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## The Influence of Infant Crying on the Developing Mother-Infant Relationship

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THE INFLUENCE OF INFANT CRYING ON  
THE DEVELOPING MOTHER-INFANT RELATIONSHIP

by

NANCY A. RUBLE

A DISSERTATION Submitted to the Faculty of the Graduate  
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## VITA

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## CHAPTER I

### INTRODUCTION

The focus of recent theoretical and research attention on the development of the mother-infant relationship has shifted from on the mother's role in shaping the interaction to a more transactional view, considering the contributions of both the infant and the mother in forming the relationship. A large series of studies has begun to explore the ways in which infants contribute to the relationship between themselves and their primary caregivers. Many infant attributes have been investigated, including appearance, maturity, physical size, state behavior and organization, and temperament. From these studies it appears that individual differences exist among infants that make them more or less successful in eliciting optimal responses from caregivers. In general, a healthy full-term infant who is adaptable and regular in his or her behavior and who provides the caregiver with clear signals to which to respond is more likely to receive optimal care than a small, sick neonate whose behavior is difficult to read and predict. It is suggested that the former infant is rewarding to interact with and the caregiver is encouraged to continue to care for and stimu-



late him or her. On the other hand, the latter type of infant may be frustrating and aversive to interact with, provoking the caregiver to avoid or even mistreat him.

While this broad outline of the types of infant characteristics that are important in the development of the mother-infant relationship is generally well-accepted, the specific ways in which a particular variable may affect mother-infant interaction is not clear. The present study considers the effects of one infant characteristic, crying behavior, on the developing mother-infant relationship. Infant crying is perhaps the most salient of early infant behaviors and has received a great deal of research attention. Studies on infant crying have investigated such aspects of infant crying as the acoustical properties of cries (Zeskind and Lester, 1978), the physiological and emotional effects on listeners (Frodi and Lamb, 1978), and the relationship between crying and maternal responsiveness (Bell and Ainsworth, 1972). A recent study (Holmes, Ruble, Kowalski, and Lausen, 1984) found that amount of crying before discharge from the hospital at birth was instrumental in predicting quality of attachment at 12 months. Since it is apparent that crying behavior has a dramatic effect on adult humans and may be related to at least one important index of the development of the mother-infant relationship as much as 12 months later, it would seem that early crying

behavior qualifies as a variable deserving of intensive study.

This study will examine the relationships between crying at various ages during the first year of life and attachment to the mother at 9 and 12 months. It will be of interest to discover whether crying at earlier ages will be predictive of crying at later ages, whether crying at the various ages will be predictive of attachment to the mother and whether quality of attachment at 9 months will be predictive of quality of attachment at 12 months.

## CHAPTER II

### REVIEW OF THE LITERATURE

Traditional views of mother-infant<sup>1</sup> interaction have emphasized the mother's role, attributing the quality of the relationship to the type and quality of the caregiving. The mother's role in the developing relationship has been well-documented, beginning with the mother deprivation studies (Spitz, 1965) and, later, the explorations of the attributes of mothers that are predictive of the developmental outcomes of their children, such as demographic variables like age, education, and socioeconomic status and personality variables like sensitivity (Ainsworth, Bell, and Stayton, 1974) and aggression and suspiciousness (Egeland and Farber, 1984).

Although the mother's contribution to the developing mother-infant relationship is still given a place of importance in the literature, the infant's role in the dyad has also become a focus of research concern. Current views of

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<sup>1</sup> The terms mother and caregiver will be used interchangeably in this paper because the primary caregiver for most infants, including those in the sample reported here, is the biological mother, although this is certainly not always or necessarily the case.

mother-infant interaction suggest that the relationship of mother and infant develops out of their interactions with each other, interactions that affect the caregiver as well as the infant. This type of dyadic process assumes an interaction between two active participants. Rather than simply being acted upon, the infant is an active participant in the interaction, one who affects as well as being affected. Just as the caregiver's behavior affects the infant's behavior, the infant's behavior influences the behavior of the caregiver, eliciting some responses and reducing the probability of occurrence of others. By affecting the behavior of the caregiver, the infant influences the interactions and so contributes to the development of the relationship between himself and the caregiver (Lewis and Rosenblum, 1974; Bell and Harper, 1977).

The complexity of the dyadic relationship, and the complex chains of effects, makes it difficult to determine in any particular instance outside laboratory situations whether environmental factors (including caregiving) are influencing infant behavior or whether infant behavior is influencing the environment. For example, if the mother appears to be cold and rejecting in her interactions with her infant, it could be the case that the mother is in fact cold and rejecting, has always been cold and rejecting and can be expected to continue to be cold and rejecting. Or,

the mother's cold and rejecting behavior could be secondary to physical or behavioral abnormalities in the child.

Perhaps the clearest discussion of the complexities of causation can be seen the work of Sameroff and Chandler (1975) in which they have challenged the retrospective approach to explaining deviancy, claiming that it overemphasizes the contributions of early experience, and sees the infant as a steady-state organism, while ignoring the complex dyadic interactions that can occur. For example, Sameroff and Chandler report that retrospective studies found a clear relationship between anoxia at birth and later brain damage. However, when asphyxiated infants were followed prospectively, only a few were found to be affected; for most, the effects of the early trauma were not observable.

Sameroff and Chandler proposed a transactional model to explain these findings. In this model, the relationships among constitution, environment, and developmental outcome are all considered, acknowledging the changing nature of the environment and the fact that the child is "an active participant in its own growth" (p. 235). Thus, behavioral disorder is seen as the result of an ongoing dysfunction in the transaction between individual and environment rather than the result of a single traumatic event. Specifically, then, if one finds retrospectively a high incidence of behavior disorder in anoxic infants, it is impossible to determine

whether this is due primarily to the anoxia or to changes in caregiving behavior that occur when parents have a high risk infant.

In a similar vein, Clarke and Clarke (1976) suggest that the ongoing dysfunction itself is mediated by both the child and the environment. For instance, on the basis of some perceived constitutional deficit (e.g., mental retardation) a child in an inadequate institutional environment may be considered to be unadoptable. As a result of being maintained in an inadequate environment, he becomes even more retarded, thereby confirming the notion that he was unadoptable. It is very difficult in such a case to determine how much constitutional and environmental factors each contribute to developmental outcome.

The issue of relative contributions of individual constitution and the caregiving environment to developmental outcome has been explored in a number of studies that have examined the ways in which infants affect adult caregiving, as well as many that have focused on the caregiver's contribution to the interaction. The fact that the quality of caregiving affects the mother-infant relationship has been well demonstrated. Approaches to investigating what the mother brings to the relationship have ranged from studying the effects of maternal deprivation to examining the impact of such variables as socioeconomic status (SES), education,

and obstetric experience on the development of infants. What the infant contributes to the formation of the relationship has received more attention as such variables as the infant's appearance (Maier, Holmes, Slaymaker, and Reich, 1984), state organization (Korner, 1972), and temperament (Thomas and Chess, 1977) have been investigated. These studies have begun to document the infant's role as an active participant in the mother-infant dyad and to transform the image of the infant as a "blank slate" receptacle of experience into one in which the infant actively organizes experiences and affects the environment from the very beginning of life.

The infant brings several characteristics into the mother-infant relationship, one of the most obvious being her physical appearance. Ethologists have suggested that particular infant characteristics evoke certain behavioral responses in adults. In a recent study (Maier, Holmes, Slaymaker, and Reich, 1984), composite drawings were made from photographs of three groups of infants: young preterms (31-34 weeks conceptional age, older preterms (35-37 weeks conceptional age) and full-terms (40 weeks conceptional age). From the original photographs it was determined that the preterm infants differed significantly from the full-terms in the location and width of the eyes and the roundness of the face. In general, full-terms had wider, rounder

faces with larger eyes and with their eyes closer to the middle of the face. Since these characteristics correspond closely with the "babyish" features that Lorenz (1971) suggested evoke nurturant behavior in adults, one would expect that the full-terms would be more successful in eliciting such behaviors. This view was supported by the further finding that when these drawings were shown to college students, with no other information, they rated the composite drawing of the full-term infants as more likeable, attractive, cute, and normal. Moreover, the preterms depicted were judged to "function" more poorly: they were believed to cause their parents more worry, to be less fun to be with, to be more irritating, to have more eating problems and be less able to make people happy. In addition, subjects reported that, on the basis of the appearance of these infants alone, they would be less inclined to interact with the preterms (i.e., take them home, babysit for them, be close to them or take care of them) than with the full-term infants. It is evident that, with no other information available, the appearance of these infants influenced the reactions of adult raters. It is likely that parents of such children might have some of the same reactions, resulting in problematic interaction with less attractive infants, especially preterms.

Preterm birth also affects the health and integrity of



the infant, which, in turn, affects adult reactions to him or her. DiVitto and Goldberg (1979) suggest that a preterm birth results in an infant who is socially less competent than a full-term infant combined with parents who are less confident because of the perception of having failed to produce a normal infant. This combination can produce parent-infant interactions that are more problematic and less rewarding for both parent and infant. DiVitto and Goldberg studied the neonatal behavior and later feeding interactions of healthy full-terms, healthy preterms, sick preterms and the infants of diabetic mothers. They administered the Brazelton Neonatal Behavioral Assessment Scale (BNBAS) at birth and again after the infant had been at home for 10 days. It was found that full-term infants were more alert and less irritable at birth and they became even more alert and less irritable after 10 days at home. The three high risk groups were found to be less alert and more irritable at birth. After the preterm infants had been home for 10 days, they were even more irritable, and were more difficult to interact with than healthy full-terms. When observations were made during feeding interactions, significant group differences were found both at the first feeding and at the feeding observed in the home after 10 days. Differences were found in the percentage of time infants were held in the lap: sick preterms were held in the lap more than infants

of diabetics, who were held more than healthy preterms, who were held more than healthy full-terms. Conversely, healthy full-terms and infants of diabetic mothers were cuddled in the arms during feeding more than were the preterm infants. At four months feedings, group differences were no longer significant but some infant neonatal behaviors were significantly related to maternal behaviors (e.g., infants' response to voice during the pre-discharge BNBAS was significantly and positively correlated with percentage of time the infant was cuddled in the mother's arms at the four month feeding session). These findings indicate that parental behavior is affected by the birth status of their infants and by specific neonatal behavior. DiVitto and Goldberg note, however, that these infant variables, while significant, accounted for only a small percentage of the variance in maternal behavior, suggesting that while infant variables affect maternal behavior they do not determine it.

Another important infant characteristic that may facilitate or inhibit interaction between mother and infant is the infant's state pattern. The infant's state at any given time is the major behavioral cue he or she presents to the mother and it influences how successful her attempts at interaction will be (Thoman, 1975). For instance, mother's interventions may have very different effects depending upon the state of the infant. Korner and Thoman (1970) found

that holding an infant was extremely effective in producing alertness in and soothing a crying infant but only moderately effective in changing the state of a sleeping infant. The state of alert inactivity, when the infant is awake, with eyes bright and actively looking, and relatively little motor activity, is the optimal state for learning and for fixating visually (Korner, 1972). A mother who chooses to interact with her infant when he or she is in this state is more likely to be rewarded with the infant's attentive gaze than if the infant is in any other state category. Because there are individual differences in the amount of time spent in the various state categories, an infant who spends relatively less time in the alert inactive state may be a generally less rewarding infant with whom to interact and may in fact be interacted with less than other infants. Similarly, an infant who fusses and cries a great deal may be more aversive to interact with and may evoke avoidance in caregivers (Bell and Ainsworth, 1972). Similarly, an infant who sleeps a lot may simply be unstimulating and receive less attention than a more alert infant.

Some researchers have suggested that it may not be discrete behaviors alone that evoke positive or negative responses in caregivers (e.g., Korner, 1972). Overall competence in organizing his or her own behavior and responding to stimulation may affect caregiving responses. An infant

who is not well organized or whose states are indistinct fails to give clear signals to which a caregiver can respond (Thoman, 1975). The result is that caregivers intervene in ways which are inappropriate for the infant and experience a great deal of frustration themselves.

A state variable that has received considerable research attention is crying behavior. Crying is one of the earliest and most potent means that the infant has of influencing the behavior of the caregiver. Neonatal crying is the first form of communication for humans and it mediates the initial interactions with the environment, those that are essential for survival. Moss and Robson (1968) found that 80% of the interactions between normal one-month-old infants and their mothers were initiated by the infant's cry, indicating that the infant determines, to a great extent, the amount of attention he or she receives from the mother. An infant who does not cry enough may not receive the attention and stimulation he or she needs (Korner, 1972) while a very irritable infant may evoke avoidance in the mother (Bell and Ainsworth, 1972). Infants who cannot communicate properly from the very first, whether they cry too much or too little, may not receive the type of care that is necessary to optimal development.

It appears that infant crying is a particularly effective form of communication because of the strong impact it

has on adult listeners. A series of research studies, outlined below, has examined the acoustic features of the cries of normal and at-risk infants and their physiological and emotional effects on adult listeners, both parents and nonparents, male and female.

One of the ways in which crying exerts its influence on the environment is by producing physiological arousal in human listeners, especially adult caretakers. Frodi and her associates (Frodi and Lamb, 1978; Frodi, Lamb, Leavitt, and Donovan, 1978) used skin conductance and diastolic blood pressure measures to assess physiological effects of infant crying on listeners of differing age and gender. They found that hearing an infant cry elicited increases in blood pressure and skin conductance. Mothers and fathers did not differ in their physiological responses to infant cries, and, in fact, all male and female subjects had the same response to infant crying at all ages, although male and female adolescents differed in their overt behavior toward infants.

The cries of some groups of infants differ from those of other groups, producing differential arousal in adult listeners. Zeskind and Lester (1978) found that there were acoustical differences in the cries of newborns with prenatal and perinatal complications. The cries of newborns with complications had a higher fundamental frequency (813.9 hz vs 468.3 hz) than those of healthy, normal newborns. Adults

rated such cries as "more aversive, grating, sick, urgent, distressing, piercing, discomforting and arousing". In another study (Frodi, Lamb, Leavitt, Donovan, Neff, and Sherry, 1978) it was found that the physiological response to the cries of a premature infant was more pronounced than the response to the cry of a normal newborn, especially if the cry was paired with the videotaped face of the crying premature infant. In addition, parents reported that the cry of a premature infant was more aversive than that of a full-term infant.

In addition to being sensitive to the differences in cries of infants who physically at risk, adult listeners can also detect variance in the cries of infants of differing temperaments. Lounsbury and Bates (1982) measured the acoustic properties and effect on listeners of the cries of infants of differing temperaments. They found that the cries of infants who had difficult temperaments had a higher fundamental frequency at the peak of loudness. The difficult infants also paused longer within and between cry bursts, which the authors interpreted as adding a sense of urgency to the cry. Unrelated mothers rated the cries of these infants as more irritating and spoiled-sounding. Boukydis and Burgess (1982) focused on the physiological and emotional responses of adults differing in parental status who listened to the cries of infants of differing tempera-

ments. Nonparents and multiparous parents had highest levels of physiological arousal to the cries of infants with difficult temperaments and lowest levels of arousal to the cries of infants rated as easy, although primiparous parents experienced the highest level of arousal to the cries of average infants. The cries of difficult infants in this study were also rated as more irritating and spoiled-sounding and were described as more grating, piercing, arousing, and less similar to their own infants' cries.

These studies have demonstrated that from birth infants' cries have a profound physiological and emotional effect on other humans that is only partially mediated by social role and caregiving experience. From an ethological perspective, crying can be seen as a primary factor in ensuring the infant's survival by keeping caretaking adults nearby (Bowlby, 1969, 1980). In addition to fulfilling this initial role in the infant's early survival, crying may also play a role in the development of the social relationship between mother and infant. In a study of crying behavior in infants during the first year of life, Bell and Ainsworth (1972) observed infants and their mothers in the home for approximately four hours every three weeks during the first year. The number and duration of infant crying episodes were recorded, as was the mother's response (i.e., whether or not she ignored the cry). They found several interesting

relationships between the frequency and duration of infant crying and maternal responsiveness. In terms of frequency of crying, there was a tendency for babies whose mothers ignored their cries to cry more frequently after the first quarter of the year. The frequency of infant crying did not, however, seem to affect maternal responsiveness. The effects of maternal responsiveness on duration of infant crying were similar: infants whose mothers ignored their cries tended to cry for longer periods after the first quarter. Unlike the frequency of crying, however, duration of crying did seem to influence maternal responsiveness in the second half of the year. The already unresponsive mother became even more unresponsive to her infant's persistent crying, creating what Bell and Ainsworth call a "vicious spiral". The mother's unresponsive behavior induces the infant to continue crying, producing even more reluctance on the mother's part to respond, which results in even more irritability in the infant. These findings clearly illustrate the mutual influence the infant and the caregiver have on each other.

A recent study (Holmes, Ruble, Kowalski, and Lauesen, 1984) addressed the question of whether neonatal behavior has an effect on the mother-infant relationship that persists into the development of attachment as measured at 12 months. Twenty-four full- and preterm infants from intact



middle-class families were assessed along several dimensions during the neonatal period and then again at 12 months. Data collected in the neonatal period included pre-and post-natal risk factors, Apgar scores, Brazelton Neonatal Behavioral Assessment Scale (BNBAS) scores, and behavioral state observations, as well as sex, length of hospitalization and gestational age. At the 12-month follow-up, the infants and their mothers experienced Ainsworth's Strange Situation (Ainsworth and Wittig, 1969), which is designed to assess the infant's response to separation from and the quality of his or her attachment to the mother. On the basis of his or her response to this strange situation, the quality of the infant's attachment was classified as anxious (with two subtypes, avoidant and ambivalent) or secure.

The results of this study indicated that quality of attachment at 12 months is most successfully predicted by a combination of obstetric risk complications and crying behavior in the neonatal period. Secure attachment was preceded by lower perinatal risk factors and lower amounts of crying after birth. Avoidant and ambivalent attachment were related to increased perinatal risk factors combined with more crying in the neonatal period. Crying alone discriminated the Avoidant and Secure groups and the Secure and Anxious groups at a level very near significance. In addition, 87% of the anxious infants were above the mean in crying

while only 29% of the securely attached infants cried more than average. These findings support those reported by Ainsworth and her associates (Ainsworth, Blehar, Waters, and Wall, 1978), who found that anxious babies cried more frequently than securely attached infants had in the first year of life and that the duration of their cries was almost twice as long as that of securely attached infants during that period.

Ainsworth argues that such findings cannot be interpreted as a reflection of the infant's contribution to the development of attachment since another study (Bell and Ainsworth, 1972) found that infant crying behavior is highly related to maternal responsiveness. The relationship between the duration of infant crying and maternal responsiveness is particularly strong. However, they also found that infant crying was not affected by maternal responsiveness until after the infant was three months old. The Holmes et al results suggest somewhat more strongly that individual differences in the amount of infant crying may be present from birth and may have more influence on the development of the mother-infant relationship than Ainsworth's results indicated.

Differences in the way the data were collected in the Bell and Ainsworth study and in the Holmes et al study may have implications for the issue of the relative contribu-

tions of the mother and the infant to the development of attachment. The data Bell and Ainsworth reported were averaged from observations in the home every three weeks for each of the four quarters of the first year. Since the Holmes et al data were obtained only during the neonatal period, before the infants left the hospital, it is more difficult to argue that the differences found in infant crying are attributable to the mother's responsiveness. Although the experiences of the preterm and full-term infants during hospitalization were different, neither length of gestation nor length of hospitalization was a significant variable in discriminating the attachment groups, while amount of crying was very significant. These findings suggest that the individual differences in crying behavior that were found to be related to later attachment may have been present from birth.

The connection found between neonatal crying and later attachment to the mother is particularly noteworthy because a large body of literature has implicated attachment to the mother as an essential factor in infant development (e.g., Sroufe and Waters, 1977; Ainsworth et al, 1978). The development of caregiver-infant attachment figures in many psychological theories, although each explains it in a somewhat different way. In all of these theories, it is assumed that the infant's attachment to the mother or other caregiver is

the prototypic relationship, on which all later relationships are based. It is suggested that this relationship is of utmost importance because it is the first, and, therefore, the most influential. What the infant experiences or learns in this first relationship will be the basis upon which the adult will perceive and behave in further social relationships.

The term attachment refers to the affective tie that develops over time between an infant and mother or other primary caregiver. The development of attachment assumes an ability on the part of the infant to discriminate the caregiver from other adults, to display preference for and differential behavior toward the caregiver and a negative response to separation from the caregiver. Attachment can be inferred from certain behaviors (e.g., locomotion toward the caregiver or crying behavior in response to separation) but it is more than a set of particular behaviors. The term attachment is reserved to refer to the emotional bond between infant and caregiver while the phrase "attachment behaviors" refers to discrete behaviors that are related to attachment.

Attachment is central to such divergent theories as learning, psychoanalysis, and ethology, both in relation to normal social development and to the genesis of psychopathological behavior. Attachment has been called an "organiza-

tional construct" (Sroufe and Waters, 1977) which acts to integrate various behavioral systems (e.g., locomotion) to achieve certain goals (e.g., proximity to the caregiver). Bowlby (1969) suggests that the infant uses the attachment figure as a "secure base" from which to explore the environment. This observation supports the idea that attachment is a necessary prerequisite to normal development since, according to Piaget, such active exploration of the environment is fundamental to cognitive development (Flavell, 1977). The classic studies of Spitz (1965) and Harlow (1971) offer ample evidence that failures in attachment can result in severe behavioral deficits and even death in both humans and other animals. When attachment is disturbed, which is much more common than a complete failure to attach, it can be expected that some type of deficit, although less severe, may result (Bowlby, 1977).

There are several differing accounts of the ways in which the attachment between infant and caregiver develops. According to traditional learning theorists, attachment develops as a learned association. In an optimal situation, the presence of the caregiver is consistently paired with such unconditioned positive stimuli as food, warmth and dryness. The absence of the caregiver is associated with noxious stimuli such as hunger, coldness and wetness. The caregiver soon becomes a conditioned stimulus and the infant

begins to respond positively to his or her presence alone. Or, in operant terms, being in the presence of the caregiver is usually followed by positive reinforcement in the form of food, warmth and comfort and, as a result, the infant learns to maintain proximity to the caregiver. Thus, the mother becomes a reinforcer in her own right, her presence is rewarding, and she is actively sought by the child. Similarly, the absence of the mother is associated with aversive events and hence comes to be negatively reinforcing. As a result, the mother's absence is actively avoided. These associations are eventually generalized from the mother to include other people and the individual continues to perceive people in a positive way. Conversely, an infant who learns to associate negative outcomes with the presence of the mother, or who forms no consistent associations, would be expected to develop interpersonal problems (Dollard and Miller, 1950).

The psychoanalytic view is similar to the learning perspective in the sense that it also involves an association of the caregiver with the satisfaction of basic needs, especially feeding. According to psychoanalytic theory, the infant first becomes cathected to the breast as the source of the reduction of tension arising from hunger. Gradually, the infant begins to associate this drive reduction with the mother herself and becomes cathected to her. Because the

infant recognizes mother as necessary to the continued satisfaction of his or her basic needs (and, thus, the preservation of life), her presence becomes of utmost concern to him or her. When the mother is absent, the infant experiences anxiety because he or she fears that basic needs will not be satisfied. As a result of these experiences around feeding, mother is for the infant "unique, without parallel, established unalterably for a whole lifetime as the first and strongest love-object and as the prototype of all later love relations" (Freud, 1938; Ainsworth, 1969).

Like these two theories, ethological theory sees attachment as fundamental to development. However, unlike the two theories just described, ethological theory does not conceive of attachment as deriving from an association of the mother on the one hand and pleasurable feelings and satisfaction of needs on the other. Rather, according to the ethological perspective, attachment results from a set of instinctual behaviors on the parts of both the infant and adult caregivers. For example, Lorenz (1971) has suggested that the infant has a number of physical characteristics that are perceived as "babyish" and that evoke nurturant behavior in adult humans. These characteristics include heavy, short limbs, proportionally large heads, high and protruding foreheads, large eyes placed in the middle of the face, small noses and mouths, and fat cheeks (Maier, Holmes,

Slaymaker and Reich, 1984). These physical traits, combined with certain types of behavior (e.g., uncoordinated movements) and specific reflexes (e.g., Moro) serve to ensure the maintainance of proximity of the caregiver to the infant. This in turn, ensures the survival of the individual infant and, ultimately, the species as a whole.

These three theories share the view that attachment to the mother (or other primary caregiver) in infancy is critical to normal development, although they differ in the mechanisms involved. However, the theories outlined above share, to a greater or lesser degree, at least two limitations. First, they conceive of attachment as something that develops in the infant alone. Secondly, they portray the infant as a more or less passive recipient of caregiving, although this is less true of ethological theory than of the other two. These explanations emphasize the mother's role in shaping the interaction, attributing the quality of the relationship to the quality of the caregiving and see the child as something of a "blank slate", thereby ignoring much of the dynamic process of the development of attachment. In contrast to the learning, psychoanalytic, and ethological theories, the transactional model offers an explanation of the development of attachment that is based on the evolving interactions of both mother and infant behaviors. The transactional model accounts more adequately for recent



research on the various effects of infant behavior on caregivers, such as responses to infant crying.

As can be seen, theories about the development of the caregiver-infant relationship have moved from an emphasis on the caregiver's contribution to a more recent consideration the infant's role and of the interaction of caregiver and infant contributions to the development of the mother-infant relationship. It appears that various aspects of infant behavior are of particular importance in influencing the developing mother-infant relationship, including appearance, state behavior, and perinatal status. Of these characteristics, crying has been identified as a particularly salient stimulus to caregivers.

Since neonatal crying appears to have an impact on the developing mother-infant relationship, it is important to understand the specific ways in which that impact is manifested. The present study was designed to examine the relationship between infant crying and the development of attachment between infant and mother. Crying behavior during the first year of life will be examined and an attempt will be made to determine whether neonatal crying is related to later crying in ways that affect the attachment relationship. This will be done by observing mother-infant dyads at several points during the first year of life. A discriminant analysis will be performed and a correlation matrix

will be generated in order to determine what types of relationships exist between amount of crying at birth and at later ages and whether crying at these various ages is related in such a way that the connection between neonatal crying and attachment at 12 months can be explained within the framework of the transactional model. The transactional model suggests that the development of the mother-infant relationship is dependent upon the behavior of each partner in the dyad and that the behavior of each partner is modified by the behavior of the other. This study poses a question about a segment of infant behavior and its effect on the mother-infant relationship: does neonatal crying influence both mother and infant behavior so that their interactions with each other are modified in such a way that the quality of the attachment between them is affected? It is expected that crying at earlier ages will be predictive of crying at later ages (that is, an infant who cries a great deal at birth in comparison to other infants will also cry a great deal two months and at six months as compared to other infants of the same ages). In addition, it is expected that higher amounts of crying and a shorter latency to cry will be associated with anxious attachment to the mother, while lower amounts of crying and longer latency to cry will be related to secure attachment. Finally, it is expected that quality of attachment at 9 months will be predictive of

quality of attachment at 12 months.

## CHAPTER III

### METHODS

#### Subjects

The subjects of this study are 44 infants who were born at Evanston Hospital in Evanston, Illinois from 1979-1980. All of the infants were from middle class, intact families, had appropriate prenatal care, were of appropriate birth weights for their gestational ages, and were without known central nervous system damage.<sup>1</sup> The infants differed in perinatal experience, which varied in length of gestation, length of hospitalization, and illness, and were grouped according to their perinatal status.

1. Preterm birth (PT). The gestational age of these 15 infants was less than 36 weeks (mean gestational age was 33 weeks, with a range of 28 to 36 weeks) as determined by the Dubowitz assessment (Dubowitz, Dubowitz, and Goldberg, 1970). All but

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<sup>1</sup> These subjects are a group of medically-at-risk infants who are participants in an ongoing long-term study of the effects of perinatal experience on development. Co-principal investigators are Deborah L. Holmes, Ph.D. and Jill N. Reich, Ph.D. of Loyola University of Chicago and Evanston Hospital. This research is supported in part by a social and behavioral sciences research grant from the National Foundation of the March of Dimes.

one of these infants suffered mild to moderate Respiratory Distress Syndrome; one of them was stable from birth. All of the infants were hospitalized in the Intensive Care Nursery (ICN) until they could sustain 4-hour feedings. Mean length of hospitalization was 26 days, with a range of 4 to 78 days.

2. Full-term infants in intensive care (FT/ICN). This second group of 10 infants are those who, although they were full-term at birth (mean gestational age was 40 weeks, with a range of 37 to 42 weeks) remained in the Intensive Care Nursery because of medical complications. The infants had various medical problems, including 5 with surgical problems, 3 with sepsis, 3 with meconium aspiration and Respiratory Distress Syndrome and 1 with severe anemia. They remained in the ICN until no medical crisis existed, for an average of 13 days, with a range to 7 to 35 days.
3. Full-term infants with sick mothers (FT/M). The third group of infants were 7 healthy full-terms who remained in the hospital for an extended period because their mothers had postnatal complications. They remained in the normal newborn nursery until their mothers were able to leave the

hospital. Their mean gestational age was 40 weeks with a range of 39 to 41 weeks. They remained in the hospital for an average of 7 days, with a range of 5 to 11 days.

4. Healthy full-terms (HFT). The remaining infants were 12 healthy full-terms with healthy mothers. They received routine hospital care in the newborn nursery and remained in the hospital for fewer than 5 days. Their mean gestational age was 40 weeks, with a range of 39 to 42 weeks. They were hospitalized for an average of 4 days, with a range of 2 to 7 days.

Further descriptive information about the infants may be found in Table 1, including the results of clinical assessments made along several dimensions during the perinatal period. These include length of gestation, length of hospitalization, sex, prenatal risk factors, postnatal medical complications, Apgar scores, physical size, and behavioral organization. Comparison of groups along these characteristics using oneway analyses of variance revealed only the expected differences between the groups: Group 1 (PT) differed from the other groups in gestational age and birth weight; Group 4 (HFT) differed from the other groups on Obstetric Complications; Groups 3 and 4 (FT/M and HFT) from Groups 1 and 2 (PT and FT/ICN) on Postnatal Complications;

Group 2 (FT/ICN) differed from Groups 3 and 4 (FT/M and HFT) on one-minute Apgar scores and from Group 4 on five-minute Apgar scores; Group 1 differed from the other groups on length of hospitalization. This last difference was surprising only in that Group 2 (FT/ICN) subjects were not hospitalized significantly longer than the healthy infants. There were no significant sex differences among the groups.

A measure of perinatal risk was obtained by completion of the Parmelee Obstetric Complications Scale (OCS). This scale evaluates the extent of obstetric and perinatal risk in terms of 41 conditions that are frequently associated with problematic pregnancies and the birth of sick and/or premature infants. The items on this scale pertain to the general history and health of the mother, events during this pregnancy, events surrounding labor and delivery and the condition of the infant. The percentage of nonoptimal conditions is converted to a score from 160 to 0, with lower scores indicative of greater obstetric and perinatal risk.

TABLE 1

## Descriptive Statistics of Subjects at Birth:

## Means and Standard Deviations

<u>Variable</u>		<u>Preterm</u>	<u>Full Term/ Intensive Care</u>	<u>Full Term/ Sick Mother</u>	<u>Healthy Full Term</u>
Gestational Age in Weeks	M	33.3	40.1	40.3	40.6
	SD	2.6	1.5	0.8	0.9
Birth Weight in Grams	M	2104.9	3290.1	3569.9	3584.9
	SD	722.4	559.8	413.5	475.3
Obstetric Complications Scale Score*	M	88.6	92.9	88.4	118.4
	SD	13.6	22.3	20.1	32.6
Postnatal Complications Scale Score*	M	84.0	79.0	160.0	155.3
	SD	21.8	13.7	0.0	0.2
1 Minute Apgar Score	M	6.8	5.9	8.4	8.0
	SD	1.4	2.8	1.1	1.7
5 Minute Apgar Score	M	8.1	7.6	8.9	9.2
	SD	0.7	2.3	0.4	0.6
Length of Hospitalization in Days	M	25.9	12.8	7.3	4.2
	SD	21.8	7.8	2.1	1.4

\*Higher scores indicate fewer complications. The maximum possible score is 160.



Postnatal medical status was measured with the Parmelee Postnatal Scale (PCS), which is a 10-item scale similar in its administration and scoring to the OCS. The conditions evaluated with the PCS are respiratory distress, infection, ventilatory assistance, non-infectious illness or anomaly, metabolic disturbance, convulsion, hyperbilirubemia or exchange transfusion, temperature disturbance, no feeding within 48 hours and surgery. The number of nonoptimal conditions are summed and converted to a score from 160 to 0, with lower scores indicative of greater incidence of postnatal complications.

To assess behavioral organization the Brazelton Neonatal Behavioral Assessment Scale (BNBAS) was administered to the infants before discharge from the hospital. The BNBAS is a clinical assessment tool that yields four cluster scores (Als, 1978): interactive processes; motoric processes; organizational processes, state control; and organizational processes, physiological response stress. The cluster scores are based on the infant's responses to stimulation across several dimensions. The dimensions assessed by the BNBAS include infant activity, state and state changes, general style, social responsiveness and reactions to visual, auditory and tactile stimulation. The physiological response to stress scores are not reported for these infants because all subjects received optimal scores on this

dimension.

### Procedure

As part of a longitudinal study, the infants were assessed during the newborn period and then they and their mothers returned to the hospital for follow-up assessments when the infants were two, four, six, nine, and twelve months old (corrected for gestational age). The measures included in this study are a subset of those used to assess social and emotional development. The assessments made at each age are described below, followed by a summary of the statistical methods used to analyze them.

### Perinatal Assessment

The infants' behavioral states were monitored and recorded for periods of 1.4 to 12.2 hours within 72 hours of discharge (with a mean of 5.7 hours of recording). Since the infants had differing lengths of stay in the hospital, the number of days from birth to day of observation differed, with a mean of 12 days after birth and a range of 1 to 74 days. The state categories used in this study were defined solely on the basis of directly observable behavioral criteria. An observer recorded which of the following states was predominant in a ten second interval: quiet sleep, active sleep, drowsiness, alert inactivity, alert activity, and crying. The state categories were adapted from those

described by Thoman (1975). Only the amount of time spent crying was used in this analysis and was recorded as the percentage of 10-second intervals during the observation in which the infant cried. Crying was coded when the infant's behavior during a 10-second interval fit the following description:

The infant's eyes may have been open or closed, and motor activity was usually present. Agitated vocalizations (i.e., fussing or crying) were present.

Descriptions of the other state categories and the amount of time infants in each of the four perinatal groups spent in each state are available in Holmes, Reich, and Gyurke, in press.

#### Two, Four, and Six Month Assessment

The quality of mother-infant interaction was assessed at each age with a standardized interaction sequence. The sequence consisted of eleven 30-second sections, during which the mother varied the amount of her interaction with the infant. Beginning with no interaction, moving to minimal and then increasing levels of interaction, the sequence ended with a withdrawal of attention to the infant and the mother's departure from the room. Before beginning the interaction sequence the mothers were given a verbal description of what to expect and were given index cards

that summarized each of the 11 sections. During the sequence the mothers received taped cues via earphones at the beginning of each section. Both the index cards and the taped cues consisted of the following instructions.

1. IMPASSIVE FACE. Sit face to face with your baby.  
Do not smile, talk or move your head or body.
2. SMILE. Sit face to face with you baby and smile at him or her. Do not talk or move your head or body.
3. SMILE AND TALK. Sit face to face with your baby and smile and talk to him or her.
4. ATTRACT BABY'S ATTENTION. Sit in front of your baby and try to get him or her to look at you.
5. TRY TO GET BABY TO IMITATE. Try to get your baby to imitate a facial expression such as opening your mouth wide or sticking our your tongue.
6. IMITATE BABY. Imitate everything your baby does.
7. VISUAL FOLLOWING. Move the red ball slowly back and forth and try to get your baby to follow it with his eyes.
8. GRASPING. Pick one of the toys from the box and try to get your baby to grab hold of it.
9. IMPASSIVE FACE. Sit face to face with your baby.  
Do not smile, talk, or move your head or body.

10. READ MAGAZINE. Look away from your baby and read a magazine.
11. LEAVE ROOM. Stand up and walk out of the baby's sight.

The interaction sequence was videotaped in a laboratory playroom. During the interaction the infant was positioned in an upright infant seat located on a tabletop. The mother was seated in a chair in front of her child so that they were in a face-to-face position. A mirror was placed behind the infant and to the side of the mother so that the videotape camera was able to simultaneously record the baby's face and body and the mother's face and upper body reflected in the mirror.

The videotaped interaction sequences were coded by four trained undergraduates to assess several specific characteristics of both mother and infant. Coders observed a number of behaviors of mothers and infants in 4-second intervals throughout the interaction sequence across five behavioral categories. For this analysis, only observations of crying were used. Crying was defined in this analysis as the proportion of time during the interaction sequence that the infants' state was coded as either crying or fussing. The interrater reliability estimate for infant state behavior was  $r^2 = 0.81$ . The reliability for crying was much higher but an estimate of reliability for this specific

state behavior is not available.

#### Nine and Twelve Month Assessment

When the infants were 12 months old (corrected for gestational age), they were videotaped (along with their mothers) as they experienced the Strange Situation devised by M.D.S. Ainsworth and her associates (Ainsworth et al, 1978). The Strange Situation is designed to assess the infant's response to separation from his or her mother and the quality of his or her attachment to the mother. It consists of a series of three minute episodes with differing degrees of separation of mother and infant:

1. The mother is seated in a chair while the baby plays nearby on the floor.
2. A female stranger enters and sits quietly for one minute, talks with the mother for one minute and interacts with the infant for one minute.
3. The mother leaves and the stranger sits in a chair while the infant plays on the floor.
4. The mother returns, comforts the baby if necessary, and re-engages him or her in the toys.
5. The mother leaves the room and the baby seems to be alone. (Actually, a camera operator is hidden behind a screen and watches the baby to ensure his or her safety.)

6. The stranger returns to the room and, if necessary, attempts to comfort the baby and re-interest him or her in the toys.
7. The mother returns and the stranger leaves. The mother comforts and plays with her infant.

The videotapes were scored according to the system developed by Ainsworth and her associates (Ainsworth et al, 1978). Each episode is viewed in 15 second intervals and a record of the frequency of such behaviors as locomotion, hand movements (e.g., touching, grasping or reaching for toys), orientation of visual regard, vocalization, oral behavior (e.g., sucking thumb or toy) and smiling is obtained. The infant's level of activity and initiative in interactive behavior in each episode is then rated along six dimensions: proximity- and contact-seeking, contact maintaining, avoidant behavior, resistant behavior, search (for the mother in separation episodes) behavior, and distance interaction. The ratings were made by comparing the infants' behavior to behavioral descriptions provided by Ainsworth and her associates (Ainsworth et al, 1978), in which the greater the activity and initiative in a particular type of interactive behavior, the higher the numerical rating is for that type of interaction in an episode. Finally, the infant was classified into one of three groups, again by comparing his or her reaction to the strange situ-

ation to the standard provided by Ainsworth. The classifications reflect the following patterns of behavior: Group A: avoidant attachment; Group B: secure attachment; Group C: ambivalent attachment. The subjects were also more broadly classified as being either securely (Group B) or anxiously (Groups A and C) attached to the mother. The videotapes were scored by one of two observers, who was blind to the infants' perinatal group. A reliability estimate based on 9 dyads and using Cohen's Kappa was  $k = .80$ . It should be noted that this statistic takes into account the likelihood of assigning a subject to a particular category by chance. This is a particularly important consideration in using the Strange Situation classification since other studies have found that about 65 to 70 percent of the subjects in a sample such as the one used here are likely to be classified as secure (e.g., Ainsworth et al, 1978).

In addition to the classification of patterns of attachment, quantitative measures of crying during the Strange Situation were obtained. The latency to cry in seconds and the episode in which the infant first cried were recorded for each subject.



## Data Analysis

In order to determine whether early crying behavior is predictive of later attachment to the mother, two discriminant analyses were performed, using the attachment classification at 12 months as the dependent variable and crying at birth and at two, four, six, nine, and twelve months, and attachment classification at nine months as predictor variables. The two general classification groups, anxious and secure, were used in the first analysis and all the subjects were included. The anxious group was composed of both the avoidant and the ambivalent subgroups. In the second discriminant analysis, the ambivalent subgroup was removed and the anxious group included only the avoidant subgroup. A correlation matrix was also generated in order to discover what types of relationships exist between crying behavior at the various ages and quality of attachment at 9 and 12 months. Again, one correlation matrix included all subjects and the second excluded the C babies (ambivalent subgroup). Finally, analyses of variance were performed on the latencies to cry and the episode in which crying first occurred during the Strange Situation, in order to determine whether there were significant differences in crying behavior during the Strange Situation among the attachment groups.

## CHAPTER IV

### RESULTS

Two stepwise discriminant analyses were performed and two correlation matrices were generated for these data. The first discriminant analysis was performed using two attachment groups: the secure group and a combination of the avoidant and ambivalent groups, which was termed the "anxious" group. Quality of attachment at 12 months was the dependent variable. In the second analysis, the ambivalent group was eliminated and the analysis was performed on only the secure and avoidant groups. This was done because other researchers have suggested that combining the avoidant and ambivalent groups obscures differences that actually exist between secure and avoidant infants. It may be that avoidant and ambivalent reactions, while both are anxious reactions to the Strange Situations, are so different from each other that they should be considered separately. For the same reason, the correlation matrix was also generated with and without the ambivalent group.

The results of the first discriminant analysis, involving the full sample divided in the two attachment patterns, will be discussed first. One discriminant function

was produced and it proved to be significant in separating the two groups (see Table 2). Three variables entered this function in the following order: quality of attachment at 9 months, crying at birth and crying at 4 months. As can be seen in Table 3, using this function it was possible to successfully classify 75% of the subjects into the two attachment patterns (anxious and secure). (Eight of the subjects were excluded from the analysis because they had at least one missing discriminating variable). In Table 4 it can be seen that the function consists mainly of quality of attachment at 9 months, with the other variables contributing only slightly to the function. In fact, as Table 5 shows, the function was already significant at the  $p=0.0093$  level when only quality of attachment at 9 months had been entered. The inclusion of the other variables actually decreased the significance of the function, although the Wilks' Lambda lowered slightly, indicating that the separation of the groups had become a little more clear.

TABLE 2  
Discriminant Analysis, All Subjects

Function	Eigenvalue	Percent of Variance	Cumulative Percent	Canonical Correlation
1	0.29521	100.00	100.00	0.4774155

Wilk's Lambda	Chi Squared	Degrees of Freedom	Significance
0.7720744	9.4416	3	0.0240

TABLE 3  
Classification Results, All Subjects

Actual Group	Number of Cases	Predicted Group Membership	
		<u>Group 1</u>	<u>Group 2</u>
1	14	9 64.3%	5 35.7%
2	26	5 19.2%	21 80.8%

Percent of cases correctly classified: 75.00%

TABLE 4  
Correlation Coefficients, All Subjects

Function 1	
Cry0	0.52051
Cry4	-0.49330
Att9	1.04446

TABLE 5  
Summary, Stepwise Discriminant Analysis, All Subjects

<u>Variable Entered</u>	<u>Wilks' Lambda</u>	<u>Significance</u>
1. Att9	0.835165	0.0093
2. Cry0	0.810332	0.0204
3. Cry4	0.772074	0.0240

The second discriminant analysis, in which the ambivalent subgroup was excluded, yielded a very similar discriminant function to that produced in the first analysis. Once again, quality of attachment at 9 months, crying at birth and crying at 4 months were the discriminating variables and entered the function in the same order (Table 6) and the function consisted mainly of quality of attachment at 9 months, with the other variables contributing only slightly (Table 7). The discriminating power of this function was slightly greater than the previous function and was able to successfully classify 81.25% of the subjects (Table 8). Once again, the function was significant after the entrance of quality of attachment at 9 months (see Table 5) and the inclusion of the other variables reduced the significance slightly.

TABLE 6

Summary, Stepwise Discriminant Analysis, Group C Excluded

<u>Variable Entered</u>	<u>Wilks' Lambda</u>	<u>Significance</u>
1. Att9	0.789610	0.0083
2. Cry0	0.756317	0.0174
3. Cry4	0.712262	0.0217

TABLE 7

Correlation Coefficients, Group C Excluded

Cry0	0.55572
Cry4	-0.47887
Att9	1.03404

TABLE 8

## Classification Results, Group C Excluded

Actual Group	Number of Cases	Predicted Group Membership	
		<u>Group 1</u>	<u>Group 2</u>
1	7	5 71.4%	2 28.6%
2	25	4 16.0%	21 84.0%

Percent of cases correctly classified: 81.25%

The importance of quality of attachment at 9 months in the prediction of quality of attachment at 12 months was underscored in the correlation matrix, found in Table 9. The highest correlation found between variables in the correlation matrix occurred between attachment at 9 months and attachment 12 months ( $r=.4576$ ,  $p=.002$ ). Four of the other pairs of variables were also significantly correlated: crying at birth with crying at 4 months ( $r=.2618$ ,  $p=.043$ ); crying at 4 months with crying at 9 months ( $r=.2977$ ,  $p=.037$ ); crying at 6 months with crying at 12 months ( $r=-.3050$ ,  $p=.023$ ); and crying at 12 months with quality of attachment



at 12 months ( $r=-.3165$ ,  $p=0.019$ ). There was a trend for latency to cry at 9 months to be correlated with quality of attachment at 9 months ( $r=-.2290$ ,  $p=.086$ ). This relationship is the opposite of that between crying at 12 months and quality of attachment at 12 months, when the relationship between crying and attachment was negative.

TABLE 9

## Correlation Matrix, All Subjects

	Cry0	Cry2	Cry4	Cry6	Cry9	Att9	Cry12	Att12
Cry0	1.0000							
Cry2	-.1362 p=.189	1.000						
Cry4	.2618 p=.043	.0261 p=.433	1.0000					
Cry6	-.0767 p=.310	.0485 p=.377	.0759 p=.312	1.0000				
Cry9	.1352 p=.212	.0198 p=.454	.2977 p=.037	-.0709 p=.338	1.0000			
Att9	-.1854 p=.136	.0173 p=.460	.1237 p=.233	.0404 p=.406	.2290 p=.086	1.0000		
Cry12	.1054 p=.251	.1172 p=.227	.1284 p=.206	-.3485 p=.011	.2072 p=.109	.0776 p=.324	1.0000	
Att12	.0192 p=.451	.0261 p=.433	-.0192 p=.451	.0930 p=.274	-.0671 p=.347	.4576 p=.002	-.2855 p=.032	1.0000

The preceding correlations represent the following patterns of behavior, illustrated schematically in Figure 1. Infants who cried more during hospitalization also tended to cry more in mother-infant interaction at four months while those who cried less at birth also cried less when observed during mother-infant interaction at four months. Infants who cried more during mother-infant interaction at four months cried earlier in the strange situation at nine months, while infants who cried less at four months cried

later or not at all at nine months. However, infants who cried more during mother-infant interaction at six months were less likely to cry or cried later during the strange situation at 12 months and infants who cried less during mother-infant interaction at 6 months cried earlier in the strange situation at 12 months. There was a trend for infants who cried earlier in the Strange Situation at 9 months to be seen as more securely attached to the mother while those who cried later in the Strange Situation, or not at all, were likely to be seen as less securely attached. Conversely, infants who cried earlier in the Strange Situation at 12 months were seen as being less securely attached while infants who cried later in the Strange Situation at 12 months were seen as being more securely attached. Quality of attachment itself was stable between 9 and 12 months: infants classified as securely attached at 9 months were also seen as securely attached at twelve months while those who were classified as anxiously attached at 9 months were also tended to be classified as anxiously attached at twelve months. Table 10 shows the actual classifications for the subjects at both ages. Overall, 76% of the subjects retained the same attachment classification at both 9 and 12 months, with 83% of the securely attached infants and 61% of the anxiously attached infants stable over the 3 month period.

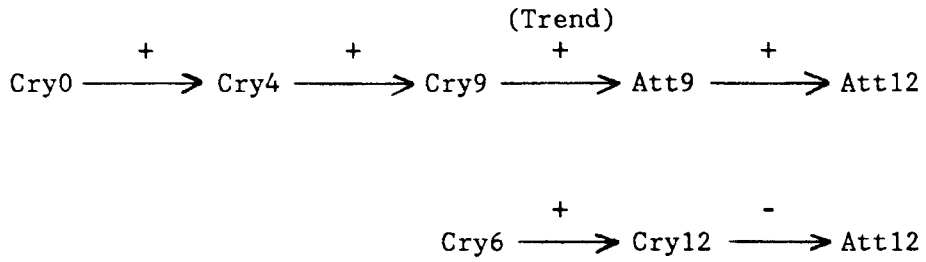


Figure 1: Schematic Representation of Significant Correlations of Crying Behavior and Attachment at Various Ages

TABLE 10

Classification at 9 and 12 Months

		Classification at 12 months		
		A	B	C
Classification at 9 Months	A	5	5	3
	B	2	20	2
	C	0	0	0
	Not Seen	0	7	0

When the ambivalent subgroup (C babies)<sup>1</sup> were excluded from the correlation matrix, the significant correlations found in the first analysis were relatively unaffected (see Table 11): crying at birth with crying at 4 months ( $r=.2258$ ,  $p=0.058$ ); crying at 4 months with crying at 9 months ( $r=.3553$ ,  $p=0.023$ ); crying at 6 months with crying at 12 months ( $r=-.3488$ ,  $p=0.016$ ); attachment at 9 months with attachment at 12 months ( $r = 0.4587$ ,  $p=0.004$  level). Significant changes occurred in the relationship between crying during the Strange Situation and attachment classification at both 9 and 12 months. When all subjects were included there was a trend at 9 months for latency to cry to be positively correlated with attachment classification (i.e., those who cried earlier were classified as more securely attached to the mother). When the ambivalent subgroup was excluded from the analysis, this trend became a significant correlation ( $r=.3223$ ;  $p=.036$ ). The relationship between crying and attachment at 12 months, which was significantly negatively correlated when all subjects were included in the analysis, was nonsignificant when C babies were excluded ( $r=.0879$ ,  $p=.300$ ).

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<sup>1</sup> The subjects excluded were the 5 infants classified as ambivalently attached at 12 months. No infants in this sample were classified as ambivalently attached at 9 months.

TABLE 11  
Correlation Matrix, Group C Excluded

	Cry0	Cry2	Cry4	Cry6	Cry9	Att9	Cry12	Att12
Cry0	1.0000							
Cry2	-.1107 p=.251	1.000						
Cry4	.2558 p=.058	.0409 p=.402	1.0000					
Cry6	-.0734 p=.328	.0237 p=.443	.0711 p=.334	1.0000				
Cry9	-.1415 p=.220	.0019 p=.496	.3553 p=.023	-.0661 p=.360	1.0000			
Att9	.2473 p=.086	-.0591 p=.374	-.0264 p=.443	-.0345 p=.460	.3223 p=.036	1.0000		
Cry12	-.1256 p=.226	-.0673 p=.344	.2102 p=.103	-.3488 p=.016	-.2420 p=.091	.0306 p=.434	1.0000	
Att12	.0357 p=.415	-.0532 p=.374	-.1291 p=.217	.0328 p=.422	-.0385 p=.417	.4587 p=.004	-.0879 p=.300	1.0000

In order to clarify the differences in the relationship between crying behavior and attachment classification, the latencies to cry and episode in which the first cry occurred were recorded for each subject and analyses of variance were performed. Table 12 shows the means and standard deviations for each attachment group by

age, while Table 13 shows the results of one way analyses of variance for each variable at each age. At 9 months there were no significant differences between the groups (A and B) for either latency to cry or episode of first cry. At 12 months, however, there were significant differences between groups B and C for both latency to cry and episode of first cry. Group C infants were likely to cry significantly earlier than B babies. The difference in latency to cry and episode of first cry between Groups A and C was statistically significant when the variance estimates were considered separately, although this cannot be seen as a robust relationship because it was not significant when the variance estimates were pooled. The trend in this case was the same as that between Groups B and C: C babies cried earlier than the A babies.

TABLE 12

Means and Standard Deviations, Latency to

Cry and Episode of First Cry, 9 and 12 Months

		9 Months		12 Months	
		Mean	S.D.	Mean	S.D.
Latency to Cry	A	813.85	377.21	632.86	250.06
	B	775.79	378.88	700.16	275.94
	C	---	---	348.00	167.84
Episode of First Cry	A	8.00	1.41	5.57	1.81
	B	7.08	2.34	5.97	2.02
	C	---	---	3.60	0.89



TABLE 13

Oneway Analyses of Variance, Latency to

Cry and Episode of First Cry, 9 and 12 Months

	Source	D.F.	Sum of Squares	Mean Square	F Ratio	F Probability
9 Months by Latency	Between Groups	1	12211.38	12211.38	0.08	0.77
	Within Groups	35	5009133.65	143118.10		
	Total	36	5021345.03			
9 Months by Episode	Between Groups	1	7.09	7.09	1.65	0.21
	Within Groups	35	149.83	4.28		
	Total	36	156.92			
12 Months by Latency	Between Groups	1	538563.92	269281.86	3.88	0.03
	Within Groups	35	2848397.08	69473.09		
	Total	36	3386960.79			
12 Months by Episode	Between Groups	2	24.30	12.15	3.32	0.05
	Within Groups	41	149.83	3.66		
	Total	42	174.18			

## CHAPTER V

### DISCUSSION

The present study was designed to address the questions of whether infant crying behavior influences the development of mother-infant attachment at 12 months, whether crying is a stable infant characteristic and whether quality of attachment is stable between 9 and 12 months. The crying behavior of 44 infants from intact middle-class families was assessed at birth and at 2, 4, 6, 9, and 12 months. At 9 and 12 months the infants and their mothers experienced Ainsworth's Strange Situation (Ainsworth et al, 1978), which is designed to assess the infant's response to separation from the mother and the quality of his attachment to her. On the basis of his response to this strange situation, the quality of the infant's attachment was classified as anxious (with two subtypes, avoidant and ambivalent) or secure.

In view of the fact that earlier studies of infant-mother attachment have been of infants 12 months or older, perhaps the most noteworthy result of this study is that quality of attachment was fairly stable between 9 and 12 months for this stable, middle-class sample. Attachment at

9 months was the best predictor of attachment at 12 months, with a discriminant function significant at the 0.0093 level after only this one variable had entered the equation. Quality of attachment (secure or anxious) was stable for 76% of the infants in this sample. Of the securely attached infants, 83% were stable from 9 to 12 months, while 61% of the anxiously attached infants were stable over the 3 month period.

Earlier studies have found varying degrees of stability in attachment classification at other ages. Waters (1978) found that 96% of the infants in his sample were stable between 12 and 18 months, with 94% of secure and 100% of anxious infants similarly classified at both ages. Egeland and Farber (1984), using a much less homogenous sample, found a 60% stability over the 12 to 18 month period, with 73% of securely and 57% of anxiously attached infants stable over this period. (The percentage for a combined anxious group was computed by this author from the data presented. Egeland and Farber reported results for all three attachment classifications, with 45% of A babies and 37% of C babies classified as such at both ages). They found that changes in attachment classification were related to mothers' caretaking abilities. The major distinction between these two studies were demographic differences among the subject pools. Differences in attachment classification have been

attributed in part to these kinds of demographic differences (Egeland and Farber, 1984).

Since the present group of infants resembles the Waters sample demographically but attachment classification over time was less stable, it may be that real differences exist in the stability of quality of attachment at this earlier age. It is possible that the attachment relationship is less well-established between 9 and 12 months and, while still fairly stable, is more subject to change than it is between 12 and 18 months. One possible explanation for this is that the period from 9 to 12 months marks the beginning of the infant's ability to physically move toward and away from the mother independently, which makes it the earliest period in which quality of attachment can be assessed using the Strange Situation. It seems likely that both mother and infant are in the process of adjusting to this change between 9 and 12 months and setting up the patterns of their attachment relationship. Dyads observed at 12 and 18 months may have already assimilated the changes that the infant's increased physical independence made in their relationship and settled into their characteristic ways of responding.

However stable attachment classifications may be between 9 and 12 months, it is clear that the way crying behavior and quality of attachment interact was different at the two ages for this sample. At 9 months crying behavior

and quality of attachment were positively correlated at a level approaching significance ( $p=.086$ ), with infants who cried earlier during the sequence more likely to be classified as securely attached. The infants who communicated their distress to the mother by using signalling behavior (i.e., crying) soon after separation were those who were most easily comforted by contact with the mother on reunion and were seen as securely attached. At 12 months, however, crying and quality of attachment were significantly negatively correlated, with infants who cried earlier being seen as anxiously attached. This result at 12 months was revealed in further analysis to be due to the fact that those infants who were classified as C babies (ambivalently attached) cried significantly earlier than the other subjects. Although infants cried more overall at 12 than at 9 months, secure and avoidant infants tended to cry, if at all, only during the second separation, when they were left completely alone. All of the ambivalently attached infants, on the other hand, cried at the first separation, if not during the preseparation episodes. These results are consistent with other reports of the behavior of ambivalently attached infants. Ainsworth and her associates (1978) found that C babies cried more and earlier than securely or avoidantly attached infants. When the C babies were excluded from the analysis in the present study, the relationship

between crying and attachment at 12 months disappeared.

The relationships between crying at earlier and later ages are also quite interesting. Although amount of crying at one age was not consistently predictive of crying behavior later on, there was a discernible pattern of behavior. In general, crying behavior was fairly stable for the first nine months. Infants who cried more at birth also cried more at 4 months. Those who cried more at 4 months cried earlier in the Strange Situation at 9 months. These significant correlations were positive ones. The picture changed somewhat when crying behavior at 12 months was examined. The significant correlation between crying at 6 months and crying at 12 months was negative: infants who cried more at 6 months cried later in the Strange Situation at 12 months. As discussed above, those infants who cried later at 12 months were also those who were seen as more securely attached.

If crying is seen as the earliest form of human communication, infants who cry adaptively in the first few months of life are those who are better able to make their needs known to the caretaking environment. Yet, those who cry too much or have an unusual or particularly irritating cry can evoke avoidance or even abuse in caretakers, (Frodi and Lamb, 1978) while those who cry too little may not receive optimal amounts of stimulation (Korner, 1972). In the meas-

ures used in this study, it was adaptive for infants to cry in the interaction sequences at 2, 4, and 6 months because these sequences included periods of withdrawal by the mother (e.g., when she became silent, turned to read a magazine, and walked away). The Strange Situation is also designed to elicit responses by infants upon mother's withdrawal. In both types of interaction sequences the appropriate response to the situation was to cry in an effort to attract mother's attention and, eventually, induce her to return.

The data reported here suggest a complicated relationship between crying behavior and attachment to the mother. Crying during the Strange Situation itself clearly appears to be related to attachment classification, at least for this small sample. The patterns that can be discerned in crying behavior during interaction with the mother at earlier ages suggest some relation to behavior during the Strange Situation at 9 and 12 months. However, attachment classification was not directly predicted by early crying behavior, as had been reported in an earlier study (Holmes et al, 1984).

There are two conflicting explanations for the fact that early crying behavior was not directly predictive of quality of attachment. One is that crying is not, in fact, predictive of quality of attachment and that the earlier study (Holmes et al, 1984) in which crying at birth was a

strong predictor of quality of attachment at 12 months was an artifact of that particular sample. The other is that a relationship between early crying and later attachment to the mother actually exists but was obscured in part in this study.

The first argument, that no relationship actually exists between crying behavior in the first year and attachment to the mother, is lent support by the fact that a replication by this author of the Holmes et al study using a larger sample failed to find the same relationship between neonatal crying and later attachment to the mother (Ruble, unpublished data). In addition, there was no significant correlation between crying at birth and attachment classification at 12 months in the present study. Therefore, early crying behavior is probably not directly related to later attachment to the mother. In light of the other results reported here, however, it is clear that crying and attachment are not completely unrelated.

The second explanation is that the methodology used in this study failed to uncover a relationship that does actually exist. The transactional model suggests that the relationship between infant and mother develops in such a way that the behavior of each influences the behavior of the other over time, so that the relationship is constantly evolving as a result of the reciprocal influence that the



behavior of each participant has on the other and on the relationship itself. Since the behavior of each participant is so intimately connected to the behavior of the other, it is this author's speculation that reductionist methodologies are inadequate for the analysis of the transactional relationship between mother and infant. It is possible that in examining a variable such as crying behavior in isolation the crucial parameters of its relationship with other variables are lost. Since crying is such a salient infant characteristic and has such strong, well-documented effects on adult listeners, it is unlikely that crying behavior is not related in some way to the development of attachment. It is likely, however, that the importance of crying behavior is mediated by other aspects of the relationship (e.g., maternal personality, maternal response to crying, other infant characteristics, environmental factors, etc.) and that the relationship between crying and attachment is not a direct, linear one that can be uncovered with methodologies such as that employed in this study. Perhaps what is needed is an analysis that includes as many of the parameters of the mother-infant relationship as possible in order to delineate the patterns of relationships that develop between mothers and infants. Such an analysis would, of course, require a much larger sample size than was available for this study, perhaps necessitating collaborative efforts in which mother-

infant samples from various locations could be combined.

As is often the case in research on social and emotional behavior, not all the questions posed in this study were clearly answered. The results of this analysis indicated that while crying behavior is not directly predictive of quality of attachment at 12 months, infant crying does have some effect on the development of attachment. Certainly, the classification of quality of attachment as assessed by the Strange Situation was affected by infant crying. In this sample significant differences in crying behavior during the Strange Situation existed between those infants classified as ambivalently attached and those classified as avoidantly or securely attached. In addition, some relationships were found between crying at earlier ages and crying at later ages, which in turn were predictive of attachment. Finally, attachment classification at 9 months was a good predictor of attachment classification at 12 months, although the correlation was far from perfect.

Clearly, if the visissitudes of mother-infant interaction are to be understood, more research on these important questions remains to be undertaken. This research should be designed so as to take into account not only the separate contributions of mother and infant but especially their interactions and transactions as the relationship develops. This endeavor will require collaboration by many researchers

and the use of alternative methodologies. Collaborative studies are needed so that sufficient numbers of infants, especially in the anxious categories, can be sampled. With sufficient numbers of subjects, studies can be designed in which variables not isolated and interpreted individually but are examined as they naturally occur, in the relationships and variations that are the essence and richness of human interaction.

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The dissertation is therefore in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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