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MOTHER AND INFANT AT PLAY: RECIPROCITY IN GAZING BEHAVIOR

City University of New York PH.D. 1979

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1979

MOTHER AND INFANT AT PLAY:

RECIPROCITY IN GAZING BEHAVIOR

by

GOLDIE ALFASI-SIFFERT

A dissertation submitted to the Graduate Faculty in Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

1979

This manuscript has been read and accepted for the Graduate Faculty in Psychology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

8/6/79
date

Steven J. Ellman
Chairman of Examining Committee

8/6/79
date

Martin L. Hoffman
Executive Officer

Professor Steven J. Ellman
Doctor Anneliese Riess
Professor Gilbert Voyat

Supervisory Committee

The City University of New York

Abstract

MOTHER AND INFANT AT PLAY:
RECIPROCITY IN GAZING BEHAVIOR

by

Goldie Alfasi-Siffert

Adviser: Professor Steven J. Ellman

Twenty mothers and their 3-month-old male infants were studied in an attempt to isolate and describe some of the motivational components that contribute to infant gaze. Infants were videotaped in two conditions: playing with mother and playing with a female stranger. The videotapes were then analyzed on a second-by-second basis with respect to infant gaze and a variety of maternal/stranger behaviors. Results show that infants spend more time gazing at the stranger than at mother and that looks at the stranger are of much longer duration. In addition, high levels of infant gaze tend to be associated with facial and vocal expressiveness in the infant's partner, and with the assumption of an intermediate position vis a vis the infant.

These findings are discussed in the context of the infant's growing capacity to discriminate between his mother and others. Since this process points to the existence of memory, it is suggested that by 3 months, gazing in the infant may have a number of motivational components, including previous experience with that object.

ACKNOWLEDGMENTS

I would like to thank the members of my committee for their help and support in the planning and writing of this dissertaton: Professor Steven J. Ellman, chairman of the committee, Dr. Anneliese Riese, Professor Gilbert Voyat. The two readers, Dr. Phyllis Ziman and Dr. A. David Lynch, were extremely generous with their time and assistance. In addition, I owe a great debt of gratitude to Professor Larry Nyman for the use of his video equipment and his invaluable technical assistance.

In running this study, I was fortunate to have the help of two dedicated assistants. Eileen Kemether did all the videotaping, and her skill and sensitivity provided a remarkable portrait of infants in action. Beverley McGarrell spent many months on the demanding and often tedious process of scoring the videotapes.

Anita M. Smith typed this manuscript with great patience, care and skill.

Dr. Donald Gribetz, Dr. Elihu Sussman, and Dr. Lonna Yegen were tireless in helping to locate mothers who were interested in taking part in the study. And, of course, I am particularly indebted to the mothers and babies who played for us and made this study possible.

Without the support, affection, and help of my husband, John Sand Siffert, this dissertation could never have been completed. This work is dedicated to him, with gratitude and love.

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CHAPTER I

INTRODUCTION

Research Rationale

For many years, research in the field of infant development has been dominated by the notion of the infant as a "tabula rasa" upon which the environment imprints its message. The infant's caregiver was seen as a socializer who shaped and molded an infinitely pliable young child into some permanent shape.

As a result of this theoretical bias, research design was dominated by a standard empirical model: some parental behavior, attitude or trait was observed and correlated with the child's behavior, personality or pathology. Implicit in this design was the assumption (usually unwarranted by the data) that such a correlation indicated cause and effect: that parental behavior was shaping the infant's response.

By the late 1960's, this model of early development had come under increasingly heavy attack for a variety of reasons: 1. Research employing this correlational design had, by and large, failed to establish a relationship between specific aspects of caretaker behavior and later child personality

characteristics (Escalona, 1968). 2. The notion of the infant as a "tabula rasa" was inconsistent with a growing body of literature which indicated that even very young infants are equipped with well-developed sensory capacities (Fantz, 1963; Haynes, White, & Held, 1965; Greenman, 1963; Bridger, 1961; Fantz & Nevis, 1967; Fantz, 1964; Fantz, 1961; Fantz, Ordy, & Udelf, 1962). 3. This model of early development did not take into account individual differences among infants at birth and in early infancy (Escalona, 1968, 1973; Birns, 1965; Weil, 1970; Korner & Thoman, 1970; Tautermannova, 1973; Thoman, 1975a; Thoman, 1975b); how these individual differences may affect the infant-caregiver relationship (Thoman, 1975b; Osofsky & Danzer, 1974; Easton, 1966; Brazelton, 1963; Korner & Grobstein, 1967; Osofsky, 1976; Bennett, 1971); and the important consequences these differences may have for later development (Bergman & Escalona, 1949; Brazelton, Scholl, & Robey, 1966). 4. The "tabula rasa" concept further failed to account for the many important effects the infant has on his caregiver, that is, the extent to which the infant actively shapes the world around him (Harper, 1971; Etzel & Gewirtz, 1967; Brazelton, 1963; Yarrow, 1963; Corter & Bow, 1976).

A number of researchers, including Bell (1968, 1971, 1974), Lewis & Lee-Painter (1974), Schaffer (1971), Yarrow (1963), and Escalona (1968), called for a revision in theoretical biases and a concurrent change in research methodology (Moss, 1965). They pointed to the need for a bidirectional approach to the study of infant-caregiver interactions, one which recognizes the stimulus properties, as well as the response capabilities of the young infant.

This change in underlying theoretical assumptions called for a shift in experimental design. Infant-caregiver interactions began to be studied in a naturalistic setting in an attempt to observe and describe what actually occurs in such an interaction. Influenced in part by ethological studies of animal behavior (for instance, Hind & Spencer-Booth, 1971), many investigators (Stern, 1971, 1974a, 1974b; Collis & Schaffer, 1975; Korner & Thoman, 1972; Korner, 1970, 1974; Moss, 1965; Brazelton, 1975) moved towards a careful study of observable phenomena with the understanding that the phenomenology of early experience is a valid subject for scientific scrutiny.

Infant development has, of course, continued to be studied using laboratory methods. However, since the 60's the focus of this research has shifted. The primary focus now appears to be the development of perceptual and cognitive abilities.

Thus, recent studies of development fall into two broad categories: those employing empirical methods in a laboratory setting and those using observational methods, often in a naturalistic setting. These differences in methodology are reflected in the different kinds of questions that are raised: experimental studies tend to focus on the infant's developing perceptual and cognitive skills, to the relative exclusion of the infant's experiential context, while recent obervational studies focus on the dynamics of the mother-infant dyad, and on the process of interaction (Schaffer, 1977).

Interestingly, both sets of studies have frequently chosen to study the infant's looking behavior. There are a number of reasons for this: first, looking is easily measured and rater reliability is consistently high. In addition, it is now known that the visual system in humans matures quite

rapidly and that gazing is one of the first systems to come under the infant's voluntary control. As a result, investigators have tended to think of gazing as a behavior which provides a window on to the inner world of the infant.

In empirical studies of gazing the essential interest has been two-fold: first, to describe the infant's perceptual capacities and second, to use these findings to further understand developing cognitive abilities and their relation to the infant's behavior. Thus, early studies address themselves primarily to questions concerning perception and sensation: Can an infant see at birth? Is the neonate capable of visual following? When does visual accommodation begin to develop? The studies of Fantz and others succeeded in answering many of these questions and in demonstrating very convincingly that the visual-perceptual system is remarkably sophisticated at birth and matures with astonishing speed so that at 6 months the infant's visual capabilities are very similar to those of the adult.

One ubiquitous method for studying visual abilities was a simply stimulus discrimination test. If an infant looked consistently more at one stimulus than at another, it could be concluded that he was able to discriminate between the two. Experimenters were quick to see that this design could be taken one step further. Not only did a differential response indicate discrimination between stimuli, it also indicated a "preference" for one stimulus over the other.

Since Fantz's early studies less than 20 years ago, a large body of literature has grown up around the issue of infants' visual preferences, including the preference for complexity, contour, novelty, etc.. Yet few studies have addressed themselves to the meta-theoretical implications of the concept of "preference." Some authors seem to say nothing more than that an infant looks longer at one stimulus than another. These studies remain in the descriptive realm and make no attempt to explain the "why" of these differential behaviors. Other studies are more ambitious and either explicitly or implicitly endorse one of two views: One view is that visual preferences in early infancy are determined by

"innate releasing mechanisms," that infants are "programmed" to respond preferentially to certain visual stimuli (see, for instance, Loren, 1970; Bowlby, 1958, 1969). The second school of thought seems to view visual preference as the behavioral manifestation of underlying cognitive structures which, in turn, develop via the infant's transactions with his surround.

At the heart of this controversy lies a deceptively simple question: "Why does the infant look?" Investigators have been justifiably reluctant to tackle this question head-on. The way in which the question is framed requires an answer that can only be highly speculative; it requires that we make some statement about the infant's inner life. We are no longer asking, "What is it about this particular stimulus that elicits longer fixations?", but rather, "Why does this baby show longer fixations to a stimulus of this kind?"

Making decisions about motivation in adults (determining the issue of intent in a court of law, for instance) presents problems that are staggering. Determining motivation in a pre-verbal infant presents problems that seem insurmountable. Without verbal

introspective reports we are left to draw inferences from behaviors that often appear disorganized or mysterious. The danger of "adultomorphizing," of projecting adult concepts on to the infant, is every-present. Yet our growing knowledge of infant development has made it clear that we can no longer begin with a notion of the infant as a primitive organism who responds reflexively to impinging stimuli. In recent years, sophisticated studies have revealed that certain cognitive abilities such as memory are present in early infancy, at least in rudimentary form. Our assumptions about motivation in infancy have not kept pace with our understanding of other aspects of infant experience.[1]

Therefore, to describe infant gazing as "elicited" by particular stimuli bypasses a central issue. It is clear that there is tremendous variability among infants in looking behavior. Is this simply "random noise" or is there something about this particular infant in this particular stimulus situation that can account for this variability? In other words,

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[1]A similar point has been made by Bower (1974) with respect to infant reaching.

can the act of looking have different meanings in various experiential contexts? Can we continue to assume that a 3-month-old infant gazes at a stimulus because some quality of that stimulus "pleases" him, and that he averts gaze because a stimulus has ceased to "please" him? Or must we say that although looking is sometimes determined by hedonistic principles, at other times, it serves other functions?

A comparison with looking in adults may be instructive. It is certainly the case that adults will look at sights that give them pleasure. But it is also true that they will stare at things that they experience as repugnant and also at sights that seem to have no strong positive or negative valence, an unchanging road while driving, for instance. In fact, in adults, looking, like most other behaviors, serves a myriad of functions, pleasure, of course, being one of them.

It is here proposed that by the fourth month of life, looking and looking away have come to have many different "meanings," that is, many different affective and motivational components. A crucial determinant in this regard is the identity and behavior of the object of the infant's gaze, and the infant's previous experience with that object.

This study is an attempt to isolate and describe some of the motivational components that contribute to infant gazing. Twenty infants will be observed in two stimulus conditions: playing with mother, and playing with a stranger. Differences in gazing in the two conditions will shed some light, first on the infant's ability to discriminate between his mother and a stranger, and also on the nature of that discrimination. Differences within conditions will be examined in the light of the partner's (mother or stranger) behavior. In this way, it may be possible to identify some of the factors that contribute to the complex process of visual attentive behavior.

Gazing and Mahler's Object Relations Theory

An attempt to understand the motivational-affective differences in behavior requires an understanding of the vicissitudes of development of the infant's affective life at this point. Mahler (1968, 1972) and Mahler, Pine, and Bergman (1975) have described the psychological birth of the infant which is taking place at this period. No brief description can do justice to the complexity of Mahler's formulations, but an attempt will here be made to

summarize those aspects of her theory that seem most relevant to an understanding of early gazing behavior.

Mahler describes the first weeks after birth as the "normal autistic phase." During this period, sleep periods predominate and states of "alert inactivity" (Wolff, 1959) are rare. The infant is protected from a barrage of stimulation by an innate stimulus barrier (Freud, 1920; Spitz, 1950) and, as a result, attention to external stimuli tends to be brief and diffuse.

An important feature of the normal autistic phase is the the infant is unaware of his mother, or of a mothering agent. Perceptions, according to Mahler, are dominated by needs and need reduction, but there is no awareness that this need reduction is being achieved through the help of an outside agent. Mahler has suggested that in this period the infant "seems to be in a state of primitive hallucinatory disorientation in which need satisfaction seems to belong to his own 'unconditional,' omnipotent, autistic orbit." (Mahler, et al. 1975). The essential task for the infant during this period is to achieve an adaptation to the external environment primarily through physiological channels.

Recent studies of neonatal development have indicated that infants in the normal autistic phase may be more sensitive to external stimuli than Mahler has suggested (Fantz, 1963; Meltzoff & Moore, 1977; Greenman, 1963; Eisenberg, 1970). In addition, physiological need reduction as a primary motivating factor has become increasingly discredited. The infant is, in fact, an active seeker of stimulation from birth on. Simple need gratification can be a less effective motivator than increased levels of stimulation (Siqueland & DeLucia, 1969) or even the opportunity to engage in problem-solving behavior (Papousek & Papousek, 1975). These findings suggest that the very young infant may be more sensitive to complex aspects of his surround than was previously suspected.

Despite these difficulties with Mahler's formulations, one aspect of her theory remains of particular interest here: the very young infant is unable to recognize a mother or even a mothering agent. Although certain aspects of the external world appear to elicit attention, he is still unaware of a mother who exists in the external world.

By the second month of life, this begins to change. Mahler believes that the infant becomes dimly aware of an agent that helps to relieve needs. His own attempts at need reduction, such as coughing, sneezing and elimination, all help him to distinguish between pleasurable and unpleasurable aspects of experience. The infant now comes to see his mother and himself as an undifferentiated unit. Mahler calls this stage of development the "symbiotic phase." "The essential feature of symbiosis is hallucinatory or delusional somatopsychic omnipotent fusion with the representation of the mother and, in particular the delusion of a common boundary between two physically separate individuals." (Mahler et al., 1975, p. 45). Mahler, like Spitz (1965), feels that the emergence of the smile at the sight of the human face represents an important milestone in the infant's development. It is an indicator that, "the infant begins dimly to perceive need satisfaction as coming from some need-satisfying part-object -- albeit still within the orbit of the omnipotent symbiotic dual unity -- and he turns libidinally toward that mothering source or agency." (Mahler et al., 1975, p. 46). It is this libidinal investment

of the mother within the symbiotic unity that is the core of future object relations.

The end of the symbiotic phase is marked by the beginning of the separation-individuation process. Mahler suggests that this begins to occur at about 4 to 5 months of age. In the two years that follow this, the infant begins to differentiate self from other, inside from outside. As he learns to make these crucial distinctions, he beings to achieve both individuality and object constancy.

The Development of Attention

As was discussed above, there has been an implicit assumption in the developmental literature that looking is a behavioral indicator of affective preference, that, in effect, an infant looks longest at that which he likes best. In psychoanalytic terms, this implies that gazing is an early indicator of libidinal investment. Thus, this model suggests that looking and pleasurable affect are closely related in infancy. This model, therefore, would predict that an infant in the symbiotic phase who had libidinally cathected his mother would show higher levels of gazing at his mother than at others.

In my view, this model oversimplifies the affective components of gazing. By the fourth month of life, gazing has come to serve a number of different functions and to have a variety of different motivational-affective components. I would like to suggest that these components change over time and in the context of different stimuli.

During the earliest part of the normal autistic phase (the neonatal period), attention to external events in most infants is, as Mahler has suggested, diffuse, fleeting, and largely unfocused.[2] In the following weeks, however, an important change occurs. Infants begin to show extended visual fixations of objects in their surround. During the first months of the infant's life, two patterns of visual attentive behavior have been described.

A very early pattern of attention to emerge is what Stechler and Latz (1966) have described as "obligatory attention." They describe it as consisting of extremely long periods of fixed gazing which can go on, without interruption, for many

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[2]There is some evidence that maternal medication during birth may prolong this stage of unfocused attention.

minutes. The infant's attention appears almost trapped; he can only avert gaze after a long period of time and then aversion is frequently accompanied by crying. This pattern was observed in infants as young as 6 days and was seen when the infants were fixating a non-social stimulus (a bullseye pattern). The authors imply that these long gaze durations have an involuntary quality and that it is only when the infant has become quite overstimulated that he is able to avert gaze.

Brazelton, Koslowski, and Main (1974) have reported a very similar set of visual behaviors in infants during the first month of life when looking at a moving toy. They also comment on the "hooked" quality of the infant's attention at this stage.[3]

Brazelton et al. (1974), and Stechler and Latz (1966), further report that by the third week of life a very different pattern of attentive looking has begun to emerge, specifically in response to the sight of the human face (the mother in the Brazelton

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[3]Walsh and Hoyt (1969) have found that people who have experienced bilateral damage to the frontal eye fields may experience difficulty in "unlocking" gaze from those objects they have visually fixated.

study; one of the experiementers in the Stechler study). While "obligatory attention" was characterized by extremely long durations of gaze, this new pattern was marked by much shorter periods of gazing which were followed by a period of gaze aversion and a re-engagement shortly thereafter. A cycle of attention-withdrawal-re-engagement seemed to be taking place, with each phase of the cycle being of much shorter duration than the looking and looking away in "obligatory attention." Both sets of authors further report a quality of intentionality that characterized the second pattern of attention, which had been lacking in obligatory attention. The cycling of attention seemed to be under the infant's active control. It therefore seems appropriate to refer to this second pattern of attention as "volitional attention."

This change in infants' gazing behavior from obligatory to volitional attention has been demonstrated experimentally by Mundy-Castle and Anglin (1969). Five groups of infants, aged 0 to 8 months, were shown colorful balls in alternate windows. The authors found three main stages of infant response:

1. Infants under 1 month showed long fixations on

one window and few cross-looks from one window to the other. These infants showed the fewest number of looks and appeared "stuck" on one window. 2. Infants at 1 and 2 months showed shorter fixation times and an increased number of looks and cross-looks. Their looking was much more contingent on a presentation of the ball and on anticipation of presentation. 3. Older infants showed even shorter fixations and even greater number of looks and cross-looks. Long fixations were interrupted by saccadic looks to the other window. They also tended to look at the top of the box from which the balls descended. The authors further note that older infants in the more advanced stages often showed behaviors characteristic of earlier stages. However, the reverse did not appear to be true.

The shift from obligatory attention to volitional attention has been further described by Wolff (1965). He found that this change seemed to occur at about 4 to 5 weeks, when infants showed less fixation of a stimulus, and more scanning. Bronson (1974) has made a similar distinction in types of visual behavior. He suggests that the developmental changes which take place are mediated by important changes in the neurological underpinnings of the visual system.

These patterns of visual attention provide important clues about the infant's cognitive and social development. It may be that "obligatory attention" at this age reflects an early bridge between the normal autistic and the symbiotic phases of development. Although attention is directed towards an external source of stimulation, this attentive behavior seems forced, reflexive, undifferentiated. At this point, the infant has not yet achieved the ability to voluntarily regulate the amount of incoming sitmulation (and hence his level of excitation). As long as attention is outside the infant's voluntary control, his only protection against overstimulation is his innate stimulus barrier and his mother's empathic care.

It is only with the development of volitional attention that these regulatory processes begin to come under the infant's control. The appearance of this attentional pattern thus represents a major advance in the infant's organizational capacities. While during obligatory attention, the infant gazed until he was overwhelmed by stimulation, now the infant is able to titrate the amount of incoming stimulation by averting gaze before he is massively

overstimulated. The progression of obligatory attention to volitional attention may be an example of what Bower (1974) meant when he said, "In development there is thus a progression away from dependence on immediate stimulus input toward dependence on rules that combine perceptual information with information from memory" (p. 180). It is this very progression that, according to Bower, is the essence of cognitive development.

Why does volitional attention first emerge in response to the human face? I believe that it is a result of the libidinal cathexis of the mother, and is thus an important indicator that the infant has begun to move from the normal autistic to the symbiotic phase.

The first weeks of the infant's life have been marked by two important processes: the rapid maturation of the central nervous system and a series of repeated interactions with the mother. As a result of both of these processes, the infant begins to libidinally cathect his mother, albeit in the context of the mother-infant symbiotic unit (Mahler, Pine, and Bergman, 1975). With this libidinal investment comes, I believe, the beginnings of internalization.

Just as the infant has been taking inside him the milk proferred by his mother, so he now takes inside an image of the mother which includes visual elements. This early internal representation of the mother is very far from the notion of the mother as a separate, unique individual. In fact, the infant initially responds to all faces, and even to masks, as though they were the mother's face. The first internal representation of the mother is therfore probably an undifferentiated product of the infant's early experiences with his mother, as well as early experiences of his own internal bodily processes. Since inside and outside are not differentiated at this age, the image of the mother is shaped by the effectiveness of the mother-infant symbiotic unit in maintaining a dynamic homeostasis which allows the infant the optimal amount of stimulation. In this sense, the mother cannot be thought of as a true object, but only as a part-object still enclosed in the dual unity of the symbiotic infant.

As the internal image of the mother becomes more differentiated, it serves as an important organizor of other experiences. A complex feedback system is set into motion. An infant who has had

particularly negative experiences in the early months may introject an image of his mother that is largely characterized by unpleasure. When confronted with the sight of his mother, the internalized negative image may be evoked and result in the infant's withdrawal through aversion of gaze. This may, in certain mothers, result in her redoubling her attempts to capture the infant's attention. The overstimulated infant then has yet another unpleasurable experience to assimilate to an already negative image of the mother.

The introjected image of the mother might begin to shape interactions with new human partners. Pleasurable or unpleasurable affect might, in time, come to be associated not only with the specific image of the mother, but with other human interactions. Clearly, encounters with persons other than the mother would here play an important modifying role. However, it is possible that the first internalized image of a human partner might serve to shape other interactions. It might present the infant with his first rudimentary model of other-ness which would, in turn, effect his expectations and experiences with new persons in his environment.

As the pattern of infant gazing changes from obligatory to volitional attention, so too do the affective components of gazing. During obligatory attention, gazing may initially be accompanied by positive affect. However, since the infant is unable to voluntarily regulate the amount of income stimulation, he soon becomes overstimulated and may exhibit negative affect. Indeed, Stechler and Latz (1966) report that periods of obligatory attention were almost always terminated when the infant began to cry.

In volitional attention, the relationship between gazing and affect is far more complex and would depend on a number of factors. Affect accompanying gazing and gaze aversion in volitional attenton can be predominantly positive, predominantly negative, or somewhere in between. What appears to determine affect is a complex amalgamation of various factors: the infant's own ability to regulate incoming stimulation; his mother's present behavior in terms of level of stimulation provided and her ability to allow the infant to regulate his interactions with her; and finally, the infant's previous history of interaction with his

mother. The element of previous experience here, for the first time, is extremely important in determining affect. This is because the mother is one of the first part-objects to be introjected by the infant. It is only when such an introjection occurs that we can speak of memory (except in its most rudimentary forms). Once an internal image of the external object has been established, the infant can then check the new perception with the image that was previously introjected. While new perceptions may alter various aspects of the internal image, it is also the case that this image might effect the infant's current interaction. To use Piaget's terminology, while new experiences might be assimilated to the primitive schema of the mother, these schema might also result in accommodation of the infant's behavior. (Piaget & Inhelder, 1969).

The cycling of attention might then acquire a meaning beyond a simple regulation of incoming stimulation. It might also be the behavioral manifestation of a rudimentary form of recollection. When the infant looks at his mother, he receives a sensory impression of her (perhaps already colored by his expectations based on previous experiences).

He then turns away and compares this new impression with the already introjected image. He then returns his gaze to his mother to gather new information and the process is repeated again and again. Thus the introjected image of the mother becomes increasingly complex and composed of many, many different encounters. It is obvious then that it is impossible to predict the infant's affect during this process without knowing something about the nature of both his mother's present behavior and the already existing internal image.

The existence of such relatively complex cognitive processes implies the existence of a rudimentary ego. If this is the case, then gazing and gaze aversion may come to serve another related function. The cycling of gazing characteristic of volitional attention may begin to acquire a defensive function. As gazing and gaze aversion come under the infant's voluntary control, he is able to use gaze aversion as a way of escaping an unpleasurable situation. By turning away his eyes or his head, he is able to make the external image of his mother disappear. It is possible, therefore, that gaze aversion could serve as a primitive behavioral precursor of the intrapsychic mechanism of denial.

At the height of symbiosis, the infant is already making his first tentative steps in the direction of differentiation (Mahler, 1968). Volitional attention at this point thus acquires yet another meaning. Looking and looking away become precursors of later separation behaviors, like crawling away. In an optimal interaction, the infant is able to "leave" his mother by turning away from her, only to experience a joyous "reunion" when he returns his gaze.

By the fourth month of life the internal image of the mother has become quite complex and differentiated. Smiling to the sight of a stranger begins to decrease at about this time (Ambrose, 1961) and sober examination of the stranger becomes more common (Bronson, 1971). The image of the "human not-mother" is slowly becoming differentiated from the schema of the mother. As this process occurs, I believe, infants show different patterns of attention to the mother and to the stranger.

Gazing at mother continues to follow the pattern of "volitional attention." More and more, the mother's behavior becomes an important factor in how much the infant looks. The infant continues to

cycle attention in the service of regulation of incoming stimulation and also of further differentiation of the image of the mother.

The infant's reaction to a stranger is now quite different than it was just a few weeks before. While the 2-month old infant smiled at any face indiscriminantly, he now, at 3 months, smiles less at strangers than he did before. The infant is now beginning to develop a new image, that of the "human not-mother" and his patterns of attention reflect the fact that this new stimulus is both similar to and different from the infant's mother.

A number of studies have found that the infant, in the second quarter of his first year, tends to show long, uninterrupted periods of looking at a stranger. The novelty of the stranger, the stranger's "not-motherness" now becomes an important factor in determining infant gazing. This pattern of extended periods of looking may serve as a behavioral "bridge" between the obligatory attention described by Stechler and Latz in much younger infants, and the more dramatic stranger reactions of the third and fourth quarters.

Although this intent gazing closely resembles the pattern of obligatory attention, it seems unlikely that obligatory attention, which seemed a very early and rather primitive adaptation, should remain unchanged through weeks of rapid central nervous sytem maturation and after many repeated experiences with human partners. Certainly some aspects of obligatory attention may continue to exist, although the pattern may begin to take on a more volitional quality. At the same time, the stranger is not only different from mother, but also similar to her. Thus, although the novelty of the stranger may result in a pattern of gazing very similar to that seen in obligatory attention, attention will also be affected by a second factor: the nature of the internal image of the mother. This is because the mother is the infant's first model of human-ness. It is only later, if at all, that he will be able to completely detach the image of others from this first image. At this age, it is the history of interactions with the mother that helps to shape the infant's expectations of all human interaction.

A third motivational factor in attention to strangers becomes evident in an interaction between the infant and a stranger. How the stranger behaves may serve to play an important role in the amount of infant gazing, just as it does in the interaction with the mother. The stranger as a stimulus differs significantly from an inanimate object in that the stranger is an active partner in the interaction. By responding appropriately to the infant's cues, the stranger, like the mother, can facilitate or inhibit the interaction.

The Visual World of the Infant

A brief description will be given here of the infant's visual response systems. The infant's innate visual capabilities, and the development of these abilities during the first four months of life will be described. A developmental hypothesis will then be proposed which suggests that the infant moves from an early preference for the "eye-Gestalt" to a more differentiated schema for the entire face, which, in turn, permits the infant to distinguish among different faces and among different facial expressions. Evidence will be presented to show that many infants are able to respond differentially

to their mother and to a stranger by 3 to 4 months of age. An interpretation of this differential response will then be made, which will emphasize developmental changes in the infant's underlying motivational and attentional systems.

The neonate. For many years, it was widely held that the young infant's visual capacities were profoundly inferior to those of the adult. It was not unusual to hear that babies were blind for quite some time after birth. Since Fantz's pioneering studies in the early 1960's, however, investigators using modern techniques have conclusively demonstrated that this is not the case. A large body of literature has shown that the young infant's visual system is considerably more sophisticated than was previously thought possible.

The neonate is equipped with a remarkable repertoire of visual abilities: within hours after birth an infant shows positive orientation of the head and eyes to a light of low intensity and will visually follow a moving target (Greenan, 1963; Wolff & White, 1965). At birth, the lens does not change to adjust to changes in the distance of the object; however, accommodation is fixed at an average

of about 19 cm.--at this distance, the infant's vision is quite acute (Haynes, White, & Held, 1965)[4]. Neonates have at least 20/150 vision, as measured by optokinetic nystagmus to moving stripes of different widths (Dayton, Jones, Aiu, Rawson, Steele & Rose, 1965). In addition, a number of researchers have demonstrated distinct visual preferences in neonates (Fantz, 1963; Hershenson, 1964; Hersensen, Munsinger, & Kessen, 1965). Fantz, Ordy, and Udelf (1962), in their study of pattern vision in young infants, conclude:

> The results imply that all parts of the visual mechanism, from cornea to cortex, function to some degree in the neonate, although further development of visual structures and functions during the first six months causes progressively more acute vision (p. 917).

Visual abilities in the neonate have proven to be so important that they have been used diagnostically to determine high-risk infants. Brazelton, Scholl, and Robey (1966) examined 96 newborns on their ability to alert to, fixate, and pursue a

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[4]It is interesting to note that this is about the same distance that separates the nursing infant from his mother's face.

visual stimulus. These infants were then followed up at 1 year of age. Nine infants were found to be neurologically abnormal or suspect and none of these had shown positive visual responses at birth. The authors conclude that "the capacity of a neonate to fixate, follow, and alert to a visual stimulus appears to be good evidence for an intact central nervous system" (p. 290).

Miranda, Hack, Fanaroff, and Klaus (1974), looked at infants with a variety of physical problems at birth (prematurity, asphyxia, herpes, tremors, etc.). At 25 to 36 weeks of age, each infant was given a neurological examination and a visual test based on techniques developed by Fantz. At a later age (4 to 60 months, with a mean of 28 months) the infants were given a Bayley. The visual examination correctly predicted the Bayley scores in 13 of the 14 babies in the sample; the neurological examination made correct predictions for only seven of the babies. Similarly, Miranda (1976), using visual preference tests, has found that neurologically handicapped neonates show defective visual responses

and suggests that a relationship exists between early visual selectivities and later intellectual functioning.

The development of visual abilities. In the first three months of life, the infant's visual system matures rapidly. Gough (1962) states that while the infant's eyes are shut most of the time during his first week, by the middle of the second week he begins to fixate the mother's face. By 3 weeks of age, his eyes are open during most of his waking time. As the infant begins to become more alert and attentive at about 8 weeks, he also shows an increased capacity for sustained visual attention (Fish, 1963). By 8 weeks also, the infant has smooth continuous binocular convergence (Ling, 1942). Flexibility of the accommodation response begins in the middle of the second month and is comparable to the adult response by the fourth month (Haynes, White, & Held, 1965). By the second month, the infant can distinguish configurational differences in stimuli, with an increasing preference for circular or random patterns over linear and regular ones (Fantz & Nevis, 1967). These authors also found a difference in the age of preference change

in home-reared and institutional infants, thus indicating that the environment may play a role in the development of certain visual abilities. By 2 to 4 months, some infants can follow their mother's gaze when she breaks gaze with them and looks to the right or to the left (Scaife & Bruner, 1975).

Gazing and the early smile. Since Spitz and Wolf's classic study of the smiling response in infants (1946b), it has been widely accepted that smiling is an important indicator and organizor of social development. A number of studies have shown that smiling and eye contact are closely related during the first months of life.

Visual fixation of the fact and "social" smiling develop side-by-side. In some sense, this is almost true by definition, since as Robson and Moss (1970) and Wolff (1963) point out, the infant's early smiles are seldom preceived as social by the mother unless the infant visually fixates her face while smiling.

Wolff (1963) reports that at about 3 1/2 weeks, the infant begins to focus on the observer's eyes, "as if it were true eye-to-eye contact." Shortly thereafter, an important landmark is reached: the

infant makes eye contact and this eye contact appears to result in a smile. After this, both responses, smiling and eye contact, increase in frequency and intensity (Tautermannova, 1973), reaching a peak at about 3 1/2 to 5 months (Ambrose, 1963; Polak, Emde, & Spitz, 1964; Spitz & Wolf, 1946b). After this point, the indiscriminate smile to the human fact disappears to be replaced by the specific smile at about 6 to 8 months of age. In the second quarter, negative affect in the presence of a stranger is frequently accompanied by gaze aversion (Robson, Pederson, & Moss, 1969).

In the course of social interaction, smiling is often accompanied by gazing. Beebe (1973), in her study of one baby, found that at 2 1/2 months, during a play period with the mother, 76% of the time spent smiling was also spent gazing. By 3 1/2 months, the percentage had increased to 99%.

Ambrose (1963) found only one baby in his sample of eight who showed little smiling by 12 weeks of age. This baby is described as also showing an extraordinary reluctance to face the investigator, and often turned away from him, refusing to meet his

gaze. Similarly, Spitz and Wolf (1946b) using institutionalized infants, reported that children who do not smile by 3 to 6 months often fail to visually fixate, as well.

Smiling and gazing thus develop side by side. Both responses serve as important indicators and organizors of social behavior in the infant. Perhaps equally important, both gazing and smiling serve as powerful cues to the mother. In the presence of a gazing and smiling infant, the likelihood is greatly increased that the mother will respond to her infant in a positive way.

The Role of Vision in the Formation of Internal Images of the Face

A number of studies have demonstrated that infants show an early visual preference for the face over non-social stimuli (Fantz, 1961, 1963; McCall & Kagan, 1967; Carpenter & Stechler, 1967; and others). What are the elements that contribute to this preference, and what information does it provide regarding the formation of internal images of the face?

Of all the features of the face, the eyes seem to be particularly interesting to the young infant (Spitz, 1946). Maurer and Salapatek (1976) have

shown, through the use of corneal photography, that while 1-month-old infants looked more at the periphery of the face, 2-month-olds looked more at the internal features. Of the features examined, the eyes appear to evoke the most interest, at least until 5 months of age (Caron, Caron, Caldwell, & Weiss, 1973). Similarly, Haith (quoted by Robson, 1967) has found that scanning of the face area, and particularly of the eyes, increases markedly at 5 to 7 weeks of age. Hainline (1978) has also found a sharp increase in looking at the eyes during the second month. Fantz (1967) has shown that by 2 to 3 months of age, infants look longer at two dots in the "eye position" than at dots in any other position. Spitz (1946) and Spitz and Wolf (1946b) have pointed to the importance of the two-eye Gestalt in eliciting smiling in 3-month-old infants. Ahrens (1954) reports that eyes elicit smiling by 2 to 3 months of age.

In an ingenious experiment Bloom (1974) used the operant reinforcement paradigm to establish the importance of the eyes for 3-month-old infants. He attempted to increase the rate of vocalizations though the use of social reinforcement (the sight of

the experimenter). There were four reinforcement conditions: the experimenter wearing glasses with clear lenses, glasses with opaque lenses (so that his eyes were not visible), glasses with a photograph taped to them of the experimenter's eyes in direct gaze at the baby, and glasses with a photograph of the experimenter's eyes with averted gaze. He found that all conditions were effective in increasing vocalization except the one where opaque lenses were used and the infant was unable to see the experimenter's eyes. The author concludes, "The finding of the present study indicated that contingent reinforcement increased the rate of vocalization only when the infant could see the adult's eyes or a two-dimensional representation of eyes" (p. 259).

A number of explanations have been proposed for the visual preference for the eyes. It has been suggested that the eyes' psychophysical properties might be of particular interest to the infant, their brightness, contrast, complexity, movement, color, and so on. However, this visual preference is remarkably resistant to habituation over many months. It seems unlikely that psychophysical variables alone would account for such a powerful preference.

Szekely (1954) has suggested that the two eyes are associated with the "enemy schema." He points to the fact that in the animal kingdom mutual gazing is a sign of threat or danger and suggests that in man this "enemy schema" is a phylogenetic inheritance. Thus, the first smile "is the first mastering of archaic real fear, through the enemy schema acquiring, in course of contact with the mother, a libido cathexis, and becoming a partial object" (p. 61). This theory does not explain why the infant fixates the eyes more than any other feature, since it is generally accepted that even quite young infants will avert gaze from a stimulus that is aversive.

Robson (1967) has suggested that the Gestalt of the mother's eyes may serve as a perceptual organizor of incoming stimulation and that during the first months of life, the infant may experience many forms of stimulation as arising from the eyes of his mother.

The notion of the eyes as a perceptual organizor has been further elaborated by Vine (1973). In an extensive review of the literature on looking and smiling in infants, Vine suggested that the eyes play an important role in the formation of internal schema of the human face.

> The two eyes pattern is the first aspect of the face which the infant successfully incorporates into an internal schema. It is thus the first aspect to be recognizable, and this recognition following on attention will thus lead to an uncertainty reduction signified by the appearance of a smile (p. 251).

The development of recognition then proceeds from recognition of the two eyes to the whole face, and from there to the differences between faces and even between different facial expressions.

Vine's formulations help to explain some of the observed patterns of infant behavior, and a number of his predictions about the development of recognition are born out by empirical findings (see below). However, Vine fails to address one crucial issue: why are the eyes, or the face for that matter, among the first stimuli to be used in schema formation?

I believe that this process can only be fully understood in the context of the mother-infant relationship. It is only in association with the "specialness" of the mother that the eyes and the face come to have "special" significance. We might say that the eyes initially "stand for" the face, which, in turn, "stands for" the whole mother.

We have already seen that an interest in the eyes begins very early in life. Selective attention to the face, based on features other than only the eyes seems to appear at about 3 to 4 months of age. There is some evidence that at about this time, the infant begins to be able to distinguish among different facial expressions. Spitz (1946, 1965) found that infants would smile indiscriminately to both a "smiling" mask and one whose mount was widened in a "savage grin." However, Browne (1974) and Young-Browne, Rosenfeld, and Horowitz (1977) found that 3-month-olds were able to discriminate slides of a "happy" face from a "surprise" face, but were unable to distinguish between "sad" and "happy" faces. They were able to discriminate between the "sad" and "surprise" faces, but only if "sad" followed "surprise." These differences in findings can be accounted for by an important difference in design: Browne used the habituation-recovery paradigm to measure visual discrimination, while Spitz used smiling. Browne found that when she used a simple fixation time measure, she could discover no differences in response to the various facial expressions. She suggests that the habituation-recovery measure is a particularly sensitive measure of discrimination.

By the age of 4 months, infants show longer first fixations to slides of a face showing "joy" than to "anger" or "no emotion" (LaBarbera, Izard, Vietze, & Parisi, 1976). At 5 months, Wilcox and Clayton (1968) found preferential responses to movement verses non-movement and to different facial expressions. Infants looked most at movies showing "smiling" faces, then "frowning" faces, and looked least at movies of "neutral" faces. However, when the length of each presentation was increased from 28 to 60 seconds in a second experiment, the findings on differential fixation to different facial expressions were not replicated, perhaps because of habituation effects. By 7 months, infants show differential smiling to different facial expressions (Ahrens, 1954).

Thus, it does appear that infants are able to make increasingly fine visual discriminations to aspects of the human face. As Vine (1973) suggests, it may be that the eyes are the first visual elements of the face to be used in the formation of an internal image of the face. As the infant develops, more and more information is included in this internal image, making possible ever more complex discriminations.

These findings raise an important question: at what age do infants become capable of perceiving the entire face as a whole Gestalt and thereby differentiating one person from another? Most studies addressing this issue have focused on the question of when an infant is able to discriminate a familiar person (usually the mother) from a stranger.

Differential Response to Mother and to Stranger

Very few studies exist which examine infants' differential response to mother and to a stranger during the infant's first three months of life. Maurer and Salapatek (1976), using six 1-month-olds and six 2-month-olds, showed mother's real face or the real face of a male or female stranger. Eye movements were then traced by corneal photography. It was found that 1-month-olds looked less at the mother than at the stranger. However, 2-month-olds showed no differences in looking behavior at mother or at a stranger.

Blehar, Lieberman, and Ainsworth (1977) obtained similar results in a longitudinal study of infants aged 6 to 15 weeks. The infants were observed in face-to-face interaction with their mothers and with a stranger. No differences were observed in the

infants' responsiveness to the mother or to the stranger at any age. However, it should be pointed out that these authors do not use the microanalytic techniques used in most of the other studies reported here, and as a result, their results are not strictly comparable to those of other studies.

A study by Laub (1973) sheds some light on the development of the ability to distinguish between mother and stranger. Laub showed 10- and 11-week-olds repeated presentations of a slide of the mother until the infants had habituated and ceased to fixate the mother. The infants in the control group were then shown the mother again, while the experimental group viewed a slide of a stranger. A response recovery measure was thus obtained which provided a measure of the infant's ability to discriminate the slides of the mother and the stranger. In addition, there were two experimental conditions: slides with voice, and slides without voice. Results showed that the experimental group showed significantly longer fixations to the new stimulus (the stranger), but this was true only if the slide was accompanied by the voice. In the no-voice condition, some

infants were able to make the discrimination, but differences were not significant for the experimental group as a whole.

Thus, at 10 or 11 weeks, some infants, but not others, seem able to distinguish their mothers from strangers by sight alone. Some infants at this age seem to require both visual and auditory cues to make this distinction. There may be a developmental transition in cues required to distinguish the mother from a stranger. The mother's voice alone is distinguished from other voices very early in life, perhaps by the fifth week (Wolff, 1963). The next developmental step may be the ability to distinguish the mother's face from other faces when the visual stimulus is accompanied by auditory cues. This may occur in the second or third months of life. And finally, in the third to fifth month, the infant is able to distinguish his mother from others on the basis of visual cues alone. Different infants might achieve these developmental milestones at slightly different ages.

More research, particularly of a longitudinal nature, is needed to claify this hypothesized developmental trend, but some evidence does exist to support it. Studies of differential visual response to mother and stranger in the second quarter are consistent in the finding that infants of this age do look longer at strangers than at their mother. Bernard and Ramey (1977) found that 4- and 6-month-old infants looked longest at slides of a stranger, then at slides of the mother, and they looked least at slides of another infant. In addition, they found that girls looked more at strangers than did boys, and their preference for the stranger over the mother was greater than that of boys. This result is congruent with the developmental hypothesis proposed above, since it is generally accepted that girls achieve most perceptual and cognitive landmarks at an earlier age than boys.

In a similar finding, Fitzgerald (1968) discovered that 4-month-old infants showed greater pupil dilation to a photograph of a female stranger's face than to a photograph of the mother. However, 1- and 2-month-olds showed no significant differences in pupil dilation to the two photographs.

Yarrow (1968) found that, at 3 months, 40% of his sample showed an "active differentiation of a stranger," as measured by a variety of behavioral indices including "intent visual concentration on the stranger without affect." By 5 months the percentage had increased to 71. Rosenzweig (1977) found that 4-month-olds showed more eye contact with a stranger than with mother.

In a related study, Roe (1978) had mothers and a stranger sit in front of an infant and talk for three minutes while the infant's vocializations were tape recorded and measured. Roe found that differential vocal responses to mother and to stranger at 3 months were positively related to I.Q. on the Stanford-Binet at 3 years and to scores on the Illinois Test of Psycholinguistic Abilities at 5 years.

By 5 months, infants visually fixate a stranger longer than the mother, regardless of whose voice they are hearing. Cohen (1974), in an ingenious study to test the effects of sight-voice incongruity, seated 5- and 8-month-old infants half-way between their mother and a stranger. The mother and stranger then simultaneously mouthed in the direction of the infant, but, in fact, sound was prerecorded and fed

into speakers near the mother and the stranger. There were four visual-auditory conditions: mother with mothers' voice, mother with stranger's voice, stranger with stranger's voice, and stranger with mother's voice. Infants in both age groups looked longer at the stranger than at the mother, regardless of the voice that seemed to emanate from them. There was some differential response to the voice-sight incongruity at 8 months, but not at 5 months. Thus, regardless of the auditory cues, infants showed a significant visual preference for the stranger's face by 5 months of age.

These findings suggest a developmental progression of schema formation. In the first three months of life, the emerging internal image of the mother seems to be composed, not only of visual elements, but of information derived from other sensory modalities as well. In order for the infant to be able to recognize the mother, he must have cues in both visual and auditory modalities. Over time, the internal image becomes increasingly complex and differentiated. Visual elements take on ever greater importance. By the fourth or fifth month of life, visual cues alone are sufficient to evoke recognition of the mother.

But does the infant actually recognize his mother (that is, is the process of memory involved?) or does he simply make a discrimination between two different faces? There is no direct evidence for either position, but one study does point to the fact that the mother's face seems to occupy a special position among faces. We have seen that infants are able to respond differentially to mother's or to stranger's face by 4 months of age. Fagan (1972) found that 4-month-olds were not able to distinguish between the faces of different strangers. It was not until they were 7 months old that infants were able to discriminate among photographs of different adult male faces and among different poses of the same man's face (Fagan, 1976).

I believe that this finding further demonstrates the "specialness" of the mother's face for the infant. It appears that the first discrimination among faces is between "mother" and "not-mother." Only later is the "not-mother" category further elaborated to make discriminations among various strangers possible.

Stranger Reaction in the Second Quarter

The studies of differential visual response to mothers and strangers cited above have indicated that an infant, by the fourth month of age, will gaze more at a stranger than at his mother. These findings are in marked contrast to studies of older infants. "Stranger anxiety" or "eight month anxiety" is a frequently described phenomenon, and is almost invariably associated with aversion of gaze from strangers (Moss, Robson, & Pedersen, 1969). While most authors studying stranger anxiety have placed its onset in the second six months of life (Spitz, 1965; Tennes & Lampl, 1964; Gaensbauer, Emde, & Campos, 1976; Campos, Emde, & Gaensbauer, 1975; Sroufe, 1977; Morgan & Ricciuti, 1969), there is some evidence to show that there is another type of stranger reaction that occurs as early as 3 months, and that prolonged gazing at the stranger is not inconsistent with that reaction.

Schaffer (1966) has reported that between the ages of 13 and 19 weeks, all the babies in his sample "sobered" at the sight of the experimenter. Similarly, Ainsworth (1967) found in her sample of Ganda infants "prolonged staring" at a stranger by

the end of the first half year (at 20 weeks in one infant). She views this as a sign that the infant has begun to make the differentiation between the mother and a stranger. Even in studies purporting to find the onset of stranger reaction at 5 months, there is evidence that this, in fact, occurs earlier. An examination of the oft-quoted study by Tennes and Lampl (1964) reveals that eight of their 19 subjects showed some distress when approached by a stranger at 3 months of age. Yet the authors ignore this finding in their conclusions and place the range for stranger anxiety at 5 to 19 months. (No infants in this sample showed stranger anxiety at 4 months.) Spitz (1950) has found that some infants display stranger anxiety before the fifth month, but he feels that this is indicative of pathology in the mother-infant relationship.

Bronson (1971) found a "wary" response to strangers in infants as young as 3 months old. His explanation of why previous studies failed to find this early response is particularly convincing: previous studies tended to use short trials which required a short latency to respond to the stranger. Bronson found that in order to detect an affective

response in 3- and 4-month-old infants, a period of up to 60 seconds was required. He describes the difference between a 3-month and a 6-month-old infant in this way:

> Typically a [3-month-old] baby would at first stare with neutral expression, then begin to frown and sometimes breathe heavily, and finally he would cry. By age six-and-a-half months, most infants who were going to cry began almost immediately to resist looking at the stranger (pp. 1141-1142).

Thus, the affective response to the stranger, if it comes at all, is preceeded by a long period of "inspection." This period might correspond to the periods of intense gazing at the stranger (in preference to the mother) that were described above.

In a later paper (Bronson & Pankey, 1977) a distinction is made between "wariness" and "fearfulness." The former appears to be a response to novelty, while the latter is attributed to the effects of previous negative experiences. The authors find that in a sample of 1- to 2-year-olds each of these factors is an independent source of individual differences and that "fearfulness" proved

to be predictive of behavior at 3 1/2 years, while "wariness" did not. Bronson (1978) suggests that it is "wariness" of the unfamiliar, and not "fearfulness," that one observes in some infants (particularly more highly reactive infants) under 6 months of age. By 9 months, he suggests, the more intense negative reaction to the stranger might be the result of previous disturbing encounters which override the infant's initial proclivities. Thus, according to this view, the classic "stranger anxiety" of the second half year would be more likely to reflect previous experiences, while the "wariness" of the first half year would be an indicator of innate response tendencies. A specific series of behaviors might be associated with each of these constellations. Thus, the "wary" infant might be characterized by long periods of unsmiling visual fixation followed by an affective display, while the "fearful" infant would be more likely to display immediate gaze aversion and strong negative affect.

Thus, by the second quarter, the affective "message" of the intent gaze at the stranger might be quite complex. Although gazing is often accompanied by smiling at this age, this does not appear

to be the case with respect to gazing at a stranger (Bronson, 1971). Spitz and Wolf (1946b) found that in institutionalized infants, smiling to a stranger begins to decrease at about 20 weeks. This decrease occurs even earlier--at 14 weeks--in home-reared infants (Ambrose, 1961). Watson (1966b) finds no significant differences in smiling at the mothers' face or at a stranger's face in infants aged 7 to 8 weeks, 13 to 14 weeks, 19 to 20 weeks, or 25 to 26 weeks. Thus, although infants gaze considerably longer at a stranger than at their mother, they do not appear to smile more at the stranger.

In summary, infants from the age of 3 months appear to show an unusual constellation of behaviors in response to a stranger. Although gazing has traditionally been associated with positive affect (witness, for instance the word visual preference), and gaze aversion with negative affect, here long periods of gazing are accompanied by an affective state that is neither clearly positive nor negative.

A possible explanation for this discrepancy is here proposed. These episodes of prolonged, unsmiling gazing at the stranger represent for the young infant a period of perceptual integration and evaluation, a period which, given sufficient time, could

be terminated by positive or negative affect. These periods could be viewed as an emotional "holding pattern" during which the infant is able to process novel incoming stimulation. The adaptive value of this constellation of behaviors is clear: by showing high levels of attenton unimpaired by high levels of affective display, the infant is in a uniquely favorable position to perceive and integrate new information. This pattern may thus represent a behavioral precursor of later stranger reactions.

Some evidence for this hypothesis comes from an investigation of developmental aspects of fear. Hrsuka and Yonas (1971) studied infants' response to impending collision. Three groups of infants, aged 2 to 4 months, 5 to 7 months, and 8 to 10 months, were presented with an optical stimulus that seemed to mimic impending collision. The authors found that infants under 7 months of age showed heart rate deceleration (usually associated with attention), while older infants showed heart rate acceleration (usually associated with arousal and affect). These findings suggest that at least under certain conditions, attention may precede fear developmentally.

Gazing and the Game

By the time an infant is 3 months old, most mothers and babies have engaged in some variations of the Game. The Game has been described by a number of researchers (Brazelton, Koslowski, & Main, 1974; Stern, 1974a, 1974b, 1977; Sander, 1969; and others). Richards (1971) describes it as follows:

> After eight weeks or so when social smiling is well established, the mother may spend long periods eliciting smiling in her infant. During such periods the infant is held on the mothers lap facing her and supported by her arms or is placed in an infant seat. The mother smiles and vocalizes to the infant and moves her head rhythmically towards and away from his face. The infant first responds by rapt attention, with a widening of his eyes and a stilling of his body movements. Then his excitement increases, body movements begin again, he may vocalize and eventually a smile spreads over his face. At his point, he turns away from his mother before beginning the whole cycle once again. Throughout this sequence the mother's actions are carefully phased with those of the infant (p. 38).

The Game consists of a number of discrete behaviors: vocalization, smiling, gross bodily movements, facial expressions, and so on. However, the focus here will be on mutual gazing and on aversion of gaze.

The visual pattern described here by Richards follows closely the look/look away/look pattern described in the discussion of volitional attention. Cycling of attention during the Game has come to serve a number of different functions. It serves as a way of actively regulating incoming stimulation, it serves important defensive and communcative functions, it represents the behavioral manifestation of an early cognitive process, and finally, it appears as a precursor of separation behaviors.

The regulatory aspects of gazing have been noted by a number of researchers. Stern (1974b) has pointed out that the Game seems to have as a specific goal "the mutual maintenance of a level of attention and arousal within some optimal range in which the infant is likely to manifest affectively positive social behaviors such as smiles and coos" (p. 404). Thus, the infant's pleasure may be related to some optimal level of arousal. Both mother and infant strive to keep the level within optimal limits. Here, gaze serves an important role. Stern (1974a) has found that in the great majority of cases, it is the infant who determines the length of mutual gaze periods. This is because mothers are much less likely

to avert their gaze than are infants; they tend to remain visually fixated on the infant throughout the Game (Peery & Stern, 1975). Thus, when an infant looks at his mother he is very likely to establish eye contact. When he averts gaze, he breaks eye contact. Meeting and averting gaze are thus important ways of modulating incoming stimulation. Since each period of eye contact represents, for the infant, a period of maternal stimulation, his gaze aversion is an effective way to decrease or terminate this stimulation.

Brazelton, Koslowski, and Main (1974) have also emphasized the importance of gaze aversion in the regulation of the infant's level of arousal. They state:

> He can use the period of looking away as if he were attempting to reduce the intensity of the interaction, to recover from the excitement it engenders in him, and to digest what has taken place during the interaction. These perhaps represent a necessary recovery phase in maintaining homeostasis at a time in infancy when constant stimulation without relief could overwhelm the baby's immature systems (p. 59).

In this way, gaze and gaze aversion come to serve a communicative function. The infant's state of attention is a cue to the mother which helps her

to regulate the amount of stimulation she is providing to her infant. Frequent aversions of gaze, particularly if accompanied by fussing or crying, might signal to the mother that she is providing levels of stimulation that are not optimal. She is then able to modulate the level of stimulation to help her infant achieve a new homeostatic balance. The mother's role in the Game will be discussed in greater detail below. What is important to note here is that during the Game, the important issue is no longer merely amount of stimulation provided by the mother to the infant. Instead, the mother's ability to respond to her infant's cues is what becomes crucial in maintaining a reciprocal interaction between mother and infant.

The Game and the growth of dialogue. Spitz (1963) has used the term "dialogue" to describe a pre-verbal experience of reciprocity between mother and child: "It is a dialogue of action and response which goes on in the form of a circular process within the dyad, as a continuous, mutually stimulating feedback circuit. Actually, it is a precursor of the dialogue, an archaic form of conversation" (p. 173).

Spitz sees this early dialogue as an experience of crucial importance in the life of the young infant, one which precedes all other relationships. Because it is the infant's first experience of reciprocity, of give and take, it serves as a prototype for all later modes of interaction.

But the dialogue does more than establish a "template" for human interaction; it also, according to Spitz, plays a major role in the development of psychic structure and the management of drives. Spitz points out that one of the major differences between animate and inanimate objects, from the infant's point of view, is that the inanimate object does not respond. It is the child who must initiate and maintain any series of behaviors. In short, one cannot speak of an "interaction" between a child and an inanimate object; this term must be reserved for the infant's dealings with a living partner. Although the infant is able to use the inanimate object to discharge some drive energy (by biting or banging it, for instance), even in this sense, the inanimate

object is not very useful. Since it fails to respond, since no dialogue is possible, it engages the infant in only a very specific and limited way.[5]

The human partner, particularly the mother, is able to respond to the infant's initiatives and to initiate interaction on her own. In Spitz's words, she is "the child's counterplayer in the dialogue." The early dialogue with a living partner,

> offers the child inexhaustible resources for every new, stimulating avenues for discharge of both libidinal and aggressive energy, opportunities to elaborate these discharges, to make them manageable, to make them ego syntonic, and to modulate them so that he can reap rewards from the dialogue in the form of affective gratification (p. 180).

Because the mother responds to the infant's expressions of drive discharge, she is able to help the child to "tame" the drives, to express them in ever more acceptable ways. She does this first by helping the child to keep his drive pressures within tolerable limits, that is, through her caretaking

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[5]Spitz has pointed out that the transitional object (Winnicott, 1953) is something of an exception to this statement. Because the infant has endowed it with a semblance of object attributes, it possesses certain qualities of both the animate and the inanimate.

activities; but also by prohibiting and rewarding various expressions of drive discharge via the dialogue.

As an important modulator of drive discharge, the dialogue also serves a central role in the formation of psychic structure. As drives become less insistent, more energy becomes available to be used in the structuralization of the psyche and in the development of the defense mechanisms. Thus, according to Spitz, the developing relationship with the mother, via the dialogue, becomes central in the formation of psychic structure.

What happens when this early dialogue fails? In an article entitled, "The Derailment of Dialogue," Spitz (1964) again emphasized the importance of mutual exchange in the mother-infant pair. Here, however, he focused on the mother's failure to provide her child with optimal levels of stimulation and specifically stressed overstimulation or overloading as a prime example of "inappropriate mothering." It is this inappropriate mothering that frequently results in a derailment of dialogue, a profound failure of communication between mother and infant. This early failure of dialogue can have disasterous

results on the infant's further development: "For when the dialogue breaks down in infancy, ego formation is inhibited, ego functions are distorted, and atrophied, ego apparatuses are crippled and the integrity of the ego, of the principal organ of adaptation, is in jeopardy" (p. 772).

In summary, Spitz has emphasized the crucial importance of the early experience of dialogue. He has delineated a number of areas of development that appear to be profoundly affected by this early dialogue. These include formation of psychic structure through drive reduction and ego formation; cognitive development; and the beginnings of social relatedness.

Other authors have studied reciprocal response in the mother-infant dyad in a variety of contexts: sucking and jiggling the bottle during feedings (Kaye, 1977); during various care-giving behaviors (Beckwith, Cohen, Kopp, Parmelee, & Marcy, 1976); and during vocal interactions (Anderson, Vietze, & Dokecki, 1977; Stern, Jaffe, Beebe, & Bennet, 1975).

Sander (1962, 1964, 1969) has described the central issue between mother and child during the second quarter as the issue of "reciprocal exchange."

He describes this as follows: "In the second three months,. . . the mother develops active reciprocations with her infant around the spontaneous development of smiling play. Both come to participate in this with delight and mounting expressions of exuberance as the period wears on" (p. 194). In his clinical studies of a number of mother-infant pairs, Sander has shown that a failure of this early reciprocal exchange may have important consequences for the infant's later development.

Call and Marschak (1966) have pointed to the importance of reciprocity in any mother-infant game. Mutual accommodation to each other's styles of interaction is crucial in the development of the young infant's ego. Infants who experience adequate physical caretaking, but no reciprocity, may experience a range of psychological or psycho-somatic disturbances.

The effects of reciprocity. While most authors in the field agree that reciprocity is important in the infant's development, they differ somewhat in the emphasis they place on how this experience benefits the infant. These studies can perhaps be divided into two large, and somewhat overlapping

areas of interest: those that emphasize the importance of reciprocity in the development of cognitive structures and those that point to the role played by reciprocity in the formation of the mother-infant bond.

Blehar, Lieberman and Ainsworth (1977) belong to the latter group. They were interested in studying some of the precursors of mother-infant attachment. In observing infants, aged 6 to 15 weeks in face-to-face interactions with their mothers, they found that the mother's "contingent pacing" of the interaction was associated with increased interaction and with infant excitement and delight. When these infants were re-examined at 51 weeks of age, it was found that infants who were judged to be "securely attached" to their mothers were the same infants who, at the earlier age, were more responsive during the en face encounter and who had mothers who were "contingent pacers." The authors concluded that the experience of mutuality in the en face position contributed to the infant's attachment to his mother at a later age.

Authors who emphasize the importance of reciprocity in cognitive development tend to speak of White's (1959) affectance motive, the need within the human infant to produce an effect on his environment. It is this awareness of his ability to change his world that is highly rewarding to the infant and contributes to the development of his cognitive abilities.

Watson (1966a, 1966b, 1967, 1972) is perhaps the most emphatic proponent of the cognitive viewpoint. He states, "'The Game' is NOT important to the infant because people play it, but rather, people become important to the infant because they play 'the Game'" (1972, p. 338). Watson feels that at about 2 months an infant achieves "contingency awareness," that is, he realizes that his actions are having an effect on his stimulus world. This contingency situation is <u>in itself</u> rewarding, regardless of the reinforcement conditions under which it occurs. Thus, it is not the social aspects of the Game per se that are pleasurable to the young infant, but rather the awareness that he is affecting his partner's behavior.

Watson invented a "contingency game" in which the opening of his fist was made contingent on an infant's looking behavior. The infant showed operant learning and in the process spent so much time looking at the experimenter's hand, that he stopped looking at the experimenter's face. In another study Watson and Ramey (1969) constructed a special crib which allowed 2-month-old infants to rotate a geometric mobile by moving their head. The authors found a high rate of head moving in the experimental group in comparison with controls (where movement of the mobile was randomly determined). In addition, mothers of the experimental babies spontaneously reported that smiling and vocalizing at the mobile emerged rapidly. When measured, it was found that smiling and vocalizing at the mobile were significantly more frequent in the experimental group than in the control group. The authors conclude that the ability to control a stimulus may be more rewarding than the stimulus itself. They suggest that "contingency awareness" be systematically introduced into the infant's early learning experiences.

Papousek and Papousek (1975) also report operant learning in the young infant. Using milk as a reinforcer in a variety of learning situations, they found, to their surprise, that there was no relationship between the rate of response and the level of satiation of the infant. They discovered that the correct solution of the learning problem was often accompanied by positive affect in the infant, including increased smiling and vocalization. By contrast, when the infant was exposed to learning situations which were too complex for him to master, the authors report a predictable series of responses:

> In these situations, infants were observed first to intensify their orienting, total motor activity and autonomic reactions, then to lose coordination of responses if they proved to be ineffective, and finally to turn away from the experimental situation (p. 247).

The authors suggest that the infant's experience of influencing the environment powerfully elicits orienting responses which are then remarkably resistant to habituation. By contrast, an inability to effect changes results in an avoidance response.

There is some evidence that reciprocity at an early age may have an effect on later cognitive and emotional development. Beckwith, Cohen, Kopp,

Parmelee, and Marcy (1976) observed 61 premature infants and their mothers at home. Observations were conducted at 1, 3, and 8 months of age, and at 9 months infants were given a sensorimotor test and the Gesell developmental schedule. Those infants who at 9 months had higher sensorimotor scores, had experienced more mutual mother-infant gazing at 1 month, more interchanges of smiling during gazing, and more contingent responses to distress at 3 months. At 8 months their mothers were more generally attentive to them and showed more contingent responses to their non-distress vocalizations. The authors conclude:

> The significant dimension appears to be reciprocal social transactions, that is, transactions that occur contingently to the infant's signals, either simultaneously as in mutual gazing or successively as in contingency to distress or contingency to non-distress vocalizations (p. 586).

Of course, in studies of this nature, it is extremely difficult to untangle direction of effect. It is conceivable that infants that are cognitively precocious could show more interest and social exchange and elicit more attention and responsiveness from their mothers.

Vine (1973) has suggested that the reciprocal exchange is crucial in both cognitive development and in the development of attachment. He has suggested that a successful interaction will help the infant to form cognitive schema, first for the human face in general, then for the mother's face in particular. An optimal level of stimulus-schema discrepancy is important in leading to positive affect in the infant. It is this optimal level of stimulus-schema discrepancy, and the positive affect that accompanies it, that makes possible the formation of social attachments. By contrast, "the inappropriate contingencies of early facial-visual interaction between the infant and the mother or caretaker should delay schema acquisition, and thus also delay the growth of the infant's first social attachments" (p. 275).

Thus, a number of theorists and researchers have emphasized the importance of the dialogue in the formation of cognitive structure and in the development of social attachments. The discussion which flows will attempt to relate these findings to the role of the mother in facilitating the dialogue.

The Role of the Mother

The importance of reciprocity in the mother-infant dyad has been discussed above. In order for a reciprocal relationship to exist between mother and infant, particular skills and sensitivities are required of the mother. In the discussion that follows there will be an examination of the mother's role in organizing and structuring her infant's experience during the course of the Game.

Variations in maternal response to infant's aversion of gaze. An examination of the literature has suggested that a mother will tend to experience the infant's visual fixation of her face as an affectively positive response. Conversely, an aversion of gaze, since it represents a disengagement on the part of the infant, may be experienced as a rejection of the mother. A few investigators have noted individual variations in maternal response to this "rejection."

Stern (1974b) has described two groups of deviant maternal responses to aversions of gaze. "Overcontrolling" mothers are those who overstimulate their infants in non-contingent ways. Stern describes them as follows:

> They do not let the infant freely regulate the initiation and termination of attention episodes. When the infant gaze averts, terminating an attention episode, these mothers may immediately and markedly escalate the intensity and variety of their behavior to recapture the infant's attention and, in a sense, return control of the attention episode into their hands (p. 413).

Stern notes that such escalation is usually ineffective, since the infant usually seems to avert gaze when stimulation is too great. When such a mother fails to recapture her infant's gaze, she usually "pursues" the infant's gaze by moving her head and body. Stern summarizes this pattern of maternal response as follows: "They will not allow the infant to terminate the attention episode. In these situations, the mother deprives the infant of the important experience of self-regulation through gaze control and is interfering with the operation of an early ego mechanism" (p. 413).

The "undercontrolling" mother seems to abdicate all initiative and waits for the infant to provide the necessary impetus for the interaction. Typically, this type of mother markedly decreases stimulation when her infant turns away and waits for him to return his gaze before providing him with further

stimulation. Such a mother often terminates a play session permaturely, interpreting a gaze aversion as a permanent "cut-off behavior, a terminal rejection.

Brazelton, Koslowski, and Main (1974) have described three possible patterns of maternal response during the Game. The mother can adjust her rhythms to the rhythm of her infant. This tends to result in an increase in the amount of time that her infant spends looking at her. She can ignore the infant's rhythm and his gaze aversions and continue to stimulate him at a high rate. This usually serves to reinforce the infant's looking away and to decrease the amount of time the infant spends looking at her. Or, she can increase and decrease stimulaton, but not in synchrony with her infant. This usually results in brief, unsatisfactory interactions between mother and infant.

Stern and Brazelton describe similar dimensions in variations of normal maternal response during the Game. One dimension appears to be overstimulation-understimulation of the infant. The other dimension reflects a lack of sensitivity on the mother's part to the rhythms of her infant, a dissynchrony in the interaction between mother and child.

Maternal behavior during the Game. The discussion that follows draws heavily on the work of Daniel Stern (1971, 1973, 1974a, 1974b, 1977). Stern has used microanalytic techniques, including frame-by-frame analysis of films, to describe the intricate sequence of behaviors that comprise the Game. He has coined the term "infant-elicited social behaviors" to describe a class of maternal behaviors during the Game that are, in many respects, very different from behaviors seen during interactions between adults. Stern (1977) describes the common features of these behaviors as follows:

> They are exaggerated in space and the fullness of display can be maximal. Their performance is exaggerated in time, usually marked by a slow formation and an elongated duration. And the repertoire is usually limited to several selected expressions that are performed very frequently and with much stereotypy (p. 14).

The maternal behaviors to be considered here are gazing, vocalizing, facial expressions, movement and position, and touching.

Gazing. When adults interact, there are rules which govern their gazing behavior (Argyle & Cook, 1975; Argyle, 1970; Kendon & Cook, 1969). These rules require a shifting from looking to not-looking

with factors such as sex, status, and speaker-listener role all reflected in who looks and who looks away, how long and how much they look, etc. (Exline, 1963, 1971; Fugita, 1970; Rubin, 1970; Strongman & Champness, 1968).

However, mothers consistently violate these rules during the Game. They look at their infants for long, almost uninterrupted period of time (Fogel, 1977). Stern (1977) reports that during the Game, mothers spend upwards of 70% of the time gazing at the infant, with an average gaze duration of 20 seconds. This compares with the results of one study using two interacting adults, which found that the mean individual gaze was 61% of the total time, while the length of individual looks was 2.95 seconds (Argyle & Ingham, 1972).

The mother's extended looking can serve two important functions: first, it enables the mother continuously to monitor her infant's state and make the appropriate adjustments in her own behavior. Secondly, gazing, particularly when combined with certain facial expressions, provides the infant with very important cues regarding his mother's readiness

to interact. Making eye contact with her infant is the mother's way of saying, "Here I am. Let's play."

Facial Expression. Perhaps the most strikingly "deviant" aspect of mother-infant interacton, as compared with adult-adult interaction, is the facial expressions assumed by the mother. "Making faces" at a baby may appear to be a queer, if harmless, aberration of our species. Stern, however, has decisively demonstrated that these exaggerated expressions are subtly tuned to the infant's perceptual abilities and serve as important cues to the infant as to his mother's wish to initiate, maintain, terminate or avoid social interaction.

It is important to note that these "faces" are, in fact, highly exaggerated forms of recognizable affective expressions. In this case, the facial musculature and the features of the face (particularly the eyes, eyebrows, and the mouth) are used in a wildly exaggerated way. These expressions are not only intensified in terms of fullness of display, they are also considerably exaggerated in time, that is, they are slowed down, sometimes almost appearing

to be in "slow motion." Thus, both degrees of expression and timing seem geared to the infant's perceptual abilities.

Stern (1977) has described five classic facial expressions seen during the Game: the neutral expression and the smile are essentially similar to those seen in adult interactions. Three other expressions described are: mock surprise, frown, and concern.

The mock surprise is often used by the mother as a form of greeting behavior and serves as a signal to the infant that she is ready to begin an interaction (or a new round of the interaction). It usually involves a widened mouth, raised eyebrows, and widened eyes, and may be accompanied by long, drawn-out vocalizations such as, "Hiiiiiiii."

The frown is almost the inverse of the mock surprise face. While the latter involves a widening or opening up of all the features, the frown usually requires that the features be drawn in. Here, the eyebrows are knit and lowered, the eyes are narrowed and the mouth is pursed. At its fullest, this may look like a "disgusted" face, with all the features of the face tightly knit and drawn in.

The concern face (Stern calls it the "'Oh, you poor dear' expression of concern and sympathy) is a cross between the mock surprise and the frown. Here the brows are somewhat knit, but the eyes are widened and the mouth is slightly opened. It may be accompanied by vocializations such as, "Awwwwwww."

Stern points out that certain constellations of facial expression appear to be universal signals of a readiness to engage in, or a wish to avoid, social interaction. The eyes are particularly crucial in this respect: widened eyes indicate interest in the other and a readiness to interact, while narrowed eyes are associated with anger or fear and indicate a decreased readiness to interact and a possible termination of contact. It is interesting to note that, as has been discussed above, it is the eyes to which the infant selectively attends, in preference to almost any other stimulus. Thus, from a very early age, the infant is "tuned in" to just those aspects of his environment that provide him with the most information regarding the other's willingness to engage in social interaction.

Each facial expression described above is thus a cue to the infant. The mock surprise face serves as an attention-getting device and signals orientation and readiness to interact. The smile and the concern face serve to maintan interaction: the smile signals "all is well," while the concern is a reflection of the mother's wish to refocus the interaction when things are not going smoothly. When the frown is accompanied by head and gaze aversion, this may be a signal to terminate the interaction, or perhaps pause in the interaction before re-engaging. A mother can signal her wish to avoid interaction by doing none of these, that is, by simply showing a neutral expression, especially if this is accompanied by an aversion of gaze.

Thus, the mother's facial expression serves as a potent part of a signal system. Each facial expression, together with head and body presentation and gaze variables, all make up a complex Gestalt that informs the infant of his mother's present state.

Vocalization. "Baby talk" differs from normal adult speech in much the same way that "making faces" differs from normal affective display. Here

what is exaggerated is the pitch: much of maternal vocalization is in falsetto, with an occasional growl in the lower registers. Loudness may vary from intimate whispers to near-shouts of exuberance. In addition, the timing of utterances is slowed down with long vowel durations. And finally speech may be intensely rhythmical, with much sing-song and even frequent snatches of actual song.

An important aspect of maternal vocalizations during the Game is the organization of utterances in time. Stern, Jaffe, Beebe, and Bennett (1975) have pointed out that there appear to be two different temporal patterns of mother-infant vocalization: vocalizing in unison, and vocalizing in turns. Stern (1977) suggests that the former tends to serve more as a bonding function, while the later serves a communicative function.

Vocalizing in unison, or "chorusing," usually occurs in moments of exuberance when both mother and infant appear to be intensely involved in the interaction.

In turn-taking the mother structures her vocalizations in a particular way: the "bursts" of speech are shorter than in average adult conversation, and

the pauses are considerably longer. Stern has suggested that the short "bursts" provide the infant with small "packages" of information, carefully geared to his immature processing abilities. The longer pauses provide more time in which to process the incoming information. However, the pauses may serve yet another function. Often the mother acts as though, during this pause, the infant were responding to her (even if he is silent). Thus, she pauses for the average pause length in adult conversations, plus the time for the infant's (imagined) response, plus the pause following his "pretend" utterance. It is interesting to add that mothers direct many of their utterances to infants in the form of questions requiring a response, and then often act as though the infant had answered their query. Thus, both in form and content, mothers structure the interaction as though a verbal dialogue were taking place between them and their pre-verbal infants.

Stern suggests that the mother is here teaching her infant "timing," that is, the rhythm and timing of adult conversation. Newson (1977) makes a similar point and suggests that early mother-infant interaction prepares the way for later language development

by training the infant in the process of communication. He states:

> The mother's task is seen to be one of organizing her own actvity in synchronous alternation with certain discrete actions produced by her baby, so as to establish temporally linked patterns of reciprocation which continually recur in the baby's experience in the course of ordinary human caretaking (p. 48).

Mothers' temporal patterning of vocal responses serves to place the infants' responses in a social communicative context. By giving social meaning to the actions of her infant, the mother helps him take the first steps in becoming social (Richards, 1974).

Position. A mother playing with her infant frequently violates yet another social convention of adult intercourse. Most people have a "personal space," an invisible "bubble" which surrounds them and may not, according to convention, be penetrated except under conditions of high affiliation (as with lovers) or high aggression (as with combatants).

Mothers again tend to disregard this rule. They often "loom" towards a baby, their face only inches away from the baby's face. Although there is some evidence to indicate that babies respond negatively to objects which loom towards them, there is

no evidence that they have the same response to their mother's looming face.

Movement is a stimulus characteristic that tends to increase the likelihood of infant gazing (Carpenter, 1974; Spitz, 1965; Wilcox & Clayton, 1968). During the Game, mothers make frequent changes in head and body position vis a vis the infant. This may serve two important functions. First, it serves to capture and hold the infant's attention. Second, it also presents the infant with a variety of different views of the mother's face, views from many different angles and perspectives. This experience may enable the infant to begin to subsume various psychophysical changes in the sight of the mother's face into one consistent unchanging schema. Thus, again, the mother's behavior during the Game appears to serve both an affective and cognitive function.

Touch. Harlow (1959) studied monkeys reared in isolation who were provided with a cloth or wire "surrogate mother." He demonstrated that cloth mothers were preferred and emphasized the importance of body contact and tactile stimulation in the development of attachment in infant monkeys.

In humans, theorists such as Winnicott (1960) and Ribble (1943) have stressed the importance of the "holding envornment" in soothing and comforting the infant. Yet there has been little research in this dimension of stimulation. A small body of literature has examined the impact of tactile stimulation on soothing (as opposed to stimulating) the infant. Generally these studies have found that merely providing an infant with tactile stimulation is not a particularly effective method of soothing him. Movement and vestibular stimulation, as well as swaddling (all of which may, of course, involve tactile stimulation) appear to be more effective than touch alone (Korner & Grobstein, 1966; Korner & Thoman, 1970).

During the Game mothers may use touch to both soothe and stimulate their infants. As yet, however, there have been no systematic studies examining mothers' tactile stimulation of their infants during play.

Deviant Gazing Behavior

While the alternation of look/look away/look, as described above, appears in almost all sighted infants, there are variations of this cycle that

appear to be pathological. It is often difficult to determine whether such variations originate with the mother or with the infant, yet it becomes clear that the reciprocal system has been disrupted. A number of possible factors may contribute to this "derailment of dialogue."

Blind Infants. A number of studies (Fraiberg, 1971, 1972, 1977; Fraiberg & Freedman, 1964; Nagera & Colonna, 1965; Burlingham, 1972) have pointed to the retardation, and sometimes to the permanent impairment of ego development in many blind children. Fraiberg (1974) has focused on those aspects of the blind infant that are of particular interest here: What are the consequences of the total absence of mutual gazing in blind infants and their mothers? Fraiberg has reported that even after many years of working with blind infants, she still experiences something lacking in the interaction: "The blind eyes that do not engage our eyes, that do not regard our faces, have an effect upon the observer which is never completely overcome. When the eyes do not meet ours in acknowledgement of our presence, it feels curiously like a rebuff" (1974, p. 220). Fraiberg has stated that blind infants do not smile

as readily as do sighted babies. Clinicians who have not had experience working with blind infants consistently remark on the lack of affect in the blind infant's face. For the mother of the blind infant, grief at her child's blindness is compounded by the infant's seeming lack of response, his lack of interest in a social exchange.

Fraiberg has helped mothers to learn that a blind infant expresses "interest," acknowledges the mother's presence, not by visual fixation and facial expression, but through a subtle tactile language. However, of the eight mothers and infants studied by Fraiberg, only two mothers could "hook in" to this tactle language without assistance. The other six mothers had to be taught that there are channels other than the visual mode that can be used by the infant to express his part of the "dialogue."

Psychopathology and gaze aversion. Hutt and Ounsted (1966) studied gazing in eight autistic boys, aged 3 to 6 years. They had previously observed that autistic children, even when seeming to interact with an adult, often seem extremely reluctant to fixate on the adult's face. The authors investigated this by constructing models of five faces: a happy human face,

a sad human face, a blank oval, a monkey's face, and a dog's face. These models were placed on stands in an otherwise empty room. The children were then brought into the room and time spent in the vicinity of each model was recorded. Six non-autistic children of the same age as the experimental group served as controls.

The authors found that the autistic children spent less time with the faces as a whole and more time with the fixtures in the room. While there was little difference between the autistic children and the controls on time spent looking at the blank oval, autistic children spent significantly less time with the happy and the sad human face.

Like the blind infant, the autistic infant fails to provide the mother with cues that help to form the mother-infant bond. Even when the autistic infant smiles, he tends to do so in the absence of visual fixation, thus giving the mother an ambiguous communication. The authors speculate the the "double bind" parental reaction described by Bateson, Jackson, Haley, and Weakland (1956) may come about in response to ambiguous, preverbal messages on the part of the autistic infant. The authors further suggest that

the social withdrawal and aloofness often described in autistic children is largely attributable to their failure to visually fixate the human face.

Richer and Coss (1976) have reported findings similar to those of Hutt and Ounsted. They presented ten autistic children, aged 5 to 11 years old, with an adult who looked at them with both eyes, with one eye covered, or with both eyes covered. The autistic children looked more at the adult with his eyes covered and showed less flight behavior. Similarly, they looked more when the adult had one eye covered than when both eyes were exposed. The authors suggest that this finding supports the idea that the two-eye pattern is particularly potent in provoking gaze aversion in autistic children.

What function does gaze aversion serve for the autistic child? Hutt and Ounsted suggest that autistic children may be in a constant state of high physical and behavioral arousal. Because the face, and particularly the eye area, seems to be the most arousing social stimulus, gaze aversion may represent an active attempt on the part of the autistic child to reduce his level of arousal. It is one method available to the autistic child to modulate incoming

stimulation. Hutt and Ounsted suggest that gaze aversion be viewed as an "arousal-equilibrating act."

Spitz (1965) has remarked that aversion of gaze is a feature of anaclitic depression and of hospitalism in infants. He relates this to "emotional starvation" brought about through lack of adequate affective stimulation. Thus, Spitz views gaze aversion in these infants as one of the results of insufficient maternal stimulation of an affective nature.

Maternal predisposition to gaze aversion. Robson (1967) has reported that total maternal gaze aversion is rare (perhaps limited to cases of severe psychopathology). A more common pattern of eye contact is one where the mother's eyes make only transient, fleeting contact with the eyes of her infant. Clearly, such variations in mothers' gazing behavior can have important consequences for the interaction, since the probability of the infant gazing at the mother is greatly increased when the mother is looking at the baby (Stern, 1974a). When maternal gazing is absent or relative infrequent, the probability of mutual gazing will be greatly decreased.

"Derailment of dialogue" and gaze aversion. Ainsworth and Bell (1970) studied 1-year-old infants in a laboratory setting. Infants were exposed to both a stranger and a separation from the mother. While almost all infants showed some form of negative affect upon being parted from their mothers, their behavior upon reunion with the mother was considerably more variable. One pattern consisted of an ambivalent turning away from the mother; conspicuous in this pattern was a consistent aversion of gaze and a staunch refusal to look at the mother.

These findings were compared with data obtained during the first three months of life of these same infants. At that time, mothers and infants had been observed during feeding situations and mothers had been rated on a sensitivity-insensitivity scale, indicating how responsive each mother was to her infant's signals. Mothers who were rated particularly sensitive during the first three months of the infant's life, tended to have infants who displayed little or no ambivalence (and gaze aversion) when reunited after a separation. Conversely, mothers rated relatively low on sensitivity tended to have

infants who at 1 year of age seemed either uninterested or ambivalent (and who showed much gaze aversion) when reunited with their mothers.

Other authors have reported clinical examples of similar phenomena. Call and Marschak (1966) discussed the case of baby Dale and his mother. When Dale was 4 1/2 weeks old, his mother became estranged from both her husband and her infant. At 5 1/2 weeks, the mother began a sequence of teasing games: she brushed Dale's mouth with the nipple of the bottle and forced the baby to "snap" for it. By the time Dale was 2 months old, he "was observed to consistently turn his head and body away from the mother while being held for feeding in the mother's left arm. . . When held by the father, the baby always turned toward the father, looking in his face. All of the positive social responses in the first eight months were directed toward the father" (p. 206). The authors also noted that at a later age, when confronted with a stranger, Dale turned toward the stranger and away from his mother. He showed neither stranger anxiety nor separation anxiety.

Ambrose (1963) found that in one baby of the eight that he studied, little smiling had emerged by 12 weeks of age. The mother of this infant had experienced great difficulty in mothering her baby during the first three months of life. Ambrose has described this baby as "conspicuous for the frequency and intensity of his. . . turning away from the investigator" (p. 22).

In an empirical study of the smiling response, using a learning theory paradigm, Brackbill (1958) employed social reinforcement (smiling, vestibular stimulation, vocalization) to increase the rate of smiling in infants aged 3 1/2 to 4 1/2 months. During the extinction phase, no social reinforcement was given. Brackbill noted that the response rate dropped, not to the operant level, but to a rate of zero responses. At the same time, the infant averted his head and would not fixate the experimenter's face (in marked contrast to his consistent visual fixation during conditioning). Even when the infant's head was propped so that he could not turn his head to the left or right, he still would not fixate the experimenter's face, but turned his gaze to the ceiling. Brackbill has suggested that this aversion

of gaze could be seen as an avoidance response to a stimulus that is perceived as frustrating. This avoidance response is reinforced when the infant is able to escape from the frustrating situation.

It is interesting to note the similarities between the infants studied by Brackbill and those described by Spitz and Wolf (1946a) suffering from anaclitic depression. In both cases, aversion of gaze was an important behavior exhibited by infants. While the effects were considerably milder in Brackbill's study, probably due to much milder levels of deprivation, the similarities in the two patterns of response are highly instructive. In both cases, the infants had experienced an initial situation marked by affective gratification (social reinforcement in Brackbill's study, "good mothering" in Spitz's study) which was followed by a period of affective deprivation (extinction in Brackbill's study, separation in Spitz's study). Both groups of infants characteristically responded by withdrawing attention from the external environment via repeated and pronounced aversions of gaze.

In each of the cases described here, infants responded to past or present experiences of a non-gratifying partner by averting gaze. Here gaze aversion was used defensively: the infant was able to decrease or terminate contact by looking away. These infants appear to have learned that by breaking gaze, they could begin to voluntarily escape from an interaction which had become unpleasurable.

CHAPTER II

METHODOLOGY

The purpose of this study was to isolate and describe some of the factors that contribute to infant gazing. Infants were videotaped while playing with their mothers and while playing with a stranger. A variety of behaviors were scored, with particular attention to infant fazing and gaze aversion, and to maternal behaviors including gaze, facial expression, use of toy, vocalization, position and touch.

Subjects

Subjects were 20 full-term normal infants, aged 12 to 15 weeks, and their mothers. All infants were first-born males, since some investigators have found sex and parity effects in mother-infant interactions (Moss, 1967; Moss & Robson, 1970; Lewis, 1972; Jacobs & Moss, 1976; Bakeman & Brown, 1977). All mothers were white, middle- or upper-middle class, and 21 to 37 years old.

Choice of Age of Infants

The age of 12 to 15 weeks was chosen because a number of investigators (Wolff, 1963; Spitz & Wolf, 1946b; Ambrose, 1963) have agreed that at this age

the infant is capable of a social exchange in the form of the "smiling game," here referred to as the Game. In addition, at this age visual acuity is quite good (Haynes, White & Held, 1965); infants seem to be able to discriminate forms; and they appear to respond preferentially to the human face (Haaf & Bell, 1967; Spitz, 1965; and others).

Equipment

In order to obtain a split-screen effect (see below), two Shibaden PC-TV cameras, model number HV-40 SU were used. Other equipment included a special effects amplifier GBC MEA 5100, together with a Shibaden video tape recorder SV 510.

Method

Mother-Infant Condition

Mothers and their infants were video-taped using a split-screen effect; one camera was trained on the infant's face, the other camera on the mothers' face. Both the mother's and the infant's face were visible simultaneously on the video monitor.

Video taping was conducted in a sunny, cheerfully furnished room, usually used to videotape family therapy sessions. Most of the equipment was housed in a wooden console and was therefore not

visible to the subjects. Similarly, the video monitor was out of their direct line of vision. The camera trained on the mother's face was attached to the wall well above her head, while the camera trained on the baby's face was equipped with a zoom lens which permitted placement of the camera at a considerable distance from the infant. Thus, all video equipment was arranged in such a way as to be as unobtrusive as possible.

After the mothers arrived, they chatted for a while with the experimenter about their infants. When they appeared fairly comfortable in the experimental setting, they were given the following instructions:

> "We are interested in learning more about what it is babies do when they play. We are going to ask you to play with your baby, just as you would at home. You and your baby will be videotaped and we can watch the tape when you've finished playing. We would like to ask you to try not to lift the baby out of the infant seat. Other than that, we would like you to do whatever you would usually do at home. There is no right or wrong way to act -- just be yourself. Anything you do will be helpful. If you sense that the baby is getting tired, please feel free to stop the game at any time. Do you have any questions? Then let's begin."

Infants were then placed in a standard, commercial infant seat which was set on a small table. Mothers were seated at the table, facing the infant, and about a foot or two away. When mothers felt ready, the taping sessions began.

Sessions lasted until mothers decided to stop or until the babies became too fussy to continue interacting. All sessions were terminated after about ten minutes, if they had not been terminated before then.

Stranger-Infant Condition

In addition to the mother-infant play condition, a second condition was included. Here a female, who was a stranger to the infant, played with him, and the two were videotaped.

Mother-infant and stranger-infant conditions were counter-balanced with respect to order of presentation. When the stranger-infant condition preceded the mother-infant condition, mothers were told that the stranger would spend a little time with the baby to make sure that the recording equipment was functioning properly. When the stranger followed the mother, mothers were simply asked, "Do you mind if I play with your baby for a while?"

Mothers were asked to wait outside in the waiting room during the recording of the stranger-infant condition. Similarly, the stranger was not present during the mother-infant condition.

Other Information

When they had finished playing with their babies, mothers were asked to fill out a questionnaire providing developmental data on their babies and demographic information about themselves. In addition, they were requested to complete an MMPI at home and to return it to the experimenter.

Inclusion Criteria

In order for a mother-infant pair to be included in this sample, the infant had to complete six minutes of play with the mother and six minutes with the stranger. Two babies had to be dropped from this sample, one because he was unable to play with the stranger for six minutes, the other because his mother picked him up before six minutes of play with her had been completed. Twenty infants were able to meet the inclusion criteria.

Data Scoring

A rating scale which was used to score the video-tapes is presented in Appendix A. This scale measured infant gaze and a number of behaviors of the infant's partners, including gaze, facial expression, use of toy, vocalization, position vis a vis the infant, and touch. Each category of response was divided into sub-categories in an attempt to order responses along a continuum according to the amount of stimulation provided by the mother (or stranger) to the infant. For instance, a score of 0 in the category of touch (TC0) indicated that the mother or stranger was not touching the infant; TC1 was a gentle touch; TC2 was a jab, a touch of higher intensity than the one preceeding; and TC3 was the highest intensity of touch, involving active manipulation of the infant's body. (Detailed definitions of each of the sub-categories are presented in the scoring manual, Appendix B.)

For purposes of this analysis, Minutes 2 and 5 of the interaction were scored. These minutes were chosen to allow for a "warm up" period and also to provide an indication of how the interaction changed over a period of time.

Each category of response was scored for every second of the two minutes, yielding 120 scores per category. Within each behavioral category, it was possible to assign only one score per second. Thus, within each category, the various sub-categories were mutually exclusive. For the category of touch, for instance, in any given second, the score would be only one of the four possible sub-categories.

Scoring was accomplished by playing and re-playing small portions of the video-tape, often at extremely slow speeds. Each category of response was scored separately, with mothers' (and stranger's) responses rated first, and infant gaze always rated last.

Two raters scored the tapes, one scoring mother-infant interaction, the other scoring stranger-infant interaction. Reliabilities on the various categories of response ranged from .865 to .990, with a mean reliability of .950 for the scale as a whole. Percentage of agreement ranged from 74% to 99%, with a mean of 87%.

CHAPTER III

RESULTS

Infant Gaze

Results of this study show that 3-month-old male infants look more at a stranger than at mother. Mean total gazing time (TIG1)[6] at mother for all infants was 42.65 seconds, with a standard deviation of 22.63 seconds. Mean total gaze time at the stranger (S) was 69.70 seconds, with a standard deviation of 27.67. Differences between gazing at mother and at S are highly significant (t (19) = -4.14, $p < .001$).

Differences in gaze aversion time are also significant. Mean gaze aversion time (TIG0) for the mother-infant condition was 72.4 seconds[7], with a standard deviation of 21.57. Mean gaze aversion time from S was 50.3 seconds, with a standard deviation of 27.67 (t (19) = 3.59, $p < .001$).

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[6]There is no significant difference in either mother-infant or stranger-infant conditions in the amount of gazing in Minute 2 as compared with Minute 5 (t (19) = 1.11, t (19) = 1.44 for gazing at mother and at S respectively, $p > .05$). Thus, only figures for the total interaction (Minute 2 plus Minute 5) are presented here.

[7]The sum of TIG0 and TIG1 does not always equal 120, since infants were sometimes not clearly visible on camera. At such times, a score of 9 ("can't tell") was given and these scores were excluded from the present analysis.

Gaze durations show a pattern similar to gaze frequencies. Mean gaze duration at mother is 2.86 seconds, with a standard deviation of 2.19. Mean gaze duration at S is 8.39 seconds, with a standard deviation of 7.18. These differences are significant at the .002 level (t (19) = -3.67).

Since there are large differences in gazing within each of the two stimulus conditions, one question that is raised is whether differences among infants carry over from one condition to the other. In other words, do infants who gaze a great deal at their mothers also gaze a great deal at S?

For the total 120-second period under study, the correlation of gazing time at mother with gazing time at S is .34. This correlation is not significant. Breaking these findings down by individual minutes reveals differences between correlations that occur early in the play session and those that occur later in the session. While there is almost no correlation in Minute 2 (r = -01, df = 18, $p > .05$), there is a significant positive correlation in Minute 5 (r = .56, df = 18, $p < .01$). The same pattern exists with respect to correlations of gaze aversions (r = .40, $p > .05$ for Total

time; r = .05, $p > .05$ for Minute 2; r = .57, $p < .01$ for Minute 5). Thus, although infants gaze more at S than at mother, there is a strong correlation between the two in Minute 5 of the interaction, but not in Minute 2.

The mean number of looks for all babies at mother was 16.3, with a standard deviation of 5.58. The mean number of looks at S was 11.05, with a standard deviation of 5.48. A look is here defined as that period from the moment an infant looks at his partner until the moment he looks away. Differences in the number of looks at mother and at S are significant (t (19) = 2.97, $p < .01$).

Mother-Stranger Differences in Behavior

Table 1 shows the means for each scored behavior for both mothers and for S, and the relationship between the two. The following behaviors are significantly different for mother and for S.

Maternal Gaze. S tends to look (MG1) significantly more at infants than do the mothers as a group. S also tends to look away (MG0) significantly less.

Facial Expression. S is significantly less likely to show a neutral facial expression (FE0) and significantly more likely to smile (FE3) than are mothers.

Toy. Mothers tend to play with toys (TY1) more than does S.

Vocalization. Mothers were much more likely to speak in a normal tone of voice (VC1), while S was much more likely to use "baby talk" (VC3).

Position. Mothers were much more likely to assume extreme positions vis a vis the baby, either seated all the way back in the chair (PS0) or "looming" very close to the baby (PS2). S, on the other hand, was more likely to assume the intermediate "forward" position (PS1).

Touch. On this dimension, mothers tended to stimulate their babies more vigorously than did S. While mothers showed significantly more high level touch and proprioceptive stimulation (TC3), S was more likely to touch the infant in a gentle way (TC1).

TABLE 1

Means of Behaviors for Mothers and Stranger in Seconds

Behavior	Mothers	Stranger	t (19)
MG0	13.40	6.25	2.55*
MG1	106.60	113.35[a]	-2.28*
FE0	74.75	51.40	3.42***
FE1	1.10	2.65	-1.38
FE2	3.90	5.45	- .56
FE3	29.75	50.70	-3.66****
FE4	9.95	6.30	1.57
TY0	91.90	115.70	-3.23***
TY1	28.10	4.30	3.23***
VC0	46.75	57.35	-2.06*
VC1	29.65	9.90	7.08****
VC2	1.10	0.00	1.00
VC3	42.50	61.75	-4.12****
PS0	20.85	6.80	2.14*
PS1	50.85	98.80	-7.64****
PS2	38.35	7.05	4.90****
PS3	9.35	6.60	1.38
PS4	0.60	0.45	.38
TC0	47.75	32.45	1.67
TC1	33.65	68.30	-4.51****
TC2	10.90	10.55	.12
TC3	27.60	8.65	2.99***

[a]The sums of ratios do not always equal 120 due to rounding off and to missing data.

*$p < .05$
**$p < .01$
***$p < .005$
****$p < .001$

In an attempt to clarify these findings, each maternal behavior was re-analyzed after being broken down by infant gaze condition. For instance, MG1 was rated for those times when the infant was looking (MG1IG1) and for those times when the infant was looking away (MG1IG0). However, since there existed such large differences between IG0 and IG1 variables, a pure frequency count proved to be misleading. Therefore, a ratio was calculated. Each composite score (for instance, MG1IG1) was divided by the total gaze or gaze aversion frequency for that baby. If, for example, Mother A spent 30 seconds gazing at her baby while her baby was also gazing at her (MG1IG1=30), and the total time that Baby A gazed at his mother was 45 seconds (IG1=45), then the ratio score was $\frac{30}{45}$ or .667 (RTMG1IG1=.667).

Differences in the ratios of mothers and S were then tested. These differences are summarized in Table 2 for periods of infant gaze aversion, and Table 3 for periods of infant gaze.

TABLE 2

Ratio of Mothers' Behavior and Stranger's Behavior During Periods of Infant Gaze Aversion.

Behavior	Mothers	Stranger	t (19)
MG0	12.49	9.74	.80
MG1	87.51	90.13[a]	.76
FE0	67.98	48.35	3.26**
FE1	.88	3.73	-1.83
FE2	3.18	4.53	- .58
FE3	21.75	35.46	-2.75*
FE4	6.13	1.93	2.43*
TY0	74.81	95.07	-2.96**
TY1	25.19	4.93	2.96**
VC0	39.45	50.14	-2.06
VC1	24.71	.78	6.46****
VC2	.74	.00	1.00
VC3	35.09	49.08	-2.79*
PS0	19.25	4.53	2.57*
PS1	41.90	78.32	-6.46****
PS2	28.44	9.61	3.20**
PS3	9.70	7.10	1.30
PS4	.72	.43	.60
TC0	41.26	20.11	2.73*
TC1	25.95	59.19	-4.63****
TC2	9.39	11.86	- .74
TC3	23.40	8.76	2.44*

[a]The sums of behaviors do not always equal 120, due to rounding off and missing data.

*$p < .05$
**$p < .01$
***$p < .005$
****$p < .001$

TABLE 3

Ratio of Mothers' Behavior and Stranger's Behavior During Periods of Infant Gaze

Behavior	Mothers	Stranger	t (19)
MG0	9.26	2.83	3.32**
MG1	90.74	96.46[a]	-2.62*
FE0	53.74	38.38	2.63*
FE1	.46	1.63	-1.03
FE2	3.06	4.32	- .50
FE3	29.78	46.19	-3.02**
FE4	11.85	8.05	1.47
TY0	84.10	99.38	-3.30**
TY1	15.90	.62	3.30**
VC0	37.61	45.53	-1.61
VC1	23.59	2.22	5.28****
VC2	1.12	.00	1.00
VC3	37.68	52.25	-3.25**
PS0	15.08	6.91	1.63
PS1	41.34	84.45	-6.61****
PS2	38.30	3.86	5.50****
PS3	5.01	3.88	.63
PS4	.28	.18	.29
TC0	37.93	26.87	1.26
TC1	32.14	59.54	-3.23**
TC2	10.15	8.23	.58
TC3	19.58	5.36	3.06**

[a]The sums of ratios do not always equal 100, due to rounding off and missing data.

*$p < .05$
**$p < .01$
***$p < .005$
****$p < .001$

Maternal Gaze. Table 1, above, showed significant differences between mothers and S in both MG sub-categories (MG0 and MG1). Tables 2 and 3 reveal that these differences were mainly attributable to differences in behavior when the infant is gazing at his partner (IG1). At such times, S is likely to spend a significantly larger proportion of the time than mother returning the infant's gaze and a significantly smaller proportion of the time averting gaze. When the infant averts gaze (IG0), differences between mothers and S in proportion of MG to IG0 do not achieve significance.

Facial Expression. For neutral expression (FE0) and smile (FE3), infants' gazing condition does not play a large role in differentiating mothers' behavior from S's. Regardless of infant gaze condition, mothers tend to spend a significantly larger proportion of time in FE0 than does S. S, on the other hand, is likely to spend a larger proportion of both gaze and gaze-away time in smiling (FE3). Mothers spend more of the gaze-away time than S in the "surprise" face (FE4), but this is not the case when the infant is looking at his partner.

Toy. Regardless of infant gazing condition, mothers spend a significantly greater proportion of time playing with toys than does S.

Vocalization. This category of response resembles the pattern for facial expression in that, regardless of infant gaze, mothers tend to spend more time than S in the lower levels of stimulation (VC1), while S spends more time than mothers in higher levels (VC3). Thus, mothers tend to talk to their infants in normal adult tones of voice more than does S, regardless of whether the infant is looking at them or away from them. By contrast, whether the baby is looking or looking away, S is more likely than mothers to use "baby talk" than are the mothers.

Position. S spends significantly larger proportions of time than mothers in the "forward" position (PS1), while mothers spend significantly larger proportions of time in the "loom" position (PS2). These differences between mothers and S exist whether the infant is looking at or away from his partner. In addition, when the infant looks away, mothers are more likely than S to spend time leaning back (PS0), but this is not the case when the infant is looking.

Touch. The pattern here is very similar to the pattern for position. Mothers spend larger proportions of both look and look-away time than S providing their infants with large amounts of tactile and proprioceptive stimulation (TC3). S is more likely than mothers to touch the infant in a gentle fashion (TC1), regardless of whether the baby is looking or not. When infants look away, mothers are also more likely than S to not touch babies at all (TC0), but there are no significant differences in TC0 when the infant is looking.

In summary, mothers and S appear to show some differences in behavior, regardless of whether the infant is looking or looking away. Thus, mothers are more likely to play with toys (TY1), more likely to talk in a normal tone of voice (VC1), more likely to "loom" (PS2), and more likely to provide large amounts of tactile and proprioceptive stimulation (TC3). S is more likely than mothers to smile (FE3), to talk "baby talk" (VC3), to take a "forward" position (PS1) and to touch infants gently (TC1). Additional differences emerge during periods of gaze aversion. At such times, mothers are more likely than S to display more extreme levels of stimulation (very high and very low) for

three of the six response categories, including facial expression, position, and touch. S, on the other hand, is more likely than mothers to show intermediate levels of stimulation on these behaviors. In touch, for instance, mothers spend a significantly larger proportion of time than S in both no touch (TC0) and high touch (TC3) behaviors, while S spends more of the time than mothers in medium levels of touch (TC1).

The sole mother-S difference to emerge only when infants are looking (and not when they are looking away) is in the category of maternal gaze. Here, S is more likely than mothers to look at the infant and less likely to look away.

Infant Gaze and Partner's Behavior

Table 4 presents correlations of infant gaze and partner's (mother and S) behavior. In the mother-infant condition, there is a positive correlation between infant gaze (IG1) with smiling (FE3) and the "forward" position (PS1), while there is a significant negative correlation of infant gaze with neutral facial expression (FE0) and normal tone of voice (VC1). In the stranger-infant condition,

TABLE 4

Correlation of Infant Gaze with Mothers' Behavior and with Stranger's Behavior

Behavior	Mother	Stranger
MG0	-.44	-.49*
MG1	.44	.47*
FE0	-.57**	-.20
FE1	-.30	-.38
FE2	.25	-.20
FE3	.51*	.49*
FE4	.32	.22
TY0	.41	.35
TY1	-.41	-.35
VC0	.24	.41
VC1	-.56**	.20[a]
VC2	.25	---[a]
VC3	.26	.38
PS0	-.16	.17
PS1	.53*	.33
PS2	-.20	-.12
PS3	-.29	.50*
PS4	-.08	.16
TC0	.27	.06
TC1	-.02	.10
TC2	-.26	-.28
TC3	-.22	-.21

[a]There were no observations in this sub-category.

*$p < .05$
**$p < .01$

there is significant positive correlation between infant gaze and S's gaze (MG1) and with smiling (FE3), while there is a significant negative correlation between infant gaze and S's gaze aversion (MG0) and the "pursuit" position (PS3).

Are there certain maternal behaviors that are consistently associated with one of the two infant gaze conditions? Are mothers, for instance, more likely to smile during periods of infant gaze than during periods of gaze aversion? The ratios of partner's behavior during the two infant gaze conditions calculated above, were re-examined in an attempt to answer this question. Ratios of partner's behaviors during gazing periods were compared with ratios of partners' behaviors during periods of gaze aversion to discover if there were any significant differences between the two. Results are displayed in Tables 5 and 6, for mother and S respectively.

For two of the six response categories, mothers and S show identical patterns.

TABLE 5

Comparison of Mothers' Behavior During Periods of Infant Gaze Aversion (IG0) with Mother's Behavior During Periods of Infant Gaze (IG1)

Behavior	IG0	IG1	r	t (19)
MG0	12.49	9.26	.485*	1.68
MG1	87.51	90.74	.485*	-1.68
FE0	67.98	53.74	.832****	5.04****
FE1	.88	.46	.283	1.08
FE2	3.18	3.06	.830****	.12
FE3	21.75	29.78	.834****	-3.57***
FE4	6.13	11.85	.724****	-3.37***
TY0	74.81	84.10	.853****	-3.01**
TY1	25.19	15.90	.853****	3.01**
VC0	39.45	37.61	.771****	.72
VC1	24.71	23.59	.625***	.36
VC2	.74	1.12	1.000****	-1.00
VC3	35.09	37.68	.671****	- .90
PS0	19.25	15.08	.933****	2.11*
PS1	41.90	41.34	.749****	.15
PS2	28.44	38.30	.885****	-3.43***
PS3	9.70	5.01	.481*	2.87**
PS4	.72	.28	.232	1.01
TC0	41.26	37.93	.903****	1.15
TC1	25.95	32.14	.885****	-2.48*
TC2	9.39	10.15	.704****	- .39
TC3	23.40	19.58	.798****	1.19

*$p < .05$
**$p < .01$
***$p < .005$
****$p < .001$

TABLE 6

Comparison of Stranger's Behavior During Periods of Infant Gaze Aversion (IG0) with Stranger's Behavior During Periods of Infant Gaze (IG1).

Behavior	IG0	IG1	r	t (19)
MG0	9.74	2.83	.560**	2.88**
MG1	90.13	96.46	.559**	-2.69*
FE0	48.35	38.38	.483*	2.88**
FE1	3.73	1.63	.350	1.37
FE2	4.53	4.32	.782****	.16
FE3	35.46	46.19	.462*	-2.90**
FE4	1.93	8.05	.342	-7.66****
TY0	95.07	99.38	.138	-1.24
TY1	4.93	.62	.138	1.24
VC0	50.14	45.53	.267	1.13
VC1	.78[a]	2.22	.029	- .78
VC2	-----[a]	-----	----	-----
VC3	49.08	52.25	.234	- .80
PS0	4.53	6.91	.660***	-1.16
PS1	78.32	84.45	.472*	-1.65
PS2	9.61	3.86	.467*	2.35*
PS3	7.10	3.88	-.205	2.01
PS4	.43	.18	-.092	.78
TC0	20.11	26.87	.189	-1.04
TC1	59.19	59.54	.322	- .05
TC2	11.86	8.23	.137	1.19
TC3	8.76	5.36	.231	1.20

[a]There were no observations in this sub-category.

*$p < .05$
**$p < .01$
***$p < .005$
****$p < .001$

Facial Expression. Both mothers and S tend to be more facially expressive when the baby is looking than when he is looking away. Thus, both tend to smile more (FE3) and to show more "surprise" faces (FE4) when he is looking than when he is looking away. In contrast, when the baby is looking away, they tend to show more neutral expression (FE0) than when he is looking.

Vocalization. No sub-categories of vocalization vary significantly with infant gaze. Both mothers and S are just as likely to do any of the four possible types of vocalizing when the infant is looking as when he is looking away.

Mothers and S show varying patterns of differential response in the four remaining response categories.

Maternal Gaze. Mothers are equally likely to gaze at their babies when the baby is looking or looking away. However, S is more likely to look at the baby when the baby is looking at her.

Toy. Mothers tend to play with toys more when the infant is looking away than when he is looking. S shows no significant difference in use of toys in the two gazing periods.

Position. Mothers are more likely to assume the "sitting back" position (PS0) and the "pursuit" position (PS3) when the baby is looking than when he is looking away. When the baby is looking, they are more likely to "loom" (PS2) than when he is looking away. By contrast, S shows the opposite pattern with respect to "looming." She is less likely to "loom" when the infant is looking and more likely to assume this position when the infant is looking away.

Touch. Mothers are more likely to gently touch their babies when they are looking at her than when they are looking away. S's pattern here is similar to the pattern she shows for vocalization and use of toy, in that S shows no significant difference in response in this category when the infant is looking or looking away.

Thus, when the baby is looking (as compared with looking away), both mothers and S tend to be more facially expressive, showing more smiling (FE3) and more "surprise" face (FE4), while showing less neutral expressions (FE0). In addition, when the infant is looking, mothers, but not S, tend to use toys less, and to show less "sitting back" (PS0) and less "pursuit" (PS3). They also tend to show more gentle

touching (TC1) and more "looming" (PS2) when the baby is looking than when he is looking away. S's behavior is less likely to be associated with infant gazing then is the mother's behavior. Thus, none of the vocalization, toy, or touch sub-categories are more likely to occur in one or the other of the infant gaze or gaze aversion periods. S does tend to be more facially expressive when the infant is gazing then when he is averting gaze. The only other difference is that S, unlike mother, is more likely to "loom" close to the infant (PS2) when he is looking than when he is looking away.

High Gaze Infants and Low Gaze Infants

Two groups of mother-infant pairs were examined in greater detail. These were infants who, in playing with their mothers, either showed very high amounts of gazing (High Gaze Infants or HGI's) or very low amounts of gazing (Low Gaze Infants or LGI's). The groups were defined by those infants who scored one standard deviation above or below the mean gaze time for all infants for the total period under study. There were four infants in each of the two groups.

Infant Gaze. The mean total gaze time (TIG1) for the HGI's was 77.0 seconds, with a standard deviation of 10.23, while the mean gaze aversion time (TIG0) for this group was 38.25 seconds, with a standard deviation of 11.76. The figures for the LGI's was a mean of 15.25 seconds of gazing time, with a standard deviation of 4.57, and a mean gaze aversion time of 96.5 seconds, with a standard deviation of 3.77. Differences between the two groups for both gaze and gaze aversion were very highly significant (t (6) = 9.47 and t (6) = 10.93 for gaze and gaze aversion respectively; $p < .001$).

Differences in the behavior of mothers of High Gaze Infants (MHGI's) and mothers of Low Gaze Infants (MLGI's) were examined to determine if differences between the two groups of mothers were in the same direction as differences between mothers as a group and S. Differences between MHGI's and MLGI's are displayed in Table 7. The following behaviors show significant differences.

Maternal Gaze. MHGI's showed more gazing (MG1) and less gaze aversion (MG0) than did MLGI's.

Facial Expression. While MLGI's showed more neutral expressions (FE0), MHGI's showed more "surprise" faces (FE4).

TABLE 7

Means of Behaviors of Mothers of High Gaze Infants (MHGI) and Mothers of Low Gaze Infants (MLGI) in Seconds.

	MHGI	MLGI	t (6)
MG0	7.00	20.75	-4.07***
MG1	113.00	99.25	4.07***
FE0	59.75	103.00	-2.98**
FE1	.25	1.75	- .85
FE2	3.50	.25	1.59
FE3	43.00	13.75	1.92
FE4	13.50	1.25	2.01*
TY0	117.25	86.25	2.09*
TY1	2.75	33.75	-2.09*
VC0	43.00	33.00	1.35
VC1	13.00	41.25	-3.21**
VC2	5.50	.00	1.00
VC3	58.50	45.75	1.12
PS0	7.75	26.50	- .78
PS1	67.25	27.75	2.24*
PS2	36.25	53.25	- .71
PS3	8.75	11.75	- .45
PS4	.00	.75	-1.00
TC0	55.25	34.00	.71
TC1	36.00	42.00	- .34
TC2	4.25	5.75	- .32
TC3	24.50	38.25	- .58

*$p < .05$
**$p < .01$
***$p < .005$

Toy. MLGI's were more likely than MHGI's to play with toys (TY1).

Vocalization. MLGI's were more likely to talk in normal tones of voice (VC1).

Position. MHGI's were more likely to asume a "forward" position (PS1) vis a vis the baby than were MLGI's.

Table 8 shows that there is some similarity between the pattern of significant differences in the mother-stranger comparison and in the MHGI-MLGI comparison. Of the 12 behaviors that were significantly different in the mother-stranger comparison, seven were also significantly different (and in the same direction) in the MHGI-MLGI comparison (MG0, MG1, FE0, TY0, TY1, VC1, PS1). Of the five remaining behaviors, four were in the predicted direction, but failed to achieve significance (FE3, VC3, PS2, TC3). Only one behavior was in the opposite direction, but this difference failed to achieve significance (TC1).

TABLE 8

Differences Between Stranger (S) and Mothers (M) Compared to Differences Between Mothers of High Gaze Infants (MHGI) and Mothers of Low Gaze Infants (MLGI).

S Higher Than M's	MHGI's Higher Than MLGI's	M's Higher Than S	MLGI's Higher Than MHGI's
MG1	MG1	MG0	MG0
TY0	TY0	TY1	TY1
PS1	PS1	FE0	FE0
	FE4	VC1	VC1
FE3	+	PS2	+
VC3	+	TC3	+
TC1	-		

+ = No significant difference, but in predicted direction.
- = No significant difference, not in predicted direction.

Behaviors of MHGI's and MLGI's were analyzed to determine if differences between the groups occurred in each of the two infant gaze conditions. A ratio was calculated, as above, with mother's behavior during a particular gaze period being divided by time the infant spent in that gaze period. Thus, if a mother smiled (FE3) for 15 seconds while the infant was looking at her (IG1), and if the infant looked at her for a total of 30 seconds, then the computed ratio was .50 ($RTFE3IG1 = \frac{FE3IG1}{IG1} = \frac{15}{30} = .50$).

Means for the two groups are presented in Tables 9 and 10, for periods of gaze aversion and gaze respectively. Results show that the only significant differences between the two groups during times when the infant is gazing, is in the category of facial expression, where MLGI's show more neutral expression (FE0) and MHGI's show more "concern" faces (FE2).

Additional differences between the two groups emerge during periods of gaze aversion.

Maternal Gaze. When the infant is averting gaze, MLGI's also show aversion of gaze more than do MHGI's, while the latter show more gazing at the infant.

Facial Expression. MLGI's show more "neutral" (FE0) facial expressions than do MHGI's.

Vocalization. MLGI's show more normal patterns of speech (VC1) than do MHGI's.

Position. MHGI's are more likely to assume a "forward" position (PS1) than are MLGI's.

Thus, in the categories of facial expression and vocalization, MLGI's are more likely to show behaviors at the lower, less expressive levels than were MHGI's. However, the results did not indicate that the converse was true, namely that MHGI's showed more expressive behavior during periods of gaze aversion.

TABLE 9

Ratio of Behaviors for Mothers of High Gaze Infants (MHGI) and Mothers of Low Gaze Infants (MLGI) During Periods of Infant Gaze Aversion.

	MHGI	MLGI	t (6)
MG0	11.00	20.25	-2.27*
MG1	89.00	79.75	2.73*
FE0	61.75	87.50	-2.09*
FE1	.75	1.00	- .20
FE2	2.25	.25	.89
FE3	29.25	10.25	1.56
FE4	6.25	.75	1.42
TY0	95.75	70.00	1.81
TY1	4.25	30.00	-1.81
VC0	36.00	27.25	1.14
VC1	6.50	36.25	-4.65***
VC2	3.75	.00	.36
VC3	53.75	36.75	1.64
PS0	9.50	22.75	- .62
PS1	53.25	22.75	2.05*
PS2	24.75	44.00	- .91
PS3	12.00	8.00	.57
PS4	.00	.75	1.00
TC0	55.00	27.25	1.12
TC1	21.50	33.00	- .86
TC2	6.00	4.25	.31
TC3	17.50	35.50	- .96

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*$p < .05$
**$p < .01$
***$p < .005$

TABLE 10

Ratio of Behaviors fr Mothers of High Gaze Infants (MHGI) and Mothers of Low Gaze Infants (MLGI) During Periods of Infant Gaze.

Behavior	MHGI	MLGI	t (6)
MG0	4.00	6.75	- .84
MG1	96.00	93.25	.84
FE0	44.00	80.25	-2.26*
FE1	.00	.00	.00
FE2	2.25	.00	2.18*
FE3	39.00	16.75	1.43
FE4	14.50	3.00	1.83
TY0	99.00	90.25	1.53
TY1	1.00	9.75	-1.08
VC0	35.75	26.75	1.06
VC1	12.50	33.50	-1.91
VC2	5.50	.00	1.00
VC3	45.75	40.00	.57
PS0	4.25	18.25	- .97
PS1	57.75	24.00	1.86
PS2	33.75	50.50	- .73
PS3	4.00	7.50	- .69
PS4	.00	.00	.00
TC0	41.25	30.00	.43
TC1	34.50	47.00	- .72
TC2	1.75	7.00	1.00
TC3	22.25	15.75	.35

*$p < .05$

In a post-hoc analysis, an attempt was made to determine whether the use of a number of expressive sub-categories had obscured this trend. Thus, for facial expression and vocalization, the more expressive sub-categories were collapsed. For facial expression, sub-categories FE1 to FE4 were collapsed into the single category of "facial expressiveness." Here, differences between the two groups did, indeed, emerge, with MHGI's showing significantly more expressiveness than MLGI's (t (6) = 2.09, $p < .05$). Similarly, VC2 and VC3 (singing and "baby talk") were collapsed into a single category of "vocal expressiveness." Here, too, differences between MHGI's and MLGI's achieved significance (t (6) = -2.13, $p < .05$), with MHGI's showing higher levels of expressiveness than MLGI's. These results raise the possibility that MHGI's and MLGI's may show different levels of facial and vocal expressiveness.

MMPI and Infant Gaze

Mothers were given an MMPI questionnaire to complete at home and were requested to return the completed questonnaire to the experimenter. Fifteen questionnaires were returned and were then computer-scored and analyzed (Fowler, 1969; Kleinmuntz, 1969).

The following analysis is based on these fifteen protocols.

Of the fifteen mothers, eight has no scores on any of the clinical scales which exceeded the normal limit (below 60). Three showed low scores on some of the clinical scales. Of the remaining four profiles, three showed some mild evidence of pathology, but only one profile suggested serious psychological difficulties. Here, results pointed to a serious personality disorder characterized by rigidity and intolerance of others. "This patient is likely to show peculiarities in her behavior which suggest the presence of a personality disorder. Manifestations may range from social maladjustment and under-achievement to delinquency, bizarre mentation, and frankly psychotic behavior."

Correlations between scores on the ten MMPI scales and infant gaze ranged from .009 to .328. They are displayed in Table 11. No scores on any of the scales were significantly correlated with infant gaze.

TABLE 11

Correlations Between Scores on MMPI Scales with Infant Gaze Aversion (TIG0) and with Infant Gaze (TIG1).

	TIG0		TIG1	
MMPI Scale	r	p (13)	r	p (13)
HS	.0195	N.S.	-.0207	N.S.
D	-.2257	N.S.	.2168	N.S.
HY	-.1847	N.S.	.1380	N.S.
PD	-.1128	N.S.	.0390	N.S.
MF	.0540	N.S.	-.0229	N.S.
PA	.1505	N.S.	-.1347	N.S.
PT	.2287	N.S.	-.2073	N.S.
SC	.1174	N.S.	-.1329	N.S.
MA	.3134	N.S.	-.3277	N.S.
SI	.0326	N.S.	.0093	N.S.

Mothers were then divided into two groups: those whose infants scored above the median in total infant gaze (Group 1) and those whose infants scored below the median (Group 2). MMPI's were available for eight of the mothers in Group 1 and for seven of the mothers in Group 2.

Table 12 shows that there were no significant differences on any of the individual scales of the MMPI for the two groups. Means for both groups on all clinical scales were within normal limits (below 60).

TABLE 12

Mean Scores on the MMPI Scales
for Group 1 and Group 2.

	Group 1		Group 2			
Scales	X	SD	X	SD	t (13)	p
HS	46.25	5.87	44.86	5.18	.49	N.S.
D	49.38	4.31	49.29	5.31	.04	N.S.
HY	52.88	5.89	51.57	7.14	.38	N.S.
PD	52.75	7.63	52.43	13.56	.06	N.S.
MF	40.00	5.10	41.43	11.43	- .32	N.S.
PA	51.50	7.17	57.71	6.21	-1.78	N.S.
PT	49.25	5.39	52.57	5.77	-1.15	N.S.
SC	51.50	5.61	52.29	8.77	- .21	N.S.
MA	48.88	9.20	56.71	11.59	-1.46	N.S.
SI	53.75	8.91	48.86	8.90	1.06	N.S.

Of the four mothers with some pathology in their MMPI profiles (see above), three were in Group 2, and one was in Group 1. The one mother who showed serious pathology on the MMPI had an infant whose total gazing time at his mother was lower than any other infant in the sample. In other words, the mother with the greatest pathology on the MMPI had an infant who looked at her least.

CHAPTER IV

DISCUSSION

Patterns of Infant Gaze

Results of this study have demonstrated that when a 3-month-old infant is presented with cues in a number of different sensory modalities, he is able to make clear differential response to his mother and to a stranger. Babies at this age look consistently more at a stranger than at their mothers. But they not only look more, they look differently. While there are fewer distinct looks at the stranger than at mother, each look is of much longer duration, thus resulting in greater over-all gaze time. Gazes at the mother tend to be of short duration, alternating with long periods of gaze aversion; gazes at the stranger are of much longer duration interspersed with brief period of gaze aversion. Thus, patterns of gazing at the stranger appear to resemble the "obligatory attention" pattern described by Stechler and Latz, and Brazelton, et al.. Gazing at mother seems to follow the pattern of volitional attention, with the cycling of gaze/gaze aversion characteristic of this pattern.

We can therefore say that by the fourth month of life, male infants are able to respond differentially to the sight of the mother or of a stranger. Infants now "know" their mothers; the use of volitional attention heralds the beginning of recognition memory and thus implies the existence of at least primitive versions of the cognitive structures that make memory possible.

However, infants have shown cycling of attention in response to the mother's face for a number of weeks prior to this (Carpenter and Stechler, 1967). It is the relative absence of this pattern of gazing to the stranger's face which appears to be new at this age and it is this re-emergence of an old pattern of response that needs to be understood.

At the age of 3 months, infants show a sharp increase in information-processing abilities (Bower, 1974). Central nervous system maturation and early experiences with the mother no doubt contribute to this change. The effect of this growth spurt seems to be that the infant is now able to attend to those aspects of the stimulus that permit him to discriminate the stranger from the mother. As a result of this new discriminative capacity, the infant is

confronted with a new category of stimulus: a person who is discernibly different from mother. It should come as no surprise that infants respond to this new experience with a pattern of attention that appears to be ontogenetically older than the pattern displayed to mother. Development is conservative. Old response patterns are pressed into the service of new needs of the organism and subtle altered in the process. Piaget has suggested that cognitive processes recur whenever a concept must be used on a different level and has called this process "decalage."

A pattern of attention which is characterized by long, uninterrupted periods of gazing has obvious adaptive value. It provides the infant with the opportunity for long periods of concentrated inspection and perceptual integration, unimpaired by strong affective displays. Similar patterns have been described by Ainsworth (1967) and Schaffer (1966) in somewhat older infants. Bronson (1971) has observed a similar pattern in infants as young as those in this sample. He has referred to this behavior as "wariness" and suggests that it is an early (perhaps innate) response to novelty. These findings support Bronson and suggest that it is only

when the infant has achieved a complex image of the mother that he is able to respond differentially to the stranger. In other words, it is only when the image of the mother has become sufficiently detailed that the stranger becomes a novel, "not-mother" object.

Although infants appear to initially respond to the stranger as an entirely new category of stimulus, as the interaction proceeds, the similarities between "mother" and "not mother" become more important. Looking at mother and looking at stranger become positively correlated by Minute 5, although there is no correlation earlier in the play session. It seems that, in time, the stranger becomes implicated in the vicissitudes of the infant's relationship with his mother. By three months, the data suggest, infants already begin to show a template for interaction: the infant comes into a new relationship with a stranger with a tendency to respond in a certain way. While it is not possible to rule out response tendencies that exist at birth, the findings also suggest that there is some relationship between different qualities of infant response and maternal behavior. Thus, it may be that infants are shaped

by interactions with their mothers in such a way that they are then "primed" to respond in a similar fashion to new people in their environment.

The emergence of volitional attention seems to occur during the first month of life in response to the human face. At this age, the cycling of gaze/gaze aversion may represent the infant's early attempts to regulate incoming stimulation. This pattern of gazing may serve, in effect, as a behavioral stimulus barrier -- a way of preventing overstimulation of the infant's still immature nervous system.

As the infant develops, this same behavioral pattern may come to serve a number of different functions. With the waning of the autistic phase and the establishment of the symbiotic phase, the infant begins to show a dim awareness of a mothering agent who relieves his needs and who provides him with pleasurable levels of stimulation. Vision then becomes a way of making contact with the mother and of obtaining new information about her. When the libidinal investment of the mother occurs, the sight of the face is experienced as pleasurable and the infant shows the first signs of the social smile

(Spitz, 1965). As development proceeds, the infant establishes a primitive internal image of the mother. At first, the visual aspects of this image probably consist of nothing more than two eyes seen in the en face position. But with repeated experiences with the mother and with the increasing capacity to process information, this image becomes more complex and differentiated. Thus, by the second and third months of life, volitional attention may be not only a way of regulating stimulation, but also the behavioral index of a cognitive process. Now the infant looks at his mother to acquire new information about her, then he looks away to assimilate this new information to the already existing internal image. At this point, how much the infant looks is no longer determined by aspects of the present interaction alone. Looking now must be understood in its historical context. The nature of the internal image of the mother, the process of recollection, will new exert its own influence on the infant's gazing behavior.

By the fourth month of life, all faces are no longer mother's face. A new category has been established and it is now specifically mother's face

that elicits volitional attention. Here, I believe, the cycling of attention comes to have yet another meaning. As the infant prepares to leave the symbiotic phase, he beings "trial runs" of separation behaviors. These early attempts at separation and differentiation are modest when compared with the more dramatic separation behaviors of later stages. However, at this age, aversion of gaze appears to resemble the later peekaboo game. By averting gaze, the baby "causes" his mother to "disappear"; by looking back at her, he creates her anew. He thus learns an effective means of "moving away" from mother, of creating a space for himself where mother is very briefly excluded. Two points are crucial here: first, the infant is the active agent in this process and it is through his volition that mother "appears" or "disappears." Second, in this process, mother remains unchanged and she is still there when the infant re-engages. In this way, the cycle of gaze/gaze aversion becomes a "trial run" for later, more dramatic separation behaviors.

At this age, infants no longer smile indiscriminantly at the sight of the human face. How much the infant looks and his accompanying affective

state are now determined, in part, by the mother's behavior, her response to her infant's early attempts at differentiation. Thus, although all infants in this sample show the gaze/gaze aversion pattern in response to mother's face, there is also great variability among infants with respect to how much of the total play session is actually spent gazing. Some part of the variance appears to be related to maternal behavior, and this relationship is discussed more fully below.

The Mother's Role

By the fourth month of life, most of the infants in this sample seem to have some rudimentary internal image of the mother which enables them to respond differentially to the mother and to the stranger. Without careful longitudinal observations, we can only speculate about the nature of this image and how it comes into being. It may be created during the course of innumerable mother-infant interactions during the first months of the infant's life and may represent a fusion of real aspects of the mother with various aspects of the infant's own experience.

It is this internal image, and perhaps also response tendencies existing at birth, that the infant brings to an interaction with his mother. By contrast, the mother brings a much more complex and differentiated set of experiences, fantasies, and expectations to this interaction. We know very little about the psychic determinants of maternal behavior, but we have seen in this study that there is a very wide range of play behavior displayed by these mothers even in a rather circumscribed situation. Mothers' scores on the MMPI were examined to see if clinical phenomena measured by the MMPI were related to maternal behavior and hence to infant gaze. Here, results were largely negative. No scale correlated significantly with levels of infant gaze. However, these findings should not be regarded a conclusive. Mothers in this sample were a remarkably stable group: 14 of the 15 mothers who returned the MMPI showed no substantial pathology. The mean for every scale for this group was below the pathological level. Since the range of pathology was so small, it may have been impossible to detect relationships between psychopathology in the mother and infant gaze. One finding is suggestive: the one

mother who showed serious pathology on the MMPI had an infant who looked at her least. This issue could only be settled conclusively with another sample of mothers who showed more severe levels of pathology than the present group.

Despite great variability in mothers' behavior during play, results of this study indicate that certain maternal behaviors are consistently associated with infant gaze. For mothers, smiling, gazing at the infant, and assuming an intermediate position are positively correlated with infant gaze. Looking away, an expressionless face, and normal, adult vocalizations by the mother are all negatively associated with infant gaze.

Some of the same maternal behaviors differentiate between mothers of high gaze infants (MHGI's) and mothers of low gaze infants (MLGI's). Thus, MHGI's look at their infants more and are more likely to assume an intermediate position, while MGLI's show more gaze aversion, more expressionless face, and more adult vocalizations. Additionally, MHGI's are more likely to show a "surprise" face and are less likely to use a toy.

Similar differences emerge between the behavior of mothers as a group and stranger's behavior. Here, again, smiling, looking at baby, and assuming an intermediate position are more characteristic of the stranger than of the mothers, while an expressionless face and adult vocalizations are more characteristic of mothers. In addition, mothers are more likely to use a toy, to sit far from the infant or loom very close, and to vigorously manipulate the infant's musculature. The stranger is also more likely to use "baby talk" or remain silent and to touch the infant gently.

Thus, in these comparisons, looking at the infant, smiling or "surprise" face, and assuming an intermediate position tend to be significantly associated with high levels of infant gaze. Averting gaze from the infant, an expressionless face, and normal, adult vocalizations are all negatively associated with infant gaze.

Mutual gazing is the setting event for interaction. A tendency to avert gaze on the mother's part, whether initially an intrinsic response tendency or a response to her infant's behaviors, conveys to the baby the message, "I'm not interested

in interacting right now." The baby who is cycling his attention and returns his gaze to his mother, finds her not looking at him. He is thus deprived of the experience of returning to an attentive mother, a mother who is awaiting his cues.

The scenario is very similar for smiling or "surprise" face. Mother's smiling face signals delight and tells the baby that things are going well. Returning his gaze to an unsmiling face, the baby fails to receive the joyous greeting which encourages him to begin a new round of interaction.

Even when seated, mothers move quite a bit when playing with their infants. This may be a particularly effective way of capturing the infant's attention since babies seem to show longer fixations to a moving stimulus than to a stationary one (Carpenter, 1974). However, many mothers also seem to have a "preferred" distance between themselves and their infants. While some mothers sit far back in the chair, quite far from their babies, others consistently sit with their faces just inches from the baby's face. Here babies are completely at their mothers' mercy: they cannot move closer or farther away. All they can do is avert their gaze. The

optimal distance from the point of view of infant gaze appears to be an intermediate position. The mother is close to her infant without seeming to intrude on his personal space. In this position, the baby is able to get a good look at the mother's face. This appears to be positively associated with high levels of gazing.

At first glance it might appear surprising that normal, adult speech is negatively associated with infant gaze. However, Stern (1977) has pointed out that it is "baby talk" that is uniquely geared to the infant's sensory capacities. A mother who consistently uses adult speech (as opposed to "baby talk"), particularly if she also shows little facial expression, appears uninvolved and rather remote. Smiling and baby talk communicate the mother's exuberant playfulness. Without them, there is little reward for the infant in gazing at his mother.

Thus, there emerges a picture of two different constellations of maternal response. The first is characterized by facial and vocal expressiveness. It is primarily face and voice, not toys, that are used to stimulate the infant. This expressiveness,

as well as a preference for a position neither too close nor too far from the baby, conveys a sense of involvement and warmth.

The second constellation of behaviors is characterized by a preference for the use of toys instead of facial and vocal behaviors as a way of stimulating the infant. By showing more neutral expressions, more "adult" vocalizations, and by sitting quite far from the baby, these mothers appear uninvolved and less tuned in to the infant's perceptual capacities.

It is interesting to note that differences between mothers and stranger, as well as differences between MHGI's and MLGI's are more likely to occur during periods of infant gaze aversion than during periods when the infant is looking. This finding may at first appear paradoxical. Why should different levels of behavior in the infant's partner be particularly important when the infant has turned away?

This finding seems to underline the importance of the mother's response to the infant's early attempts at differentiation. We have seen that the pattern of gaze/gaze aversion is an important way for the infant to regulate his interactions with his

human partner. However, it is not always possible for a mother to allow her infant to tune in or out as he chooses. To allow the infant to be an omnipotent little magician who conjures up his mother one moment, only to make her disappear the next, is simply not possible for some mothers. They experience the infant's aversion of gaze as a rejection and react to it accordingly. They may respond by themselves withdrawing or by redoubling their efforts in an attempt to re-engage the infant. In either case, the infant is deprived of the vital experience of small trial separations which are terminated by a joyful reunion with an unchanged mother.

Appendix A

MATERNAL VARIABLES

Gaze

0 = look away
1 = look
9 = can't tell

Facial Expression

0 = neutral
1 = frown
2 = concern
3 = smile
4 = surprise
9 = can't tell

Toy

0 = no toy
1 = present toy
9 = can't tell

Vocalization

0 = no vocalization
1 = vocalization
2 = sing
3 = infant-elicited variation of maternal speech
9 = can't tell

Position

0 = upright
1 = forward
2 = loom
3 = pursuit
4 = move infant
9 = can't tell

Touch

0 = no touch
1 = touch
2 = jab
3 = stress
9 = can't tell

INFANT VARIABLES

Gaze

0 = look away
1 = look

Appendix B

MATERNAL VARIABLES

Gaze

Look Away - eyes away from infant's face.

Look - eyes on infant's face.

Facial Expression

Neutral - neutral expression.

Frown - eyebrows knit and lowered, head may be averted or slightly lowered; mouth is pursed or may form a circle and the wings of the nose are tensed or nose may be wrinkled; (often accompanied by a vocalization such as "aaaoooh" with sliding drop in pitch and lower volume at the end); at its most extreme, this looks like a "disgusted" look.

Concern - combination of frown and surprise; brows are slightly knit, but eyes are wide; mouth may be partly open; (may be accompanied by vocalization such as "Awwwww," as in "Oh, you poor thing.").

Smile - corners of mouth up, eyes bright; head may be forward

Surprise - eyes very wide, eyebrows raised; mouth is wide open; head is raised and may be tilted up slightly; (often accompanied by vocalizations such as "heey," "oooooh").

Toy

No toy - no use of toy to stimulate baby.

Toy - mother presents toy to baby or uses it to make a sound.

Auditory

No vocalization - mother makes no vocalization.

Vocalization - vocalization in normal tone of voice, at about average pitch and average speed; normal adult speech.

Sing - mother sings or hums melody.

Infant-Elicited Variation of Maternal Speech - Baby talk": pitch is higher, sometimes almost falsetto, and speed is slowed down, vowel duration is long; speech elements are often repeated.

Position

Upright - mother sits back in chair with torso perpendicular to surface of table; arms are usually off the table.

Forward - leans forward so torso is at an angle to the table; elbows or arms may be resting on table, but face is at least a foot away from baby's face.

Loom - leans forward and brings face to within a few inches of baby's face; often has weight resting on arms or elbows which are on the table, mother's face is within baby's reach.

Pursuit - mother's head and/or body move to right or left or towards infant for purposes of bringing own face into infant's line of vision (score only if infant is not looking at mother when this is initiated).

Move Infant - mother moves infant's head in attempt to get infant to look at her.

Touch

No Touch - mother has no skin contact with infant.

Touch - mild stimulation of surface of infant's skin.

Jab - vigorous, sometimes abrupt touch; provides more than surface stimulation of infant; includes jabs, pokes, tickles, etc..

Stress - stresses infant's musculature by vigorously flexing or extending infant's body parts, especially the extremities.

INFANT VARIABLES

Gaze

Look Away - eyes away from mother's face, head may be turned away or it may be raised or lowered.

Look - eyes on mother's face, head directly facing mother or only very slightly turned away.

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