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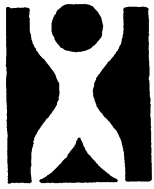

INTERACTIONS BETWEEN MOTHERS AND THEIR YOUNG CHILDREN: CHARACTERISTICS AND CONSEQUENCES

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ABSTRACT

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The present study examined relations between behaviors of mothers and children. Over a 9-month period repeated observations were made of 36 mothers and their firstborn children (9–18 months old) as they interacted at home, spontaneously and in structured situations. Ratings, frequencies, and measures of contingencies between sequential maternal and child behaviors were based on these observations.

Infant variables. Measures of competence in all areas of development—cognitive, language, and social—were highly intercorrelated. On these measures white children scored consistently higher than black children. They also smiled, vocalized, and moved more, and were less physically attached to their mothers—differences which increased as the children got older. Sex differences which increased with age were also observed: boys became more object oriented; girls more socially oriented. A change observed for all children was an increasing interest in the physical environment and a decreasing amount of interaction with the mother.

Maternal variables. One complex factor subsumed all measures of "optimal" maternal care: expression of affection, social stimulation, contingent responsiveness, acceptance of the child's behavior, stimulation and effectiveness with materials, and appropriateness of maternal behavior for the child's age and ability. Changes over time, and race and sex differences paralleled those found for infant variables.

Mother-child relations. A highly significant linear relation was found between the factors of children's competence and mothers' care. Within this broad pattern, specific relations were found between children's language development and mothers' verbal stimulation, children's skill with objects and mothers' presentation of play materials, and mothers' and children's positive social behavior toward each other. Further analyses of rela-

tions between factors revealed that maternal restrictiveness was related to the child's involvement with objects, maternal effectiveness to the child's irritability, and maternal cuddling to the child's physical attachment to the mother. Nonlinear relations between the mother's behavior and the quality of the child's attachment were demonstrated. Children's development was related differentially to maternal stimulation, responsiveness, and appropriateness; children's activities to the mother's preferred mode of interaction. The analysis of relations over time suggested that stimulating, responsive maternal behavior influenced the child's intellectual development, whereas in the area of social relations the child's behavior influenced the mother.

I. INTRODUCTION

Psychologists have long been interested in extracting and describing the critical variables of maternal influence on child development. Early studies of children in institutions (Bakwin 1942; Brodbeck & Irwin 1946; Freud & Burlingham 1944; Goldfarb 1945; Spitz 1946; Spitz & Wolf 1946) dramatically asserted that children deprived of a mother's care suffered developmental retardation. The specific variables responsible for the deficits were not identified, but it was clear from investigations of institutionalization that to promote normal child development more was required of a mother figure than simply provision of warmth, food, and hygienic caretaking. Physical and motor development seemed to depend mainly on locomotor opportunities (Dennis & Najarian 1957; Freud & Burlingham 1944); however, social, language, and intellectual development apparently needed some kind of stimulation or caretaker attention beyond that provided in institutions (DuPan & Roth 1955; Goldfarb 1945; Pringle & Tanner 1958; Provence & Lipton 1962; Roudinesco & Appell 1950; Schenk-Danzinger 1961).

Research carried out since these early studies has suggested that some variables of maternal care are not related to children's development. Investigations which have included measures of superficial caretaking practices, such as variations in feeding, have not demonstrated consistent or significant relationships between these variables and infant development (Ainsworth 1963; Ainsworth & Bell 1969; Bernal & Richards 1969; Chodorkoff 1960; Heinstein 1963; Orlansky 1954; Robson 1967; Schaffer & Emerson 1964a; Sears et al. 1957). Nor have studies shown that maternal availability or total amount of contact with the mother (at least over a certain minimum) critically influences development (Rheingold 1960; Schaffer & Emerson 1964a). To be sure, differences in patterns of development have been attributed to differences in amount of maternal contact (Ainsworth 1963; Chodorkoff 1960; Geber 1958; Maccoby & Masters 1970; Schaefer et al. 1968; Walters & Parke 1965); measures of contact, however, have not always been separated from other significant confounding characteristics of the interaction between mother and child—such as emotional tone, percep-

tual stimulation, and immediacy of response (Ainsworth & Bell 1969; Chodorkoff 1960; Moss 1967). It appears that the most significant dimensions of maternal influence are more complex than gross caretaking patterns or measures of quantity alone.

Investigators have tried to probe the more subtle aspects of mothering by examining maternal behavior in more detail and by assessing the personality characteristics, feelings, and attitudes of mothers. This approach has been more encouraging; suggestive correlations have been found between some infant behaviors and certain such maternal attributes. For example, Caldwell and Hersher (1964) noted significant correlations between maternal needs (for affiliation, dependency, and achievement) and ratings of infants' behaviors on the same dimensions. Maternal rejection and coldness have often been held responsible for children's poor development and unhappy condition in clinical case studies (Escalona 1953; Heinstein 1963; Lewis 1954; Milner 1951; Spitz 1951; Wittenborn 1956). And, similarly, in empirical research maternal anxiety and negative attitudes toward child rearing have been found to be associated with children's retarded intellectual development (Davids 1968). Conversely, maternal attitudes which are positive, accepting, and which express eagerness for close interaction with the infant have been shown to be positively related to infants' development (Lakin 1957; Moss & Robson 1968; Stern et al. 1969). Although research not often has included examination of the specific maternal behaviors which mediate these attitudes, a connection has been established between the mother's positive attitudes and her expressively affectionate and social behavior (Levy 1958; Stern et al. 1969). Further, overt demonstration of affection has been empirically related to enhanced infant development, involvement with the mother, social and play initiative, and ability to cope with stress (Caldwell 1967; Stern et al. 1969; Yarrow 1963; Yarrow & Goodwin 1965).

As a result of psychologists' interest in cognitive approaches to development, the study of maternal influence has included extensive investigation of perceptual-cognitive variables. Touching, talking, looking, and playing have been measured or experimentally manipulated. Differences in children's behavior have not been reliably predicted by mothers' preferred sensory modes of stimulation (S. M. Bell 1971; Schaffer & Emerson 1964a), but the amount and style of maternal stimulation have demonstrated consistent relationships with infant variables.

Physical handling that is gentle, firm, close, and relatively frequent seems to have a beneficial effect on the infant's early cognitive and motor development and on his attachment and responsiveness to his mother (Ainsworth et al. 1971; Casler 1965; Chodorkoff 1960; Dennis 1938, 1941, 1960; Dennis & Najarian 1957; Dennis & Sayegh 1965; Lewis & Goldberg 1969; Provence & Lipton 1962; Yarrow 1963). Such handling is beneficial only when given to young infants, however; as a child matures, such contact

seems to become restrictive (Ainsworth 1969). Moreover, as we would expect from work on amount of contact, the relationship, even with young infants, is not a simple one of more physical stimulation necessarily leading to better development; when separated from other conditions of physical stimulation, the amount of physical contact is not associated with reduced crying (Ainsworth et al. 1971).

Distinctive and frequent verbal stimulation from the mother, by reading or talking to the infant, has also been related to children's cognitive development expressed by more frequent vocalization and greater language ability (Bing 1963; Goldberg & Lewis 1969; Gordon 1969; Irwin 1960; Kagan 1971; Milner 1951; Schaefer et al. 1968). A high degree of eye-to-eye contact between mother and infant has been observed to lead to an immediate cessation of crying, a stronger tie with the mother, and, possibly, to advanced social and cognitive development (Lewis & Goldberg 1969; Moss & Robson 1967; Wolff 1969). The combination of verbal and visual stimulation, when frequently given, appears to accelerate development and to benefit adjustment generally; moreover, such stimulation seems to be particularly advantageous for the child if it occurs during play rather than caretaking (Chodorkoff 1960; Lewis & Wilson 1971; Moss et al. 1969; Rheingold 1956; Rubenstein 1967; Saltz 1971; Stern et al. 1969; Walters & Parke 1965; Yarrow 1963; Yarrow & Goodwin 1965).

The mother not only serves as a direct source of stimulation herself, she is also a mediator of stimulation from the environment. Children of mothers who provide a greater number and variety of play materials and activities tend to be cognitively advanced (Rubenstein 1967; Tulkin 1970; Yarrow 1963; Yarrow & Goodwin 1965; Yarrow et al. 1971). Moreover, mediation of materials by the mother is more closely related to the infant's skill with objects than is mere exposure to a stimulating physical environment (Collard 1971; Rubenstein 1967; Yarrow 1963).

Research on perceptual-cognitive variables clearly suggests that deliberate and playful maternal stimulation is a potent dimension of maternal influence. A number of studies have attempted to probe more deeply into the quality of that stimulation. Variables such as sensitivity and responsiveness—previously the domain of clinicians—are receiving renewed, but now more objective and empirical, examination. Experimental and observational studies alike indicate that a mother's immediate response to her infant's behavior has a significant effect on later occurrence of the behavior. At home or in the laboratory, social responses from the mother which are contingent upon the infant's smiling or vocalizing increase the frequency of those particular behaviors (Beckwith 1971; Brackbill 1958; Caudill 1969; Etzel & Gewirtz 1967; Rheingold et al. 1959; Robertson 1962; Tulkin 1970; Wahler 1967; Weisberg 1963; Yarrow et al. 1971). Paradoxically, at least for a simple reinforcement account of such phenomena, observers of natural mother-child interaction have found that responding to a cry, rather than

ignoring it, is associated with subsequent less frequent crying (Beckwith 1971; S. M. Bell 1971; Caudill 1969; Stewart et al. 1954; Tulkin 1970). Moreover, maternal responsiveness to distress has been associated with more general indices of infant adjustment and development than the specific behaviors of crying and fretting (Ainsworth et al. 1969; Lewis & Goldberg 1969; Yarrow 1963). Watson and Ramey (1969) observed that, even when the responsiveness was not from a human, infants came to coo and smile to a response-contingent mobile which reinforced a simple sensory-motor schema (head turning). These infants also quickly learned to control a different mobile in a new and unfamiliar setting, which infants previously exposed to a noncontingent mobile could not do. Investigators who are concerned with understanding the effects of maternal responsiveness are now likely to talk about motivation, expectancy, and control (Ainsworth et al. 1971; Lewis & Goldberg 1969; Ramey et al. 1971). They would suggest that, by the mother's prompt, contingent, and consistent response to his signals, the infant learns that his behavior does have consequences and that his actions can control his environment. This belief leads to motivation which is a necessary basis for further learning—a generalized expectancy of similar control in new and different environmental and social settings. Thus, early response-contingent stimulation may become a perpetuating condition for competence and information seeking, as well as for the formation of social relationships.

Most studies of mother-child interaction have focused on limited aspects of maternal and infant behavior. An alternative approach is to study complex behavioral patterns or clusters. This approach, which demands that interrelationships among a wide variety of different variables be examined simultaneously, may provide more sensitive predictors of maternal influence than any single variable. It appears likely that several related components of maternal behavior constitute a syndrome of optimal care, whether this care is of a need-satisfying nature or involves deliberate stimulation (Ainsworth 1969; Nelson 1970; White 1969). One may hypothesize an "optimal" mother who is aware of her infant's needs and wishes—hunger, fatigue, desire for physical or social contact—and who responds to behavioral expressions of these needs and desires immediately and contingently. She gives care or stimulation which is appropriate for her infant according to his state, individual capacities, and developmental level. She is affectionate, accepting, and nonrestrictive.

But there is another side to the study of maternal influence which has often been neglected—the child himself. Biological differences among infants in physiological rhythms, sensory thresholds, and social and emotional behaviors have been well documented (Brackbill 1958; Chess et al. 1959; Freedman 1965; Schaffer & Emerson 1964b; Thomas et al. 1963). These biological predispositions and reaction patterns, along with early acquired characteristics and the immediate physical state of the infant, greatly in-

fluence both the effectiveness of parental behavior (Chess et al. 1959) and the form and likelihood of that behavior. R. Q. Bell (1971) and Harper (1971) have recently reviewed evidence which demonstrates that certain infant behaviors facilitate or inhibit the responses of their caretakers. Crying is an especially potent elicitor of maternal behavior (R. Q. Bell 1971; David & Appell 1961; Moss & Robson 1968), but infant looking and smiling, too, can affect a caretaker's responsiveness (Etzel & Gewirtz, in R. Q. Bell 1971; Robson 1967; Wolff 1963). In fact, behavioral sequences of all kinds were more frequently initiated and terminated by the infant than by adults (Gewirtz & Gewirtz 1965; Schoggen 1963). The infant can also have an effect on the quality of parental behavior: the ease of reading communications from the infant depends not only on the mother's skill but on how clearly the baby's behaviors make his needs evident (Ainsworth & Bell 1969; Escalona 1953). Moreover, the infant has a sustained effect on maternal behavior. In the same way that the mother's behavior influences the infant's future development, the infant can, over time, have long-term effects on maternal attitudes and behaviors (Harper 1971; Yarrow 1963).

The study of reciprocal mother-infant interaction has found many advocates and inspired exemplary methods (Appell & David 1965; David & Appell 1961; Gewirtz 1961, 1969; Gewirtz & Gewirtz 1965; Honig et al. 1969; Kogan & Wimberger 1966; Kogan et al. 1969; Sander 1964, 1969; Sander & Julia 1966), but few data have yet been analyzed or published. One exception is a study by Robson (1967) involving eye-to-eye contact as a two-way process of communication. From the beginning, certain infants characteristically and vigorously sought out their mother's eyes, while others avoided them. The baby's looking behavior appeared to be an important eliciter of maternal responses. But mothers also differed in the quantity of their visual activity, independent of the infant's behavior. Consequently, the resulting patterns of eye contact established by the time the infant was 4–6 months old were a product of the interaction of both maternal and infant behaviors. These patterns of eye contact, furthermore, predicted the infant's attachment to his mother's face. Robson's study gives some indication of the spiraling, expanding nature of mother-child interaction. The same is true of a study by Moss (1967) of infants at 3 weeks and at 3 months. Maternal responsiveness, he suggested, initially tends to be under the control of the stimulus conditions provided by the infant (particularly his cry). As the infant grows older, however, if the mother responds contingently to the infant's signals, her efficacy in regulating his behavior increases. Concurrently, the infant's control diminishes until a balance is reached.

Moss's study seems to imply some temporal sequence and, perhaps, causal direction for these particular aspects of the mother-infant interaction. In general, studies of mother-infant interaction have not been designed to permit assignment of causation. Chodorkoff (1960), having shown that

maternal stimulation was related to infant performance measured concurrently and 2 months later but not to performance measured 2 months earlier, inferred that it was more likely that maternal stimulation was influencing infant performance than the reverse. S. M. Bell (1971), on the basis of a similar inference, has claimed that maternal responsiveness is responsible for decreased infant crying. These examples are unusual in the literature describing relationships between maternal variables and children's behaviors. If we are to discover how the infant interacts with his environment to shape the course of his development, much more research is needed to establish and elucidate causal relationships among variables of mother-child interaction.

The purpose of the present study was to clarify relationships suggested in the literature on maternal influence, to add to our knowledge about dimensions of mother-child interaction, and to extend our understanding of

CHARACTERISTICS / PRINCIPAL INVESTIGATORS	Method: Design: Longitudinal	Design: One or Few Visits	Data Collection: Observation Record: Interview	Data Collection: Observation Record: Tests/Structured	Data Collection: Observation Record: Time Sampling	Data Collection: Observation Record: Continuous Coding	Data Collection: Observation Record: Narrative/Notes	Data Collection: Observation Record: Post-Visit Rating	Data Collection: Observation Record: Immediate Rating	Setting: Home	Setting: Laboratory/Clinic	Analysis: Multivariate	Analysis: Univariate	Analysis: Descriptive	Subjects: Size: Number of Pairs	Subjects: SES: Lower Classes	Subjects: SES: Middle-Upper	Subjects: Race: Not Controlled	Subjects: Race: Black	Subjects: Race: White	Subjects: Age: Under 6 Months	Subjects: Age: 6 to 12 Months	Subjects: Age: 12 to 24 Months	Variables: Maternal: Attitude-Personality	Variables: Maternal: Behaviors: Discipline	Variables: Maternal: Behaviors: Caretaking	Variables: Maternal: Behaviors: Social-Emotional	Variables: Maternal: Behaviors: Perceptual-Cognitive	Variables: Maternal: Behaviors: Language	Variables: Maternal: Behaviors: Amount of Contact	Variables: Maternal: Behaviors: Interactional	Variables: Infant: Personality	Variables: Infant: Physical	Variables: Infant: Social-Emotional	Variables: Infant: Perceptual-Cognitive	Variables: Infant: Language-Vocalization
Ainsworth	x			x			x	x		x	x		x		26		x			x	x	x								x	x			
Baldwin	x		x	x					x	x	x	x			89			x		x	x	x	x	x						x	x	x	x	
Bayley	x			x			x	x			x	x			54	x	x			x		x	x							x	x	x	x	
Beckwith		x	x			x				x		x	x		24			x		x		x		x							x	x	x		x
Bradshaw	x			x			x	x		x			x		19	x			x	x	x	x		x									x		
Brody		x					x	x		x	x		x		32			x		x	x			x		x	x	x		x					
Caldwell		x	x	x					x		x		x		35	x			x	x	x	x		x			x	x			x	x			x
Chodorkoff		x		x	x					x			x		20		x			x	x			x		x			x				x		
Clarke-Stewart	x		x	x		x			x	x	x	x	x	x	36	x				x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Escalona		x	x	x			x	x		x	x			x	160			x		x	x	x					x	x	x		x	x	x		x
Gewirtz*		x				x				x			x	x	29			x		x							x	x	x	x	x		x		x
Levy		x	x			x		x			x		x		19			x		x	x			x				x				x	x			x
Lewis		x		x		x				x	x		x		84	x	x		x	x	x	x						x	x	x	x	x	x	x	x
Kagan	x		x	x		x				x	x	x	x		150	x	x			x	x	x	x		x	x	x	x	x	x	x	x	x	x	x
Moss*	x	x	x	x	x		x		x	x	x		x	x	74			x		x	x	x		x		x	x	x		x	x		x	x	x
Rheingold		x		x	x					x			x		40			x		x	x						x	x	x		x				x
Robertson	x		x				x	x			x				25			x		x	x	x	x	x				x					x	x	x
Rubenstein		x		x	x					x			x		44			x		x	x								x		x				x	
Sander*	x		x	x		x	x			x	x				22			x		x	x	x	x				x				x	x	x	x	
Schaffer	x		x	x						x				x	x	60	x				x	x	x				x					x			
White*	x					x		x		x			x		NR	x	x			x				x	x	x	x	x	x	x	x	x	x	x	x
Yarrow	x			x	x				x	x			x		60	x	x		x	x	x	x					x	x	x		x	x		x	x	

*At the time of the present study, few or only illustrative data had been published.

FIGURE 1.—Descriptive characteristics of studies of mother-infant interaction

mother-child relations. To this end, a wide variety of maternal and infant variables were defined behaviorally, measured longitudinally, and integrated into complex patterns. Of particular concern were patterns among various indices of the child's competence—in the areas of social, language, cognitive, and motor development—and how these patterns were related to the child's race and sex. Patterns among measures of the mother's characteristics and care—her intelligence, attitude toward children, personality, responsiveness, affection, and the amount of time she spent in physical contact with the child, taking care of his physical needs, or stimulating senses —were also of importance, as were relationships between maternal and child patterns. In general, it was expected that patterns of maternal care would be related to patterns of infant competence; more specifically, that the mother's physical proximity or caretaking would not be related to the child's development but that her expressions of affection and her stimulation of the child by talking to him and by playing with materials would be related to the child's social, language, and cognitive development, respectively. Moreover, it was predicted that maternal behavior which is immediately and contingently responsive to the child's expressions of need, intention, or desire would be positively related to the child's behavior and development in all areas. In order to permit inferences about the direction of influence in mother-child relations, variables were measured repeatedly over a period of several months so that changes in relationships over time could be examined. To add further to our knowledge about mother-child relations, subjects were selected from an age group and a sample population which had not previously been studied in this way. A comparison of features of the present study with other research on mother-infant interaction appears in figure 1.

II. METHOD

As any review of the literature on mother-child interaction will convincingly demonstrate, this field is beset by problems of method. Strategies of data collection which are not based on direct observation (e.g., maternal interviews and questionnaires and retrospective case studies) are not sensitive to the behavioral dynamics of interaction and may even be misleading since they often involve selective recall, difficult discriminations and syntheses, and possible distortions on the part of mother or researcher. When mother-child interaction is observed directly, there are still problems of lack of standardization (in the home), confounding effects of unfamiliar setting (in the laboratory), and always the possible distorting effects of the presence of the observer. Moreover, the complexity of mother-child interaction creates problems in selecting variables to observe. Some research has avoided complexity by including only simple variables like sensory capacities or motor behaviors; other investigations have focused on isolated pairs of single dimensions, such as maternal attentiveness and infant crying or maternal discipline and children's exploration. In attempting to reduce complexity, investigators also have sometimes not taken fully into account many of the relevant variables: family structure, birth order, environmental stimulation, parents' education, ethnicity, religion, and so on. Other problems arise in choosing a method for measuring the variables selected for study. Loss of information may occur when a limited selection is made from the behavior stream or when a restricted pre-established behavioral checklist is used. Information is also lost when the continuity of individual development is not preserved through longitudinal investigation. In the past, studies have seldom been longitudinal in design, and when longitudinal, maternal behavior has often been measured at one time and infant performance at another, consequently not permitting the analysis of causal relationships.

The present study attempted to avoid or to solve many of these problems of method. The selection of variables for study was determined by a desire to preserve as much as possible of the natural diversity and complexity of mother-child interaction. Therefore, a wide variety of maternal and child variables was examined longitudinally. The main method of data

collection used was an observational one which involved continuous recording of concurrent maternal and child behaviors. Repeated observations were made of mothers and children both in natural settings (at home) and in a variety of standardized or semistructured (test and laboratory) situations. In an effort to understand the complexity of the data collected, multivariate methods of analysis were used to find behavioral patterns and clusters within the complex array of measures. Possible distortion ascribable to the presence of an observer was an unavoidable aspect of the study, but an attempt to minimize the effect was made by having observers who were similar to the mothers in obvious ways (sex, race, and age), who were inconspicuous, nonthreatening, and friendly, and who consistently visited the same families.

The period of the child's life selected for the present study—9–18 months—was chosen because it offered an opportunity to observe, within a short time span, the beginnings or early forms of such important developmental processes as walking, talking, discovering the properties of objects, and elaborating social relationships. Evidence for the emergence of these processes, and details concerning their development, were gathered over the course of a 9-month investigation of 36 children.

Altogether, 12 visits were made to each mother-infant pair in the study. During seven of the visits, observations of naturally occurring infant behavior and mother-infant interaction were recorded; in six visits standardized "probes" were given. The probe situations included an interview with the mother and questionnaires requesting her feelings, opinions, and knowledge; and tests of the baby's language competence, cognitive development, and social and play behaviors with strangers and in an unfamiliar setting. A summary statement of the visits and the variables studied is presented in figure 2.

PRETESTING, TRAINING, AND RELIABILITY

Before the study began, 5 months were spent in planning and pretesting by the investigator and three other observers. All observers were female college graduates, ranging in age from 21 to 28 years, with some education in child development. Three were white; one was black. Their first task was to observe and to make detailed running records of the interaction at home of several mothers and their children. Available published observation schedules from mother-infant studies were then reviewed, and items which seemed appropriate for children in the target age range were selected. These behaviors were supplemented by any additional and different behaviors contained in the running records. The preliminary observation schedule thus compiled (comprising more than 100 items) was pretested, revised, modified, retested, and reduced until a final repertoire was arrived at, consisting of 26 maternal and 23 infant behaviors plus various specifiers

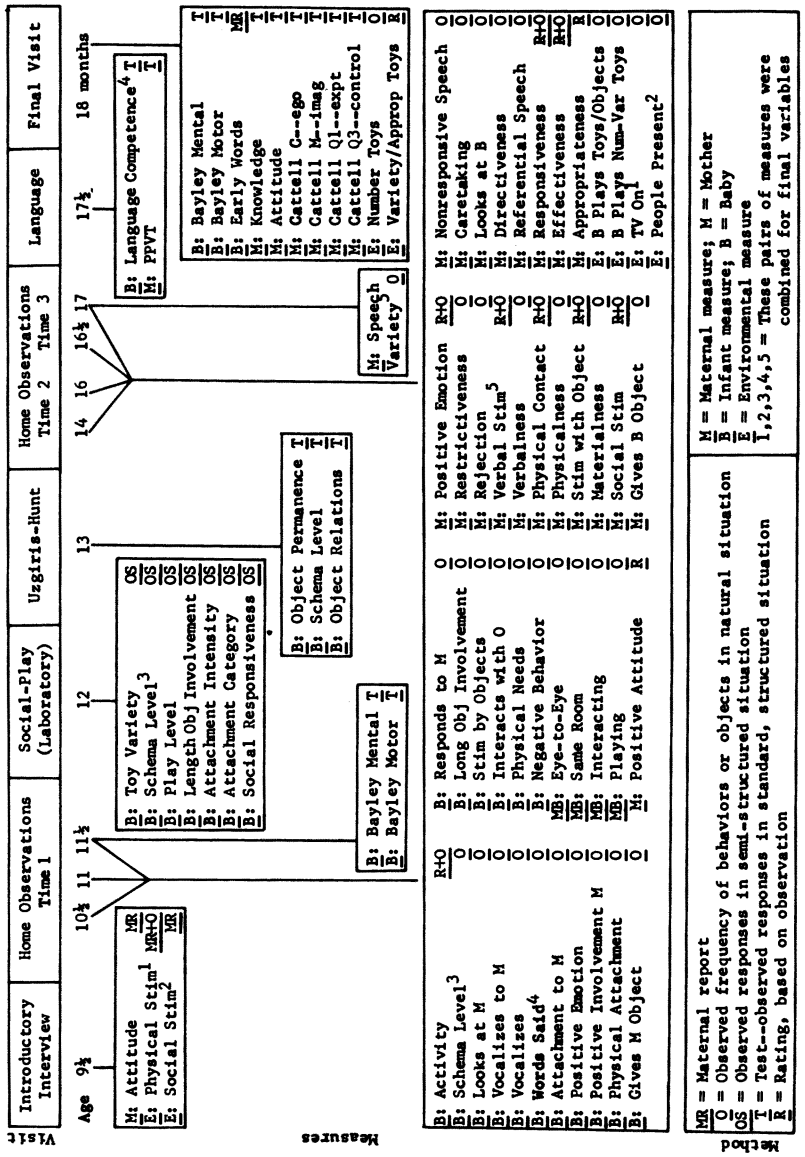

FIGURE 2.—Schedule and sources of variables

and qualifiers. Concurrently, to compensate for the reduction of detail in this final observation schedule, a developmental checklist was devised. Maternal rating scales suggested by previous research were also tested. Certain of these rating scales were chosen for use in order to replicate information available in the coded behavioral observation records, thus providing a comparison of these two observational techniques. During this time, too, the probe situations and procedures were designed, revised, and rehearsed.

In all, 22 babies, of varied social class and racial backgrounds, ranging in age from 9 to 20 months, were seen several times in pretesting the observation schedule, checklist, and rating scales; at least five babies of appropriate ages were pretested for each probe.

By the end of the 5-month period, agreement between observers on the observation checklist and the probe measures was between 90% and 100%; on the five-point rating scales, agreement was within 1 scale point. The percentage agreement between different pairs of observers using the observation schedule (for all behaviors) ranged from 70% to 78% (mean = 75%). A reliability check made between the third and fourth observation visits of the study itself revealed a comparable level of agreement (mean = 75%). Interobserver reliability coefficients for major categories of behavior are given in table 2.

RECRUITMENT AND DEMOGRAPHIC CHARACTERISTICS OF THE SAMPLE

Birth records at Yale–New Haven and St. Raphael's Hospitals in New Haven, Connecticut, were the initial source of potential subjects. In September 1970, letters were sent to all mothers of firstborn, normal babies delivered in these hospitals between December 1, 1969 and February 1, 1970 ($N = 200$). The sample was restricted to firstborns to eliminate possible variation related to birth order. To reduce variation in economic and social status, letters were sent to families lowest in occupational status when relevant information about the father's or mother's occupation was available on the birth record. Although these sample restrictions limit generalizability, they tend to increase homogeneity on dimensions which were not to be analyzed. Relatively poor families were selected for study because educational and political pressures toward intervention in the lives of the poor have created a need for descriptive data about these families, and relevant information about children's development and mother-child interaction in these families is scanty in the available literature. Another reason for limiting the sample to poor families was to increase the probability of finding economically comparable samples of black and white families.

Telephone calls to recipients of letters were made within a week to find mothers who were interested in the study and to get information about occupation when it was not already available. The projected goal was 10

infants in each of four groups: black male, black female, white male, and white female. Primarily because of our inability to reach the many mothers who had moved since the baby's birth, only 29 subjects were found through hospital records. Two other tactics of subject recruitment were then employed: advertising in local supermarkets and newspapers, and asking private pediatricians. Altogether, from all these sources, 43 mothers, of low economic status, agreed to participate in the study. An introductory visit to each of these mothers was then made by an observer who was of the same race as the mother. The 38 subjects finally selected were those for whom the mother was the baby's *primary* caretaker, those of lowest economic and social status, and, as far as possible, those who were living in nuclear families. There were 20 males and 18 females at the beginning of the study; one mother (of a black boy) disappeared during the study; data collected on one white male was not used after it became obvious that this was not a "normal" baby in a "normal" family. The final 36 subjects were equally distributed by race and sex, nine in each group.

All families in the study resided in the greater New Haven area. Nine black mothers and 13 white mothers were married; the others were single or divorced. However, in all but four black and three white families there were uncles or grandfathers living in the household or frequently available. With one exception (a 15-year-old), the mothers ranged in age from 18 to 26. The religion of 22 mothers was Protestant; 11 mothers were Roman Catholic, and three were Jewish. Thirty-two of the 36 mothers had graduated from high school; four had completed only tenth or eleventh grade, four had some post–high school technical training, and three had nursing degrees.

Even within this occupationally restricted sample, a variety of jobs was included. For half of the sample (nine white and nine black) the father's occupation was unskilled (e.g., a garage helper, a construction laborer, a janitor). In eight other families (three black and five white) the father was a skilled worker (e.g., a fireman, a salesman, a technician). Ten mothers were not working, and, if married, their husbands were unskilled and unemployed; for the most part they were on welfare. The occupational and educational distributions were approximately equivalent for the two racial groups; according to criteria such as neighborhood and physical conditions in the home, however, the black group was somewhat poorer.

All black subjects were assigned to one (black) observer, and the white subjects were randomly distributed among the three (white) observers. All home visits for a particular family were made by only one observer, since the positive practical effects of increased familiarity and rapport between mother and observer were believed to outweigh the possible disadvantages of having the same person make all observations throughout the study.

DATA COLLECTION

Home Observation Visits

Seven observation visits were made to each home, and during each visit three half-hour time samples of observation were recorded. Identical procedures were followed during each visit. The observer arrived at the home at a time prearranged with the mother to maximize the likelihood that the baby would be awake. Visits were deliberately scheduled to sample different times of day in each home. After she arrived, the observer first talked with the mother briefly, inquiring about the baby's health and schedule for that day, and requesting the mother to continue her normal duties and ignore the observer, who would be watching and following the baby. In a two-columned stenographer's notebook the observer wrote a brief descriptive paragraph about the setting (people present, T.V. on, toys out), baby's state (health, when last fed, slept, changed), and his appearance (mood, dress). Then, for the next 30 minutes, she recorded the naturally occurring activities of the infant and, when the mother was in the same room as the infant, of mother and infant. In the right-hand column of the notebook, short abbreviations for the infant behaviors were written; in the left column, maternal behaviors which impinged on the child were recorded. The behaviors noted by the observers were limited to the 26 maternal and 23 infant behaviors which had been established and defined during pretesting, and to a small group of qualifiers (e.g., "responsive") and specific object, person, and place names. Table 1 displays the complete list of behavior units coded.

Behaviors of mother and baby which occurred simultaneously were written on the same horizontal line in the notebook; sequential behaviors were written on alternate lines. Every 10 seconds, at the sound of a timer in an inconspicuous earphone, the observer made a horizontal mark on the notebook line. Any single behavior was written only once in a 10-second period unless it was interrupted by another behavior and then resumed. A continuous behavior was indicated by a vertical line for as many time periods as it continued. Figure 3 represents a sample page of such recording.

After observing and recording for ½ hour, the observer described in a few sentences what had happened during the observation, including inferences and editorial comments. She then completed a developmental checklist to provide a quick summary of the infant's language level, play with materials, and attachment to mother.

This sequence of coded observation, descriptive statement, and developmental checklist was repeated twice more during the visit, making a total of 1½ hours of observation. If the baby fell asleep for more than ½ hour during the visit, the observation was discontinued and concluded at a later visit. At the end of each visit the observer made ratings based on that ob-

TABLE 1

OBSERVATION BEHAVIOR UNITS

Code	Name	Description
		Infant Behaviors
h	Holds	B holds M, climbs onto lap, touches, clings to, holds hand.
atc	Affectionate Tactual Contact	B hugs or kisses M.
exp( )	Expressive Physical( )	Expressive physical (nonverbal) behavior (specified). Includes expressions of state (e.g., rubbing eyes, yawning), positive emotion (e.g., laughing loudly, bouncing excitedly), negative emotion (e.g., banging head on floor, hitting M), physical need (e.g., cough, sneeze), or desire (e.g., pointing, reaching out for object).
hurts	Hurts	B hurts himself, falls, shuts finger in door, gets hit by a person not his M.
appr( )	Appropriate Response( )	B makes an appropriate response to a directive from M, object offered by M, game initiated by M. (What the response is, is specified, e.g., "appr goes," "appr voc," etc., if it is one of the behaviors in this prearranged repertoire.)
goes( )	Goes( )	B moves more than 4 ft by any means of self-propelled locomotion. (If B goes to a specific person, object, or place, who, what, or where is specified.) "Goes OR" (other room) is written if B leaves M's view; "goes M's room," if he comes into M's view; "goes M," if he goes to within arm's reach of M and stops.
l( )	Looks( )	B looks at person or object (who or what)—looks only, not during his play with the person or object. Must be of at least 10-sec duration.
lM	Looks M	B looks at M—no matter how short a glance—when not doing anything else with M.
sm	Smiles	B smiles or laughs at or with M.
drops( )	Drops( )	B drops or throws an object (what) out of his reach, accidentally or purposefully.
gives( )	Gives( )	B gives, offers, or takes object (what) to M.
shows( )	Shows( )	B shows or points to inaccessible object, in M's presence.
eats	Eats	B eats or drinks: food, candy, other edibles, drinks from glass or bottle, eats by himself or is fed. Continues as long as food, etc., is still in hand or mouth.
takes( )	Takes( )	B takes object, toy, or food (what) offered by M.

TABLE 1 (*Continued*)

Code	Name	Description
ntakes( )	No Takes( )	B deliberately refuses (not just ignores) object offered by M.
pl( )	Plays with( )	B manipulates, sucks, bounces, bangs, examines, etc., M, toy, or any object (what). Behavior is considered continuous as long as B still has object.
calls	Calls	B calls M.
neg	Negative Vocalization	B frets, fusses, whines, or makes other vocal sounds of negative cast.
cries	Cries	Intense, continuous, negative vocalization—usually loud, prolonged, and tearful.
voc	Vocalizes	B makes a vocalization—speech or prespeech. If speech, the word is written in.
vocD( )	Vocal Demand( )	B makes a demand vocalization (speech or prespeech) for a specific thing (what).
imit	Imitates	B imitates M's vocalization, speech.
sleeps	Sleeps	B is actually asleep (eyes closed, regular breathing, etc.).
		Maternal Behaviors
h	Holds	M holds B on knee, touches, picks up, carries, puts arm around, uses physical soothing with B.
atc	Affectionate Tactual Contact	M hugs, kisses, caresses, fondles, ruffles hair of, cuddles B.
phys	Physical Stimulation	Deliberate, active, physical stimulation; M rocks, bounces, tickles, plays physical game (e.g., pat-a-cake), roughhouses with B.
rest	Restrains	M restrains baby's activity physically, deliberately.
att( )	Attends Needs( )	M attends to B's physical need—diapers, wipes nose, dresses, bathes, Band-Aids, feeds, etc. (Is considered continuous unless a break of more than 10 sec occurs.) M's action is specified in parentheses.
appr	Appropriate Response	M makes appropriate nonverbal response to B, if not covered in another category.
cm rm	Comes Room	M comes within B's view or reaches out from across the room. (If M "comes room" and then "comes baby," within one 10-sec period, only "comes baby" is recorded.)
cm B	Comes Baby	M comes within arm's reach (4 ft) of B.
lv rm	Leaves Room	M goes out of baby's view (If M leaves B *and* room in one 10-sec period, only "leaves room" is recorded.)
lv B	Leaves Baby	Goes out of arm's reach of baby.

TABLE 1 (*Continued*)

Code	Name	Description
puts(R)( )	Puts(R)( )	M puts B somewhere (where is specified)—in playpen, crib, high chair, on couch, on floor, etc. (*not* on lap). Responsive (R) or not depends on whether M was responding to B's demand.
l	Looks	Looks at B when not doing anything else, or when holding B or attending his need.
sm	Smiles	M smiles or laughs at B, or shows other positive, nonverbal expression.
pun	Punishes	M physically punishes the B (e.g., slaps, hits).
gives( )	Gives( )	M offers or gives object, toy, or food to B (what).
shows( )	Shows( )	M points to inaccessible object, like dog out window, light on ceiling (specified).
ngives( )	No Gives( )	M deliberately refuses to give object which B demands (what).
takes(R)( ) ...	Takes(R)( )	M takes object away from B (what). Responsive (R) if B first gives or offers object to M.
pl( )	Plays with( )	M entertains B with book, toy, or fingers, plays game, or soothes with materials (what).
n	Names	M uses B's name, alone or in sentence.
inst	Instrumental Speech	M gives definite "do" or "don't" directions, orders, with expectation of compliance.
pr	Praises	M praises B verbally.
rep	Reprimands	M rebukes B sharply, reprimands.
imit	Imitates	M imitates B's speech or nonspeech vocalization.
soc(R)	Social Speech(R)	M sings, whistles, whispers, verbally soothes, plays verbal game (e.g., peek-a-boo), or uses single responsive words (whoops, oh, etc.) or short responsive questions (What? What do you want? What's the matter? Where are you going?). When this speech or play is responsive to B's state, situation, or signal, it is labeled "soc(R)."
ref(R)	Referential Speech(R)	All M's speech which refers to the environment directed toward B—labeling, giving information about objects, toys, people, the baby. All speech with referential *content*. Ref(R) is speech which refers to or responds to the B's activity or vocalization.
... .	Extraneous Stimuli	Telephone ringing, doorbell, another person entering the room, etc., are written in.

servation period. These included the infant's activity level, the mother's emotional expression and tone of voice, the amount, closeness, and vigor of her physical contact with the child, the mother's verbal and social stimulation, stimulation of the child with materials, responsiveness to the child's distress, and responsiveness to social behaviors. (Rating scales and developmental checklist can be found in Appendix A.)[1]

Probe Visits

Maternal Interview and Questionnaires

The first visit made to every home consisted of an introductory interview and observation session. After the observer had introduced herself and described the project to the mother, she asked her about the infant's history, his typical schedule of activities, the people he saw often, and the toys he liked. She also asked questions to find out about the mother's feelings and behavior toward children and toward her own baby (see Appendix B). The observer then demonstrated to the mother what an observation session would be like, and in the course of the demonstration noted certain aspects of the infant's physical environment such as the noise level, decor, and variety of toys available.

During the final visit of the study similar measures were taken through questionnaires and observation. The mother's attitude toward the child was again probed, and the child's playthings were counted and rated on dimensions of variety and complexity. The questionnaire also presented items to assess the mother's knowledge about child rearing and child development. It included questions like the following: What should a mother do if her 6-year-old child still wets the bed every night? At what age does a child usually start to talk? How do you think a mother can help her child do well in school? Who is Dr. Spock? Jean Piaget? What toys do you think a 6-month-old baby (or a 2-year-old child) should have? At the same visit, certain maternal personality characteristics were assessed with items from the Cattell Sixteen Personality Factor Questionnaire (Cattell & Eber 1968).

Bayley Scales of Infant Development

The Mental and Motor Scales of the Bayley Scales of Infant Development (Bayley 1969) were given to the infants at home at the end of the third observation visit when the infants were $10\frac{1}{2}$–$12\frac{1}{2}$ months old, and again, during the final visit of the study, when they were 17–18 months old.

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[1] The complete set of checklists, rating scales, interview forms, questionnaires, and probe procedures, and explicit instructions for scoring these forms are contained in Clarke-Stewart (1972) and are available from the author.

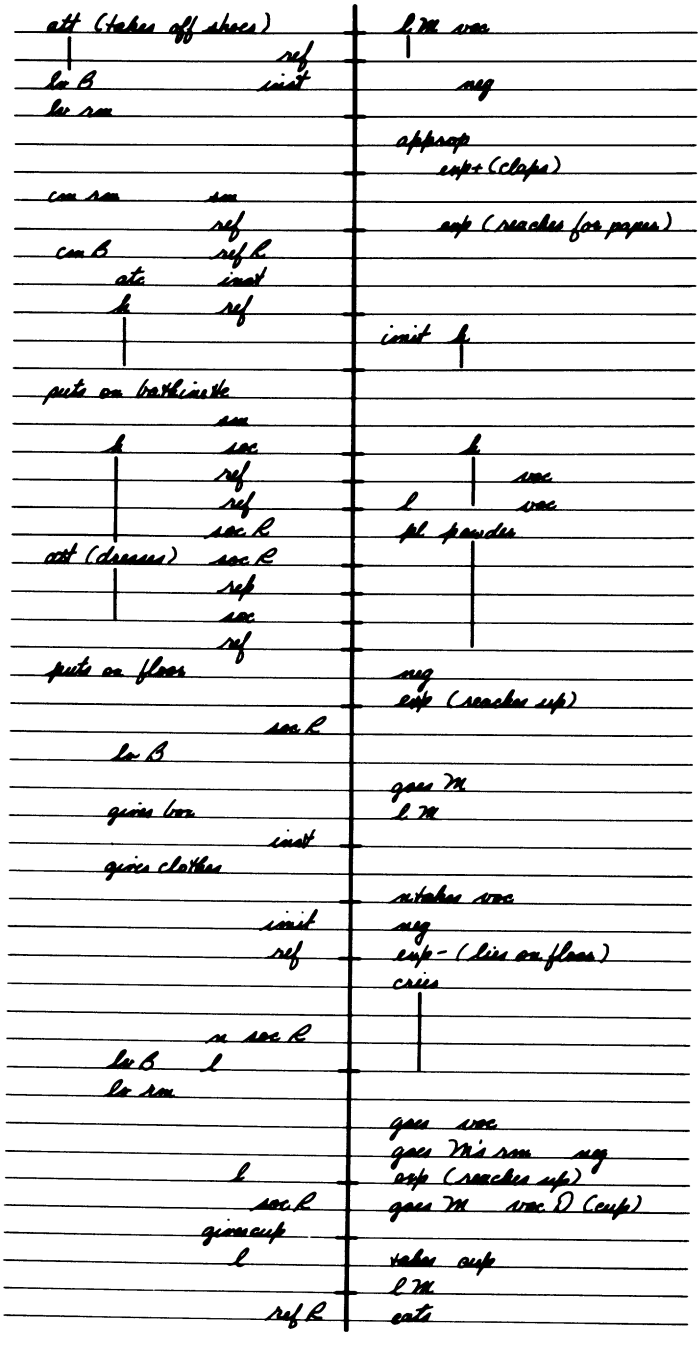

FIGURE 3.—Sample page of observation record

Social-Play (Laboratory) Probe

When the infants were 11–13 months old, the observer and another adult female, unfamiliar to mother and infant but of the same race, visited them at home. There the observer and stranger each performed a sequence of behaviors (based on a procedure devised by Rheingold [1956]) designed to assess the infant's social responsiveness, his reaction to strangers, and his attachment to his mother. This "approach sequence" consisted of looking, smiling, and talking to the baby, approaching, touching, picking him up, offering a toy, and leaving him. In the home, this sequence was carried out first with the mother present, then absent.

After this brief session, the observer guided mother and child to an observation laboratory at the university. The observation room, despite its three one-way windows, was a pleasant room, with wall-to-wall carpeting, air-conditioning, curtains, and pictures. A comfortable chair, magazines, and ashtray were provided for the mother, and 13 attractive toys for the baby. After mother and infant were ushered into the room, the observer led the baby to the toys, which were grouped together on the floor at one end of the room, and directed the mother to her chair, which was about 5 feet from the toys. The general purpose of this part of the visit—to find out how her child would react to new toys, an unfamiliar room, and strangers—was explained to the mother, and she was instructed to let the baby play freely with the toys, without interference, responding only if the baby initiated an interaction.

The sequence of events which followed during the next half-hour was similar to experiments by Ainsworth et al. (1969), Fleener and Cairns (1970), and Schaffer and Emerson (1964a), among others. It consisted of varying episodes of free play, stranger intrusion, and mother absence, in an order designed to be increasingly stressful for the infant. During the episodes, the infant's social behaviors and play activities were recorded on a checklist by an observer behind the one-way glass. A sample of the procedures is shown in figure 4.

Uzgiris-Hunt Series

Age-appropriate items for assessing cognitive development from four of the Uzgiris-Hunt series (Uzgiris & Hunt 1966) were selected and compiled to form a probe which could be administered in one session. The probe was given at home when the infants ranged in age from 12 to 14 months.

Language Assessment

A probe to assess the language competence of the infant was made at a time when most infants were beginning to utter several words (17–17½

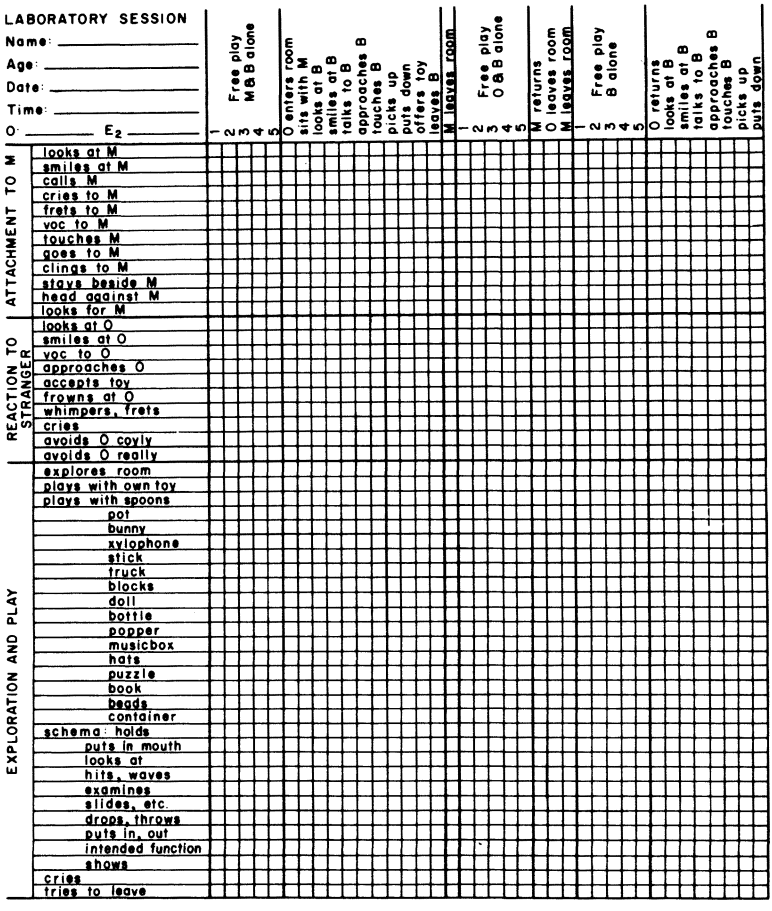

FIGURE 4.—Social-Play Probe sample of procedure and record form

months). One component involved presenting familiar objects (such as keys, clock, blocks) to the child and asking him to name them, or, if he could not or would not name items, asking him to point to those the observer named. Using another set of toys, the observer then attempted to assess the infant's comprehension by asking him to perform simple manipulations with the objects. Examples of her instructions were: "Give me the car," "Give the bottle to your mommy," "Hit the car with the spoon," and so on. Finally, the observer asked the child a set of questions and recorded his verbal and nonverbal responses. The questions included: "Where's daddy [or grandma, auntie, etc.]?" "Who's that [mirror]?" "Do you want to go to bed [night-night]?" "Would you like a cookie?" At the end of this visit the mother was asked to fill out a list of the baby's early words.

To examine the mother's verbal behavior, a tape recording was made of the mother's speech while she was interacting naturally with the child during the seventh observation visit. At the end of the language probe visit the mother was given the Peabody Picture Vocabulary Test (PPVT) (Dunn 1965).

DATA REDUCTION

Home Observations

Observational data from visits made within 6 weeks of each other were grouped together to provide greater reliability. In 28 cases the first three observation visits, which were made when the infants were 9–12 months old, were combined, and all scores were based on the sum of these three visits. In eight instances it was not possible for the observer to make the third visit until the baby was 13 months old. For these subjects the third visit was combined with the fourth visit at 14 months. For the other subjects the fourth visit was scored alone. Data from the fifth, sixth, and seventh observation visits, occurring when the child was between 16 and 17 months, were combined for all subjects.

Developmental Checklists and Rating Scales

Rating scores consisted of the mean scores on each scale combined across visits. The child's schema development score was the mean score of the schemas observed, according to the Uzgiris-Hunt hierarchy of schema development. The measure of attachment to mother was the sum of the frequencies of social behaviors toward the mother in specified situations, like the entrance of the observer and the entrance or the exit of the mother. (Appendix A displays the specific scales, checklists, and situations.)

Frequencies and Proportions

The general strategy for making use of the coded observational data was to define—in terms of combined frequencies of simple behavioral units —more conceptually complex maternal and infant dimensions which had been discussed by previous investigators. The number of 10-second periods in which each behavior unit or specified combination of behavior units occurred was tallied, a behavior recorded more than once in a 10-second period being counted only once. These frequencies were then converted to proportions in order to provide comparable data from subjects whose observation sessions differed in length. Maternal, infant, and mutual mother-infant variables which were defined and calculated in this way can be found in table 2 (labeled "observed frequency"). Details of how each variable was formed from simple behavior units are also given in table 2; footnote [c] illustrates how to interpret the calculation summaries.

TABLE 2

DESCRIPTION OF VARIABLES

Measures	Abbreviations	Inter-observer Agreement
Infant		
1. Variety of toys played with in lab during M-present free play; 12 months[a]	Toy variety (L)	
2. Average length of involvement with individual objects during M-present free play in lab; 12 months[a]	Obj. inv. (L)	
3. Play level (toy complexity × schema level) during M-present free play in lab; 12 months[a]	Play (L)	
4. Ainsworth attachment classification, lab visit; 12 months	Attachment category	
5. Intensity of attachment to M, lab visit; 12 months[a]	Attachment (L)	
6. Positive social responsiveness to unfamiliar female adults, lab visit; 12 months[a]	Soc. resp. (L)	
7. Object permanence, Uzgiris-Hunt Series I; 13 months[a]	Obj. perm. (UH)	
8. Schema development, Uzgiris-Hunt Series III; 13 months[a]	Schema (UH)	
9. Object relations, Uzgiris-Hunt Series II + V; 13 months[a]	Obj. relns. (UH)	
10. Language competence, total language probe + observed words; 17 months[a]	Language	
11. Bayley Scale of Mental Development; 11½ months[a], 17½ months[a]	Bayley Ment.	
12. Motor development, Bayley Scale of Motor Development, and developmental checklist for visit 4; 11½, 14, 17½ months[a]	Motor dev.	
13. Schema development, developmental checklist + lab measure for visit 4; 11, 13, 17 months[a]	Schema (O)	
14. Activity level, rating + observed frequency goes/time B awake[a,b]	Activity	
15. Attachment, developmental checklist[a]	Attachment (O)	
16. Prolonged involvements with objects, observed (number involvements ≥ 200 sec); 11, 17 months[a]	Long obj. inv.	
17. Looks at M, observed frequency (l + inf l)/MB same room[a]	Looks M	.80
18. Positive emotional expression to M, observed frequency (atc + sm + exp +)/MB same room[a,c]	+ Emotion	.66
19. Positive involvement with M, observed frequency (atc + h + goesM + lM + gives + calls + sm + plM − lvM)/time B awake	+ Involv. M	

TABLE 2 (*Continued*)

Measures	Abbreviations	Inter-observer Agreement
20. Interaction with observer, observed frequency (l + plO)/time B awake	Interact O	
21. Physical needs, observed frequency (eats + sleeps)/total number 10-second periods	Phys. needs	
22. Vocalization, observed frequency. (calls + voc + vocD + imit)/time B awake	Vocn.	
23. Vocalizes to M, observed frequency (calls + [voc + lM] + vocD)/MB same room[a]	Voc. M	.93
24. Negative behavior, observed frequency (exp— + cries, not hurt + neg voc)/time B awake[a]	Neg. beh.	.82
25. Physical attachment to M, observed frequency h/MB same room[a]	Phys. attach.	.66
26. Stimulation by materials, observed frequency (l + pl with toy, obj)/time B awake[a]	Stim. by obj.	.88
27. Gives to M, observed frequency (gives fd, toy, obj)/MB same room	Gives M	
28. Responsiveness to M's behavior, contingency measure (variable 65)	Respons.	
29. Responsiveness to M's physical contact, contingency measure (variable 61)	R M's phys.	
30. Responsiveness to M's stimulation with materials, contingency measure (variable 62)	R M's obj.	
31. Responsiveness to M's instrumental speech, contingency measure (variable 63)	R M's inst.	
32. Responsiveness to M's social behavior, contingency measure (variable 64)	R M's soc.	
Maternal		
33. Positive attitude: toward infants, introductory interview; toward children, questionnaire; 10, 17½ months[d]	+ Attit. (I) or (Q)	
34. Age[d]	Age	
35. Verbal intelligence, PPVT; 17 months[d]	PPVT	
36. Ego strength, Cattell factor C; 17 months[d]	Ego (C)	
37. Imaginativeness, Cattell factor M; 17 months[d]	Imag. (C)	
38. Experimentingness, Cattell factor Q1; 17 months[d]	Expt. (C)	
39. Control, self-discipline, Cattell factor Q3; 17 months[d]	Control (C)	
40. Knowledge about child development and child rearing, questionnaire; 17 months[d]	Knowledge	
41. Positive attitude toward B, observation ratings (tone of voice + accepting attitude)[d]	+ Attit. (O)	

TABLE 2 (*Continued*)

Measures	Abbreviations	Inter-observer Agreement
42. Positive emotional expression to B, observed frequency (atc + sm + pr + soc)/time B awake + ratings (+ emtnl expression + closeness + vigor of physical contact)[d]	+ Emotion	.78
43. Restrictiveness, observed frequency (restr + pun + inst + rep + takes + puts + ngives + h)/total M behaviors[d]	Restrict.	.80
44. Verbal stimulation, tape variety + observed frequency (names + inst + pr + rep + imit + soc + socR + ref + refR)/time B awake + rating auditory-verbal stimulation[d]	Verb. stim.	.94
45. "Verbalness," observed frequency (names + inst + pr + rep + imit + soc + socR + ref + refR)/total M behaviors		
46. Physical contact, observed frequency (h + atc + phys stim)/time B awake + rating amt of phys contact[d]	Phys. cont.	.85
47. "Physicalness," observed frequency (h + atc + phys stim)/total M behaviors		
48. Stimulation with materials (objects), observed frequency (gives + shows + pl toy or obj)/time B awake + rating stim with materials[d]	Stim. w. obj.	.86
49. "Materialness," observed frequency (gives + shows + pl toy or obj)/total M behaviors		
50. Social stimulation, observed frequency (l + sm + soc + cmB + imit + ref + refR)/time B awake + rating social stimulation[d]	Soc. stim.	.96
51. Gives B, observed frequency gives fd, toy, obj/time B awake	Giving	
52. Nonresponsive speech, observed frequency (soc + ref)/time B awake	N-R speech	
53. Rejectingness, observed frequency (lvB + lv rm + pun + ngives + rep)/total M behaviors[d]	Reject.	
54. Caretaking time, observed frequency att/time B awake	Caretaking	
55. Looks at B, observed frequency (l + inf l)/MB same room	Looking	
56. Directiveness, observed frequency inst/total M behaviors	Direct.	
57. Referential speech ratio, observed frequency (ref + refR)/(soc + socR)[d]	Ref. sp. ratio	
58. Responsiveness, observed frequency R behs/total M behaviors + contingency measure proportion of all expressive B behaviors to which M responded positively within 20 sec (listed under variables 59 and 60)	Respons.	

TABLE 2 (*Continued*)

Measures	Abbreviations	Inter-observer Agreement
59. Responsiveness to social signals, rating responsiveness to social signals + contingency measure proportion of B's expressive social behaviors to which M responded positively within 20 seconds, i.e., when B h, atc, goes M, lM, sm, gives, shows, calls, voc, or plM; M h, atc, phys, sm, socR, refR, pl, gives, takesR, cm, or appr[d]	R soc.	.90
60. Responsiveness to distress/demand, ratings (responsiveness to demand + responsiveness to distress) + contingency measure proportion of B's expressive distress or demand behaviors to which M responded positively within 20 seconds, i.e., when B calls, neg, cries, vocD, or exp—; M h, atc, phys, att, cm, putsR, gives, pl, socR, refR, appr, or stops[d]	R distress	.95
61. Effectiveness of physical contact, contingency measure proportion of M's physical behaviors to B to which B responded positively within 20 seconds, i.e., when M h, atc, or phys; B h, atc, lM, sm, plM, voc, stops neg, or exp—[d]	Effect. phys.	
62. Effectiveness of stimulation with materials, contingency measure proportion of M's behaviors with materials to which B responded positively within 20 seconds, i.e., when M gives, takes, pl, or shows; B goes M, sm, takes same object, pl same object, goes object, stops neg, or appr[d] ...	Effect. obj.	
63. Effectiveness of instrumental speech, contingency measure proportion of M's instrumental speech to which B responded appropriately within 20 seconds, i.e., when M inst or rep; B appr, stops neg, sm, or stops[d]	Effect. inst.	
64. Effectiveness of social behavior, contingency measure proportion of M's social behaviors to which B responded positively within 20 seconds, i.e., when M cm, atc, soc, imit, or ref; B h, atc, goes M, lM, sm, stops neg, exp+, voc, appr, imit, or plM[d]	Effect. soc.	
65. Effectiveness, rating effectiveness + contingency measure mean of variables 29, 30, 31, and 32 ...	Effect.	.84
66. Appropriateness, rating (selectivity of response + appropriate for age)[d]	Approp.	
Mutual		
67. Eye-to-eye contact, observed frequency (lM or inf lM + lB or inf lB in same 10 seconds)/ time B awake	E/E cont.	
68. M and B in same room, observed frequency/ time B awake	Same room	

TABLE 2 (*Continued*)

Measures	Abbreviations	Inter-observer Agreement
69. M and B interacting, observed frequency (M att, pl, speaks, takes, gives, rest, atc, h, puts, or phys and mutual l, sm)/time B awake	Interacting	
70. M and B playing, observed frequency (mutual plays, social, phys, game, or with materials)/time B awake	Playing	
Environmental		
71. Functional availability of toys, observed frequency B pl toys/B pl obj	Toy/obj. (O)	
72. Number toys and playthings available at 17 months, observed	Num. toys	
73. Variety and age appropriateness of available toys at 17 months, rating	Var. toys	
74. Social stimulation, introductory interview + observed number of people	Envt. soc.	
75. Physical stimulation, introductory interview + observed number of visits with TV or radio on	Envt. phys.	
76. Number and variety objects played with, observed; 11, 17 months[a]	Num.-var. obj (O)	

NOTE.—Unless otherwise indicated, all measures are at 11, 14, and 17 months.

[a] These measures were included in the factor analysis of infant variables.

[b] The measure of activity level was formed by adding the activity level rating score to the proportion of 10-second periods during which the infant was awake that he moved more than 4 feet (i.e., observed frequency of "goes").

[c] The variable "positive emotional expression to mother" was defined as the sum of the frequencies (number 10-sec periods) with which the child touched his mother affectionately (atc), smiled at her (sm), or expressed joy physically (exp+), divided by the number of 10-second periods during which mother and child were in the same room.

[d] These measures were included in the factor analysis of maternal variables.

Contingencies

Operational measures of a mother's responsiveness were based on an analysis of contingencies between observed infant and maternal behaviors. A number of specific infant behaviors which might be expected to elicit maternal responses were selected. These included: B holds M, B is hurt, B cries, B makes a vocal demand, B calls M, and so forth. For each of these infant behaviors a set of maternal behaviors was selected which would indicate an "appropriate" response to the specific infant behavior. For example, for B calls M, appropriate responses from the mother were: comes to B, looks at B, or speaks (R) to B. If the infant were hurt and cried, to be scored as responsive, the mother had to come to the baby, hold, hug, kiss, physically soothe him, or attend to his hurt. If the baby made a vocal demand, responsive maternal behaviors included giving him what he demanded, or putting him where he wanted to go, or answering his demand verbally. Each recorded occurrence of each of these infant behaviors was

thus considered, its consequents within the same or the next 10-second period examined, and each behavior given a responsiveness score of 1 or 0. Three measures of maternal responsiveness were calculated based upon the proportion of infant behaviors to which the mother responded—an overall responsiveness score (the total proportion of responsive maternal behaviors) and two specific responsiveness scores (responsiveness to the infant's distress or demand, and responsiveness to his social signals). Details regarding the formation of responsiveness scores can be found in table 2.

Contingencies between observed maternal and infant behaviors similarly produced measures of the effectiveness of the mother's behavior. For a set of specific maternal behaviors, certain infant responses were selected which it was judged, a priori, would indicate that the maternal behavior had been effective or appropriate. For example, if the mother gave, offered, or showed some object to the baby, her behavior was deemed "effective" if the baby then smiled, went to his mother or the object, took it, ate it, or played with it, or stopped crying or fretting within the same or the next 10-second period. If the mother ordered the child to do or stop some behavior, her behavior was considered effective only if the child carried out the order, smiled, or stopped crying. On the other hand, if the infant responded to such maternal behavior by crying, fretting, refusing the object, expressing anger at the command, or leaving the room, such maternal behavior would be scored negatively. Each maternal behavior was thus examined and scored ($+1$, 0, or -1). Scores for certain combinations of behaviors were then summed and converted to proportions by dividing them by the total recorded frequencies of those maternal behaviors. The effectiveness scores calculated were: effectiveness of physical contact, of stimulation with materials, of instrumental speech, of social behaviors, and the mean of these. Details of the formation of these scores are given in table 2. Of course, maternal effectiveness scores can be considered also as indicating the infant's responsiveness to these categories of maternal behavior.

Other Observational Measures

Several other simple measures came from nonstructured observation sessions: (*a*) the number of half-hour observation sessions during which the T.V., record player, or radio was turned on; (*b*) the total number of people (other than mother and observer) present during the seven observation visits; (*c*) the number and variety of objects the infant played with; (*d*) the variety and age appropriateness of the toys and playthings available; (*e*) the frequency of the child's involvements with objects which lasted more than 200 seconds (an arbitrarily selected index of prolonged object involvement); and (*f*) the number of distinct words uttered by the child.

Probe Measures

Maternal Interview and Questionnaires

Three measures were derived from the information gathered in the initial interview with the mother: (*a*) a maternal attitude score (the number of "yes" answers to attitude questions in Appendix B) representing the extent to which the mother's attitude toward children and toward her own child was positive, interested, and accepting; (*b*) a score for the physical stimulation inherent in the environment based on the mother's report about the baby's activities and the observer's observations concerning the quality of the physical aspects of the home and the baby's playthings; and (*c*) a score for the social stimulation inherent in the environment expressing the amount of contact that the mother reported the baby had with other children and adults.

The maternal personality questionnaire given at the final visit provided measures of four of the 16 Cattell factors. These were: ego strength and emotional stability (Cattell factor C), imaginativeness, as opposed to practicality (factor M), experimentingness or radicalism (factor Q1), and self-control and social rule following (factor Q3). The other questionnaire given at this visit provided two maternal scores: positive attitude toward the child, and knowledge about child rearing and child development.

Bayley Scales of Infant Development

The Bayley test was administered and scored according to instructions in the manual, giving four Bayley scores for each infant: a Mental Scale score and Motor Scale score at 11½ and 17 months.

Social-Play (Laboratory) Probe

Measures of the infant's social responsiveness to the observer and a stranger were calculated according to a scheme which gave high positive weights (+3 or +2) to approaching the adult or vocalizing to her, moderately positive weights (+1) to looking or smiling at her, a neutral score (0) to ignoring her, slightly negative weights (−1 or −2) to frowning or whimpering, and strongly negative weights (−3) to avoiding her or crying. The final social responsiveness measure was the mean of these weighted scores for each replication of the "approach sequence."

Two measures of the infant's attachment to his mother were based on data from this visit. One (intensity of attachment) was the total number of proximity- or attention-seeking behaviors displayed by the infant during the entire session. These behaviors were weighted so that approaching the mother, clinging to her, or following her when she left received higher scores than smiling or vocalizing to the mother or crying or fretting when the stranger approached or the mother left; these behaviors, in turn, received higher scores than ignoring or merely looking at the mother. The

second attachment measure (attachment category) was a qualitative classification of the infants according to Ainsworth's categories (Ainsworth et al. 1969). The five attachment groups thus formed could be designated "unattached," "low attached," "secure attached," "very attached," and "malattached."

One measure of the infant's play behavior was the level of schema development (according to the Uzgiris-Hunt hierarchy) which he exhibited in free-play episodes in the laboratory when the mother was present. A measure of his variety- or stimulation-seeking behavior consisted of the number of different toys with which he played during these free-play periods. The average number of minutes during mother-present free play that the baby played with a single toy was taken as a measure of his length of involvement. For a comprehensive play measure incorporating both the infant's choice of toys and his activities with them, the 13 toys were assigned weights based on the diversity of activities they offered, the complexity of the socially approved schemas which they usually elicited, and their novelty for a child of this age. The product of this "toy level" and the schemas which the infant used with the objects was calculated and called the "play level."

Since a 2-month age spread was unavoidable in administering this probe, the distribution of scores made by biweekly age groups was examined. Slight compensatory age corrections were made in order to equalize the mean scores of the age groups for the schema, play level, intensity of attachment, and social responsiveness measures. The corrected scores were not correlated with the infants' ages.

Uzgiris-Hunt Series

A rank score was calculated for each child on the four developmental series tested in the Uzgiris-Hunt probe: I—Visual Pursuit and Permanence of Objects, II—Development of Means for Achieving Desired Environmental Events, III—Development of Schemas in Relation to Objects, and V—Construction of the Object in Space.

Since there was for this probe, too, an age range of just over 2 months, two procedures were employed to examine the effect of age differences of this magnitude on performance on the Uzgiris-Hunt test items. Five babies who had been tested at approximately 12 months were retested at 14 months, and changes in their scores were examined. Also, the distributions of the scores when infants were divided into weekly age groups were examined for age trends within the 2-month period. By both procedures, no age trends were apparent for Series I, II, and III. An increasing trend was evident in Series V, however. Consequently, age corrections to equalize means for weekly age groups were made on scores from Series V. This made the correlation of these scores with age at testing very close to zero.

Language Assessment

Each component of the infant language probe—comprehension, expressed vocabulary, and verbal responses—received a separate score based on the proportion of correct responses. The number of different distinct words uttered by the child during the home observation visits comprised another index of the infant's language competence. On the basis of the particular words which the child was observed or reported to have said by 18 months, children were divided into "referential word learners" and "social-expressive word learners" (Nelson 1971).

Measures of maternal language consisted of the PPVT score and the diversity of content in the maternal language sample recorded during the seventh observation (according to 19 possible content categories).

DATA CONSOLIDATION

The scoring procedures which have been described resulted in a total of more than 100 different measures (many repeated three times), a number which it was not statistically reasonable to analyze simultaneously. The next type of data reduction, therefore, was to consolidate these measures into a smaller, statistically stronger set of distinct variables.

Different measures of conceptually related or identical behaviors were combined whenever correlations were $\geq .45$ ($N = 36$). Thus, correlated ratings and observed frequencies of the same behaviors (e.g., rating and frequency of mother's verbal stimulation) were combined; correlated components of the same test or probe (such as the three parts of the language probe) were combined; and correlated measures of the same behaviors in different settings (e.g., schema development observed at home and in the laboratory) were combined. The resulting reduced set of variables and their components are displayed in table 2; footnote [b] illustrates how to interpret the summarized calculation of each variable.

DATA ANALYSIS

Several types of statistical analysis were performed on the core set of variables. Pearson product-moment correlation coefficients were calculated to discover individual relationships among infant variables, among maternal variables, and between the two sets of variables. To investigate effects over time, maternal variables measured at Time 1 (11 months) were correlated with infant variables measured at Time 3 (17 months), and these correlations were compared with those between infant variables measured at Time 1 and maternal variables at Time 3. A test for the significance of differences between correlation coefficients which takes into account all the intercorrelations between contemporaneous and time-lagged variables (Peters & Van

Voorhis 1940, pp. 185–189) was made on these cross-lagged correlational differences.

When variables were significantly correlated across the three time periods at which they were assessed, mean scores for these measures were calculated, weighted by the number of observation visits on which the scores were based. When measures were not correlated across time, either the Time 3 measure or both Time 1 and Time 3 measures were used in further analyses instead of the weighted mean. Multivariate analyses on these measures were then performed. A principal-components factor analysis was made on a set of 23 infant variables to discover those variables which clustered together; the same was done with 26 maternal variables. The variables used in the factor analysis were selected from among the total 32 infant and 34 maternal variables to be, as much as possible, methodologically independent (i.e., having no overlapping behavioral units). Factor analyses with one varimax rotation resulted in five infant factors and six maternal factors with eigenvalues greater than one. Relationships between the two sets of factors were then analyzed by stepwise multiple regression.

Group differences on demographic and psychological dimensions were examined by analysis of variance on mean scores and on repeated measures (Winer 1962). When measures were extreme proportions, the arcsin transformation suggested by Winer was performed first to normalize their distributions. Such analyses tested the significance of differences between groups based on observer, sex, race, infant's attachment category, and selected maternal characteristics, and the significance of linear or quadratic trends. The Mann-Whitney *U* statistic (Guilford 1965) was used to test the significance of differences between specific pairs of means.

III. RESULTS AND DISCUSSION

The results of the study will be presented in five sections. The first involves a simple description of how young children, 9–18 months old, living in relatively poor families, usually spend their waking time. The second section presents interrelations among individual infant variables, changes in children's behaviors which occur across age, and differences in children's competencies related to sex and race. The third section presents a parallel treatment of maternal variables. Relations between these two sets of variables are the focus of the fourth section. Finally, in the last section, evidence for cause and effect relations between maternal and infant variables is examined. Except when otherwise noted, only statistically significant results ($p < .05$ or $p < .01$) are discussed.

1. A DAY IN THE LIFE . . .

At 9–13 months of age, the infants spent a high proportion of time with their mothers. Even though, in these homes, the number of rooms available (mean = 4.7; range 3–6) was sufficient to permit separation of mother and child, the infants spent about 84% of their waking time in the same room as their mothers (range 56%–99%) and 53% within arm's reach of her.[2] By the time the child was 16 or 17 months old, the average

[2] It is impossible to know how the presence of the observer affected these proportions. However, it cannot be assumed that the observer's presence necessarily created an inflated estimate of the amount of time mother and infant naturally spent together rather than an underestimate. The observer discouraged the mother's attempts at interaction with her and continually emphasized that she was interested in the infant's activities, not the mother's; therefore, it is unlikely that mothers deliberately spent more time in the child's room just to be with the observer. From extensive informal conversations with these mothers about child rearing, it also appears doubtful that mothers spent more time with the child in order to impress the observer with their attentiveness. Furthermore, since the children did not display any other behavioral indices of anxiety toward the ob-

proportion of the time spent with the mother had dropped to 77% (range 38%–97%), and the time during which mother and child were within arm's reach had decreased to 45%.

Considering the high proportion of time mother and child spent together, it is interesting that only during about 36% of the time the infant was awake were he and his mother interacting in any way—physically, socially, verbally, or visually. Table 3 presents the relative proportions of different types of interaction as well as other infant activities; figure 5 displays the overall patterns of activities graphically.

The infant's activities were divided into time spent involved with physical objects, interacting with mother, interacting with other people, satisfying physical needs, and moving from one place to another. At 9–13 months, about equal time was given to interacting with mother and to playing with physical materials (38% and 37%, respectively). When the child was 16 or 17 months old, the proportion of time spent interacting with mother was approximately the same as before (34%), but fully half the child's time was spent playing with, looking at, and investigating objects. During about 40% of this time, he was engaged with conventional toys; the other 60% was taken up by examining household objects—pots, spoons, clothes, appliances, crumbs on the carpet, and so forth. The average number of different toys and objects to receive attention during 10½ hours of observation was 43 (range 39–71). The child's activities with objects were likely to include manipulating, shaking, banging, pushing, pulling, and putting in and out. By 16 or 17 months, he was also able to use many objects according to their intended functions (e.g., drinking from cups, throwing balls, rocking dolls, turning pages of books).

Television was a frequent accompaniment to infant and maternal activities in these homes; on the average, the television set was turned on during four of the seven observation visits, for 58% of the half-hour observation sessions. However, at this age, children actually *looked* at television on the average less than 10 minutes a day (2% of an 8-hr day), and the maximum watched by any child was an estimated 1 hour per day.

The time spent by the child looking at television was, interestingly, of the same magnitude as the time he typically spent looking at and interacting with the people in his environment (other than his mother or the observer). In these families where the mother was the primary caretaker, other people had very little contact of any kind with the study children. The number of people available in the home during observational visits, including grandparents, fathers, cousins, friends, and neighbors, ranged from 0 to 20 (for seven visits). On the average, there was one additional person present during any observation.

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server, it does not seem entirely likely that they would have initiated an unnatural amount of time near the mother.

TABLE 3

MATERNAL AND INFANT ACTIVITIES AS PROPORTIONS OF THE TIME THE INFANT WAS AWAKE

	INFANT'S TIME AWAKE						
	Mean Proportion Time 1	Range of Proportions Time 1		Mean Proportion Time 3	Range of Proportions Time 3		F^a Change from Time 1 to Time 3
		Low	High		Low	High	
Maternal contact:							
Attending infant's physical need	.084	.012	.235	.047	.000	.224	16.34**
Restricting infant's activity	.182	.033	.453	.170	.049	.513	
Physical contact with infant	.138	.010	.363	.081	.004	.388	15.14**
Stimulating infant with materials	.044	.001	.187	.046	.000	.291	
Looking at infant	.390	.127	.650	.365	.124	.757	
Eye-to-eye contact	.072	.020	.177	.071	.021	.137	
Positive emotion toward infant	.054	.005	.150	.050	.004	.133	
Verbal stimulation	.236	.044	.578	.276	.071	.715	
Instrumental speech	.045	.008	.092	.072	.012	.256	22.69**
Social speech	.062	.002	.218	.057	.007	.174	
Referential speech	.105	.008	.330	.106	.009	.314	
Infant activities:							
Positive mother-directed activities (looks, holds, smiles, goes M, gives, etc.)	.223	.098	.393	.205	.069	.335	
"Going" from place to place	.062	.007	.187	.118	.050	.305	35.95**
Looking at or playing with materials	.430	.284	.593	.499	.252	.735	13.45**
Playing with materials	.367	.261	.513	.441	.206	.681	15.93**
Playing with toys	.122	.008	.339	.168	.008	.406	7.56**
Playing with objects	.242	.068	.476	.265	.085	.422	
Looking at television	.025	.000	.118	.022	.000	.114	
Crying, fretting, negative expression	.080	.016	.163	.071	.006	.166	
Eating	.134	.016	.303	.141	.002	.322	
Interacting with people (excluding mother and observer)	.017	.000	.100	.022	.000	.159	

TABLE 3 (*Continued*)

	INFANT'S TIME AWAKE						
	Mean Proportion Time 1	Range of Proportions Time 1		Mean Proportion Time 3	Range of Proportions Time 3		F^a Change from Time 1 to Time 3
		Low	High		Low	High	
Mutual mother-infant activities or locations:							
In same room	.838	.562	.990	.768	.377	.969	6.79*
Within arm's reach	.527	.327	.725	.451	.158	.734	11.37**
Interacting	.382	.097	.667	.340	.097	.758	
Playing	.036	.000	.161	.042	.000	.274	

NOTE.—In all tables showing analyses of variance for sex, race, or time, only significant *F* values are included.
[a] Analysis of variance, $df = 1,34$.
* $p < .05$.
** $p < .01$.

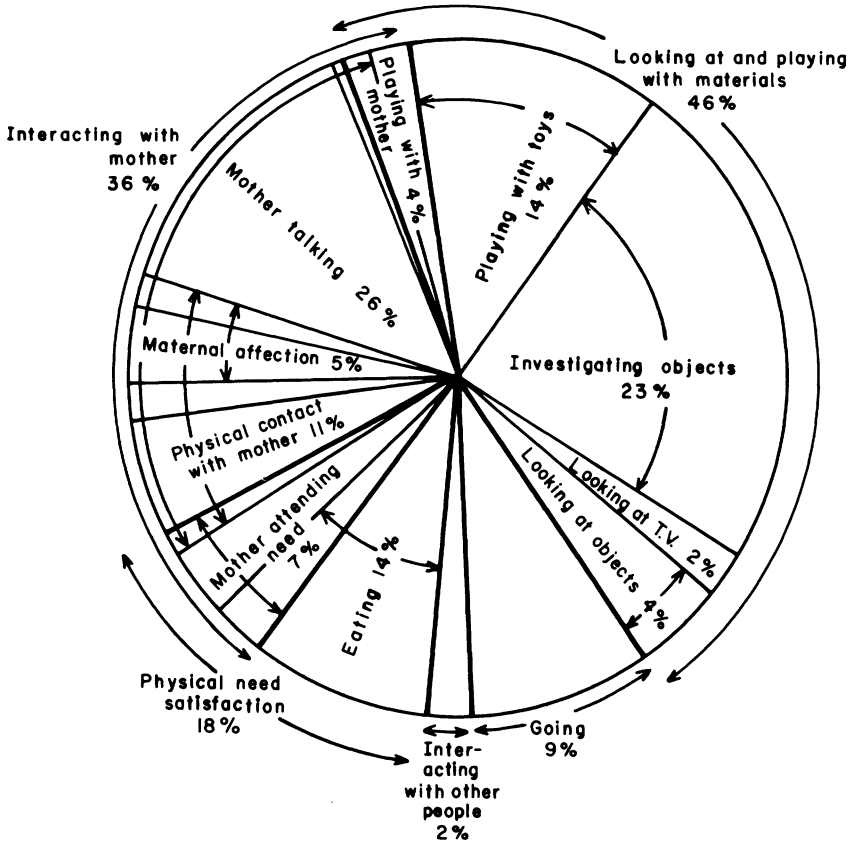

FIGURE 5.—Diagram representing relative proportions of maternal and infant activities during the time the infant was awake, based on home observation data from 9 to 18 months.

On the basis of quantity, maternal contact was clearly the central component of the child's social experience. In the study, contact with the mother was divided into several qualitative categories. The most frequently observed maternal behavior directed at the infant was visual attention. The mother looked at her child, at least briefly, during almost 40% of the 10-second time units during which he was awake. The second most frequent form of maternal contact was verbal (25%). Wide individual variations in frequency were especially evident on this dimension of maternal behavior; the amount of verbal stimulation directed toward the child ranged from 4% to 72%. Examining the content of this maternal speech revealed that most frequently the mother was labeling, describing, and talking about things in the environment, including the child (40%–45%). At 9–13

months, 25% of the mother's speech was social in content—singing, soothing, positively affective speech, verbal games—and 20% was directive; but by 16–17 months these percentages were reversed. Mothers were becoming relatively less verbally playful and more demanding of their children. The amount of physical contact between most mother-child pairs had also declined, from 14% to 8%, although there were several children who were still in physical contact with their mothers from 30% to 40% of the time. Physical caretaking—feeding, diapering, cleaning, dressing—was also a decreasingly frequent activity for the mother. Although the child continued to spend the same amount of time eating (14%), he was more likely to be feeding himself by this age, and consequently the mother was not so often engaged in active caretaking.

Relatively infrequent forms of maternal contact overall were affectionate behavior (5%) and stimulation with toys and other objects (5%). Even less frequent was any mother-child interaction that could be called playful—whether it involved toys or objects, conventional games, or any enjoyable shared activity. Children were engaged in this kind of interchange only 4% of the time they were awake (i.e., less than ½ hour a day). The maximum proportion of time that any child spent playing with the mother was 27%. Generally, however, the percentage was much lower, and for some mother-infant pairs observed play was nonexistent.

This description of the daily home activities of children 9–18 months old applies to black and white families of relatively low socioeconomic status. In general, these children were not left alone or neglected; they spent nearly all of their waking time with their mothers. However, mother and child actively interacted much less frequently, and, when they did, the contact was seldom playful, stimulating, or affectionate. The situation may be quite different for children of more highly educated and wealthy parents. Therefore, caution must be applied in generalizing from these data. It is unfortunate that equivalent descriptive data for middle-class homes are not available.

2. THE CHILDREN

A basic premise of this study, which influenced both design and analysis, was that in order to understand the nature of mother-child interaction it is not appropriate to examine only single, isolated relations between specific pairs of maternal and infant variables; rather, it is important to examine patterns among many variables. Consequently, relations among the entire set of infant variables are developed in this section, prior to consideration of particular mother-child relationships. Results are discussed in three subsections: (*a*) relations among different areas of development, (*b*) developmental changes, and (*c*) individual differences in these areas.

a) Complexity and Competence

In general, conceptually related measures of the child's behavior were found to be correlated (table 4). Measures of the child's cognitive development—the complexity of schemas exhibited spontaneously, awareness of the permanence of objects, complexity of play behavior in the laboratory, variety of objects played with there, and the speed with which the child processed information (length of involvement with different toys in the laboratory [see Messer & Lewis 1972])—were intercorrelated. Assessments of language and communicative competence (language probe, amount of vocalization, vocalization to mother, giving things to mother) were intercorrelated as were measures of the child's social development (individual attachment behaviors, responsiveness to the mother, and stranger anxiety). Moreover, not only were relationships evident among different measures of these separate areas of development, relations between the developmental systems were also observed. The Bayley Scale of Mental Development, which is a comprehensive measure of performance in each of these three areas of development, provides a summary of these intercorrelations. Scores on the second Bayley test were highly correlated with other independently assessed cognitive, language, and social measures. The child's ability to understand and use language at 17 months was also correlated with many conceptually independent measures, including those which were nonverbal (motor development, involvement with objects, complexity of play with toys). These intercorrelations may indicate a general competence and motivation which provides a basis for performance in all areas of development. They dramatize the necessity for multivariate research.

Factor analysis of infant variables provided further evidence for the existence of a general overall competence by demonstrating that competence in one area of development is related to competence in other areas. The set of 23 variables included in the analysis is indicated in table 2; the factors are summarized in table 5. The most powerful factor (I)—labeled "competence"—included measures of cognitive and intellectual ability, motivation to perform in new situations, language skill, frequent expression of joy, and positive interest in and attachment to the mother. Another kind of competence was represented by the factor labeled "early test talent" (III). This seemed to reflect the ability to do well in test situations at about 1 year of age. This early ability was not, however, related to general competence (factor I). It may represent a precocity which is associated with later retardation, as found by Geber (1958). These competence factors contrasted with the "personal style" factors: object orientation (II)—a tendency to spend a lot of time deeply involved with different physical objects in the environment; physical attachment (IV)—a preference for staying in close physical contact with the mother; and irritability (V)—which indicated a high degree of crying, fretting, or expressing negative emotion physically.

TABLE 4

INTERCORRELATIONS AMONG INFANT VARIABLES*

Infant Variables[a]	Intercorrelations										
	1	2	3	4	5	6	7	8	9	10	11
1. Toy variety (L)											
2. Obj. inv. (L)											
3. Play (L)	.33										
4. Long obj. inv.											
5. Schema (O)			.59								
6. Stim. by obj.				.59							
7. Num.-var. obj. (O)				.50		.70					
8. Obj. perm. (UH)		—.34									
9. Schema (UH)						.42					
10. Obj. relns. (UH)				—.33					.41		
11. Bayley Ment. 1									.55	.38	
12. Bayley Ment. 2		—.47	.53		.49					—.34	
13. Language		—.39	.58		.65			.37		—.33	
14. Vocn.											
15. Voc. M		—.35									
16. Attachment (L)						—.40					
17. Attachment (O)			.44					.39		—.38	
18. Phys. attach.								—.36			
19. + Involv. M					.46						
20. Looks M					.37	—.37					
21. Gives M		—.45	.41		.57			.54		—.37	
22. + Emotion	.38				.35					—.33	
23. Soc. resp. (L)											
24. Interact O											
25. Neg. beh.											
26. Respons.											
27. Motor dev. T1			.42								
28. Motor dev. T3											
29. Activity T1						.41					
30. Activity T3						.41					
31. Phys. needs T1					—.33	—.39					—.36
32. Phys. needs T3				—.37		—.49					

TABLE 4 (*Continued*)

Infant Variables[a]	Intercorrelations										
	12	13	14	15	16	17	18	19	20	21	22
13. Language	.73										
14. Vocn.		.46									
15. Voc. M	.35	.45	.58								
16. Attachment (L)											
17. Attachment (O)	.44	.36									
18. Phys. attach.					.55						
19. + Involv. M	.42	.41		.40		.61	.43				
20. Looks M		.57		.38		.54		.80			
21. Gives M	.52	.61	.55	.38		.41		.45			
22. + Emotion	.56	.50				.50		.57	.52		
23. Soc. resp. (L)			.34		—.67						
24. Interact O											
25. Neg. beh.											
26. Respons.	.35						.40	.44	.35		.33
27. Motor dev. T1					—.50						
28. Motor dev. T3	.43										
29. Activity T1										.35	
30. Activity T3			.37							.50	.58
31. Phys. needs T1										—.34	
32. Phys. needs T3							.37				

	23	24	25	26	27	28	29	30	31	32
24. Interact O										
25. Neg. beh.										
26. Respons.			—.54							
27. Motor dev. T1										
28. Motor dev. T3										
29. Activity T1			—.38		.36					
30. Activity T3										
31. Phys. needs T1							—.43			
32. Phys. needs T3										

[a] Complete descriptions of these variables are in table 2.
* All significant correlations shown: $r_{p<.05} = .33$; $r_{p<.01} = .42$.

TABLE 5

SUMMARY OF INFANT FACTORS

I, Competence	II, Object Orientation	III, Early Test Talent	IV, Physical Attachment	V, Irritability
% Variance[a] Accounted For				
21.5	12.7	10.1	11.1	7.8
Variable[b] Loadings[c]				
−.57 obj. inv. (L)	.47 toy variety (L)	.77 Bayley Ment. 1	.68 attach. (L)	.70 neg. beh.
.60 play (L)	.74 long obj. inv.	.72 obj. relns. (UH)	−.53 soc. resp. (L)	
.77 Bayley Ment. 2	.85 stim. by obj.	.75 schema (UH)	.82 phys. attach.	
.81 language	.79 num.-var. obj. (O)			
.69 schema (O)				
.65 attach. (O)				
.63 + emotion				
.57 voc. M				
.63 looks M				
.49 obj. perm. (UH)				

[a] Cumulative percentage of variance accounted for = 63.1%.
[b] Complete descriptions of variables included in this analysis are in table 2.
[c] All variable loadings > .45 included.

The relations between these factors and maternal variables are dealt with in later discussion of mother-child interaction.

b) Developmental Change

Most noticeably, between 9 and 18 months, the child's dependency on his mother diminished and his interest in aspects of the physical environment increased (table 6). His proximity-seeking behaviors—looking at mother, following her, crying when she left, and seeking physical contact with her—became less frequent; and, concurrently, the proportion of time spent involved with objects, especially toys, the number and variety of objects contacted, and the prolonged attraction objects provided, increased. The child's ability to deal with objects and people also systematically improved (schema development [nonsignificantly], Bayley mental test raw scores, frequency of giving objects and vocalizing to mother, and responsiveness to mother's instrumental speech and social behaviors).

TABLE 6

CHANGES IN INFANT VARIABLES OVER TIME

Variable[a]	Mean Time 1 (11 Months)	Mean Time 2 (14 Months)	Mean Time 3 (17 Months)	F[b] Time	F[c] Linear Trend
Bayley Ment. Raw ..	100.9		124.6	10.53**	
Bayley Ment. DQ ..	103.9		103.9		
Schema (O)	4.6	5.8	6.1		
Attachment (O)	7.45	7.40	6.35		10.68**
+ Emotion	0.031	0.043	0.035		
+ Involv. M	0.214	0.234	0.194	3.72*	
Voc. M	0.041	0.057	0.063	9.01**	19.42**
Looks M	0.175	0.183	0.163		
Long obj. inv.	2.72		4.06	5.06**	
Stim. by obj.	0.429	0.479	0.500	6.96**	13.70**
Num.-var. obj.	40.2		43.0		
Phys. attach.	0.048	0.039	0.026	7.51**	22.11**
Neg. beh.	0.067	0.065	0.059		
Giving	0.002	0.007	0.008	16.38**	37.47**
Activity	4.8	7.2	7.2		
Phys. need	0.214	0.182	0.204		
Vocn.	0.205	0.217	0.257	6.10**	15.95**
Motor dev.	105.6		110.0		
Interact O	0.046	0.051	0.041		
Toy/obj.	0.678	1.19	0.937	3.35*	
R M's soc.	0.415	0.433	0.505	4.83*	10.02**
R M's inst.	0.045	0.136	0.190		28.89**
R M's obj.	0.624	0.563	0.617		
R M's phys.	0.643	0.607	0.648		

[a] Complete descriptions of these variables are in table 2.
[b] Analysis of variance, $df = 2,33$.
[c] Analysis of variance, $df = 1,33$.
* $p < .05$.
** $p < .01$.

Superimposed on these general developmental trends, a 14-month peak appeared in a number of measures. Children's social and positive emotional behavior toward their mothers tended to be more frequent at 14 months than either earlier or later. Although this finding may be an artifact of measurement caused by relatively fewer observations in this middle time period, it seems unlikely that such an explanation would completely account for the observed trend. Other measures based on the same number of observations, including measures of physical attachment (distress at the mother's absence and responsiveness to her physical contact), did not exhibit the peak. This finding suggests the possibility that the general trend of decreasing social attachment is not monotonic from 11 to 17 months. For these children it appeared that psychological and emotional independence from the mother did not begin until at least 14 months and that it was preceded by physical independence.

c) Differences in Infant Behavior Related to Sex and Race

Some research with children in the second year of life (Goldberg & Lewis 1969) has demonstrated sex differences in the way children play with toys in the laboratory. Although the present study did not reveal significant differences in *how* children play with objects, it did demonstrate a significant, perhaps related, difference in how *much* they played with toys and objects at home—both in total time and in the length of encounters (table 7). Boys were more object oriented. Girls, on the other hand, could be classified as more socially oriented. The girls' positive involvement with the mother and their language skills were significantly higher than those of boys. In fact, higher scores for girls were consistently, though not significantly, demonstrated on all competence variables. These findings are not novel; they concur with research describing the precocious development of girls (Kagan 1971) and their more intense attachment to mother (Goldberg & Lewis 1969; Messer & Lewis 1972; Miller et al. 1970). Since other studies (Ainsworth & Bell 1970; Maccoby & Feldman 1972; Schaffer & Emerson 1964a) have not found sex differences in children's attachment, however, this issue remains a controversial one awaiting further delineation and investigation.

The data in the present study demonstrated a discrepancy between groups which increased over time. This divergence, observed for girls and boys, was even more pronounced for differences between black and white children. Although assessments made when the children were under 14 months revealed few significant differences between the two racial groups, by the time the children were 16–17 months old numerous differences were apparent. By that age, the black children—who had excelled in early test performance—were consistently lower than the white children on measures of competence. They were also more irritable and unhappy, vocalized less, were less active, and were more physically attached to their

TABLE 7

DIFFERENCES IN INFANT BEHAVIORS RELATED TO SEX AND RACE

Variable[a]	Black Male Mean	Black Female Mean	White Male Mean	White Female Mean	Race F[b]	Sex F	Interaction F
			All Visits				
Factor I, competence	−0.85	−0.16	0.35	0.67	11.79**		
Factor II, object orientation	−0.18	−0.25	0.89	−0.47		5.63*	4.29*
Factor IV, phys. attachment	0.34	0.48	−0.27	−0.60	7.00*		
Factor V, irritability	0.30	0.47	−0.11	−0.38	4.27*		
			Time 1				
Factor I, competence:							
Obj. inv. (L)	3.86	3.39	3.11	3.22			
Play (L)	14.3	15.4	18.4	21.1	6.57*		
Schema (O)	4.2	4.9	4.7	4.6			
Attachment (O)	7.1	6.9	7.5	8.3			
+ Emotion	0.028	0.023	0.042	0.031			
+ Involv. M	0.201	0.229	0.209	0.216			
Voc. M	0.048	0.041	0.035	0.039			
Looks M	0.172	0.165	0.177	0.189			
Obj. perm. (UH)	12.5	13.1	21.7	27.4	14.87**		
Factor II, object orientation:							
Toy variety (L)	3.24	3.83	4.44	3.72			
Long obj. inv.	3.56	1.67	2.44	3.00			
Stim. by obj.	0.436	0.437	0.434	0.410			
Num.-var. obj.	41.1	40.2	42.6	37.0			

TABLE 7 (*Continued*)

Variable[a]	Black Male Mean	Black Female Mean	White Male Mean	White Female Mean	Race F[b]	Sex F	Interaction F
				Time 1			
Factor III, early test talent:	0.32	0.49	—0.51	—0.31	6.20*		
Bayley Ment. 1	104.9	106.1	98.6	105.9			
Obj. relns. (UH)	26.3	22.0	13.6	12.8	22.27**		
Schema (UH)	16.6	21.9	20.3	16.3			
Factor IV, phys. attachment:							
Attachment (L)	171.1	153.3	125.7	138.7			
Soc. resp. (L)	8.66	6.47	5.03	6.00			
Phys. attach.	0.049	0.066	0.042	0.037			
Giving	0.001	0.003	0.003	0.003			
Activity	4.60	4.45	4.94	5.02			
Phys. needs	0.245	0.225	0.203	0.184			
Vocn.	0.230	0.227	0.172	0.191			
Motor dev.	103.0	100.6	110.6	108.1			
Interact O	0.051	0.046	0.028	0.058			

[a] Complete descriptions of these variables are in table 2.
[b] Analysis of variance, $df = 1,32$.
* $p < .05$.
** $p < .01$.

TABLE 7 (*Continued*)

Variable[a]	Black Male Mean	Black Female Mean	White Male Mean	White Female Mean	Race F^b	Sex F	Interaction F
	Time 3						
Factor I, competence:							
Bayley Ment. 2	94.7	98.8	109.9	112.4	9.07**		
Language	18.8	42.6	53.1	64.7	14.49**	5.68*	
Schema (O)	5.8	5.7	6.4	6.4	6.12*		
Attachment (O)	5.4	5.7	6.7	7.5	4.87*		
+ Emotion	0.025	0.022	0.049	0.044	9.96**		
+ Involv. M	0.148	0.199	0.194	0.233		4.26*	
Voc. M	0.050	0.066	0.062	0.073			
Looks M	0.152	0.164	0.152	0.184			
Factor II, object orientation:							
Long obj. inv.	3.56	3.22	7.11	2.33		12.48**	9.44**
Stim. by obj.	0.482	0.415	0.622	0.477	7.99**	8.69**	
Num.-var. obj.	42.9	40.6	45.9	42.6			
Factor IV, physical attachment:							
Phys. attach.	0.024	0.037	0.018	0.025			
Giving	0.003	0.004	0.010	0.015	23.41**		
Activity	5.59	5.18	8.73	9.25	38.70**		
Phys. needs	0.142	0.299	0.161	0.216		10.84**	
Vocn.	0.213	0.228	0.275	0.313	7.40*		
Motor dev.	115.8	107.4	107.0	109.8			
Interact O	0.046	0.045	0.025	0.048			

mothers.[3] Differences on measures of competence and activity have been observed between groups of children from different social classes (Kagan 1971; Messer & Lewis 1972; Wachs et al. 1971). The differences observed here between black children and white children included physical and emotional behavior to the mother as well.

3. MOTHERS

Changes in Maternal Behavior

Over the 9-month period of the present study, the children were not the only ones who changed—their mothers changed, too (table 8). The child's increasing independence was reflected by the mother's decreasing attention (physical contact, caretaking, social stimulation) and increasing "rejection" (leaving the child, punishing him, scolding him). The 14-month peak for children's attachment to their mothers was paralleled by the mothers' more frequent social behavior directed toward the children at that age (looking, playing, initiation of speech).

As the children got older, mothers became more directive and more effective in their direction. They also became more responsive to their children's behavioral expressions, particularly to their social behaviors—possibly because children were becoming more skilled at signaling their social desires. There was no change in the frequency of maternal responsiveness to distress, perhaps because by 10 months of age, when this study began, crying and fretting were already well-formed communicative behaviors.

Characteristics of Maternal Care

The behavior and relations that characterize maternal care present a complicated picture (table 9). Consequently, as with the infant variables, a set of 26 behaviors and characteristics which represented various distinct aspects of maternal functioning was factor analyzed (see table 2 for the complete list of variables thus analyzed). The resulting factors and their components are listed in table 10.

The first and most comprehensive maternal factor can be called "optimal maternal care." This factor depicts maternal care which was not only warm, loving, and nonrejecting but which was stimulating and enriching—

[3] There exists the possibility of the effect of observer artifact on these racial differences, since all black families were visited by only one observer. However, the prestudy interobserver agreement and ongoing reliability checks indicated that (*a*) agreement between the black observer and the white observers was as high as that between white observers; (*b*) no observer differences were found by analysis of variance between the white observers' scores; and (*c*) the children's behaviors, when assessed in the laboratory by other (black and white) observers, exhibited differences similar to those observed in the home.

TABLE 8

CHANGES IN MATERNAL VARIABLES OVER TIME

Variable[a]	Mean Time 1	Mean Time 2	Mean Time 3	F^b Time	F^c Linear Trend
+ Attit. (O)	3.78	3.37	3.50		
+ Emotion	8.95	9.66	7.90	4.53*	
Phys. cont.	5.16	4.33	3.39	7.18**	18.43**
Caretaking	0.084	0.055	0.047	10.10**	16.35**
Restrict.	0.245	0.263	0.255		
Reject.	0.054	0.067	0.079	7.68**	19.43**
Direct.	0.063	0.095	0.110	27.39**	55.39**
Looking	0.407	0.434	0.385		
Verb. stim.	6.49	6.51	7.38		
N-R speech	0.074	0.078	0.064		
Ref. sp. ratio	0.98	0.66	0.74		
Giving	0.021	0.026	0.021		
Stim. w obj.	2.09	2.10	1.76		
Soc. stim.	4.99	4.90	4.14	5.60**	10.41**
Playing	0.036	0.046	0.042		
Interacting	0.382	0.379	0.340		
Same room	0.838	0.826	0.768		6.79*
Approp.	4.66	3.99	3.97	6.67**	9.60**
Effect.	8.19	7.47	8.25		
Effect. inst.	0.045	0.136	0.190		28.89**
Effect. obj.	0.624	0.563	0.617		
Respons.	6.39	6.86	7.33	7.55**	15.71**
R distress	14.4	12.8	14.1		
R soc.	7.80	7.94	8.28		
Effect. phys.	0.643	0.607	0.648		
Effect. soc.	0.415	0.433	0.505	4.83*	10.02**
E/E cont.	0.072	0.082	0.070		

[a] Complete descriptions of these variables are in table 2.
[b] Analysis of variance, $df = 2,33$.
[c] Analysis of variance, $df = 1,33$.
* $p < .05$.
** $p < .01$.

visually, verbally, and with appropriate materials—and which, as well, was immediately and contingently responsive both to the child's signs of distress and to his social behaviors. This factor was also correlated with conceptually related variables not included in the factor analysis. A mother who was high on this factor spent more time in the same room as her child, interacting with him, playing with him, and in eye-to-eye contact with him. Moreover, she provided him with more toys, and with toys of greater variety. This "optimal" mother continued to behave adaptively; her responsiveness to the child's social demands, her playfulness, her social stimulation were correlated with an increasing frequency of playing and stimulating the child as he got older. The existence of this factor of general maternal competence clearly demonstrates that maternal behaviors which stimulate child development are interrelated.[4]

[4] A methodological concern in this research, pointed up by the comprehen-

TABLE 9

INTERCORRELATIONS AMONG MATERNAL VARIABLES*

Maternal Variables[a]	Intercorrelations											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Age												
2. PPVT	.43											
3. Knowledge	.37	.69										
4. Ego (C)		.46										
5. Imag. (C)		.53	.41									
6. Expt. (C)		.42	.37		.41							
7. Control (C)				.52								
8. + Attit. (I)												
9. + Attit. (Q)		.48	.63				.34	.35				
10. + Attit. (O)												
11. + Emotion	.38	.63	.49					.42	.56	.48		
12. Phys. cont.								.41				
13. Caretaking			—.34	—.33					—.37		—.38	
14. Restrict.		—.50	—.43			—.36					—.44	.52
15. Reject.										—.41		—.53
16. Direct.		—.39					.34			—.47		
17. Looking		.63	.34		.34				.35		.62	
18. Verb. stim.		.65	.40		.36				.45		.82	
19. N-R speech		.42						.39	.37	.36	.75	
20. Giving		.59	.45		.43				.46		.45	
21. Stim. w obj.		.55	.51		.34				.51	.35	.70	
22. Soc. stim.		.63	.35						.43	.38	.84	
23. Playing		.42							.40		.63	
24. Interacting		.50			.33						.61	.58
25. Same room											.44	.44

TABLE 9 (*Continued*)

Maternal Variables[a]	Intercorrelations											
26. Approp.	.37	.56	.46		.36			.47	.51	.56	.72	
27. Effect. inst.			.42								.49	
28. Effect. obj.		.35			.35					.40	.57	.42
29. Respons.		.65	.33		.33				.36	.36	.68	
30. R distress		.42							.34	.56	.58	.44
31. R soc.		.63	.36						.44	.44	.80	.33
32. Num. toys		.38									.40	
33. Var. toys			.37	.43							.36	
34. Ref. sp. ratio T3				.40				.41			.43	
35. Effect. soc. T3										.34		
36. Effect. phys. T3												.35
	13	14	15	16	17	18	19	20	21	22	23	24
14. Restrict.	.42											
15. Reject.												
16. Direct.		.37										
17. Looking		—.51										
18. Verb. stim.		—.44			.85							
19. N-R speech					.48	.72						
20. Giving		—.41			.75	.69	.35					
21. Stim. w obj.	—.46	—.52			.68	.81	.46	.60				
22. Soc. stim.		—.52	—.33		.87	.93	.68	.68	.80			
23. Playing	—.34	—.35	—.51		.70	.73	.35	.50	.86	.80		
24. Interaction			—.50		.76	.87	.59	.64	.62	.80	.69	
25. Same room			—.58		.33	.56	.38		.51	.51	.57	.68
26. Approp.		—.36	—.36		.51	.68	.52	.39	.71	.67	.56	.53
27. Effect. inst.			—.54			.47			.57	.45	.57	.39

[a] Complete descriptions for these variables are in table 2.
* All significant correlations shown: $r_{p<.05} = .33$; $r_{p<.01} = .42$.

TABLE 9 (*Continued*)

Maternal Variables[a]	Intercorrelations											
	13	14	15	16	17	18	19	20	21	22	23	24
28. Effect. obj.			—.48		.41	.57	.46	.47	.61	.59	.61	.60
29. Respons.		—.51	—.40		.85	.89	.50	.71	.75	.87	.69	.81
30. R distress			—.57		.52	.69	.42	.51	.63	.65	.56	.69
31. R soc.		—.43	—.37		.83	.87	.66	.62	.69	.92	.68	.76
32. Num. toys		—.40	—.36		.51	.58			.58	.47	.49	.45
33. Var. toys			—.33			.38			.38	.33	.39	.34
34. Ref. sp. ratio T3					.55	.67			.58	.69	.41	.51
35. Effect. soc. T3			—.48					—.38				
36. Effect. phys. T3		.38	—.57									
	25	26	27	28	29	30	31	32	33	34	35	36
26. Approp.	.37											
27. Effect. inst.	.55	.40										
28. Effect. obj.	.56	.53	.43									
29. Respons.	.58	.68	.41	.58								
30. R distress	.65	.67	.47	.62	.80							
31. R soc.	.42	.76	.40	.60	.87	.69						
32. Num. toys	.35	.59			.67	.53	.50					
33. Var. toys		.56			.35	.39	.47	.48				
34. Ref. sp. ratio T3			.56	.37	.66	.38	.62					
35. Effect. soc. T3			.52	.41		.36						
36. Effect. phys. T3	.36		.51	.38		.35					.67	

TABLE 10

SUMMARY OF MATERNAL FACTORS

I, Optimal Care	II, Effectiveness	III, Control	IV, Cuddling	V, Intellectuality	VI, Restrictiveness
		% Variance[a] Accounted For			
28.7	11.6	8.8	7.1	10.7	8.4
		Variable[b] Loadings[c]			
.89 verb. stim.	.91 effect. phys.	.83 control (C)	.84 + attit. (I)	.78 expt. (C)	.75 caretaking
.88 R soc.	.86 effect. soc.	.75 ego (C)	.61 phys. cont.	.70 knowledge	.51 restrict.
.87 soc. stim.	.58 effect. inst.			.69 PPVT	.51 phys. cont.
.87 R distress	−.51 reject.			.68 imag. (C)	−.51 + attit. (O)
.78 ref. sp. ratio					
.77 stim. w obj.					
.76 approp.					
.71 + emotion					
.58 effect. obj.					
−.56 reject.					

[a] Cumulative percentage of variance accounted for = 75.4%.
[b] Complete descriptions for variables included in this analysis are in table 2.
[c] All variable loadings > .50 included.

An independent cluster of variables revealed by factor analysis calls attention to maternal effectiveness (II). A high score on this factor indicated that when the mother initiated physical or social contact with the child it was accepted and enjoyed. The mother was not rejecting. She effectively soothed and calmed her child when he was distressed. The child attended when she talked to him; he obeyed her when she directed him.

A third factor which appeared in this analysis was labeled "control" (III). It was a composite of two personality factors from the Cattell personality test: self-control, and ego strength. This factor, interestingly, was also correlated with two behavioral indices of maternal control over the child: maternal directiveness (a behavior which was not included in the factor analysis), and effectiveness of maternal instrumental speech at Time 3.

"Cuddling" was the name given the fourth maternal factor, which represented a positive attitude toward infants and a high degree of physical contact. Physical contact was also significantly related to the total amount of interaction between mother and child, to maternal responsiveness to distress, and negatively to the mother's rejection. The notion that a positive and accepting maternal attitude is related to affectionate, nondirective, and social maternal behaviors was supported for affection and mother-initiated social behaviors (table 9). Moreover, a positive maternal attitude was negatively correlated with maternal directiveness at Time 3.

This factor of *warm* physical contact contrasted with factor VI which may be characterized as *restrictive* physical contact. The variables which made up this factor were: an unaccepting, negative attitude toward the child; frequent physical caretaking and contact; and restriction of the child's freedom by physical restraint or manipulation, punishment, verbal control, taking away his playthings, or refusing to give him what he wanted. Furthermore, these maternal variables of restrictiveness and caretaking were negatively correlated with stimulating, responsive, playful, and appropriate maternal behavior.

The other factor (V) revealed by this analysis reflected the intellectual aspect of mothering: verbal intelligence, imagination, the desire to experiment, and knowledge about child rearing and child development. This factor is interesting not only for the demonstrated relations among variables within it—which are predictable since they all represent some kind of intellectual predilection or ability—but for the relations it has with other,

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siveness of the first maternal factor, was the possibility of a halo effect—since one observer collected nearly all the data for each mother and child. Since the observers' task was demanding, immediate, and on a highly specific and minute level, however, biasing of observation was unlikely. Moreover, observers did not score their own observations (these were all scored by the investigator), nor were the observers aware of any hypotheses or issues being examined.

independent maternal variables. Research has demonstrated that verbal intelligence or intellectual ability predicts success in school or business. From this study, it appears it may also predict success at mothering. The mother's PPVT score and her knowledge about child development were highly correlated with her positive attitude toward children, and with all variables of "optimal care," giving support to the proposition that stimulating and competent maternal behaviors are related to maternal intelligence. The relation between maternal vocabulary level and other indices of maternal competence parallels that observed between infants' language competence and competence in other areas of development. Language skill may well be an easily assessed index of a broader general competence—for both mother and child.

Differences in Maternal Behavior Related to Sex and Race

Researchers who have observed sex differences in infants have often attributed these findings to differences in mothers' handling of boys and girls (e.g. Goldberg & Lewis 1969; Moss 1967). They have also observed some maternal behavioral differences to substantiate their claim (Goldberg & Lewis 1969). In the present study, however, as can be seen in table 11, only one significant difference between mothers of girls and mothers of boys was found. Boys' mothers generally expressed more positive attitudes toward their children on the final questionnaire. Differences in mothers' behaviors related to the sex of the child that were short of statistical significance, however, were observed in the ratio of social to referential speech, the effectiveness of social behaviors, the proportion of directive and restrictive behaviors, the amount of time spent by mother and child in the same room, and the amount of eye-to-eye contact. On each of these variables mothers of girls scored higher. These variables all seem to be related to a central concept of maternal protectiveness or nurturance. This characteristic of girls' mothers may have been related to the difficulty experienced in recruiting girls for the study, and to the fact that only boys were brought to a final picnic held for all the families in the study. These differences in maternal behavior may be related, furthermore, to girls' more intense attachment to their mothers and to their greater dependency. Relations between these maternal and infant variables are examined in the next section.

While differences between the mothers of girls and boys in this study were small, differences related to race were often highly significant. On demographic characteristics of age, education, and occupation, the two racial groups were equivalent. A measure of the stimulation and variety provided by the physical environment of their homes also was approximately the same for both groups—although in black homes the baby usually saw more people and had fewer toys. Moreover, the two groups of mothers expressed equally positive views toward infants in the initial interview and appeared equally accepting of their own children during the observations.

TABLE 11

DIFFERENCES IN MATERNAL BEHAVIOR RELATED TO SEX AND RACE OF THE INFANT

VARIABLE[a]	ALL VISITS						
	Black Male Mean	Black Female Mean	White Male Mean	White Female Mean	Race *F*[b]	Sex *F*	Interaction *F*
Factor I, optimal care	−0.56	−0.28	0.60	0.05	5.76*		
Verb. stim.	4.57	6.30	8.84	7.81	13.73**		
Stim. w obj.	0.91	1.67	3.09	2.12	15.56**		6.60*
Soc. stim.	3.45	3.90	5.89	5.17	14.27**		
+ Emotion	6.93	7.68	10.33	9.60	8.77**		
R distress	12.8	13.9	15.5	13.4			
R soc.	7.30	7.51	9.12	8.19	6.52*		
Approp.	3.88	4.07	4.68	4.44			
Effect. obj.	0.563	0.635	0.678	0.557			
Reject.	0.065	0.055	0.071	0.077			
Ref. sp. ratio	0.772	0.752	0.961	0.768			
Looks B	0.323	0.335	0.502	0.443	23.23**		
Gives B	0.015	0.017	0.030	0.026	22.54**		
Respons.	0.580	0.620	0.813	0.730	12.56**		
Factor II, effectiveness	0.33	0.77	−0.42	−0.45	11.99**		
Effect. phys.	0.685	0.743	0.576	0.569	12.24**		
Effect. inst.	0.078	0.122	0.154	0.121			
Effect. soc.	0.500	0.523	0.401	0.405	13.52**		
Factor III, control	0.13	−0.56	0.40	−0.02			
Ego (C)	14.3	12.1	17.2	13.1		5.07*	
Control (C)	12.8	11.1	12.5	11.6			
Direct.	0.095	0.100	0.077	0.083			
Factor IV, cuddling	0.16	0.21	−0.05	−0.08			
+ Attit. (I)	13.2	13.0	13.3	13.2			
Phys. cont.	4.18	4.95	4.34	3.78			

TABLE 11 (*Continued*)

Variable[a]	All Visits						
	Black Male Mean	Black Female Mean	White Male Mean	White Female Mean	Race F[b]	Sex F	Interaction F
Factor V, intellectuality	−0.57	0.02	0.48	0.14			
PPVT	88.9	89.2	121.4	110.6	22.83**		
Imag. (C)	8.78	11.89	12.33	11.78			
Expt. (C)	6.89	8.33	9.00	7.89			
Knowledge	11.2	11.0	17.6	14.9	10.05**		
Factor VI, restrictiveness	0.10	0.49	−0.29	−0.49	4.69*		
Restrict.	0.294	0.306	0.201	0.218	22.56**		
Caretaking	0.078	0.082	0.045	0.044	10.34**		
+ Attit. (O)	3.80	3.79	3.57	0.323			
Age	21.6	22.0	21.1	21.4			
+ Attit. (Q)	7.0	5.3	8.8	7.3	8.59**	5.83*	
N-R speech	0.052	0.073	0.078	0.080			
Playing	0.017	0.028	0.078	0.036	7.63*		4.15*
Interacting	0.302	0.356	0.418	0.369			
Same room	0.769	0.848	0.802	0.813			
Num. toys	18.1	18.8	26.7	23.7			
Var. toys	2.98	2.89	3.26	2.69			
E/E cont.	0.058	0.074	0.078	0.082			
Envt. soc.	16.3	16.9	10.7	11.6	5.70*		
Envt. phys.	13.3	16.2	16.3	14.3			
Toys/obj.	0.542	0.679	1.431	0.782	6.56*		

[a] Complete descriptions of these variables are in table 2.
[b] Analysis of variance, $df = 1,32$.
* $p < .05$.
** $p < .01$.

They spent the same amount of time with their children, held them as much, were as responsive to their distress. There were, however, marked—and increasing—differences in what mothers and children were likely to be doing while they were together: white mothers looked at their children, talked to them, played with them more, and were more openly affectionate; black mothers, by contrast, were more restrictive and spent more time caring for children's physical needs. Judging by children's immediate responses to maternal behaviors, black mothers' physical and social behaviors also were more effective than were those of the white mothers.

A difference in the philosophy of child rearing may be reflected by varying behavior in the two groups: black mothers emphasized the physical aspect of child care; white mothers emphasized the educational aspect. These differences are similar to those which have been observed between mothers of different social classes (Bronfenbrenner 1958; Chilman 1968; Kamii & Radin 1967; Kohn 1959). According to these writers, all mothers are concerned with preparing their children for the lives they will face. Lower-class mothers value education for their children as much as do mothers of higher social status, but they are forced by historical and present demands to deal with problems of obedience, neatness, and cleanliness—first. Middle-class mothers, freer of immediate physical pressures and more aware of current trends in child rearing, can afford to experiment with techniques of educating children advocated by "experts." A similar contrast may exist between these two racial groups who, although occupationally and educationally equivalent, are products of very different histories, traditions, social, and perhaps economic, pressures.

The previous two sections of this report examined the behavior of mothers and children separately. In each section, discussion focused on developmental changes, individual differences, and interrelations among variables, and in each discussion the correspondence between maternal and infant variables or relationships was apparent. These correspondences provide a background for the next section in which empirical relations between maternal and infant variables are examined directly.

4. MOTHER-CHILD INTERACTION

Linear Relations between Maternal and Child Variables

Linear relations between maternal and infant variables—the primary focus of the present study—were statistically analyzed by multiple regression. This type of analysis allows one to predict the value of a dependent criterion variable on the basis of its association with multiple independent variables in a weighted combination. Maternal variables were thus predicted from a set of infant variables and infant variables from a set of maternal variables. The variables used first in the analysis were maternal and infant factor scores (table 12A). Regression equations were computed by

TABLE 12

RELATIONS BETWEEN MATERNAL AND INFANT FACTORS

A. INTERCORRELATIONS AMONG FACTORS

	1	2	3	4	5	6	7	8	9	10	11
1. Infant factor I, competence											
2. Infant factor II, object orientation	.00										
3. Infant factor III, early test talent	.00	.00									
4. Infant factor IV, physical attachment	.00	.00	.00								
5. Infant factor V, irritability	.01	—.02	—.01	—.04							
6. Maternal factor I, optimal care	.67***	.04	—.16	.12	—.22						
7. Maternal factor II, effectiveness	.10	.03	.20	.55***	—.47***	.10					
8. Maternal factor III, control	.07	.15	.00	—.11	.25	—.02	.02				
9. Maternal factor IV, cuddling	—.03	—.03	—.09	.29*	.25	.10	—.13	.03			
10. Maternal factor V, intellectuality	—.29*	—.15	.21	—.13	—.17	—.03	.03	—.01	.04		
11. Maternal factor VI, restrictiveness	—.18	—.42***	.11	.00	—.10	—.08	.10	—.02	.11	—.03	

TABLE 12 (*Continued*)

B. STEPWISE MULTIPLE REGRESSION EQUATIONS[a]

Dependent Factor	Independent Factors	*t* for Coefficients	R^2 Coefficient of Determination	*F* for Equation
Infant I	.69 Maternal I	5.3****	.45	27.7****
	.69 Maternal I + .27 Maternal V	5.5**** 2.2**	.52	18.0****
Infant II	−.44 Maternal VI	2.7***	.18	7.5***
Infant IV	.58 Maternal II	3.8****	.30	14.5****
	.63 Maternal II + .39 Maternal IV	4.5**** 2.8***	.43	12.6****
Infant V	−.45 Maternal II	3.1****	.22	9.7***
	−.46 Maternal II + .24 Maternal III	3.3**** 1.8*	.29	6.7***
Maternal I	.65 Infant I	5.3****	.45	27.7****
	.65 Infant I − .24 Infant V	5.5**** 1.9*	.50	16.6****
Maternal II	.52 Infant IV	3.8****	.30	14.4****
	.50 Infant IV − .47 Infant V	4.3**** 3.7****	.50	16.7****
	.50 Infant IV − .47 Infant V + .18 Infant III	4.4**** 3.8**** 1.6	.54	12.5****
Maternal IV	.27 Infant IV	1.8*	.09	3.2*
	.28 Infant IV + .27 Infant V	1.9* 1.6	.15	3.0*
Maternal VI	−.41 Infant II	2.7***	.18	7.5***

[a] Equations with up to the maximum number of steps for significant (or approaching significant) *t* values.
* $p < .10$.
** $p < .05$.
*** $p < .01$.
**** $p < .001$.

a stepwise method that entered maternal factors into the regression equations in order of their utility in predicting each independent infant factor and, similarly, entered infant factors in equations to predict each maternal factor. Each step of the regression analysis for each dependent factor, up to the point at which a nonsignificant correlation coefficient entered the equation, is presented in table 12B. This analysis, thus, showed overall linear relations between maternal and infant variables. To examine specific individual relations between maternal and infant variables which were of special interest, regression analyses were performed on individual variables, too. Since these variables were not independent, only the first step in each stepwise multiple regression analysis was used (tables 13 and 14) to find the "best" predictor. Finally, specific relations were examined by reference to intercorrelations of individual maternal and infant factors and variables (tables 15, 16, and 17). Results from each of these analyses are integrated in the following discussion of mother-child relationships.

Optimal Maternal Care and Children's Competence

The strongest relation found by regression analysis of maternal and infant factors was between optimal maternal qualities and children's competence. Optimal maternal care (maternal factor I) was related positively to children's competence (child factor I) and negatively to their fretfulness (child factor V). Children's competence was predictable from optimal maternal care and the mother's intellectuality (maternal factor V). It is not surprising that researchers in the past have discovered significant original relations between many different pairs of individual maternal and infant variables, since the variables they selected were often part of these factors of overall maternal and infant competence. The relation found between these factors indicates the potential danger of attributing relations to specific variables when only a few variables are studied, and demonstrates the need for multivariate approaches to parent-child research in order to reveal overall *patterns* of relations.

Although these mother-child relations were highly significant ($p < .001$), it should be noted that each equation accounted for only about 50% of the variance in the dependent factor (i.e., $R^2 = .50$ and .52). Children's competence depends on more than optimal and informed maternal care, and, conversely, mothers of competent and content children do not necessarily always provide optimal care.

The single maternal variable which was most highly related to the factor of children's competence was verbal stimulation. Competence was not, however, correlated with nonresponsive maternal speech (a subset of verbal stimulation)—which suggests that mere quantity of auditory stimulation is not sufficient for children's optimal development. The particular variable within the competence factor to which verbal stimulation was especially closely related was the child's language ability. Moreover, children's

TABLE 13

"BEST PREDICTORS" OF INFANT VARIABLES FROM STEPWISE REGRESSION ANALYSIS

Dependent Infant Variable[a]	Independent Maternal Variable[a]	Standardized Correlation Coefficient	t	t Probability Value	R^2 Coefficient of Determination (% Variance Accounted For)	F	F Probability Value
Competence factor	Verb. stim.	.84	8.87	.001	<.70	78.73	<.001
Object orientation factor	Envt. phys.	.49	3.03	.008	<.23	9.47	<.008
Physical attachment factor	+ Attit. (O)	.49	3.31	.001	<.24	10.94	<.002
Irritability factor	Effect.	−.56	3.98	.001	<.32	15.80	<.001
Play (L)	Stim. w obj.	.42	2.73	.010	<.12	7.43	<.010
Bayley Ment. 2	Soc. stim.	.69	5.61	.001	<.48	31.43	<.001
Language	Verb. stim.	.68	5.42	.001	<.46	29.42	<.001
+ Emotion	+ Emotion	.82	8.49	.001	<.68	72.03	<.001
+ Involv. M	+ Emotion	.66	5.15	.001	<.48	26.48	<.001

NOTE.—Set of independent (maternal) variables: referential speech ratio, positive emotion, positive attitude, verbal stimulation, stimulation with objects, social stimulation, responsiveness to distress demand, appropriateness, effectiveness, responsiveness to social behaviors, intellectual maternal factor, restrictive maternal factor, physical stimulation of environment.

[a] Complete descriptions of these variables are in tables 2 and 5.

TABLE 14

"BEST PREDICTORS" OF MATERNAL VARIABLES FROM STEPWISE REGRESSION ANALYSIS

Dependent Maternal Variable[a]	Independent Infant Variable[a]	Standardized Correlation Coefficient	t	t Probability Value	R^2 Coefficient of Determination	F	F Probability Value
+ Attit. (O)	+ Involv. M	.43	2.81	<.008	.19	7.90	<.008
+ Emotion	+ Emotion	.82	8.49	<.001	.68	72.03	<.001
Verb. stim.	Language	.68	5.42	<.001	.46	29.42	<.001
Stim. w obj.	Bayley Ment.	.57	4.05	<.001	.33	16.43	<.001
Soc. stim.	Bayley Ment.	.69	5.61	<.001	.48	31.43	<.001
R distress	+ Involv. M	.52	3.59	<.001	.28	12.90	<.001
R soc.	Bayley Ment.	.66	5.08	<.001	.43	25.78	<.001

NOTE.—Set of independent (infant) variables: play (lab), Bayley Mental 2, language, + emotion, + involvement with M, object orientation (factor II), early test performance (factor III).

[a] Complete descriptions of these variables are in table 2.

language ability was related not only to the total amount and variety of maternal speech to the child, it was also related to the mother's nonresponsive speech—even more than to maternal responsiveness to vocalization. This suggests that during early stages in language development—acquiring a primitive lexicon and learning to understand verbal communication—the

TABLE 15

CORRELATIONS BETWEEN MATERNAL VARIABLES AND INFANT FACTORS*

MATERNAL VARIABLES[a]	INFANT FACTORS				
	I, Competence	II, Object Orientation	III, Early Test Talent	IV, Physical Attachment	V, Irritability
Age				.38	
PPVT	.52		−.47		
Knowledge	.35				
Ego (C)		.35			
Imag. (C)	.33				
Expt. (C)					
Control (C)					
+ Attit. (I)					
+ Attit. (Q)	.38				
+ Attit. (O)				.49	
+ Emotion	.74				
Phys. cont.				.42	
Caretaking		−.49			
Restrict.	−.43				
Reject.					.55
Direct.			.41		
Looking	.68				
Verb. stim.	.84				
N-R speech					
Giving	.57				
Stim. w obj.	.71				
Soc. stim.	.79				
Playing	.62				
Interacting	.67				
Same room	.46			.34	
Approp.	.53				
Effect. phys.				.49	−.40
Effect. inst.	.40				−.33
Effect. obj.	.52			.38	−.35
Respons.	.68				
R distress	.44				−.34
R soc.	.69				
Num. toys	.39				
Var. toys	.34	.35			
E/E cont.	.79				
Envt. soc.	−.42				
Envt. phys.		.49			
Toys/obj.	.46				

[a] Complete descriptions of these variables are in table 2.
* All significant correlations shown: $r_{p<.05} = .33$; $r_{p<.01} = .42$.

TABLE 16

CORRELATIONS BETWEEN INFANT VARIABLES AND MATERNAL FACTORS*

INFANT OR OTHER VARIABLES[a]	MATERNAL FACTORS					
	I, Optimal Care	II, Effectiveness	III, Control	IV, Cuddling	V, Intellectuality	VI, Restrictiveness
Toy variety (L)					.42	
Obj. inv. (L)						
Play (L)	.34					
Long obj. inv. T3	.33		.33			
Schema	.55					
Stim. by obj.						—.46
Num.-var. obj.						—.37
Obj. perm. (UH)	.37					
Schema (UH)						
Obj. relns. (UH)	—.35	.35				.37
Bayley Ment. 1						
Bayley Ment. 2	.52				.37	
Language	.43					
Vocn.						
Voc. M						
Attachment (L)		.39				
Attachment (O)	.42				.35	
Phys. attach.		.52				
+ Involv. M	.57	.35				
Looks M	.43					
Gives M	.56					
+ Emotion	.48				.36	—.35
Soc. resp. (L)				—.34		
Interact O						—.35
Neg. beh.		—.53		.37		
Activity						—.41
Num. toys	.63					
Var. toys	.38		.34			
Toys/obj.	.71					
E/E cont.	.79					
Same room	.59	.36				
Interacting	.82					
Playing	.74					

[a] Complete descriptions of these variables are in table 2.

* All significant correlations shown: $r = .33$; $p < .05$; $r = .42$, $p < .01$.

TABLE 17

CORRELATIONS BETWEEN MATERNAL AND INFANT VARIABLES*

Maternal Variables[a]	Infant Variables[a]									
	Toy Var. (L)	Obj. Inv. (L)	Play (L)	Long Obj. Inv.	Schema (O)	Stim. by Obj.	Num.-Var. Obj. (O)	Obj. Perm. (UH)	Schema (UH)	Obj. Relns. (UH)
Age							−.37			
PPVT		−.34						.50		−.52
Knowledge						.33		.37		
Ego (C)				.44						
Imag. (C)										
Expt. (C)	.50									
Control (C)				.41						
+ Attit. (I)										
+ Attit. (Q)				.34				.37		
+ Attit. (O)										
+ Emotion					.45					−.34
Phys. cont.						−.39				
Caretaking				−.40		−.48	−.54			.49
Restrict.				−.34				−.37		.47
Reject.										
Direct.										.48
Looking			.34		.54			.48		−.48
Verb. stim.		−.39	.41		.64			.47		−.39
N-R speech					.36					−.34
Giving		−.38	.35					.66		−.33
Stim. w obj.			.42	.49	.57			.39		−.36
Soc. stim.		−.38	.35		.54			.39		−.42
Playing				.42	.55					
Interacting					.52	−.35		.34		
Same room					.40					
Approp.			.33		.46			.35		

TABLE 17 (*Continued*)

Maternal Variables[a]	Infant Variables[a]									
	Toy Var. (L)	Obj. Inv. (L)	Play (L)	Long Obj. Inv.	Schema (O)	Stim. by Obj.	Num.-Var. Obj. (O)	Obj. Perm. (UH)	Schema (UH)	Obj. Relns. (UH)
Effect. phys.								.33		
Effect. inst.				.35						
Effect. obj.										
Respons.					.54			.45		—.41
R distress										
R soc.		—.34		.35	.52			.34		—.33
Num. toys					.53		.35			
Var. toys			.35	.37			.43			
E/E cont.		—.37			.61					
Envt. soc.			—.33	—.33						
Envt. phys.						.37	.35			
Toy/obj.				.39	.56					
	Bayley Ment. 1	Bayley Ment. 2	Language	Vocn.	Voc. M	Attach-ment (L)	Attach-ment (O)	Phys. Attach.	+ Involv. M	
Age		.54				.38			.43	
PPVT			.36				.52		.36	
Knowledge		.34					.50			
Ego (C)										
Imag. (C)		.42								
Expt. (C)				—.42						
Control (C)										
+ Attit. (I)										
+ Attit. (Q)							.57			
+ Attit. (O)								.41	.43	
+ Emotion		.60	.56				.53		.66	

TABLE 17 (*Continued*)

Maternal Variables[a]	Infant Variables[a]								
	Bayley Ment. 1	Bayley Ment. 2	Language	Vocn.	Voc. M	Attach-ment (L)	Attach-ment (O)	Phys. Attach.	+ Involv. M
Phys. cont.						.41			
Caretaking									
Restrict.		—.41				.39			
Reject.									
Direct.									
Looking		.59	.57				.43		.46
Verb. stim.		.68	.68		.36		.48		.66
N-R speech			.55		.33		.45		.61
Giving		.48	.45				.54		.34
Stim. w obj.		.57	.46				.49		.55
Soc. stim.		.69	.59				.52		.64
Playing		.48	.44				.36		.50
Interacting		.52	.57		.35		.35		.61
Same room			.33						.69
Approp.		.49					.40		.47
Effect. phys.								.50	
Effect. inst.		.39							.40
Effect. obj.		.44							.51
Respons.		.54	.47				.47		.57
R distress							.33		.52
R soc.		.66	.47				.47		.56
Num. toys									
Var. toys		.45							
E/E cont.		.55	.47		.37		.50		.86
Envt. soc.									—.39
Envt. phys.									
Toy/obj.		.37	.36					—.38	

TABLE 17 (*Continued*)

Maternal Variables[a]	Infant Variables[a]								
	Looks M	Gives M	+ Emotion	Soc. resp. (L)	Interact O	Neg. Beh.	E/E Cont.	Motor Dev.	Activity
Age	.42								
PPVT		.36	.55				.42		.40
Knowledge			.49						
Ego (C)									
Imag. (C)									
Expt. (C)		—.33							
Control (C)									
+ Attit. (I)									
+ Attit. (Q)			.54						
+ Attit. (O)	.40						.45		
+ Emotion	.53	.42	.82				.72		
Phys. cont.				—.42					
Caretaking			—.37						—.42
Restrict.		—.32	—.35				—.37		—.36
Reject.						.51	—.42		.38
Direct.									
Looking	.36	.62	.56				.68		.37
Verb. stim.	.50	.62	.62				.82		
N-R speech	.50		.66						
Giving		.55					.42		
Stim. w obj.	.40	.61	.54				.71		
Soc. stim.	.49	.66	.67				.84		

TABLE 17 (*Continued*)

Maternal Variables[a]	Infant Variables[a]								
	Looks M	Gives M	+ Emotion	Soc. resp. (L)	Interact O	Neg. Beh.	E/E Cont.	Motor Dev.	Activity
Playing	.33	.61	.56				.71		
Interacting	.40	.57	.43				.75		
Same room		.44					.65		
Approp.	.45	.36	.48				.62	.35	
Effect. phys.						—.46			
Effect. inst.			.37			—.59	.52		
Effect. obj.	.35		.46				.61		
Respons.	.38	.61	.43	—.35			.75		
R distress	.33	.36				—.36	.64		
R soc.	.44	.49	.62				.78	.40	
Num. toys		.37		—.41			.43		
Var. toys									
E/E cont.	.77	.58	.60						
Envt. soc.	—.43	—.34	—.33				—.38		
Envt. phys.									
Toy/obj.		.52	.35	—.39			.58		

[a] Complete descriptions of these variables are in table 2.
* All significant correlations shown: $r_{p<.05} = .33$; $r_{p<.01} = .42$.

child needs a language model more than a language reinforcer (an observation also made by Cazden [1965] about children's early learning of grammar).[5] Similarly, the amount of maternal verbal stimulation was related to the child's social use of language as communication: vocalization to the mother was related to verbal stimulation but not to responsiveness to vocalization. The frequency of the child's nondirected vocalization was not related to maternal behavior.

A specific proposition supported in this study concerned the relation between maternal and infant emotional expression. The child's positive involvement with his mother and his expression of happiness were found to be most closely related to the mother's expression of positive emotion. Happy, loving mothers had affectionate, smiling children. It appears from this relation, and from the relation between verbal stimulation and language development, that although maternal variables are highly intercorrelated, as are infant abilities, there may be a specificity of influence within relations between more global factors. Which particular pairs of variables are most highly related, however, can be established only after examining multiple relations and by viewing specific variables in that context.

Specificity within interactional patterns was further suggested by the finding that the best single predictor of the child's play behavior in the laboratory was the amount of stimulation with toys and objects which he received from his mother at home. The complexity of the child's play was not related to the number of playthings available in the home, nor to whether he played with toys or with household objects—how much, how many, how varied. The essential role of mother as mediator of environmental stimulation is apparent. Mere exposure to a stimulating environment was not related to skill with objects.

Similarly, mere availability of people, including the mother, was not highly positively related to the child's development. In the present study the amount of time spent by mother and child in the same room, while correlated with the child's competence, had a lower relation with competence than did stimulating, responsive, or affectionate maternal behavior. Children's competence was also not related to the amount of maternal caretaking.

Signs of the child's attachment to his mother—looking at her, smiling, following, giving, and so on—were highly positively related to the frequency of her social behaviors—looking, talking, playing. The amount of reciprocal eye-to-eye contact reflected this social relation between mother and child; it represented more than mutual looking. Among infant variables, it was more strongly related to positive involvement with the mother

[5] The level of complexity in maternal speech may also affect the child's early language development. Mothers in this sample all spoke within a fairly homogeneous and apparently effective range: 2½–5 words per utterance (mean = 3½).

than to mere time during which the infant looked at the mother; among maternal variables, it was related to verbal and social stimulation, positive emotion, and responsiveness to social behaviors more than to "mother looks at infant."

The Bayley Scale of Mental Development measures a comprehensive range of specific competencies as they are affected by the child's motivation to perform in a novel situation. This measure was correlated most highly with the mother's social, nonphysical stimulation—looking and talking. However, it was also very highly correlated with the responsiveness of the mother to the child's social behaviors. Maternal responsiveness was, in fact, more highly related to measures of the child's general competence and motivation than it was to the frequency of the specific infant behaviors responded to (looking at mother, vocalizing to her, approaching her, giving or showing her objects). Responsiveness was related to the child's Bayley mental score, to his speed of processing information, and to his schema development, as well as to language, social, and emotional indices of competence. This finding is one step toward confirming the suggestion that contingent responsiveness to an infant's behavior does more than reinforce specific behaviors, that it creates in the infant an expectancy of control which generalizes to new situations and unfamiliar people (Ainsworth et al. 1971; Lewis & Goldberg 1969; Yarrow et al. 1971). Investigators have most often based this suggestion on the finding of relations between infant behaviors and maternal responsiveness to distress (Ainsworth et al. 1971; S. M. Bell 1971; Moss 1967). However, in the second year of life, at least, it appears that for promoting a broad range of competencies responsiveness to social behavior may be a more valuable maternal quality than responsiveness to distress. Responsiveness to distress was related only to indices of the child's social attachment to his mother and (negatively) to his fretfulness.

Children's competence was also related to the maternal factor of intellectuality. Moreover, the relation between the mother's intellectual score and an increase in the child's Bayley mental test score was even higher than that between maternal intellectuality and the finally attained Bayley score. This may imply both that mothering is a job for which women can prepare by learning about child development and child rearing and, also, that more intelligent women (beyond their genetic contribution) may be better at the job.

The relations described in this section have all been related to maternal and infant variables found in the factors of overall competence. In the next three sections relations between other factors are examined.

Restrictiveness

A second mother-child relation revealed by regression analysis of maternal and infant factors was that between maternal restrictiveness and children's involvement with physical objects. On the basis of past research,

it was expected that restrictive maternal behavior would be related to less activity and exploration by the child and to slower intellectual growth. Children's activity and exploration and their frequent and sustained involvement with numerous and diverse objects were indeed found to be negatively related to maternal restrictiveness—holding, restraining, reprimanding, directing, and caretaking. Moreover, observed maternal restrictiveness was also negatively related to the child's second Bayley mental test score.

Children's *involvement* with objects, unlike their *skill* with objects, was positively correlated with stimulation from the physical environment. This relation contrasts with that described in the discussion of competence showing that children's competence with objects was not related to the number or variety of objects available or played with.

Warm Physical Contact

Regression analysis between maternal and infant factors also demonstrated that the infant's fretfulness and his physical attachment to his mother were positively related to the physical attention he received from her and to the effectiveness of her physical contact. The "cuddling" mother was generally older and more accepting; she spent a great deal of time with her infant, often in close physical proximity. Her child, in an unfamiliar setting or at home, tended to stay close to her and to hold her often. He was distressed when she left the room and exhibited marked anxiety when a stranger approached him or touched him.

Effectiveness and Irritability

Maternal effectiveness and infant irritability are negatively related by definition. That they are also empirically related was made clear by regression analysis. The child's fretfulness was negatively related to the effectiveness of the mother's physical, social, and instrumental behavior and positively to her rejection and her self-control (which was related to her control of the child). Fretfulness was also negatively related to the mother's responsiveness to distress. It appears unlikely that contingent responsiveness to infant's signs of distress—crying, fretting, fussing—reinforces those negative behaviors.

Maternal effectiveness was also related to the child's early test performance. This relation may imply either that precocious children, being developmentally advanced, increase mothers' apparent effectiveness, or that mothers, by behaving effectively, produce children who do well in directive test situations. The present analysis does not permit a choice between these alternatives.

Thus far, the mother-child relations which have been discussed have been based on analysis of data for the sample as a whole. In the following section the applicability of these relations to mother-child pairs differing in race and sex of the child is examined.

Differences in Mother-Child Relations Related to Sex and Race

Some researchers studying infant development have found or speculated that girls are more susceptible than boys to maternal or environmental influence (Kagan 1971; Moss 1967; Sears et al. 1953; Yarrow et al. 1971). An examination of sex differences in mother-child correlations in this study (table 18) reveals the opposite trend. When differences occurred (and they were not common), correlations for girls were lower on cognitive, language, social, and emotional measures. The only relation for which the girls' correlation was higher was between the mother's PPVT score and the child's Bayley mental test score. Since the PPVT is not a measure of the mother's direct behavior toward the child, these data seem to suggest that girls of this age were *not* influenced by their mothers' behavior more than were boys. Bayley and Schaefer (1964) reached the same conclusion for older children; they suggested that for girls, in contrast to boys, IQ scores were more closely related to inherited ability than to environmental conditions.

The possibility that trends for girls were not linear (Goldberg & Lewis 1969; Sears et al. 1953) was considered. Scatter plots were made for the relations in which sex differences occurred. The only relation for which curvilinearity appeared to be a defensible hypothesis (although it was not statistically significant) was that between maternal responsiveness to distress and the child's negative behavior. Maternal responsiveness was related to both high and low fretfulness in girls.

Differences in mother-child relations also occurred between racial groups in the present study (table 18). Correlations for white subjects were higher on most cognitive, verbal, and social variables; for black mothers and children correlations between emotional variables were higher despite the fact that black subjects were uniformly lower in amount on *all* these variables. The processes involved in mother-child interaction may be different in black and white homes. Sources of variation in the environment that are important for white mothers and children may not be for black families (Scarr-Salapatek 1971). The number of toys available at home and the frequency of playthings offered by the mother were more highly related to Bayley mental test scores and prolonged object involvement for black children than for white. Perhaps this was because the number of toys in their homes (which was lower than in white homes) was low enough to make differences in *number* consequential (Tulkin 1970). In white homes, where there were more toys, *variety* had a higher relation to the infant's object involvement than did number. The correlation found between the mother's intelligence (PPVT score) and the child's (Bayley mental test score) was also higher for whites than for blacks. Since Scarr-Salapatek suggests that in environmentally advantaged groups genetic variance accounts for a greater proportion of intelligence scores than in disadvantaged

TABLE 18

SEX AND RACE DIFFERENCES IN CORRELATIONS[a] BETWEEN MATERNAL AND INFANT VARIABLES

MATERNAL VARIABLE[b]	INFANT VARIABLES[b]							
	Race		Sex		Race		Sex	
	B	W	M	F	B	W	M	F
	Bayley Ment. 2				Play (Lab)			
PPVT	.00	.63**	.49*	.64**				
E/E cont.	.28	.62**						
Playing	.53*	.35	.74**	.37				
+ Emotion	.29	.65**						
Verb. stim.	.45*	.63**			.43	.14	.52*	.36
Stim. w obj.	.66**	.33	.77**	.46*			.56*	.40
Respons.	.23	.44						
R soc	.21	.71**						
R distress								
Approp.	.39	.52**						
+ Attit.								
Same room								
Interacting								
Soc. stim.								
Num. toys								
Var. toys								
Envt. phys.								
Reject.								
	+ Involv. M				Neg. Beh.			
PPVT								
E/E cont.								
Playing								
+ Emotion	−.83**	.53*						
Verb. stim.								
Stim. w obj.								
Respons.								
R soc.	−.28	.63**						
R distress							−.58**	.16
Approp.	.39	.52**						
+ Attit.								
Same room			.82**	.46*				
Interacting	.56*	.70**	.70**	.56*				
Soc. stim.								
Num. toys								
Var. toys								
Envt. phys.								
Reject.	−.15	−.47*	−.41	.00	.60**	.45*	.60**	.31

[a] Table includes all instances of differences > .12 for this set of variables.
[b] Complete descriptions of these variables are in table 2.
* $p < .05$.
** $p < .01$.

TABLE 18 (*Continued*)

Maternal Variable[b]	Infant Variables[b]							
	Race		Sex		Race		Sex	
	B	W	M	F	B	W	M	F
	Language				+ Emotion			
PPVT			.49*	.36				
E/E cont.	.15	.58**	.53*	.36				
Playing					.73**	.44	.60**	.41
+ Emotion	.21	.61**						
Verb. stim.			.75**	.67**				
Stim. w obj.								
Respons.			.63**	.41	.62**	.18		
R soc	.11	.46*						
R distress								
Approp.								
+ Attit.					.67**	.25		
Same room								
Interacting								
Soc. stim.								
Num. toys								
Var. toys								
Envt. phys.								
Reject.								
	Stim. by Obj.				Long Obj. Inv.			
PPVT								
E/E cont.								
Playing					.15	.40	.49*	.00
+ Emotion								
Verb. stim.								
Stim. w obj.								
Respons.								
R soc.								
R distress								
Approp.								
+ Attit.								
Same room								
Interacting								
Soc. stim.								
Num. toys					.40	.20	.44	.20
Var. toys					.05	.58**	.51*	.13
Envt. phys.	.16	.57**	.50*	.36				
Reject.								

groups, the finding may imply that the white sample in this study was, in fact, more environmentally advantaged than the black sample. This implication was supported by some observations already mentioned.

Beyond Correlations: Nonlinear Mother-Child Relations

The preceding discussion of relations between maternal and child variables has relied on correlational analyses which expose only linear re-

lationships. The following sections probe central issues of mother-child interaction using nonlinear organizations and analyses of data.

Quality of Infant Attachment

The infant's relation with his mother may be characterized in ways other than intensity of attachment or frequency of proximity-seeking—in ways which do not fit a linear analysis. Ainsworth, for example, has created a classificatory system for attachment based on qualitative differences in the mother-child relation. Children in the present study were divided into groups according to Ainsworth's categories on the basis of their social behavior in the laboratory at 1 year of age. Relations were then examined between the child's attachment classification, his other behaviors, maternal characteristics, and features of his social environment. Those variables which were systematically related to the quality of the child's attachment are given in table 19. Three maternal variables were selected to represent different aspects of maternal functioning—stimulating, contingent responding, and expressing affection; their relations to attachment are displayed graphically in figure 6. The quadratic curves are each significant and strikingly parallel. Mothers who were highest on each of these three dimensions had, in Ainsworth's terms, securely attached children—children who were able to use the mother as a secure base from which to venture forth to explore the environment, returning to her periodically for reassurance or at times of stress. Children of mothers with the lowest scores displayed maladaptive social behaviors in the laboratory situation. The infants' Bayley test scores and maternal attitude scores were similarly curvilinearly related to attachment, as was the number of people in the child's social environment. Maternal physical contact and the intensity of the infant's attachment in the laboratory were linearly related to the quality of attachment. As expected, the child's positive involvement with his mother at home showed a peak for the group of children labeled "very attached"; it was lowest for the "mal-attached" group. A parallel trend was found for the mother's positive attitude toward infants. In sum, optimal secure attachment was associated with homes where the child was not constantly exposed to a great number of people and where the mother was socially stimulating, responsive, and affectionate, but not excessively physical in her contact.

Preferred Mode of Stimulation

It was expected that maternal stimulation would have specific relations with child development and behavior. Support for this position from correlational analysis has been discussed; the amount of relevant maternal stimulation was related to the level of the child's language ability, emotional expression, skill with objects, and social development. A somewhat related hypothesis was tested also: that the mother's preferred mode of stimulation is related to the child's preferred activity.

TABLE 19

DIFFERENCES IN MATERNAL AND INFANT BEHAVIORS RELATED TO THE INFANT'S ATTACHMENT CATEGORY

VARIABLE[a]	MEANS FOR ATTACHMENT CATEGORIES					F^b FOR MEAN DIFFERENCES	TREND	F^c TREND
	I, Unattached ($N = 8$)	II, Low Attached ($N = 7$)	III, Secure Attached ($N = 12$)	IV, Very Attached ($N = 6$)	V, Mal-attached ($N = 3$)			
M + emotion (T1)	7.03	7.89	11.17	9.61	6.41	3.63*	Quad.	8.30**
M verb. stim. (T1)	4.98	4.93	8.55	7.78	3.35	6.46**	Quad.	14.35**
M soc. stim. (T1)	3.98	4.60	6.26	5.31	2.83	4.00**	Quad.	11.59**
M R soc. (T1)	6.78	7.64	8.82	8.33	5.74	3.10*	Quad.	10.40**
M respons. (T1)	0.552	0.580	0.761	0.683	0.426	3.91*	Quad.	10.54**
M looks B (T1)	0.375	0.370	0.482	0.405	0.280	2.65	Quad.	5.82*
M approp. (T1)	4.02	4.69	4.92	5.42	3.79	1.36	Quad.	4.19*
M attit. (Q)	5.00	8.00	8.17	7.50	5.67	4.28**	Quad.	12.34**
M R distress (T1)	11.90	13.89	16.41	14.72	13.28	1.35	Quad.	2.55
M + attit. (T1)	3.46	3.43	4.16	4.64	2.22	1.35	Quad.	3.64
B + involv. M (T1)	0.184	0.201	0.238	0.264	0.130	3.07	Quad.	9.46
B Bayley Ment. 2	105.0	102.9	110.9	95.2	93.3	1.51	Quad.	<1
B attach. (L)	84.13	134.0	143.1	219.6	217.3	13.18**	Lin.	38.36**
M phys. cont. (mean)	3.86	4.15	4.01	4.62	6.51	2.35	Lin.	8.12**
Envt. soc.	13.8	16.0	9.5	15.0	24.3	3.82	Quad.	7.10*

[a] Complete descriptions of these variables are in table 2.
[b] Analysis of variance, $df = 4,31$.
[c] Analysis of variance, $df = 1,31$.
* $p < .05$.
** $p < .01$.

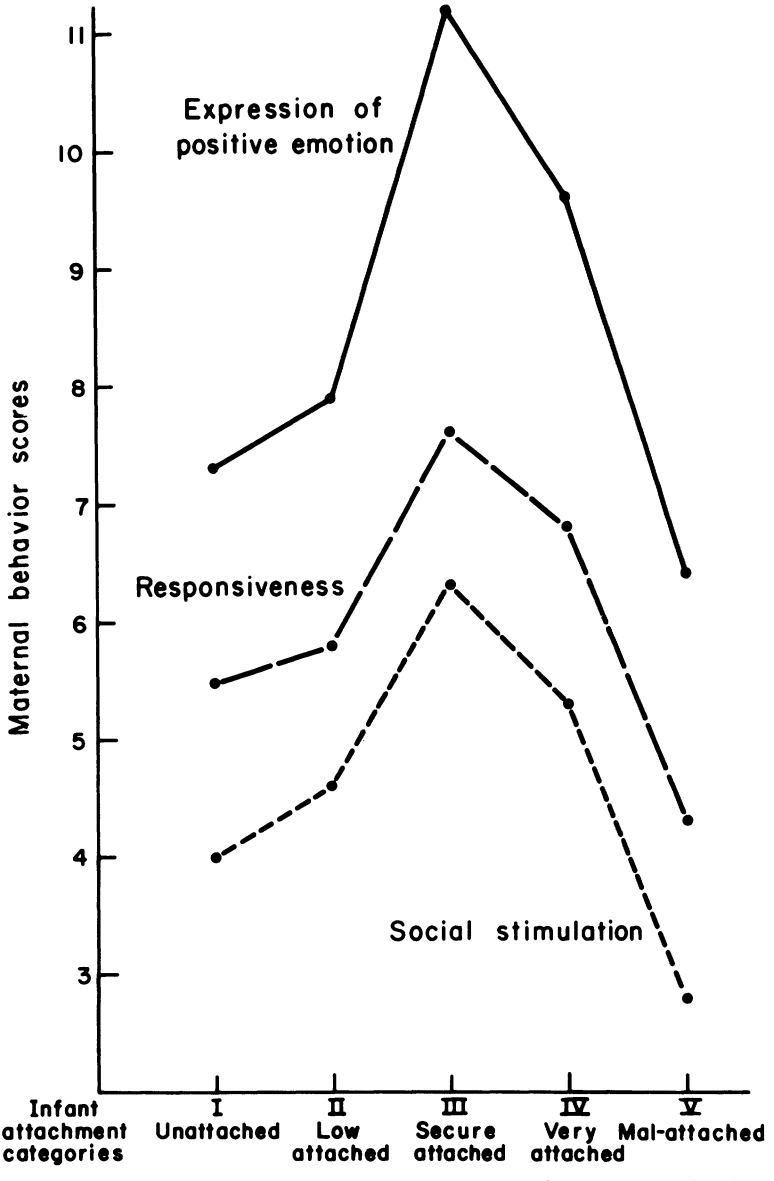

FIGURE 6.—Relations between maternal behaviors and categories of infant attachment.

Mothers were divided into three groups according to their relative ranks on the measures of "materialness," "verbalness," and "physicalness." These measures were the proportion of all maternal behaviors directed toward the child which were mediated by objects, words, or physical contact. Three mothers who had equal ranks on two of the three modes were not included in the analysis. Infant measures were selected to represent preference on these same dimensions at 17 months—prolonged object involvement, language competence, and physical attachment to the mother. Scores on these infant measures for infants in the three maternal modality groups were then compared (table 20). Mothers' preferences were—to a limited

TABLE 20

DIFFERENCES IN INFANT BEHAVIORS RELATED TO MOTHER'S PREFERRED MODE OF STIMULATION

INFANT BEHAVIOR	MOTHER'S PREFERRED MODE OF STIMULATION			
	Material ($N = 11$)	Verbal ($N = 11$)	Physical ($N = 11$)	F[a]
Object involvement, Time 3	6.0	3.7	2.5	3.59*
Language, Time 3	43	53	33	1.39
Physical attachment, Time 3	0.026	0.014	0.034	2.64

[a] Analysis of variance, $df = 2,30$.
* $p < .05$.

extent—reflected in their children's behavior. On each dimension the highest mean score was obtained by children whose mothers characteristically behaved toward them in that mode. Children also were divided into three groups according to their relative ranks on the three dimensions. A χ^2 calculated to test the probability of the mother-child modality match was statistically significant ($p < .05$).

Sex and race differences in preferred maternal mode were also evident and were related to differences in children's behavior which have already been discussed. Black mothers favored a physical mode of contact, white boys' mothers preferred using materials, and the mothers of white girls were most highly verbal ($\chi^2 = 6.08$ and 4.90, $p < .05$).

Maternal Speech Content and Children's Language Development

Results of correlational analysis have already shown that the amount of maternal verbal stimulation was related to children's early language competence. One might also ask about the effects on language development of the specific *content* of maternal speech. Nelson (1971) has argued that the two are related. She observed that children's early vocabularies (first 50 words) were either largely referential—these children talked about things—or predominantly social or expressive—these children talked about themselves and others. This difference in the content and function of early

vocabularies was related to parallel emphases in mothers' language. To look for such a relation in the present study children were divided into referential or social-expressive speakers on the basis of their 18-month vocabularies. The number of words mothers reported that children had said at this age ranged from 0 to 102 (mean = 53); it was possible to classify the vocabularies of 30 children. There were no sex or race differences in this classification, nor, interestingly, was there a difference between the two groups in language competence—the number of words recognized, understood, responded to, or expressed by the child, independent of the specific words first spoken. The ratio of referential to social maternal speech was compared for these two groups (table 21). Although differences, particu-

TABLE 21

DIFFERENCES IN MATERNAL SPEECH AND INFANT LANGUAGE COMPETENCE RELATED TO INFANTS' EARLY VOCABULARY

MATERNAL AND INFANT LANGUAGE	INFANT VOCABULARY GROUP		
	Social Expressive ($N = 9$)	Referential ($N = 21$)	F[a]
Maternal referential:			
Speech ratio T1	0.81	1.06	1.85
Speech ratio T2	0.42	0.83	2.73
Speech ratio T3	0.65	0.77	0.56
Infant language 17 months	42	44	0.03

[a] Analysis of variance, $df = 1,28$; $F_{p<.05} = 4.20$.

larly at the younger ages (11 and 14 months), were in the predicted direction, they were not significant. Measures of the specific content of mothers' or children's speech may have been insufficiently detailed or too dependent on maternal report to reach significance.

Separating Correlated Maternal Variables

In earlier discussion it was demonstrated that optimal maternal qualities are highly intercorrelated. In this section an attempt is made to separate pairs of such maternal variables.

Stimulation versus responsiveness.—Two highly correlated variables are the responsiveness of the mother to her infant's social behaviors and the frequency of her own social behaviors. Some psychologists (e.g., Casler 1961, 1968) have argued that a mother's impact on child development is due solely to her provision of sensory stimulation; others (e.g., Ainsworth 1969) maintain that a mother's behavior should be more than indiscriminately stimulating—that it is important that her behavior be contingent upon the age, state, mood, desire, or need of the infant and that she re-

spond immediately and appropriately to the signals which indicate these needs and feelings.

In the present analysis maternal behavior which was responsive to the child's advances was separated from the mother's nonresponsive social stimulation. Mothers were divided by a median split into four groups: high stimulating–high responsive, low stimulating–low responsive, high stimulating–low responsive, and low stimulating–high responsive. Infants in these four groups were then compared on representative measures of competence and positive emotion. The results are given in table 22. As expected from

TABLE 22
DIFFERENCES IN INFANT VARIABLES RELATED TO MATERNAL STIMULATION VERSUS MATERNAL RESPONSIVENESS

	MATERNAL BEHAVIOR				
INFANT VARIABLE	Hi Stim[a]–Hi Resp[b] ($N = 12$)	Lo Resp Lo Stim– ($N = 6$)	Hi Resp Hi Stim– ($N = 6$)	Lo Stim–Lo Resp ($N = 12$)	F[c]
Bayley Ment. 2	115	105	100	94	5.20**
Language	56	48	52	28	2.63*
+ Emotion	0.048	0.039	0.035	0.018	5.26**
+ Involv. M	0.254	0.199	0.233	0.159	8.74**

[a] Stimulation: mother-initiated verbal stimulation.
[b] Responsiveness: responsiveness to social behaviors.
[c] Analysis of variance, $df = 3,32$.
* $p < .06$.
** $p < .01$.

correlational analysis, the combination of high stimulation and high responsiveness was associated with the highest infant scores, low stimulation and low responsiveness with the lowest. Although the middle two groups were not significantly different from each other, the child's positive involvement with his mother was associated more highly with maternal stimulation than with responsiveness. Language scores were in this direction, too; and although the difference was very small, this further suggested the importance of a stimulating model for early language development. The infant's expression of positive emotion and his Bayley mental test score, on the other hand, were more closely related to maternal responsiveness than to stimulation. Clearly, there is evidence for a relation between maternal responsiveness and indices of the child's overall competence, motivation, and happiness.

Stimulation versus appropriateness.—The same kind of analysis described for separating stimulation and responsiveness was applied to stimulation and appropriateness (table 23). Although there was considerable overlap of members in the high stimulating–high appropriate group with the high stimulating–high responsive group (8/18) and in the low stimulating–low appropriate group with the low stimulating–low responsive group (10/14), there was no overlap for the high-low groups. Once again,

TABLE 23

DIFFERENCES IN INFANT VARIABLES RELATED TO MATERNAL STIMULATION VERSUS MATERNAL APPROPRIATENESS

	MATERNAL BEHAVIOR				
INFANT VARIABLE	Hi Stim[a]–Hi Approp[b] ($N = 14$)	Hi Stim–Lo Approp ($N = 4$)	Lo Stim–Hi Approp ($N = 6$)	Lo Stim–Lo Approp ($N = 12$)	F[c]
Bayley Ment. 2	114	104	103	93	5.84**
Language	59	56	40	27	5.34**
+ Emotion	0.047	0.048	0.033	0.017	7.26**
+ Involv. M	0.243	0.231	0.197	0.171	3.91*

[a] Stimulation: social stimulation (verbal and visual).
[b] Appropriateness: for age, selectivity of response rating.
[c] Analysis of variance, $df = 3,32$.
* $p < .05$.
** $p < .01$.

the children of consistently high-scoring mothers were significantly superior to those of consistently low scorers on every measure. On the Bayley mental test, the two mixed groups, midway between the consistently high and consistently low groups, were indistinguishable. However, for the other three measures—language competence, positive emotion, and involvement with the mother—scores for children of high stimulating–low appropriate mothers were as high as those of consistently high mothers. These relations are not unreasonable. Appropriateness of the mother's behavior, based on the child's age and ability, would be expected to affect his intellectual performance more than it would affect his emotional state or attachment to his mother. The previously discussed suggestions that verbal stimulation is essential for language development, but that sheer stimulation is not sufficient for overall competence or motivation in a new situation (Bayley test), are further supported by this analysis.

5. CAUSES AND CONSEQUENCES OF MOTHER-CHILD INTERACTION

Until now, in examining relations between infant and maternal variables, assertions of "causal direction" have generally been avoided. The analyses discussed thus far do not permit the assignment of causal direction. In the following section, however, effects over time are examined by means of a cross-lagged panel correlational technique (Campbell 1963) to determine the relative plausibility of causal hypotheses. These hypotheses were evaluated for a set of variables selected to represent different dimensions of maternal and infant functioning (table 24).

The pattern of correlations for one particular mother-child relation is diagramed in figure 7—the relation between the child's Bayley mental test score and the frequency of maternal visual attention. The correlations on the diagonals are the cross-lagged correlations. The cross-lagged correlation

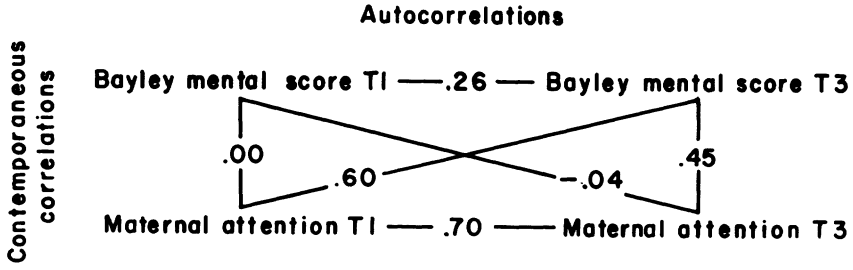

FIGURE 7.—Correlations between the child's Bayley mental test score and the mother's social attention at Times 1 and 3.

between maternal attention at Time 1 (11 months) and Bayley mental test score at Time 3 (17 months) was highly significant. Combined with the lack of a relation between the Bayley mental score at Time 1 and maternal attention at Time 3, this significant correlation supports the hypothesis that the amount of maternal visual attention influences the child's later intellectual competence. This causal hypothesis is diagramed in figure 8*a*. The probability that the difference between these cross-lagged correlations occurred by chance is low ($t = 3.6$, $p < .01$). However, certain rival hypotheses are seemingly consistent with this difference and were therefore examined.

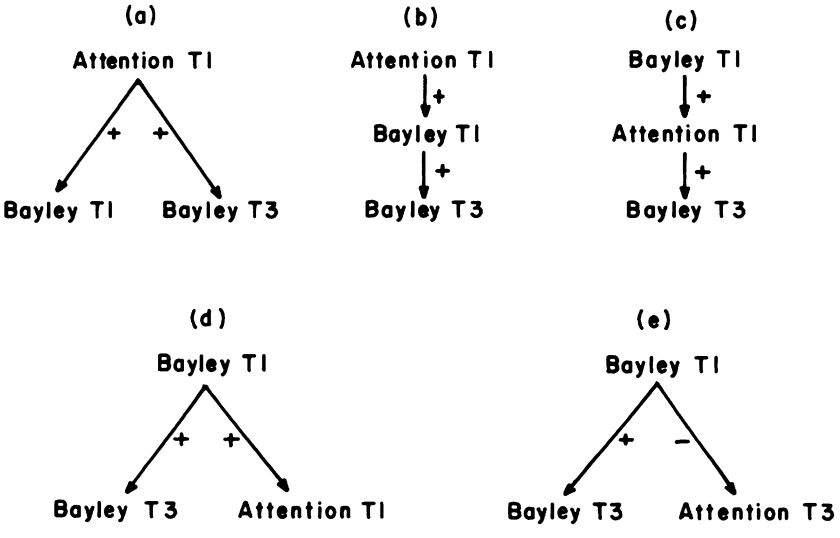

FIGURE 8.—Diagram of plausible alternative causal hypotheses relating the child's Bayley mental test score and the mother's social attention at Times 1 and 3.

TABLE 24

CROSS-LAGGED, CONTEMPORANEOUS, AND AUTO-CORRELATIONS FOR MATERNAL AND INFANT VARIABLES AT TIME 1 (11 MONTHS) AND TIME 3 (17 MONTHS)

		CROSS-LAGGED CORRELATIONS		CONTEMPORANEOUS CORRELATIONS		AUTO-CORRELATIONS	
INFANT VARIABLE	MATERNAL VARIABLE	MT1 × IT3	IT1 × MT3	MT1 × IT1	MT3 × IT3	IT1 × IT3	MT1 × MT3
Bayley Ment.	Looking	.60	—.04	.00	.45	.26	.70
	+ Emotion	.47	.00	.13	.63	.26	.68
	R soc.	.50	.07	—.01	.67	.26	.64
	Playing	.44	.02	.33	.41	.26	.59
+ Emotion	+ Emotion	.47	.78	.65	.71	.58	.68
	Same room	—.20	.30	—.10	.24	.58	.25
Voc. M	R distress	—.12	.44	.13	.30	.34	.63
	Reject.	.17	—.23	.10	—.17	.34	.54
	Same room	—.09	.35	.17	.24	.34	.25
Looks M	R distress	—.11	.37	.29	.33	.38	.63
	Same room	—.09	.42	.13	.01	.38	.25
Neg. beh.	Reject.	.51	.24	.29	.42	.27	.54

NOTE.—Significant cross-lagged differences from set of infant variables: Bayley Mental test, positive emotion, vocalizes to M, looks at M, stimulation by objects, schema development, negative behaviors; and maternal variables: looking, positive emotion, responsiveness to distress demand, responsiveness to social behaviors, effectiveness, effectiveness with objects, rejection, playing, MB in same room.

[a] Computed for the two variables in the significant cross-lagged correlations, while controlling for the Time 1 variable being "caused":

$$r_{12.3} = \sqrt{\frac{r_{12} - r_{13}r_{23}}{(1 - r_{13}^2)(1 - r_{23}^2)}}$$

[b] This value reflects the synchronous correlations between maternal and infant variables, corrected for time attenuation:

$$\left(\frac{r_{MT1\cdot IT1} + r_{MT3\cdot IT3}}{2}\right) \sqrt{\frac{r_{MT1\cdot MT3}}{\text{Mean internal reliability}} \times \frac{r_{IT1\cdot IT3}}{\text{Mean internal reliability}}}$$

Internal reliability = r between combined visits (see Rozelle & Campbell 1969).

[c] For test of significance, see Peters and Van Voorhis (1940, p. 185).

* $p < .05$.

** $p < .01$.

One alternative hypothesis is that maternal attention at Time 1 affects concurrent infant competence, and this leads to infant competence at Time 3 (fig. 8*b*). This interpretation was rejected, because if it had been true the relation between the end points of the causal sequence would have been less than the product of the relations between all adjacent intermediate points (Eron et al. 1972). For a similar reason, the causal chain diagramed in figure 8*c* was eliminated as a plausible hypothesis.

TABLE 24 (*Continued*)

Partial[a] Correlation	No-Cause Comparison[b]	*t*[c] Difference between Cross-Lagged Correlations	*t* Difference between Cross-Lagged Correlations and No-Cause Comparison		Most Plausible Causal Hypothesis
			MT1 × IT3	IT1 × MT3	
.62	.12	3.6**	2.7**	0.9	M looking at B $\xrightarrow{+}$ Bayley mental score
.47	.20	2.5*	1.4	1.0	M + emotion $\xrightarrow{+}$ Bayley mental score
.54	.18	2.2*	1.6	0.5	M R soc. $\xrightarrow{+}$ Bayley mental score
.39	.19	2.1*	1.2	0.9	M plays with B $\xrightarrow{+}$ Bayley mental score
.60	.60	2.0*	0.9	1.2	B + emotion $\xrightarrow{+}$ M + emotion
.34	.03	2.4*	1.1	1.3	B + emotion $\xrightarrow{+}$ MB in same room
.47	.17	2.9**	1.5	1.8	B voc. M $\xrightarrow{+}$ M R distress
—.33	.00	2.0*	0.8	1.1	B voc. M $\xrightarrow{-}$ M rejection
.34	.12	2.1*	1.0	1.1	B voc. M $\xrightarrow{+}$ MB in same room
.65	.12	2.6*	1.2	1.4	B looks M $\xrightarrow{+}$ M R distress
.41	.03	2.5*	0.5	2.0*	B looks M $\xrightarrow{+}$ MB in same room
.46	.28	1.5	1.3	0.2	M rejection $\xrightarrow{+}$ B neg. beh.

Figure 8*d* depicts another alternative hypothesis: that initial infant ability causes both contemporaneous maternal attention and later infant ability. The central question to be examined is whether the relation between early maternal attention and later Bayley test score could be explained as dependent on early ability. Since the correlation between maternal attention and infant ability at Time 1 was zero, this hypothesis was not accepted. Moreover, it was rejected because the partial correlation between early maternal attention and later infant ability, controlling for early ability, was as high as the cross-lagged correlation between early looking and later ability.

The final alternative hypothesis which was considered was that early ability causes diminished maternal attention (fig. 8*e*). Rozelle and Campbell (1969) have suggested that cross-lagged correlations be compared with a "no-cause baseline" in order to eliminate this possibility. The appropriate no-cause comparison, they argue, is the average of the two contemporaneous correlations attenuated for the internal reliabilities of the variables. In this example the no-cause comparison was .12. Since the correlation between early maternal attention and later Bayley score deviated significantly from this figure, in a positive direction, and the correlation be-

tween early Bayley score and later maternal attention did not, the hypothesis that early ability causes diminished maternal attention was clearly untenable.

On the basis of these statistical manipulations, the conclusion was drawn that the single most plausible causal hypothesis relating these particular variables was that the amount of maternal attention (looking) influenced the child's later performance on a comprehensive test of intellectual competence and motivation. This is not to suggest that visual attention *alone* caused the improvement in the child's Bayley test score. This particular maternal behavior was only one of a number of highly correlated maternal characteristics which exhibited parallel patterns of causation. When other maternal variables were submitted to similar cross-lagged analysis, verbal and social stimulation, positive emotion to the child, contingent responsiveness to his social behavior, and the amount of time spent by the mother playing with the child also all seemed to have a positive effect on the child's overall intellectual development. Although these maternal variables were all included in the single factor of optimal maternal care, they are not synonymous with that factor. Moreover, some components of optimal care (responsiveness to distress, effectiveness with objects, and rejection) did not follow this causal pattern. The best label to summarize the subset of optimal maternal care which increased children's intellectual competence appears to be "social attention."

Another relation in which maternal behaviors appeared to influence children's behaviors (although it did not reach significance) was between maternal rejection and the infant's increased crying and fretting.

The relation between maternal responsiveness to distress and infant irritability could not be assigned a causal direction in this analysis, since the cross-lagged correlations were not significantly different ($-.22$ and $-.12$). Similarly, no cause-and-effect relations were revealed for the child's behavior with objects (schema level or number of prolonged object involvements) or for the effectiveness of maternal behavior.

Although it was not possible to get comparable measures of infant language competence at the beginning and end of this study, one may generalize from relations between maternal variables and the Bayley mental test (which includes language items) that maternal stimulation influenced language development. When relations between maternal behaviors and the child's vocalization directed to his mother were analyzed, however, a different pattern of causation appeared. This pattern occurred whenever any of the child's social behaviors to the mother (looking, smiling, or vocalizing) were involved. The pattern and its associated hypotheses are illustrated by figures 9 and 10. The cross-lagged correlation between the child's social expression to the mother at Time 1 and the amount of time mother and child spent in the same room at Time 3 was highly significant. Since the opposite cross-lagged correlation was close to zero, this suggested that

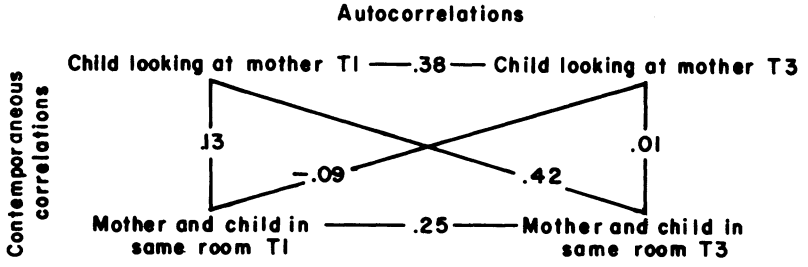

FIGURE 9.—Correlations between the frequency with which the child looks at his mother and the amount of time they spend together, at Times 1 and 3.

the child's looking, smiling, and vocalizing to the mother, when she was in the room, caused them to spend more time together later (fig. 10*a*). The process of elimination described for maternal attention and infant ability was applied to rival hypotheses relating these variables. Hypotheses 10*b* and 10*c* were rejected because the correlations between the end points were greater than the products of the correlations between adjacent intermediate points. Hypothesis 10*d* was eliminated because the partial correlation between the child's social behavior at Time 1 and the time mother and child spent together at Time 3, controlling for time together at Time

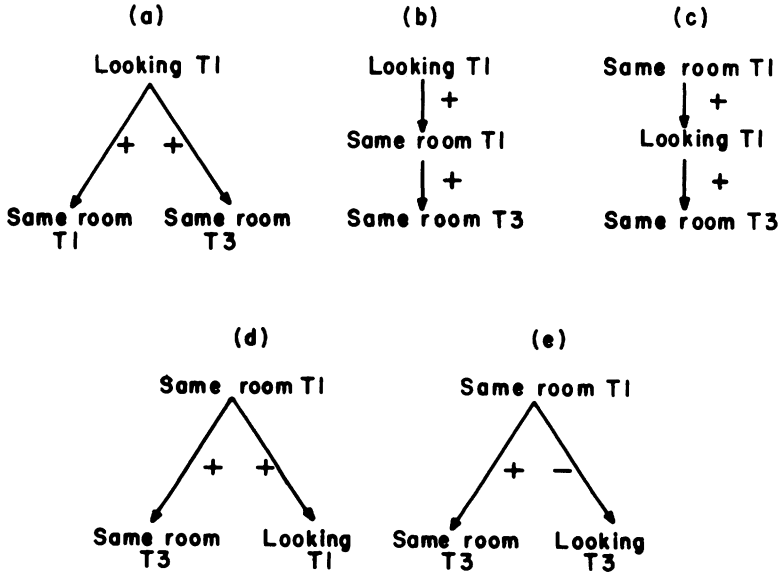

FIGURE 10.—Diagram of plausible alternative hypotheses relating the frequency with which the child looks at his mother and the amount of time they spend together, at Times 1 and 3.

1, was equal to the cross-lagged correlation between the child's early social behavior and later time together. Finally, hypothesis 10*e* was not accepted because the positive cross-lagged correlation between early social behavior and later time together deviated significantly from the no-cause comparison figure, while the other cross-lagged correlation did not. It was, therefore, concluded that hypothesis 10*a* was most plausible; that is, that the child's social behavior affected the amount of time he and his mother spent together. By a similar process, it was concluded that the child's expression of positive emotion to his mother caused her to express more positive emotion to him later. Looking at and vocalizing to the mother also caused the mother to be less rejecting and more responsive to the child's distress and demands. Obviously, the infant's social behaviors are an influential force in mother-child interaction. The reciprocal nature of mother-child relations is demonstrated by these findings which illustrate that, over time, both mothers and children affect each other's behavior.

Another set of causal hypotheses that was investigated in this research probed relations between maternal attitudes and maternal behaviors. Table 25 summarizes the significant correlations between attitudes and behaviors;

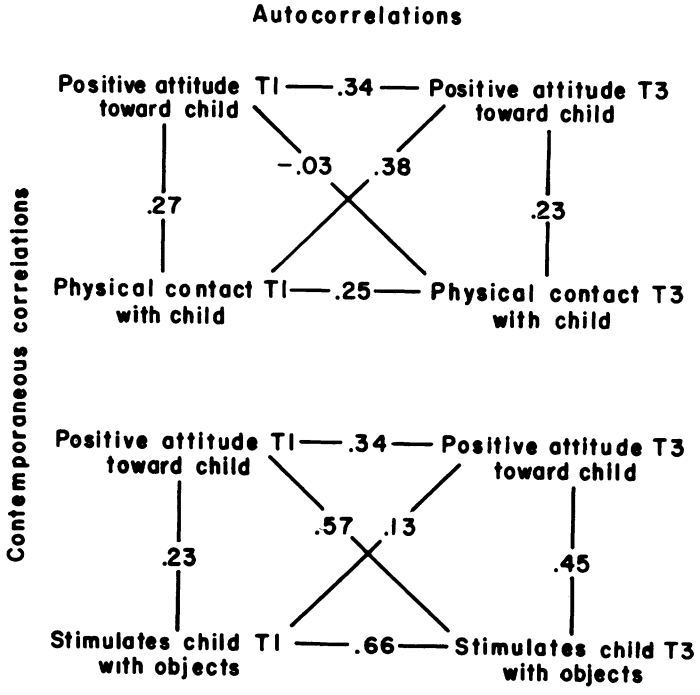

FIGURE 11.—Correlations between maternal attitudes and maternal behaviors at Times 1 and 3.

TABLE 25

CROSS-LAGGED, CONTEMPORANEOUS, AND AUTO-CORRELATIONS BETWEEN MATERNAL ATTITUDES AND MATERNAL BEHAVIORS

ATTITUDE[a]	BEHAVIOR	CROSS-LAGGED CORRELATIONS: Attit. T1 × Beh. T3	CROSS-LAGGED CORRELATIONS: Beh. T1 × Attit. T3	CONTEMPORANEOUS CORRELATIONS: Attit. T1 × Beh. T1	CONTEMPORANEOUS CORRELATIONS: Attit. T3 × Beh. T3	AUTO-CORRELATIONS: Attit. T1 × Attit. T3	AUTO-CORRELATIONS: Beh. T1 × Beh. T3	MOST PLAUSIBLE CAUSAL HYPOTHESIS
+ Attit.	Phys. cont.	.38	−.03	.27	.23	.34	.25	+ Attit. $\xrightarrow{+}$ phys. cont.
+ Attit.	Direct.	−.36	.03	−.03	−.09	.34	.49	+ Attit. $\xrightarrow{-}$ direct.
+ Attit.	Playing	.10	.42	.28	.34	.34	.59	Playing $\xrightarrow{+}$ + attit.
+ Attit.	Stim. w obj.	.13	.57	.23	.45	.34	.66	Stim. w obj. $\xrightarrow{+}$ + attit.

[a] Positive accepting attitude toward child.

two correlational patterns are diagramed in figure 11. When implausible alternative hypotheses were eliminated, it appeared that an initially positive attitude toward infants caused the mother to be less directive toward her child and to engage in a great deal of physical contact with him; playing with the child and stimulating him with objects, on the other hand, led to a more positive attitude toward the child later. This suggests one interactional pattern wherein maternal attitudes affect maternal behaviors which the mother imposes on the child, but, at the same time, maternal attitudes are influenced by the mother's playful and stimulating contact with the child. This demonstrates the complex reciprocity of mother-child interaction.

Since it was not possible to calculate internal reliabilities for the second time period at 14 months (because for most subjects it consisted of only one visit), comparisons of cross-lagged correlations between maternal and infant variables at Times 1 and 2 and Times 2 and 3 are not included in this report. One relation is mentioned as an illustration of a pattern of correlations which appeared when more than two time periods were considered (fig. 12). At Times 1 and 2 the cross-lagged correlations for infant

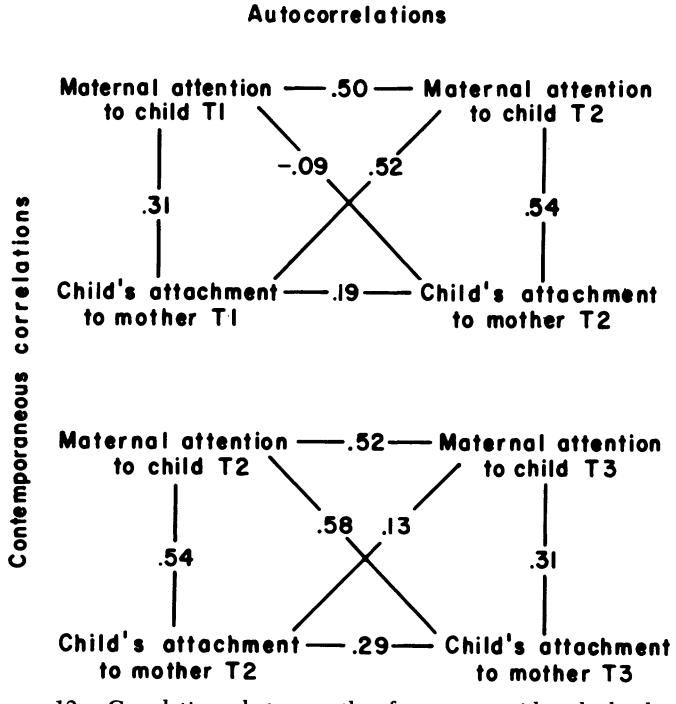

FIGURE 12.—Correlations between the frequency with which the mother looks at or speaks to the child (maternal attention) and the child's attachment to the mother, at Times 1, 2 and 3.

attachment and maternal attention suggested that maternal attention was causing an increase in infant attachment. From Time 2 to Time 3, however, the cross-lagged correlations implied the opposite: that infant attachment was causing maternal attention. This finding suggests the possibility that, as mother and child search for harmonious, balanced interaction over the course of development, first one then the other assumes the "causal role."

IV. CONCLUSION AND SUMMARY

Mother-child relations discovered in the present research closely parallel those found in related research in middle-class homes with younger children, including those who were not firstborns. Such congruity gives support to the generalizability of principles of mother-child interaction to children of other ages who have siblings and who live in different economic circumstances. However, it is necessary to keep in mind the limitations which sample selection places on generalizability. In fact, even within this sample, significant differences were found related to sex and race (perhaps confounded by economic condition). Such differences were apparent not only in the frequencies of certain behaviors and the levels of competence attained by different groups but also in the degree of correlation between certain maternal and child variables. Consequently, and as always, caution must be applied before generalizing from relations found in this study to particular mothers and children.

The central finding revealed by this research was that children's overall competence was highly significantly related to maternal care. A cluster of infant variables which included measures of the child's competence in the areas of cognitive, language, and social development was strongly and positively related to a similarly complex maternal factor which subsumed measures of optimal maternal care on the dimensions of positive emotion, stimulation, and responsiveness. These patterns of interrelated measures, observed for both mother and child, suggest the need for a broad definition of competence.

Within this broad relationship between competencies, correlations between specific maternal and child variables were also found. The examination of one set of relations provided evidence about the effects of maternal stimulation on children's development. The total amount of maternal stimulation was found to be highly related to infants' overall development. Moreover, relations existed between specific forms of maternal stimulation and conceptually parallel infant competencies and behavior. The amount of verbal stimulation directed toward the child significantly influenced the child's intellectual development, particularly the ability to comprehend and

express language. The possibility of a relation between the content of maternal speech and children's early vocabularies was also suggested. And it was noted that girls and their mothers, especially, interacted in a verbal-social mode.

The child's cognitive development and the complexity of his play with objects was apparently influenced by the amount of time his mother spent with him playing with materials. Cognitive development was not related to the stimulation inherent in the physical environment per se, a finding which demonstrates the importance of the mother as a mediator of the physical environment. Moreover, the mother's preference for interaction mediated by materials was reflected by the child's preference for involvement with objects. Although in general all children became increasingly involved with their physical environments and decreasingly with their mothers over this time period, boys and their mothers were particularly object oriented. In contrast, girls were more socially oriented (at least vis-à-vis their mothers). These sex differences increased with age. Differences between mothers were in the same direction but smaller.

Further reflecting a specificity of relations within comprehensive patterns, a correspondence between the mother's physical contact with the child and his physical attachment to her was observed—especially among black children and their mothers. Black children tended to be more physically attached to their mothers than white children. They also smiled, vocalized, and moved around less. Although they excelled in early test performance, by 17 months they were consistently lower on all measures of competence. Similar race differences were observed between the two groups of mothers. Black mothers—who spent as much time with their children as did white mothers—spent more time controlling and physically caring for their children, while white mothers were more likely to spend time talking and playing with their children.

Social-emotional relations were congruent with findings of previous research. A significant correspondence was observed between children's and mothers' social and emotional behaviors toward each other. The child's optimal, secure attachment to the mother was significantly related to high maternal scores on dimensions of affection, stimulation, and responsiveness. In the area of social interaction, however, unlike the relation between maternal stimulation and the child's intellectual development, the influence of the child's behavior on his mother's activities was strongly felt. The process of reciprocal mother-child influence was clearly demonstrated. The more often the child looked, smiled, or vocalized to his mother, the more affectionate and attached to the child she became and the more responsive she was to his distress and demands. That this causal direction is maintained throughout infancy and childhood cannot be asserted. In fact, the possibility of causal "role reversal" throughout the course of development was suggested by the study.

Maternal emotional behavior also influenced certain aspects of the child's behavior and development: notably, maternal rejection led to negative behavior, and positive emotion to enhanced performance on a comprehensive measure of intellectual development and motivation.

This same comprehensive measure of the child's development (Bayley Mental Scale) was also related to differences in the quality of maternal behavior: the appropriateness of maternal stimulation for the age and ability of the child, and the contingent responsiveness of maternal behavior. Maternal responsiveness was, in fact, more highly related to measures of the child's overall competence than to the frequency of the specific child behaviors responded to. It was strongly suggested that maternal responsiveness to the child's social signals was enhancing the child's later intellectual and social performance.

The conclusion that maternal behavior influences children's development is based on statisical analysis of correlations across time. Although this type of analysis is a neat utilization of observational data, it does not permit the same degree of confidence in a causal relation as does deliberate experimental manipulation. A sound approach, integrating basic and applied research, would be the application of conclusions based on observational studies to programs of experimental intervention. For example, variables suggested by naturalistic observation to benefit children's development could serve as bases for educational curricula, and naturally occurring child behaviors could be used as criteria of evaluation. The present study suggests that, in many homes, mothers are often available to their children but seldom interact with them in playful, affectionate, and stimulating ways, nor is their behavior consistently responsive to the child's expressions. Since these kinds of maternal behavior seem to enhance children's development, they might be made the focus of further study through educational training for mothers of young children. Wholesale unassessed application of conclusions drawn from this or any other observational study must be guarded against, however. In the present study, although there appeared to be generally applicable principles describing the interaction of all mothers and children, the extent to which maternal behaviors affected children's performance differed according to the child's age, sex, and race. Nor was it possible in this study to separate completely the effects of maternal behavior from the mother's genetic contribution to the child's development. If programs designed to change behaviors of mothers or children are to be useful and successful, more research—observational *and* experimental—is needed.

APPENDIX A1

DEVELOPMENTAL CHECKLIST

I. Motor Development
- Crawled
- Crept (on hands and knees)
- Other prewalking locomotion
- Pulled self to standing
- Got to feet unaided
- Stood, holding on
- Stood, alone
- Walked, holding on
- Walked, alone
- Trotted
- Ran
- Jumped
- Climbed
- Stooped

II. Language Development
- Nonspeech vocalization (noises)
- Prespeech vocalization
- Expressive sounds (directed)
- Imitated sound
- Said one to three words
  - Nondirected
  - Directed
  - As response
  - Referential
- Said four to six words
  - Nondirected
  - Directed
  - As response
  - Referential
- Said more than six words

Nondirected
Directed
As response
Referential
Imitated word
Said sentence
Responded to some familiar words
Understood all familiar words
Responded to some verbal requests
Understood all verbal requests (sentences)

III. Play Behavior

A. Objects and toys available

B. Objects and toys played with

C. Schema development
Put object in mouth
Looked at object
Banged, hit, patted, or shook object
Examined object (looked and manipulated)
Slid, crumpled, stretched, tore, pushed, or pulled object
Dropped or threw object
Put in, took out object
Used object for intended or socially approved function (drank from cup, built with blocks, made doll walk, blew whistle, bounced ball, put puzzle together, etc.)
Showed object to another person
Used object in creative, constructive, unusual way

D. Exploration
Crawled, walked around room, looked at, touched objects
Deliberately went toward new object
Examined new object

E. Symbolic play
Rudimentary
"Full blown"

IV. Attachment to Mother

A. When observer enters
Looks at mother
Goes to, reaches up to mother
Touches, clings to mother
Buries head in mother's lap
Cries, frets

B. When mother leaves room
Follows or starts to follow
Frets
Cries

C. While mother is out of room
   Frets or cries till return
   Calls mother
   Searches physically or visually

D. When mother returns
   Quiets
   Cries till comforted
   Approaches or reaches toward
   Greets (look, smile, vocalization)

E. While mother is in room
   Follows visually
   Goes to or follows physically
   Vocalizes to
   Says "mama"
   Smiles at
   Holds, face toward mother
   Holds, back to mother

F. When mother puts baby down
   Frets or cries
   Reaches up
   Holds

V. Reaction to Observer

Looks at observer, mother present
Looks at observer, mother absent
Smiles at observer, mother present
Smiles at observer, mother absent
Approaches observer, mother present
Approaches observer, mother absent
"Talks" to observer, mother present
"Talks" to observer, mother absent
Plays with observer, mother present
Plays with observer, mother absent
Avoids observer coyly, mother present
Avoids observer coyly, mother absent
Avoids observer really, mother present
Avoids observer really, mother absent
Shows fear of observer, mother present
Shows fear of observer, mother absent

VI. Physical Restriction of Activities

Mother restraining
In playpen, crib, or on couch
In one room, physical barrier
In one room, social barrier
In high chair or jumper
In walker

APPENDIX A2

RATING SCALES

I. Infant's Activity Level

Passive, inactive 0 1 2 3 4 Very active

II. Mother's Positive Emotional Involvement with Baby

A. Tone of voice

Angry, hostile	Distant, cold	Unemotional, neutral	Lukewarm	Warm, kind	Very warm, lovey
−2	−1	0	+1	+2	+3

B. Amount of expressed positive emotion

None 0 1 2 3 4 Very much

III. Mother's Attitude toward Child's Behavior

Unaccepting 0 1 2 3 4 Completely accepting

IV. Mother's Skill in Caretaking

Inefficient 0 1 2 3 4 Super efficient

V. Amount and Kind of Contact with Mother

A. Physical

Amount: Never 0 1 2 3 4 Very frequent
Closeness: Distant 0 1 2 3 4 Close
Vigor: Passive 0 1 2 3 4 Vigorous

B. Auditory-verbal

Amount: Never 0 1 2 3 4 Very frequent

C. Visual, eye-to-eye

Amount: Never 0 1 2 3 4 Very frequent

D. With materials

Amount: Never 0 1 2 3 4 Very frequent

E. Social stimulation

Amount: Never 0 1 2 3 4 Very frequent

F. Communicative stimulation
Amount: Never 0 1 2 3 4 Very frequent

VI. Responsiveness of Mother to Child's Behavior

A. Frequency
To distress: Never 0 1 2 3 4 Always
To social expressions: Never 0 1 2 3 4 Always
To demands: Never 0 1 2 3 4 Always
To physical need: Never 0 1 2 3 4 Always

B. Latency
Very slow 0 1 2 3 4 Immediate

C. Selectivity of response
Never 0 1 2 3 4 Always

VII. Appropriateness of Mother's Behavior

A. Effectiveness
Never 0 1 2 3 4 Always

B. For age and ability of child
Never 0 1 2 3 4 Always

APPENDIX B

MATERNAL INTERVIEW ATTITUDE QUESTIONS

1. Did baby "invent" his own schedule?
2. Did mother like children before her own was born?
3. When pregnant, did mother want and look forward to baby?
4. Was mother pleased with baby's sex?
5. Does mother find baby attractive?
6. Does mother like to hold baby, play with him; does she think he's fun?
7. Does mother like to take care of baby (including diapering)?
8. Does mother think baby will be more interesting later?
9. Has mother ever regretted having the baby; does she feel restricted?
10. Does mother want more children?
11. Does mother pick baby up when he cries?
12. Does mother (ever) find baby irritating?
13. Does mother express her anger to the baby?
14. Does mother think the baby demands a lot of attention from her?
15. Does mother give the baby attention even when she is busy with other things?
16. Does mother think the baby's reactions are natural, normal?
17. Is mother a permissive disciplinarian?
18. Is mother responsive to baby's demands, desires?
19. Does mother encourage children to talk?
20. Does mother favor teaching educational things at home?

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