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Face-to-face interactions between normal and high-risk infants and their mothers.

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FACE-TO-FACE INTERACTIONS BETWEEN NORMAL AND HIGH RISK INFANTS AND THEIR MOTHERS

A Dissertation Presented

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A C K N O W L E D G M E N T S

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A B S T R A C T

The purposes of this study were: 1) to investigate the effects of infant-mother separation during the neonatal period on later infant-mother interactions of high-risk premature compared to interactions of normal and post-mature infants, and 2) to manipulate experimentally infant-mother interactions in these diagnostic groups to discover how early face-to-face interactions might be facilitated.

Ss were 12 normal, 12 post-mature, and 12 high-risk premature infants of 3 1/2 months chronological age for normal and post-mature Ss and 5 1/2 months for prematures. Normals were full-term, healthy babies; post-matures were post-term babies with symptoms of post-maturity, and high-risk Ss were 2 months premature and hospitalized for one month for respiratory distress syndrome. The high-risk prematures were the early separated group, and the normals and post-matures were the early contact groups. Post-matures were included because both high-risk prematures and post-matures had received very low Brazelton Neonatal Interaction scores, placing them in the "worrisome" category, while only the high-risk prematures had experienced early separation.

Infant-mother interactions were videotaped, with mother and baby seated face-to-face. Interactions were 3 minutes long with a 1-minute rest period between. Interaction situations were: 1) a spontaneous baseline interaction in which the mother was asked to

pretend she was at home playing with her infant, 2) an attention-getting manipulation during which she was asked to try to keep her infant looking at her face, and 3) an imitation manipulation in which she was requested to imitate all of her infant's behaviors as they occurred. Measures coded from the videotapes and analyzed by repeated measures ANOVA were: 1) percentage of maternal activity during time infant was looking at and looking away from her, analyzed in terms of interaction situation and infant's diagnostic group, 2) percentage of time infants looked at mother, analyzed in terms of interaction situation and diagnostic group. A difference was considered significant if $p < .05$.

For all groups combined, the percentage of maternal activity during infant looking and looking away was significantly different for each interaction situation: maternal activity was greatest during attention-getting and least during the imitation situation. For all interaction situations combined, mothers of high-risk infants and mothers of post-matures averaged significantly more activity than did mothers of normals. There were no significant differences between any of the groups in amount of maternal activity during the imitation situation. Percentage of infant looking time varied inversely with amount of maternal activity. Combining all situations, normals looked at mothers most, post-matures less, and prematures least. High-risk prematures looked at their mothers significantly less during the spontaneous and attention-getting situations than did

normal Ss. There were no significant differences between diagnostic groups on percentage of infant looking time during the imitation situation. The increase in infant looking during the imitation situation may have been related to a reduction in amount of maternal stimulation to be processed and an increase in the mother's attentiveness and contingent responsiveness to her infant's communication signals. Maternal imitation of infant behavior, therefore, appears to be an effective facilitator of face-to-face interaction.

That no significant differences were found in percentage of maternal activity or percentage of infant looking and looking away between the high-risk premature and post-mature groups suggests that early separation did not contribute to the differences in infant-mother interaction found between the high-risk prematures and the normals. A regression analysis suggested that the lesser interaction capabilities of the high-risk prematures and post-matures at birth (indicated by their low Brazelton Neonatal Interaction scores) may have contributed to the higher level of maternal activity and infant gaze aversion in these groups.

CHAPTER I

INTRODUCTION

Face-to-face interactions between infants and their mothers provide a foundation for the development of the infant's social and cognitive skills. These interactions are generally established during the first few months of life, and are said to peak at around three to six months. Following this period, and with the advent of object manipulation, there appears to be a "cooling" of the infant's interest in face-to-face play with the mother. Implicit in these observations is the notion that there is a critical or sensitive period for the early development of face-to-face interaction. If this is so, could the early separation frequently experienced by the high-risk infant-mother pair interfere with the development of their face-to-face interactions? Would we expect to find disturbed infant-mother interactions in a high-risk population?

An investigation of this question requires a comparison of typical and disturbed mother-infant interactions. Clinical examples of both typical and aberrant infant-mother interactions appear in the literature. Therefore, it is possible to compare and assess the interactions of early separated infant-mother pairs in relation to these examples. Infant gaze aversion and maternal hyperactivity have been cited as early symptoms of disturbed interaction. The extent to which gaze aversion and hyperactivity characterize the interactions of early separated infant-mother pairs has not yet been investigated but could be measured and compared to "normal" and "aberrant"

interactions. The possibility of disturbed interaction in high-risk infants also poses the problem of designing early intervention techniques. Manipulations of early infant-mother interactions are the subject of recent studies, and some of these manipulations are now being used as intervention techniques for the facilitation of more optimal interactions in "risk" groups.

The following review of the literature suggested that 1) there is minimal evidence for a relationship between early separation and later disturbances in interaction, and 2) the effects of manipulated interactions have not been quantified. The present study was, therefore, designed to 1) investigate the effects of early separation on later infant-mother interaction, and 2) quantify the effects of manipulated interaction. In this study the spontaneous and manipulated interactions of 3-6-month-old normal, postmature and high-risk infant-mother pairs were videotaped and coded. The behaviors measured were 1) the amount of infant looking, and 2) the amount of maternal activity. The results of the study are then discussed in the context of theoretical notions regarding the underlying processes of infant-mother face-to-face interaction and suggested early intervention techniques.

CHAPTER II

REVIEW OF THE LITERATURE

Infant researchers have begun to chart the course of early face-to-face interaction. Some who have closely followed the weekly developments of this early form of communication have observed that efforts toward synchrony of infant-mother interaction commence with the first interaction (Condon & Sander, 1974; Stern, 1971). As early as the first week of infancy mother-infant interactions have been characterized as basically synchronous or asynchronous (Brazelton, Koslowski & Main, 1974; Stern, 1971). Face-to-face "conversation" has been observed to peak at around 3-6 months (Cohen & Beckwith, 1976; Stern, 1971; Trevarthen, 1974). This is not surprising inasmuch as physiological rhythms are beginning to stabilize during this period, wakeful and attentive activities are increasing, and social behaviors such as gazing, smiling and vocalizing are beginning to converge (Dittrichova & Lapachova, 1965; Robson, 1967). Following this period, and at about the time that voluntary reaching and grasping of objects is achieved, there appears to be a "cooling" of interest in face-to-face play with the mother. At this time the reaction of the infant to the mother characteristically changes from one of undivided attention to one of intense focalization of interest elsewhere, away from the mother (Trevarthen, 1974). Observations such as these suggest that the first few months of infancy may be a critical or sensitive period for the development of face-to-face communication skills. Investigators of early face-to-face interac-

tions have further suggested that there is a continuity between the earliest reciprocal behavior of mutual gaze during the postpartum period and later reciprocal interactions (Ferguson, 1971; Klaus, 1975; Sander, 1975).

Typically the sensitive period notion is assessed by the investigation of the effects of enrichment or deprivation of an experience during a period thought to be critical for a given development. Several researchers of infant-mother interaction have adopted a critical period thesis, suggesting that the presence or absence of early contact is a significant variable in the development of infant-mother interaction (Barnett, Leiderman, Grobstein, & Klaus, 1970; Fanaroff, 1976; Kennell, Jerauld, Wolfe, Chesler, Kreger, McAlpine, Steffa, & Klaus, 1974; Klaus & Kennell, 1970; Klaus, Jerauld, Kreger, McAlpine, Steffa, & Kennell, 1972; Leifer, Leiderman, Barnett, & Williams, 1972; Ringler, Kennell, Jarvell, Navojosky, & Klaus, 1975).

An animal model which posits that early separation contributes to a disturbed infant-mother relationship (for example in the goat and the rat) has been adopted by these human infant researchers. Their investigations have suggested close parallels between early infant-mother animal and human relationships (Barnett et al, 1970; Klaus et al, 1972; Leifer et al, 1972). The animal literature is replete with demonstrations of the effects of early contact and contact deprivation on animal infants (Moore, 1968; Rosenblatt, 1965; Sackett, 1975; Sackett, Holm, & Landesman-Dwyer, 1975; Seay,

Alexander, & Harlow, 1964). The relative difficulty of testing the contact deprivation variable with human infants, however, is exemplified by the paucity of such studies in the literature.

The Effects of Early Separation on Infant-Mother Interaction

A priori, it would seem that early contact deprivation might contribute to a lag in the development of infant-mother interaction. That 30% of failure-to-thrive infants are prematures who have experienced early separation lends support to this notion (Klaus & Kennell, 1970). Early separation might interfere with the development of optimal infant-mother interaction which might lead to inadequate caretaking. In this way early separation might contribute to the developmental lags of unknown etiology manifested by this group. The extent to which failure-to-thrive infants exhibit early interaction disturbances has not yet been reported.

Empirical work on the effects of early separation relates only tangentially to the investigation of early face-to-face interaction. Fantz's research, for example, suggests that the visual behavior of institution-reared infants differs markedly from that of home-reared as early as the second month of life (Fantz, 1964). Klaus et al (1974) report that additional infant-mother contact during the postpartum period led to increased eye-to-eye contact during filmed feedings one month later.

A series of studies have been reported by the Klaus and Kennell group investigating the early contact variable by increasing the amount

of postpartum contact by assigning a rooming-in arrangement to one group of mothers and then comparing the rooming-in dyads with non-rooming-in controls over the first several years. The mothers who had experienced rooming-in showed more maternal involvement and displays of affectionate behaviors toward their infants during pediatric clinic visits a year later (Kennell et al, 1974). Observations of mother-infant play as late as two and five years postpartum also suggested subtle differences between rooming-in and non-rooming-in groups in maternal speech patterns (Fanaroff, 1976; Ringler et al, 1975). The mothers who had been given extra contact with their infants during the neonatal period used significantly more questions, adjectives, words per proposition, and fewer commands and content words than did the control mothers (Ringler et al, 1975). They predicted that the richer speech patterns of the contact mothers would enhance the language development of their infants. At the five-year followup of these groups the infants who had received additional postnatal contact, had engaged in more eye-to-eye contact at the one-month feeding observations, and had been exposed to richer maternal speech patterns demonstrated superior speech comprehension and performance on IQ tests (Fanaroff, 1976).

Another group of infant researchers have approached the question of early contact or separation from the opposite direction, i.e., by observing contact-deprived as opposed to additional-contact groups, an early deprivation as opposed to an early enrichment approach

(Barnett et al, 1970; Leifer et al, 1972). Their groups included a full-term contact group, a premature contact group and a premature separated group. Unlike the premature separated group, the premature contact group of mothers were given an opportunity to handle and feed their prematures through the portholes of their incubators for the duration of their extended hospital stay. The proximal and distal attachment behaviors of the mothers were then observed during the first few months postpartum. Although the groups did not differ in the amount of proximal attachment behaviors such as holding or affectionate touching of the infant, there were significant differences between groups on the amount of ventral holding of the infants. Of the distal attachment behaviors such as looking at the infant, talking to the infant, laughing at or singing to the infant, smiling was the only behavior which differentiated the contact and separated groups (Leifer et al, 1972).

These studies illustrate the equivocal nature of the early separation question. At one extreme the Cleveland group (Ringer et al, 1972) is suggesting that as little as 16 hours additional contact during the newborn period has behavioral effects as subtle as maternal language patterns which persist for as long as five years and are statistically significant for a rather small sample (Fanaroff, 1976; Ringler et al, 1972). At the other extreme the Stanford group (Leifer et al, 1972) assert that mothers separated from their premature infants showed minimal differences in maternal behaviors during the period immediately

following their separation (Leifer et al, 1972). Despite their unanswered questions, these appear to be the only groups who have directly investigated the effects of extended contact and contact deprivation on early mother-infant interaction. Neither group, however, measured the infant behaviors which featured in those early mother-infant interactions.

Descriptive data on the role of the "normal" infant in early face-to-face infant-mother interactions have been published in a recent volume on the impact of the infant on its caregiver (Brazelton, Koslowski, & Main, 1974; Stern, 1974). The behaviors reported are those characteristic of typical face-to-face conversations, behaviors such as mother and infant looking, smiling and talking. The analyses of the dynamics of these interactions and an assessment of their "synchrony" have then focused on the amount and pacing of maternal behaviors (such as looking, smiling, talking, etc.) and the gaze patterns or looking behavior of the infant. Clinical descriptions of abnormal interactions often detail these same measures, i.e., the amount of maternal stimulation and the gaze patterns of the infant. The mother is often described as under or over-stimulating (Greenberg, 1971), and the infant as gazing or gaze averting (Hutt & Ounsted, 1966). It would appear from both literatures that the amount of maternal activity in general and the amount of infant looking in particular are salient measures of early face-to-face interaction. These, then, are the dimensions which have been inves-

tigated in the studies to be reviewed in the following discussion on the typical and the disturbed face-to-face interaction, and they are the primary variables which are both manipulated and measured in the present study.

Characteristics of the Typical Infant-Mother Face-to-Face Interaction

The infant's looking patterns seem to be a meaningful measure of his interaction since the most observable way in which the 3-6-month-old infant interacts with objects and people is via the looking mode. Being the only voluntary on-off perceptual system, looking allows the infant to modulate or eliminate external sensory input. Looking is also the only motor system over which this age infant has substantial voluntary control, and the only reliable signal of his readiness to interact socially. Eye-to-eye contact probably mediates a substantial part of the early mother-infant interaction simply because it is the first dyadic system in which both members have almost equal control and facility with the same behavior.

The visual-motor skills of the very young infant are reportedly more developed than other perceptual-motor systems (White, Castle, & Held, 1964). This control over vision allows for selection of perceptual input and regulation of arousal levels (Stechler & Carpenter, 1967; Walters & Parke, 1965). The infant can turn away from a stimulus that is too complex or too redundant and thereby adjust his perceptual input and arousal level (Fantz, 1964; McCall & Kagan, 1967).

Similarly, the amount of social contact can be controlled to some degree by gazing and gaze averting (Robson, 1967). Visual gaze as a signal indicates a readiness to engage in interaction and accordingly has been observed to release social behaviors (Goffman, 1963). Gaze aversion on the other hand serves as a signal to alter or terminate interaction, and has been described as a social "cut-off" behavior (Chance, 1962; Hutt & Ounsted, 1966). Gaze patterns later become integrated with speech patterns. In adult conversations, for example, the listener engages in gazing throughout much of the conversation, while the talker's speech is punctuated by looks away from the listener (Kendon, 1967). Kendon postulates that the looking away periods during interaction provide an opportunity for the interactant to reduce the amount of stimulus input while processing the information just received.

The infant comes to an interaction with a fairly organized pattern of looking at/looking away alternations of his gaze. This wakeful behavior is temporally organized in bursts of looking, pauses of looking away, and longer looking away rest periods. A recent study suggests that there are mathematical regularities in the gross temporal pattern of gaze in both infant-mother and adult-adult interactions (Jaffe, Stern, & Peery, 1973). For this reason gaze alternation has been labelled an activity/rest rhythm, a high-frequency rhythm which is superimposed on the lower frequency state cycle of wakefulness.

Gaze patterns of both the infant and mother during face-to-face play have been recorded by Stern (1974). His analysis suggests that the temporal durations of gaze at/gaze away behaviors depends upon the stimulus aspects of the interaction, but the temporal relationship of these behaviors is a manifestation of the biology of the central nervous system. That is, in spite of whether the infant appears to seek or avoid contact with his mother, the alternation between gazing-at and gazing-away continues. What differs as a function of his interest in the stimulus is the duration of gazes-at and gazes-away. Gaze alternation, then, seems to be an intrinsic behavior which is partially modified by the behavior of the partner.

In a similar study of mother-infant play Brazelton and his colleagues filmed five infants and their mothers over the first five months of development (Brazelton et al, 1974). These films also revealed a cyclic waxing and waning of attention, the unit of observation being looking and looking away from the mother. About these findings the authors state that

> "...although the quality and quantity of stimulation must play important roles in determining the timing of the infant's withdrawal, there seemed to be a basic regulatory mechanism which was most evident in the early weeks, but which persisted throughout the observations. Just as there is an oscillating regulatory mechanism that maintains homeostasis in physiological parameters such as temperature control and cardiovascular mechanisms, the curve of activation, discharge, and recovery seems to be necessary for attention in an ongoing interaction. The autonomic system is dominated by this kind of homeostatic mechanism, a mechanism

> which underlies all the physiological reactions of the neonate, and one which might also represent the immature organism's capacity to attend to messages in a communication system."

There is, then, some empirical evidence for a gaze alternation pattern in infant-mother face-to-face interaction. The extent to which this is an endogenous biological rhythm is mere speculation. Of greater interest, perhaps, is the way in which this rhythm is modulated by interaction with the physical environment or with the mother, and what function these alternations of gaze and gaze aversion might serve. It is unclear, for example, to what extent gaze aversion reflects habituation, fatigue, frustration, boredom, stimulus-seeking, and/or information-processing. Habituation, arousal, and information-processing models are frequently invoked to explain this waxing and waning of visual attention. Studies of human infants typically refer to the amount of infant looking and looking away as a function of the habituation process. In studies of primates visual contact with an animate or inanimate object is often presumed to heighten the level of arousal, and the withdrawal of visual attention to lower or modulate arousal levels (Mason, 1967; Welker, 1961). An arousal model has also been used to explain gaze aversion in mother-infant interaction (Stern, 1974).

A dual model of arousal and information-processing has been used to explain the infant's periodic withdrawal of visual attention from toys (Fischer-Field, 1973), and from people (Brazelton et al, 1974). In these studies periods of inattention were variously des-

cribed as pauses for information-processing or for "letting off steam" and providing recovery from the excitement of the activity by modulating the amount of stimulation received. The infant is said to reduce his state of arousal by turning away from a stimulus that is too intense, too complex, or too discrepant from an internal model. Similarly, he can turn away from a redundant and boring stimulus to seek a new stimulus thereby increasing his state of arousal. Thus, the early control of visual regard is seen as the infant's attempt to self-regulate his internal state within a given range.

Several investigators have noted differences between infant-object and infant-mother interaction (Brazelton et al, 1974; Trevarthen, 1974; Tronick, Adamson, Wise, Als, & Brazelton, 1975). Periods of looking are said to be longer, for example, in play with an object. Although no interpretations of this difference have been made, possibly more looking and less gaze aversion in play with an object is due to the inanimate object evoking less cognitive dissonance simply because it is inanimate and does not vary in its stimulus dimensions. The animate object may produce a stimulus overload resulting in a need for more pauses during the interaction.

These studies suggest, then, that during bursts of looking the infant is receiving information, and in the brief looks away he is processing information. The longer looks away serve to modify the level of arousal by closing off further visual stimulation from the mother and by signalling the mother to modify or reduce her other

stimulation. By turning away the infant can also attend to more or less arousing stimulation from other sources. Presumably as the infant becomes increasingly familiar with his mother, the cognitive dissonance produced by her behaviors would be reduced. That coupled with his increasing tolerance for stimulation and ability to process information might enable him to more closely attend to her behaviors. Because the young infant is limited in his information processing abilities, memory, reaction time, response repertoire and state regulation, it is incumbent on the mother to modulate her behaviors and to respond contingently in such a way that the infant's information processing and arousal modulating needs are met. If she mistimes or mismatches her behaviors so that they exceed the capabilities of her infant, their interactions will be ineffectual. An example of mistiming is the mother's presentation of stimuli at a time when the infant is attempting to take pause from the interaction as signalled by his gaze aversion. An example of mismatching is the presentation of stimuli which exceed the infant's experiences and capabilities, for example, playing peek-a-boo with a two-month-old or pat-a-cake with a one-month-old. Some mistiming or mismatching would inevitably occur since the infant cannot invariably send unambiguous signals and since the mother is not a perfect decoder of signals. In any case, some degree of mismatching and mistiming is desirable for the growth of mother-infant interaction.

Just as the infant is predisposed to gaze alternation, the mother

is predisposed to alter her socially-learned, adult-like behaviors or to "infantize" her behaviors in interaction with her infant. These infantized behaviors seem to be "released" by infant eye-to-eye contact and are stage-specific to the period of infancy. Wolff (1963) found that as soon as babies developed eye-to-eye contact (4-6 weeks) their mothers began to coo at them. "Baby talk", exaggerated facial expressions and continuous gazing are examples of "infantized" maternal behaviors that seem to be elicited specifically by infant gaze. Words are exaggerated, higher pitched and more slowly spoken (Ferguson, 1965). Vowels are elongated to the extent that they approximate the vowel durations of childrens' speech (Anderson & Jaffe, 1972). Facial expressions are formed more slowly and are exaggerated. Stern (1974) describes the expression of "mock surprise" that exemplifies the exaggerated quality of these expressions. The mother's eyebrows go way up, her eyes open very wide, her mouth opens and purses and usually emits a long "Ooooooh." The visual behavior of the mother is characterized by continuous looking at her infant. Although adult interaction is punctuated by frequent looks away while speaking, the mother almost ceaselessly looks at her infant both when she is talking and when she is listening to him. This steady looking presumably enables her to continuously monitor her infant's signals. The infant's on/off visual behavior seems to signal the mother that he has "had enough" or is "ready for more". The mother accordingly modulates or paces her activity. For example, she pauses as her in-

fant looks away, and reinstates her stimulating behaviors when her infant once again looks at her. Both the mother and infant contribute to the interaction by the modulation and sequencing of their behaviors, the infant by altering his looking at/looking away activity, and the mother by pacing her facial and vocal expressions. The mother's behavior is at the same time a configuration and a series of stimulus events (Stern, 1974). She often exhibits several behaviors simultaneously as well as in succession. She modulates the level, nature, timing and patterning of stimuli by continually changing the array of sounds, motions, facial expressions, tactile and kinesthetic events. Changes from one modality to another are made as the infant habituates to one or another. Mothers seem to perceive and interpret signs of boredom or over-excitement, and accordingly alter the amount, tempo and intensity of their behaviors. It is adaptive that the infant can regulate the amount of visual stimulation he receives by modifying his own on/off looking behavior, and equally adaptive that the mother can pace the amount of her stimulation to her infant's visual signals.

Mothers naturally and unconsciously modify their own rhythms by slowing down and exaggerating their speech and facial expressions when interacting with their infants (Stern, 1974). Although these "infantized" behaviors appear to be elicited or released by infant gaze, the function of these behaviors has not been established. The exaggerated variations in tempo and degree of display may closely

match the infant's rate of information processing. They might also facilitate the infant's formation of schemata for human expressiveness by making it easier for him to maintain the identity of the mother's face across several expressive transformations. In addition to slowing down and exaggerating her expressions, the mother sensitively responds to her infant's signals by reserving stimulation for those times when infants signal a readiness for stimulation, e.g., during nipple-out rest period of a feeding (Richards, 1972). Presumably the mother's ability to decode her infant's signals improves with experience. Likewise, the infant's growing repertoire of signalling behaviors and increasing capacity to process information contributes to this process. Although much of the already suggested evidence for a mutual adjustment of interaction behaviors comes from observational studies, additional illustrations derive from clinical examples of "experiments in nature".

Experiments in Nature or the Characteristics of Disturbed Interactions

The importance of a mother's sensitivity to her infant's signals has been emphasized by many (Brazelton et al, 1974; Richards, 1971; Stern, 1974; Tronick et al, 1974). What emerges from their observations is a set of rules for maintaining interactions. The most important rule for maintaining an interaction seems to be that a mother develop a sensitivity to her infant's capacity for attention and his need for withdrawal (partial or complete) after a period of

attention to her. Unless the mother responds appropriately to these variations, the infant's attention span is less than optimal. When the mother can allow for the cyclic turning away from her, which seems to be necessary for the infant, she can be assured of longer periods of attention when the infant turns back to her.

Videotapes of mother-infant interaction depict this varying sensitivity (Kaye, 1975). Some mothers' actions are carefully phased with those of the infant. During the infant's attention phase the mother's behavior is somewhat restrained, but as the infant's excitement increases she vocalizes more rapidly, and the pitch of her voice rises. Her movements decrease as the infant initiates a response, seeming to allow him time for responding. Other mothers are constantly barraging the infant with stimuli in an unphased, mistimed, and mismatched fashion. The infant is given no pauses in which to reply, and instead of playing the game for a long period, he is suddenly reduced to fussing or prolonged gaze aversion. When the infant averts his gaze, the overstimulating mother may immediately escalate the intensity and variety of her behaviors to recapture the infant's attention. Most of these escalations are counter-productive since the infant is probably gaze averting because arousal level is already too high. In such a situation he is more likely to return his gaze to a mother who has, instead, decreased the intensity of her stimulation. The overstimulating mother appears to be over-controlling the interaction, never giving her infant time to "take

his turn", and allowing for very little reciprocity. In adult interactions of this kind it appears to be the repeated stress of not getting an immediate response that speeds up the tempo and increases the intensity of the initiator's actions (Chapple, 1970). The responder finds himself being initiated to repeatedly without being given the time to respond. His rhythm of action/inaction is disturbed, and the initiative to respond is lost. Asynchrony may result, then, from either the long latency responding or from the interruptive actions of either member of the dyad.

In an attempt to experimentally manipulate interactions between adult subjects, Chapple (1970) designated periods of long-latency responding and periods of interruptions to be imposed by the Experimenter on his interactions with subjects. Base levels of a spontaneous interaction were first recorded. This period of relative synchrony was followed by one of E manipulation (latent responding or interrupting) which in both cases desynchronized the interaction and drove the subjects' verbal activity to dramatically low levels. The termination of these periods of "stress" (experimental manipulations) were followed by a recovery period during which the subjects' interacting activity returned to baseline levels. Extending Chapple's model to infant-mother interaction, the infant might contribute to asynchrony by his latency of responding and the mother by her interrupting. Not unlike the adults in Chapple's study, the mother might interpret her infant's response latency as his withdrawal or rejection

which in turn stimulates her interrupting, initiating behaviors. When this occurs, the infant finds little time to initiate or respond. Apparently reciprocal interaction can be maintained only when the initiator and responder can read each other's signals and "take turns" being initiator and responder.

Similarly, the understimulating mother contributes to an asynchronous interaction. While the hyperactive mother appears to be intrusive and controlling, the hypoactive mother allows the infant to proceed at his own pace and "control" the interaction. The hypoactive mother not only deprives her infant of stimulation, but also does not help modulate his activity. In a study of interactions between "atypical" infants and their mothers, half of the mothers clustered around a high average of stimulation and the other half around a low average (Greenberg, 1971). "Atypical" infants included those who manifested a "failure-to-thrive syndrome" (a variety of behavioral abnormalities centered around a retarded rate of weight gain and physical abuse of the infant) and "patterned hypermotility syndrome" (body-rocking and head-banging). The hypoactive mothers seemed depressed and exhibited limited repertoires. The hyperactive mothers were very busy or very interactive. Other striking features of the hyperactive mothers were their poorly organized play, rapid shifts of attention and repetitious physical overstimulations. The latter included moderate slapping, playful biting, mild hitting, vigorous rubbing of the baby's body with toys, harsh stroking, tight

grasps, poking, nibbling and an inordinate amount of time spent grooming various parts of the infant's body. The "atypical" infants seemed enveloped by an array of simultaneously occurring events or stimulations introduced by the mother (Greenberg, 1971).

While the hyperactive mother appears to be intrusive and over-controlling, the hypoactive mother seems to allow the infant to control the interaction by default. There are varying views as to who "controls" the typical mother-infant interaction. Some researchers have reported more action sequences being initiated by the mother and conclude that the mother is the primary initiator and pacemaker of the interaction (Brazelton et al, 1974; Lewis & Lee-Painter, 1974; Stern, 1974). Trevarthen (1974) on the other hand suggests that infants as young as two months largely determine the form of interactions to the extent of directing "conversation" with an adult and being the model for the mother's imitations rather than the reverse.

Seemingly the infant has his source of control in his gaze alternation, and the mother in her attention-getting infantized behavior, for example, her infantized vocalizations and her steady looking or monitoring of the infant's behavior. The infant could be described as "controlling" inasmuch as he is more frequently making and breaking eye contact than is his mother. This age infant has been reported to initiate and terminate as much as 94% of all mutual gazes (Stern, 1974). The mother, on the other hand, remains visually fixed on the infant most of the time. If the mother cannot maintain a relatively uninter-

rupted gaze at her infant, both the infant and mother would probably lose a large measure of their control. The mutual attention episode would no longer be a unit defined by the infant and under his control. And the mother would lose control since the presentation of her attention-getting infantized behavior could no longer be timed to her infant's gaze alternation patterns (Stern, 1974). The problem of determining who is the initiator and who is the responder or who "controls" the interaction in a continuous flow of activity sequences is difficult at best, and perhaps academic. Most interaction researchers would probably concur, however, that if either the mother or infant are too controlling their interaction will be disturbed.

Just as the hypo or hyperactive mother contributes to a disturbed interaction, so does the hypo or hyperactive and gaze-averting infant. An example in the extreme is the sustained impairment of interpersonal relationships experienced by the autistic child. Hutt & Ounsted (1966) speculate that prolonged gaze aversion of autistic infants is threatening to their parents and deprives them of their infant's stimulation. The failure to engage in eye-to-eye contact by the autist along with his persistent gaze aversion seems to contribute to reduced enthusiasm, ambivalent attitudes and feelings of rejection on the part of the mother.

Although the infant can contribute to his own disturbed interactions, he initially has fewer controls over his activity than the mother has over hers. The mother, therefore, becomes an important

source of regulation of their interactions. Brazelton et al (1974) cite the example of two similarly tense, overreactive and gaze-averting infants, and their mothers' different responses to these behaviors. One mother responded with increased activity and stimulation to her baby's "turning her off"; another maintained a steady, low level of activity which gradually modulated her infant's overreactivity and gaze aversion. The end result was in favor of the latter dyad. That is, the baby whose mother maintained a steady, low level of activity was more responsive and for longer periods.

The ambiguity of signals and the difficulties of reading signals in face-to-face interaction is another source of disturbed interaction. An example provided by Adamson et al (1975) is that of a naturally occurring distortion of mother-infant interaction between a congenitally blind mother and her sighted infant. The expressionless face of the blind mother was devoid of signals for the infant, and the blindness of the mother in turn curtailed her reading of the infant's signals. The sighted infant was initially able to maintain a rhythmic cycling of looking at/looking away behavior with her non-congenitally blind father and with the experimenters, but maintained gaze aversion with her mother. The interaction difficulties this dyad experienced probably related to the absence of communication signals in the blind eyes of the mother. This situation has its parallels in the interactions observed between sighted mothers and their blind infants. Fraiberg (1974) relates the detachment and

frustration experienced by mothers and experimenters alike as they interact with very young blind infants. During the period that is normally characterized by eye-to-eye communication these dyads were experiencing considerable difficulties. It was only when the infants had learned to signal with their hands and the mothers to focus on hand instead of visual signals that these pairs could communicate.

A clinical example of the difficulty even sighted pairs have in reading each others' signals is given by Stern's film of a mother interacting with her twins (Stern, 1971). A stop-frame film analysis of the mother-twin interactions revealed the mother's sensitivity to the rhythms and signals of one twin and her insensitivity to those of the other. The signals of the former twin were less ambiguous and his looking behavior more organized. The mother did not make approaches to this infant when he turned away from her. The twin's face-to-face interactions with his mother were synchronous and sustained. The signals of the other twin were more ambiguous, and his visual behavior less organized. The mother frequently attempted to regain his attention when he turned away from her. This twin ultimately engaged in considerable head and gaze aversion, and, consistent with his maladaptive early interactions, he was later seen to withdraw from childhood social situations. Stern (1974) reports having repeatedly seen in 3-4-month-old infants extreme head aversion which he suggests serves to terminate intrusive maternal behavior. He relates this behavior to the more exaggerated and persistent form of

gaze aversion seen in autistic infants (Hutt & Ounsted, 1966) and in blind infants (Fraiberg, 1974).

These, then, are some clinical illustrations of disturbed mother-infant face-to-face interaction. The insensitive pacing of the interaction by the overcontrolling, overstimulating mother, the ambiguity of looking signals transmitted by gaze averting infants, or the failure to decode the looking signals by insensitive mothers seem to contribute to the disturbed interaction. These effects have been explored further by experimental manipulations of mother-infant face-to-face interactions.

Experimental Manipulations of Mother-Infant Face-to-Face Interaction

Some attempts have been made to manipulate experimentally the face-to-face interactions of mothers and their infants (Trevarthen, 1974; Tronick *et al*, 1974). Manipulations in the Tronick experiment included the following: 1) instructing the mother to slow down her already "infantized" rate of interaction by counting slowly; 2) asking the mother to remain stone-faced in an *en face* position with her infant; and 3) positioning the mother to show only her profile to her infant (Tronick *et al*, 1974). In the first condition, the slowed rate of interaction, the infant's interactive behaviors (looking, smiling, and vocalizing) were sustained for longer periods than in a spontaneous interaction. In the stone-faced condition there were repeated attempts by the infant to reinstate the previously synchron-

ous play interaction. That failing, the infant averted gaze and withdrew from the interaction. In the profile condition infants became fussy. The latter two conditions are so contrived or unnatural that they would predictably lead to aborted play interactions. The first condition, however, (the slowed rate of interaction), illustrates how mother-infant interaction might be enhanced by the mother's modification of her own rhythm to more closely approximate that of her infant.

The research in Trevarthen's lab (using a reflecting mirror and changing lights) made the mother visible to the baby, but she saw instead of the baby another adult (Trevarthen, 1974). The mother automatically reverted from her "infantized" style of talking to that appropriate for an adult-adult interaction. When the mother reverted to an adult style of interacting, the infant appeared puzzled and made repeated overtures to her. When he failed to regain her attention, he averted gaze and withdrew from the interaction. These researches together suggest that the more closely the mother's pacing of behaviors approximates that of her infant, the more synchronous and sustained their play together may be.

Summary of the Review of the Literature

In summary, there is some evidence that the foundations for early face-to-face interaction are established during the first few months of life. This suggests that this period may be a critical time

for the development of face-to-face interaction. The question raised by the present study was whether the high-risk infant-mother pair who had been separated during the infant's first months of life might experience disturbed social interactions. Although the animal literature suggests that the mother-infant relationship is impaired by early contact deprivation, the literature on human infants does not unequivocally establish that infant-mother interaction suffers from early contact deprivation.

The investigation of this question requires a comparison of the typical and the disturbed infant-mother interaction against which the interactions of early separated dyads may be compared. Both observational studies and clinical reports seem to suggest that the amount of maternal stimulation and the amount of infant looking are salient and sensitive indexes of the infant-mother face-to-face interaction. These variables were therefore elaborated in an attempt to formulate a comparison of the typical and disturbed interaction.

The primary way in which the 3-6-month-old infant engages in face-to-face interaction is via his looking behavior. The mother's role is seen as a constantly changing configuration of "infantized" behaviors. Her "infantized" behaviors appear to be elicited specifically by infant gaze. Because her infantized behaviors are more slowly paced and more exaggerated than her adult behaviors, the mother's infantized behaviors seem to facilitate the infant's processing of the information contained in them as well as the regulation of his arousal

level. The infant's looks at the mother probably signal his readiness to interact with her, while his looks away from her signal a desire to take pause from the interaction. The sensitive mother seems to read these signals and accordingly modulate the amount and distribution of her stimulus behaviors. That is, she tends to reserve stimulation for her infant's periods of attention to her, and reduces the amount of her activity as the infant turns away from her.

The disturbed interaction is characterized by excessive gaze aversion on the part of the infant and hypo and hyperactivity on the part of the mother. Characteristically the mother's hypo or hyperactivity contributes to infant gaze aversion, and gaze aversion elicits more of the same counter-productive behavior from the mother. When the infant averts gaze, the hyperactive mother tends to accelerate her activity in her attempt to recapture her infant's attention. In this way both the mother and infant contribute to a disturbed interaction. Inasmuch as the mother has greater control over her behavior than the infant has over his, one can alter the mother's interaction behavior and observe the effects of that modification on the behavior of her infant.

Several experimental manipulations of interaction have been observed to alter both the mother's and infant's behaviors. Unfortunately these manipulations are unnatural. Consistent with their label, "perturbations", they have been noted to disrupt and disturb infant-mother face-to-face interaction. Only one of the manipulations

appearing in the literature facilitated more effective interaction. Instructing the mother to count slowly as she interacted diminished her activity and increased her infant's attentiveness (Tronick et al, 1974). This observation suggested the problem for the following study.

CHAPTER III

THE PROBLEM

The problem investigated by the following study was two-fold: 1) Did early separation contribute to disturbances in early face-to-face infant-mother interaction, and 2) Could manipulations be designed to facilitate more optimal interactions?

Studies to date have not explored the effects of early separation as specifically related to effects on infant-mother face-to-face interaction. Investigations of the effects of early separation have, instead, utilized rather global attachment measures and have primarily reported the effects of separation on the behaviors of the mother rather than the infant. Studies of manipulated infant-mother interactions which appear in the literature have demonstrated that interactions can be altered, although they have not quantified the effects of the manipulations. Also, since the manipulations have been considerably contrived and unnatural, they would probably not be effective intervention techniques.

The literature suggests that a disturbed infant-mother interaction is characterized by excessive infant gaze aversion and by maternal hypo/hyperactivity and insensitivity to infant communication signals. A manipulation of the mother's amount and distribution of stimulation might serve to alter and facilitate a more optimal interaction. The slowing down of maternal behavior used by Tronick et al (1974) appeared to increase the amount of infant attentiveness to his mother. Asking the mother to count slowly during interaction tended

to facilitate her "infantized" behavior and to elicit more attention from her infant. Conversely, the manipulation used by Trevarthen (1974) in which the mother looked at an adult while she talked to her baby tended to increase the pace of the mother's activity and decrease the number of her "infantized" behaviors which might have contributed to the decrease in her infant's attentiveness.

The experimental manipulations just described appeared to alter both mother and infant behaviors, but they are too contrived or unnatural to be used for intervention purposes. It would be desirable to design manipulations which would achieve the same effects as well as lend themselves to the intervention process. If the mother is hypoactive, intervention would desirably increase the amount of her stimulation, and conversely if she is hyperactive, a manipulation would decrease the amount of her activity. Presumably the increase or decrease of stimulation by mothers of these respective descriptions would facilitate more eye-to-eye contact on the part of the infant.

Two manipulations which seemed to be more natural, yet would presumably decrease or increase the amount of infant looking at the mother were proposed as follows: 1) The amount of maternal activity could be increased by an attention-maintaining manipulation in which the mother is encouraged to try to keep her infant looking at her. This simulates the natural situation of trying to keep an infant's attention while filming a home movie. During this situation the mother would probably increase her activity, and become less sensitive to her infant's looking signals as well as less contingently

responsive to his actions than in a spontaneous interaction. Opposite to the mother's expectations, we would expect the infant to engage in more gaze aversion than he would during a spontaneous interaction. This situation would simulate the interaction in which the mother tends to be overstimulating, intrusive, and overcontrolling, and the infant excessively gaze-averting. Although a manipulation of this kind would probably worsen the interaction for most dyads, it might serve to elicit more activity from the typically hypoactive mother and, in turn, more attention from her infant. 2) The amount of activity of the mother could be decreased by suggesting to her that she imitate all of her infant's behaviors as they occurred. Since very young infants are typically less active than their mothers, a mother's imitation of her infant's behavior would necessarily minimize and slow down her own behavior which would prevent overstimulation and consequent withdrawal of her infant's attention. Since she would have to attend very closely to her infant's behaviors in order to imitate them, she would also be more attentive to his looking signals which indicate a readiness to interact or withdraw. Since a greater number of infant behaviors occur during his attentive periods (Brazelton et al, 1974; Stern, 1974), the mother's imitative behaviors would also be reserved for the infant's attentive periods. This manipulation would presumably diminish the amount of activity characteristic of the hyperactive mother and the amount of gaze aversion of her infant. Since imitation is a very potent form of contingent re-

inforcement, this situation would presumably elicit more attention from the infant. Since the mother's imitative behavior would be more "infantized", or more similar in kind to the behaviors of her infant, there would be less discrepancy for the infant to process. Behaviors already in the infant's repertoire would be more readily assimilated, and thus, there would be less need for the infant to take pause from the interaction to process the information contained in them. For the hypoactive mother with a limited repertoire the imitation task would provide a concrete repertoire of behaviors enabling her to be more active and, in turn, elicit more attentiveness from her infant. The imitation situation is natural inasmuch as mothers frequently spontaneously imitate the behavior of infants 3 to 6 months of age (Trevarthen, 1974).

In addition to the above manipulations, a spontaneous interaction was observed for the purpose of providing a baseline condition against which the manipulated interactions were compared. In this situation the mother was simply asked to pretend that she was at her own kitchen table playing with her infant.

Several investigators have suggested that infants engage in longer periods of looking at objects than at their mothers (Brazelton et al, 1974; Trevarthen, 1974). The decrease in gaze aversion seen during object play might relate to the lesser information processing demands of the object interaction and, hence, the lesser need to take pause or turn away to process the information. A popular "social" object, an

infant-size Raggedy Ann doll, was used in this study to assess the differences in infant looking behavior during infant-mother versus infant-object interaction.

The assertions made in the literature to the effect that 1) infant and mother behaviors can be modified by experimental manipulations of their interactions, and 2) infants attend to objects for longer periods than to their mothers, have not yet been quantified. We attempted to quantify these behaviors in this study.

The measures used in the present study were the amount of maternal activity and the amount of infant looking as a function of the experimental situations described above. Since the literature has suggested that one of the chief indexes of a synchronous infant-mother interaction is the mother's ability to minimize or terminate her behaviors during infant gaze aversion and reserve them instead for periods of infant attention, we looked at the amount of maternal activity both during the infant looking and during the infant looking-away periods.

To determine the impact of early separation on infant-mother interaction, a spontaneous and two manipulated interactions were observed for both high-risk separated and normal contact groups. Since it might be argued that the inferior interaction capabilities of the high-risk group rather than their early separation experience per se contributed to the disturbed interaction, a second control group was chosen which was comparable to the high-risk group in its early

interaction capabilities, but had not experienced early separation. This was a group of postmature infants (those born post-term and manifesting symptoms of intrauterine growth deprivation). The postmatures had tended to perform as poorly as the high-risk prematures on the Brazelton Neonatal Scale interaction items (orienting to animate and inanimate objects, alertness, cuddliness and consolability) (Brazelton, 1973). However, they did not require hospitalization, and thus did not experience early separation. By using the post-mature group as a control, the early separation variable was less confounded with the early interaction difficulties as a factor contributing to later interaction disturbances.

Hypotheses

The hypotheses tested were as follows:

1. Maternal activity during infant looking time would decrease across the three interaction situations, i.e., the mother's activity would be least during imitation of her infant, intermediate during the spontaneous interaction, and greatest during the attention-maintaining interaction.
2. Maternal activity during infant looking-away time would also vary as a function of the interaction situation and in the same direction as in hypothesis #1.
3. Maternal activity during the infant's looking-away time

would be less than that occurring during the infant's looking time, illustrating that the mother typically reserves her stimulation for her infant's attentive periods and respects his occasional need to withdraw his attention. This would be the case for the spontaneous and imitation situations but not for the attention-getting manipulation. In the latter condition the mother might be equally active during her infant's looking and looking-away periods.

4. Infant looking time would increase across the three situations in ascending order from the attention-maintaining to the spontaneous to the imitation situations.
5. The amount of infant looking would be greater during the infant's interaction with the doll than during the spontaneous interaction with the mother.
6. There would be a greater amount of maternal activity and a lesser amount of infant looking across the three groups in ascending order from the normal to post-mature to high-risk groups.

CHAPTER IV

METHOD

Subjects

The interactions of three groups of infant-mother pairs were observed. Infants were assigned to these groups according to neonatal status: 1) normal full-term, 2) normal post-mature, or 3) high-risk premature. The normal full-term and normal post-mature babies constituted the early contact groups of this study, while the high-risk prematures were the early separated group. The post-mature was included as a control for the "worrisome" baby syndrome. That is, both the post-mature and the high-risk babies had scored in the "worrisome" range on the Brazelton A Priori Interaction cluster score at birth (interaction items including orienting, alertness, consolability and cuddliness), while only the high-risk infants had experienced early separation.

Twelve separated high-risk, 12 contact normal and 12 contact post-mature infant-mother dyads comprised the three groups which were balanced for sex. The neonatal condition of the high-risk premature was a mean gestational age of 32 weeks and respiratory distress syndrome which required a mean hospital stay of 32 days and, thus, 32 days of separation from their mothers. The normal and post-mature did not experience early separation. The post-matures averaged 16 days post-term and manifested Clifford's "postmaturity syndrome" of parchmentlike skin, a long thin body and a wizened look as well as

other symptoms of intrauterine growth deprivation (Clifford, 1954).

At the time of the interaction observation the three groups were 3 1/2 months conceptional age (age figured from expected date of delivery). There was, however, a difference in their chronological ages since the high-risk infants were corrected for prematurity, and as a result, averaged 51 days older than the other two groups.

The demographic characteristics of the groups were similar. This happened by chance rather than by design. The median education of the parents was completion of high school, median social class on Hollingshead's Index (1957) was III (middle-class), median age of mothers and fathers was 25 and 27 years, all parents were white and parity was equally distributed among the three groups. There were no significant differences between groups on these factors.

Experimental Manipulation

Each of the 36 infant-mother dyads were videotaped for a total period of 15 minutes including a warm-up feeding situation and four separate three-minute interaction situations. The interaction situations were preceded by a "warm-up" period during which time the mother was filmed feeding her infant. This situation was intended to provide a control for state and a period for adaptation to the video studio and to the videotaping situation.

The interaction situations were as follows:

1. A spontaneous face-to-face play situation in which the

mother was asked to pretend she was at home at her kitchen table playing with her infant.

2. An attention-getting situation during which the mother was requested to pretend her husband was taking a movie of their infant and she in turn was trying to keep her infant looking at her face.
3. An imitation situation during which time the mother was asked to imitate all of her infant's behaviors as they occurred.
4. An infant play interaction with a doll.

These situations were interspersed with a 60-second period for rest and a written instruction to the mother. (The written instructions appear in Appendix A). During this interval the mothers held their infants in order that the infants might not "grow tired" of sitting in the infant seat. The situations occurred in the above order for all subjects except that the attention-getting and imitation situations were counterbalanced to control for infant state and/or distress effects.

The spontaneous interaction occurred first for the following reasons: 1) We wanted a baseline condition which was free of the effects of the manipulated interactions. 2) We anticipated that the infants might become tired or experience a state change over the course of the session. The doll situation was included as a control condition to determine whether any increasing inattentiveness on the part

of the infant related to the stress of the manipulated infant-mother interactions or a state change.

The attention-getting situation was intended to facilitate an increase in the amount of maternal activity. Conversely, the imitation situation was designed to decrease the amount of maternal activity in interaction. The spontaneous situation was to serve as a baseline for comparison purposes, and the doll (an infant-size Raggedy Ann doll) was included to assess infant interaction with a very minimally stimulating "social object".

Quantitative measures were: 1) The percentage of interaction time that the infant spent looking at the mother in the interaction situations and at the doll in the doll situation, 2) the percentage of infant looking time that the mother was active, and 3) the percentage of infant looking-away time that the mother was active.

It was predicted that the amount of maternal activity would increase in a linear fashion from the imitation to the spontaneous to the attention-getting situations. Conversely, it was expected that the amount of time the infant spent looking at the mother would decrease across those situations.

Procedure

The interactions were videotaped in a video studio which was partially furnished like a living room. The infant was positioned in a fairly upright infant seat on a table which was situated in a

curtained alcove in order to minimize the amount of extraneous stimulation. During the mother-infant interactions the mother was seated opposite her infant such that they were in an en face position separated by approximately 18 inches. During the doll interaction the doll was suspended in a fixed, immobile position facing the infant approximately 18 inches away and out-of-reach of the infant. Throughout the doll situation the mother remained behind her infant so that she would not distract him.

The use of a split screen generator console enabled the simultaneous recording of the infant's body on one-half of the screen, the mother's torso and face on the other half, and a digital clock image across the lower half. The cameras were positioned approximately six feet away from the mother and infant at an angle such that they were in the periphery of the subjects' visual fields, as well as partially hidden by surrounding curtains.

One experimenter was present to give instructions to the mother immediately before each situation, and to operate the video equipment. If the infant cried for any 30-second duration, the filming was terminated. Three infants were lost to the study for this reason, and a fourth because of technical difficulties.

Data Reduction

Coding of data. The videotapes constituted the raw data for this study. The absolute durations of selected behaviors were then coded using a 20-key Esterline-Angus event recorder while viewing the

videotapes. A pilot study suggested that the following behaviors occurred with the greatest frequency in this-age-infant interaction, and were the most amenable to interobserver reliability. They were operationally defined as follows:

A. Mother's behaviors

1. Looking away: mother's face averted from baby's face;
2. Talking: any audible vocalization;
3. Smiling: mouth open, corners of lips upturned and teeth bared;
4. Poking: discrete tactile stimulation which usually involved the mother's fingertips and the infant's face;
5. Caretaking: activity clearly intended to "comfort" baby, e.g., burping, wiping face, repositioning infant;
6. Gameplaying: activity universally recognized as a game or a variation thereof, e.g., peak-a-boo, hide-and-seek, itsy-bitsy spider, "I'm going to get you", "tell me a story", and pat-a-cake.

B. Infant's behaviors

1. Looking away: infant's head averted from mother's or doll's face;
2. Vocalizing: sounds which seemed to be voluntary and contented rather than stress-associated fussing,

crying, grunting or hiccups;

3. Fussing or crying: mouth open, closed eyes, and distress sounds such as whining and wailing;
4. Smiling: mouth widened and corners of lips upturned, a slightly sustained expression as opposed to a mere snicker;
5. Cycling: movement of head, legs and arms in rhythmic and circular fashion as in bicycling, typically alternating with brief rest periods;
6. Squirming: straining and twisting of entire body, usually including an arching of the back, moving the head from side-to-side, extending the legs and pushing down or out with them.

Six naive observers (college seniors) were trained to code these behaviors, using pilot study tapes, until at least 80% interobserver reliability was achieved on each of the behaviors. Since the maximum number of behaviors coded was 12 per situation, each of the coders was depressing no more than two event recorder buttons at a time. Since the mother appeared on one-half of the video monitor screen and the infant on the other half, each coder coded either two infant of two maternal behaviors.

Following the reliability training period and over the course of a semester's coding periodic reliability checks were made. Reliability was measured by the number of agreements divided by the sum

of agreements and disagreements. A one-second error for differential reflex time was allotted at each end of the coded behavior in the measurement of agreements. The interobserver reliability coefficients derived from four periodic reliability checks averaged .91 for the maternal behaviors and .87 for the infant behaviors. The reliability coefficients for the individual behaviors appear in Table 1.

The polygraph output of the event recorder was handscored for the temporal duration of the coded behaviors. The polygraph sheets were then blocked according to infant looking behavior, i.e. periods of looking at the mother and periods of looking-away from the mother. The durations of the other 11 behaviors occurring within each of the looking/looking-away periods were then calculated. This resulted, for example, in one figure for the total number of seconds a mother was talking while her infant was looking at her, and another figure for mother talking while her infant was looking-away from her during any particular three-minute period of interaction.

For each 3-minute interaction situation totals were calculated for the following measures: 1) the number of seconds that the infant was looking at the mother and the number of seconds that the infant was looking-away from the mother, 2) the number of infant looking-away seconds that the mother was active. Total infant looking time per three-minute situation was then converted to a percentage score. Likewise, the total number of seconds of infant looking and the total number of seconds of infant looking-away which featured

Table 1

Interobserver Reliability Coefficients for Coded Maternal and Infant Behaviors

Maternal Behaviors		Infant Behaviors	
Looking Away	.98	Looking Away	.95
Talking	.95	Vocalizing	.89
Smiling	.91	Fussing or Crying	.93
Poking	.84	Smiling	.84
Caretaking	.86	Cycling	.89
Gameplaying	.91	Squirming	.83

maternal activity were also converted into percentage scores. A maximum of one behavior per second figured in the maternal activity totals. A density measure of maternal behavior was not used, since mothers invariably displayed two or three behaviors simultaneously in a kind of stimulus configuration whenever they were active. A "stimulus configuration" typically included smiling and vocalizing, and almost always involved looking at the infant. Similarly, behavior frequencies were not used since they do not reflect the temporal duration of the behaviors which are typically extended in time, particularly in infant-mother interaction.

The three dependent measures used in the analysis, then, were: 1) the percentage of infant looking per 3-minute situation, 2) the percentage of infant looking time that the mother was actively displaying at least one of her six coded behaviors, and 3) the percentage of infant looking-away time that the mother was active.

Analyses of Data

Analyses of the data included a repeated measures analysis of variance, follow-up Student's *t* tests, a Pearson Correlation, and a multiple regression analysis. The repeated measures analysis of variance was a 2 x 2 x 3 x 3 design (sex by order by diagnosis with the interaction situation as the repeated measure). The dependent measures were 1) the percentage of interaction time which featured infant looking, 2) the percentage of infant looking time that the mother was active, and 3) the percentage of infant looking-away time that the mother was active.

The t tests were performed on all of the above measures and also on the chronological age and Brazelton A Priori Interaction score. The t tests were performed to test differences among means within subsets smaller than the entire treatment set. The Bonferroni t table was used to determine levels of significance for the t values (Myers, 1973).

For a Pearson Correlation analysis all subjects were combined to test the relationship between the infant looking time and maternal activity during infant looking measures taken from the spontaneous interaction.

Multiple regression analysis was performed with infant looking time and maternal activity variables along with two transformation variables as outcome measures. The two transformation variables were: 1) the amount of time the infant spent looking at the doll during the doll situation versus the amount of time the infant spent looking at the mother during the spontaneous interaction, and 2) the amount of maternal activity during infant looking time versus the amount of maternal activity during infant looking-away time. The infant's chronological age, diagnostic group and the Brazelton A Priori Interaction score were used as predictors.

On all of the above analyses a minimum level of $p < .05$ was set as the level of significance.

C H A P T E R V

RESULTS

The main effects of interaction situation, order of situation, diagnostic group and sex of infant and the interactions yielded by the repeated measures analysis of variance and the t test comparisons are presented first for each of the three dependent variables. The means and marginals of these variables appear in Table 2, Appendix B. The ANOVA tables appear in Appendix C.

Percentage of Maternal Activity during Infant Looking Time

The hypotheses related to the amount of maternal activity during infant looking were as follows: 1) maternal activity would decrease in a linear fashion from the attention-getting to the spontaneous, to the imitation situations, and 2) maternal activity would increase across the three diagnostic groups in the order of normal, post-mature and high-risk groups.

ANOVA Main Effects

The repeated measures analysis of variance on the percentage of infant looking time that the mother was active during the spontaneous, imitation and attention-getting situations yielded three main effects. They were 1) interaction situation, 2) order of interaction, and 3) diagnostic group.

Interaction situation effect. The most dramatic main effect was that of the interaction situation. Maternal activity for all groups

combined was 87% in the attention-maintaining situation, 78% in the spontaneous situation and 57% in the imitation situation ($F(2,48)=75.30$, $p < .001$). Each of these percentages was significantly different from each other (See Figure 1).

Order of situation effect. There was a main effect for the order of the interaction with maternal activity averaging 78% in order 1 (attention-getting followed by and including imitation), and 69% for the order 2 subjects (imitation followed by and including attention-getting), $F(1,24)=7.39$, $p < .01$.

The t tests suggested that this difference was accounted for by the occurrence of significantly more maternal activity during imitation when it followed attention-getting (order 1), and significantly less maternal activity during attention-getting when it followed imitation (order 2) ($t(34)=2.53$, $p < .025$).

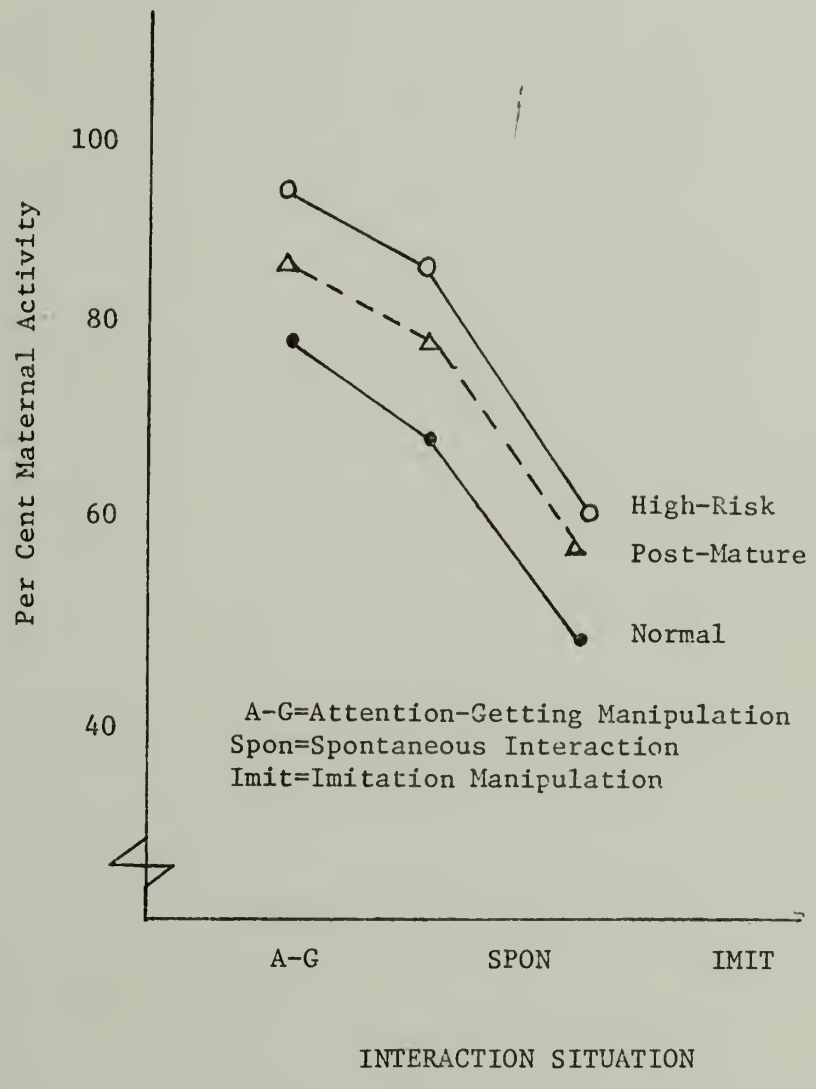
Diagnostic group effects. There was a significant difference between diagnostic groups on the amount of maternal activity during infant looking time averaged across the interaction situations. The mothers of normal infants were active 66% of the time, mothers of post-matures 75% of the time and mothers of high-risk infants 80% of the time, $F(2,24)=7.12$, $p < .005$.

The t tests of the diagnostic group comparisons suggested the following (See Figure 1):

1. A significant difference between normal and high-risk groups with the mothers of high-risk infants being more

Figure 1

Percentage of Maternal Activity during Infant Looking Time
Diagnostic Group Effect



active than the normal mothers during the spontaneous interaction ($t(22)=3.69$, $p < .001$) and during the attention-getting situation ($t(22)=2.44$, $p < .025$).

2. A slight but non-significant difference between normal and post-mature groups.
3. No significant differences between the amount of maternal activity of the post-mature and high-risk mothers in any of the situations.
4. No differences between any of the groups on the amount of maternal activity during infant looking time in the imitation situation.

ANOVA Interactions

There were some simple first-order as well as second-order interactions for the maternal activity during infant looking time measure.

Order by diagnosis. An order by diagnosis effect (See Figure 2) suggested that there was a greater amount of activity manifested by the mothers of normal and post-mature infants when attention-getting was followed by imitation (order 1) than when imitation was followed by attention-getting (order 2), $F(2,24)=8.75$, $p < .001$.

Situation by order. A situation by order interaction (Figure 3) suggested that the order in which the manipulations were assigned made a difference for the imitation situation, $F(2,48)=5.46$, $p < .01$. There

Figure 2

Percentage of Maternal Activity during Infant Looking Time
Order by Diagnosis Interaction

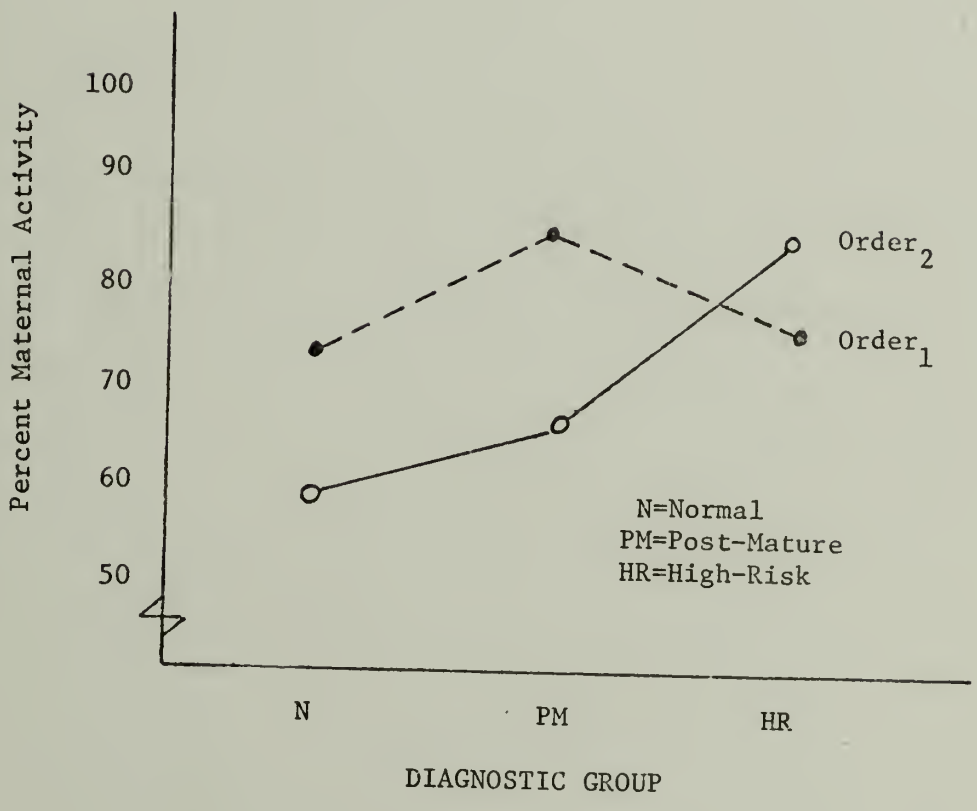
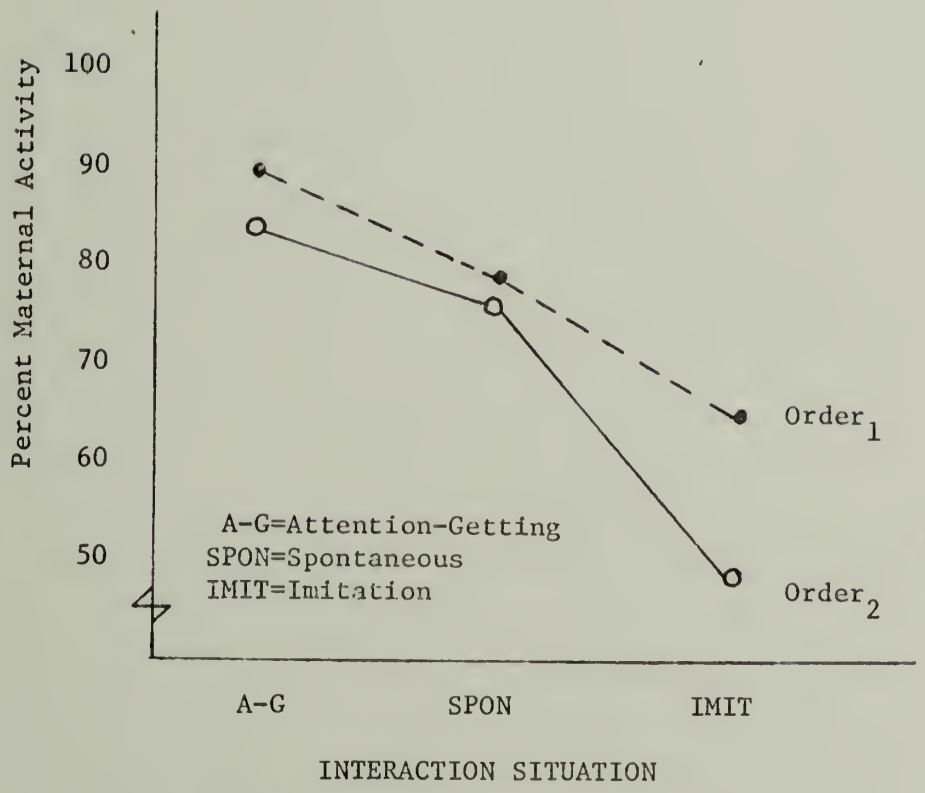


Figure 3

Percentage of Maternal Activity during Infant Looking Time Situation by Order Interaction



was a greater amount of activity during imitation of order 1 than order 2 (65% when imitation followed attention-getting and 47% when imitation was the first manipulation).

Situation by sex by diagnosis. A second order interaction was that of situation by sex by diagnosis (Figure 4), $F(4,48)=3.52$, $p < .01$. In all situations the mothers of high-risk male and female infants were more active than the normal control mothers except during the imitation situation when mothers of normal babies and high-risk female babies were equally active.

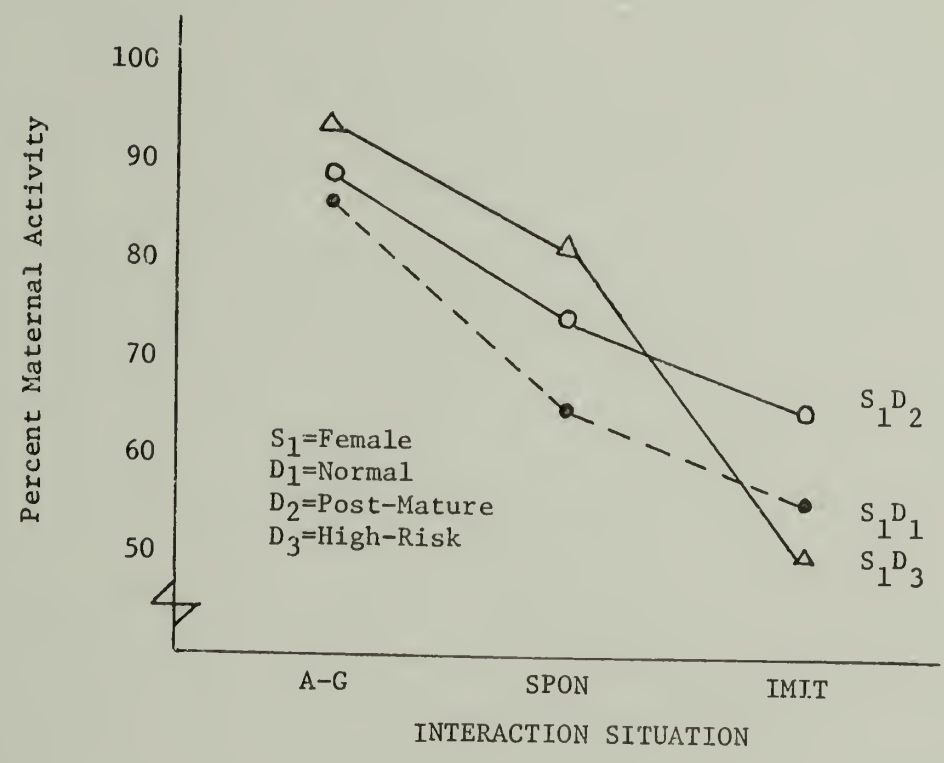
Situation by sex by order by diagnosis. A higher order interaction, situation by sex by order by diagnosis (Figure 5) suggested that order 1 mothers of high-risk females were less active than the other mothers during imitation. Conversely, order 2 mothers of high-risk males were significantly more active than the other mothers during imitation, $F(4,48)=3.74$, $p < .01$.

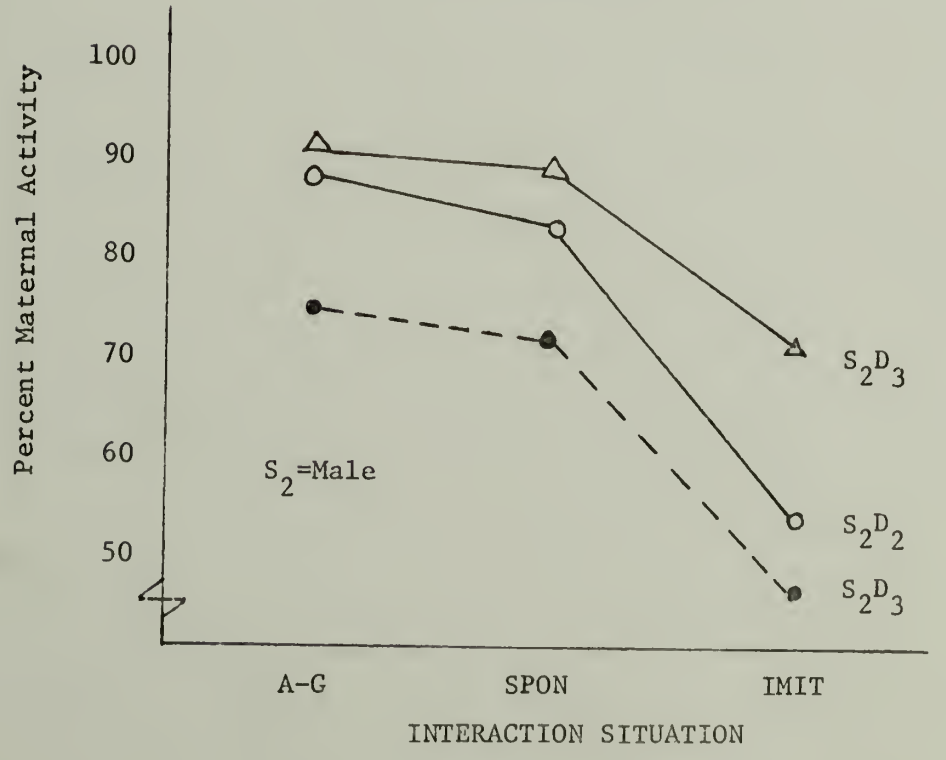
Percentage of Maternal Activity during Infant Looking-Away Time

The hypotheses for the percentage of maternal activity during infant looking-away time variable were: 1) maternal activity would decrease in a linear fashion across the three interaction situations from the attention-getting to the spontaneous to the imitation situations, and 2) maternal activity would increase across the three diagnostic groups in the order of normal, post-mature and high-risk groups.

Figure 4

Percentage of Maternal Activity during Infant Looking Time Situation by Sex by Diagnosis Interaction





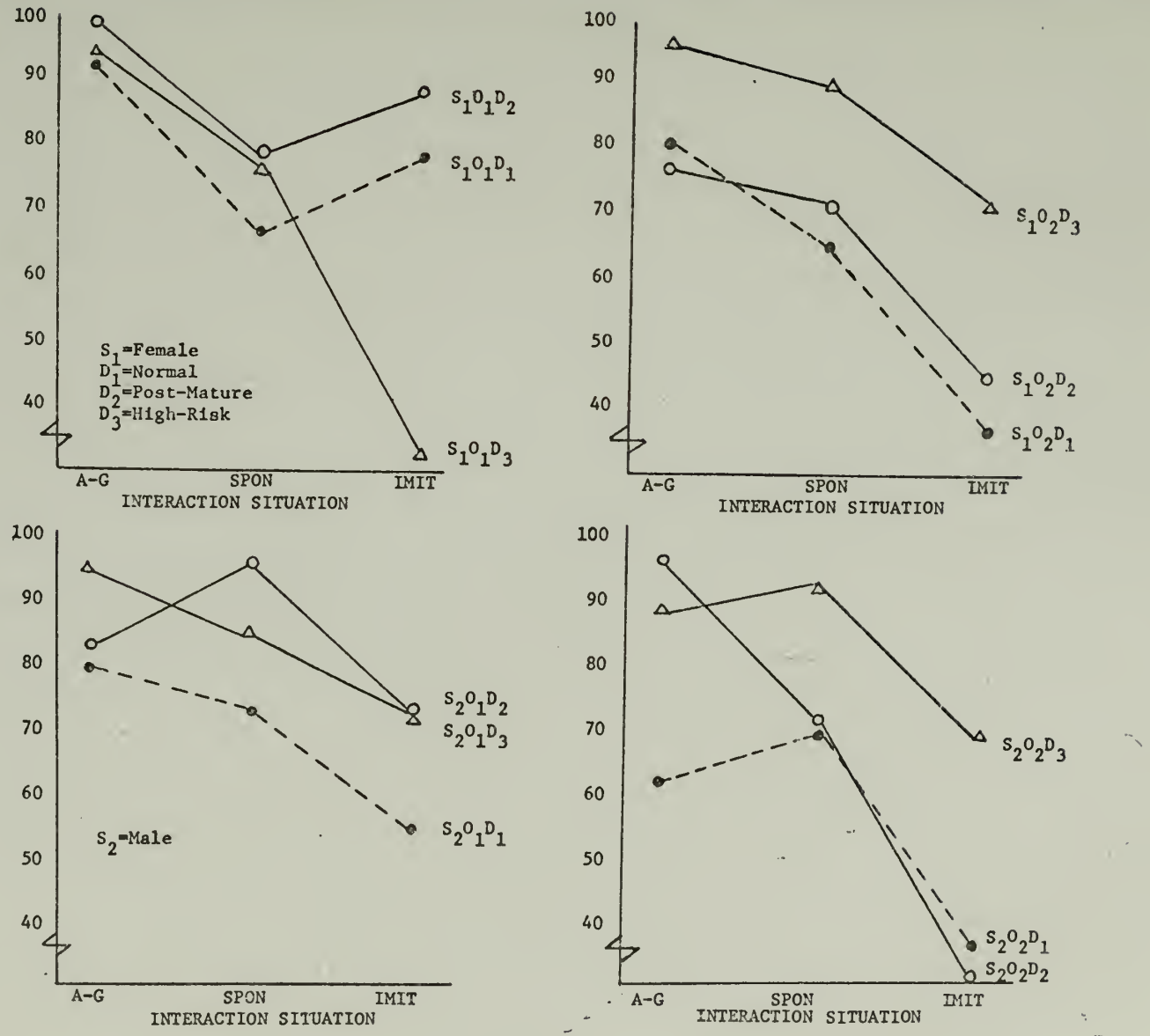


Figure 5

Percentage of Maternal Activity during Infant Looking Time Situation by Sex by Order by Diagnosis

ANOVA Main Effects

The repeated measures analysis of variance on the percentage of infant looking-away time that the mother was active yielded main and interaction effects similar to those found on the percentage of maternal activity during infant looking time measure.

Interaction situation effect. The interaction situation effect for the percentage of maternal activity during infant looking-away time was the most dramatic of the main effects, $F(2,48)=42.49$, $p < .001$. Mothers showed 80% activity during the attention-getting situation, 64% activity during the spontaneous interaction and 46% during the imitation situation. All t test comparisons were significant (See Figure 6).

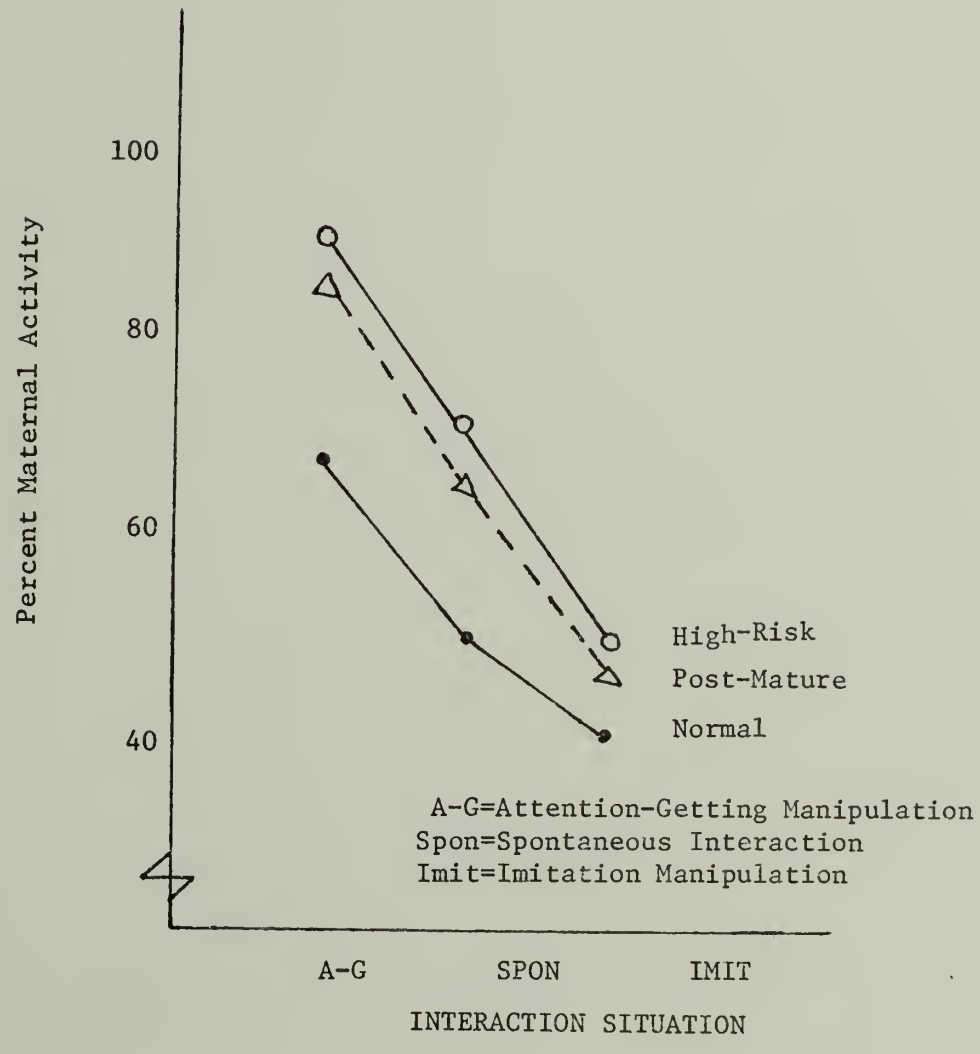
Diagnostic group effect. There was a significant main effect for diagnostic group with mothers of normal infants being active 52% of the infant's looking-away time, mothers of post-mature infants being active 66% of the time and mothers of high-risk premature infants 72% of the time, $F(2,24)=7.06$, $p < .005$.

The t tests for group comparisons (Figure 6) suggested the following:

1. Mothers of high-risk infants were significantly more active than were the mothers of normal babies during their infants' looking-away periods in both the spontaneous interaction ($t(22)=2.50$, $p < .025$) and the attention-getting situation ($t(22)=4.78$, $p < .001$).

Figure 6

Percentage of Maternal Activity during Infant Looking Time
Diagnostic Group Effect



2. Mothers of post-matures were more active than those of the normal infants only during the attention-getting situation ($t(22)=3.45$, $p < .005$).
3. There were no differences between mothers of post-matures and mothers of high-risk infants on this measure.
4. There were no differences between any of the groups on the amount of maternal activity during the imitation situation.

ANOVA Interactions

Although there was no order main effect for the maternal activity during infant looking-away time measure, there were significant first order interactions of order by diagnosis and situation by order. Also, as was found for the maternal activity during infant looking time measure, there was a higher order interaction of situation by sex by order by diagnosis.

Order by diagnosis. The order by diagnosis interaction (Figure 7) for the maternal activity during infant looking-away time measure suggested that order made a difference only for the mother of the post-mature infant. Maternal activity was greater for order 1 post-mature subjects (76%) who had experienced the attention-getting manipulation first than it was for order 2 post-mature subjects (55%), $F(2,24)=3.23$, $p < .05$.

Situation by order. A more significant interaction was that of situation by order (Figure 8), $F(2,48)=5.11$, $p < .01$. As was the case for the maternal activity during infant looking time measure, order

Figure 7

Percentage of Maternal Activity during Infant Looking-Away Time Order by Diagnosis Interaction

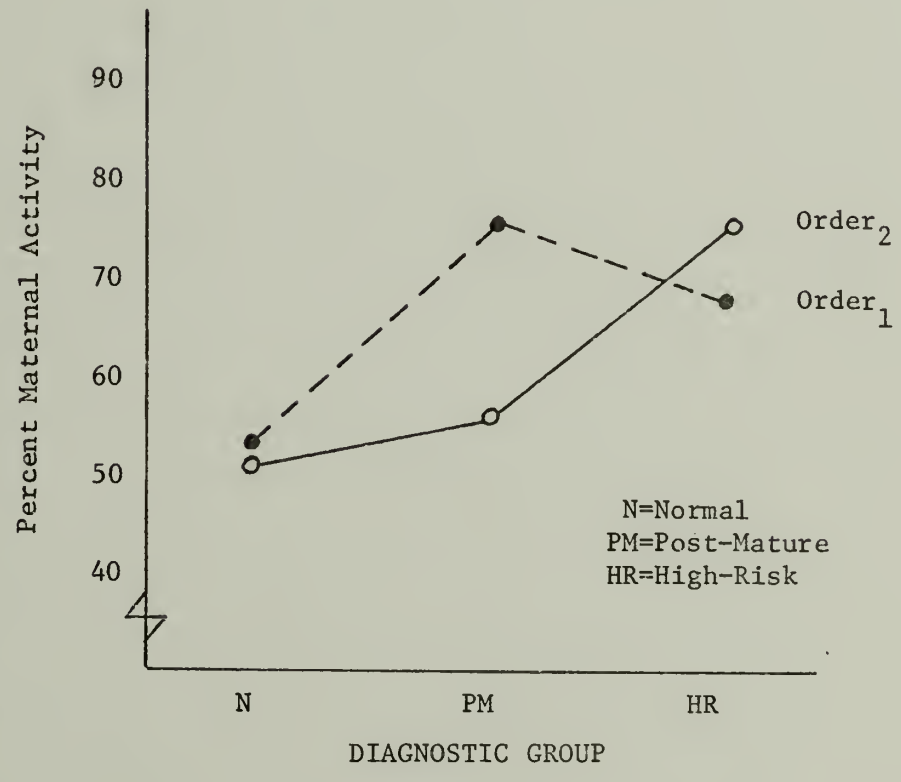
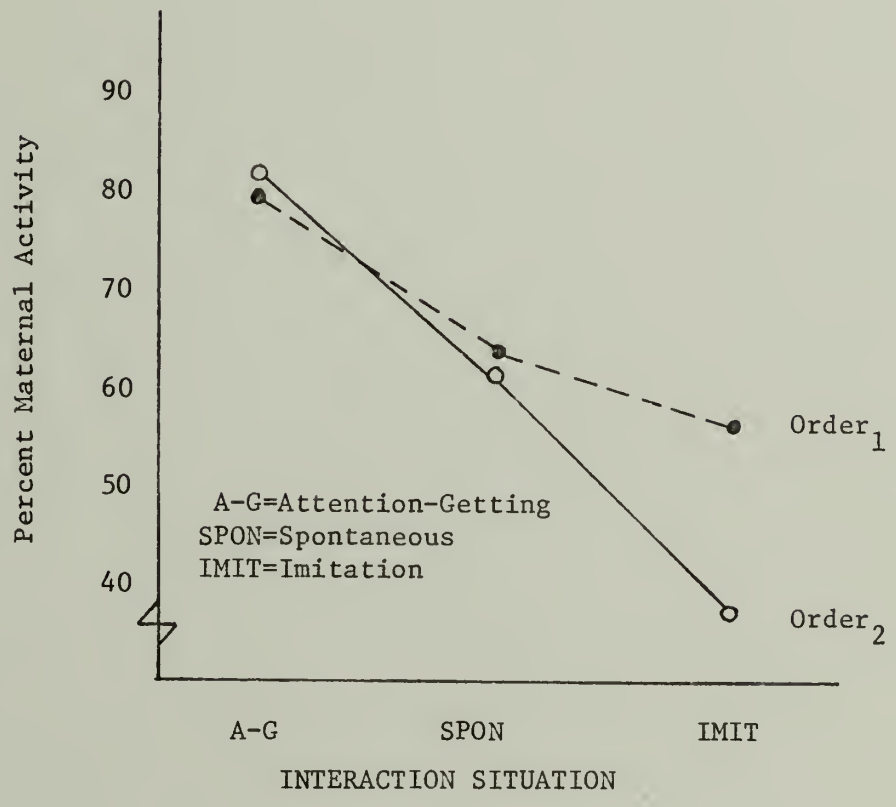


Figure 8

Percentage of Maternal Activity during Infant Looking-Away Time Situation by Order Interaction



appeared to affect the activity level of the imitation situation with mothers experiencing attention-getting first being more active than those who experienced the imitation situation first.

Situation by sex by diagnosis. There was, again similar to the maternal activity during looking time measure, a situation by sex by diagnosis interaction (Figure 9) for the maternal activity during looking-away time measure. Mothers of high-risk infants as a group were significantly more active than mothers of normal infants during the spontaneous and attention-getting situations. During the imitation situation, however, mothers of high-risk females were comparable to the mothers of normal infants ($F(4,48)=6.01$, $p < .001$.

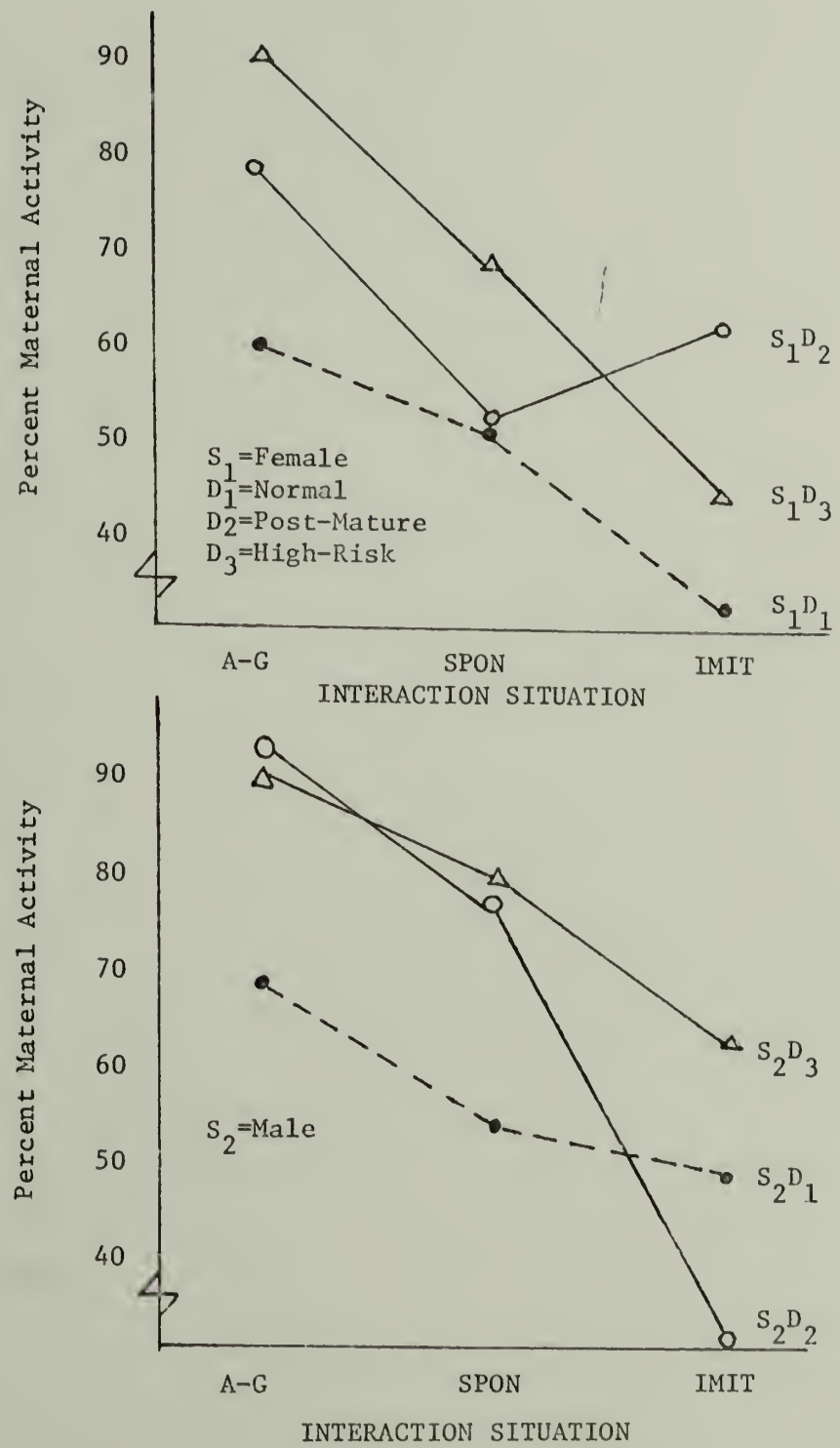
Situation by sex by order by diagnosis. A situation by sex by order by diagnosis higher order interaction for the maternal activity during infant looking-away time measure (Figure 10) suggested that the mothers of post-mature females who experienced the attention-getting situation first (order 1) engaged in more activity, and the mothers of post-mature males who experienced the imitation situation first (order 2) engaged in less activity than did the other groups of mothers ($F(4,48)=2.56$, $p < .05$).

Percentage of Infant Looking Time

The hypotheses tested for the percentage of interaction time that the infant was looking at the mother were: 1) the percentage of infant looking time would increase linearly across the three interaction

Figure 9

Percentage of Maternal Activity during Infant Looking-Away Time Situation by Sex by Diagnosis Interaction



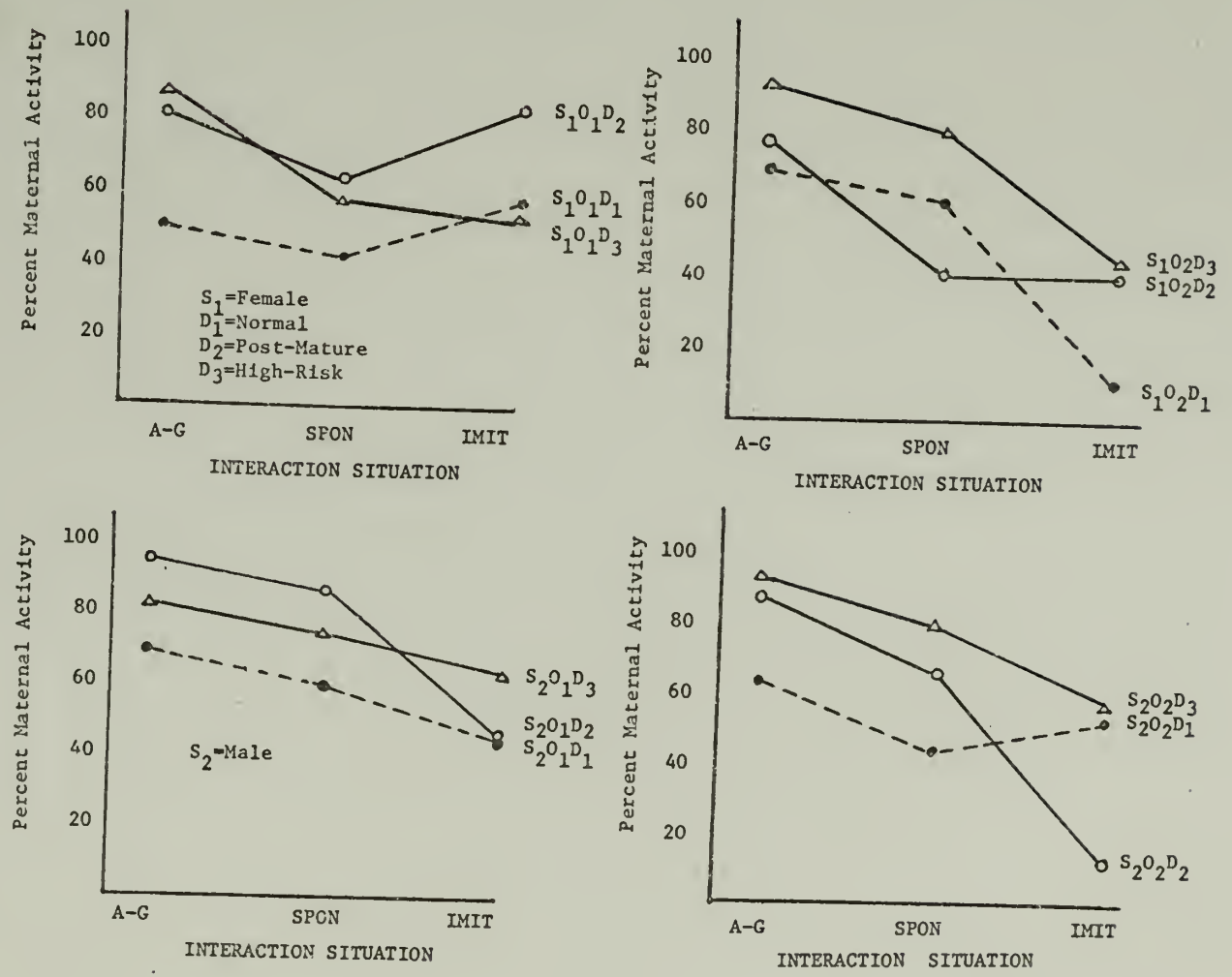


Figure 10

Percentage of Maternal Activity during Infant Looking-Away Time Situation by Sex by Order by Diagnosis Interaction

situations from the attention-getting manipulation to the spontaneous interaction to the imitation manipulation, and 2) the percentage of infant looking time would decrease across the three diagnostic groups from the normal to the post-mature to the high-risk group.

ANOVA Main Effects

The repeated measures analysis of variance for the infant looking time measure yielded the same main effects as for the maternal activity measures but, in general, the effects were in the opposite direction of those for the maternal activity measures, i.e., in situations where there was more maternal activity, there was less infant looking. This inverse relationship is depicted in Figures 11 and 12.

Interaction situation effect. The interaction situation effect for the percentage of infant looking time was extremely pronounced, $F(2,48)=120.93$, $p < .001$. Infants showed a mean percentage of 40% looking during the attention-getting situation, 54% during the spontaneous interaction and 79% during the imitation situation, all of which were significantly different (See Figure 13).

Order effect. An order effect, $F(1,24)=5.20$, $p < .05$, suggested that there was significantly less infant looking at the mother during the imitation situation when it had been preceded by the attention-getting manipulation.

Diagnostic group effects. A main effect for diagnostic group revealed that there were significant differences between groups on the percentage of infant looking averaged across the interaction situations.

Figure 11

Inverse Relationship Between Maternal Activity and Infant Looking Time

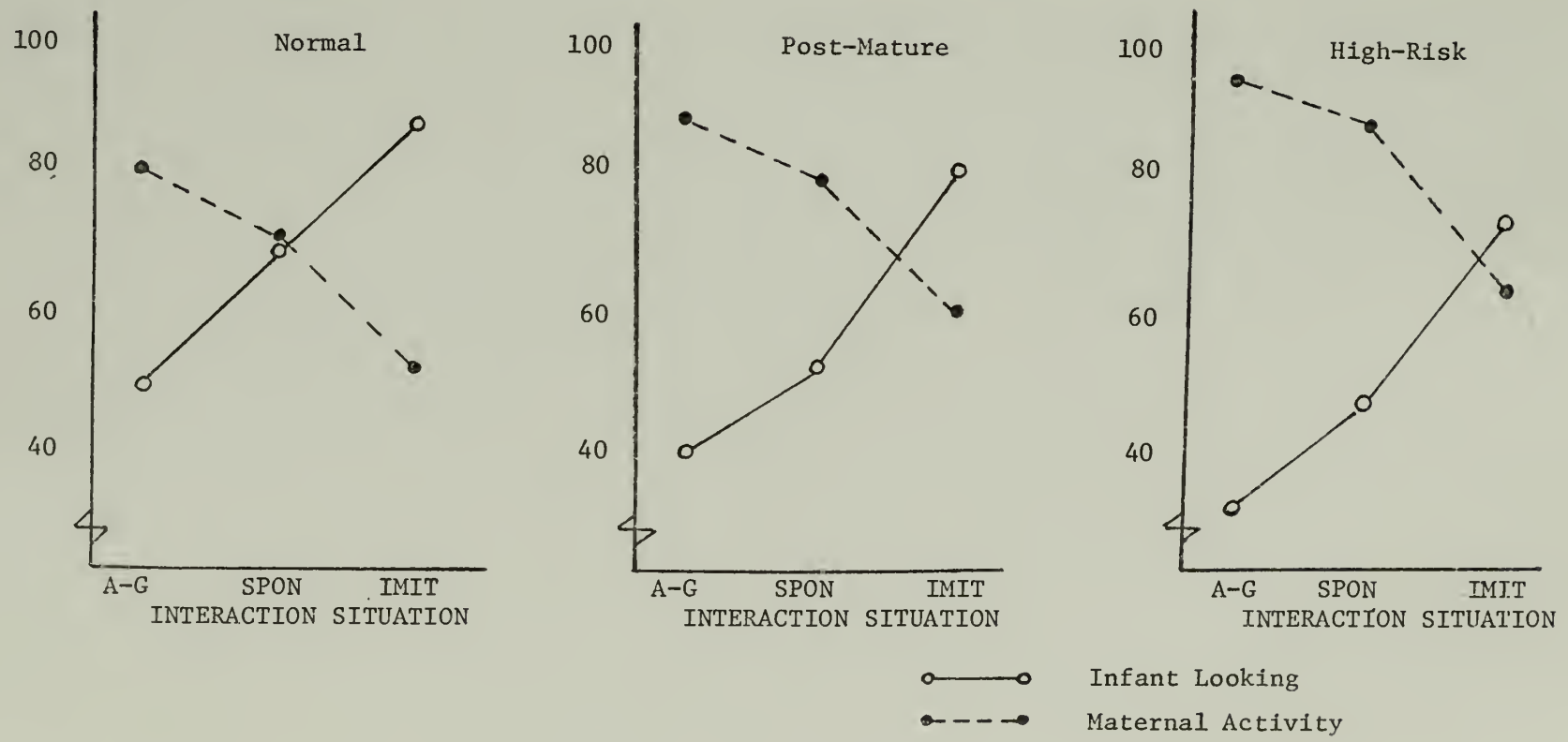


Figure 12

Inverse Relationship Between Maternal Activity during Infant Looking-Away Time and Infant Looking Time

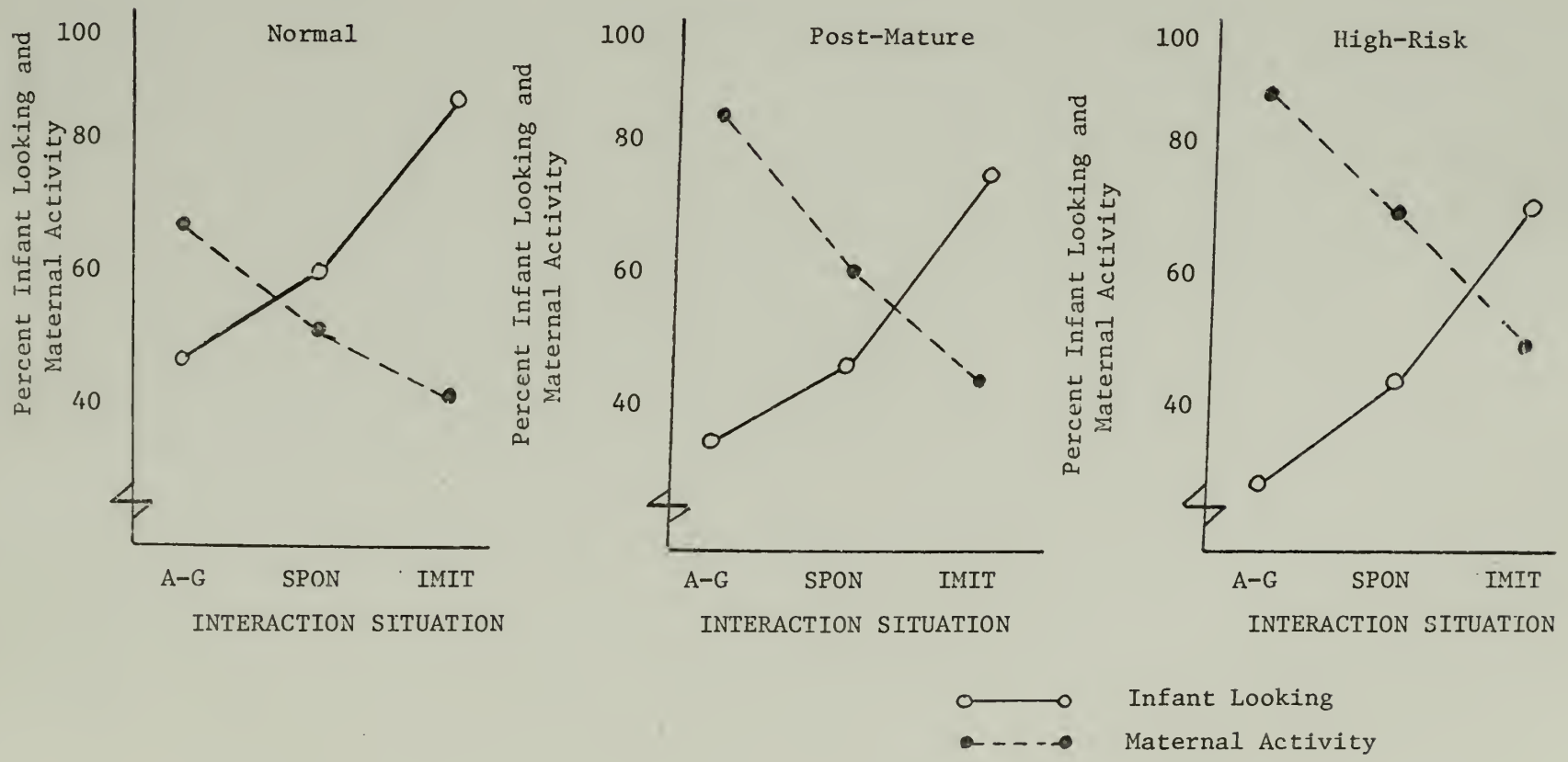


Figure 13

Percentage of Infant Looking during Interaction Time
Diagnostic Group Effect

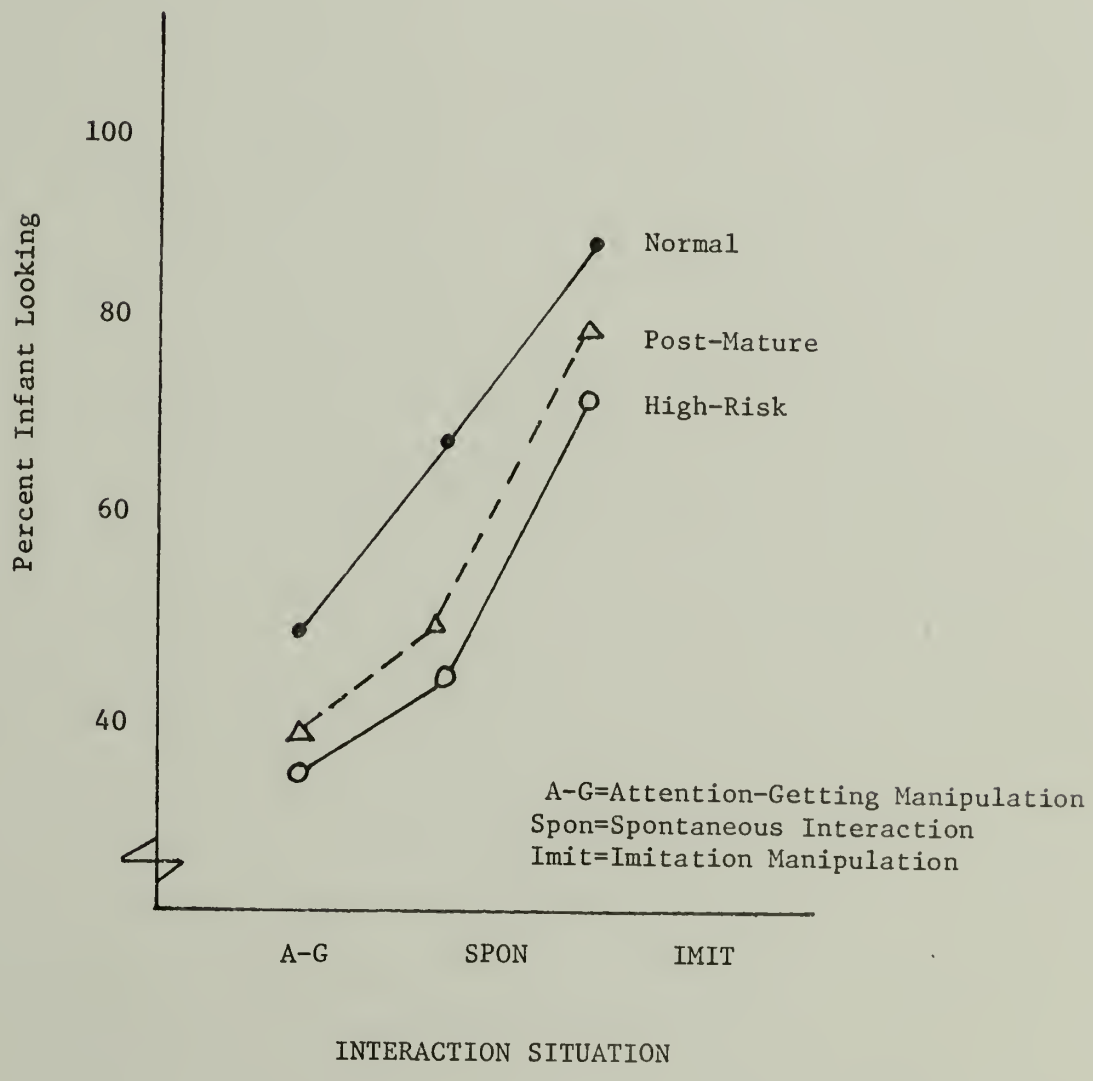
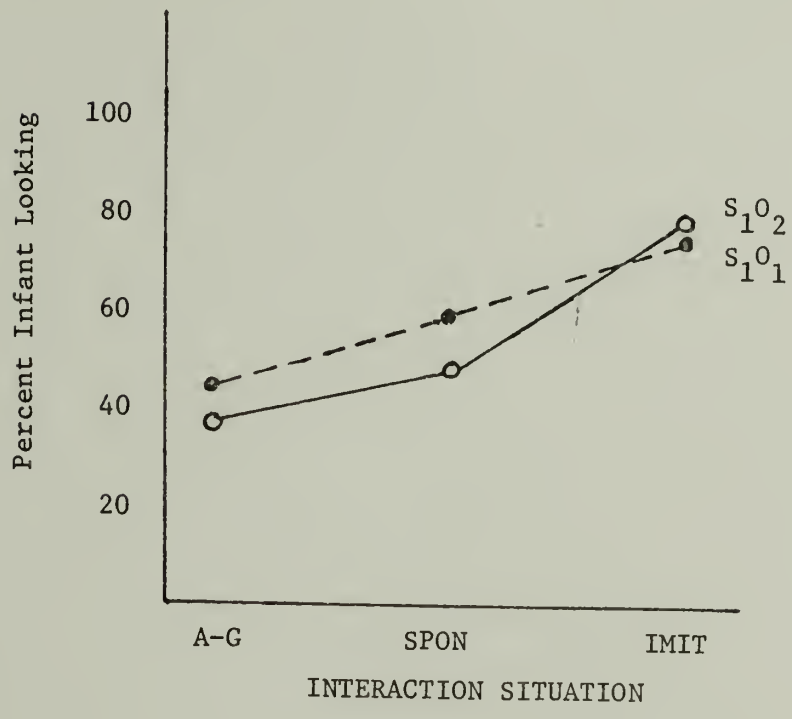
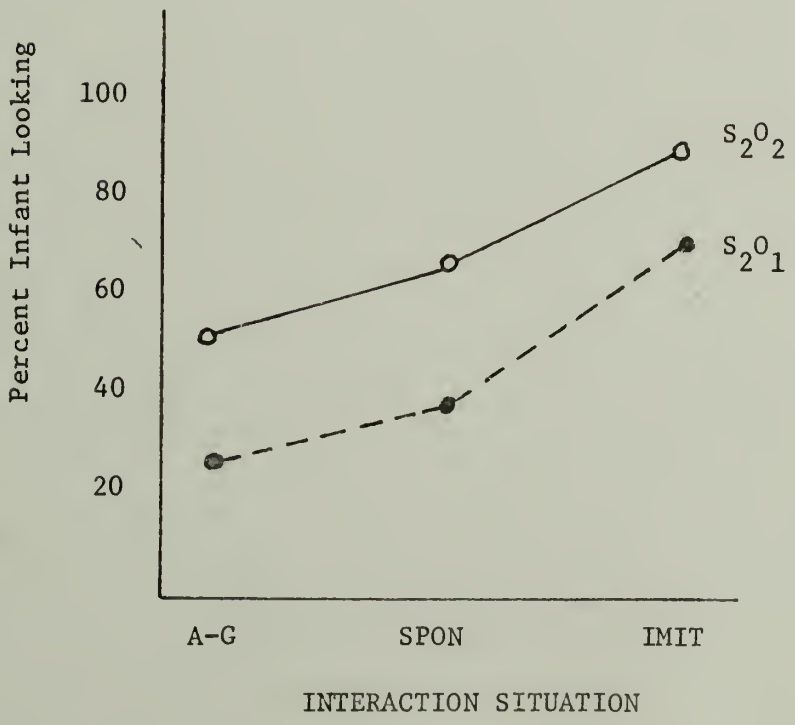


Figure 14

Percentage of Infant Looking during Interaction Time Situation by Sex by Order Interaction





The normal group engaged in looking at the mother 66% of the time, the post-mature group 57% and the high-risk group 51% of the time, $F(2,24)=3.75$, $p<.05$.

The t tests demonstrated the following specific comparisons (Figure 13):

1. The normal infant engaged in more looking at the mother than did the high-risk infant during the spontaneous interaction ($t(22)=2.54$, $p<.025$) and during the attention-getting manipulation ($t(22)=2.41$, $p<.05$).
2. Differences in looking time between the normal and post-mature groups, and between the post-mature and high-risk groups were not significant.
3. There were no significant differences between diagnostic groups on the infant looking time measure during the imitation situation.

These differences and non-differences between groups were very similar to those found for both maternal activity measures.

ANOVA Interactions

Situation by sex by order. A second order interaction for the percentage of infant looking during interaction time suggested that there was significantly more looking by males during the attention-getting situation if they had experienced the imitation manipulation first ($F(2,48)=3.50$, $p<.05$) (Figure 14).

Situation by sex by order by diagnosis. A situation by sex by order by diagnosis interaction for the infant looking time measure (Figure 15) suggested that normal females spent significantly more time looking at their mothers during the spontaneous situation, $F(4,48)=2.87$, $p<.05$.

Analyses of Transformation Variables

Two transformation variables were created and analyzed by t tests for zero means. These transformation variables were designed to test the following: 1) the difference between the percentage of infant looking at the doll during the doll situation versus looking at the mother during the spontaneous and during the imitation situations; 2) the difference between the percentage of maternal activity during infant looking time and during infant looking-away time across all situations.

The results were as follows: 1) The percentage of infant looking at the doll during the doll situation was greater than the percentage of infant looking at the mother during the spontaneous interaction, $t(35)=8.50$, $p<.001$. The difference between infant looking at the doll and infant looking at the mother during the imitation situation, however, only approached significance, $t(35)=2.01$, $p<.10$. 2) There was a greater amount of maternal activity during infant looking time than during infant looking-away time during the spontaneous interaction $t(35)=2.95$, $p<.05$, and during the imitation situation, $t(35)=4.23$,

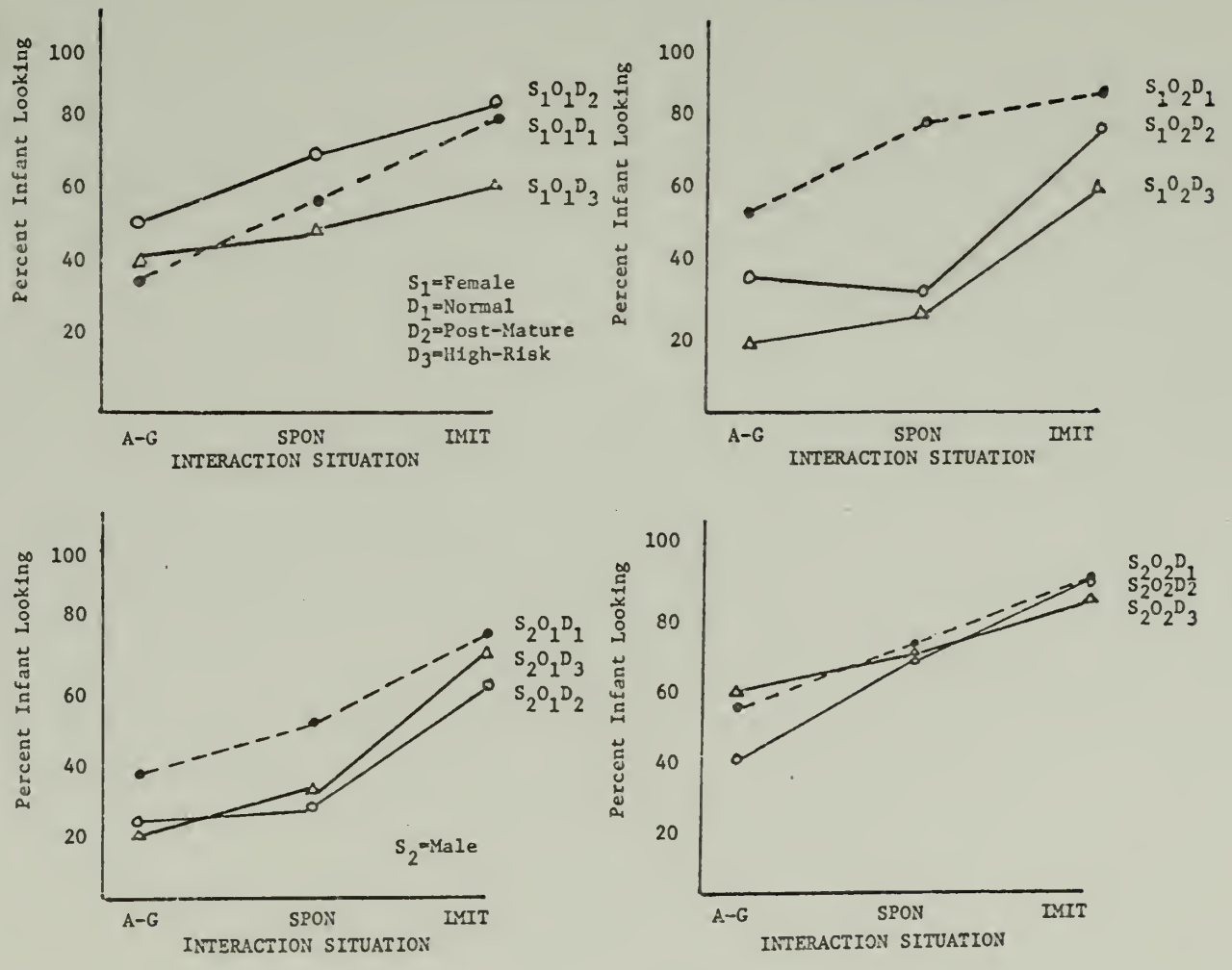


Figure 15

Percentage of Infant Looking during Interaction Time-Situation by Sex by Order by Diagnosis

$p < .001$. The difference between maternal activity time during infant looking and looking-away periods of the attention-getting situation only approached significance, $t(35)=2.16$, $p<.10$.

Other Analyses

t Tests

The t tests on chronological age of the infant and on the Brazelton A Priori Interaction score variables suggested the following:

1. The difference between the chronological ages of the normal and high-risk infants only approached significance, $t(22)=-2.29$, $p<.10$.
2. The normal group had significantly better scores on the Brazelton A Priori Interaction cluster than did the post-mature ($t(22)=-4.73$, $p < .001$) or the high-risk ($t(22)=-4.17$, $p < .001$). (A lower score is a superior score on the Brazelton cluster). There was no difference between the post-mature and the high-risk infants on the Brazelton Neonatal Interaction measure.

Pearson Correlation

The Pearson Correlation coefficient for the relationship between infant looking time and maternal activity during infant looking time in the spontaneous situation was -.392 ($r(34)=-.392$, $p < .02$).

Multiple Regression Analysis

Since there were significant diagnostic group and Brazelton Inter-

action score differences between subjects, the data for all subjects were entered into a multiple regression analysis to determine which of these factors might explain the variance on the outcome measures. The multiple regression analysis using the three dependent variables (infant looking time, maternal activity during infant looking time and maternal activity during infant looking-away time) as outcone measures and diagnostic group and Brazelton Interaction scores as predictors revealed the following:

1. Diagnostic group as a predictor had a squared multiple correlation of .41, $F(4,31)=5.36$, $p < .005$.
2. The R square for the Brazelton A Priori Interaction score was .38, $F(4,31)=4.78$, $p < .005$.
3. Together the diagnostic group and Brazelton Interaction variables explained 32% of the variance of maternal activity during infant looking time of the spontaneous interaction ($F(5,30)=2.79$, $p < .05$; 36% of the variance of the maternal activity during infant looking in the attention-getting situation ($F(5,30)=3.31$, $p < .05$; and 46% of the variance of the maternal activity during infant looking-away during the attention-getting situation ($F(5,30)=5.04$, $p < .005$.

Curiously, they did not explain more than 24% of the variance of the infant looking time measure which only approached significance at the $p < .10$ level.

Summary of the Results

Since the effects were consistent for all three dependent measures, infant looking time, maternal activity during infant looking time and maternal activity during infant looking-away time, they can be summarized together. The most dramatic effect was that of the infant-mother interaction situation. The percentage of infant looking time and the percentage of maternal activity during infant looking time and during infant looking-away time differed rather dramatically in the predicted direction across the interaction situations. Infant looking time increased and maternal activity decreased in a linear fashion across the attention-getting, spontaneous and imitation situations. The infant looking and maternal activity measures were inversely related as was seen in Figures 11 and 12. The imitation situation featured the least amount of maternal activity and the greatest amount of infant looking. Conversely, the attention-getting situation was characterized by the greatest amount of maternal activity and the least amount of infant looking. Thus, the interaction manipulations modified the percentage of maternal activity and the percentage of infant looking in the predicted directions.

The order in which subjects experienced the interaction manipulations affected their activity levels. The high level of maternal activity and low level of infant looking which occurred when the attention-getting situation was experienced first appeared to carry over into the imitation situation. And the low level of maternal

activity and high level of infant looking activity which occurred when imitation was experienced first persisted across the attention-getting situation which followed.

The mothers of normal infants were less active than were the mothers of the high-risk infants, and the normal infants spent more time looking at their mothers than did the high-risk infants during the spontaneous and attention-getting situations. The female high-risk and the normal groups exhibited equivalent amounts of activity during the imitation situation. Surprisingly, there were no differences between the post-mature and high-risk groups on any of the measures taken from any of the situations.

The amount of maternal activity during the infant's looking periods was greater than the amount of her activity during his looking-away periods except during the attention-getting situation. The infants spent more time looking at the doll during the doll situation than they spent looking at their mothers during the spontaneous interaction. The diagnostic group and Brazelton A Priori Interaction scores explained a significant amount of the variance between subjects on the maternal activity measures but only approached significance as predictors of infant looking time differences.

CHAPTER VI

DISCUSSION

Experimental manipulations of interaction have dramatic effects on the behavior of the interactants. Manipulations of adult interactions by Chapple (1970) and infant-mother interactions by Tronick et al (1974) and Trevarthen (1974) have already suggested that phenomenon. The magnitude of effects of the particular manipulations used in this study, however, was striking. Attention-getting and imitation manipulations appeared to modify considerably the face-to-face interactions of 3-6-month-old infants and their mothers.

These manipulations appeared to directly alter the mother's activity level which in turn affected the infant's looking activity. A possible argument for this direction of effects goes as follows: During the spontaneous and imitation situations there was more maternal activity during infant looking time than during infant looking-away time suggesting that the mother is sensitive to her infant's attentive and inattentive periods (see Figures 1 and 6). Accordingly, she tends to reserve her stimulation for his looking periods and reduce her activity during his looking-away periods. If more maternal activity corresponds to more infant looking and less maternal activity to less infant looking, we would predict that there would be a greater amount of infant looking, and a lesser amount of maternal activity during the attention-getting situation characterized by less infant looking. These are the predictions one would make if the mother's behavior is expected to be contingent on the infant's looking activity.

The results of this study suggest, however, that the mother's activity was greater during attention-getting and less during imitation. Furthermore, the mother's activity during attention-getting was more evenly distributed across both infant looking and looking-away periods as if that instruction had encouraged her to persist in activity, irrespective of her infant's looking signals, in order to keep her infant's attention. Seemingly, then, the mother's activity was controlled to a greater degree by the manipulation instructions of this study than by her infant's looking activity. The infant's looking activity was contingent upon the amount of maternal activity rather than the reverse.

The potency of the mother as an initiator and a contingent reinforcer in interactions with her infant has frequently been suggested in the literature (Beckwith, 1971; Jones & Moss, 1971; Lewis & Lee-Painter, 1972; Moss, 1967; Olley, 1973; Strain & Vietze, 1975; Watson, 1972). The assignment of one of these roles to the mother via an instruction, however, appears to exaggerate significantly her initiating and contingent behaviors. For example, the instruction to keep her infant's attention in the present study seemed to increase appreciably the amount of time the mother spent initiating conversation. When she was asked to imitate her infant, she decreased her activity and appeared to become more contingently responsive to her infant's behaviors.

The attention-getting situation parallels those stressful manipu-

lations used with adults by Chapple (1970). Like Chapple's subjects, the mother was encouraged by the attention-getting task to be an initiator and continuously make overtures to her infant. Allowing him very little time to respond effectively appeared to drive the infant into a withdrawal state as evidenced by his excessive looking away from her. The repeated stress of not getting an immediate response from her infant as well as his almost continuous looking away from her tended to speed up the tempo and increase the quantity and intensity of the mother's (initiator's) actions. The infant (responder), finding himself being initiated to repeatedly without being given the time to respond or to "get a word in edgewise," ultimately withdrew from the interaction.

In addition to the frustration the mother probably experienced because of her infant's inattentiveness and latency of responses and due to her inability to successfully carry out the assigned attention-getting task, the mother reputedly feels rejected by the gaze aversions of her infant (Hutt & Ounsted, 1966). During a situation of excessive gaze aversion the mother is interacting in the relative absence of the "releasing-stimulus" (infant gaze) which is said to elicit her "infantized" behaviors (Stern, 1974; Wolff, 1963). If infant gaze elicits "infantized" behaviors, then gaze aversion or looking away would presumably result in fewer "infantized" behaviors or in quantities and rates of behaviors not typical of an optimal infant-mother interaction. During Trevarthen's manipulation the

mother's infantized behaviors were transformed to adult-like behaviors both in quantity and quality as well as in pacing when she was no longer allowed to see her infant during their interaction (Trevarthen, 1974). The infant's latency of responses and the mother's continual interruptions disrupted their interaction, and the infant ultimately withdrew from the interaction. In the present study the mothers, while engaging in the attention-getting situation, became significantly more active both during the infant's looking time (which probably contributed to the increase in his looking-away from her) and during his looking-away time (which may have contributed to his persistence in looking-away from her).

Gaze aversion or excessive looking-away from the mother may be a social "cut-off" behavior (Chance, 1962), an attempt to evade maternal intrusive behavior (Stern, 1974), and a source of frustration for mothers (Hutt & Ounsted, 1966). When gaze aversion becomes excessive, some mothers have been observed to engage in counter-productive activity, i.e., to accelerate the intrusive behavior which seems to have initiated the gaze aversion (Brazelton et al, 1974; Tronick et al, 1974). Although the results of the attention-getting situation in the present study suggest that this situation led to a significant increase in maternal activity and infant looking-away, it is difficult to determine which aspect of the mother's "hyperactivity" may have contributed to her infant's excessive looking-away from her. The increase in maternal activity certainly appeared to be an information

overload which might have been overtaxing the infant's information processing abilities, necessitating more frequent pauses to assimilate the information. However, in several instances the excessive stimulation also seemed to be redundant. This would suggest, instead, that the infant was looking-away because of boredom and a desire to attend to other less redundant stimuli. Furthermore, the stimulation frequently used by mothers to maintain their infants' attention appeared to be aversive to the infants. For example, the mother frequently poked at her infant's cheeks and physically moved the infant's head to an en face position as he squirmed about and averted his head. Repetitive physical behaviors of an aversive nature have been known to characterize intrusive, overstimulating mothers interacting with their "atypical" infants (Greenberg, 1971). Seemingly the quantity as well as qualities of stimulation such as redundancy or aversiveness (although they were not measured), might have contributed to the increase in infants looking-away from their mothers during the attention-getting manipulation.

In the present study there appeared to be a carry-over of the high levels of maternal activity and infant looking-away from the attention-getting to the imitation situations for the subjects who experienced attention-getting first. These subjects continued to be more active during imitation or at least more active than those mothers experiencing the imitation situation first. The carry-over of activity level from one situation to the next suggests the potency

of the attention-getting manipulation for both the mother and infant. Their arousal levels may have been high as a result of the stress of the attention-getting situation and may not have been given sufficient time to return to baseline prior to the imitation situation. The stressfulness of the attention-getting manipulation is exemplified by the fact that the three subjects lost to this study became so upset during this situation that they were not only unable to complete the 3-minute attention-getting interaction but also could not be sufficiently pacified to engage in the ensuing imitation situation. It was only when the infants were presented with the relatively non-intrusive, non-stimulating Raggedy Ann doll that they quieted down and became visually attentive.

Although it was hypothesized that an attention-getting manipulation would worsen the interaction of infants and mothers in the case of mothers who tended to be "hyperactive", it was thought that this manipulation might facilitate the interactions of "hypoactive" mothers, merely by increasing their activity levels. Curiously, this study did not appear to include any "hypoactive" mothers. Although this is difficult to explain, it might relate to a restrictive range problem. Hypoactivity has been observed amongst lower-class mothers of atypical infants (Greenberg, 1971). The sample of this study was comprised of Hollingshead III middle-class mothers. The relatively high activity levels of these mothers might represent a middle-class interaction style, but also might be related to the stress of the laboratory

situation. Brazelton et al (1974) have commented that the laboratory observation of infant-mother interaction is intrinsically an attention-getting situation. The increase in activity level from the spontaneous to the attention-getting situation in this study, although significant, did not approach the magnitude of the decrease in activity from the spontaneous to the imitation situation. The lower magnitude of change from the spontaneous to the attention-getting situation might mean that the mothers had already acted during the spontaneous interaction in this laboratory setting as if it were an attention-getting situation.

Attention-getting is not necessarily characterized by hyperactivity and intrusive behaviors or gaze aversion on the part of the interactants. For example, the mothers who experienced the imitation situation first manifested significantly lower activity levels and experienced less gaze aversion from their infants during the attention-getting situation than did the mothers who experienced attention-getting before imitation. It seemed as if some of the former mothers had "learned" during the imitation situation that a good attention-getting device is to imitate the infant. Accordingly, many of these mothers used imitative behaviors during the attention-getting situation. Since imitative behavior was not measured, however, a "learning" explanation is mere speculation.

The mother's interpretation of the attention-getting instruction or her natural style of interacting rather than something

intrinsic to the manipulation itself might have contributed to her intrusive hyperactivity. This point is suggested by a series of videotaped interactions of Hopi and Navajo Indian as well as American Caucasian infant-mother dyads recently filmed by a University of Chicago study group (Martini, 1976). An adaptation of the attention-getting instruction was used, although it did not specify that the mothers try to keep their infants' visual attention. In this situation the activity levels of the Navajo mothers were surprisingly low, and the eye-to-eye contact of their infants strikingly sustained, as compared to the behavior of the Hopi and Caucasion dyads. The effects of the attention-getting situation for the Navajo Indian infant-mother pairs, then, were very similar to the effects of the imitation situation for the Springfield dyads of this study.

The effectiveness of the imitation situation perhaps stands out in bold relief in contrast to the attention-getting manipulation. Imitation has been noted to be a powerful form of contingent reinforcement, particularly for this age infant. Several researchers have suggested that at this age infants begin to recognize and imitate modelled behaviors which are already in their own repertoires (Gardner & Gardner, 1970; Jones & Pawlby, 1975; Piaget, 1945). Although imitation is typically investigated in the context of an adult modelling an action for the infant, it has also been observed that infants provide models for their mothers' imitations or at least that mothers frequently imitate their babies during spontaneous inter-

actions (Trevarthen, 1974). Trevarthen (1974) goes so far as to suggest that it is the mother's imitation of her infant's behavior which sustains his communication acts. A study by Jones & Pawlby (1975) supports this notion. They observed that the activities of the mothers which served to sustain their infants' conversations were those which were imitative and those which highlighted or described the infant's behaviors to him as they occurred. Curiously, none of these investigators have suggested that infants might just enjoy being imitated. The imitation situation of this study was characterized by gleeful smiling and laughing behaviors of a secondary-circular-response or game-like nature in which the same infant behaviors and the mothers' imitations of them were repeated several times in succession.

Although many of the behaviors of the 3-6-month-old infant are difficult to imitate, for example hiccups, it might be the slowed-down, exaggerated quality of the maternal imitations rather than their perfect match which sustains the infant's attention. Presumably the more closely the mother's action approximates that of her infant, the less discrepancy there is for the infant to process or assimilate.

The imitation task in the present study required the mother to closely attend to her infant's behaviors so that she might imitate them. This requisite attentiveness also enhanced the mother's awareness of her infant's looking signals and contributed to the dramatic reduction in her activity during the infant's looking-away periods.

Being more sensitive to his "cut-off" signals the mother emitted fewer behaviors during her infant's looks away from her. It is also the case that the infants emitted fewer behaviors for the mother to imitate during their looking-away periods.

The potency of imitation as an interaction facilitator is further exemplified by three other findings of this study including: 1) the minimal differences between the amount of infant looking during the imitation and doll situations, 2) the carry-over of imitative behavior across the attention-getting situation, and 3) the absence of significant differences between risk and non-risk groups in the amount of maternal activity and infant looking during the imitation situation.

That the difference between infant looking during the doll and the imitation situations was significantly less then the difference between looking time during the doll and the spontaneous situations lends support to an information processing model. If we assume, as is suggested by the adult interaction literature, that an individual looks away while processing information or taking pause from an interaction, then this result is interpretable (Kendon, 1967). Although the relative amounts of information processing demands placed on the infant are difficult to measure, it is intuitively reasonable to suggest that the imitation situation placed fewer demands on the infant than did the spontaneous interaction simply because the mother's behaviors while imitating her infant are similar to those

already in the infant's repertoire, which would make them easier for an infant of this age to recognize and assimilate (Piaget, 1945). The stimulus information inherent in the immobile, unresponsive doll is unquestionably less than the behavior of an interacting mother, even when her behaviors are "infantized".

Intuitively the situations used in this study might be ranked in order of their increasing amount of information processing demands from doll to imitation to spontaneous to attention-getting situations. The time afforded the infant to process information is greater in the doll and imitation situations than in the spontaneous and attention-getting situations. In the doll situation the infant is his own organizer of his looking and looking-away periods. The imitation situation encourages the mother to respond in a contiguous fashion thereby allowing her infant to pace himself to some degree, and respecting his pauses from the interaction. In the spontaneous situation, however, the pace-making of the interaction is more subject to the whims and rhythms of the mother, and in the attention-getting situation the mother's pace is too rapid for effective processing or responding.

In the absence of an objective measure of the relative stimulus complexity of the Raggedy Ann doll and the mother, an information processing interpretation is fairly subjective. Equally plausible interpretations are: 1) the doll might have elicited a greater amount of infant looking due to its relative novelty. Although the Raggedy Ann doll is very life-like and was already "owned" by many of the

infants, its grossly exaggerated facial features and infant-size might continue to be perceived by the infant as relative novelty. A very old study suggested that a doll is also a more effective elicitor of infant smiles than is a mother's face (Spitz, 1946); 2) the greater amount of infant looking during imitation and the doll situation than in the spontaneous interaction might relate to the order of these situations. Both the imitation and the doll conditions occurred later in the session. The infant might have been busily adapting to the laboratory surroundings during the earlier spontaneous interaction, enabling him to be more attentive during the later mother and doll situations. The spontaneous and doll conditions would necessarily be counterbalanced to establish any real differences between infant attentiveness to animate and inanimate objects.

The persistence of a lower level of maternal activity from the imitation to the attention-getting situation might relate to the mothers having "learned" during imitation that imitation is an effective attention-getter, and to use it accordingly during the attention-getting situation. Although the frequency of imitative behaviors was not measured, the videotapes featured several mothers actively employing imitative behaviors after having just previously experienced the imitation manipulation. More substantial evidence for a carry-over effect is the significantly lower level of maternal activity and the increased infant looking during attention-getting when it followed imitation. That the mothers might have learned imitation as an atten-

tion-getting device in such a brief manipulation is doubtful, but the imitation manipulation may have simply increased their awareness of its effectiveness.

The absence of differences between the normal and risk groups during the imitation situation suggests that imitation can facilitate infant-mother interaction irrespective of the degree of maternal hyperactivity and infant gaze aversion seen in their spontaneous interactions. Despite the high level of maternal activity and infant looking-away during the spontaneous interaction, the activity levels of the high-risk group approximated those of the normal group during the imitative interaction. Specifically, the female high-risk infant-mother pairs showed activity levels equivalent to the normal pairs during imitation. Higher-order interactions on the dependent measures suggested that the high-risk male infant-mother pairs did not experience this change in activity levels during imitation. A sex differential in maturation might explain this difference. The videotapes suggest, for example, that the high-risk males exhibited less advanced or more limited repertoires and more looking-away (lesser information processing abilities?) than did the high-risk females. In addition, the high-risk males probably experienced stormier interaction histories by virtue of their typically more serious medical condition at birth and their longer period of early separation. In any case, having fewer behaviors to imitate and more inattentiveness to tolerate might have contributed to the high-risk mothers' seeming difficulty imitating and

frequent reversion to adult-like, intrusive behaviors with their male infants.

The instruction to imitate the infant appeared to limit the variability or individual differences in maternal interaction style. During imitation the mother's range and tempo of behaviors were limited to those of her infant. Since the range of behavior of this age infant is relatively limited, the mother's range of behavior is also limited by virtue of the task. Thus the differences in interaction styles between normal, post-mature and high-risk dyads appeared to be minimized during the imitation situation.

Unlike the imitation interactions, the spontaneous interactions of the normal and high-risk dyads were dramatically different. If those groups alone had been observed, this difference might have been interpreted as an effect of early separation. The absence of differences between the post-mature contact and the high-risk separated groups obviates an early separation interpretation. An explanation for the absence of differences between those two groups combined and the normal group is difficult at best. Some speculative remarks might be made, however, regarding the age differences and the differences between groups on the Brazelton Neonatal A Priori Interaction score. The chronological age of the high-risk group was slightly greater than the normal. The age of the post-mature was not corrected for post-maturity (as was the hig-risk for prematurity) so the post-mature was older than the normal in conceptional age. Chronological age did not

appear to explain any of the variance on maternal and infant behaviors, but it might have contributed to subtle differences in the groups. Although the preceding discussion has implied that the information processing abilities of the high-risk infant may be less developed, explaining his need to take pause and look-away more frequently than the normal, it also might be the case that the high-risk infant has more advanced information-processing abilities by virtue of his greater amount of experience (the high-risk infants were at least a month older chronologically). It has been noted that the high-risk and post-mature infants were generally less attentive to both animate and inanimate stimuli, i.e., to both the doll and to their mothers. These infants may have habituated to the situations faster, and hence their looking-away periods may have represented their attempts to find new stimuli. These infants may have been beyond the stage of being interested in face-to-face play at the time of this assessment. Trevarthen (1974) has noted that five-month-olds seem to be less interested than four-month-olds in face-to-face play with their mothers, and tend to avoid their mothers' gaze more often. The greater amount of gaze aversion of the high-risk and post-mature infants may have been an artifact of the correction for prematurity and a failure to correct for post-maturity. The high-risk and post-mature may have been unwittingly assessed at a less interactive period which may have accounted for their equal but greater amounts of gaze aversion than the normal infants. A normal

group which matched the high-risk group on chronological age would be required to test this possibility.

Alternatively, it might be argued that the "worrisome" baby syndrome was a contributing factor in the interaction differences between these groups. Both the post-mature and the high-risk infants had received significantly inferior Brazelton Neonatal A Priori Interaction scores than the normal infants at birth. Their significantly inferior scores on the Brazelton interaction items places the post-mature and high-risk infants in the "worrisome" category on interaction. They are described as being difficult babies, and their inferior scores do not augur well for their interaction capabilities. The Brazelton Neonatal scores were found to predict to some degree to the infants' looking activity during their later interactions. This suggests some continuity between the orientation, alertness and responsiveness of these babies during the Brazelton assessment at birth and their orienting and alertness to the mother and doll during play at three to six months.

A continuity of infant behavior over the first few months is perhaps not surprising. That the Brazelton interaction scores of the babies at birth is a stronger predictor of maternal activity levels three to six months later is perhaps less intuitive. Sameroff's transactional model might be borrowed to explain this finding (Sameroff, 1975). That is, the infant's behavior at birth (Brazelton scores) has been found to predict to maternal interaction behavior

and attitudes at four months (which in turn has been found to predict to infant behavior at eight months) demonstrating a criss-crossing of infant-mother and mother-infant effects which he calls a transactional phenomenon.

These speculative remarks, then, might suggest reasons for the differences between the normal and the combined post-mature and high-risk groups of this study. The non-differences between the post-mature and the high-risk dyads do not suggest that early separation has no effect on infant-mother interaction but merely that this effect appears to be of lesser import than the baby's interaction style at birth and its possible effect on his mother and their later interactions.

That the high-risk dyads at least match the post-mature dyads on interaction behaviors, despite the early separation they had experienced, suggests another possibility. Both the high-risk and post-mature babies were labelled "worrisome" interactants at birth. The early separation experienced by the high-risk dyads would appear to compound that problem unless there was some form of compensatory experience for their separation during the period thought to be critical for the development of interaction behavior. A recent report suggests that there might have been a compensation in the form of very sensitive nurse-neonate interaction (Thoman, 1975). Thoman suggests that some infants give cues to experienced nurses, but not to inexperienced mothers during early feeding interactions. The mothers in turn

stimulate their infants more and are less sensitive to their infants' subtle signals than are the nurses who perceive the cues and contingently respond to them. The "worrisome" high-risk infants of this study may have inadvertently benefited from their interactions with the more "sensitive" nurse mother substitutes during their extended hospitalization enabling them to "catch-up", at least to the post-matures, despite the early separation they had experienced.

Summary

In summary, the absence of interaction differences between the high-risk early separated and the post-mature early contact groups of this study does not lend support to the thesis that early separation contributes to disturbances in infant-mother interaction. It would seem, instead, that there is some "transactional" relationship between the interaction difficulties these babies exhibit at birth and their later interactions with their mothers. The imitation manipulation of this study appeared to facilitate the interactions of all three groups, the normal, post-mature, and the high risk, despite the excessive gaze aversion and maternal activity observed during the spontaneous interactions of the latter two groups of infant-mother dyads. That is, imitation appeared to reduce the amount of maternal activity and in turn the amount of infant gaze aversion. This result does not permit any causality interpretation, i.e., it does not imply that the mother's decrease in activity caused a reduction in infant gaze aversion, but

merely that they were associated events. A plausible explanation for the efficacy of the imitation manipulation is the lesser information processing demands placed on the infant and the greater attentiveness of the mother to the infant's communication signals. The imitation instruction encourages the mother to read her infant's signals and contingently respond to his behaviors with imitations of them. Having less information to process and fewer disruptions of his gaze alternation, the infant averts gaze less often. Infant gaze in turn elicits more "infantized" behavior from the mother. And, in this circular way, their mutual adjustments facilitate a more harmonious interaction. Since imitation is a very natural behavior for the mother and a very enjoyable one for the infant, it could effectively be used as an early intervention strategy. Certainly more careful analyses of infant-mother face-to-face interactions are needed before more than speculative interpretations can be made. In the interim, the state of the art is highly subjective, and based largely on our impressions of what merely looks like harmonious infant-mother interaction.

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APPENDIX A

Instructions to Mothers

Spontaneous

During this situation we would like you to pretend that you are at home at your kitchen table playing with your baby.

Attention-Getting

For this situation we would like you to pretend that your husband is taking a movie of your baby so you are trying to keep your baby looking at your face.

Imitation

In this situation we would like you to try imitating all the things that your baby does.

Doll

During this situation we are filming your baby's play with a Raggedy Ann doll. We would like you to stand behind the table so you will not disturb your baby.

APPENDIX B

Table 2
Means and Marginals for Dependent Variables

	♀ ORDER #1			♀ ORDER #2			♂ ORDER #1			♂ ORDER #2			
	N	PM	HR	N	PM	HR	N	PM	HR	N	PM	HR	MARGINAL
MALT 1	66.33	77.67	76.00	66.33	71.67	91.33	72.00	95.00	84.33	69.33	70.67	93.00	77.81
MALT 2	92.67	98.00	93.00	81.00	77.00	96.00	79.67	81.67	93.67	62.33	96.67	88.67	86.69
MALT 3	76.67	87.67	32.33	35.67	45.00	70.67	52.67	72.00	71.00	35.00	30.67	69.00	56.53
MARGINAL	78.56	87.78	67.11	61.00	64.56	86.00	68.11	82.89	83.00	55.56	66.00	83.56	73.68
MALA 1	40.00	60.00	56.67	62.00	43.00	80.33	60.67	87.00	76.33	45.67	68.67	82.00	63.53
MALA 2	49.33	80.33	86.33	70.33	77.33	95.33	71.00	98.00	86.33	65.67	88.67	93.00	80.14
MALA 3	54.33	80.67	42.00	9.67	43.33	46.00	43.00	48.67	65.00	53.33	12.00	58.67	46.39
MARGINAL	47.89	73.67	61.67	47.33	54.56	73.89	58.22	77.89	75.89	54.89	56.44	77.89	63.35
ILT 1	59.00	72.33	50.00	82.33	35.33	29.00	50.67	26.33	31.00	74.00	70.33	70.67	54.25
ILT 2	38.67	52.33	44.00	56.33	36.67	20.00	35.67	23.33	20.00	55.67	40.67	60.00	40.28
ILT 3	82.67	85.67	64.00	90.33	80.00	64.33	77.67	63.33	70.67	94.00	92.67	88.00	79.44
MARGINAL	60.11	70.11	52.67	76.33	50.67	37.78	54.67	37.67	40.56	74.56	67.89	72.89	57.99
ILT 4	82.67	93.67	83.00	87.33	90.00	80.00	78.00	87.67	84.00	81.33	92.33	84.00	85.33
MARGINAL	65.75	76.00	60.25	79.83	60.50	48.33	60.50	50.17	51.42	76.25	74.00	75.67	64.83

	FEMALE			MALE			
	N	PM	HR	N	PM	HR	MARGINAL
BRAZ	1.17	2.33	2.67	1.33	2.33	2.00	1.97
AGE	108.50	104.67	135.33	109.00	100.83	131.33	114.94

1=Spontaneous
2=Attention-Getting
3=Imitation
4=Doll

MALT=Maternal Activity during Infant Looking
MALA=Maternal Activity during Infant Looking-Away
ILT=Infant Looking Time

Table 3

Analysis of Variance for the Percentage of Maternal Activity during Infant Looking Time

Source	Degrees of Freedom	Mean Square	F	Prob. F Exceeded
Between Subjects				
Sex	1	26.00926	---	---
Order	1	1933.78704	7.38975	.012
Diagnosis	2	1863.81481	7.12236	.004
Sex x Order	1	36.75000	---	---
Sex x Diagnosis	2	487.70370	---	---
Order x Diagnosis	2	2288.48148	8.74517	.001
Sex x Order x Diagnosis	2	433.00000	---	---
Error	24	261.68519	---	---
Within Subjects				
Manipulation	2	8650.70370	75.30233	.000
Manipulation x Sex	2	332.25926	---	---
Manipulation x Order	2	627.70370	5.46401	.007
Manipulation x Diagnosis	4	40.13426	---	---
Manipulation x Sex x Order	2	170.33333	---	---
Manipulation x Sex x Diagnosis	4	404.32870	3.51959	.013
Manipulation x Order x Diagnosis	4	721.35648	6.27922	.000
Manipulation x Sex x Order x Diagnosis	4	430.29167	3.74559	.010
Error	48	114.87963	---	---

Table 4

Analysis of Variance for the Percentage of Maternal Activity during Infant Looking-Away Time

Source	Degrees of Freedom	Mean Square	F	Prob. F Exceeded
Between Subjects				
Sex	1	1337.03704	---	---
Order	1	685.03704	---	---
Diagnosis	2	3831.78704	7.05959	.004
Sex x Order	1	176.33333	---	---
Sex x Diagnosis	2	107.06481	---	---
Order x Diagnosis	2	1752.39815	3.22857	.057
Sex x Order x Diagnosis	2	44.19444	---	---
Error	24	542.77778	---	---
Within Subjects				
Manipulation	2	10252.39815	42.48965	.000
Manipulation x Sex	2	339.56481	---	---
Manipulation x Order	2	1233.62037	5.11257	.010
Manipulation x Diagnosis	4	232.85648	---	---
Manipulation x Sex x Order	2	718.52778	---	---
Manipulation x Sex x Diagnosis	4	1450.88426	6.01299	.001
Manipulation x Order x Diagnosis	4	109.68981	---	---
Manipulation x Sex x Order x Diagnosis	4	618.18056	2.56196	.050
Error	48	241.29167	---	---

Table 5

Analysis of Variance for the Percentage of Infant Looking during Interaction Time

Source	Degrees of Freedom	Mean Square	F	Prob. F Exceeded
Between Subjects				
Sex	1	.23148	---	---
Order	1	3104.08333	5.29197	.030
Diagnosis	2	2200.25926	3.75109	.038
Sex x Order	1	7583.56481	12.92878	.001
Sex x Diagnosis	2	914.37037	---	---
Order x Diagnosis	2	388.00000	---	---
Sex x Order x Diagnosis	2	1507.14815	---	---
Error	24	586.56481	---	---
Within Subjects				
Manipulation	2	14184.06481	120.93463	.000
Manipulation x Sex	2	69.78704	---	---
Manipulation x Order	2	18.25000	---	---
Manipulation x Diagnosis	4	130.18981	---	---
Manipulation x Sex x Order	2	410.34259	3.49862	.038
Manipulation x Sex x Diagnosis	4	37.05093	---	---
Manipulation x Order x Diagnosis	4	89.79167	---	---
Manipulation x Sex x Order x Diagnosis	4	336.80093	2.87160	.033
Error	48	117.28704		