of considerable interest to the developmental psychologist (Als, Tronick, & Brazelton, 1979; Holmes, Reich, & Pasternak, 1984; Goldberg, 1979). The effect of infant condition on parent-infant interaction and subsequent developmental outcome has been explored by several investigators (Bakeman & Brown, 1977; Brazelton, Tronick, Adamson, Als, & Wise, 1975; Devitto & Goldberg, 1979). Presently, we can describe several of the variables that characterize a given mother-infant pair (e.g., activity level, smiling and gazing behavior). Further, we can predict that these variables will influence the subsequent relationship shared between a mother and her infant (Field, 1977; Holmes, Reich, & Pasternak, 1984). Lastly, it can be established that the premature infant deviates in several ways from his full-term counterpart (e.g., appearance, threshold for stimulation, medical condition)(Bakeman & Brown, 1979; Karger, 1979; Maier, Holmes, Slaymaker, & Reich, 1983). We now recognize that the possibility for breakdown in

parent-infant interaction is heightened with the birth of a premature and/or sick infant. Not surprisingly, this population of infants and their parents provide the researcher an opportunity to better understand (as well as provide a basis for remediation) the dynamics of parent-infant relations.

In the present investigation maternal and infant responsiveness was examined within the context of a structured face-to-face interaction sequence. We recorded various behaviors observed in mothers and infants and set out to explore the interactive consequences of 3 perinatal risk factors: prematurity, illness and hospitalization. In the sections that follow we will address in turn the major variables dividing our sample of mother-infant pairs; group (premature, full-term/sick, full-term/momsick, healthy full-term), event (the structured events mother is asked to complete during the interaction sequence 1-11) and age (2, 4 and 6 months). Specifically, we will present current literature findings and suggest in what ways we expect the present investigation may support such findings.

Group

Earlier in this paper we have established that the more readable, responsive, and predictable an infant is, the greater the potential for effective interactions. Conversely, the unreadable, unresponsive, unpredictable

infant is at a greater risk for establishing ineffective interaction patterns (Field, 1977; Goldberg, 1977). In our sample, such characteristics describe in part differences between our full-term and premature infant groups, differences we would expect to emerge given our present research design. For example, mothers of premature infants tend to be highly active and carry more of the "interactive burden" (Field, 1977). This behavior is frequently described as "overloading" and the response of the premature infant is often withdrawal. Given such a finding, we would expect then to see more withdrawal activity in our group of premature infants in comparison to our other groups. While the literature strongly suggests that high gaze averting prematures are in response to a highly active mother, Noble (1982) demonstrated with his sample of full-terms that high gaze averting infants had mothers with lower frequencies of behavior in all categories. This information is suggestive of an optimal range of maternal activity which when too low or too high results in infant gaze aversion and withdrawal. Perhaps the effects of maternal behavior interacts with diagnostic group and age allowing for some "frequency of maternal behavior index" that will differentiate the risk groups.

On the basis of identifying different states describing a given mother-infant dyad, Karger (1979) established a positive synchrony rate and a negative synchrony rate as a

global measure of interaction effectiveness. The states were: mother communicative, infant communicative and quiescient (a period where neither mother or infant communicative behavior occurred). He found that a negative synchrony rate was defined by reduced probabilities of a quiescent state and elevated probabilities of a mother communicative state. Not surprisingly, the frequency of a negative synchrony rate was higher for premature mother-infant dyads than for full-term mother-infant dyads. It may be that as mothers and their premature infants become "trapped" in a downward spiral of nonrewarding, ineffective interaction, withdrawal of activity on the part of these mothers can be traced across age.

Event

There has been relatively little reserach observing mother and infant in a structured interaction sequence (excluding the feeding situation and short task-oriented session). Yet situation provides an important structure to the interaction observed, supporting that differences between groups will emerge as a function of these events. Field (1977) studied 3 groups of infants (premature, post-mature and full-term) and found maternal activity for all groups combined was greater during the attention getting event (mother tries to get infant's attention) than either the spontaneous or imitation (mother imitates infant) events. Further, Field found that infants gaze at their

mothers least during the attention-getting event and most during the imitation event. In addition, full-term infants gazed at their mothers more than did either the premature or postmature groups, with mothers of the full-term infants less active than mothers of the premature or postmature groups. In our investigation, an assessment of mother's ability to maintain her infant's behavior during the attention-getting event might reveal greater variability in timing and quality for mothers of full-term infants in comparison to their high risk counterparts.

Tronick (1982) and his colleagues looked at maternal and infant responsivity while mother was asked to face her infant with no expression ("impassive face"). They found that infants look away signifianctly more often during this event while fussing behaviors increase. The authors interpret these findings as supporting their conceptualization of mother-infant interaction as a goal-oriented, rule-governed, reciprocal system in which the infant plays an active role. In our own sample of mother-infant dyads we would anticipate group differences to emerge as a function of the "impassive face" event in the interaction sequence. In this event we have experimentally distorted the feedback the infant normally receives from his mother. Here one would expect the full-term infant to be more active in trying to elicit a response from mother while the premature infant would be less active (because he is less responsive

and less socially competent). With advancing age one would expect the premature infant to become more active during this event, possibly because the mother is allowing the infant (whose own behavior is now more organized) to take a "leading" role in the interaction dialogue. For all groups of infants we anticipate more intense reactions to this event with age resulting in more gaze aversion.

Age

With age, one would anticipate both change and stability in given dimensions of infant, mother, and mother-infant behavior patterns. One area in which change would be expected would be infant's looking behavior. As infants get older they spend more time looking at things other than mother. As other researchers have reported, we would suspect a decrease with age in the frequency of infant's orientation toward mother's face (Hartup & Lempers, 1973; Kaye & Fogel, 1980). However, it is also the case that infant's looking behavior may be mediated by event and group affiliation (e.g., more gaze during certain events and/or more infants characterized by gaze aversion if they belong to a certain group). Our present research design will allow us to tease apart the impact event and group may have on infant's looking behavior.

Another age-related issue is that of overall activity level observed in mothers and their infants. Russell (1983) observed 4 healthy full-term boys and their mothers and

found that mother "dominance" declined over sessions as infant "dominance" increased over sessions. In other words, infants had become a more active partner in the interaction dialogue. Russell also found that when mother behaviors and dyadic measures (rather than infant measures) were taken, stability across age was likely to be found. We would anticipate a similar pattern of results in our analysis. In our study we might, for example, interpret a dominant pattern as one that shows a high frequency of interactive behavior in all categories. If, as Russell (1983) suggests, infants become more dominant in the interaction dialogue with age and mothers less so, we might trace this pattern in terms of overall frequency of behavior of mothers and infants.

Previously reported findings suggest that young infants vocalize more when mom is absent than when she is present (Anderson, Vietze, & Dokecki, 1977). On the basis of this information we would expect to confirm this finding by observing an increase in the frequency of young infants' vocalizations during event 11 (mom leaves the room) in comparison to the frequency of older infants' vocalizations during this event.

METHOD

Subjects

Parents were recruited at the time of their infant's birth for a longitudinal study that included various assessments (social, emotional, developmental and cognitive) spanning the child's first five years (See Holmes, Reich, & Gyurke, in press). As part of this larger study, the present investigation probing the interactional patterns of mothers and their infants was conducted at 2, 4 and 6 months of age.

All infants were from middle-class, intact families, had appropriate prenatal care, were without known damage to the central nervous system and were born at the Evanston Hospital, Evanston, Illinois from 1979-1980. There were a total of 59 mother-infant pairs in the sample, Infants were of appropriate weight for their gestational age (gestational age as determined by the Dubowitz [1970] but varied in health, maturity and length of hospitalization as described by the following groupings: [See Table 1 for a description of subject population])

1. Short gestation infants. These infants were less than 37 weeks gestation (range = 29-36 weeks; $\bar{X}$ = 33.7 weeks). All had some degree of postnatal

Table 1

Description of Subject Population

	PREMATURITY	ILLNESS	HOSPITALIZATION
GROUP 1 : PREMATURE	+	+	+
GROUP 2 : SICK FULL-TERM	—	+	+
GROUP 3 : HEALTHY FULL-TERM/ MOM SICK	—	—	+
GROUP 4 : HEALTHY FULL-TERM	—	—	—

medical problems secondary to prematurity, and all were hospitalized in the intensive care nursery for a minimum of 6 days (range = 6-78 days; $\bar{X}$ = 23.0 days). There were 17 infants in this group: 9 males and 8 females.

2. Full-term infants with medical complications. These infants were full-term with a gestational age of at least 37 weeks (range = 37-42 weeks; $\bar{X}$ = 39.4 weeks). All had some degree of postnatal medical problems resulting in intensive care for at least 6 days (range = 6-35 days; $\bar{X}$ = 13.4 days). There were 15 infants in this group: 6 males and 9 females.
3. Full-term healthy infants hospitalized due to maternal illness. These infants were full-term with a gestational age of at least 39 weeks (range = 39-42 weeks; $\bar{X}$ = 40.4 weeks). All were healthy at the time of birth but were separated from their mothers and hospitalized in the normal newborn nursery for at least 5 days due to maternal illness (range = 5-11 days; $\bar{X}$ = 7.5 days). There were 11 infants in this group: 9 males and 2 females.
4. Healthy full-term infants. These infants were full-term with a gestational age of at least 39 weeks (range = 39-42 weeks; $\bar{X}$ = 40.4 weeks). All

were healthy at the time of birth and discharged from the normal newborn nursery within 7 days (range = 2-7 days; $\bar{X}$ = 4.1 days). There were 16 infants in this group: 8 males and 8 females. The number of participants at each observational session (2,4 and 6 months of age corrected for gestation) ranged from 30-48 mother-infant pairs. The actual breakdowns for the different follow-up visits are given in Table 2.

Procedure

Infants were seen at bith, 2, 4, 6, 9, 12, 39, 60 and 72 months (corrected for gestational age at birth). Although a number of measures were obtained on the infants at birth (measures of the degree of obstetric and perinatal risk [Littman & Parmelee, 1978], BNBAS, state observations, measures of physical size and APGAR scores) and at 2, 4 and 6 months (face-to-face mother-infant interaction, measures of physical size, neurological functioning, perceptual functioning and developmental level), only the data obtained from the face to face mother-infant interactions at 2, 4 and 6 months will be discussed here.

Mother-infant interactions were videotaped in our laboratory which was furnished much like a playroom. The infant was positioned in an upright infant seat stationed on a table, while mother sat in a chair in an en face position toward her infant. The use of a mirror placed to the side where mother was sitting and behind the infant

Table 2

Study Participants at Each Observational Session (2,4,6 Months)

AGE	
2 Mo.	30 Mother-Infant pairs (Male=14, Female=16)
4 Mo.	41 Mother-Infant pairs (Male=20, Female=21)
6 Mo.	48 Mother-Infant pairs (Male=25, Female=23)

allowed the simultaneous recording of the infant's face and body and the mother's face and upper body.

Each of the mother-infant dyads was videotaped in a 6-minute structured interaction sequence, at 2, 4 and 6 months of age (corrected for gestational age at birth). To maximize control of the situation as well as capture a broad range of behaviors exhibited by mother and infant, a structured interaction sequence divided into 11 different events was used as the interactive situation. Mothers were instructed about the timing of each event via an ear microphone. As can be seen from Figure 1, the interaction sequence begins and ends with events that ask the mother to remain peripherally involved with her infant. To begin the session, mother is asked to sit facing her infant showing no emotion (impassive face). Subsequently, she is asked to interact with her infant at increasing levels of intensity with each new event. Initially she is asked to merely get the infant's attention, then to try to imitate the infant, and finally try to elicit from the infant a given response (e.g., grab a toy). This event is followed by three final events that instruct the mother to attend to her infant with an impassive face, move yet further from "interacting" by reading a magazine with no attention paid to the infant, and finally culminating with an instruction to leave the room. One might think of these 11 events as an orchestrated movement. The sequence begins silently, picks up

CODED CHARACTERISTICS OF MOTHER-INFANT INTERACTION SEQUENCE

STATE	EYES	REACH	FACE	VOICE
DROWSY	LOOKING TOWARD	REACHING TOWARD	SMILE	POSITIVE
ALERT INACTIVE	LOOKING AWAY	GENERAL MOVEMENT	NO SMILE	NONE
ALERT ACTIVE		OR NO MOVEMENT		NEGATIVE
FUSSING				
CRYING				

SEQUENCE OF STRUCTURED EVENTS

1. MOTHER SITS FACING INFANT WITH AN IMPASSIVE FACE
2. MOTHER SMILES AT INFANT
3. MOTHER SMILES AND TALKS TO INFANT
4. MOTHER TRIES TO GET INFANT'S ATTENTION
5. MOTHER TRIES TO IMITATE INFANT'S FACIAL EXPRESSION
6. MOTHER IMITATES INFANT
7. MOTHER TRIES TO GET INFANT TO FOLLOW A RED BALL
8. MOTHER TRIES TO GET INFANT TO GRAB A TOY
9. MOTHER SITS FACING INFANT WITH AN IMPASSIVE FACE
10. MOTHER READS MAGAZINE
11. MOTHER LEAVES ROOM

Figure 1. Coded Characteristics of Mother-Infant Interaction Sequence

momentum reaching a crescendo of interaction and ends with maternal withdrawal from the interaction. The sequence of events shown in Figure 1 remained constant for all mother-infant pairs.

Coding

Four trained observers coded the videotapes in continuous real time to assess specific characteristics of the mother and of the infant in the interaction sequence. Behavior categories included state, eyes, reach, face and voice variables (see Figure 1). The state variable included 5 different state categories: 1) Drowsy, 2) Alert Inactive, 3) Alert Active, 4) Fussing, 5) Crying. The eyes variable was divided into 2 mutually exclusive categories: 1) Looking Toward or 2) Looking Away. Similarly, the reach and face variables were divided into: 1) Reaching Toward or 2) No Reaching/General Movement and 1) Smiling or 2) No Smiling, respectively. Finally, the voice variable was divided into 3 dimensions: 1) Positive, 2) None, 3) Negative. The continuous stream of behavior of mothers and infants was divided into 4-second time intervals called epochs (e.g., 15 epochs per minute). In other words, coders had 4 seconds of interaction to observe and determine the appropriate code to be assigned each behavior category in that time interval. Videotaping allowed observers to stop and play back several times any interval that was difficult to code. If, for example, in a given

epoch the mother's behavior was coded 2,1,1,1,1, such numbers would be translated into the following description: Mother was in an inactive state, looking toward her infant, reaching toward her infant, smiling at her infant, and positively vocalizing to her infant.

Mother and infant behaviors were coded separately. The videotape was first coded by observing only the baby in all 11 events of the interaction sequence while later the same videotape was coded observing only the mother. Mothers and infants were coded separately so as to minimize the possibility of the behavior of one or the other member of the dyad influencing the code given to the partner in the interaction sequence. Figure 2 presents a copy of the raw data coding sheet used in the present analysis. Inter-observer reliability was estimated from reviewing by a different observer the videotapes of 6 mother-infant dyads selected at random and ranged from $\underline{r}$ = .70 to .81 across all behaviors for both mother and infant. Briefly, this computation entailed a matrix in which matches and mismatches in coding between observers could be assessed. Based upon this matrix, the measurement of interobserver reliability was then computed (Hayes, 1981). Interobserver reliability estimates for each separate category of behavior computed for mothers and infants can be found in Table 3.

The coding of the videotapes in continuous real time

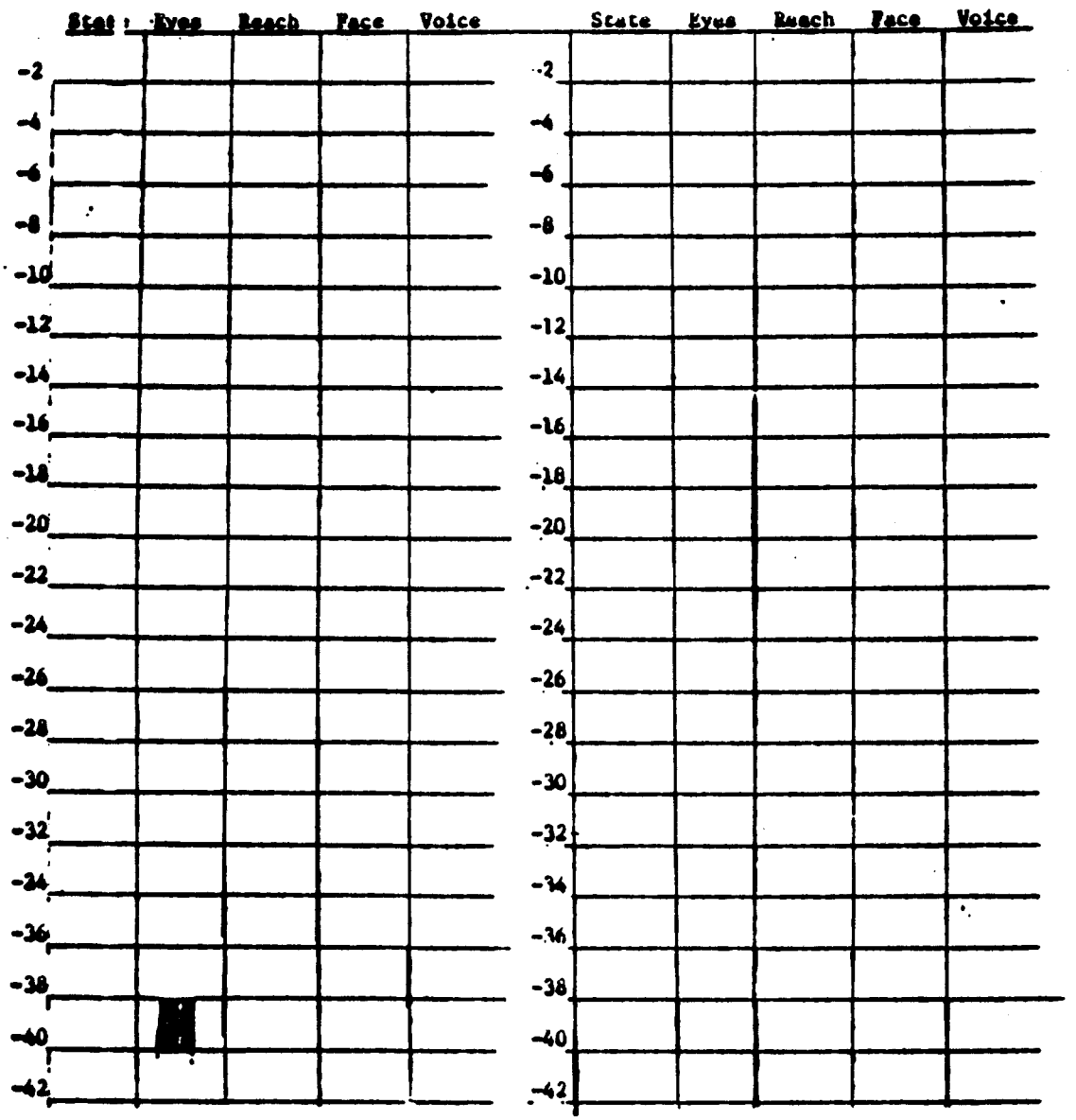

Figure 2. Copy of Raw Data Coding Sheet

Table 3

Interobserver Reliability Estimates for the Separate Behavior Categories

FACE	EYES	REACH	STATE	VOICE
0.70	0.78	0.79	0.81	0.81

constituted the raw data in the present investigation. This body of information was then reduced into a set amenable to analysis, while maintaining the richness of the interaction captured on videotape. In an attempt to standardize the duration of each event (some mothers spent a slightly shorter or longer time in each event in disregard of instructions), it was decided that the most reliable index of the interaction during a given event would be the middle 6 epochs of that event. An example seems in order. Let us say that for a given mother-infant pair, event 1 (mother sits with an impassive face) lasts from second 4 to second 40. The middle 6 epochs (each 4 seconds in duration) chosen to index this event would be epochs 12, 16, 20, 24, 28 and 32. The final data set for each mother-infant dyad was then 6 scored epochs (coded in terms of state, eyes, reach, face and voice variables for mother and infant) in each of 11 different events. The dependent variable used in the following analysis was the number of behavior occurrences of a particular type within an event sequence.

RESULTS

The major variables dividing our sample are: age (within-subjects: 2,4,6 months); group (between-subjects: premature (PT), sick full-term (SFT); healthy full-term/ mom sick (FT/MOMSICK), healthy full-term (HFT); event (within-subjects: 1-11); and sex (between-subjects: 1,2).

Because of the problems with different subjects missing at different ages and events, it was decided to conduct one-way analysis of variance tests. Three hundred eighty-four one-way ANOVA's were examined in which, for both mother and infant, we conducted GROUP ANOVA'S for each event at each age level. These analyses include 120 analyses of the data obtained on mother for the behavior categories of FACE, REACH, EYES, and VOICE (positive). For the data obtained on the INFANT, 264 analyses were conducted for the behavior categories of FACE, EYES, VOICE (positive) and STATE (all dimensions). These ANOVA'S specifically examined the effects of groups on mother and infant behavior for each of the 11 events at each age. Specific contrasts were conducted to determine the source of differences that emerged from the analysis of variance procedure. The first contrast compared the preterm infants with all other groups (PT vs. SFT, FT/MOMSICK, HFT)

producing a premature contrast. A second contrast compared the preterm and full-term sick groups with the remaining 2 groups (PT, SFT vs. FT/MOMSICK, HFT) producing an illness contrast. A final contrast compared the healthy full-term group with all other groups (PT, SFT, FT/MOMSICK vs. HFT) revealing a hospitalization contrast. Thus, these planned comparisons allowed us to determine how the perinatal factors of prematurity, illness and hospitalization contributed to differences in our results.

Mother

As can be seen from Table 4, 5 measures of maternal behavior were significant. Moreover, the majority of significant findings regarding maternal behavior emerged at 6 months of age. Not surprisingly these differences tended to occur in the middle events in the structured sequencing of the interaction dialogue; that is, those events where the mother was asked to become actively involved with her infant (and hence was given the greatest freedom in her behavior). As expected, the more passive and tightly constrained maternal events (e.g., IMPASSIVE FACE) produced few differences in maternal behavior at any age. The sections that follow discuss the specific analyses conducted on maternal behavior.

Dependent Variable: Mom Face (Smiling)

One-way analyses of variance were performed on the MOMFACE variable for each of the 10 events using group as

Table 4

Significant Mean Frequencies of Behavior for Mother and Baby

MOTHER			GROUP			
			1 (PT)	2 (SFT)	3 (FT/MOMSICK)	4 (HFT)
BEHAVIOR	EVENT	AGE	PRETERM	SICK FULL-TERM	FULL-TERM/MOMSICK	HEALTHY FULL-TERM
REACH (TOWARD)	4	6 Mo.	3.25	5.27	1.71	4.73
FACE (SMILE)	4	6 Mo.	5.54	4.50	1.71	4.43
	6	6 Mo.	4.45	4.00	1.14	2.43
	8	6 Mo.	2.09	2.88	1.00	3.21
EYES (TOWARD)	6	2 Mo.	6.00	4.66	6.00	5.66

BABY			GROUP			
			1 (PT)	2 (SFT)	3 (FT/MOMSICK)	4 (HFT)
BEHAVIOR	EVENT	AGE	PRETERM	SICK FULL-TERM	FULL-TERM/MOMSICK	HEALTHY FULL-TERM
EYES (TOWARD)	2	2 Mo.	1.91	1.33	1.50	5.12
	5	4 Mo.	5.00	4.67	2.83	4.22
	1	6 Mo.	0.58	2.38	1.25	0.80
	6	6 Mo.	3.08	3.28	1.86	1.71
	7	6 Mo.	5.42	4.14	5.86	5.50
VOICE (POSITIVE)	1	4 Mo.	1.11	0.64	0.50	0.45
	3	4 Mo.	2.18	0.45	0.00	1.00
	7	4 Mo.	0.60	0.11	0.00	2.50
	8	4 Mo.	0.40	0.33	0.60	1.67
STATE (COG. ALERT)	2	4 Mo.	5.73	5.82	5.38	4.80
	1	6 Mo.	5.92	5.46	5.00	5.93
	5	6 Mo.	5.67	4.67	3.71	5.53
STATE (DROWSY)	3	2 Mo.	0.75	1.39	0.07	0.89

Table 5

Planned Comparisons Revealing Significant Contribution to Observed Differences

MOTHER			CONTRAST 1 PREMATURITY				CONTRAST 2 HOSPITALIZATION				CONTRAST 3 ILLNESS			
BEHAVIOR	EVENT	AGE	S.E.	T	DF	PROB	S.E.	T	DF	PROB	S.E.	T	DF	PROB
REACH (TOWARD)	4	6 Mo.									0.99	-2.05	41	0.05
EYES (TOWARD)	6	2 Mo.									0.5	2.66	22	0.01
FACE (SMILE)	4	6 Mo.	2.25	2.66	38	0.01								
FACE (SMILE)	6	6 Mo.	2.49	2.32	35	0.03								

BABY			CONTRAST 1 PREMATURITY				CONTRAST 2 HOSPITALIZATION				CONTRAST 3 ILLNESS			
BEHAVIOR	EVENT	AGE	S.E.	T	DF	PROB	S.E.	T	DF	PROB	S.E.	T	DF	PROB
EYES (TOWARD)	1	6 Mo.	1.42	-1.88	44	0.06					0.57	-3.18	44	0.003
EYES (TOWARD)	8	2 Mo.									1.18	-2.59	20	0.02
EYES (TOWARD)	2	2 Mo.					2.67	3.84	25	0.001				
EYES (TOWARD)	7	6 Mo.									0.62	2.06	36	0.05
VOICE (POSITIVE)	3	4 Mo.	1.82	2.80	35	0.008					0.72	2.39	35	0.02
VOICE (POSITIVE)	7	4 Mo.					1.47	4.62	28	0.001				
VOICE (POSITIVE)	8	4 Mo.					1.42	2.57	29	0.02				
STATE (DROWSY)	3	2 Mo.									0.72	-3.08	25	0.005

an independent variable. This procedure was repeated for each of the ages assessed (2,4 and 6 months). These analyses produced a total of 4 significant effects for the 30 different analyses. Although there were no significant group differences at 2 and 4 months of age, at 6 months of age a number of significant differences in maternal smiling occurred.

The event where mother was asked to try to get her infant's attention (EVENT 4) produced a significant difference between our groups at 6 months of age, $\underline{F}(3,37) = 4.71$, $\underline{p} < .007$. Results obtained from the planned comparison procedure revealed the prematurity contrast as significant, $\underline{T} = 2.66$, $\underline{p} < .01$. As can be seen from Table 4, mothers of the premature infants smiled more at their infants than mothers in the other 3 groups ($\overline{X} = 5.54$). Although this pattern did not emerge as significant from our analyses, mothers in our FT/MOMSICK group also appeared to be different from the other groups in that they smiled at their infants much less than mothers in the other groups ($\overline{X} = 1.71$). This smiling pattern obtained for mothers in the FT/MOMSICK group remains consistent for all of the events assessing mother's smiling behavior at 6 months of age.

The events where mother was asked to imitate her infant (EVENT 6) and to try to get the infant to grab a toy (EVENT 8) produced trends at 6 months of age, with

$F(3,30) = 2.41$, $p < .08$ and $F(3,30) = 2.42$, $p < .08$, respectively. Again, the prematurity contrast emerged as significant with $T = 2.32$, $p < .03$. Review of the mean scores for mother's smiling behavior for each group during the imitation event (EVENT 6) reveals a similar pattern to that found earlier: mothers of the premature infants smiled more at their infants than did mothers in each of the other groups ($\bar{X} = 4.45$). When mothers tried to get their infants to grab a toy (EVENT 8) a change in mother's smiling behavior occurred. Because no contrast produced significant results here, it is difficult to say what is affecting this pattern. However, review of the mean scores suggests that mothers of the HFT infants smiled more at their babies than did mothers in each of the other groups ($\bar{X} = 3.21$).

Dependent Variable: Mom Reach (Toward)

One-way analyses of variance were performed on the MOMREACH variable for each of the 10 events using group as an independent variable. This procedure was repeated for each of the ages assessed (2,4 and 6 months). These analyses produced one significant effect, at 6 months, for the 30 different analyses. There were no significant group differences at 2 and 4 months of age.

In particular, the event where mother was asked to try and get her infant's attention (EVENT 4) produced a significant difference between our groups at 6 months of age, $F(3,40) = 3.84$, $p < .02$. Results obtained from the

planned comparison revealed the illness contrast as significant, $\underline{T} = -2.05$, $\underline{p} < .05$. As can be seen from Table 4, mothers from the PT group and mothers from the FT/MOMSICK group appear to have been reaching toward their infants less than mothers in the other two groups ($\bar{X} = 3.25$ and $\bar{X} = 1.71$, respectively).

Dependent Variable: Mom Eyes (Toward)

One-way analyses of variance were performed on the MOMEYES variable for each of the 10 events using group as an independent variable. This procedure was repeated for each of the ages assessed (2,4 and 6 months). These analyses produced one significant effect at 2 months for the 30 different analyses. No group differences emerged at 4 and 6 months of age.

At 2 months, a trend emerged between our groups when mother was asked to imitate her infant (EVENT 6), $\underline{F}(3,22) = 2.66$, $\underline{p} < .07$. Although results obtained from the planned comparison procedure revealed the illness contrast as significant, $\underline{T} = 2.66$, $\underline{p} < .01$, it is primarily SFT mothers whose behavior is different than mothers in the other groups. Review of Table 4 reveals that mothers in the SFT group looked less at their babies than mothers in each of the other groups ($\bar{X} = 4.66$). Mothers in the PT and FT/MOMSICK groups looked continuously at their infants ($\bar{X} = 6.0$ for each group) while HFT mothers looked more at their infants than SFT mothers but looked less than mothers in

the other groups ($\bar{X}$ = 5.66).

Baby

Recall the significant findings obtained for maternal behavior predominantly appeared at the 6 month age level. Further, significant patterns tended to appear during active events in the interaction sequence. Differences in infant behavior, however, were obtained at both the 4 and 6 month age periods. In addition, a more varied pattern of results reflected the fact that infant behavior was never constrained but was allowed to vary in response to maternal behaviors. For example, both active and passive events produced differences in infant behavior. The sections that follow discuss the specific analyses conducted on infant behavior.

Dependent Variable: Baby Eyes (Toward)

A one-way analysis of variance was performed on the BABYEYES variable for each of the 11 events using group as an independent variable. This procedure was repeated for each of the ages assessed (2,4 and 6 months). These analyses produced a total of 5 significant effects for the 33 different analyses.

The event where mother faces her infant while smiling (EVENT 2) produced a significant differene between our groups at 2 months of age, $F(3,21) = 5.27$, $p < .007$. Results obtained from the planned comparison procedure revealed the hospitalization contrast as significant, $T = 3.84$,

$p < .001$. As can be seen from Table 4, infants in the HFT group looked toward their mothers more than infants in the other 3 groups ($\bar{X} = 5.12$).

At 4 months of age, the event where mother is asked to imitate her infant's facial expression produced a strong trend with $F(3,25) = 2.81$, $p < .06$. Because no contrast yielded significant results here, it is difficult to determine what is affecting this pattern. Review of the mean scores (Table 4) indicates that infants in the FT/MOMSICK group demonstrate a different looking pattern than infants in the other groups. Specifically, these infants are looking at their mothers less than are infants in the other groups ($\bar{X} = 2.38$). In addition, infants in the PT group are looking toward their mothers more than are infants in the other groups ($\bar{X} = 5.0$) during this event.

At 6 months of age a number of significant patterns emerge across 3 different event sequences. The event where mother faces her infant with an impassive face (EVENT 1) produced a significant difference between our groups $F(3,40) = 3.85$, $p < .01$. Results obtained from the planned comparison procedure revealed the prematurity contrast ($T = -1.88$, $p < .06$) and the illness contrast ($T = -3.18$, $p < .003$) to be significantly contributing to observed differences. As can be seen from Table 4, the premature infants looked toward their mothers significantly less than did infants in the other 3 groups ($\bar{X} = .58$). It appears because infants

from the SFT group looked toward their mothers more than infants from the other groups ($\bar{X}$ = 2.38), the very low mean score obtained for the PT group contributed to the illness contrast revealing a significant pattern.

The event where mother is asked to imitate her infant (EVENT 6) produced a significant difference between our groups $F(3,35) = 3.26$, $p < .03$. It remains difficult to say what is contributing to this difference as no contrast revealed any significant patterns here. However, Table 4 suggests infants from the PT and SFT groups looked toward their mothers more than are infants in the HFT groups during this particular event.

Similarly, the event where mother tries to get her infant to follow a red ball (EVENT 7) yielded a significant difference between our groups $F(3,35) = 2.81$, $p < .05$. Results obtained from the planned comparison procedure revealed the illness contrast as significant, $T = 2.06$, $p < .04$. It appears that infants from the PT and SFT groups looked toward their mothers less than infants in the other groups (See Table 4).

Dependent Variable: Baby Voice (Positive)

A one-way analysis of variance was performed on the BABYVOICE variable for each of the 11 events using group as an independent variable. This procedure was repeated for each of the ages assessed (2,4 and 6 months). These analyses produced 4 significant effects for the 33 different

analyses. There were no significant group differences at 2 and 6 months of age. However, at 4 months of age a number of significant differences in BABYVOICE appeared.

The event where mother faced her infant with an impassive face (EVENT 1) produced a significant difference between our groups $\underline{F}(3,28) = 2.91$, $\underline{p} < .05$. No significant results were obtained from the planned comparison procedure for this event. However, a review of Table 4 suggests that infants from the PT group are responding to their mothers with more positive voice than are infants in the other 3 groups ($\overline{X} = 1.11$).

The event where mother faces her infant while smiling and talking (EVENT 3) produced a trend at 4 months with $\underline{F}(3,28) = 2.64$, $\underline{p} < .06$. Results obtained from the planned comparison procedure revealed the prematurity contrast ($\underline{T} = 2.80$, $\underline{p} < .008$) and the illness contrast ($\underline{T} = 2.39$, $\underline{p} < .02$) to be significantly contributing to observed differences between our groups. Review of Table 4 suggests infants from the PT group displayed more positive voice than infants in the other 3 groups ($\overline{X} = 2.18$). Infants in our FT/MOMSICK group also appear to be different from the other groups in that they display no positive voice during this event ($\overline{X} = 0$).

Again at 4 months of age, the event where mother tries to get her infant to follow a red ball (EVENT 7) produced a significant difference between our groups, $\underline{F}(3,26) = 7.34$,

$p < .001$. The hospitalization contrast was revealed as significant from the planned comparison procedure ($T = 4.62$, $p < .001$). As can be seen from Table 4, infants in the HFT group responded with more positive voice than infants in the other groups ($\bar{X} = 2.50$). Again, infants from the FT/MOMSICK group appear to be different from the other groups in that they displayed no positive voice during this event ($\bar{X} = 0$). The event where mother tried to get her infant to grab a toy (EVENT 8) produced a significant trend in this same direction. Thus, hospitalization appears to be contributing most to this pattern, T 2.57, $p < .02$, with HFT infants responding with more positive voice than infants from the other 3 groups ($\bar{X} = 1.67$).

Dependent Variable: Baby State (Cognitive Alert)

A one-way analyses of variance procedure was performed on the BABY STATE COGNITIVE ALERT variable for each of the 11 events using group as an independent variable. This procedure was repeated for each of the ages assessed (2,4 and 6 months). These analyses produced a total of 3 significant effects for the 33 different analyses. Significant group differences appeared at 4 and 6 months of age. The planned comparison procedure did not reveal any significant patterns here. Therefore, it is difficult to ascertain what factors contributed to the following observed differences.

The event where mother faces her infant while smiling

(EVENT 2) produced a significant difference between groups at 4 months of age, $F(3,28) = 3.16$, $p < .04$. As can be seen from Table 4, HFT infants displayed less cognitive alert behavior ($\bar{X} = 4.80$) than did infants from the other groups. However, this difference is small and might reflect a chance pattern rather than a true difference.

At 6 months of age, the event where mother faces her infant with an impassive face (EVENT 1) produced a trend with $F(3,40) = 2.43$, $p < .08$. It appears from Table 4 that infants in the FT/MOMSICK group were less often in a cognitive alert state than were infants in the other groups ($\bar{X} = 5.0$). Again, at 6 months of age, the event where mother tried to imitate her infant's facial expression (EVENT 5) revealed a significant effect between our groups $F(3,35) = 2.97$, $p < .04$. Table 4 indicates that PT infants are displaying more cognitive alert behavior ($\bar{X} = 5.67$) and FT/MOMSICK infants displayed less cognitive alert behavior ($\bar{X} = 3.71$) than did infants in the other groups.

Dependent Variable: Baby State (Drowsy)

One-way analyses of variance were performed on the BABY STATE DROWSY variable at 2, 4 and 6 months for each of the 11 events. Group served as an independent variable. These analyses produced one significant effect for the 33 different analyses.

The event where mother faced her infant while smiling and talking (EVENT 3) produced a significant difference

between groups $\underline{F}(3,23) = 4.43$, $\underline{p} < .01$. Results obtained from the planned comparison procedure revealed the illness contrast as significant, $\underline{T} = -3.08$, $\underline{p} < .005$. As can be seen from Table 4, infants from the SFT group displayed more drowsy behavior than did infants from the other groups ($\overline{X} = 1.39$). Combining infants from the PT and SFT groups revealed that they displayed more drowsy behavior than infants in the HFT groups ($\overline{X}$[PT/SFT] = 1.07, $\overline{X}$[FT/MOMSICK/HFT] = .48).

DISCUSSION

Examining maternal and infant responsiveness within the context of a structured face-to-face interaction sequence revealed some interesting differences among our groups of mother-infant dyads. The 4 groups of mother-infant pairs (PT, SFT, FT/MOMSICK and HFT) varied systematically along dimensions of perinatal risk (illness, prematurity and hospitalization). Specifically, we examined the effects of group on 5 different behaviors observed in mother and infant (eyes, reach, face, voice, state) for each of the 11 events of the structured interaction sequence at each age (2,4 and 6 months) (See Figure 1). In addition, we were interested in determining whether illness, prematurity and/or hospitalization contributed to observed differences in our pattern of results.

For both mother and baby, very few differences between our groups emerged at 2 months of age. There were a total of 3 significant effects at the 2 month age level. In addition, 2 out of the 3 significant findings (at 2 months) occurred when examining the EYES TOWARD dependent variable. Finding fewer differences at 2 months is not surprising given the context of our investigation (a structured interaction sequence) and that the infant's

behavior becomes increasingly organized with age as he learns the rules and nuances that govern mutual interaction. As Russell (1983) suggests, the mother dominant pattern of interaction decreases with age as infant dominance increases. It is at later ages, then, we would expect to find the majority of differences among our groups of mother-infant pairs. The remaining significant differences occurring for maternal behavior were obtained at the 6 month age level. Differences in infant's behavior, however, emerged at both the 4 and 6 month ages.

As expected, the structured interaction sequence produced fewer significant differences between our groups for maternal behavior (5 significant effects) as compared to that obtained for infant behavior (13 significant effects). In interpreting this finding one must recall that the environment is structured; mother in instructed via an ear microphone the timing of each event involved in the interactive situation. Not surprisingly, then, those events in which mother is most actively involved with her infant and at the same time demand that she elicit a given response from her baby (e.g., get infant to follow a red ball or grab a toy) produced significant differences in maternal behavior. In addition, it is in these events where mother must rely upon her own sensitivity to the individuality that her baby presents, test her skills at maintaining interaction within an "optimum level" and

choose appropriate patterns of stimulation to elicit a response from her infant.

On the other hand, differences in infant behavior occurred across a more diverse spectrum of the interactive sequence including both passive and active events. Such a finding reflects the infant's growing sensitivity to both subtle (e.g., mother smiles while facing infant) and profound (e.g., mother sits facing infant with an impassive face) changes in the environment. Further, the pattern illustrates, as well, the infant's competency in carrying part of the interactive burden as when he signals mother that interaction has become too demanding or too slow.

In general, examining the source of differences obtained for mother and baby reveals prematurity and illness as significantly contributing to our pattern of results. Whereas for infant behavior prolonged hospitalization contributed to observed differences, differences in maternal behavior were not similarly affected. The sections that follow discuss separately the pattern of results obtained for mother and infant.

Mother

At 6 months of age mothers of once sick infants (PT and SFT groups) reach toward them more in trying to get their infant's attention than mothers in the other groups. These mothers may be more inclined to invade their infant's personal space when seeking a given response. As the

literature suggests (Bakeman & Brown, 1979; Field, 1977), mothers of at risk infants continue to take the lead in interaction even when their infant's condition may no longer warrant such intrusive maternal behavior. As Bakeman and Brown (1979) suggest, the dialogue between a mother and her premature infant is driven by the mother, with the infant being a relatively passive recipient. Mothers of premature infants compensate for their infant's lack of development even when this may no longer be necessary. In addition, it has been suggested that controlling and intrusive caregiver behavior robs the infant of self-regulating behavior (e.g., gaze aversion not respected and allowed to achieve its goal). If such a loss is chronic, the infant may learn that his expressions have no communicational value (Stern, 1977).

All differences in mother's smiling behavior are revealed at 6 months. As already indicated, mothers of once sick infants reach toward them more than mothers in the other groups. Similarly, these mothers smile more at their infants when trying to get their attention as compared to other mothers. This pattern might indicate a more limited repertoire of maternal behaviors used to get and maintain attention. Clearly, parents of infants having spent a prolonged period in the hospital have had fewer opportunities to interact with them. Mother is a less skilled social partner exacerbating the potential for

feelings of incompetence in interaction (Goldberg, 1979). Such a possibility is strengthened when we turn to the event where mom is asked to imitate her baby. Again, mothers of PT and SFT infants smiled more at their infants than mothers in the other 2 groups. In addition, the range of mean smiling scores between these groups is large ($\bar{X}$[PT/SFT = 4.23, $\bar{X}$[FT/MOMSICK/HFT] = 1.78). These mothers appear less adept at imitating their infants, a finding that supports research demonstrating that mothers of high-risk infants spend less time imitating them than mothers of low-risk infants (Field, 1977).

In general mothers smile less overall when asked to try to get their infants to grab a toy. During this event mom is pressed for an active response from her infant. Mothers of HFT infants smile the most with mothers of PT and FT/MOMSICK infants smiling least. This finding might indicate that mothers in the PT and FT/MOMSICK groups are less confident in their own capabilities to produce a given response from baby. It is not clear whether such a pattern is reflective of infant condition (a history of an inability to respond appropriately in similar circumstances) or maternal condition (mom's own inability to elicit a desired behavior from her infant). An alternate possibility is that such a pattern indicates that mother may be depressed. She may be unable to play with her own behavior and therefore cannot play with her infant's

behavior; especially when a particular response is being demanded (Stern, 1977).

Finding the prematurity and illness contrasts to contribute to differences here is suggestive that infant appearance and fragility of the infant (real or presumed) continue to affect the way mothers of at risk infants interact with them. Preterm infants in particular usually look quite different than healthy full-term infants. Obviously, they are much smaller (with birth weights as low as 750 grams and birth lengths as small as 31 centimeters) (Battaglia & Lubchenco, 1967; Lubchenco, Hansman, & Boyd, 1966; Lubchenco, Searls, & Brazie, 1972). The preterm infant also has less body fat than the healthy full-term, especially in the cheeks, arms and legs. As a result, the preterm infant is both small and thin and should be less likely to share in those physical traits associated with "babyishness" and which are believed to be responsible for the elicitation of caregiving behavior (Brooks & Hochberg, 1960; Gardner & Wallach, 1965; Hildebrandt, & Fitzgerald, 1979; Lorenz, 1943; Sternglanz, Gray, & Murakami, 1977). Significantly, these differences in attractiveness have been found to persist until at least 4 months of age (Holmes, Reich, & Gyurke, 1986).

Because differences in mother's looking behavior emerged only at the 2 month age level, with mothers of sick infants looking toward them less than mothers in the

other groups when asked to imitate their infants, one might argue that biological and/or functional immaturity might preclude mothers of once sick infants from a continuous gaze at their infants. In her observations of early parent-infant interaction, Goldman (1982) found that parents of preterm and sick infants are less active with their young infants than are parents of healthy full-term babies. They hold them at a greater distance (Divitto & Goldberg, 1979) make fewer attempts at face-to-face interaction (Klaus et al., 1970) touch them less (Klaus et al., 1970) and talk to them less (Divitto & Goldberg, 1979) than parents of full-term infants. However, at older ages these parents are more active, expending more energy and effort in the interaction dialogue. Present findings confirm both of these patterns of maternal responding.

In general, all mothers spend a great deal of time looking at their infants. The range of mean looking scores for all groups of mother-infant pairs is evidence of this pattern ($\overline{X}$ = 4.66 - $\overline{X}$ = 6.0). This is not surprising given that at this age mothers are heavily involved in getting to know their young infants; what better way to recognize and be recognized than through a continuous gaze. Examining the temporal structure of face-to-face communication between mothers and infants 2-6 months of age, Kaye and Fogel (1980) found that mothers spend nearly 100% of their time watching their babies directly.

For both the positive behaviors of reach and smile, mothers in the FT/MOMSICK group respond differently than mothers in the other groups. That is, they reach toward their infants and smile significantly less than mothers in the other groups. As we shall reveal in the section that follows, infants in this group look at their mothers less than infants in the other groups. In a study of neonatal gaze aversion Noble (1982) demonstrated that high gaze averting infants had mothers exhibiting a lower frequency of behaviors overall. A similar pattern seems to be suggested by the present findings.

Summary

These data suggest that the environment does influence maternal behavior where differences between our groups of mother-infant dyads emerge as a function of environmental structure (EVENT). For the most part, differences in maternal responsivity emerge during active events at 6 months of age. The positive (approach) behaviors of reach, face and eyes seem to cluster together demonstrating a pattern of maternal interaction that is different for mothers of low- and high-risk infants. (Mothers of once sick infants smile and reach toward their babies more when asked to get their attention. In addition, mothers of full-term sick infants look at them less when asked to imitate their behavior.) Research has shown that mothers of preterm infants work harder and are more active

in carrying the "interactive burden" (Bakeman & Brown, 1979). In so doing, these mothers appear to be compensating for their infant's relative passivity in the interaction dialogue. The present investigation supports this thesis.

Infant

A review of Table 4 reveals that most of the observed differences between our groups occur in the responsivity of the infant as it is assessed along the 5 behavioral dimensions of reach, face, eyes, voice and state. This pattern is not surprising given the context of our investigation, a structured interaction sequence between mother and baby. Further, it is clear that most significant findings emerge in the infant's looking behavior, suggestive that infants use their eyes most to initiate, maintain and control interaction. As noted earlier, both passive (e.g., mother faces her infant smiling) and active events (e.g., mother tries to get her infant to grab a toy) produced significant differences in infant behavior. The majority of significant patterns were revealed at both 4 and 6 months of age. The section that follows discusses the pattern of results obtained for infant behavior.

When mother is asked to imitate her infant's facial expressions, PT infants look more at their mothers at 4 months than infants in the other groups. As we found

earlier, mothers of high-risk infants imitate them less than mothers of low-risk infants. Finding the preterm infant to be engaged by this activity (evidenced by his increased gaze toward mom behavior) is consistent with literature that suggests imitation of the preterm infant's behavior elicits more positive responding than other kinds of interactive attempts. Assessing maternal activity and infant gaze in 2 structured face-to-face interaction sequences (1. Mother is asked to get her infant's attention and 2. Mother is asked to imitate her infant). Field (1977) demonstrated a similar pattern of results. Specifically, she found more maternal activity and less infant gaze during the attention-getting event and less maternal activity eliciting increased infant gaze during the imitation event. Field suggested that the facilitating effects of imitation were related to its lower information processing demands in conjunction with greater attentiveness and contingent responsiveness of the mother. In addition, such a pattern illustrates the preterm infant's preference for a less intrusive interaction style and his competency to respond positively when interaction is established within a more "optimal range." The pattern is repeated at 6 months when mother's task is again imitation of her infant; the subsequent response of the high-risk infant (PT and SFT groups) being a positive approach with the eyes.

When mom faces her infant with an impassive face, again we see that the PT infant responds differently with his eyes than the other groups of infants. Specifically, at 6 months he looks significantly less toward mom during this event. This finding suggests that the preterm infant is indeed more passive in the interaction dialogue and that he is less able to maintain interaction when it has fallen below a more preferred level. He evidences less skill in drawing mom "in" and makes fewer attempts to elicit from her other kinds of more appropriate behavior. When mother's behavior becomes uninvolved, his response is to turn away rather than to reestablish the conversation. On the other hand, full-term infants take more initiative and exhibit more skill in trying to elicit from mom more appropriate stimulation. Further (although such a pattern was not statistically confirmed), the infant's skill in reestablishing reciprocal interaction increases with age. In the present investigation preterm infants seem to evidence, then, a less mature response pattern during the impassive face event.

Tracing gaze aversion during a face-to-face mother-infant interaction sequence, Field (1981) concluded that excessive stimulation by mother and still-face interactions (impassive face) were accompanied by gaze aversion on the part of the infant. She suggested such nonoptimal stimulation patterns constitute a stimulus overload which

is stressful or arousing for the infant. The response of the baby is to reject stimulation by gaze aversion. Our findings reveal a similar pattern in infant behavior and maternal activity.

During the event where mother tries to get her infant to follow a red ball, once sick infants (PT and SFT groups) evidence less looking toward mom behavior at 6 months. Such a pattern again supports findings already presented (Field, 1981). The mean range of infant's looking behavior during this event is small with all babies in general engaged by this activity ($\bar{X}$ = 4.14 - $\bar{X}$ = 5.86). This event represents a very involving, very demanding task. Such a pattern may indicate the high-risk infant's attempt to disengage his mother (cue her to slow down by turning away) or the high-risk mother's inability to elicit from her infant an appropriate response. The literature is suggestive of both (Brazelton, Tronich, Adamson, Als, & Wesl, 1975; Field, 1981). Although inconclusive, the lack of significant differences in maternal behavior during this event suggests that the problem may be with the infant rather than the mom.

When mother is asked to sit facing her infant smiling, HFT infants look significantly more toward their mothers at 2 months than infants in the other 3 groups. The range of mean scores is wide, $\bar{X}$ = 1.33 - $\bar{X}$ = 5.12. As hospitalization is the most powerful contributor to

between group differences here, one might argue that prolonged hospitalization depresses infant's looking behavior toward their mothers. Because this finding emerged at the 2 month age level, residual hospitalization effects might still be influencing the baby's behavior. Hospitalized infants have had less experience with the prolonged gaze of their mothers than infants who have not spent protracted periods in the hospital. (It is interesting that mothers of sick infants at 2 months spent considerably less time looking at them than mothers in the other groups). Possibly maternal smiling (EVENT 2) may not be interesting (stimulating) enough for once hospitalized infants to respond with a mutual gaze toward mom. This may be due to their relatively less experience with smiling faces and the events usually contingent on them. Interestingly, this deficit in responding to smiling seems to be short-lived as it was not apparent at 4 or 6 months.

This finding is consistent with past research. When tracing the effects of hospitalization on infant's looking behavior Whitten (1978) found more mutual looking behavior (a 7 times greater frequency rate) in his contact group (nonhospitalized infants) than in his separated group (hospitalized infants). Just as we cannot trace the source of this pattern to either mother or infant behavior specifically, Whiten was unable to ascertain whether contact mothers were more responsive or contact babies produced

more behavior likely to elicit maternal responding. However, because we found no differences in maternal behavior during this event at 2 months we can cautiously attribute this difference to infant condition.

When we examine the differences obtained in infant positive voice behavior, two general patterns are indicated. First, all of the differences in positive voice behavior were revealed at 4 months of age. Second, in contrast to the other behaviors that reflected differences in infant responding across group, all groups of infants seem to use their voice less during interaction. A review of Table 4 highlights this pattern ($\overline{X}$ = 0 - $\overline{X}$ - 2.18).

During the event where mother faces her infant with an impassive face, the HFT infants at 4 months respond with positive voice the least while the PT infants evidence the most positive voice behavior. Earlier we noted the PT infant as showing much less eyes toward mother behavior during this same event at 6 months. It is interesting that at 4 months the PT infant's positive voice pattern suggests he may indeed be attempting to engage his mother as nondistress vocalizations function to mediate the dyadic conversation by eliciting reciprocal vocalizations from the mother (Freedman, 1974). Thus, while not using their eyes to reestablish interaction, the preterm infant group seems to have chosen another mode in trying to elicit a response from mom. An alternative interpretation

is provided by Anderson et al. (1976). When investigating the influence of interpersonal distance on vocal activity in the mother-infant dyad, the authors found that infants spent more time vocalizing during maternal absence than while being held. It is possible that the PT group is responding in a similar way; although not physically absent mother has withdrawn from interaction.

In sum, our finding is suggestive of the PT infants' tendency to respond positively with their voices to "peripheral" interaction while other groups of infants find the impassive face event not worth much "chatter." Our interpretation is strengthened when we again find the PT infant group responding with more positive voice when interaction is imposed more subtly (mom faces her infant while smiling and talking).

Contrary to the pattern established above, during the most active structured events (mother tries to get her infant to follow a red ball and grab a toy), it is HFT infants that respond with the most positive voice behavior. The 3 hospitalized infant groups respond with much less positive voice. Such a finding is consistent with research that has shown hospitalized infants to vocalize less than other groups of babies (Frodi, 1978). It is interesting that what seems to be occurring is that PT infants use their voice when the interactive dialogue does not demand too much of them. When interaction taxes their interactive

repertoire (e.g., mother tries to elicit an active response), we see an apparent lack of synchrony suggested between the PT infant and his mother. Whereas she is turning "on" during these events, her infant is turning "off." A maternal tendency to persistently respond in the absence of infant responding could account for a negative synchrony rate between mother and her preterm infant (Karger, 1979).

Examining the infant's display of cognitive alert behavior, it is apparent that most infants are in a cognitive alert state throughout the duration of the structured interaction sequence. While overall frequency of this behavior was high, the range of mean scores for our groups of infants was small ($\overline{X}$ = 3.76 - $\overline{X}$ = 5.93). Still, some interesting differences were revealed. In addition, for all of the events producing differences, the FT/MOMSICK group of infants showed the least cognitive alert behavior overall.

At 4 months of age, when mother sits facing her infant smiling, HFT infants display less cognitive alert behavior than the other infant groups. It might be that such an activity is not stimulating enough for these infants to remain engaged. Infant state is a powerful cue to the maintenance of interaction within an optimal level. As Brazelton (1975) argues, the infant's regulation of state is initially his most powerful control and response

system. Not surprisingly, the PT infant group displayed the most cognitive alert behavior at 6 months when mother was instructed to imitate her infant. This finding is consistent with the pattern established throughout this paper suggesting that the PT infant approaches mother more positively when mother is imitating him (Field, 1977).

Few infants displayed drowsy behavior during the course of the interaction sequence. However, at 2 months of age a significant difference did emerge between groups when mother was asked to face her infant smiling and talking. SFT infants displayed the most drowsy behavior and together with PT infants displayed more drowsy behavior than the HFT groups. Examining a number of behavioral dimensions in low- and high-risk infants (e.g., sleep/wake organization), Holmes et al. (1982) found that preterm birth, illness and hospitalization increased the proportion of wakefulness spent in a drowsy state. Others have found sick infants to spend less time alert and more difficult to keep in alert states (Bruner, 1973; Goldberg, 1979; Minde, Farran, Manning, & Hines, 1980).

Summary

These data indicate that the environment influences infant responsivity. When mothers are asked to imitate their infants, PT infants look at them more and display increased cognitive alert behavior in response to this kind of interactive attempt. A more global pattern is indicated

suggesting the high-risk infant's preference for a less active interaction style. Such a finding is consistent with literature that demonstrates as maternal activity is increased, infant attentiveness is decreased for the PT infant-mother pair. What seems to be occurring in such instances is a form of mismatching, overloading. The caretaker will perform too many displays for the infant's limited capacity and the infant turns away (Field, 1977, 1981; Kowalski, 1986; Tronick, 1982). To the contrary, the more active events (e.g., mother tries to get her infant to follow a red ball or grab a toy) produced increased looking behavior on the part of HFT infants. In addition, these infants display more positive voice in response to the passive events. Although illness and prematurity contributed to differences obtained in the majority of significant patterns, hospitalization had the greatest impact on infant positive voice at 4 months and infant gaze toward mom at 2 months.

Conclusion

In our study, we examined maternal and infant responsiveness within the context of a face-to-face interaction sequence at 2,4 and 6 months of age. We observed a pattern of results indicating that both partners in the interaction dialogue are affected by immediate environmental contingencies that alter the tone and level of stimulation the interactive conversation affords. As expected, because of

the nature of the task, more significant differences emerged for infant behavior with the majority of significant findings revealed at 4 and 6 months of age.

Specifically, the data are suggestive of differences in maternal responsiviity for mothers of low- and high-risk infants. In general, mothers of high-risk infants tend to increase the frequency of their responses to decreases in their infant's attention. Although few differences emerged in maternal responsivity overall, those events where mother's behavior becomes less constrained suggested some interesting patterns. Mothers of once sick infants reach toward them more and smile more at their infants than mothers in the other groups (even when the task may not warrant such behavior). However, when the task asks that mother elicit a particular response from her baby, these mothers smile at their infants significantly less than mothers in the other groups. Similarly, low- and high-risk infants seem to respond differently to the structured sequence of interactive events. A more global pattern is indicated suggesting that the high-risk infant prefers a less active interaction style. That is, he is more attentive and responsive when maternal activity is decreased. Given that mother's behavior remained basically stable across group, we tentatively can trace most of our differences to infant condition. Further, the perinatal risk factors of prematurity and illness most

powerfully contributed to observed differences between our groups of mother-infant pairs.

A pattern we find most interesting to be noted in our data (and one most clearly established throughout this paper) was the finding that mother's imitation of their preterm infant's behavior functioned to elicit the most positive responding (attentive behavior) from her preterm infant. Such a finding illustrates what several authors have postulated as "synchrony" in the mother-infant dialogue (Brazelton, 1975; Karger, 1979; Stern, 1977; Tronick, 1977). When mother is forced to remain sensitive to her infant's cues, the infant's response is a positive approach. As Brazelton (1974) argues, the mother who reduces the intensity and frequency of her responses to decreases in the infant's attentive behavior maintains longer periods of interaction. Present findings support this conclusion.

The data also revealed that the FT/MOMSICK group of mother-infant pairs yielded some interesting differences between our groups. More specifically, mothers in this group reached toward and smiled significantly less at their infants than mothers in the other groups. Similarly, infants in this group looked less at their mothers, offered less positive voice behavior and displayed the least cognitive alert behavior than did the other groups of infants during the course of interaction. Such findings seem to lend support to the notion that mother's "risk status" will

affect the outcome of both mother and infant responsivity (just as we have presently demonstrated that infant "condition" affects changes in the mother-infant dialogue). In addition, such a pattern reflects the difficulty in assessing interactional data in truly interactional terms. Clearly, both mother and infant bring certain capacities to the interactive dialogue that (as presently demonstrated) affects the beahvior of each member.

A final note must address the issue of the tentativeness of findings revealed in the present investigation. Having been forced to conduct one-way analysis of variance tests limited the scope and power we are able to afford the observed pattern of results. Although we remain concerned about the large number of analyses conducted and the relatively few significant findings herein produced, we are encouraged that the direction of effects were consistent with expectations and previous findings reported in the literature. We feel that the consistency in our results have, to some extent, enabled us to overcome the statistical weakness of the present investigation.

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APPROVAL SHEET

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The final copies have been examined by the Director of the thesis and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the thesis is now given final approval by the Committee with reference to content and form.

The thesis is therefore accepted in partial fulfillment of the requirements for the degree of Master of Arts.

Oct 16, 1986
Date

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