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THE PRETERM INFANT AND MOTHER AS SOCIAL PARTNERS: INFANT RESPONSIVENESS AND MATERNAL FOLK THEORIES

by

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Dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Psychology in the Graduate School of Duke University

1984
ABSTRACT
(Psychology-Clinical)

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It has been repeatedly documented that during mother-infant interaction, mothers of preterm infants exhibit higher rates of stimulation than do mothers of fullterm infants. The present research explored characteristics of mother and infant which may contribute to this pattern. In Study 1, preterm and fullterm infants were compared on two dimensions of neonatal behavior thought to elicit heightened maternal activity: (1) lesser positive responsiveness and (2) greater irritability or drowsiness. Further, the preterm sample was divided into two groups (mildly ill, moderately ill) to explore the impact of severity of neonatal medical complications on infant behavior. Assessment of neonatal responsiveness included orientation items and ratings of alertness and state control adapted from the Brazelton Neonatal Behavior Assessment Scale.
Preterms exhibited less mature visual tracking of moving stimuli than fullterms but showed similar optimal responsiveness to an animate visual and auditory stimulus. Within the preterm sample, the two illness groups did not differ on any measure.

In Study 2, variations in maternal folk theories about special needs of preterms were explored. Mothers of mildly ill and moderately ill preterms were compared on three sets of attitudes thought to affect maternal stimulation during interaction—Vigilance, Protection, and Developmental Expectations. Vigilance refers to providing attention, monitoring behavior, and worry about future development. Protection reflects a view of the infant as vulnerable and fragile. Preterm mothers were also compared to fullterm mothers on expectations for infant achievement of cognitive and motoric milestones. Mothers of moderately ill preterms expressed more Vigilance attitudes than mothers of mildly ill preterms; no difference in Protection attitudes were found. Mothers of preterms expected delayed motoric development more frequently than mothers of fullterms.

The implications of the findings from these studies for hypotheses about the origins of the high maternal activity pattern were discussed.
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L. A. S.
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GENERAL INTRODUCTION

In 1977, in the United States, 8.8% of all recorded births were premature, featuring delivery prior to completion of the 37th week of gestation and birthweight below 2500 grams, 5 lb. 8 oz. (Werthman, 1981). Currently, approximately 250,000 preterm infants are treated per year in special care nurseries. Over the past 20 years, research with this special group of neonates has shifted in focus. Once the goal of prolonged life for the vulnerable preterm was realized, research turned to comparing the development and behavior of preterm and full-term infants. The historical impetus for these efforts may have been reports in the 1950's and 1960's that preterm infants were over-represented in child abuse cases (Elmer & Gregg, 1967; Klein & Stern, 1971) and that preterm and very-low-birthweight infants were "at risk" for developmental lags and/or behavioral or school difficulties (Drillien, 1967; Fitzhardinge & Ramsey, 1979; Francis-Williams & Davies, 1974; Neligan, Kolvin, Scott, & Garside, 1976). The search began for between-group differences which could either explain these findings or serve as predictors of problematic outcomes so that remedial intervention could be instigated at the earliest time.
Concurrent with the research on predictors of developmental outcome was an evolving paradigm which analyzes moment-by-moment characteristics of mother-infant interaction in order to identify bidirectional patterns of influence. Given the concern about child abuse toward preterm and low-birthweight infants, a merger of the two research traditions—observational analyses of mutual regulation in mother-infant interaction and identification of developmental and behavioral differences between preterm and fullterm infants—took place in the later 1970's.

Resulting from this merger were descriptions of differences in mother-infant interactions for preterm and fullterm dyads and a search for the consequences of these interactional differences for later infant development. Since 1977, observational studies have repeatedly documented differences in the patterns of face-to-face interaction between mothers and preterm versus fullterm infants. The timing and frequency of social stimulation provided by mothers and the frequency of infant attention and affective expressions have been contrasted during face-to-face play and in feedings situations. Maternal behaviors (e.g., talking, smiling, touching, proximal and distal holding, and looking) have been related to such infant behaviors as looking-at-mother, vocalizing, fussing, motoric arousal, and gaze aversion. The frequency of infant behaviors considered indices of social responsiveness has been found to vary from high to low as the quantity of maternal behavior varies from moderate to high (Field, 1980a). Preterm mothers have emerged from such studies as
appearing more socially stimulating ("more active") and as less attentive to infant pauses (i.e., less inactive when the infant is visually inattentive) than fullterm mothers. In turn, preterm infants have been observed to attend less frequently to their mothers, to respond less consistently to maternal stimulation with positive responsiveness ("less responsive"), and to suck during feedings more poorly than their fullterm counterparts. This identified pattern of high maternal activity and low infant positive responsiveness will henceforth be referred to as "high active-low responsive." Brown and Bakeman (1980) characterized this phenomenon as the mother of the preterm infant having to bear an unequal share of the dyadic responsibility for the flow of interaction during the first 12 months of life.

The literature review that follows evaluates the descriptive studies documenting the high active-low responsive pattern and the evidence for concern about possible consequences of this pattern. Then, different explanations which have evolved to account for both the origin and function of the pattern are outlined. Lastly, a research design is described which addresses questions about the origin of individual differences in levels of maternal stimulation—the "high activity" in the high active-low responsive pattern.

Although much of the existing research literature treats the premature population as if it were an homogeneous population, the following discussion will attempt to specify details of the study samples. Preterm
birth spans a wide range of gestational ages (25-37 weeks) and birthweights (500-2500 grams) and is frequently accompanied by multiple medical complications. Although the probability of medical problems is generally a function of the degree of immaturity of the preterm infant, there are very-low-birthweight infants of early gestation who make smooth adaptations to breathing and feedings, whereas some older (e.g., 33-34 weeks' gestation) and larger infants (e.g., 1700 grams) experience multiple medical problems. Medical problems arise both from demands placed on the immature organs in adaptation to the extrauterine life and/or complications from treatment procedures. Preterm infants are more susceptible than fullterm infants to a host of complications--respiratory problems (e.g., hyaline membrane disease, apnea), intracranial hemorrhages, hyperbilirubinemia (jaundice), patent ductus arteriosus, and infections (e.g., sepsis) (Werthman, 1981). Clearly, preterm infants comprise an extremely heterogeneous population, and investigators of the effects of "prematurity" on any dependent variable face the challenge of untangling the effects of immaturity from the effects of accompanying illness during the neonatal period.

The bidirectional model of caretaker-infant interaction (Bell, 1968) provides the framework for understanding the high active-low responsive pattern. Interaction observed across time is seen as a system in which the behavior of each partner affects that of the other. Historically, this model reflects a shift from identifying how caregiver acts shape infant
behaviors to considering, as well, how infant behaviors affect caregiver behavior. More recently, co-occurring behaviors of both partners have been used by some as the unit of conceptual analyses (e.g., Brown & Bakeman, 1980). Here, interaction is viewed as changes in the dyadic state across time.

In the research to be reported, sources of variation in maternal behavior during mother-infant enface interaction (i.e., face-to-face interaction) is the focus of investigation. However, given that characteristics of the infant will be posited as a potential source of influence, the bidirectional model of interaction seems well suited to framing the discussion that follows. The dyadic state model is also acknowledged insofar as the interactional pattern of interest—"high activity-low responsivity"—is defined as a dyadic phenomenon.

**Documentation of the Phenomenon**

The high active-low responsive pattern for preterm infants was first described and subsequently replicated in five studies by Field. In the studies to be reported, unless otherwise indicated, ages of preterm infants are calculated from expected date of birth rather than from actual date of birth (i.e., corrected for gestational age), and term infants are healthy and born between 38 and 42 weeks. Field's studies focused on enface play (i.e., face-to-face) between mothers and infants. Typically, the mother sat at a table facing her infant, who was positioned in an infant seat, and played with her child for several minutes. In the first study,
Field (1977a) contrasted mothers' interactions with preterms with a history of respiratory distress syndrome (RDS) during the neonatal period, postterms (infants born after 42 weeks' gestational age), and fullterms at 14 weeks after expected date of birth. The face-to-face play was coded for frequency of maternal stimulation--visual, tactile, and auditory acts directed toward the infant--and for duration of infant gaze directed toward the mother. Maternal activity during infant gaze and infant gaze aversion was significantly higher for preterm dyads than for postterm or fullterm dyads during both a spontaneous play situation and an attention-getting situation in which mothers tried to maintain their infants' visual attention. In contrast, no differences between preterm and fullterm dyads were found when mothers were instructed to imitate their infants' behavior, thus reducing the mothers' levels of activity. Higher levels of maternal activity were accompanied by decreased frequency of infant gaze.

In a second study of 12-week-old white middle-class dyads (Field, 1979), visual attention to animate and inanimate stimuli (mother's face and doll's face, respectively) was compared for preterm and fullterm infants. No differences were found in infant attention to the inanimate stimuli; but, as in the first study, mothers of preterms were more active than were term mothers during spontaneous play, and the preterm infants spent less time than term infants looking at their mothers. A third study (Field, 1981) replicated this finding across a variety of interactive partners--doll, the infant's face reflected in a mirror, father, mother,
infant peer, and a preschool-age sibling. Preterm infants' gaze averted more than term infants' in all situations except for the mirror and the doll. When maternal activity was defined as vocal stimulation, mothers of preterm infants were more active than mothers of term infants. In a fourth study (Field, 1979a), which featured global ratings of maternal and infant behavior during enface play at 4 months of age, mothers of preterm infants were rated as more active, less imitative of their infants' behavior, and less attentive to infant pauses. Preterm infants were rated as less attentive, more fussy, and more restless than fullterm infants--characteristics viewed by Field as indicating "nonoptimal" mother-infant interaction. During enface play at 4 months, recent comparisons (Field, 1982) between preterm infants with a history of respiratory distress syndrome and term infants have continued to document the high active-low responsive pattern. Mothers of the preterm infants talked more frequently than did mothers of term infants, and term infants gazed more often at their mothers than did preterm infants.

Three studies have compared interaction during play sessions of older preterm and fullterm infants with their mothers. First, Wasserman, Soloman-Schenzer, Spieker, and Stern (Note 1) observed dyads during a free play situation at 9, 12, and 18 months and focused on the content and function of maternal activity. Seven preterms who required respiratory support during the neonatal period and 14 fullterms served as subjects. High maternal activity, in the form of more verbal and physical teaching
of object play and more supportive behaviors (e.g., positive and empathetic behaviors) was reported for mothers of preterm infants at 9 months but not at 12 or 18 months. These mothers used fewer unstructured games (e.g., games without rules) in their play at 9 and 12 months than did fullterm mothers, but no differences at any age were found in maternal behaviors indicative of an intrusive and controlling stance toward the infant (e.g., directing the infant's focus of attention) or in use of structured games.

Second, Field, Dempsey, and Shuman (1981) analyzed maternal conversation with preterm infants with a history of RDS and fullterm infants at 2 years. Their analyses revealed that mothers of preterms issued more imperatives and questions and made fewer statements than did mothers of fullterms. It appeared that the mothers of preterms used grammatic forms that attempted to elicit infant responses. The preterms, however, emitted fewer words and had both a smaller working vocabulary and a shorter mean length utterance than the fullterm infants.

The third study of older infants (Goldberg, Brachfeld, & DiVitto, 1980) observed dyads during free play at 8 and 12 months of age, and included two preterm groups differing in severity of illness history. Field's observations of greater maternal activity for preterm mothers was found only at 8 months and only for mothers of preterms with more severe medical complications. Mothers of sicker preterms touched their babies and demonstrated toys most frequently of all the groups. Mothers
of healthy preterms did not significantly differ from mothers of fullterms during either observation. Differences in infant behavior were also present only at 8 months: In contrast to the preterms with severe medical histories, the fullterms spent the most time in play and smiling and fretted the least.

In addition to enface play situations, the high active-low responsive pattern has been described for interactions during feedings, although with far less consistent results. The most clear-cut evidence for the phenomenon in this context is an observational study by Brown and Bakeman (1980). Twenty-six preterm and 26 fullterm black, lower class dyads were observed during feedings at time of discharge, 1 month, and 3 months postdischarge. Differences resembling those reported by Field and Goldberg during play were found for feedings in the hospital and at 1 month, although all differences were absent by 3 months postdischarge. In the hospital and at 1 month, mothers were observed to expend more effort giving directive commands and physically manipulating their infants. The infants fed less and gave less signs of a successful feeding interaction. The preterm infants also looked less frequently at their mothers and less at the environment at 1 month. Similar findings were reported by Field, Dempsey, and Shuman (1981). Ratings of feedings at 4 months of postterm, preterm, and fullterm dyads revealed preterm mothers to be most stimulating in efforts to encourage milk intake and preterm infants to be the slowest feeders.
-

10

Brown and Bakeman

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Similarly, ratings of adult and teenage lower class dyads


during feedings at 3 months (Field, 1980b) revealed that, although mothers of preterms were more physically active and burped their infants more, they made less frequent eye-to-eye contact, despite the lack of difference in gaze behavior by the two groups of infants.

The findings of Goldberg, Brachfeld, and DiVitto (1980) are also not consonant with a portrayal of the preterm mother as more active than the fullterm mother during feedings. During the neonatal period and at 4 months, mothers of fullterms were found to cuddle their infants in their arms more frequently (thereby providing more tactile stimulation) than preterm mothers, to touch, and to talk to their infants more often. And, in sharp contrast to Field's (1977) report of more gaze-aversion in preterms, no between-group differences in amount of infant gaze were found. In another study, Goldberg (1978) observed four feedings of 4-month-old infants and coded maternal behavior separately for touching and vocalizing, in contrast to Field's single coding of combined modes of stimulation. Field's finding that parents of preterm infants were more active than fullterm parents during sucking was replicated for only one of four feedings and for only one stimulation category—touching. Goldberg concluded that:

the data for parent touching and vocalizing do suggest that parents of fullterm infants differentiated their behavior more as a function of infant behavior than did parents in the preterm groups. However, since this did not occur reliably for the same parent behavior at each feeding, the data are not strong enough to warrant the conclusion that fullterm parents are more sensitive to infant cues or that fullterm infants give clearer signals. (p. 141)

Several qualifications regarding the generalizability of the high
active-low responsive pattern follow from the preceding review. First, the interactional context in which reliable differences have been documented are restricted thus far to face-to-face play at 3 or 4 months from expected birthdate and free play with toys at 8 to 9 months of age. Feeding observations during hospitalization or during the first month home have only partially validated the high active-low responsive pattern. The inconsistency across contexts may be due to methodological differences in operationalization of maternal activity or to differences in maternal goals in the two situations. For example, the mother's focus on milk intake may supercede attention to social responsiveness so that the pattern might logically be less likely in nonsocial play interaction.

Second, there are several suggestions that differences in severity of medical complications between the preterm samples may contribute to the discrepancies in findings. For example, Field repeatedly used samples of preterms with a history of respiratory distress syndrome. Some studies that utilized samples of preterms differing in illness from Field's sample have either failed to obtain reliable differences (Crnic, Greenberg, Ragozin, Robinson, & Basham, Note 2) or report fullterm-preterm differences only for the "sicker" preterm group (Goldberg et al., 1980). For example, Crnic et al. (Note 2) observed mother-infant play at 4 months in play situations modeled after Field's (1977a) enface paradigms. No significant differences between preterm and fullterm dyads on ratings of each partner's affect and responsiveness or on ratings of
maternal sensitivity to infant cues were found. Descriptive information concerning the illness history of the preterm sample was not provided, but the available information concerning gestational age and birthweight suggests that these preterms were both larger and more healthy than the subjects in Field's studies. Similarly, Goldberg et al. (1980) reported that only the mothers of preterms with more severe medical histories were more active at 8 months; mothers of preterms with more benign histories behaved similarly to mothers of fullterms.

**Consequences of the High Activity-Low Responsiveness Pattern**

Three consequences of the high active-low responsive pattern in preterm dyads have been hypothesized: (a) decreased synchrony in mother-infant interaction which leads to inadequate development of the infant's understanding of the "conversation rules" or structure of interaction; (b) increased maternal feelings of frustration resulting from interactions which feature "long silences, failures to elicit reactions, and abortive conversations" (Field, 1980a, p. 139); and (c) decreased cognitive abilities as measured by standard developmental and intellectual assessments during the preschool years. Such consequences have been proposed as cause for concern and justification for clinical interventions to "improve" aspects of mother-infant interactions.

Research concerning the relationship of the high active-low responsive pattern to synchrony in mother-infant interaction have yielded
conflicting findings. On the one hand, Field's studies suggest that a highly active mother is likely to fail to recognize and respect her infant's needs for time-outs or "pauses" (infant gaze aversion) from the bombardment of maternal stimulation. For example, in her studies, infantized and imitative behaviors by the mother and repetitive structured games (e.g., peek-a-boo) have been rated as occurring less frequently when the mother's level of activity is high. Further, Field (1982) provided evidence that mothers of preterms with a history of respiratory distress syndrome (RDS) may be less responsive to their infants' needs for reduced stimulation during play. Changes in intensity of maternal behavior which followed the escalation of infant arousal during a game (i.e., "I'm gonna get you!") were contrasted for fullterm and preterm dyads. Mothers of fullterms decreased or ceased their auditory and tactile stimulation a greater percentage of the time when the infants laughed, averted gaze, or cried than did mothers of preterms. Mothers of preterms appeared to persist in their stimulation rather than modifying their behavior so as to give the infant a "break" from stimulation. Field (1980a) has theorized that quantitative differences in activity-responsiveness during interaction may result in alteration of the conversation "rules" that characterize normal face-to-face interaction and prevent the acquisition of social skills by the infant.

Two studies which analyzed the relationship of level of maternal activity to maternal sensitivity to infant cues—a hallmark of "synchronous
interaction"—suggest that Field's alarm may be unwarranted. In the first study, Minde, Marton, Manning, and Hines (1980) examined co-occurrences of maternal behavior (e.g., look, touch, smile, vocalize) and social signals of the infant (e.g., opening of eyes, yawn, mouth movement) for high, medium, and low activity mothers of preterms during a nursery visit. In contrast to Field's interpretations of the high active mother as "insensitive," they inferred that such a mother shows greater sensitivity to infant behaviors than a low active mother, on the basis of a finding of more significant co-occurrences of maternal and infant behaviors. The second study (Arco & McCluskey, 1981) examined the impact of changes in maternal temporal style on mother-infant synchrony during play with 3- and 5-month-old fullterm infants. At both ages, synchrony, defined as positive attunement between partners shown by active social participation or visual monitoring of the partner, was highest in the phases of natural speed and faster speed of maternal behavior. In addition, the faster play phase included more positive affective behaviors (e.g., babbling, smiling) than the slower play phase for both age groups. This increase in synchrony during the faster play phase directly contradicts Field's (1977) finding that when mothers were instructed to imitate their infant's behavior, thereby decreasing the amount of maternal activity, infant gaze increased. Thus, both an analysis of preterms during the first weeks of life and an analysis of fullterms during the 3- to 5-month period fail to replicate Field's report that high levels of maternal activity
decrease indices of interactional synchrony. Clearly, additional research is needed before the proposed negative consequence of high maternal activity for interactional synchrony can be firmly asserted.

Clinical experience with mothers has suggested a second potential consequence of the high active-low responsive pattern: The mother may experience face-to-face interaction as aversive and unpleasant. An observed between-group difference, such as the high active-low responsive pattern, might be worthy of clinical intervention if mothers in the "high active" group responded to the phenomenon with feelings of incompetence, negative perceptions of and/or feelings toward their infants, or heightened concern about the infant's well-being due to his/her inability to meet maternal expectations. Thus far, however, maternal subjective reports of the high active-low responsive pattern have been omitted by investigators. Only one study (Field, 1979) has addressed the question of whether the preterm infant's inattentiveness (i.e., gaze aversion) is an aversive situation for the mother. Unfortunately, Field did not conduct interviews with mothers, but relied solely on an ambiguous physiological index of aversiveness--heart rate acceleration. EKG recordings were made of mothers of 12 preterms and 12 fullterms during three situations--spontaneous enface play, maternal imitation of infant behavior, and an attention-getting protocol. The heart rate of the two groups of mothers differed only in the imitation situation, which was the one context in which the high active-low responsive pattern was not found. During the
spontaneous play situation when the preterm infants were more frequently gaze-avoiding than fullterm infants, the mothers of preterms did not appear to experience the interaction more negatively than the mothers of fullterms.

Clinical reports from field studies, although not directly concerned with the high active-low responsive pattern, suggest the potential impact of an unresponsive infant partner on the mother's feelings during play or feeding. Als, Tronick, Adamson, and Brazelton (1976) reported maternal responses to 10 small-for-gestational-age fullterm infants. During the early postpartum period, the parents described their babies as undemanding, seldom crying, not appearing to want to be played with or fed, and preferring to be left alone. These mothers felt "uneasy" (p. 599) with their infants and puzzled by their poor motoric abilities and lack of energy. At follow-up interviews (ranging from 6 weeks to 9 months) 8 of the 10 babies were described as difficult to live with, easily over-stimulated, and highly reactive with irritability. Interviews with mothers of Downs Syndrome infants (ranging in developmental age from 8 to 19 months) revealed that they were aware of their infants' lack of eye contact and were concerned about its possible meaning (Jones, 1980).

With respect to preterm infants, Brown and Bakeman (1980) reported that some preterm mothers remarked that their babies did not seem to like being at home. These authors linked the mothers' impressions to results from 1-month examinations of neonatal behavior which
indicated that these infants had become more active and irritable during the first month home, and had not improved in their ability to orient to auditory or visual stimuli. The range of attributions about the behavior of preterm infants is further extended by Cramer (1976). He described a mother's reaction to her preterm infant's lack of responsiveness (e.g., smiling, moving, vocalizing) as the following:

The mother interpreted the lack of feedback as a sign of her child's total lack of defenses. The child would not be capable of protecting herself against the mother's possible wrongdoings. This made the mother feel dangerous, overpowering, and extremely anxious. (p. 162)

Parents may also rely on responsive behaviors as evidence that their infants are intellectually bright or potentially mentally capable. As one mother of a preterm infant explained during an interview, "I can tell from the way he listens and watches me that he's smart--you know, in baby ways." It seems reasonable to hypothesize that the absence of behaviors viewed as socially responsive may be noted by parents, and may potentially be a source of worry or concern about the baby's well-being. However, it may also be the case that parents adapt to the range of responsive behaviors their infant provides. For example, a parent may not worry about the absence of pronounced responsiveness to his/her voice if the infant has demonstrated that he/she can indeed hear and if he/she is highly responsive to visual stimuli. Until further research concerning the range of thresholds for parental concern about infant responsiveness is available, clinical interventions anchored in an assumption
that highly active mothers are necessarily more distressed with the interactions with their infants than are less active mothers is unwarranted.

The third possible consequence of the high active-low responsive pattern which has been investigated is decreased cognitive abilities during the preschool years. The underlying contention is that gaze aversion, promoted by high activity of the mother during interaction, reduces the infant's opportunity for exposure to stimulation from the mother and for the learning of means-end relationships. Such deficiencies in opportunities for learning during the neonatal period are linked to lower scores on standardized assessments (e.g., Bayley, Gesell, or Stanford-Binet tests) during the preschool years.

Longitudinal studies which have related levels of maternal activity and infant responsiveness to later cognitive and sensorimotor assessments have yielded inconclusive findings, discounting the proposed link between developmental achievements and particular moment-by-moment interactions during the first months of life. For example, Brown and Bakeman (1980) explored the relationship between their dyadic state indices of maternal activity during feedings in the first 3 months at home and measures of cognitive ability (Stanford-Binet scores) and social ability (ratings of social competence and social participation) at 3 years of age. The lack of significant predictive relationships led to their conclusion that the "data provide little support for the notion that how a mother interacts with her
baby during the baby's first few months of life has any particular consequence for later social or cognitive development" (p. 444). Similarly, a rating of "interaction difficulty" during enface play at 4 months was not a significant predictor of delay on either the Bayley motor or mental scores at 12 months in a sample of preterm infants who experienced respiratory distress syndrome (Field, Hallock, Ting, Dempsey, Dabiri, & Shuman, 1978).

Several studies, however, suggest a developmental sequence in which differences in maternal activity which continue across the first year of life may relate to later indices of cognitive development. Field et al. (1981) found that a group of preterm mothers, rated as more active and less sensitive to their infants' gaze signals than a group of fullterm mothers at 4 months of age, issued more imperatives to their children at 2 years in a free play setting. The preterm infants, who were less attentive at 4 months, displayed more language delays at 2 years. In contrast, Beckwith, Cohen, Kopp, Parmelee, and Marcy (1976) found that, within a preterm sample, infants who received lower scores on a Piagetian sensorimotor assessment at 8 months were involved in less mutual gaze with their mothers at 1 month, fewer interchanges of smiling during gaze at 3 months, and received less maternal contingent responsiveness to distress at 3 months. In addition, they experienced less overall social attention and contingent responsiveness to nondistress vocalizations at 8 months.
The discrepancy in findings between Field et al.'s (1981) preterm-fullterm comparisons and Beckwith et al.'s (1976) analyses within a preterm sample inspires a cautionary note concerning the assumption that high levels of maternal activity across the first year of life necessarily has deleterious effects on developmental outcome for all preterm infants. Indeed, the function of high levels of maternal activity may differ both within the heterogeneous preterm population and across preterm-fullterm groups. For example, Cohen and Beckwith (1979) found that, within a preterm population, infants who received more social stimulation from their mothers displayed a higher level of infant competence on cognitive and sensorimotor measures at 2 years (Cohen & Beckwith, 1979).

Current models of developmental processes (Sameroff, 1981; Siegel, 1982; Sigman, Cohen, & Forsythe, 1981) hypothesize that caregiver behavior is the "missing link" in the relationship between early severity of neonatal medical complications and developmental outcome. Although medical variables are predictive of developmental scores at later points in time, they do not account for much of the variance in outcome. The current models propose that environmental influences, particularly those provided through caregiver-infant interactions, have potential for either a remedial or detrimental effect on infant development.
Neonatal Illness and Maternal Behavior

A handful of studies have tested the hypothesis that mothers of pre-terms with a history of severe medical complications provide more social stimulation--are "more active"--than mothers of healthier preterms. The most compelling evidence comes from two analyses of maternal behavior within preterm groups. First, Beckwith and Cohen (1978) related the frequency of maternal social behavior to scores reflecting obstetric complications and postnatal complications for a sample of 123 preterm infants (mean gestational age at birth of 33 weeks). Each dyad was observed for 1 1/2 hours in the home at 1 and 3 months after expected birth date. At 1 month, a factor including caregiver distal social behavior (affectionate touches, social play, contingent responses to vocalization, and mutual gaze) was positively related to the indices of prior illness. At 3 months, a factor of responsive social behavior (talking, contingent responses to infant vocalization) was also related to the perinatal medical indices. It appeared that "infants who had experienced a more hazardous obstetrical and postnatal medical course were receiving more interaction from the primary caretaker than those infants who had experienced a more optimal course" (p. 408).

Additional evidence that mothers differentiate their activity levels according to prior illness of their preterm infants is provided by Minde, Whitelaw, Brown, and Fitzhardinge (Note 3). Minde and his colleagues divided preterms into subgroups on the basis of severity of medical
complications and observed mother-infant interaction during three visits to the Intensive Care Nursery. On two or more visits, significantly less smiling, touching, and enface gaze were found for mothers of sick preterms than for mothers of well preterms. During a fourth visit at home (approximately 50 days after expected birth date), mothers of the sick preterms continued to touch and smile significantly less than mothers of well preterms during feedings, despite the fact that the sick infants exhibited behaviors similar to their well counterparts.

Maternal behavior was then compared for different durations of infant illness: long (illness longer than 35 days) and short (illness less than 17 days). Again, three nursery visits across hospitalization and a postdischarge feeding in the home were observed. Mothers in the long and short illness groups behaved similarly during the first two visits. During the third observation, which occurred when the medical condition of the infant was stable, mothers in the long illness group were less active--looking enface, touching, and smiling less than mothers in the short illness group. During the home visit, mothers in the long illness group were again less active in looking enface and vocalizing.

Comparisons of fullterm and preterm infants have also documented an effect of infant illness on maternal stimulation. Levav, Fox, and Stolz-Loike (Note 4) observed four groups of infants during feedings with their mothers in the hospital--healthy preterms, sick preterms, healthy terms, and sick terms. The significant differences in maternal touching,
kissing, and feeding were a function of illness status (healthy versus sick) although differences in infant behavior were a function of preterm-fullterm birth and not of illness. As in the study by Minde et al. (Note 3), social behaviors like touching and kissing occurred more frequently with healthy infants than with sick infants. Feeding attempts, however, occurred more frequently with sick infants.

The impact of infant illness on maternal behavior during play with older infants was explored by Goldberg, Brachfeld, and DiVitto (1980). White middle-class dyads were observed at 8 and 12 months during free play sessions. Four groups were compared—healthy preterms, healthy fullterms, preterms with a history of respiratory distress syndrome, and infants of diabetic mothers (both preterms and fullterms). Although the preterms were not matched to the fullterm infants on postconceptional age, no differences between parents of healthy preterms and parents of healthy fullterms were found. When the preterms with a history of illness were matched for postconceptional age to fullterms, their parents were found to touch and to demonstrate toys more often. Parents of the infants born to diabetic mothers spent more time in their infants' proximity, touched them and demonstrated toys more than did fullterm parents.

The preceding review suggests that during the first year after birth, variation in illness history exerts an influence on maternal stimulation during both face-to-face play and feedings. Minde et al.'s (Note 3) finding of decreased maternal activity as a function of greater neonatal
illness would seem at first glance to conflict with Beckwith and Cohen's (1978) positive relationship between severity of obstetric and postnatal complications and maternal social stimulation. The discrepancy may reflect the difference in contexts for sampling maternal activity: During home visits, Minde et al. observed feeding sessions whereas Beckwith and Cohen observed interaction across a cycle of infant waking, eating, and sleeping. An alternative explanation is Minde and his colleagues' suggestion that there may be a spectrum of parental responses following the illness of an infant, ranging from adequate responses shown to the child with an uncomplicated medical course via attempts to "make up" for lack of stimulation after a moderate illness to a more or less permanent reduction in responsiveness to the infant following a serious long illness. (p. 17)

Further, there is some evidence that additional factors—such as the demands of caring for two preterm twins—can modify the influence of illness on maternal behavior. Observations with 16 pairs of same-sexed preterm twins differing in medical complications (Minde, Perotta, & Corter, 1982) revealed that mothers did not differ in their social behavior toward the twins during either intensive care nursery visits or home feedings at 6 weeks' or 3 months' postdischarge.

**Explanations for the Phenomenon of High Maternal Activity—A Research Strategy**

Two variables have been posited to account for the higher level of maternal activity with preterm infants than with fullterm infants during face-to-face play. Goldberg (1978) alluded to both—maternal cognitions
and infant behavioral characteristics—when she suggested that perhaps because they perceive their parental task as more important and challenging than that of the average parent, perhaps because their infants remain less responsive, parents of preterm infants seem to adopt a strategy in which they invest more time and energy in interactions than is usual with fullterm dyads. (p. 142)

This model, which points to contributions from both mother and infant, is also echoed by Beckwith and Cohen's (1980) conjecture that perhaps the attitude of the parents, their wish to compensate or to protect, or perhaps deficits in the behaviors of the infant itself... acted to heighten the caregivers' efforts. (p. 174)

It is hypothesized that aspects of infant social responsiveness and maternal attitudes or "folk theories" concerning the needs of preterm infants contribute jointly to the documented pattern of high activity by mothers toward preterm infants during the first year of life. Further, the combination of preterm behavioral characteristics and maternal propensity to provide stimulation may be critical in determining whether the caregiving environment has a remedial or a detrimental effect on infant development, whether it "limit(s) or enhance(s) the child's cognitive problems" (Sigman, Cohen, & Forsythe, 1981, p. 326). For example, a preterm whose lesser responsiveness elicits more maternal activity and/or whose mother believes he/she requires extra stimulation may be likely to receive an adequate amount of stimulation for nonproblematic development. In contrast, a preterm whose lesser responsiveness is not striking enough to elicit a high level of maternal activity and/or whose mother does not feel that her infant needs other-than-ordinary care may be less
likely to receive the high level of stimulation he/she may need for development.

A research strategy has been developed to explore the contribution of infant characteristics and maternal beliefs to the pattern of high maternal activity toward preterm infants. Explication of the role of the infant and mother in the genesis of the pattern may enhance the understanding of variation in environmental stimulation received by preterm infants. The research strategy would address at least three questions:

1. Can the high activity pattern be replicated during face-to-face play of mothers with fullterm and preterm infants observed 4 months after expected birth date? Naturally occurring enface play in the home setting would optimally serve as the interactive context. In contrast to Field's laboratory paradigms, such play is nested within the "real world" context of mother-infant interaction across the course of the day's activities.

2. Is the high activity pattern generalizable to the heterogeneous population of preterm infants or are there variations in maternal activity as a function of severity of neonatal illness history?

3. Further, do infant characteristics and/or maternal cognitions begin to influence maternal activity during early mother-infant interactions (e.g., during the first month postdischarge), thereby establishing an interactive "habit" which continues across time? Alternatively, do either/both of these variables first become influential at 4 months when
face-to-face play becomes a frequent occurrence between infants and their caretakers?

A longitudinal study which samples mother-infant play during the first month postdischarge and at 4 months from expected birth date would permit identification of the temporal appearance of the high activity pattern. Assessments of infant social responsiveness and maternal cognitions at both points in time would optimally address the questions of origins and timing of influence.

Two studies, necessary first steps in the research program, form the present report. Descriptive analyses of each predictive variable of interest—neonatal responsiveness and maternal cognitions concerning caretaking of preterm infants—were conducted. Study 1 explored differences in neonatal social responsiveness as a function of preterm-fullterm birth and preterm illness severity. The second investigation, Study 2, examined variation in maternal folk theories about the caretaking needs of preterm infants as a function of neonatal medical complications. In addition, variation in developmental expectations as a function of preterm-fullterm birth was explored.
STUDY 1

Introduction

Two dimensions of neonatal behavior which may influence the level of maternal activity during face-to-face play will be proposed, followed by evidence for preterm-fullterm differences on these dimensions. Then, the influence of neonatal illness on the behavior of preterms will be explored, followed by a description of the research questions addressed in Study 1.

Two dimensions of neonatal responsiveness may affect the amount of maternal activity during face-to-face interaction: positive responsiveness to stimulation and irritability-state control. The description of "the lethargic depressed premature infant who will not respond to any stimulation, thereby preserving his fragile autonomic regulations" (Als, Lester, Tronick, & Brazelton, 1980, p. 24) relates to the dimension of positive responsiveness. During the neonatal period, positive responsiveness may translate into the ability to attend to maternal stimulation, and to exhibit orienting and alertness. At 3 to 4 months, this dimension might be seen again in alertness, orientation, and in social responses of cooing, smiling, and motoric excitement. A mother may be highly active...
during play in an attempt to elicit such responses from a preterm infant who infrequently responds to her actions with signs of positive attention or whose threshold for responsiveness is higher than that of a fullterm infant.

The description, "The infant who continuously is at the mercy of environmental and internal stimuli" (Als et al., 1980, p. 24), refers to the second dimension of irritability-state control. During the neonatal period, an irritable infant may seldom seem available for interaction when awake due to the toxicity of stimulation for his poorly organized autonomic system. He/she may display poor state modulation (i.e., the ability to move from one state to another without taxing his/her physiological functioning) and/or irritability-fussiness. At 3 or 4 months, such an infant might appear easily stressed by maternal stimulation, avoiding of interaction, and frequently irritable. A mechanism whereby irritability-state control might elicit heightened maternal activity is suggested by findings from a comparative study of healthy preterm and term infants tested with the Brazelton Neonatal Behavior Assessment Scale (adapted for preterms) at 40 and 44 weeks (Als, Note 5). Scores on a scale reflecting the amount of examiner facilitation necessary to "bring the infant to optimal performance and/or to help him return to an integrated balanced state" (p. 15) were significantly higher for preterm than for fullterm infants. Thus, in order to elicit optimal orientation and attention, greater examiner activity was necessary. This finding suggests that some of the higher
levels of activity documented for preterm dyads during face-to-face play may be maternal efforts to help the baby maintain his/her physiological arousal within a moderate range and/or to soothe irritability or fussiness.

**Positive Responsiveness to Stimulation**

The characteristic most often discussed for the preterm infant is a lessened degree of positive responsiveness to stimulation. Such lessened positive responsiveness has been described as an interaction deficit. For example, Parmelee, Beckwith, Cohen, and Sigman (1981) described the preterm as an "inadequate social partner in its natural role in initiating, maintaining and promoting caregiving due to altered or diminished behavioral capacities" (p. 7).

Differences in positive social responsiveness between preterm and fullterm infants have been documented both by studies of face-to-face play and by scores on the Interactive Process cluster of the Neonatal Behavior Assessment Scale (Brazelton, 1973). The review of the literature provided earlier (see *Documentation of the Phenomenon*) suggests that preterm infants with a background of moderate medical complications exhibit less enface gaze during face-to-face play at 3 or 4 months than do fullterm infants. Although these findings are confounded by the co-occurring level of maternal activity during play, a possible origin of the decreased gaze is lessened positive responsiveness within the preterm sample. A recent investigation (Field, 1982) compared the affective expressions of
preterms with a history of respiratory distress syndrome and healthy fullterm infants at 4 months old during face-to-face play with their mothers. Field reported that term infants exhibited significantly more happy faces than did preterm infants. Contingent smiling responses, continent smiling-and-vocalizing responses, and cooing were made more frequently by term than by preterm infants. Global ratings of expressiveness were more positive for term than for preterm infants, and the number of game trials necessary to elicit infant laughing during a stylized game ("I'm gonna get you!") were greater for preterm than for term infants.

Clinical evidence for lessened positive responsiveness in preterms is provided in two case studies by Als and Brazelton (1981). Compared to a fullterm infant (40 weeks' gestation, 3170 grams at birth), a preterm infant (28 weeks, 950 grams at birth) who had experienced multiple medical complications scored more poorly on the Interactive Process cluster of the Neonatal Behavior Assessment Scale at term. Further, during mother-infant play at 3 and 5 months, the preterm was frequently unavailable for interaction due to gaze aversion whereas the fullterm was socially attentive to her mother. On a measure of affective involvement in the interaction, the preterm scored more poorly than the fullterm at both testings. At 9 months, the dyads were provided an interactive toy (a plexiglass box containing a kangaroo accessible through a movable port-hole), and again the preterm infant was less engaging with her mother.
than was the fullterm. Whereas the preterm infant showed predominantly
sober and neutral affect, the fullterm infant displayed more positive
affect.

The second way in which positive responsiveness has been assessed
has been the Interactive Process cluster of the Neonatal Behavior
Assessment Scale. This cluster includes items which traditionally have
been interpreted as tapping alertness and positive responsiveness to
stimulation—the ability to orient to animate and inanimate stimuli. In
addition, cuddliness, consolability, and alertness are assessed as indi-
cators of infant sociability and/or as influences on ease of caretaking.
Several studies independently confirm that during the early neonatal
period surrounding term (37-40 weeks' gestational age) preterm infants
score less optimally than fullterm infants on this cluster. Lester, Emory,
Hoffman, and Eitzman (1976) reported poorer scores on this cluster for
low-birthweight preterm infants than for fullterm infants, and Field
(1977a) found that her sample of preterms with a history of respiratory
distress syndrome (RDS) also scored less well. DiVitto and Goldberg
(1979) found between-group differences for a combined group of healthy
and sick preterm infants and a group of fullterm infants tested at time of
discharge. Further, whereas fullterm infants became more alert after
10 days at home, the preterms did not. Brown and Bakeman (1980) also
described black low-SES preterm infants at time of discharge as less
responsive than fullterms on the Neonatal Behavior Assessment Scale at
time of discharge and as less active motorically. Greater lethargy has also been reported by Sostek, Quinn, and DiVitto (1979). One month after discharge, the preterms were less alert and responsive to stimuli on the assessment and more difficult to console than the fullterm infants.

Poorer performance by preterm infants on the Interactive Process cluster, however, is not reported in all studies. Assessments by Als (Note 5) of 10 healthy preterms and 10 fullterm infants revealed only a nonsignificant trend for preterm infants to score less optimally on the cluster at term and 1 month postterm. Further, Sostek et al. (1979) reported similar responsivity for preterms with a history of medical complications, healthy preterms, and fullterms at time of discharge. In fact, the preterm infants appeared to sustain alertness and to orient as adequately as fullterms, and their orientation was described as often more rapid and coordinated than that of fullterms.

**Irritability-State Control**

Possible preterm-fullterm differences in irritability-state control have also been probed with observations of infant behavior during mother-infant enface play and with comparisons on a cluster of items from the Neonatal Behavior Assessment Scale--the Organization Process-State Control cluster. Several observational studies suggest that the amount of fussiness-irritability shown by preterms is greater than that of fullterms. Friedman, Jacobs, and Werthman (1982) observed healthy black preterms in their bassinets at expected date of birth and compared spontaneous
irritability to that of fullterm infants. Significantly more crying, fussing, and state changes characterized the preterm infants, and the authors proposed that preterm infants may present themselves initially as more demanding than fullterm infants.

Evidence that preterm infants may be more irritable during face-to-face play appeared in the observational studies cited earlier. For example, Field (1979) rated preterms with a history of respiratory distress syndrome (RDS) as more fussy and restless than term infants at 4 months. Her recent analyses of affective expressions during play (Field, 1982) also found that preterms with a history of respiratory distress syndrome (RDS) displayed significantly more sad faces and crying than did term infants. Following infant laughter during maternal game-playing, the preterm infants were more likely to avert gaze than were their term counterparts, and the probability of crying after gaze aversion was significantly greater for the preterm infants. Lastly, descriptions of play sessions between parents and their 8-month babies—term infants, infants of diabetic mothers, healthy preterms, and preterms with histories of medical complications (Goldberg et al., 1980)—noted that more sessions were terminated because of infant fussiness for sick preterms and infants of diabetic mothers (both preterm and fullterms).

The model of the preterm infant as more irritable and easily stressed during interaction than the fullterm infant has also been tested through between-group comparisons on the Organization Process-State
Control cluster of the Neonatal Behavior Assessment Scale. The items from this cluster most closely approximate Als' description of those preterms who are more highly sensitive and easily overreactive to environmental inputs, more easily stressed and overstimulated, necessitating more finely tuned, sensitive environmental structuring and support in order to free up maximally differentiated performance. (Note 5, pp. 17-18)

This cluster includes items concerned with frequency of state changes across the total exam, frequency of crying to stimulation (irritability, peak of excitement), and habituation to stimulation—the ability to shut out disturbing stimuli. Brazelton (1978) described the cluster as a dimension tapping the infant's ability to maintain a calm, alert state despite increased stimulation.

Evidence that preterms score more poorly on this cluster is sparse. Als (Note 5) reported that on the Neonatal Behavior Assessment Scale adapted for use with preterm infants, preterm infants at term scored more poorly on the cluster than did fullterm infants. In contrast, Sostek et al. (1980) and DiVitto and Goldberg (1979) found no significant group differences at 40 weeks (term) or time of discharge, respectively. The discrepancy between the Neonatal Behavior Assessment Scale findings and observations of preterm irritability during face-to-face play may be due to the differing contexts in which infant state modulation and irritability are assessed. The Organization Process-State Control cluster of items are rated across the total exam, including periods in which the infant is
presented with aversive stimuli, and during transitions from sleep to awake states. Comparability of this cluster's score to measures of infant irritability-state organization derived from observations of play would be possible only if state modulation and irritability during the Interactive Process items were specifically rated.

The preceding review of preterm-fullterm differences on positive responsiveness to stimulation and irritability-state organization provides some support for the model of the preterm infant as less positively responsive to stimulation in face-to-face play and during the administration of the orientation items of the Neonatal Behavior Assessment Scale. In contrast, greater irritability-poorer state organization is suggested primarily by studies of face-to-face play, and secondarily by the report of a measure of amount of examiner intervention during the Neonatal Behavior Assessment Scale (Als, Note 5). Discrepancies in results for preterm samples differing in illness history (Goldberg et al., 1980; Sostek et al., 1979) raise the possibility that severity of medical complications during the neonatal period may influence neonatal responsiveness.

**Illness and Neonatal Responsiveness**

Neonatal responsiveness to environmental stimuli is probably a function of multiple factors--genetic predisposition or "temperament," the infant's central nervous system integrity, and available energy for responding to the outside world. Many neonatal medical problems experienced by preterm infants potentially compromise the central nervous
system by producing either hypoxic/ischemic insult to the brain which results in cerebral lesions (Pape & Fitzhardinge, 1981) and/or by compromising adequate nutrition for postnatal brain growth (Gross, Oehler, & Eckerman, 1983). Many preterm infants experience multiple medical complications which are potential threats to the central nervous system: apnea, hyperbilirubinemia, respiratory distress syndrome, birth asphyxia, intraventricular hemorrhage, sepsis, and cardiac difficulties (Pape & Fitzhardinge, 1981). In addition, prophylactic measures (e.g., suctioning, intubation, blood drawing) used to treat medical problems may also produce adverse conditions with temporary and possibly long-ranging effects on the central nervous system. For example, Long, Phillip, and Lucey (1980) related episodes of hypoxemia (subnormal oxygenation of arterial blood) in the low-birthweight infant to disturbances by nursery personnel. In addition, excessive acoustic stimulation from incubators and/or the surrounding nursery have been implicated in some cases of injury to cochlear hair cells and consequent hearing deficits in preterm infants (Volpe, 1981). Advances in knowledge about how neonatal illness influences observable behavior have been limited by the lack of research concerning how multiple disease or pathophysiological states interact to cause either transient or permanent alterations in the structure and function of the central nervous system.

Studies of the effect of illness on infant responsiveness and irritability-state organization address the problem of disentangling the
effect of prematurity-immaturity from accompanying medical complications. A typical investigation contrasts groups of infants (matched on post-conceptional age) who vary along one or more medical parameters (e.g., prior respiratory support, respiratory distress syndrome, central nervous system involvement). Subjects are usually assessed at time of discharge or later, rather than immediately after recovery from medical problems. Thus, with occasional exceptions, it is the cumulative effect of prior medical complications which is investigated. The hypothesis of most studies is that "as the medical problems of the newborn increased ... infant social skills would decrease" (DiVitto & Goldberg, 1979, p. 312). Thus, healthier preterms are expected to be more positively responsive and less irritable than preterms with multiple complications.

Three studies support the hypothesized inverse relationships between severity of medical complications and positive responsiveness and irritability during interaction. First, Holmes, Nagy, Slaymaker, Sosnowsky, Prinz, and Pasternak (1982) contrasted four infant groups on the Neonatal Behavior Assessment Scale (Kansas modifications): preterm infants who experienced mild or moderate respiratory distress, fullterms who required an intensive care nursery stay due to medical complications, healthy fullterm infants, and healthy fullterm infants who experienced an extended hospital stay due to maternal postpartum complications. On the two pertinent clusters of the Neonatal Behavior Assessment Scale--the Interactive Process and Organization Process-State Control--there was
no preterm-fullterm difference. Illness, however, had a significant effect on the Interactive Process cluster but not on the Organization Process-State Control cluster: Sick infants, whether fullterm or preterm, had less optimal scores than well preterm infants. This effect, however, was not replicated with stepwise multiple regression analyses which used a standard index of severity of medical complications (the Postnatal Complication score) as a predictor of the Interactive Process scores. Unfortunately, the omissions of a group of healthy preterms and a group of preterms who were severely ill preclude conclusions about the role of severity of illness on neonatal responsiveness within the preterm population.

A study which did include preterms with a range of medical complications also obtained a reliable effect for illness on the Interactive Process cluster. DiVitto and Goldberg (1979) assessed four groups of infants at time of discharge and 10 days' postdischarge: preterm infants with a history of respiratory problems, healthy preterm infants, healthy full-term infants, and infants of diabetic mothers (both preterms and fullterms). An item-by-item analysis of the Interactive Process cluster revealed group differences at both testings on orientation to visual stimulation and on a measure of alertness. The sick preterm group consistently scored most poorly and the fullterm group most optimally. Again, no differences on the Organization Process-State Control cluster were found.

Goldberg et al. (1980) also observed their samples during mother-
infant floor play at 8 and 12 months after birth. The sick preterms, matched for immaturity to a fullterm control group, were found to fuss more and smile less than their fullterm counterparts at 8 months; no differences were found at 12 months. The healthy preterms and infants of diabetic mothers were indistinguishable from the healthy fullterms with respect to fussing and smiling.

Three studies do not support the hypothesis that increasing severity of medical complications dampens positive responsiveness or increases irritability. First, Sostek et al. (1979) explored how prior illness (healthy, ill, ill with central nervous system complications) and preterm-fullterm birth affect performance on the Neonatal Behavior Assessment Scale administered at time of discharge. No effect for illness was found for either the Interactive Process cluster or the Organization Process-State Control cluster. Further, when ill preterms were divided on the basis of need for respiratory support, no differences were found. Thus, "sicker" preterms who had required external respiratory support behaved similarly to "less sick" preterms.

Levav, Fox, and Stolz-Loike (Note 4) also found no effect of illness severity on neonatal behavior sampled during feedings in the hospital.

Four groups of infants—well preterm, well fullterm, preterms with medical complications, and fullterms with medical complications—were compared on eight infant behaviors. Between-group differences on cues of responsiveness (eyes open/closed, visual activity) were due to
preterm-fullterm birth and not to health status.

The most extensive investigation of the effect of variation in severity of neonatal medical complications on preterm infants' behavior was conducted by Minde, Whitelaw, Brown, and Fitzhardinge (Note 3). To quantify severity of illness, they developed a Morbidity Scale which rates both the severity of 20 individual medical complications and the duration of each across hospitalization. Summary illness scores for the total hospitalization were used to divide preterm infants into three illness groups: well, moderately ill, and sick. Observations of mother-infant interaction were conducted during nursery visits and a home feeding 1 month after discharge. When sick and well infants were compared, the sick infants made significantly less body movements than did the well infants during a nursery visit while they were acutely ill, but no differences in eye-opening were found. To explore another aspect of illness severity, Minde et al. subdivided the total group of sick infants into two groups according to illness duration: "long illness" (greater than 35 days) and "short illness" (less than 17 days). Duration of illness had no effect on either body movements or eye-opening, with the exception that, during the home visit, preterms with short illness opened their eyes more than did preterms with long illness. The work of Minde and his colleagues suggests that severity of medical complications has little impact on infant responsiveness during the nursery stay except for a decreased amount of body movement during episodes of acute illness.
Two problems with the existing research concerning the influence of severity of medical complications on neonatal behavior deserve mention. First, with the exception of Minde and his colleagues, descriptions of illness characteristics of infant groups are notably sparse. Such phrases as "mild or moderate respiratory distress syndrome" in the case of preterm infants, or "cardiac complications" in the case of fullterm infants, are commonly provided without specifics concerning duration of the illness or accompanying medical complications. The omission of such information precludes further understanding of why effects for illness are obtained. Second, many researchers rely on the global scores from the Neonatal Behavior Assessment Scale--the Interactive Process cluster score and the Organizational Process-State Control cluster score. The presentation of the global Interactive Process score without group means on the component items prevents analyses of responsiveness to specific modes of stimulation, such as visual and auditory. Further, the global score is based in part on ratings of cuddliness and consolability and may confound responsiveness to stimulation with motoric maturity (cuddliness) and state control (consolability) (Sameroff, 1978). The use of the global Organizational Process-State Control cluster score assesses infant behavior during sleep and drowsy states in addition to awake states. Thus, conclusions from this score about irritability and state modulation during interaction when the infant is awake are problematic.

Clearly, additional research is needed which utilizes measures of
responsiveness and irritability-state control which reflect the kinds of behaviors thought important to a potential caregiver during interaction. Further, to understand better the complexities of how multiple medical complications do/do not affect neonatal behavior, detailed information concerning illness course must be presented.

**Research Questions**

It is hypothesized that either lesser positive responsiveness to stimulation and/or greater irritability or drowsiness by the infant can elicit high levels of maternal activity during face-to-face interaction. As a first step toward exploring the impact of these behavioral dimensions on the documented finding of greater maternal activity toward preterms than toward fullterms during play, Study 1 compared preterm and fullterm infants on these two neonatal characteristics.

Further, within the heterogeneous preterm population, the role of variation in severity of medical complications on the targeted behavioral dimensions was explored by using two groups of preterm infants differing in neonatal medical complications. This focus on illness severity is anchored in the hypothesis that variations in maternal stimulation may interface with variations in infant biological status in explaining variations in social interactive patterns within the preterm population.
Methods

Sample

Sixteen mildly ill preterm infants, 16 moderately ill preterm infants, and 15 healthy fullterm infants served as subjects. All infants were treated at Duke Medical Center between June 1981 and July 1982. Full-term infants were healthy, had no known congenital anomalies, and had birthweights appropriate for gestational age (mean birthweight of 3381.3 grams). These infants had gestational ages of 38 to 42 weeks at birth as determined by the Dubowitz exam (mean gestational age of 40.3 weeks). Short-term complications occurred in six deliveries (e.g., nuchal cord, terminal bradycardia, frank breech); but in all such cases, 5-minute Apgar scores were 9 or 10, and no further medical problems occurred during hospitalization.

All preterm infants were between 27 and 33 weeks' gestational age at birth. The gestational age of each infant was determined through physical examination by a physician (Dubowitz, Dubowitz, & Goldberg, 1970). The two preterm samples differed on three parameters chosen through consultation with the neonatology staff at Duke Medical Center as face valid for distinguishing mild from moderate severity of illness among preterm infants. These parameters, contrasted between the two groups in Table 1, included: (a) appropriateness of weight for gestational age; (b) duration of respiratory support; and (c) timing of the initiation of oral feeding. Chronically ill infants whose need for respiratory support
Table 1
Criteria for Membership in Preterm Groups

<table>
<thead>
<tr>
<th>Mildly Ill Preterm</th>
<th>Moderately Ill Preterm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Born 27 to 33 weeks' gestational age</td>
<td>1. Born 27 to 33 weeks' gestational age</td>
</tr>
<tr>
<td>2. No congenital anomalies (e.g., major defects of any organ system, including physical appearance)</td>
<td>2. No congenital anomalies</td>
</tr>
<tr>
<td>3. Weight appropriate for gestational age</td>
<td>3. Either small for gestational age or weight appropriate for gestational age</td>
</tr>
<tr>
<td>4. Fed by 7 days after birth</td>
<td>4. Respiratory support exceeds 7 days after birth, but use of ventilator discontinued by 4 weeks after birth, and use of oxygen support discontinued by 8 weeks after birth</td>
</tr>
</tbody>
</table>
exceeded 6 weeks (e.g., diagnoses of bronchopulmonary dysplasia) were excluded.

To verify that these a priori definitions of illness clearly demarcate two groups of preterm infants who differ in severity of medical complications, comparisons on a variety of additional medical variables were performed. Table 2 summarizes the between-group comparisons and reveals that moderately ill infants were, on the average, 1 week younger at birth and 3 weeks older at time of discharge than their mildly ill counterparts. In addition, they averaged 423 grams less in birthweight and stayed in the hospital 33 days longer. On an independent assessment of severity of medical complications, the Morbidity Scale described under Measures, the moderately ill preterm group scored higher on a summary measure reflecting both number of complications and duration of complications and experienced a greater number of medical complications.

Initial attempts were made to select fullterm infants who matched a subject in either of the two preterm groups on infant sex, race, maternal parity, maternal education, and maternal age. The intent was to minimize influences on neonatal responsiveness apart from those due to prematurity and medical history. When such matching did not prove feasible, global matching of the infant groups on these characteristics guided infant selection. Familial and socioeconomic characteristics of the three resulting infant groups are presented in Table 3. Between-group comparisons were conducted on these variables using chi-square
Table 2
Comparison Between Preterm Groups on Mean Scores on Medical Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mildly Ill (n = 16)</th>
<th>Moderately Ill (n = 16)</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gestational Age (week)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth</td>
<td>30.88 (± 1.74)</td>
<td>29.50 (± 1.83)</td>
<td>2.18*</td>
</tr>
<tr>
<td>Discharge</td>
<td>35.53 (± 1.38)</td>
<td>38.88 (± 2.11)</td>
<td>-5.30***</td>
</tr>
<tr>
<td><strong>Weight (grams)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth</td>
<td>1543.44 (± 350.27)</td>
<td>1120.31 (± 281.81)</td>
<td>3.77***</td>
</tr>
<tr>
<td>Discharge</td>
<td>2060.63 (± 318.61)</td>
<td>2072.50 (± 280.48)</td>
<td>- .112</td>
</tr>
<tr>
<td><strong>Length of hospital stay (days)</strong></td>
<td>33.00 (± 12.79)</td>
<td>65.69 (± 14.90)</td>
<td>-6.66***</td>
</tr>
<tr>
<td><strong>Morbidity score</strong></td>
<td>11.31 (± 10.87)</td>
<td>96.69 (± 37.12)</td>
<td>-8.83***</td>
</tr>
<tr>
<td><strong>Number of complications</strong></td>
<td>2.69 (± 1.14)</td>
<td>6.69 (± 1.82)</td>
<td>-7.47***</td>
</tr>
</tbody>
</table>

*p < .05.

**p < .01.

***p < .001.
### Table 3
Demographic Characteristics of the Infant Groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mildly Ill Preterm (n = 16)</th>
<th>Moderately Ill Preterm (n = 16)</th>
<th>Fullterm (n = 15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% black</td>
<td>68.75</td>
<td>43.75</td>
<td>53.33</td>
</tr>
<tr>
<td>Infant Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% male</td>
<td>56.25</td>
<td>50.00</td>
<td>66.67</td>
</tr>
<tr>
<td>Parity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% multiparous</td>
<td>50.00</td>
<td>62.50</td>
<td>53.33</td>
</tr>
<tr>
<td>Twin Single Birth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% singleton</td>
<td>87.50</td>
<td>75.00</td>
<td>100.00</td>
</tr>
<tr>
<td>Maternal Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean years</td>
<td>13.09 (± 2.4)</td>
<td>12.75 (± 2.8)</td>
<td>12.03 (± 2.9)</td>
</tr>
<tr>
<td>Maternal Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean years</td>
<td>25.50 (± 4.1)</td>
<td>25.56 (± 5.2)</td>
<td>24.53 (± 5.4)</td>
</tr>
</tbody>
</table>
and Fisher exact probability tests for categorical variables and univariate analyses of variance for continuous measures. The three groups did not differ significantly on any of the demographic characteristics. The majority of mothers were black, had completed high school, and were in their middle 20's. Type and course of delivery did differ for the groups. The two preterm groups had a comparable rate of Caesarian section births (37.5% and 43.5% of mildly ill preterms and moderately ill preterms, respectively) which contrasted with the fullterm rate of 13.3%. The two fullterm Caesarian sections were performed in order to prevent delivery complications: One fullterm mother had cephalopelvic disproportion, and the other mother failed to progress in labor in conjunction with fetal bradycardia. Of the 13 fullterm vaginal deliveries, only 2 occurred without anesthesia. The remaining 11 mothers received epidural, pudential, or local anesthesia. Eleven fullterm mothers chose to bottle-feed, and of the 4 fullterm mothers who breastfed, only one received postpartum medication (Dilauded).

Recruitment of subjects for both Study 1 (infants) and Study 2 (mothers) was conducted by the principal investigator, who approached mothers individually with an explanation of the studies, a request for participation, and consent forms (see Appendix A). Recruitment of fullterm infants occurred on the first postpartum day. Enrollment of preterm infants was governed by the timing of parental visits and the course of the infants' medical complications, and usually occurred during the
2-week period prior to discharge. In the case of adolescent mothers younger than 18 years, consent was obtained from both the mother and one of her parents.

Several parents refused to allow their infants to participate. In each case, the mother was primiparous and one or both parents wished to minimize additional stress during the hospitalization. Two of the four preterm parents who withheld consent had mildly ill infants and were approached during the first week after birth—a particularly stressful period for preterm parents. One preterm mother of a moderately ill preterm agreed initially but later refused, seemingly due to anxiety aroused by the impending discharge of her infant, and one mother of a mildly ill preterm did not wish to participate in "research" of any kind. Three mothers of fullterm infants also refused to participate. Two were primiparous and appeared concerned that their competence as mothers might be assessed in some fashion, and the third gave no reason for her refusal.

Procedure

Data collection was initiated with a total of 38 preterm and 22 fullterm infants. Of this initial pool, it was possible to collect at least two infant responsivity measures from 16 mildly ill preterms, 16 moderately ill preterms, and 15 fullterm infants; these infants composed the study groups. The remaining subjects (i.e., 6 preterm and 7 fullterm infants)
could not be aroused for assessments on at least 50% of attempted trials and were not included in subsequent analyses.

Whenever possible, three responsivity assessments were attempted per subject. Due to practical limitations of hospital schedules, a maximum of two assessments were attempted with 13% of the infants. Tests with fullterm infants were initiated on the second day of life to minimize possible effects of either maternal medication during delivery and/or of silver nitrate eye drops received by the infants immediately after birth. Each exam was conducted midway between feedings (scheduled on a 4-hour basis) in order to maximize the likelihood of rousing the infant to an alert and nondistressed state for testing. Data from fullterm infants were collected in one of three settings. Eighty percent of tests were conducted in a quiet, unoccupied patient room on the obstetric floor with low background lighting provided by a portable lamp during early morning and evening hours. The remaining tests were performed in either the preterm testing room in the Convalescent-Growing Nursery or in an examination room in the Fullterm Nursery.

Measures with preterm infants were obtained during the week prior to discharge. Measures were collected 1 hour prior to feedings on a 3- or 4-hour schedule in order to maximize the likelihood of arousing the infant to an alert state. All trials took place in a small room in the Convalescent-Growing Nursery with low background lighting provided by a portable lamp.
The responsiveness/assessment consisted of presenting the infant with a series of visual and auditory stimuli in order to assess his/her capacity for providing social feedback to a potential caretaker. The stimuli and scoring procedures were adapted from items contained in the Interactive Process cluster of the Brazelton Neonatal Behavior Assessment Scale (Brazelton, Als, Tronick, & Lester, 1979). The assessment was designed to sample (a) behaviors which are frequently interpreted as denoting positive infant affect or attention to the caretaker (e.g., gaze, orienting) and (b) state cues. The state cues are thought to assume two forms: (a) irritability, motoric restlessness or distress behaviors which call forth soothing behaviors by a caretaker; and (b) drowsiness or ambiguous-state cues which may elicit stimulation to maintain the infant in an available state for interaction.

During the exam, the infant was presented with an Inanimate Visual stimulus (a ball moving across the infant's field of vision), an Animate Visual stimulus (examiner's face moving across the infant's field of vision), an Animate Visual and Auditory stimulus (examiner's face talking as it moves), an Inanimate Auditory stimulus (sound of a shaking rattle held to the side of the infant's head), and an Animate Auditory stimulus (sound of examiner's voice to the side of the infant's head). The exam typically required 20 to 40 minutes for completion and followed the following sequence.

First, at the infant's bassinet, the examiner attempted to rouse the
infant to an awake state by means of a variety of nonaversive stimulatory maneuvers (e.g., gentle shaking, talking, uncovering, holding the infant to examiner's shoulder). When an infant failed to rouse sufficiently after 5 minutes, a score of Unavailable was given for the exam. If the infant awoke, he/she was changed and swaddled prior to the testing procedure. Swaddling was a standard procedure due to the irregularity of temperatures at the testing sites. The infant was then transported to the testing room. Once seated, the examiner held the infant in a nearly supine position, supporting the head and neck with a cupped left hand, resting the infant's torso on her lap, and using her right hand and arm for manipulation of testing materials. Each stimulus was presented four times--twice to the left of the infant's midline, and twice to the right of center. Following each lateral presentation, the infant's head was repositioned at midline prior to the next stimulus presentation.

Initial item selection varied according to the receptivity of the individual subject. For example, if the infant appeared to gaze spontaneously at the examiner's face, one of the Animate Visual items was first presented. Following the initial item, auditory and visual items were alternated such that no two items of a single modality occurred consecutively, an exception being the timing of the Animate Visual and Auditory item that incorporates both modalities. Throughout the session, the examiner responded to infant cues of irritability (e.g., crying, physical restlessness) or drowsiness (e.g., closing of eyes) which exceeded 10
seconds with a variety of consoling and rousing interventions, respectively (see Appendix B for descriptions of interventions). Upon the infant's return to an awake and quiet state for 5 seconds, item presentation was resumed. Following either completion of the testing protocol or 3 minutes of continuous crying or sleeping, the infant was returned to his/her bassinet in the nursery.

**Response Measures**

The infant's behavioral responses during the exam were scored in several ways. Responsiveness to individual stimuli (e.g., ball, rattle, voice, face) was scored using criteria based on the duration of response, latency to response, and clarity of behavioral cues of alerting and orientation. Appendix C contains the scoring criteria adapted from the Brazelton Neonatal Behavior Assessment Scale. An infant whose eyes first widened and brightened to a visual stimulus, who tracked steadily the stimulus as it moved, and whose head turned in an effort to continue tracking the stimulus received a higher score than an infant who focused for a few seconds and then averted gaze.

The original scoring system for the Brazelton exam was designed to assess the infant's "best" or optimal performance across repeated trials. However, it has been argued by Horowitz, Sullivan, and Linn (1978) that mothers may use the infant's most characteristic or modal performance to guide their interactive behavior. Thus, until there is evidence that mothers selectively attend to either the optimal or modal
level of infant behavior, researchers interested in comparing infant stimulus characteristics for caretakers may wish to obtain both scores on the Brazelton items (Horowitz et al., 1978). Accordingly, both scores were collected for each of the five stimulation modalities, yielding 10 dependent measures.

In addition to the measures of responsiveness to individual stimuli, two global ratings were made on the infant's performance across the total exam. The Alertness Scale, also adapted from the Brazelton Neonatal Behavior Assessment Scale, reflects the examiner's overall impression of the infant's availability or ability to engage with the examiner across the exam (see Appendix C for a description of scoring). Coordination of eyes and neck muscles during tracking, number of kinesic cues of alertness provided, and capacity for "letting go" of the stimuli are the criteria for scoring. The Rouse-Console score was adapted from Horowitz et al.'s (1978) Examiner Persistence Scale. It estimates the amount of exam time spent stimulating the infant to an alert state (Rousing) from a drowsy state or soothing the infant to an alert state (Consoling) from a distressed state.

Reliability of scoring methods was assessed prior to and across the course of data collection. First, the primary investigator was trained on the original scoring criteria for the Brazelton Interactive Process cluster by two certified Brazelton examiners at Duke Medical Center. When a level of adequate agreement was achieved with one of the examiners (i.e., concordance on scoring of 90% of the items) on tests given to several
fullterm and preterm infants, the principal investigator began data collection and trained a second tester to conduct reliability checks on the examiner's scoring procedures. Reliability checks were then conducted on an average of two infants every 2 weeks across the 10 months of data collection. During these checks, each examiner separately scored the infants' responses, and examiners alternated serving as examiner. Reliability of scoring was considered adequate when 10 of the 12 scores (i.e., 5 modal scores, 5 optimal scores, and 2 global rating scores) were identical across examiners and discrepant scores were within one scale-point of each other. In the case of greater discrepancy, patterns of disagreement were examined and additional training in scoring took place until the two examiners again attained an adequate level of agreement on two consecutive infants. After 4 months of data collection, frequent rates of discrepancies on the scores for visual items and for the Alertness Scale led to a revision of several scale-points on the scales. Previously collected data were recoded according to the new criteria, and reliability checks were subsequently adequate throughout the remainder of data collection. (See Appendix C for a translation of the original scoring criteria to the final scoring format.)

Additional Measures

Hospital records for the infants and mothers provided information on the variables used to match infant groups on familial and socioeconomic features--maternal parity, race, maternal age, maternal education, and
twin-singleton birth. In addition, medical charts provided data for a measure of neonatal medical complications—the Morbidity Scale—devised by Minde et al. (Note 3). This scale was used to provide an estimation of illness severity across the infant's hospitalization.

The Morbidity Scale attempts to rate the frequency of occurrence and severity of 20 frequently observed neonatal medical complications for preterm infants. The score is intended for investigations of neonatal behavior rather than for prediction of either future neurological outcome or future behavioral characteristics. Each infant's medical condition is reviewed daily across hospitalization and rated on 3-point scales which distinguish "how life threatening or physically damaging the condition was to a premature infant" (Minde et al., Note 3, p. 10). Appendix D provides the clinical criteria used to score individual medical complications. On the basis of the daily scores for medical complications across the entire hospitalization period, each infant received a summary illness score. This score reflected the overall severity of illness during the neonatal period. Typically, an infant with a low Morbidity score never had a life-threatening complication, had a hospital stay of 2 or 3 weeks, required low levels of supplemental oxygen on only the first 2 days of life, and was begun on oral feedings during the first week of life. In contrast, an infant with a high Morbidity score characteristically experienced multiple life-threatening complications, had a prolonged hospitalization of 8 to 12 weeks, required supplemental respiratory support for several weeks, and began
oral feedings during the last third of his/her hospital stay.

The principal investigator coded summary Morbidity scores for all of the preterm subjects. A second score--Number of Complications--was the sum of different complications experienced on one or more day of the hospitalization. Consultations with a neonatologist at Duke Medical Center were held to verify scorings of ambiguous medical entries, radiologic reports, or laboratory values.

**Results**

**Group Comparisons**

Between-group comparisons assessed the effect on neonatal responsiveness of prematurity (preterm versus fullterm) and preterm illness (mildly ill versus moderately ill). Univariate analyses of variance for unbalanced groups (general linear model) were performed on the Rouse-Console and Alertness scores. Two multivariate analyses of variance were conducted on the scores for individual stimulation modes. One determined the effect of infant group on the set of four visual scores: two modal and two optimal scores. The other contrasted infant groups on the four auditory scores: again, two modal and two optimal scores. For these analyses, the mean of the scores for the two animate visual stimuli (Animate Visual and Animate Visual and Auditory) served as a representative Animate Visual score. Following a significant multivariate analysis, univariate analyses of variance were examined for the individual dependent
measures. Table 4 contrasts the three groups of infants on the 10 neonatal responsivity measures.

The three groups of infants did not differ reliably on either global ratings of Alertness or Rouse-Console. The multivariate analyses revealed a reliable difference among the groups on responsiveness to visual stimuli, multivariate $F(8, 82) = 3.50, p < .01$, but not to auditory stimuli, multivariate $F(8, 82) = .80, p > .05$. Subsequent univariate analyses on the four visual measures (Optimal Animate Visual, Modal Animate Visual, Optimal Inanimate Visual, Modal Inanimate Visual) indicated significant group differences on all four dependent measures. Newman-Keuls comparisons of the group means (Winer, 1962) revealed a consistent pattern in which the two preterm groups scored significantly lower than the fullterm group on each visual measure. In addition, the two illness groups within the preterm sample (mildly ill preterm, moderately ill preterm) did not significantly differ from one another.

This grouping of individual responsivity measures by modality of stimulation (visual, auditory) addressed the issue of intercorrelations between modal and optimal scores. Both scores were based in infant responses to the same stimuli (e.g., modal and optimal responses to a visual inanimate stimulus). Multivariate analysis of variance simultaneously tests the effect of an independent variable(s) on a set of dependent variables and corrects for the interrelations among the set of measures. This statistical correction prevents increased Type I error which
Table 4
Comparisons of Infant Groups on Neonatal Responsiveness Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mildly Ill Preterm</th>
<th>Moderately Ill Preterm</th>
<th>Fullterm</th>
<th>F Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Summary Ratings</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alertness</td>
<td>3.833</td>
<td>.650</td>
<td>3.677</td>
<td>.824</td>
</tr>
<tr>
<td>Rouse-console</td>
<td>1.708</td>
<td>.795</td>
<td>1.778</td>
<td>.895</td>
</tr>
<tr>
<td>Visual Responsiveness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimal animate</td>
<td>3.529&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.650</td>
<td>3.503&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.829</td>
</tr>
<tr>
<td>Optimal inanimate</td>
<td>3.559&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.936</td>
<td>3.540&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.879</td>
</tr>
<tr>
<td>Modal animate</td>
<td>2.822&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.667</td>
<td>2.650&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.751</td>
</tr>
<tr>
<td>Modal inanimate</td>
<td>2.872&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.094</td>
<td>2.780&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.029</td>
</tr>
<tr>
<td>Auditory Responsiveness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimal animate</td>
<td>5.599</td>
<td>1.202</td>
<td>5.342</td>
<td>1.048</td>
</tr>
<tr>
<td>Optimal inanimate</td>
<td>5.539</td>
<td>1.055</td>
<td>5.405</td>
<td>.970</td>
</tr>
<tr>
<td>Modal animate</td>
<td>4.768</td>
<td>1.071</td>
<td>4.770</td>
<td>.848</td>
</tr>
<tr>
<td>Modal inanimate</td>
<td>4.976</td>
<td>1.049</td>
<td>4.562</td>
<td>1.215</td>
</tr>
</tbody>
</table>

Note. In a given row, groups with the same superscript do not differ from each other; groups with different superscripts differ at $p < .05$.

* $p < .01$. 

61
accompanies repeated tests among several groups on multiple comparisons (Hair, Anderson, Tathan, & Grablowsky, 1979).

Multivariate test statistics approximate an $F$ statistic concerning the canonical variable composed of coefficients of a linear function of the dependent measures. The test statistic, Wilk's lambda, is a general statistic which tests for centroid equality in the case of several groups with multiple dependent variables. For up to three independent variables and any number of dependent variables, the distribution of the lambda statistic precisely matches the $F$ distribution (Hair et al., 1979).

**Further Analyses of Visual Responsiveness**

The availability of Morbidity scores on the preterm subjects permitted a stricter test of the effect of severity of medical complications on visual responsiveness. Whereas the a priori illness classification of "mildly ill-moderately ill" was a categorical variable, the Morbidity Scale provides a continuous measure covering a wide span of severity of postnatal complications. The Morbidity Scale was used to construct two groups of preterm infants who differed markedly with respect to their illness histories. One group, all classified as mildly ill by the a priori categorization, had extremely benign Morbidity scores ranging from 1 to 39 points. The other group, all classified as moderately ill by the a priori categorization, had extremely high Morbidity scores of 100 points or more. From these two groups, seven infant pairs were matched on familial and socioeconomic characteristics: race, maternal parity, maternal
age (18 years or less, 19 to 28 years, 29 years or older), and maternal education (less than 12 years, 12 years or greater). Two pairs could not be exactly matched on one variable each—maternal age and maternal education. These two matched groups were compared with \( t \) tests for matched samples (Levine, 1981) on each of the four visual measures for which the prior analyses had found significant differences for prematurity (preterm versus fullterm) but not for preterm illness severity. The two groups of preterm infants, differing markedly on neonatal illness, did not differ on any of the four visual measures: Animate Modal, \( t = .679, p > .05 \); Animate Optimal, \( t = .105, p > .05 \); Inanimate Modal, \( t = .019, p > .05 \); and Inanimate Optimal, \( t = .164, p > .05 \).

Further, a multivariate analysis of covariance was conducted with the two preterm groups to determine whether illness severity (mildly ill versus moderately ill), with the effect of length of postuterine experience (i.e., number of days between birth and testing) statistically controlled, would have a significant effect on visual responsiveness. Neither illness group nor length of postuterine experience had significant effects on visual responsiveness, \( F(8, 60) = .60, p > .775 \), and \( F(4, 30) = 1.40, p > .258 \), respectively.

The finding of no differences among the three original infant groups on auditory responsiveness but their differences (preterm versus fullterm) on visual responsiveness raises questions about using single Animate Visual scores (modal and optimal) which combine infant performance on
a stimulus which simultaneously presents auditory and visual stimuli—the Animate Visual and Auditory measure—with infant performance on a stimulus which presents a visual stimulus without an auditory cue—the Animate Visual measure. The question of interest was whether the addition of an auditory cue to a visual stimulus would alter the observed group differences on responsiveness to a purely visual stimulus. Four further univariate analyses of variance were conducted to compare the infant groups on (a) the joint presentation of visual and auditory cues and on (b) the presentation of a visual cue alone. These analyses explored the effect of infant group on the Modal Animate Visual score, Optimal Animate Visual score, Modal Animate Visual and Auditory score, and Optimal Animate Visual and Auditory score. To maintain an error rate of $p < .05$ for the set of comparisons as a whole, a per comparison error rate was set at $p < .01$.

Table 5 presents the means for each group and summarizes the analyses of variance which identified between-group differences for the two modal scores: Modal Animate Visual, $F(2, 44) = 8.48, p < .01$; Modal Animate Visual and Auditory, $F(2, 44) = 7.773, p < .01$. Newman-Keuls comparisons on ordered means replicated the birth status effect obtained with the multivariate analyses of the visual responsivity measures. The mean difference between the fullterm group and the preterm groups of one scale point on modal scores on these measures was similar to the mean difference on the modal scores on the combined Visual
Table 5
Summary of Analyses of Variance for Effects of Infant Group on Visual Animate Subscores

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Mildly Ill Preterm (n = 16)</th>
<th>Moderately Ill Preterm (n = 16)</th>
<th>Fullterm (n = 15)</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimal animate visual</td>
<td>3.000</td>
<td>3.374</td>
<td>4.081</td>
<td>4.221</td>
</tr>
<tr>
<td>Optimal animate visual and auditory</td>
<td>3.948</td>
<td>3.601</td>
<td>4.555</td>
<td>4.580</td>
</tr>
<tr>
<td>Modal animate visual</td>
<td>2.427&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.511&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.755&lt;sup&gt;b&lt;/sup&gt;</td>
<td>8.481*</td>
</tr>
<tr>
<td>Modal animate visual and auditory</td>
<td>3.219&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.760&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.045&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.773*</td>
</tr>
</tbody>
</table>

*Note.* In a given row, groups with the same superscript do not differ from each other; groups with different superscripts differ at \( p < .05 \).

*\( p < .01 \).
Animate measure. Thus, the addition of an auditory cue does not appear to alter the pattern of group differences on characteristic responsiveness (modal scores) to a social stimulus which is solely visual.

Recent theorists hypothesize that the social impact of infant behaviors may be influenced by "figure-ground" phenomena (Huberts & Wachs, 1982). For example, the power of an optimal response to elicit a maternal behavior may vary in proportion to its contrast to the modal response. Highly discrepant optimal and modal responses may lead to a "highlighting" of the salience to the mother of the infant's optimal response. In contrast, high similarity between optimal and modal responses may dampen the cueing value to a mother of the baby's "best" or optimal response.

To explore whether the three groups of infants differed on the contrast between "ground responses" (modal) and "figure responses" (optimal) on visual items, discrepancy scores between optimal and modal scores on the subcomponent measures of the Visual Animate score (i.e., Animate Visual and Animate Visual and Auditory) were calculated. A precedent for analysis of such indices of discrepancy between modal and optimal scores is described by Horowitz et al. (1978). Dichotomous categories of the degree of discrepancy were constructed—minimal difference (i.e., less than one scale point difference between modal and optimal) and moderate difference (i.e., greater than or equal to one scale point difference). Chi-square analyses revealed that the incidence of minimal difference and moderate difference did not differ across infant groups on either the
Animate Visual or Animate Visual and Auditory measures: \(X^2(1) = 2.496, p > .05\), and \(X^2(1) = 1.608, p > .05\), respectively.

To summarize the findings, preterm infants were found to differ from fullterm infants only in responsiveness to visual stimuli, both animate and inanimate. It appears that preterm infants present caretakers with less articulate cues of responsiveness to visual stimuli than do their fullterm counterparts. For example, when presented with the examiner's face moving across a 90-degree arc, a fullterm infant characteristically focused on the face and visually tracked its movement for a 30-degree arc. In contrast, although a preterm infant would also initially focus on the examiner's face, he/she would then disengage by averting his/her gaze from the face or, at best, would track the face for a brief period (e.g., a 15-degree arc). As a consequence, the examiner's interactional engagement with the fullterm infants was of longer duration and experienced as more gratifying than the "hit or miss" interaction with the preterm infants.

Second, moderately ill preterm infants did not differ from their mildly ill counterparts on any measure of neonatal responsivity. Thus, severity of neonatal medical complications, whether categorized on the basis of quality of adaptation to extrauterine life (i.e., the mildly ill-moderately ill categorization) or articulated as a continuum which summarizes multiple disease states and physiological imbalances (i.e., the Morbidity Scale), does not appear to have an effect on the responsiveness displayed by preterm infants at time of their discharge to their caregivers.
Third, an analysis of component scores of the Animate Visual measures revealed that the addition of an auditory cue to a visual cue did not alter the findings of preterm-fullterm differences in responsiveness. Noteworthy, however, was the finding that the three groups of infants did not differ (at the p < .01 level) on optimal responsiveness to either a single visual animate cue or to a combined presentation of visual and auditory cues. Thus, when presented with animate visual stimuli, the marked preterm-fullterm difference in visual responsiveness appears attenuated with respect to "best" or optimal performance by the infants.

Lastly, there was no evidence of reliable effects for preterm birth or illness on the degree of discrepancy between characteristic (modal) and best (optimal) responsiveness to visual stimuli. Thus, compared to mothers of fullterms, mothers of preterms may not be presented a more dramatic contrast between modal and optimal responses by their infants to visual stimuli.

A further difference between the preterm and fullterm groups potentially complicates interpretation of these findings. Preterm and fullterm infants were not matched on gestational age at time of testing, in view of the stated aim of identifying behavioral characteristics which the infants bring to their initial interactions with caregivers after discharge home. In fact, they differed by an average of 3.4 weeks, and moderately ill infants were older at time of discharge. Prior research has identified gestational age of the infant at testing as a significant predictor of neonatal
visual responsivity (Fantz & Fagan, 1975; Hack, Mostow, & Miranda, 1976; Hack, Musgynski, & Miranda, 1981). To determine whether the preterm-fullterm group difference on visual responsivity was due to the between-group difference in gestational age at testing (univariate $F(2, 44) = 39.92, p < .0001$), a multivariate analysis of covariance with gestational age at testing as the covariate was performed. The effect for infant group remained significant with the effect of gestational age partialled out, $F(8, 80) = 2.57, p < .02$. In addition, Newman-Keuls comparisons on the means adjusted for the covariate (gestational age at testing) replicated the previously obtained pattern of preterm-fullterm differences on measures of visual responsiveness, with one exception: The fullterm group reliably differed from the moderately ill preterm group but performed similarly to the mildly ill preterm group on the Optimal Animate Visual measure.

Discussion

Preterm-Fullterm Contrasts

In the present study, preterm infants, irrespective of illness history, responded to auditory stimuli similarly to fullterm infants. In contrast, there was a preterm-fullterm birth effect on visual responsiveness. Preterms, irrespective of illness history and gestational age at time of testing, exhibited lesser responsiveness than fullterms to both animate (face) and inanimate (ball) visual stimuli. This lesser responsiveness took the form of less frequent head turns toward the stimulus and smaller arcs of visual tracking.
Visual responsiveness was assessed in the present study by rating visual tracking of a moving stimulus (face or ball). A closer analysis of the infant abilities involved in visual tracking may clarify why fullterms received consistently higher scores. In contrast to corneal reflection techniques which assess responsiveness to a stationary stimulus positioned in the midline of the infant's visual field, visual following draws on (a) peripheral vision, (b) oculomotor coordination, and (c) motoric coordination for head turning. A comparison of group means on the individual visual scores presented (Tables 4 and 5) reveals that on two measures (Optimal Animate Visual and Auditory, and Optimal Inanimate) fullterm infants received scores of approximately 5 scale points. Performance at this level requires either (a) visual tracking for a 30-degree arc accompanied by a head turn or (b) visual tracking for a 60-degree arc without a head turn. In contrast, the average preterm performance on these measures (approximately 4 scale points) features visual following for a smaller arc (30 degrees) and does not include the additional head turn. On the remaining measures, fullterms typically scored 4 points and preterms scored 3 points. Again, the contrast is between a 30-degree arc (fullterm) and either focusing without visual following or less than a 30-degree arc of following (preterm). Clearly, fullterms characteristically seem better able than preterms to sustain fixation of a moving stimulus and seem to have better head control, which allows them on some occasions to present an additional cue of responsiveness to caretakers—a head turn.
The immaturity of the preterm infant's central nervous system at birth has repeatedly been proposed as an explanation for such preterm-fullterm differences in responsiveness seen at time of discharge from the hospital. Both Friedman et al. (1981) and Korner (1981) cited the differential maturity of the sensory systems at time of preterm birth to explain preterm-fullterm similarities in auditory responsiveness coupled with differences in visual responsiveness. Gottlieb (1971) described a cross-species timetable for the maturation of the sensory systems: cutaneous and tactile responsiveness followed by vestibular, auditory, and, lastly, visual. For the preterm infant, the sensory functions not yet mature at time of birth (such as the visual system) may be most vulnerable to exposure to the extraterrestrial experience prior to term (Friedman et al., 1981; Korner, 1981). In addition, both point to the deprivation of intraterine stimuli customary for normal fetal growth and development and the exposure to the unnatural extraterrestrial environment as primary influences on the functioning of the preterm infant's central nervous system. They differ, however, in their analyses of the nature of the impact of this altered experience and the duration of the impact on development.

Friedman et al. (1981) proposed a negative relationship between the maturity of a sensory system at birth and the degree of "insult" to the system. For example, a greater detrimental effect is expected on the visual system, which is immature at the time of "early birth," whereas the auditory system, which is more mature at birth, is presumed to be
less compromised. The implication of such an insult is put forth as long-lasting: "Auditory and visual deficits likely to affect their later intellectual development negatively" (p. 175) and the goal of intervention is to further auditory and visual development in the preterm infant. Korner (1981), on the other hand, saw the effect of the exposure to the nonuterine environment as a disruption or retardation of the natural maturation of immature sensory functions which results in a "lag" in overall central nervous system development. This concept of a "lag" implies both a temporary state and the potential for a catch-up point when preterms and fullterms display similar sensory responsiveness. Further, she saw the goal of early intervention as furthering normal maturation of the general central nervous system rather than of specific sensory functions (e.g., visual, auditory).

The finding of preterm-fullterm differences on visual but not on auditory responsiveness in the present study is congruent with the speculation that more immature sensory systems at time of birth are affected more by preterm birth than are more matured systems. Even when the effects of infant maturity (age at time of testing) were statistically controlled, preterm infants exhibited less mature visual responsiveness—predominantly visual fixation and brief visual tracking—than fullterm infants. However, the lack of longitudinal data in the present study precludes clarification of whether the less mature visual responsiveness reflects a long-term "insult" or a more temporary "lag" which is followed
by a "catch-up" point at which preterm and fullterm visual responsiveness becomes similar. A study by Ruff, Lawson, Kurtzburg, McCarton-Daum, and Vaughn (1982) of very-low-birthweight preterms suggests catch-up for preterms on visual tracking of moving stimuli by 1 month postterm (40 weeks): No preterm-fullterm differences at either 1 or 2 months appeared on amount of visual following of moving inanimate disks.

DiVitto and Goldberg (1979) also reported findings of less mature visual responsiveness and equivalent auditory responsiveness for preterm infants with measures similar to those used in the present study. When preterms (mean age 38 weeks) and fullterms were tested at time of discharge with the Neonatal Behavior Assessment Scale, preterm-fullterm differences were found on visual items but not on auditory items of the Interactive Process cluster.

Additional evidence of less mature visual processing in preterm infants is found in studies of brain electrical mechanisms. Engel (1965) documented less mature latencies in visual evoked potentials of preterm infants at expected date of birth compared to fullterm infants. Schulte, Stennart, Wullbrant, Eichorn, and Lenard (1977) compared the visual evoked potentials and auditory evoked potentials of newly born preterms whose development occurred in utero with those of healthy preterms born before 31 weeks of gestation, matching the infants at time of testing on postconceptional age. Consistent with Gottlieb's sequence of sensory system maturation, no group differences in the development of the
auditory evoked potential were found: Maturation of the auditory function
did not evidence an effect of additional extrauterine exposure. In contrast,
the development of the visual evoked potential in the preterm infants whose
development was extrauterine (i.e., were born at earlier gestational ages)
was delayed and still incomplete at term. The authors argued that the
visual system may be more vulnerable between 30 and 40 weeks' concep-
tional age than the more mature auditory synaptic pathways. Whereas the
maximal phase of dendritic growth in relevant areas for audition (the
hippocampus, insula and motoric cortex) occupies a period between 18 and
24 weeks' postconception (Schulte et al., 1977), the later gestational
period of 28 to 34 weeks is the period of rapid dendritic differentiation and
synaptogenesis in the visual cortex (Purpura, 1981). During this period,
basilar dendrites are elaborated, apical dendrites multiply, and dendritic
spines--sites of synaptic contact--appear (Volpe, 1981).

Two findings, however, suggest a resilience of the neonatal visual
system to two dimensions of extrauterine experience: (a) mildly and
moderately severe medical complications during the early postnatal period
and (b) duration of extrauterine experience. First, no effect for severity
of medical complications (mildly ill preterm versus moderately ill pre-
term) was found in the present study. Further, Takashima, Becker, and
Chan (1982) provide evidence that neuronal development of the visual sys-
tem in the preterm infant is not necessarily compromised more by post-
natal medical complications than that of the fullterm infant. They
compared tissue from the visual cortex of 10 preterms (26 to 34 weeks' gestation) who survived for more than 3 weeks to that of fullterms matched on postconceptional age who died from a variety of medical complications (e.g., respiratory distress syndrome, congenital heart disease, Sudden Infant Death Syndrome, spontaneous abortion). Neuronal development, assessed with Golgi staining and neuronal counting methods, was similar for 6 preterms (who died from Sudden Infant Death Syndrome, bronchopulmonary dysplasia, or patent ductuc arteriosus) and 6 fullterms. (Delay in neuronal maturation in two other cases were attributed to gross neuropathology, and definite etiologic factors were undefinable for the other two preterms.) Purpura (1981), however, reported maturational delays and/or abnormal electrographic patterns in visual evoked potentials in several case studies of preterm infants with severe medical complications (e.g., sepsis, respiratory distress syndrome). Clearly, additional research is needed to clarify consistent "identifiable changes in morphological events in the visual or auditory cortex of the preterm infant that are related to extrauterine environmental influences" (Purpura, 1981, p. 154).

Second, in the present study, an inverse relationship between amount of extrauterine existence and the maturity of visual responsiveness was not found. This failure to find a retarding or accelerating effect of amount of postnatal experience on visual responsiveness in preterm infants replicates Sigman, Kopp, Littman, and Parmelee's (1977) report
of a nonsignificant relationship between length of postnatal experience and measures of attentiveness to stationary stimuli.

The present study obtained preterm-fullterm differences on visual responsiveness to moving stimuli, only one of many facets of responsiveness to visual stimuli. There is some evidence that preterms and fullterms, matched on postconceptual age, may respond similarly to other kinds of visual stimuli. For example, a review of those studies which did not report preterm-fullterm differences in visual responsiveness revealed that the response measures in each case consisted of duration of visual fixation or speed of first response to stationary inanimate visual stimuli (e.g., checkerboard, a three-dimensional revolving colored object). In three studies (Fantz & Fagan, 1975; Friedman, Jacobs, & Werthman, 1981; Kopp, Sigman, Parmelee, & Jeffrey, 1975) preterms did not differ from fullterms on overall amount of visual attention. In those studies which reported significant differences, preterms appeared more attentive than fullterms: Preterms displayed greater total fixation and mean length of fixation episodes (Sigman, Kopp, Littman, & Parmelee, 1977) or longer durations of first fixation (Kopp et al., 1975; Sigman et al., 1977) which suggested more initial attentiveness. Only one study (Friedman et al., 1981) reported a preterm-fullterm difference which could be experienced by a mother as evidence of her infant's lesser responsiveness: Preterms were less quick to respond to the stimulus than were fullterms.

Findings in the present study from post-hoc analyses of component
scores of the Animate Visual scores (Animate Visual and Animate Visual and Auditory) lends support to the idea that preterms and fullterms may appear equally responsive on certain aspects of visual responsiveness, such as 'best' or optimal responsiveness to animate visual stimuli. Birth status differences were found on the modal scores but not on the corresponding optimal scores, which suggests that preterms exhibit optimal responsiveness similar to that of fullterms. This finding corresponds in part to similarities between healthy preterm infants and fullterm infants reported by DiVitto and Goldberg (1979) for optimal scores. On the Animate Visual item, they reported significantly higher mean scores for the fullterm group than for either of two preterm groups (healthy and sick). On the Animate Visual and Auditory item, however, the average performance of the healthy preterm group was indistinguishable from that of the fullterm group. These results suggest that, at time of discharge, preterm and fullterm infants may appear equally responsive to maternal stimulation when the mother talks to the infant as she looks at him/her and smiles or otherwise makes facial gestures.

This latter possibility raises interesting questions about the possible role of the preterm's lesser visual responsiveness in the high active-low responsive pattern of interaction. If mothers usually provide visual and auditory stimulation simultaneously during face-to-face play, and if they attend and respond primarily to their infants' 'best' (optimal) level of responsiveness, then visual responsiveness differences obtained in the
The present study would not appear to be a dimension of neonatal behavior which contributes to the high activity-low responsivity pattern of interaction documented in preterm dyads. However, the finding of higher maternal activity by mothers of preterms, when operationalized as more frequent talking during play (Field, 1981, 1982), may reflect the learning by mothers of preterm infants that they can be more interesting and attention-getting stimuli for their infants if they talk while they play.

Taking a broader view of the stimulus value of the preterm infants, they did not appear in the present study to be less alert and available for interaction than the fullterm infants. The similarity of group ratings on Alertness is at first glance puzzling, in light of the significant preterm-fullterm difference on visual responsiveness. Examination of the range of scores revealed that the fullterm group did display a wider range of mean Alertness scores (2 to 7) than either the mildly ill preterm group (2 to 5) or the moderately ill preterm group (2.5 to 5.5). Thus, whereas "best performing" fullterm infants displayed facial responses and smooth coordination of eye and head movements across the total exam, "best performing" preterms exhibited such "modulated alert responsiveness" for only one-third of the exam. Despite such differences in the spread of scores within infant groups, mean ratings of alertness did not differ across groups. The Alertness score, however, is an overall assessment of the infant's repertoire of cues of attention and interest in the stimuli. Since it considers both auditory and visual responsiveness, it reflects the
infant's "best alertness" during responsiveness to either visual or auditory stimuli. Thus, a preterm infant who exhibits immature visual responsiveness (e.g., brief fixation but no tracking) can still score highly on Alertness if he/she scores highly on auditory responsiveness, and vice versa. These overall ratings of alertness, which rate the infant's optimal alertness (either visual or auditory), suggest that fullterm and preterm infants may present similar pictures of social availability and involvement to their caretakers. However, it is possible that parents differentially attend to visual responsiveness and that preterms may appear less alert due to their immature visual tracking of moving stimuli. If so, the measure of alertness in the present study may not have adequately captured preterm-fullterm differences in alertness.

The finding of similar alertness for preterms and fullterms is at odds with DiVitto and Goldberg's (1979) finding of higher alertness scores on the Interactive Process cluster for fullterms than for preterms. The discrepancy may arise from the different contexts in which alertness was assessed. In the present study, alertness was rated for the presentation of animate and inanimate visual and auditory stimuli. In the standard administration of the Brazelton Neonatal Behavior Assessment Scale, which characterized DiVitto and Goldberg's methodology, alertness is rated both during presentation of visual and auditory stimuli and across the remainder of the total exam. Theoretically, preterms and fullterms could differ in the quality of their alertness during periods other than
presentation of the visual and auditory stimuli (e.g., following examiner response to infant crying or following the infant's waking from a sleep state).

Preterm and fullterm infants also did not differ on ratings of the amount of experimenter intervention necessary to ensure the infant's availability for stimulation—an awake state. This similarity in scores on Rouse-Console contradicts prior research which reports greater irritability and/or poor state organization during the neonatal period for preterm than for fullterm infants (e.g., Friedman et al., 1981; Als, Note 5). The use of a single scale to reflect both infant irritability, which elicits soothing interventions from the experimenter, and infant drowsiness, which elicits arousing interventions from the experimenter, may have obscured between-group differences on the two components. Future investigations might address this methodological issue with the use of two separate scales. However, pilot interviews with mothers of preterm and fullterm infants at 4 months' postconceptional age concerning maternal and infant behavior during face-to-face play revealed that many mothers, when confronted with signs of drowsiness, do not attempt to maintain the infant in an alert and awake state. Rather, they terminate the play and allow the infant to sleep, postponing additional play until he/she is well rested. In addition, infant fussiness is frequently interpreted as evidence of fatigue and may also lead to discontinuation of face-to-face play. Such accounts cast some doubt on the usefulness of such measures as Rouse-
Console, given the stated goal of exploring infant behaviors which may elicit high rates of maternal stimulation during face-to-face interaction. Further assessments of maternal responses to infant state cues during interaction are required prior to inclusion of the Rouse-Console measure in further predictive studies.

Severity of Preterm Medical Complications

The present study found that severity of medical complications, assessed in two different ways, did not affect any measure of neonatal responsiveness within the preterm sample. First, two groups of preterm infants (mildly ill versus moderately ill) were selected which differed markedly with respect to need for respiratory support and for delayed enteral feeding during the early weeks of life. Second, extreme scores of the Morbidity Scale, which summarizes variations in severity of 20 neonatal medical complications across the infant's hospitalization, were used to create two groups of "extremely well" and "extremely sick" preterm infants. In addition, a range of scores on the Morbidity Scale were represented in the preterm samples: Most of the mildly ill preterms had scores between 1 and 16 points, half of the moderately ill preterms had scores between 49 and 91, and the remainder of the moderately ill preterms had scores between 101 and 157. One possible contribution to the finding of no illness effect is the lack of overt compromise of the central nervous system in the samples of preterm infants selected for study. Although 8 of the 16 infants in the moderately ill sample had Morbidity
Scale scores which matched the Minde et al. classification of severely ill (more than 99 points), none of these infants had hydrocephalus, convulsions, meningitis, or intracranial hemorrhage. It is plausible that medical complications which directly involve the brain affect the sensory systems involved in visual and auditory responsiveness. For example, Ruff et al. (1982) found no differences in amount of visual following of an inanimate disk at 1 month postterm between healthy fullterms, healthy preterms, and preterms with one or more indicators of neurological risk (e.g., intraventricular hemorrhage, extended respiratory support). At 2 months, however, the preterms with neurological risk indicators showed a smaller mean percentage of following of the moving stimulus, suggesting a delayed impact of medical complications which involve the central nervous system.

The lack of an effect for severity of medical complications is congruent with prior findings for the Neonatal Behavior Assessment Scale (Sostek et al., 1979) and naturalistic observations of social cues such as gaze and infant vocalizations (Levav et al., Note 4). Studies which obtained effects for illness on the Interactive Process cluster of the Neonatal Behavior Assessment Scale reported inconsistent effects on the individual items (DiVitto & Goldberg, 1979). For instance, DiVitto and Goldberg (1979) reported significant differences between a healthy preterm group, a sick preterm group, and a healthy fullterm group on optimal scores for the Animate Visual item, the Inanimate Visual item, and
the Animate Visual and Auditory item. There was, however, no consistent pattern of between-group differences: On one measure the healthy preterm group was indistinguishable from the sick preterm group; on another the healthy preterm group performed like the fullterm group; and, on a third, the healthy preterm group performed differently than either of the other two groups.

The degree of effect for illness on the Interactive Process cluster also appears to be a function of how illness is operationalized. For example, Holmes et al. (1982) found that sick infants, whether preterm or fullterm, performed less optimally on the cluster when illness was defined as treatment in the intensive care nursery. However, when severity of illness was quantified as Postnatal Complication Scores (a sum of postnatal medical complications) and entered in stepwise multiple regression analyses, it accounted for only 9% of the variance in scores. The usefulness of this index of illness is again called into question by the finding that, in a sample of 62 preterm infants, Postnatal Complication Scores did not significantly correlate with the measure of visual responsiveness—total duration of visual fixation to a stationary stimulus (Sigman et al., 1977). Clearly, alternative methods for exploring the impact of combinations of neonatal medical complications on the functioning of the preterm infant's central nervous system are needed to inform comparisons of infant behavior as a function of illness history.

Recently, assessments of aspects of early brain growth have been
found to predict developmental outcome, type of developmental course, and neurological problems across the first 24 months of life for both very-low-birthweight and fullterm infants (Gross, Oehler, & Eckerman, 1983; Eckerman, Sturm, & Gross, Note 10). The combination of head circumference at birth (microcephalic—less than the 10th percentile; normocephalic—greater than or equal to the 10th percentile) and the amount of postnatal head circumference change during the first 6 weeks of life (non-normative—less than 3.5 cm; normative—greater than or equal to 3.5 cm) have been used to designate four groups of infants who differ in early biological status. Analyses of the relationships between perinatal medical complications and head circumference group revealed that the strategy effectively summarizes the cumulative effect of potentially detrimental medical problems on the developing brain. For example, less postnatal brain growth was associated with multiple problems: a greater need for mechanical ventilation, patent ductus arteriosus, sepsis, delayed tolerance of enteral feeding, and slower weight gain. This assessment circumvents problems evident in other indices of severity of medical complications (e.g., a lack of models of how medical complications interact in affecting the central nervous system; crude methods for rating severity and duration of complications) by focusing on a relevant outcome of the perinatal risk factors—brain growth during a period of known rapid brain growth. This approach to the impact of neonatal medical complications will be used in subsequent analyses of the responsiveness of the preterm
infants in the present study, once complete data on early changes in head circumference are obtained from the hospitals to which several of the preterm infants were transferred and from pediatricians in their home communities.

To summarize, it appears that if dimensions of preterm behavior are prompting high levels of maternal activity during interaction, then dimensions other than those initially hypothesized—lessened responsiveness to maternal stimulation and increased irritability-drowsiness during interaction—are involved. Preterms and fullterms exhibited similar optimal responsiveness to the Animate Visual and Auditory stimulus which may approximate most accurately the stimulation provided during play—talking and presentation of the face. Further, mothers may not demand the cues of visual tracking which were assessed in the present study. Instead, they may content themselves with visual fixation and attention to their face-body which, when it moves, is likely to "loom in" close to the infant's face rather than move across the infant's horizontal field of vision. Thus, although preterms were found to differ in the sophistication of their visual tracking, such differences may not capture infant behaviors which elicit high levels of maternal activity. Mothers may be responding to more qualitative dimensions of infant responsiveness. For example, levels of motoric arousal during interaction (e.g., "excitement" attributed to motoric activity), failure to observe changes in infant responsiveness across the first months at home (e.g., a lack of increase in infant
alertness across the first month home, a lack of decrease in infant crying) or delay in certain aspects of infant behavior (e.g., delay in smiling, delayed stabilization of a predictable schedule of awake and asleep periods) may elicit high maternal activity. Interviews with parents (see Study 2) in the intensive care nursery have revealed the awareness of many parents of changes in the behavior of their preterm infants across hospitalization. Parents frequently supported optimistic predictions for future development with examples of infant improvement in motoric activity, gaze, orientation to sounds in the nursery, medical status ("look how far he's come" or "look how much he's overcome") and weight gain.

Alternatively, dimensions of neonatal responsiveness and irritability may not contribute to the high active pattern documented for mothers of preterm infants. Instead, the meaning attributed to behaviors exhibited by the preterm infant during interaction and/or maternal beliefs about ways in which she can further the well-being of her "early baby" may guide her provision of stimulation.
STUDY 2

Introduction

Differences in maternal activity during face-to-face play may originate, in part, in differences in maternal cognitions about the needs of preterm infants for "special care." Differences in perception of caretaker roles, goals for infant development, and beliefs in infant vulnerability may explain differences in maternal stimulation toward preterm and fullterm infants. The following discussion first presents the rationale for links between maternal cognitions and caretaking behavior toward preterm infants, and then evaluates evidence that maternal reactions to preterm infants may be influenced by the severity of neonatal medical complications. Finally, detailed hypotheses about the role of specific maternal attitudes in maternal activity during face-to-face play are described.

A Cognitive Model of Caretaking Behavior

A cognitive orientation to mother-infant interaction views parental behavior during interaction as the outcome of decision-making processes involving (a) beliefs about the short-term and long-range goals for the infant, (b) selective perception and interpretation of infant behavior, and (c) optimal strategies for achievement of salient goals. Such "caretaker
psychology" or "folk theories" concern "what infants are, what they should be, and how they might get from the first to the second" (Super, Note 6, p. 6). In her discussion of folk theories about child training, Quinn (Note 7) suggested that folk theories help impose order on an "otherwise mysterious world." The early birth of a preterm infant is an occasion ripe for the mother's development of folk theories about preterm infants. For many mothers, premature labor and delivery are unexpected, and, despite advances in neonatal intensive care, the early birth of a "small baby" is frequently a source of anxiety, uncertainty, and unpredictable outcome. During pregnancy and following the birth, a mother may find herself the recipient of advice, old wives' tales, maxims, and personal accounts from family and friends about the attributes, caretaking needs, and future prognosis of preterm infants. She may comb her memory for prior experiences with preterm infants, and throughout her infant's hospital stay she may be exposed to information from the medical staff.

Parmelee, Beckwith, Cohen, and Sigman (1981) suggested that one impact of having a preterm and/or sick baby may be an alteration of maternal expectations for her role and for her infant's early months:

Whereas the healthy infant may foster feelings of competence or failure in the mother depending on how readily the infant elicits and responds to maternal participation in the behavioral dialogue . . . a sick baby may alter a mother's goals so that she judges her own competence differently and less harshly. She may derive feelings of competence from participating with her baby in overcoming problems and in achieving more normal development. (p. 11)

Wasserman et al. (Note 1) also explained the higher rates of activity by
mothers during free play with preterm infants versus fullterm infants at 9 months of age by invoking a theory of differences in maternal goals. They suggested that preterm mothers are active only in behaviors which they believe are associated with increasing the cognitive-motor skills in their children. Seemingly generalized high activity may actually be specific and targeted to the infant's presumed needs. They further proposed that an overactive maternal style may result from maternal beliefs about the optimal means for improving the infant's condition:

Anecdotal evidence suggests that the mother's hidden agenda is to compensate for the lack of responsivity and presence of deficit in her infant by providing him with a higher level of stimulation than she might otherwise employ. It is as though she feels the baby needs extra input in order to overcome his lag or potential deficit. (p. 2)

Similarly, in a comparison of nine Down's Syndrome babies (with a range of developmental ages from 8 to 19 months) to nonretarded babies, Jones (1980) attributed differences in maternal directiveness during free play to differences in maternal goals and views of the purpose of play. Mothers of nonretarded babies reported having "fun with baby" as their primary objective, whereas mothers of Down's babies felt that they were trying to teach their babies and were pleased by evidence of learning.

Maternal beliefs in infant physical vulnerability may also shape maternal behavior (Field, 1979a; Minde et al., Note 3). Field suggested that between-group differences in maternal perceptions of their infants as strong or weak contributed to the observed differences in maternal speech. She suggested that the content of frequently occurring maternal imperatives
toward preterm infants reflected overprotectiveness and anxiety about infant coordination and safety. Focusing on the earliest period of mother-infant interaction, Minde et al. proposed that the hesitation of parents to interact with their sick preterm infants in the intensive care nursery might be due to their awareness that vigorous stimulation could trigger an apneic spell in the infants.

The preceding suggested relationships between maternal cognitions and observed behavior during face-to-face interaction have all been proposed as post-hoc explanations. Studies of the relationships between maternal attitudes and various aspects of maternal behavior during play are sparse. Two studies, however (Crockenberg & Smith, 1982; Snow, DeBlaw, & Van Roosmalen, 1979), found relationships between maternal attitudes and aspects of maternal stimulation during play. In a predictive study by Crockenberg and Smith (1982), a maternal questionnaire which assessed attitudes toward responsiveness to infant crying and flexibility of parenting techniques was administered prenatally to healthy pregnant women. Home observations of mother-infant interaction at 1 and 3 months were coded for the frequency of "involved mother contact"—caretaking and noncaretaking contact in which there is additional vocal, visual, or tactile stimulation. Mothers who before the birth of their infant expressed responsive and flexible attitudes (in contrast to mothers who feared "spoiling") were observed to engage in more involved contact and to respond more quickly when their infants cried than did mothers with
nonresponsive and rigid attitudes. A second study (Snow et al., 1979) addressed the hypothesis that cross-cultural differences in the frequencies of differing modes of maternal stimulation were due to differing beliefs about infant needs. Interviews with British and Dutch mothers solicited maternal beliefs about infant abilities to comprehend speech, rules and techniques for caretaking, and optimal forms of stimulation for growth and development. Frequencies of maternal vocalization during mother-infant interaction at 3 and 6 months were determined. The types of stimulation considered appropriate for young infants were found to be related to cross-cultural differences in the frequency of talking to babies. For example, British mothers, who emphasized in their interviews the importance of visual stimulation, offered objects to their infants more frequently than did Dutch mothers at 3 months. Dutch mothers, in contrast, who considered talking to be the primary form of stimulation, talked to their infants more frequently than British mothers at 3 and 6 months.

Neonatal Illness and Maternal Attitudes

Several studies provide evidence that mothers of preterm infants are heterogeneous with respect to cognitions about "early babies," and that one source of variation in their beliefs may be the severity of neonatal medical complications. For healthy preterm infants, three studies suggest that differences in affective responses to the birth of a preterm versus fullterm infant are either minimal or short-lived. First, ratings of mothers' affective responses to their infants, derived from interviews
with mothers 3 to 5 days after birth (Smith, Schwarz, Mandell, Silverstein, Dalack, & Sacks, 1969) were similar for middle-class mothers of large, healthy preterms (mean birthweight of 2500 grams) and of fullterms. Second, Trause and Kramer (Note 8) found that differences in self-reported maternal adjustment problems during the early postpartum period between mothers of healthy preterms and mothers of fullterms disappeared by 1 month after discharge. Lastly, Ragozin, Basham, Crnic, Greenberg, and Robinson (1982) compared perceived satisfaction with parenting 1 month after discharge between white middle-class mothers of preterms (less than 37 weeks' gestation and less than 1801 grams in birthweight) and mothers of fullterms. No preterm-fullterm differences were found on ratings of overall satisfaction with parenting, satisfaction with baby, and role satisfaction.

In contrast, significant differences in attitudes do emerge within the preterm population when the range of severity of neonatal illness is expanded. Choi (1973), for example, reported that preterm mothers' self-reports of affect during the period immediately following birth varied according to infant birthweight and gestational age. Mothers of younger/smaller infants reported more depression and anxiety than did mothers of older/larger infants. This finding has been replicated in a sample including both mothers of preterm and fullterm infants (Blumberg, 1980). Maternal ratings of depression after birth were related to a measure of infant risk based on neonatal medical complications.
Minde (1982) also demonstrated considerable variation among mothers of preterms in perceptions of infant illness severity and maternal anxiety about infant welfare. He has hypothesized that "it may be precisely this personal interpretation of the events (medical status and infant behaviors in the intensive care nursery) by the mothers which will provide the most reliable prediction of their eventual behavior toward their infants" (Minde et al., Note 3, p. 18). In interviews with 36 mothers of preterm infants following their visits to the intensive care nursery, approximately one-half of the sample evaluated their infants' medical conditions accurately. The majority of other mothers overestimated, to varying degrees, the severity of current illness. Similarly, one-half of the sample were rated as appropriately anxious, and the remainder were more anxious, to varying degrees, than their infants' conditions called for. Minde concluded that nearly half of the mothers seemed "so overwhelmed with the illness of their children that they were not able to comprehend or accept their baby's condition. They thus created an internal image of their baby which was inaccurate in over half the cases" (p. 103).

Research Questions

It is hypothesized that particular beliefs about the needs of premature infants may help to mold maternal provision of stimulation during face-to-face play. The rate of maternal acts and their intended function (i.e., the maternal goal) may reflect beliefs about infant needs and goals which, in comparison to those of mothers of fullterms, are heightened in
salience. Two sets of attitudes--Vigilance and Protection--are hypothe-
sized to influence maternal stimulation, albeit in different ways. Vigi-
lance attitudes are hypothesized to increase the rate of maternal stimula-
tion during face-to-face play. These attitudes include recommendations
for caretaking which include close monitoring of infant behavior, provi-
sion of "more" attention, love, or stimulation than appropriate for a full-
term, and worry or concern about the infant's future development. A
mother who views her preterm infant as indistinguishable in abilities,
attributes, and caretaking needs from a fullterm infant may not alter her
interactional style. On the other hand, a mother who is concerned with
remedying a detrimental effect of prolonged hospitalization on her infant's
sense of "emotional security" may fashion her play so that she can pro-
vide him/her more "love" or attention. The "extra" she provides might
appear as rapid responsiveness to the infant's cues or increased affec-
tionate tactile contact. In turn, perceptions of the preterm infant as "at
risk" for developmental delay or as inherently one step behind other
infants due to his/her precarious start in life may set the stage for
increased teaching intervention, more frequent stimulation (to further
neurological development), or rich stimulation which employs multiple
modalities.

The second set of attitudes, Protection beliefs, concern limitation
or restriction of the infant's exposure to extrafamilial people or places,
an increased need for carefulness and cleanliness during contact with the
infant, and perceptions of the infant as more vulnerable than other infants to illness and as physically more "fragile." These attitudes, in contrast to Vigilance beliefs, are thought to result in lessened maternal stimulation during play due to maternal hesitancy to fatigue or stress the "fragile" infant. Maternal acts during play may be geared toward soothing or comforting rather than stimulating and eliciting responsiveness. In addition, the length of play bouts may be shorter due to early termination of play episodes when the infant exhibits signs of drowsiness or irritability.

Protection beliefs may also result in alteration of more global aspects of the infant's "social world": (a) limitation of the infant's social partners to family members; (b) delayed transfer of infant care to nonmaternal figures (e.g., daycare or babysitter); and (c) restriction of sibling interaction such as holding or touching.

In addition, anticipation of a possibly altered developmental course for the preterm infant may also contribute to heightened maternal stimulation during face-to-face play. When fullterm mothers provide different modes of stimulation has been found to dovetail with the ages that they first expect particular infant capabilities (e.g., seeing, hearing, understanding) (Ninio, 1979; Snyder, Eyres, & Barnard, 1979; Goodnow, Note 9). In contrast, an altered expectation for the preterm--that he/she will not follow an "on time" timetable--may challenge mothers of preterms to provide more stimulation either to "help him/her catch up" or to encourage his/her mastery of new skills.
Study 2 was undertaken to discover variations in maternal beliefs about preterm infants and their needs for particular types of caretaking. Two sets of beliefs and attitudes were explored: Protection attitudes and Vigilance attitudes. As previously stated, whereas Protection beliefs are hypothesized to dampen the provision of maternal stimulation during play, Vigilance attitudes are hypothesized to contribute to the high levels of maternal activity documented for mothers of preterm infants.

In addition, Vigilance and Protection attitudes were related to the severity of neonatal medical complications within the preterm sample. It was hypothesized that mothers of preterm infants who had experienced more severe medical complications would endorse more attitudes in each set than would mothers of preterms who had been less ill.

In line with the possibility that the expectation for a "nonnormal" developmental course may lead to a compensatory increase in maternal acts during face-to-face play, preterm-fullterm differences in developmental expectations were also explored. It was hypothesized that mothers of fullterms would be more optimistic about the future developmental achievements of their infants than mothers of preterms. Further, mothers of preterms who suffered more serious medical complications were hypothesized to expect less optimal development for their infants than mothers of preterms who were mildly ill.
Methods

Sample

Eighteen mothers of mildly ill preterm infants and 9 mothers of moderately ill preterm infants were interviewed concerning anticipated caretaking for their preterm infant, developmental expectations for their infants during the first 2 years of life, and, when time allowed, about additional parenting attitudes. A group of 13 mothers of healthy fullterm infants were interviewed about developmental expectations and, when time allowed, about additional parenting attitudes.

Mildly ill preterm infants, moderately ill preterm infants, and healthy fullterm infants were defined as in Study 1. Mothers of preterm infants who provided neonatal measures for Study 1 were approached by the principal investigator and were asked to participate in a single interview session when their infants were ready to go home. All mothers who agreed to their infants' participation in Study 1 also agreed to be interviewed, although, in several cases, schedule problems prevented their participation. Three mothers were recruited for interviews only (i.e., no neonatal measures were collected on their infants). Mothers of preterm infants were not approached during acute illness crises; rather, recruitment was usually postponed until discharge was impending. For 75% of preterm mothers, the principal investigator had met and chatted informally with the mother across her infant's hospitalization. For 25% of preterm mothers, the investigator was relatively new at the time of
the interview. Mothers of preterm subjects were told that the interviewer was interested in "hearing the parent's perspective" on taking a preterm baby home and that the interviews would provide information about parents' experiences which might improve discharge teaching for future parents.

Mothers of fullterm infants were recruited by the principal investigator on the first postpartum day; all 13 mothers had also enrolled their infants in Study 1. Due to the brevity of these mothers' hospital stays, the interviewer was unfamiliar to all of the fullterm mothers at time of recruitment. These mothers were told that the interviewer was interested in "hearing the parent's perspective" on taking a new baby home and were provided the same rationale as preterm mothers regarding utilization of information for future parent teaching. Appendix A includes a sample of the parental consent form.

Contrary to expectation, rates of refusal for infant and maternal participation in the two studies were not higher with mothers of moderately ill preterms than with mothers of mildly ill preterms. Two of the four preterm mothers who did not wish to participate had mildly ill preterms and were approached during the first week after birth, a particularly stressful period for parents of preterm infants. One mother of a moderately ill preterm agreed initially but refused on the day of the scheduled interview, seemingly due to anxiety aroused by the impending discharge. The fourth refusal was a mother of a mildly ill preterm who did not wish to participate in "research" of any kind. In addition, four
mothers of moderately ill preterms and three mothers of mildly ill preterms agreed to participate but schedule conflicts precluded data collection.

Initially, attempts were made to choose fullterm mothers who matched a mother in one of the preterm groups in maternal age, maternal education, race, infant sex, and maternal parity. The intent was to minimize influences on maternal attitudes other than infant illness history and birth status (preterm-fullterm). When such matchings did not prove feasible, global matching of the groups on these characteristics became the focus of subject selection. Table 6 presents familial and socio-economic characteristics for the resulting preterm and fullterm groups of mothers. To compare the groups on these characteristics, chi-square or Fisher exact probability tests (for categorical variables) and t tests (for continuous variables) were performed. All comparisons (mildly ill preterm versus moderately ill preterm, preterm versus fullterm) yielded nonsignificant differences between groups. Race, infant sex, and maternal parity were evenly split in each group. Mothers characteristically were in their mid-20's with at least a high school education.

Procedure

A structured interview, described in Table 7, was administered to each mother. Sections 1 (Caretaking Practices) and 2 (Developmental Expectations), the primary foci of the study, were completed for all preterm mothers. When time permitted, Sections 3 (Parental Influencability
Table 6
Demographic Characteristics of Interviewees

<table>
<thead>
<tr>
<th>Variable</th>
<th>Preterm Interview</th>
<th>Developmental Expectation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mildly Ill Preterm (n = 18)</td>
<td>Moderately Ill Preterm (n = 9)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% black</td>
<td>61.11</td>
<td>55.56</td>
</tr>
<tr>
<td>Infant Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% male</td>
<td>55.56</td>
<td>66.67</td>
</tr>
<tr>
<td>Parity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% multiparous</td>
<td>55.56</td>
<td>44.44</td>
</tr>
<tr>
<td>Twin-Single Birth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% singleton</td>
<td>88.89</td>
<td>88.89</td>
</tr>
<tr>
<td>Maternal Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean years</td>
<td>13.56 (+ 2.55)</td>
<td>12.67 (+ 3.12)</td>
</tr>
<tr>
<td>Maternal Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean years</td>
<td>26.50 (+ 4.26)</td>
<td>24.22 (+ 5.00)</td>
</tr>
</tbody>
</table>
Table 7
Structure of Maternal Interview

Section 1: Caretaking Practices

The mother is asked to compare optimal caretaking practices for preterm and fullterm infants in the following areas:

- Feeding
- Picking up and holding
- Play
- Response to infant cries
- Monitoring signs of colds and illness
- Provision of stimulation for growth and development

Section 2: Developmental Expectations

The mother is asked to compare her estimate of the age at which her infant will achieve particular milestones with developmental norms as she understands them. Cognitive and motoric milestones consist of the following:

- Alertness and responsiveness to environmental stimulation
- Sitting
- Walking
- Talking
- Participation in face-to-face play with adults
- Reaching and grasping for a toy
- Comprehension of adult speech

Section 3: Parental Influencability of Development

For each of the milestones in Section 2, the mother is asked to explain the following:

1. Processes which result in milestone attainment
2. Whether parents can facilitate appearance of the milestone, and if so, how
Section 4: Face-to-Face Play

These questions elicit attributions about maternal influencability on infant behaviors during face-to-face play. The mother is presented individually with three infant behaviors which occur during play and is asked to hypothesize which infant and/or maternal acts precede the targeted behavior. The hypothetical situations are the following:

1. Infant has been gaze averting and begins to visually attend to mother
2. Infant has been vocally fussing and quiets into an alert state
3. Infant smiles
of Development) and 4 (Face-to-Face Play) were also administered. All fullterm mothers completed Sections 2 and 3 and, when time constraints allowed, Section 4.

Each mother was interviewed by the principal investigator. Twenty-two preterm mothers were interviewed in a quiet hospital room away from the nurseries, two were interviewed by phone on the first postdischarge day and one was interviewed at a community hospital to which the infant had been transferred from Duke. The investigator's goal was to elicit maternal attitudes and beliefs which might influence the initial interactions at home between mother and infant, thereby setting into motion a maternal style characterized by a high rate of stimulation. Thus, an attempt was made to interview the mothers after predischarge teaching by hospital staff was completed, as near to the actual departure time as possible, in hopes of tapping attitudes the mother was "taking home" with her. Full-term mothers were interviewed in their hospital rooms on the first or second postpartum day. Given the brevity of these mothers' inpatient stays (e.g., 2 to 3 days) and the unpredictability of discharge teaching by hospital staff, no attempt was made to conduct interviews at time of discharge.

Interviews ranged in length from 20 to 75 minutes. The sequencing of questions followed the interview schedule as closely as possible, but was modified by the clinical course of the interview and by maternal time constraints. Mothers frequently pursued topics and concerns tangentially
related to the interviewer's agenda, and many mothers were limited in the time they could allot to the interview due to family responsibilities. Hospital interviews were recorded on a portable Sony tape recorder; detailed notes were made during the two telephone interviews. Interviews with preterm mothers were transcribed in full; fullterm interviews were selectively transcribed for developmental expectations.

**Measures**

The structured interview was designed on the basis of pilot interviews with seven preterm mothers and five fullterm mothers. As previously described, the interview consisted of four parts which are outlined in Table 7 and presented in their entirety in Appendix E. Sections 1 and 2 are the focus of analysis in Study 2 and will be described separately.

Section 1 was designed to solicit recommendations for caretaking of preterm infants in several domains--social, physical, and developmental. Mothers were asked to contrast preterm and fullterm infants with respect to optimal methods of feeding, play, adult responsiveness to crying, provision of stimulation, handling-holding, and monitoring for colds and illness. It was hypothesized that a particular set of maternal attitudes toward preterm infants--Vigilance attitudes--may increase the rate of maternal stimulation to the infant during face-to-face interaction during the first months at home. A second category of maternal attitudes--Protection attitudes--was hypothesized to promote either a lesser rate of
maternal stimulation during face-to-face interaction or alterations in molar aspects of social interaction.

Responses to questions in Section 1 were coded for attitudes about preterm infants' capabilities and caretaking needs which appeared frequently during the interviews. A checklist which recorded the presence of individual attitudes was completed for each interview transcript. These attitudes, defined in Appendix F, were conceptually grouped into the two categories of Vigilance and Protection. The Vigilance category encompassed endorsements of (a) monitoring the infant's behavior more frequently (than is the case with a fullterm infant); (b) responding more quickly or contingently to infant signals; (c) provision of more love, attention, or stimulation; and (d) worry or concern that the infant might be a slow learner, retarded, or developmentally delayed in the future. The Protection category consisted of attitudes concerned with (a) limitation or restriction of the infant's exposure to extrafamilial environment; (b) need for greater cleanliness or carefulness in infant handling; (c) perception of the infant's heightened vulnerability or susceptibility to illness, physical fragility, or weakness; and (d) maternal concern about adequate nutritional intake at home. After completing the checklist for an interview transcript, the number of checks beside Vigilance attitudes were summed to create a summary Vigilance score; a similar procedure was followed to derive a summary Protection score.

Section 2 of the structured interview assessed mothers' expectations
for the future development of their infants. Mothers were asked to estimate in months the ages when they anticipated that their infant would first perform targeted milestones across the first 2 years of life. Both cognitive and motoric milestones were included. The mothers' estimates were each followed by inquiry about how their estimate compared to their understanding of developmental norms. For example, a mother's response that she expected her infant to begin sitting around 8 months of age was followed by the inquiry "8 months--is that about the same time as when other babies start, a little earlier, or a little later than most babies you've known?" The mother was asked to choose one of the three alternatives (same time, earlier, later) and was encouraged by the interviewer with suggestions "to take a guess" or "what's your hunch?" The mother's selection of her infant as "on time," "earlier," or "later" served as the raw data from which six global scores were later derived.

The six summary scores evolved from pilot interviews which indicated that developmental expectations are more complex than mutually exclusive scoring systems indicate. That is, many mothers anticipate the normal "on course" appearance of some milestones but delay and/or acceleration in the appearance of others. If a mother expected delay of one or more motoric milestones, Motoric Delay received a 1; if she gave no evidence of expecting such delay, she received a 0 for the category. If she expected acceleration of one or more motoric milestone, she received a 1 on Motoric Acceleration; if she gave no indication of
expecting such acceleration, 0 was noted for the category. In like fashion, if she expected the normal appearance of one or more motoric milestone, Normal Motoric Development was coded with a 1; if no motoric milestones were expected to be "on time," then a 0 was assigned. An equivalent set of scores pertained to cognitive milestone attainment. Thus, a mother could potentially receive 'presence' scores (i.e., 1 codes) for normal, delayed, and accelerated development in one/both areas of motoric and cognitive development.

Assessments of the reliability of content coding of the preterm interview questions were conducted during April and August of 1982 with 25% of the tapes. Two coders, separately trained by the principal investigator, coded a mean of seven tapes each. The percent agreement between the principal investigator and each coder was calculated as the number of agreements divided by the number of agreements summed with the number of disagreements of coding the presence-absence of the individual attitudes used to calculate Vigilance and Protection scores.

Table 8 presents concordance for coding by individual attitude. Nine of the 11 attitudes had reliabilities of 83% or better. Similar checks on coding of maternal developmental expectations were conducted with eight tapes of preterm mothers and four tapes of fullterm mothers. Percent agreement for the six dichotomous categories, summarized in Table 8, indicate that individual reliability figures average 88% or better.

Responses of preterm mothers were somewhat more difficult to code than
Table 8

Percentage Agreement for Coding of Individual Maternal Attitudes

<table>
<thead>
<tr>
<th>Attitude</th>
<th>Mean %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Need to be more careful (in general) with baby</td>
<td>94</td>
</tr>
<tr>
<td>2. Need to limit baby's exposure to extrafamilial environment</td>
<td>100</td>
</tr>
<tr>
<td>3. Baby is more susceptible to colds or illness</td>
<td>86</td>
</tr>
<tr>
<td>4. Need to watch baby more closely (in general)</td>
<td>86</td>
</tr>
<tr>
<td>5. Need to respond faster to baby's cry</td>
<td>94</td>
</tr>
<tr>
<td>6. Need to watch baby's breathing</td>
<td>86</td>
</tr>
<tr>
<td>7. Need to provide baby more love, attention, or stimulation</td>
<td>100</td>
</tr>
<tr>
<td>8. Concern about baby's future development</td>
<td>79</td>
</tr>
<tr>
<td>9. Baby is physically more fragile</td>
<td>94</td>
</tr>
<tr>
<td>10. Concern about baby's future weight gain</td>
<td>91</td>
</tr>
<tr>
<td>11. Mother's prior exposure to preterms</td>
<td>66</td>
</tr>
</tbody>
</table>

Developmental Expectations

<table>
<thead>
<tr>
<th>Expectation</th>
<th>Mean %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Normative motoric development</td>
<td>94</td>
</tr>
<tr>
<td>2. Delayed motoric development</td>
<td>94</td>
</tr>
<tr>
<td>3. Accelerated motoric development</td>
<td>100</td>
</tr>
<tr>
<td>4. Normative cognitive development</td>
<td>94</td>
</tr>
<tr>
<td>5. Delayed cognitive development</td>
<td>94</td>
</tr>
<tr>
<td>6. Accelerated cognitive development</td>
<td>100</td>
</tr>
</tbody>
</table>

*Coder agreement calculated as
\[
\frac{\text{number of agreements}}{\text{number of disagreements} + \text{number of agreements}}.
\]
those of fullterm mothers due to occasional responses by the former which reflected varying awareness of the need to correct for gestational age in evaluating developmental progress. These responses were coded as reflecting an expectation for normal development, unless the mother otherwise specified.

Additional Measures

Familial and socioeconomic information obtained for Study 1 (see Additional Measures in Study 1) were used for descriptive analyses of sources of variance in the maternal attitudes of interest. Frequency of parental visits to the infant during the hospitalization was determined from a review of daily nursing notes and medical chart entries. In addition, during the structured interview, mothers were asked questions concerning their experience and exposure to preterm infants prior to their present infant. Responses were rated on a 4-point scale reflecting familiarity with preterm infants (see Appendix F). Reliability of the familiarity rating, included in Table 8, indicates that it was the most difficult maternal response to code.

Results

Caretaking Attitudes

Table 9 presents relative frequencies of scores on the Vigilance and Protection measures for mothers of mildly ill preterms and mothers of moderately ill preterms. The distribution of scores indicates variation
Table 9
Relative Frequencies of Scores on Measures of Attitudes Toward Preterm Infants

<table>
<thead>
<tr>
<th>Group</th>
<th>Protection</th>
<th></th>
<th></th>
<th></th>
<th>Vigilance</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Mildly ill</td>
<td>.11</td>
<td>.44</td>
<td>.11</td>
<td>.31</td>
<td>.31</td>
<td>.17</td>
<td>.44</td>
<td>.06</td>
</tr>
<tr>
<td>(n = 18)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderately ill</td>
<td>0</td>
<td>.44</td>
<td>.11</td>
<td>.44</td>
<td>0</td>
<td>.25</td>
<td>.25</td>
<td>.50</td>
</tr>
<tr>
<td>(n = 9)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 10
Comparison of Preterm Illness Groups on Mean Scores on Maternal Attitudes

<table>
<thead>
<tr>
<th>Attitude</th>
<th>Mildly Ill Preterm (n = 18)</th>
<th>Moderately Ill Preterm (n = 9)</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vigilance</td>
<td>1.22 (± 1.00)</td>
<td>1.67 (± .89)</td>
<td>6.21*</td>
</tr>
<tr>
<td>Protection</td>
<td>2.25 (± 1.09)</td>
<td>2.00 (± 1.00)</td>
<td>.60</td>
</tr>
</tbody>
</table>

*P < .05.
in the degree to which preterm mothers endorsed the two attitudes. The effect of illness group (mildly ill versus moderately ill) on these maternal attitudes, tested with a multivariate analysis of variance on the Vigilance and Protection measures, was significant (Wilk's lambda = .704, $F(2, 24) = 5.05, p < .05$). Table 10 presents group means for Vigilance and Protection and summarizes the univariate analyses of variance. A significant effect for illness group was found only on the Vigilance measure, $F(1, 24) = 6.21, p < .05$. Thus, whereas mothers in the two preterm groups endorsed the same number of Protection attitudes, mothers of moderately ill preterms on the average endorsed one more Vigilance attitude than did mothers of mildly ill preterms.

To examine the co-occurrence of Vigilance and Protection attitudes within subjects, Pearson product-moment correlations were calculated within the two illness groups. Whereas the two measures were significantly related ($r = .829, p < .0001$) in the mildly ill preterm group, no such relationship was found in the moderately ill preterm group ($r = .203, p < .629$). This suggests that, for mothers of mildly ill preterms, the Vigilance and Protection measures tap a common dimension whereas for mothers of moderately ill preterms, two attitudes are distinguishable.

To explore additional sources of variance in maternal attitudes, five multiple regression analyses were conducted on the two measures. The first featured a set of three socioeconomic characteristics of the mother as predictors: race, maternal age, and maternal education. The second
employed variables which reflect maternal familiarity with infants and prematurity: maternal parity, number of parent visits to the infant during hospitalization, and maternal report of prior exposure to preterm infants. Another equation featured infant sex as the predictor, and two additional analyses focused on medical correlates of prematurity. The first explored the influence of infant size (infant birthweight and infant weight at discharge as predictors), whereas the other focused on indicators of infant immaturity (gestational age at birth and gestational age at discharge as predictors). Table 11 summarizes the regression statistics and presents the overall coefficients of determination ($R^2$) for individual equations and the significance of the unstandardized partial regression coefficients for individual predictors (tested by $F$ ratios).

The regression statistics suggest two findings of interest. First, none of the predictor sets can significantly explain variance in the Protection measure. Second, only the equation for infant immaturity accounts for a significant proportion of variance in Vigilance scores ($R^2 = .32$, $p < .01$). Examination of the partial regression coefficients (B values) indicates that the coefficient for gestational age at discharge is significant ($p < .05$), whereas the coefficient for gestational age at birth is not. The sign of the significant regression coefficient reveals that, at time of discharge, mothers of older preterm infants have higher Vigilance scores than do mothers of younger preterm infants. A comparison of the mean gestational age at time of discharge for moderately ill and mildly ill
### Table 11

Summary of Regression Analyses

<table>
<thead>
<tr>
<th>Predictor Variable Set</th>
<th>Vigilance</th>
<th>Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R²</td>
<td>F</td>
</tr>
<tr>
<td>Infant gestational age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At birth</td>
<td>.32</td>
<td>5.33*</td>
</tr>
<tr>
<td>At discharge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infant weight</td>
<td>.12</td>
<td>1.58</td>
</tr>
<tr>
<td>At birth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maternal characteristics</td>
<td>.13</td>
<td>1.06</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race_&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maternal experience</td>
<td>.02</td>
<td>.14</td>
</tr>
<tr>
<td>Parity_&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior exposure to preterms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of nursery visits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infant sex_&lt;sup&gt;c&lt;/sup&gt;</td>
<td>.02</td>
<td>.59</td>
</tr>
</tbody>
</table>

<sup>a</sup>0 = black; 1 = white.

<sup>b</sup>0 = multiparous; 1 = primiparous.

<sup>c</sup>0 = male; 1 = female.
preterm infants (39 weeks and 35.5 weeks, respectively) indicates that the older infants are those who have experienced a more severe medical course.

To summarize the findings thus far, mothers of moderately ill preterms and mothers of mildly ill preterms were found to differ on the Vigilance measure but were indistinguishable on the Protection measure. Further, a significant correlation between the two measures emerged only for mothers of mildly ill preterms. The limited size of the sample of mothers of moderately ill preterms (n = 9) may have contributed to the low correlation obtained for this group. An alternative interpretation of these findings is that, for mothers of mildly ill preterms, Vigilance measures Protection. In contrast, the increased severity of medical complications in the moderately ill preterm group may result in an articulation of Vigilance attitudes as separate from Protection attitudes and in a heightened endorsement of the particular set of caretaking strategies aimed at monitoring infant behavior, rapid responsiveness to infant cues, provision of increased stimulation and/or attention, and concern about future infant development.

**Developmental Expectations**

Two sets of analyses were conducted on maternal expectations for infant development. First, between-group comparisons examined the effects of illness (mildly ill preterm versus moderately ill preterm) and birth status (preterm versus fullterm) on individual expectations (delay,
acceleration, and normal appearance of cognitive and motoric milestones). Then, the co-occurrence of expectations within the three groups of mothers was explored in order to examine the structure of sets of expectations of individual mothers.

Table 12 presents the relative frequencies of mothers in each group who anticipated normal, accelerated, and delayed appearance of one or more milestones in each of two arenas—cognitive and motoric. In addition, the proportion of mothers who anticipate normal development in either the cognitive or motoric areas can be contrasted to those mothers who anticipate some alteration (delay and/or acceleration) in the developmental course of their infant.

The effect of illness (mildly ill versus moderately ill) on expectations was assessed with Fisher exact probability tests (one-tailed, \( p < .05 \)). Comparisons between illness groups were not significant: Fisher exact probabilities ranged from .147 to .489. Birth status group comparisons (preterm versus fullterm), also assessed with Fisher exact probability tests, were significant on only one expectation: Delay of Motoric milestones (Fisher exact probability = .02). Preterm mothers more frequently expected delay in motoric milestones than did their fullterm counterparts. To estimate the strength of this relationship, a proportion reduction in error statistic, lambda (Borhnsted & Knoke, 1982), was calculated. The lambda value of 0, when contrasted to the statistic's range of values (0 to 1.00) reveals that knowing infant illness
# Table 12
Relative Frequency of Endorsements of Developmental Expectations

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Group</th>
<th>Mildly Ill Preterm (n = 15)</th>
<th>Moderately Ill Preterm (n = 9)</th>
<th>Fullterm (n = 13)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motoric Expectation</td>
<td>Normative</td>
<td>.81&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.56</td>
<td>.77</td>
</tr>
<tr>
<td></td>
<td>Delayed</td>
<td>.40</td>
<td>.56</td>
<td>.08</td>
</tr>
<tr>
<td></td>
<td>Accelerated</td>
<td>.07</td>
<td>.12</td>
<td>.31</td>
</tr>
<tr>
<td></td>
<td>Delayed or accelerated</td>
<td>.47</td>
<td>.67</td>
<td>.38</td>
</tr>
<tr>
<td>Cognitive Expectation</td>
<td>Normative</td>
<td>.88&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.88</td>
<td>.92</td>
</tr>
<tr>
<td></td>
<td>Delayed</td>
<td>.33</td>
<td>.33</td>
<td>.08</td>
</tr>
<tr>
<td></td>
<td>Accelerated</td>
<td>.27</td>
<td>.56</td>
<td>.39</td>
</tr>
<tr>
<td></td>
<td>Delayed or accelerated</td>
<td>.60</td>
<td>.78</td>
<td>.46</td>
</tr>
</tbody>
</table>

<sup>a</sup><sub>n = 16 for this category.</sub>
does not improve prediction of expectation of delay.

Maternal expectations toward two additional expectations may warrant attention in future research. First, the Fisher exact probability for Delay of Cognitive milestones was .088, and the relative frequencies in Table 12 suggest a hypothesis that, compared to fullterm mothers, preterm mothers more frequently anticipate delay. Further, the Fisher exact probability for Acceleration of Motoric milestones was .099. The frequencies suggest a hypothesis that fullterm mothers are more optimistic than preterm mothers in anticipating accelerated motoric development.

Table 13 summarizes Fisher exact probabilities for co-occurrence of individual developmental expectations within the three groups of mothers. Three reliable relationships are revealed. First, for mothers of mildly ill preterms, expectations of normal and delayed development in the motoric arena are related ($p < .04$). The lambda value for an expectation of delayed-not delayed motoric development, given knowledge of the expectation for normal-not normal motoric development, was moderate ($L = .50$). Second, when these mothers anticipate delay in one area, they also expect it in the other as well ($p < .002$). The lambda value for prediction of delayed-not delayed cognitive development, given knowledge of the expectation for delayed-not delayed motoric development, was again substantial ($L = .83$). Third, for mothers of fullterm infants, expectations of normal and accelerated appearance of motoric milestones are related
<table>
<thead>
<tr>
<th>Group</th>
<th>Mildly Ill Preterm (n = 15)</th>
<th>Moderately Ill Preterm (n = 9)</th>
<th>Fullterm (n = 13)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Motoric Expectations</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normative with accelerated</td>
<td>.80</td>
<td>.44</td>
<td>.01</td>
</tr>
<tr>
<td>Normative with delayed</td>
<td>.04</td>
<td>.33</td>
<td>.77</td>
</tr>
<tr>
<td>Accelerated with delayed</td>
<td>.60</td>
<td>.44</td>
<td>.69</td>
</tr>
<tr>
<td><strong>Cognitive Expectations</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normative with accelerated</td>
<td>.48</td>
<td>.55</td>
<td>.39</td>
</tr>
<tr>
<td>Normative with delayed</td>
<td>.57</td>
<td>.33</td>
<td>.92</td>
</tr>
<tr>
<td>Accelerated with delayed</td>
<td>.51</td>
<td>.40</td>
<td>.62</td>
</tr>
<tr>
<td><strong>Motoric with Cognitive Expectations</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normative with normative</td>
<td>.35</td>
<td>.44</td>
<td>.77</td>
</tr>
<tr>
<td>Accelerated with accelerated</td>
<td>.27</td>
<td>.56</td>
<td>.12</td>
</tr>
<tr>
<td>Delayed with delayed</td>
<td>.002</td>
<td>.12</td>
<td>.92</td>
</tr>
</tbody>
</table>
The lambda value for prediction of accelerated-not accelerated motoric development, given knowledge of the expectation for normal-not normal motoric development, was also strong ($L = .75$).

The contingency tables for these three findings are presented in Table 14. Considering first the mothers of mildly ill preterms, it is clear that the few "generalist" mothers who do not anticipate normal appearance of any motoric milestones expect delay. Further, mothers of mildly ill preterms seem to espouse similar expectations for delay in the cognitive and motoric realms: Delay is expected in both realms or neither realm but not in only one. In contrast, mothers of fullterm infants who are "generalists" and hold a sweeping expectation toward physical development anticipate that their infants will be "fast" and will achieve milestones earlier than other infants.

The limitations of the sample size of mothers of moderately ill preterms preclude clear comparisons of their developmental expectations to those of mothers of mildly ill infants. Concerning preterm-fullterm comparisons (mothers of fullterm versus mothers of preterms), the findings are perhaps best summarized in the form of hypotheses for future research. First, it is hypothesized that mothers of preterm infants, compared to mothers of fullterm infants, more frequently expect delay of motoric milestones. Further, when delay is anticipated, it is a "sweeping" expectation for both cognitive and motoric abilities. Second, it is hypothesized that when mothers of fullterm infants set their sights toward not-normal
Table 14

Contingency Tables for Cooccurrence of Developmental Expectations

<table>
<thead>
<tr>
<th>Group</th>
<th>Developmental Expectations</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mildly Ill Preterms</td>
<td>Normative Motoric</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>D. Motoric</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N. Motoric</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N. Cognitive</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Y. Cognitive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fullterms</td>
<td>Normative Motoric</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Motoric</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
development, they anticipate accelerated development. In particular, they see their infants as potentially "smart" or "fast" in motoric skills.

**Discussion**

Mothers of both mildly ill preterm infants and moderately ill preterm infants expressed similar degrees of concern about protecting their infants and similar developmental expectations about when their infants would reach motoric and cognitive milestones during the first 2 years of life. In contrast, they differed in their Vigilance attitudes: Mothers of moderately ill preterms expressed more attitudes concerning provision of "more" attention or love, a quicker response to infant behavior, and more worry and anxiety about possible delay of infant development (although, when later asked to estimate timing of milestone achievement, some mothers seemed to try to minimize their concerns by expecting "normal" development). Thus, parents' affective responses to preterm infants may indeed be differentiated according to severity of neonatal medical complications, as suggested by Minde et al. (Note 3); but, at time of discharge from the hospital, only a subset of attitudes toward "early babies" appear to reflect parental reactions to the prior illness of their infants. The specific attitudes affected are those hypothesized to lead to greater maternal activity during face-to-face play. Could it be that it is these mothers of moderately ill preterm infants who exhibit heightened maternal activity during play and who are responsible for the often observed high active-low responsive pattern of interaction? Two-thirds
of the sample of mothers of moderately ill infants had infants with overall Morbidity scores which fit Minde et al.'s classification of moderate illness (41-99 points). Reviewing the sample characteristics in key studies which document an inverse relationship between neonatal illness and maternal activity, Minde and his colleagues speculated that most of the pertinent samples (e.g., Field, 1977a) are composed of moderately ill preterms such as these, rather than "well" infants (i.e., who experienced a relatively uneventful postnatal course) or "seriously ill" infants who suffered "serious and longlasting complication as evidenced by at least 7 days of continuous life-threatening illnesses and a total global score of 100 or above" (p. 9). They suggested that higher levels of maternal activity in studies of moderately ill preterms may reflect parental attempts to "make up" for lack of stimulation during hospitalization by means of high rates of stimulation during social interaction. In contrast, mothers of well preterms (Morbidity scores of 0-39)--comparable to the mildly ill preterm sample in the present study--were hypothesized to display an "adequate reaction" of activity indistinguishable from that of mothers of fullterms. The present finding of greater Vigilance attitudes for mothers of moderately ill preterms compared to mothers of mildly ill preterms is congruent with the speculation that the observed high active pattern may result in large measure from heightened Vigilance attitudes of mothers of moderately ill preterms.

In the present study, developmental expectations about motoric and
cognitive milestones during the first 2 years of life differed for preterm versus fullterm infants, but not for moderately ill versus mildly ill preterms. Mothers of preterms anticipated delay in motoric development more frequently than did mothers of fullterms. Some preterm mothers also held pessimistic views toward cognitive development. Mothers of fullterms, on the other hand, appeared more optimistic about future motoric skills and rarely anticipated delay in the cognitive arena.

From these findings, two attitudes contributing to the high activity pattern among mothers of moderately ill preterms can be postulated. Expectations of other-than-normative cognitive or motoric development, together with a heightened Vigilance attitude, may increase the rate of maternal stimulation during face-to-face play in a variety of ways. First, mothers who espouse multiple Vigilance attitudes may respond more quickly to a variety of infant cues in the form of contingent responsivity. For example, several mothers stated that, in contrast to fullterms, preterms are unable to wait to be fed and that the first cues of hunger should be responded to promptly. As one mother said, "I imagine that she'll get fed the moment she cries whether she's hungry or not." Other mothers voiced, "If you think she's hungry let her have it--with a fullterm you put them on a schedule. With her, I want her to grow!" and "Whereas with a 9-month baby they can last another 20 to 30 minutes placidly, but he'll never last a routine so it'll be a big adjustment, coordinating feeding with fixing the breakfast and dealing with the rest of the family." Some
preterm mothers felt that the first signs of illness should prompt a trip to the pediatrician, that "I'll be a little quicker to call, whereas if my son [fullterm] got a cold I'd give him some Tylenol ... but with these [preterm twins] I'll be quicker to call and get some advice, because being premature, you have the other problems, the weight loss that would happen if they became ill." Another mother voiced the ultimate fear of not monitoring preterm behavior closely enough: "I'd watch them more. It's harder to tell if a premie has a cold than a 9-month baby. My aunt had a premie and she could hardly tell if the baby was breathing regularly. The baby died a month after it was born. She didn't watch that baby closely enough. She thought she was watching that baby close--the baby had a cold and she didn't know til she took her to the doctor; there's no way to tell--you have to watch them close."

A second way in which Vigilance attitudes may translate into heightened maternal activity is through increased likelihood of maternal labeling of infant acts as communicative in intent. Those mothers who are concerned about the neurological intactness of their infants or about future developmental problems may interpret more infant behavior as responsive or communicative in intention out of a need for self-reassurance about the infant's "brightness." One mother described her infant's behavior during an intensive care nursery visit with multiple attributions of social responsiveness: "She tries to pretend like she's asleep but when you turn your head and she peeks at you, she's been watching all the time. If you
take and play with her jaws she'll smile. Now sometimes she will look around at everybody else and everything but me and she won't look at me. I'll rub on her neck and she'll look back at me for a minute and then she'll change again. Then I'll play with her jaws and she'll just be staring! My mom has a special way she plays with her nose and she starts smiling." The same mother advised playing more with a preterm than with a fullterm because "that way you can tell how well they can see real good and hear, how well they respond."

Heightened maternal activity may also be seen in preterm mothers' increased assumption of a didactic "teaching" role and provision of opportunities for motoric and/or cognitive skill acquisition during play. A result from the present study sparks the hypothesis that mothers of preterms may feel that they can influence their infants' cognitive development more than their motoric development. Although there were not reliable differences between groups in expectation for accelerated cognitive development, 40% of preterm mothers expected the early appearance of one or more cognitive milestone but only 8% expected accelerated motoric development. Several mothers pointed to extrauterine experience as a potentially positive influence on cognitive and social skill acquisition by their preterm infants. For example, one mother predicted that "He should be faster in alertness because he's had time to interact. I wonder if they begin developing socially earlier because they have more stimulation." Heightened activity during play, in some cases, may reflect a
maternal belief in infant receptivity to stimulation--although the mother may expect later appearance of some milestones, she may expect earlier achievement of others due to a belief in her infant's capacity to benefit from her talking and showing him/her toys. When asked to describe playing with her 4-month-old preterm, one mother said, "I think, more for me, I want her to learn, I want her to do. She's so slow, I mean, compared to a regular baby, where every week there's something, she goes back two steps and then goes forward." Maternal goals for play may differ for mothers of moderately ill preterms and mothers of full-terms. In line with Wasserman et al. (Note 1), these mothers are expected to be more active in behaviors they believe to be associated with increasing the cognitive and motoric skills in their children.

Although Protection attitudes are not hypothesized to increase maternal activity during play, it seems likely that these attitudes could translate into alterations of the structure of play episodes (e.g., shorter play bouts due to maternal eagerness not to "stress" or fatigue the infant), the goals of maternal acts during play (e.g., comforting or reassurance), or molar aspects of social stimulation. For the first couple of months after discharge, a mother who is highly Protective may limit the range of the infant's social contacts and in some cases intensify the mother-infant attachment. For example, one mother said that, in contrast to finding a babysitter for a fullterm, "I'll stay home with the baby and tend to the baby myself." Another mother planned to restrict sibling contact
because "he [the sibling] is only 10 years old and accidents happen--a 10 year-old makes mistakes." And one mother advised that the mother of a preterm be present during sibling interaction: "Just be cautious with him, especially around other kids. Other kids will not understand how small he is or that he can't talk or run like them yet."

The cluster of attitudes and behaviors hypothesized for mothers of moderately ill infants are reminiscent of the "vulnerable child syndrome" described via case histories by Green and Solnit (1964). They speculated that parental reactions to an acute life-threatening illness in a child may have long-range implications for parent-child interaction. Following recovery, such children may be considered by parents to be still vulnerable to serious illness or accident, and may be experienced as a constant source of parental anxiety. McCormick, Shapiro, and Starfield (1982) have suggested that several neonatal events or conditions compatible with an image of an infant as sickly or vulnerable may be of greater import to maternal perceptions of infant development at 12 months than any single condition (e.g., low birthweight, hospitalization during the first year). They propose that perception of infant development may reflect past or present illness rather than current developmental level. Of the 589 children perceived as slow in their study, 72% were actually performing appropriately at age level. A comparison of maternal perceptions within the group of children who received normal scores on an assessment of motoric development suggests that low birthweight may have a continuing
impact on maternal perceptions of the infant during the first year of life. Whereas 3.5% of children with normal birthweights (> 2500 grams) were viewed by their mothers as delayed, 22.2% of children with birthweights less than 1501 grams and 49.5% of infants with low birthweights (< 2500 grams) were perceived as "slow."

The failure of variables such as infant weight, maternal experience with infants, and maternal demographic characteristics to predict either Protection or Vigilance scores in the present study deserves mention. Infant gestational age at time of discharge was predictive of Vigilance and may mirror maternal awareness of infant illness (preterms who were older at discharge had more severe medical courses) and/or length of the infant's separation from family and home due to hospitalization. In the present study, a measure of prior exposure to preterm infants was not predictive of either measure of maternal attitudes toward caretaking (i.e., Vigilance and Protection). This finding contradicts Blumberg's (1982) hypothesis that differences in prior exposure to preterm infants may result in differing expectations for medical and developmental prognoses. She suggested that the content of such expectations could serve to buffer or intensify the level of postpartum stress experienced by the mother. The prior beliefs about preterms which a mother brings to her experience in the intensive care nursery from her social network may not be rigid determinants of the attitudes that influence her caretaking during the first months after discharge. Rather, her initial orientation toward preterm
infants may be modified by the information and advice she receives from the medical staff, other parents she encounters in the intensive care nursery, family, friends, and acquaintances during her infant's hospital stay.

To summarize, it is hypothesized that the high activity during interaction previously asserted for "mothers of preterm infants" may be an accurate descriptor for mothers of preterms who have experienced moderate medical complications after birth but not for mothers of preterms with a benign medical course. The multiple Vigilance attitudes which compose the cognitive set of mothers of moderately ill preterms (e.g., maternal goals during play episodes, the optimal strategies for achieving these goals, and perception of infant abilities and needs) may translate into greater activity/stimulation during play than seen for mothers of healthy fullterms. In contrast, mothers of mildly ill preterms may exhibit a level of maternal activity comparable to that of mothers of healthy fullterms. Minde's (1982) interviews with mothers of preterm infants during hospitalization suggest a potential exception to the proposed similarity between mothers of mildly ill preterms and mothers of fullterms: Mothers who seriously overestimate the severity of illness of their mildly ill preterms may more closely resemble mothers of moderately ill preterms than mothers of fullterms.
GENERAL DISCUSSION

The results from Study 1 and Study 2 suggest several revisions for the long-range research program described in the Introduction. It was hypothesized that lesser positive responsiveness and/or increased irritability-drowsiness in preterm infants might prompt increased maternal activity during interaction. In the present study, the only evidence of variation between preterm and fullterm infants on these behavioral dimensions was less sophisticated visual tracking of a moving stimulus by the preterm infants. However, the fullterm infants did not score reliably higher than the preterm groups on the measure of "best" (optimal) responsiveness to Animate Visual stimuli (face, face and voice). This pattern suggests that the "best" show of infant responsiveness to some stimuli which mothers typically present during play does not reliably differ between preterms and fullterms. Exploration of alternate dimensions of infant behavior which may elicit heightened maternal activity is necessary prior to any further attempts to predict levels of maternal activity.

A prominent dimension of variation in biological status among preterm infants is severity of neonatal medical complications. In the present
study, neither of two indices of neonatal illness influenced any measure of positive responsiveness or irritability-drowsiness. To clarify this finding, two alterations in future sample selection are suggested: (a) expanding the range of neonatal medical complications to include those specific to the central nervous system (e.g., hydrocephalus, intraventricular hemorrhage) and (b) use of measurements of head circumference growth during the 6 weeks following birth as a summary index of the impact of perinatal risk factors on the developing brain.

With respect to maternal attitudes, Study 2 provided evidence that there is considerable variability in the degree to which mothers of preterm infants espouse protectiveness and vigilance in caretaking. Further, severity of neonatal medical complications may be especially salient to the mother's repertoire of vigilance strategies: monitoring of infant behavior, speed of responsiveness, belief in the need to provide "extra" attention and stimulation, and worry or anxiety about possible developmental outcome. The greater incidence of expected delay in motoric development among preterm mothers than among fullterm mothers also suggests the salience of developmental timetables for this group.

During the Spring of 1982, a pilot study was conducted with 12 of the preterm mothers who participated in Study 2 in order to develop measures for future use in investigating the origins of maternal behavior toward preterm infants during face-to-face play at 14-16 weeks (after expected date of birth). This study provided the opportunity for
experimenting with contexts for observation (laboratory versus home),
different approaches to assessing infant sociability, and methods of
describing aspects of "maternal activity" during face-to-face play:
sensory modalities (e.g., visual, kinesthetic, auditory), speed of
responsiveness, intent of maternal acts (e.g., teaching, encouraging,
comforting). Two case studies from this study illustrate how maternal
attitudes toward preterm infants might translate into mother's play style
during face-to-face play.

Mother A, a 17-year-old primiparous black woman, lived with her
parents and brother and dropped out of high school when she became
pregnant. Her baby was born at 33 weeks' gestation and spent 7 weeks in
the hospital intensive care nursery. At the time of her baby's discharge
home, Mother A generally equated caretaking practices for fullterm and
preterm babies, but she described two particular areas of infant vulner-
ability which called for vigilance and monitoring on her part. First, the
baby's "smallness" implied a greater need to "keep a closer watch on
her" in order to monitor responsiveness to sights and sounds, to detect
signs of hearing and vision problems, and to track adequacy of develop-
mental progress. Her chosen strategy for monitoring was to play and
talk to her baby more than she considered customary with a fullterm baby.
Second, Mother A felt that the baby's small size required closer watching
because of increased vulnerability to germs, which necessitated her
checking of the baby's breathing and of early signs of illness. As a
consequence of this belief, Mother A advised going to a preterm baby
every time he/she cried, in contrast to the more relaxed and laissez-
faire stance toward crying possible with a fullterm infant. In addition,
she recommended restricting the number of people allowed near the baby.

During the follow-up visit at 16 weeks, Mother A proved to be an
acute observer of contingencies between her play behavior and that of her
baby. She described gaze-at and gaze-away sequences in detail and
attributed her baby's frequent gaze-aversion to personality character-
istics (e.g., "she's easily bored"). At this time she expressed little con-
cern about future development and seemed contented with her baby's
progress during the first months at home. During the face-to-face play
period, the primary goal of her acts appeared to be the elicitation of signs
of responsiveness from her baby, seemingly a flip-side to her pre-
occupation at time of discharge with monitoring of sensory functions. She
repeatedly attempted to maintain eye contact with her baby either by
looming her face close to the baby's face, or by moving her head orient-
tation into the baby's averted line of vision. When attempts to make eye
contact repeatedly failed, she shook a rattle vigorously in the baby's line
of vision, shifted the baby's position from sitting or standing and vice
versa, and continued her steady stream of interrogative: "Aren't you
going to talk to me? You acting shy? You mad? Won't you smile?"

Mother B, a 26-year-old white high school graduate, lives with her
husband and 4-year-old son in a town where "apparently early babies are
not the going thing." At the time of her baby's discharge home from the hospital, she had few concerns about the future development of her baby, who was born at 28 weeks' gestation and spent 8 weeks in the hospital.

The interview revealed her heightened feeling that her baby "needed" her. She articulated that the baby's smallness meant that she needed more attention than Mother B's fullterm son had required, and she related this feeling of increased need both to the prolonged separation during hospitalization and to her frustrated feeling that the baby was not yet "all mine."

She was extremely anxious about taking the baby home and stated, "I'm not sure I'll be able to put her down or let her alone out of my sight for a long time."

At the 4-month follow-up visit, Mother B reaffirmed her optimistic expectations for development, but described her experience of play somewhat differently: "She's so slow compared to a regular baby that for me, I just want her to do and to learn." Developmental progress for her baby required patience for the baby seemed to "go two steps backwards and one step forwards," in contrast to "something new every week" with a full-term baby. Her desire for her baby to learn seemed to translate into adoption of a consistent teaching mode during face-to-face play. She encouraged the baby to vocalize both with the content of her utterances (e.g., "You smart girl. Are you going to talk? Talk to me now") and in her use of imitation, expansion and coaching of the baby's cooing and "hollering" (e.g., "say goo-d, that's right, go-oo-ood"). She encouraged
the baby to practice reaching and grasping coordination by showing her a rattle and holding it just beyond the baby's easy reach. She also positioned the baby's hand such that her baby grasped Mother B's two forefingers. Then Mother B rhythmically tugged upwards so that the baby would pull in return and develop strength in her upper torso. From this tugging position, Mother B also coaxed the baby to pull up to a sitting position, escalating her voice pitch and affective excitement as the baby struggled to sit up. She repeatedly verbalized a desired performance, encouraged approximations thereof, and discouraged unacceptable behaviors (e.g., "No, don't suck on that, that's dirty. Don't holler—that's ugly"). Despite her baby's fussing, she waited until the baby had successfully pulled up to a sitting position before she ended the play bout.

The importance of understanding the social world of preterm infants has been highlighted by recent longitudinal studies which find socioeconomic variables to be one of the strongest predictors of developmental outcome of preterm infants during the preschool years (Sameroff, 1981). There is some evidence that suggests that provision of environmental stimulation may be more important for the development of preterm infants than for fullterm infants. Siegel (1982) reported more significant relationships between scores on rating scales of provision of environmental stimulation in the home (HOME scale scores) at 12 months and cognitive developmental outcome at 3 years (Stanford-Binet Intelligence tests, Reynall Language Comprehension and Expression) for a group of preterm...
infants than for a group of fullterm infants in a lower socioeconomic sample. Given the lack of significant differences between preterm and fullterm groups on any of the HOME scales, she proposed that "preterms are more susceptible to environmental influences" (p. 971). Further, preterm infants who performed in the normal range at 12 months but were significantly delayed at 3 years came from less stimulating home environments than those who were not delayed at either age. In turn, children showing delay at 12 months but normal performance at 3 years came from more stimulatory environments than those who continued to show delay. Findings such as these reinforce the hypothesis that the impact of high levels of stimulation on the development of preterm and fullterm infants may differ. Clinicians and researchers would be advised to understand better the origins and consequence of the phenomenon of high maternal activity-low infant responsiveness prior to development of intervention programs designed to alter such mother-infant interactions.
APPENDIX A

PARENTAL CONSENT FORM

I am doing a study to find out about what it is like for mothers to take care of babies during the first three months after birth. I would like to spend some time with your baby in one of the nurseries, showing him/her some toys and picking him/her up for a few minutes. I would also like to talk with you about your baby and about your thoughts about the next couple of months with him/her at home.

When you and I talk, I would like to tape our conversation so that I can review it later. This conversation will, of course, be kept in strict confidence. I will assign a number to the tape so that no names appear.

Immediate necessary care is available if an individual is injured because of participation in a research project. However, there is no provision for free medical care or for monetary compensation for such an injury. Further information can be obtained from the Hospital Risk Management Office (684-5280).

Lynne Sturm 684-2561

I have read the above explanation of the research study and my questions have been answered. I agree that I and my baby will participate and I agree to the audiotaping of my talk with Ms. Sturm.

I understand that the researchers will attempt to answer questions that I have during the course of the investigation. I may, of course, withdraw from this study at any time without interfering with my child's or my own medical treatment at Duke Medical Center if I or my child are patients at any time.

Parent's signature ______________________

Witness ______________________________

Date ________________________________

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APPENDIX B

PROCEDURES FOR WAKING AND COMFORTING INFANT DURING ASSESSMENT

Employ the following procedures for a maximum of 5 minutes if the baby is in a drowsy state:

1. Talking and gently stroking baby
2. Jiggling the baby gently (while supporting head and back) while talking
3. Raising baby to an upright position while talking
4. Lifting baby to shoulder and walking around room while talking

Employ the following procedures for a maximum of 5 minutes if the baby is fussy, crying, or motorically agitated:

1. Loom face toward baby while talking
2. Restrain baby's arms while talking
3. Lift baby to shoulder while talking
4. Hold baby at shoulder and rock gently while talking
5. Present pacifier
APPENDIX C

ITEMS ADAPTED FROM THE BRAZELTON NEONATAL BEHAVIOR ASSESSMENT SCALE

Criteria for Scoring Auditory Responsiveness

Relevant Stimuli: Inanimate Auditory (rattle)
Animate Auditory (voice)

Score

1--No observable change in behavior following sound.

2--Eye-blinks, respiratory changes or increased motoric arousal following sound.

3--General quieting from pre-stimulus level of motoric activity; may be accompanied by eye-blinks and/or respiratory changes.

4--Stills and brightens, but no clear cues of attempt to locate source of sound.

"Stills and brightens" refers to a decrease in random activity, change in facial expression, jagged respirations, and eyes widening with a brighter look.

5--Eyes shift to sound, baby stills and brightens but head turn is not seen.

6--Stills and brightens, eyes shift toward source of sound, and head turns slightly toward origin of sound (< 90 degree head turn).

7--Stills and brightens, eyes shift toward source of sound, and head turns decidedly toward origin of sound (approximately 90 degree head turn).

8--Stills and brightens, eyes shift toward source of sound, head turns decidedly toward origin of sound (approximately 90 degree head turn); after head turn, eyes seem to search for source of sound and face seems to alert to sound.
Criteria for Scoring Visual Responsiveness

Relevant Stimuli: Inanimate Visual (ball)
Animate Visual (face)
Animate Visual and Auditory (face and voice)

Score

1--Baby does not still and brighten or focus on stimulus.

2--Baby stills and brightens to stimulus.

"Stills and brightens" refers to changes in facial expression, widening of eyes and a bright look, jagged respirations, with an associated decrease in random activity.

3--Baby stills and brightens to stimulus, focuses on stimulus for at least 2 seconds, but either no visual tracking is observed or tracking is exhibited for a very small arc (less than or equal to 15 degree arc).

4--Baby stills, focuses on stimulus, and then tracks stimulus for a 30 degree arc once during a single stimulus presentation (i.e., stimulus is moved from midline to the side in a 90 degree arc); eye movements are jerky.

5--Baby focuses and tracks for at least a 30 degree arc with smooth eye movements, visually loses stimulus but finds it again.

6--Baby tracks stimulus with head turn and eye movements for at least 30 degree arcs; eye movements are smooth.

7--Baby tracks stimulus with eyes and head for at least a 60 degree arc with partly continuous movement; loses stimulus occasionally and head turns to follow.

8--Baby follows stimulus with smooth continuous head movements horizontally for 120 degree arc.

Alterations in Scoring of Visual Responsiveness

1. Numbers 5 and 6 are combined into

#5: Baby stills, focuses on stimulus and then visually tracks stimulus for a 30 degree arc with a head turn during a single presentation
of the stimulus; baby's head and/or eyes may overshoot the stimulus, thereby losing it.

or

Baby stills, focuses on stimulus, and tracks for more than a 30 degree arc during a single presentation of the stimulus; no head turn is seen but baby seems to strain his eyes at corners to maintain visual contact; impression is of prolonged engagement with the stimulus.

2. Numbers 7 and 8 are combined into

#6: Baby stills, focuses on stimulus, and tracks for more than a 30 degree arc with an accompanying head turn during a single presentation of the stimulus; impression is of prolonged engagement with the stimulus.

3. Number 9 is altered to

#7: Baby stills, focuses on stimulus, and tracks smoothly across a single presentation of the stimulus without losing it for 60 to 90 degree arc; eye and head movements are smooth and coordinated; impression is of prolonged engagement with the stimulus.

Criteria for Scoring Rouse-Console

Rousing refers to tactile or auditory stimulation or postural changes necessary during the exam to stimulate the infant so that he is in a quiet and awake state and available for interaction.

Consoling refers to tactile or auditory stimulation or postural shifts necessary during the exam to reduce negative arousal which indicates distress, discomfort, or motoric agitation so that the baby is in a quiet and awake state and available for interaction.

Score

0—After initial positioning, the infant does not require rousing or consoling in order to be available for interaction.

1—After initial positioning, the infant requires rousing or consoling occasionally across the exam in order to be available for interaction (less than one-third of total exam time).

or

Pacifier was presented to baby and had a calmsing and alerting effect such that baby was available for interaction during remainder of exam.
2--After initial positioning, the infant predictably requires either rousing or consoling during the exam in order to be available for interaction, but there are times when he/she can maintain a quiet and alert state (intervention is necessary for one-third to two-thirds of the total exam time, whether pacifier was used or not).

3--After initial positioning, the infant constantly requires rousing or consoling in order to be available for interaction and has only fleeting periods during which he/she can maintain a quiet and alert state without examiner intervention; if pacifier was used, it failed to have a quieting effect on the baby.

Criteria for Scoring Alertness

Score

1--No alert responsivity during the examination.

2--Due to the great difficulty encountered in either bringing the infant up from lower states (1, 2, 3) or down from higher states (5, 6) the infant is only alert for fleeting periods and is rarely available for stimulation.

3--With moderate difficulty the infant is brought to brief periods of alertness and is slightly more available for stimulation.

4--Infant periodically achieves alert state but eyes wander and are generally uncoordinated; facial expression is not involved in alerting; focusing is minimal if present at all.

5--Infant achieves stable, brief alert state; eyes widen and shine and are generally coordinated; focusing is brief or minimal.

6--Infant focuses on stimuli for moderate periods, may repeatedly overshoot moving object; eye movements are saccadic; head and eye movements are not coordinated.

7--Infant demonstrates modulated alert responsiveness at times during the examination; entire face participates in responses: mouth opens and rounds, eyebrows raise; head and eye movements are at times coordinated; infant can let go of stimulus.

8--Infant demonstrates modulated alert responsiveness for moderate periods of the examination; entire face participates in the response as in (7); head and eye movements are generally coordinated; infant can let go of stimulus.
9--Infant demonstrates modulated alert responsiveness for prolonged periods of the examination; face and body participate fully in communicating the infant's responsiveness; infant can let go of stimulus.

**Alterations in Scoring Alertness**

1. Numbers 2 and 3 are combined into

   #2: Due to great difficulty encountered in either bringing the infant up from lower states (sleep) or down from higher states (motoric activity, crying), the infant is only alert for fleeting periods and is rarely available for stimulation.

2. Numbers 4 and 5 are combined into

   #3: Infant achieves an alert state for most of the exam but eyes are saccadic in their movements, appearing uncoordinated and "wandering"; facial expression is not observed during alerting spells; focusing is brief or minimal if present.

3. Number 6 is altered to

   #4: Infant achieves stable, alert state for most of the exam and can focus on stimuli for most of the stimuli presentations but may repeatedly overshoot moving object with eyes or head; eye movements may be saccadic and head and eye coordination is absent.

4. Number 7 is altered to

   #5: Occasionally, during the exam (up to one-third of stimuli presentations) the baby demonstrates modulated alert responsiveness.

   "Modulated alert responsiveness" refers to participation by the entire face in response to the stimulus: the face is softened, the mouth may open and round, the cheeks and eyebrows may raise for brief periods, alertness seems focused on the stimulus and the infant appears attentive and engaged.

5. Number 8 is altered to

   #6: For up to one-half of stimuli presentations, the baby demonstrates modulated alert responsiveness.

6. Number 9 is altered to

   #7: For nearly all of the stimuli presentations, the baby demonstrates modulated alert responsiveness.
APPENDIX D

CRITERIA FOR SCORING ON MORBIDITY SCALE
<table>
<thead>
<tr>
<th>Name</th>
<th>Birthweight</th>
<th>Gestational age</th>
<th>Apgars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admission date</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Day number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
|-------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Convulsions  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Hydrocephalus |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Intracranial hemorrhage    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Nil per os                |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Diarrhea                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Necrotizing enterocolitis  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Meningitis                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Sepsis                     |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Apnea                      |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Respiratory distress syndrome |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Pneumotherpax              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Chronic lung disease       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Congestive heart failure   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Tracheostomy               |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Hyperbilirubinemia         |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Hypoglycemia               |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Acidosis                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Bleeding tendency          |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Anemia                     |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Perinatal asphyxia         |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

Observations.
Chronic lung disease
3 confirmed on X-ray, requiring ventilation
2 nasal catheter O₂ and negative pressure box
1 extra O₂ including O₂ catheter (low flow O₂)

Cardiac failure
3 intractable CCF despite vigorous treatment
2 CCF with symptoms requiring Lasix and responding to Indomethacin
1 CCF requiring digoxin (and diuretics) but condition stable
   (do not rate PDA with no failure)

Hyperbilirubinemia
2 exchange transfusion
1 jaundice requiring phototherapy
   do not rate jaundice which is not treated with phototherapy

Hypoglycemia
3 producing apnea or convulsions
2 requiring persistent high glucose intravenous infusion
   of over 10% dextrose solution
1 transient and easily corrected <20 mg/day

Acidosis
3 pH < 7.0
2 pH between 7.01 and 7.09
1 pH between 7.1 and 7.19

Bleeding tendency
3 fulminating disseminated intravascular coagulation or
   pulmonary hemorrhage
2 bleeding requiring transfusion
1 abnormal laboratory tests for coagulation;
   i.e., PT > 15 seconds
   PTT > 70 seconds
   Platelets < 100,000

Anemia
3 Life threatening anemia requiring transfusion correction
1 anemia requiring top-up transfusion

NPO
1 if baby NPO more than 12 hours a day

Tracheotomy
3 surgery
2 problems with tracheotomy
1 satisfactory tracheotomy
Necrotizing enterocolitis

3 perforation or surgery or very poor condition
2 active necrosis with marked distention; X-ray changes confirming necrosis; concerns about perforation; or ostomy with problems in functioning
1 necrotizing diagnosis on initial X-ray; or blood in stools and patient put on total parenteral regimen; colostomy or ileostomy without problems

Meningitis

3 very poor condition; shock or convulsions
2 proven meningitis by positive blood cultures; condition stable or ventricular reservoir in place
1 meningitis well controlled by antibiotics and sterile CSF

Sepsis

3 very poor condition, shock, disseminated intravascular coagulation; clinical signs of septicemia; e.g., exchange transfusion required
2 sepsis confirmed by positive blood culture; elevated WBC and condition fair. Score 2 for 48 hours after infection confirmed or infant's condition not substantially improved (look at O₂ requirements and activity to see if better)
1 mild infection (cultures must be positive) or serious infection well controlled with antibiotics (no score for antibiotics given for suspected infection only)

WBC normal values
- at birth 20,000 to 40,000
- 2 days 10,000 to 40,000
- 2 weeks 5,000 to 25,000
- 3 months 5,000 to 15,000

Pneumothorax

3 bilateral pneumothorax; or central cyanosis, before drain
2 pneumothorax - drain inserted
1 drain inserted and functioning satisfactorily

Apnea

3 requiring ventilation
2 requiring CPAP or bagging 3 times a day
1 requiring extra Oxygen or aminophylline

Respiratory distress syndrome

3 requiring ventilation
2 requiring CPAP
1 extra O₂ requirements
**Convulsions**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>3</td>
<td>frequent motor convulsions ( \geq 6 \text{ per day} )</td>
</tr>
<tr>
<td>2</td>
<td>1 - 5 convulsions per day</td>
</tr>
<tr>
<td>1</td>
<td>anti-convulsive therapy but no seizures</td>
</tr>
</tbody>
</table>

**Hydrocephalus**

<p>| | |</p>
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<tr>
<th></th>
<th></th>
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<tbody>
<tr>
<td>3</td>
<td>surgery - shunt inserted, head size rises ( &gt; 0.5 \text{ cm/day} )</td>
</tr>
<tr>
<td>2</td>
<td>rapid increase in head size ( &gt; 2 \text{ cm per week or } &lt; 0.5 \text{ cm/day} )</td>
</tr>
<tr>
<td>1</td>
<td>hydrocephalus without increase in head circumference and good shunt function</td>
</tr>
</tbody>
</table>

**Intracranial hemorrhage**

<p>| | |</p>
<table>
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<tr>
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<tbody>
<tr>
<td>3</td>
<td>massive I.C. hemorrhage and major symptoms such as convulsions, apnea confirmed on LP or CAT scan or ultrasound</td>
</tr>
<tr>
<td>2</td>
<td>moderate ICH with signs such as irritability and head retraction or ICH with residual signs. Signs may also be: decrease in hemoglobin, deterioration in baby's condition or blood in CSF</td>
</tr>
<tr>
<td>1</td>
<td>ICH confirmed on CAT scan, or ultrasound, with some deterioration in condition (If ICH is confirmed on CAT scan but patient exhibits no signs or symptoms, do not rate - not a problem.</td>
</tr>
</tbody>
</table>

**Perinatal asphyxia**

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<table>
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<tbody>
<tr>
<td>3</td>
<td>cardiac arrest or prolonged attempts at resuscitation at birth or during transfer, severe neurological signs, apnea or frequent convulsions, Apgar &lt; 5 at 5 minutes of age</td>
</tr>
<tr>
<td>2</td>
<td>neurological abnormalities; e.g., extensor hyper-tonus, transient myocardic ischemia or moderate acute renal tubular necrosis</td>
</tr>
<tr>
<td>1</td>
<td>mild irritability or hypotonia, intubated at birth, but Apgar &gt; 5 at 5 minutes</td>
</tr>
</tbody>
</table>

**Diarrhea**

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<table>
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<tbody>
<tr>
<td>3</td>
<td>severe dehydration from diarrhea; loss of 10% body weight requiring rehydration</td>
</tr>
<tr>
<td>2</td>
<td>moderate dehydration requiring IV fluids</td>
</tr>
<tr>
<td>1</td>
<td>diarrhea noted and treated by dietary restrictions only</td>
</tr>
</tbody>
</table>
APPENDIX E

MATERNAL INTERVIEW QUESTIONS

Section 1: Caretaking Practices

Let's imagine that a friend of yours recently had a preterm baby very much like (mother's infant's name), born (gestational age of mother's infant) weeks early like (mother's infant's name) and in the hospital about as long as (mother's infant's name) was. Now suppose that she is getting ready to take her baby home from the hospital and she asks you how taking care of a preterm baby compares to taking care of a 9-month term baby. What might you suggest to her?

I'd like to run through a couple areas to make sure we didn't overlook anything.

1. What would you tell her about feeding a preterm baby, compared to a 9-month term baby?

2. What would you tell her about picking up or holding a preterm baby, compared to a 9-month term baby?

3. What about playing with a preterm baby, compared to a 9-month term baby?

4. What would you tell her about watching or checking a preterm baby, compared to what she'd do with a 9-month term baby?

5. What would you tell her about giving a preterm baby attention or stimulating him/her with sights and sounds, compared to a 9-month term baby?

6. When you think about the first three months at home with (mother's infant's name), what do you imagine in the way of colds and illness?

7. Is there anything else you would tell your friend about taking care of a preterm baby?

Section 2: Developmental Expectations

I'm also interested in mothers' hunches and feelings about their babies--how and when babies start doing things like babbling and crawling.
I'd like to hear your own hunches or guesses about the months ahead for (mother's infant's name).

Many of the things we will talk about are things that parents may not have had a chance to think about before, because they've been so busy getting ready for their baby to come home. So don't be surprised if you want to stop and think for a while before sharing your thoughts with me. We have plenty of time and there are, of course, no right or wrong answers--just feelings, guesses, and hunches.

1. From being around (mother's infant's name) so far, what is your hunch about when he/she will start to sit on his/her own?

Is that about the same time as other babies, a little earlier or a little later than most babies?

2. What is your sense of when (mother's infant's name) will become very very alert and responsive to the world around him/her--to sights and sounds?

Is that about the same time as other babies, a little earlier or a little later than most babies?

3. What is your sense of when he/she will be able to reach and grasp for a toy?

Is that about the same time as other babies, a little earlier or a little later than most babies?

4. What is your sense of when he/she will be able to walk a few steps on his/her own?

Is that about the same time as other babies, a little earlier or a little later than most babies?

5. What is your sense of when he/she will start to talk, to say a few words clearly so you can understand them?

Is that about the same time as other babies, a little earlier or a little later than most babies?

6. What is your sense of when he/she will start to play back when you are playing face-to-face with him/her?

Is that about the same time as other babies, a little earlier or a little later than most babies?
7. What is your sense of when he/she will start to understand a few words you say to him/her?

Is that about the same time as other babies, a little earlier or a little later than most babies?

8. (Prior exposure to preterm infants) Do you remember your friends or family saying anything about preterm babies--what they're like or what it's like to take care of them? Have any members of your family ever had a preterm baby?

Section 3: Parental Influencability of Development

For each of the milestones in Section 2, ask the following:

1. What about (milestone)? What is your sense of how (mother's infant's name) will come to (perform milestone)? What takes place or happens so that a baby starts (performing milestone)?

2. Is (milestone) something that babies start doing on their own or is (milestone) something that a parent can have a role in, and work with the baby on?

(If mother says parent can help baby with milestone, ask: What could a parent do?)

Section 4: Face-to-Face Play

Let's imagine that you are playing face-to-face with (mother's infant's name) during the next couple months at home.

1. Suppose that he/she is looking around at things in the room. How will he/she come to look at you? What would happen such that he/she would start looking at you?

Is his/her looking something that you think he/she'd usually do on his/her own or something that he/she would do in response to something you did? Which would happen more often--his/her looking at you all on his/her own or his/her looking because of something you did?

(If mother attributes infant's response to her actions, ask: What could you do so he/she would look at you during play?)

2. Suppose that he/she smiles at you during play. How would that come about? What would happen such that he/she would smile at you?
Is his/her smiling something that you think he/she'd do on his/her own or something that he/she would do in response to something you did? Which would happen more often--his/her smiling at you all on his/her own or his/her smiling because of something you did?

(If mother attributes infant response to her actions, ask: What could you do so he/she would smile at you during play?)

3. Suppose he/she wasn't wet or hungry or sick, but he/she became fussy while you two were playing. How would it come about that he/she would quiet down and be ready to play again? What would happen such that he/she would quiet down and be ready to play?

Is his/her quieting down something that you think he/she'd do on his/her own or something that he/she would do in response to something you did? Which would happen more often--his/her quieting down on his/her own or his/her quieting down because of something you did?

(If mother attributes infant's response to her actions, ask: What could you do so he/she would quiet down and get back into the mood to play?)
DEFINITIONS OF MATERNAL ATTITUDES

Protection Attitudes

1. Mother needs to be more careful, cautious, or cleaner with baby than with a fullterm (general statement).

2. Compared to a fullterm, mother needs to limit or restrict more of baby's exposure to people or to environment.

   For example, restrict who has contact with baby more than one would with a fullterm; do not take baby out into public as one would a fullterm; do not expose baby to large groups of people as quickly as with a fullterm; babysitter will come to the home rather than baby going to sitter's house (if latter is the standard with fullterm).

3. Baby is more susceptible to colds or illness than a fullterm.

   For example, baby is more vulnerable to picking up germs; baby needs to be kept warmer than a fullterm baby with more clothing or warmer room temperature; impact of colds once caught is greater for baby than for fullterm; weight loss that would follow from illness is considered "disastrous" or baby can't recover from a cold as quickly as a fullterm; mother fears that baby may need to return to the hospital after discharge home.

4. Baby's physical structure is more fragile than a fullterm baby's.

   For example, baby is described as "breakable," "fragile" or "weak"; baby's bones seem less strong than a fullterm's; adults should hold baby more carefully or gently than a fullterm; adults cannot play as often or as roughly with baby as with a fullterm; baby seems more easily physically hurt; baby seems weaker with less energy reserve than a fullterm; baby fatigues more easily or mother is reluctant to act in a way that would "tire" baby.

5. Mother is concerned or worried about whether baby will feed sufficiently so as to gain weight following discharge home (either due to poor feeding by baby or maternal difficulties with feeding baby).
Note: not just statement that feeding methods differ for preterms and fullterms.

**Vigilance Attitudes**

1. Mother needs to watch baby closer or more frequently than a fullterm (general statement).

   For example, to determine first signs of illness or hunger.

2. Mother needs to respond more quickly to baby's cry or to more of baby's cry than is the case with a fullterm.

3. Mother needs to watch baby's breathing/respirations.

   For example, greater need to check baby's breathing while baby sleeps than with a fullterm; more fear of Sudden Infant Death Syndrome than with a fullterm; compared to a fullterm, baby's sleeping quarters are closer in proximity to mother's sleeping quarters so mother can "hear him" more easily.

4. Mother needs to provide baby more love, attention, or stimulation than she would a fullterm.

   For example, baby needs more frequent playing or holding by adults; mother "needs to take up more time' with baby; baby 'needs' mother more than a fullterm does; baby needs more contact with family members "to catch up" time missed during hospitalization; baby needs more environmental stimulation in order to "catch up" or to develop normally.

5. Mother is concerned about baby's future development.

   For example, mother needs to watch to see how baby responds to environmental stimulation in order to determine whether baby is doing developmentally appropriate activities (to monitor developmental progress or functioning of sensory systems); maternal anxiety about whether baby will be a "slow learner," delayed in developmental milestones or "retarded" in comparison to other children.

**Prior Exposure to Preterm Infants**

**Score**

0--No report of prior contact with preterm infants or with older children who were born prematurely.
1--Mother's friends or acquaintances gave birth to a preterm infant, but mother has not directly cared for a preterm infant.

2--A member of mother's family of origin or extended family has had a preterm infant, but mother has not directly taken care of a preterm infant.

3--Mother has history of prior birth of preterm infant or has directly cared for another mother's preterm infant (e.g., babysitting).
REFERENCE NOTES


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BIOGRAPHY

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Date and Place of Birth

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Education

1972-1976 B.A. in Psychology with honors, Duke University
1977- Ph.D. program in clinical psychology, Duke University

Positions

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Presentations

