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## Predicting one-year competence from earlier infant behavior: a methodological inquiry.

Margaret H. Ricks  
*University of Massachusetts Amherst*

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PREDICTING ONE-YEAR COMPETENCE FROM EARLIER  
INFANT BEHAVIOR: A METHODOLOGICAL INQUIRY

A Thesis Presented

By

Margaret Helen Ricks

Submitted to the Graduate School of the  
University of Massachusetts in partial fulfillment  
of the requirements for the degree of

MASTER OF SCIENCE

May 1981

Psychology

PREDICTING ONE-YEAR COMPETENCE FROM EARLIER  
INFANT BEHAVIOR: A METHODOLOGICAL INQUIRY

A Thesis Presented

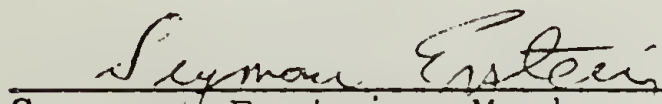
By

Margaret Helen Ricks

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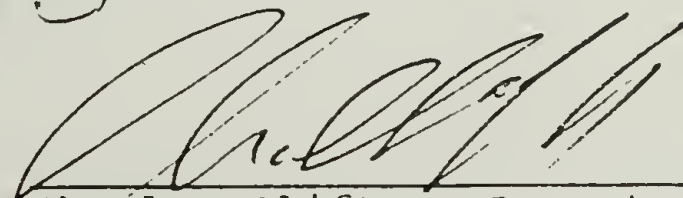
Edward Z. Tronick, Chairperson of Committee



Seymour Epstein, Member



Richard Bogartz, Member



Charles Clifton, Department Head  
Psychology

This thesis is dedicated to Dr. Richard Smith and  
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# C H A P T E R    I

## INTRODUCTION

The study of continuity of individual differences in social development presents serious methodological problems. One formidable problem has been the lack of adequate assessments of individual differences. Without reliable and valid assessments, it is not possible to discriminate methodological failure from lack of continuity.

When the longitudinal studies of the 1930's to 1960's failed to find, or found only modest, evidence of continuity of traits, both their linear model and their methods were challenged (Note 1). Recently, however, a systematic program of research has demonstrated continuity of adaptation in early development (summarized in Sroufe, 1979). Sroufe and his colleagues have shown that using developmentally appropriate challenges as assessment procedures, competence can be fairly well predicted from one year of age to two, three and five years of age (Matas, Arend and Sroufe, 1978, Waters, Wippman and Sroufe, 1979, Arend, Gove and Sroufe, 1979). They have recently outlined the principles underlying their successful strategy for designing assessments of



individual differences in competence (Waters and Sroufe, Note 2).

The present study extends their work by attempting to predict infant competence at one year of age from earlier infant behavior. It also tests two major tenets of the Waters and Sroufe model for assessment. Specifically, it tests the requirement for age-appropriate assessment and for the use of patterns of behavior rather than discrete frequencies of behaviors. The one-year outcome measure used is the extensively validated Ainsworth Strange Situation assessment of the quality of the infant's attachment to the mother (Ainsworth and Wittig, 1969, Ainsworth, Blehar, Waters and Wall, 1978).

There is no method currently available for assessing the infant's social competence prior to one year of age (see Beckwith, 1978, for a review, Waters and Sroufe, Note 2, for suggested assessment procedures). The procedure used for prediction in this study is the infant's response to the mother holding a still-face; that is facing the infant without vocalization, expression or movement.

Assessment procedures which are accurate and strong enough to allow predictions for individuals will have both basic and applied value, as tools for research and diagnosis. Such procedures will allow for further ex-

ploration of the origins and significance of individual differences in adaptation. In addition, they should be useful in clinical work.

### Assessing Social Competence

Because of its importance to this investigation, the Waters and Sroufe (Note 2) approach to assessment will be discussed at the outset. Waters and Sroufe suggest that, if there is continuity of individual differences in competence, it will be found by using broad-band, age-appropriate assessment procedures. Such assessments are drawn from developmental models which specify a particular task or issue of each stage of development (Erikson, 1954, Sander, 1962, Breger, 1974). Tasks are seen as arising from the maturation and learning expected at a given stage. As development occurs, new abilities make new patterns of behavior and interaction possible, raising new problems and leading to reorganization of cognition, affect and behavior. This view of qualitative transitions in development is a basic assumption of organismic developmental theories (see Santostefano and Baker, 1972, for elaboration of this point).

There is close agreement among developmental theo-

rists on the tasks of infancy (Erikson, 1954, Sander, 1962, Spitz, 1965, Breger, 1974, Mahler, 1974, Sroufe, 1978). Briefly, the task of the infant in the neonatal period is seen as that of physiological regulation, and from 3 to 6 months as that of learning to maintain engagement with the social surround. Forming an effective attachment relationship is widely viewed as the subsequent task and crowning achievement of the first year of life (Bowlby, 1969, 1973, 1980, Rutter, 1978, Sroufe, 1979, Sroufe and Waters, 1978, Ainsworth et al., 1978).

In contrast to expecting isometric continuity, then, Waters and Sroufe (Note 2) suggest that different developmental tasks should be assessed at different ages; what is expected, given environmental support, is continuity of individual differences in age-appropriate competence. They define competence as the ability to draw on resources, both of self and environment, to generate adaptive responses to age-appropriate challenge. The general principles of their strategy for designing competence assessments can be summarized as follows:

1. The assessment should be based on an age-appropriate challenge, without regard to the characteristics of competence at other stages



of development.

2. Strategically, assessment of competence will profit from a focus on patterns of behavior, rather than on discrete frequencies of specific behaviors.
3. Competence assessments will often be found in the affective domain, as the task should elicit engagement and tap motivation.
4. The competence assessment should broadly tap the child's abilities and should tax the child's ability to integrate the cognitive, affective and behavioral domains.
5. Assessments should be drawn from the domain of everyday life, rather than from laboratory derived indices of development.

The first two points of the Waters and Sroufe strategy are examined in the present investigation. Specifically, a task which meets the last three criteria is used at three different ages, and behavior is coded both according to patterns of behavior and by counting

discrete frequencies of specific behaviors. Thus, the importance of age-appropriate assessment and the utility of patterns of behavior, compared to discrete frequencies of behaviors, in assessing early individual differences in social competence are addressed.

In their own longitudinal studies, Sroufe and his colleagues have designed competence assessments for use with 2, 3, and 5-year-old children. They use the Ainsworth Strange Situation as a competence assessment at one year. Since the Strange Situation is used in this investigation as the outcome measure, it will now be described and its relationship to the Waters and Sroufe criteria will be indicated.

The Strange Situation: age appropriate patterns of behavior. The Ainsworth Strange Situation is a standardized laboratory procedure in which to assess the infant's ability to use the mother as a secure base from which to explore (Ainsworth and Wittig, 1969, Ainsworth et al., 1978). It consists of eight three-minute episodes, involving first the infant's introduction to an unfamiliar room and to an unfamiliar person, and then two brief separations from the mother. In each episode, the infant's behavior toward the adult present is rated on four seven-point scales: proximity-seeking, contact

maintenance, contact resistance and proximity avoidance. On the basis of the infant's pattern of behavior over all eight episodes, the infant is classified as securely attached, anxious-avoidant or anxious-resistant. (The procedures and classifications are described in detail in Chapter III.)

The Strange Situation meets the Waters and Sroufe criteria of engaging the infant, tapping the organization of affect, behavior and cognition, and reflecting everyday occurrences. Nonetheless, its power to discriminate individual differences rests on its age-appropriate use, and on classification of infants according to their pattern of behavior. Several investigations have shown while the pattern of response is stable, from 12 to 18 months, in a stable environment, discrete behaviors such as smiling, looking, approaching and so on, show very little stability (Connell, Note 3, Waters, 1978, Main, 1973, cited in Ainsworth, et al., 1978).

The Strange Situation is an age-appropriate assessment for one-year-olds in that it taps the task of the 7 to 12 month-old, that of forming an effective attachment relationship. Separation from an attachment figure in unfamiliar circumstances heightens attachment behavior in virtually all one-year-olds (Ainsworth, et al., 1978). Although the Strange Situation has not been used



with infants under 50 weeks of age, anecdotal evidence suggests that it would not be useful with younger infants. Occasionally a motorically or cognitively delayed one-year-old is seen in the Strange Situation. Typically, such infants seem unaware of the mother's departures or show such limited proximity-seeking that classification of the quality of attachment is unreliable (Note 4). Similarly, research with 2 to 4-year-olds in the Strange Situation suggests that the measures lose some of their ability to discriminate individual differences when used with children over one year of age. With increasing age, crying, proximity-seeking and contact maintenance decrease (Marvin, 1972, Maccoby and Feldman, 1972, Feldman and Ingham, 1975, Lieberman, 1977). The sum effect is that individual differences are less noticeable as attachment behavior is less activated.

#### Response to the Still-Face as a Competence Assessment

This study has two major goals. First, it applies the Waters and Sroufe (Note 2) strategy for competence assessment to individual differences in the 3, 6 and 9 month old infants' response to the mother holding a 'still-face'. Second, it provides normative data on infant response to the still-faced mother at 3, 6 and 9

months. In this section, the still-face procedure will be reviewed as a competence assessment within the Waters and Sroufe framework. Each of their criteria will be discussed in terms of the still-face procedure at 3, 6 and 9 months. It will be shown that the still-face procedure meets the third, fourth and fifth criteria of the Waters and Sroufe approach at all three ages used in this study. That is, at 3, 6 and 9 months, it elicits engagement (3), taps the coordination of affect, cognition and behavior (4) and it is drawn from the domain of everyday life (5).

First, it will be useful to describe the hypothesized meaning of the still-face procedure for the infant. Essentially, the mother's holding a still-face is thought to present the infant with a paradox. By assuming an en face position, she signals her readiness to interact; then she neither initiates interaction nor responds to infant behavior (Tronick, Als, Adamson, Wise and Brazelton, 1978). The paradox is heightened in that the procedure distresses the infant. When distressed under more normal circumstances, the infant responds by signalling the attachment figure (Bowlby, 1969, 1973, Ainsworth, et al., 1978). Yet, in the still-face procedure, it is the attachment figure who induces the distress, and she remains unresponsive to infant signals.

It was expected that the infant who is able to maintain engagement and organized behavior in this situation would be more likely than the infant who sacrifices engagement, or whose behavior becomes disorganized, to be competent (secure in the attachment relationship with the mother) at one year of age. In general, maintenance of organized behavior under age-appropriate stress is a hallmark of competent adaptation (Sroufe, Note 5). Failure to vocalize and smile to social stimulation by 3 months of age, and failure to signal an adult when stressed by 6 months of age are considered 'signs of deviance' by Provence and Lipton (1963). Investigations of the antecedents of secure attachment suggest that infants seen as secure at one year are more positive in all modes of interaction with the attachment figure throughout the first year (Ainsworth, Note 6, Ainsworth, et al., 1978); they are more responsive in face-to-face interaction at 3 months of age than are infants who will later be seen as anxious in the attachment relationship (Blehar, Lieberman and Ainsworth, 1976). By the end of the first year, infants seen as securely attached not only cry less, but also develop more sophisticated forms of vocal and gestural communication than do infants subsequently seen as anxious in the attachment relationship (Bell and



Ainsworth, 1972).

Criterion 3: Eliciting engagement and tapping effect.

Conceptually and empirically, the still-face procedure can be shown to elicit infant engagement at 3, 6 and 9 months of age. Situations which involve both familiar and unfamiliar elements elicit effectance in White's (1959) view. The still-face procedure, involving the familiar caretaker behaving in an unfamiliar fashion, should, thus, elicit motivation. Clearly it results in strong affective response. Virtually all investigations of infant response to the still-faced mother have studied 2 to 5 month-old infants, and have found that initial smiles or signs of pleasure are quickly followed by tension movements, gaze aversion, and, if the still-face is prolonged, by frank distress (Spitz, 1965, Trevarthan, 1975, 1977, Tronick, et al., 1978). The only studies of infants over 5 months have involved still-faced experimenters rather than the infant's mother, thus confounding, for present purposes, infant reaction to the stranger with infant response to the still-face.

Criterion 4: Broad-band assessment taxing the integration of cognition, affect and behavior. By three

months, the youngest age used in this study, infants

seem to have the cognitive, affective and behavioral capabilities to respond to the still-faced mother adaptively. Cognitively, by three months infants are able to perceive and recall, with cueing, contingencies between their actions and external events (Papousek, 1961, Papousek and Bernstein, 1967, Rovee-Collier, 1979, Fagen, Rovee and Kaplan, 1976, Sullivan, Rovee-Collier and Tynes, 1979). Contingent response can increase or decrease infant response as early as two months of age (Beckwith, 1971, Jones and Moss, 1971). Affectively, the infant's earliest reliable signs of delight in environmental events are seen in social interaction such as face-to-face play (cf. Stern, 1977). Behaviorally, the social smile, inviting stimulation, and gaze aversion, regulating intake, are usually considered to be well developed by three months of age (Spitz, 1965, Emde, Gaensbauer and Harmon, 1976).

Criterion 5: Drawing on the domain of everyday life.

The appearance of the social smile, full-blown by around two months of age, ushers in a period of heightened infant-adult face-to-face interaction (Emde, et al., 1976, Stern, 1977). In extensive home observations, Blehar, Lieberman and Ainsworth (1977) found that episodes of face-to-face interaction occurred with a mean frequency

of 3.8 per hour (range from 1.1 to 9.3) with 6 to 15 week-old infants. The still-face itself may not be particularly unusual; in close to 20% of the episodes, mothers initiated interaction with "unsmiling, silent" faces (p. 187). In an equal proportion of the episodes, mothers behaved in a "matter-of-fact" manner, neither affectively engaging nor responding to the infant.

Criterion 1: Using an age-appropriate challenge. The task of the infant from 3 to 6 months is widely viewed as that of learning to maintain engagement with the surround (Sander, 1962, Sroufe, 1978, 1979, Waters and Sroufe, Note 2). Caretakers are catalytic in increasing infant attention and expanding the infant's range of affective expression, teaching the infant to tolerate--and enjoy--greater and more varied stimulation. This occurs in large part through face-to-face interaction, when adults tend to show varied, exaggerated expression and vocalization, coupled with delicate responsivity to infant expression (Stern, 1974, Brazelton, Kozlowski and Main, 1974, Tronick, Ricks and Cohn, in press).

In the present study, the accuracy of prediction made from 3, 6 and 9 month-old's response to the still-faced mother are compared. It is expected that the infant's response to such stressed face-to-face interac-



tion with the mother should be especially discriminating at 6 months, when the task is thought to be most salient for the majority of infants. At 3 months, the issue of maintaining engagement with the surround is first being met; by 9 months, most infants should have developed some way of coping with the demands of the task.

Criterion 2: Assessing patterns versus discrete frequencies of behaviors. For the still-face procedure used in this study, the accuracy of predictions made from measures of discrete behaviors was compared with the accuracy of predictions made from classification of the infant's total pattern of behavior. Discrete frequencies of smiles, vocalizations, neutral looks at the mother and cries were counted for each infant as is typical in much developmental research (see Beckwith, 1978). Three patterns of behavior, seen as reflecting differing degrees of competence, were observed. Infants who maintained engagement, who smiled or vocalized toward the mother, were seen as most competent. Infants who did nothing which, under normal circumstances, would attract the caretaker's attention, were seen as least competent. Indeed, failure to signal distress may be seen as maladaptive at 6 months (Provence and Lipton, 1962). Infants who acted as if eliciting the adult's

attention, but whose elicits were all fussy vocalizations or cries were seen as more competent than those who did not signal at all, but as less competent than those who mobilized positive elicits. Both of the systems used for coding infant behavior are discussed in more detail in Chapter II.

### Summary: Chapter I

The present study is designed to apply a recent model of competence assessment to the problem of predicting individual differences in social competence at one year of age from earlier infant measures. The one year outcome measure used is the classification of the quality of the infant's attachment to the mother, based on infant behavior in the Ainsworth Strange Situation (Ainsworth and Wittig, 1969, Ainsworth, et al., 1978). The earlier behavior, assessed at 3, 6 or 9 months, is the infant's response to the mother holding a 'still-face'.

The accuracy of predictions made from the three ages, 3, 6 and 9 months, was compared. In addition, the accuracy of predictions made by two methods was compared. These two methods were (1) Coding discrete frequencies of infant behavior and (2) Classifying each infant's overall response on the basis of the pattern

of behavior observed. On the basis of the strategy for competence assessment proposed by Waters and Sroufe (Note 2) it was expected that the 6 month-old infants pattern of response to the still-faced mother would provide the most accurate predictor of the attachment classification.

The primary goals, then, of the present study is to test the predictive validity of a proposed competence assessment in the first year of life. A secondary goal is to test two tenets of a strategy for competence assessment which has had demonstrated success (Waters and Sroufe, Note 2). In addition, the study provides normative data on infant response to the still-faced mother. Comparable data are not currently available for infants over 5 months of age.



## C H A P T E R   I I

### METHOD

#### Sample

The sample included in this study is made up of 78 mother-infant pairs recruited through local birth records. They are a subsample of 102 pairs in a longitudinal study. Each mother reported a healthy pregnancy carried to full term, with no serious complications of birth or subsequent illness. Twenty-six infants entered the study at each of three ages--3, 6 and 9 months. Each initial visit took place within two weeks of the infant's monthly birthday. At each age, half of the infants were female and half were male. All mother-infant pairs were invited to return for two laboratory visits when the infant reached one year of age. Table 1 illustrates the mixed cross-sectional longitudinal design and the number of mother-infant pairs seen at each infant age (see Note 5).

#### Procedure

The data resulted from two visits to our laboratories. During the early visit, which took place when the

infant was 3, 6 or 9 months, mother-infant face-to-face interaction was videotaped and an interview was conducted. When the pair returned for the one-year visit, the quality of the infant's attachment to the mother was assessed in the Ainsworth Strange Situation, and an interview was conducted.

Table 1  
Design and Sample Size

| 3 months | 6 months | 9 months | 1 year |
|----------|----------|----------|--------|
| 26       |          |          | 13     |
|          | 26       |          | 17     |
|          |          | 26       | 19     |

N = Number of pairs for whom data were used for this study.

Early visit. In the early visit, the procedure was the same for all mother-infant pairs. Each mother was met outside the psychology building, Tobin Hall, and brought to the laboratory. On the way to the laboratory, an informal but standardly worded set of questions was asked to assess the infant's state before the procedure began. Once parent and infant appeared to be comfortable in the laboratory, the procedure was explained and informed consents obtained.

The videotaping took less than 10 minutes. The mother was seated on an adjustable stool opposite her infant, who was placed in an infant seat secured to a table. The two faced each other. Videotaping began with the mother turned away from her infant for 30 seconds. She was then instructed to play normally with her infant for two minutes, then to turn around again, facing away from her infant, for 15 seconds, then to turn back to the infant holding a still-face (motionless, expressionless and quiet) for two minutes. After the still face, she was asked to turn around for 15 seconds, then, again facing the infant, to play normally for two minutes. After the videotaping, mothers were interviewed and given an opportunity to review the videotape.

Systems for coding infant response to still-faced mother. Systems for coding infant behavior in response to the mother's still-face were developed in three steps. First, two undergraduates wrote detailed narrative accounts for over 30 pilot subjects. They were trained to note behavior considered important--particularly, any behavior which, under normal circumstances, would be expected to attract the mother's attention and any signs of infant distress or tension. Second, the



author sorted the narratives into patterns of infant response and decided on key behaviors to be coded. Third, the author wrote definitions of the discrete behaviors and descriptions of the patterns observed. All problems encountered and decisions made were written; coders worked directly from the written coding systems, to avoid "drift".

Infant response to the still-faced mother was coded for the frequency of six discrete behaviors. These included: (1) Vocalizations while oriented toward the mother, (2) Smiles while oriented toward the mother, (3) Looks at the mother, with wary to bright face, without smiles or vocalizations (henceforth called 'Neutral Monitor'), (4) Cries while oriented toward the mother, (5) Cries while oriented away from the mother, and (6) Attempts to initiate a game while oriented toward the mother.

The three patterns of behavior coded were: Pattern 1: Positive Elicits, used for infants who smiled or vocalized while oriented toward the mother at least once in the two-minute still-face episode, Pattern 2: Negative Elicits, used for infants who cried or made fussy vocalizations while oriented toward the mother,

but who did not smile or make non-fussy vocalizations, and Pattern 3: No Elicits, used to classify infants who merely looked at the mother and turned away, who neither smiled nor vocalized. The complete coding system is appended (Appendix 1).

All coding was done by undergraduate research assistants blind to all other measures used in this investigation, and blind to the specific hypotheses of the study. They viewed videotapes independently and were not aware of reliability checks. Between 61% and 77% ( $\underline{M} = 70\%$ ) of the infants were coded separately by two coders for specific behaviors; all infants were classified independently into one of the three categories by two or more research assistants. Correlation coefficients for frequencies of discrete behaviors ranged from .62 to .91 ( $\underline{M} = .82$ ). Percent agreement for the pattern classifications for the 3 ages ranged from 87.59 to 95% ( $\underline{M} = .90$ ). Table 2 presents all reliability data reported for each age. All disagreements on classification were resolved by conference; frequencies of discrete behaviors were averaged in cases of disagreement. The behavior "Initiates game while oriented toward mother" was coded so rarely (for none of the 3 month olds, 11% of the 6 month olds and 15% of

Table 2  
Inter-Observer Reliability

| Age of Infant | Frequency Data                                   |                                  |                    |                             |                      | Patterns           |
|---------------|--|----------------------------------|--------------------|-----------------------------|----------------------|--------------------|
|               | Look at <u>M</u> <sup>a</sup><br>and<br>Vocalize | Look at <u>M</u><br>and<br>Smile | Neutral<br>Monitor | Look at <u>M</u><br>and Cry | Look away<br>and Cry |                    |
| 3 Months      | .62  | .97                              | .67                | 93% <sup>c</sup>            | 88%                  | 87.5% <sup>d</sup> |
| 6 Months      | .91  | .82                              | .71                | 100%                        | 100%                 | 89%                |
| 9 Months      | .85  | .83                              | .86                | .93                         | .86                  | 95%                |

a M = mother

b Pearson product - moment correlations

c Occurred in only 11 and 15% of infants, respectively at 3 and 6 months;  
used % agreement as in (d)

d Agreement on classification calculated as Agreements + (Agreements +  
Disagreements) x 100. All infants were classified by two coders.  
Disagreements were conferenced.



the 9 month olds) that reliability could not be adequately assessed and the data were not used.

Twelve month visits. Just before the infant's first birthday, each mother was contacted and told we were doing a follow-up of the babies seen in face-to-face interaction. The twelve month visit was explained. Mothers were met outside Tobin and brought to a second laboratory, in Bartlett Hall. Before beginning, the procedure was explained and informed consent obtained. After the Strange Situation was completed, the experimenter conducted an interview with the mother.

### The Ainsworth Strange Situation

The Ainsworth Strange Situation is a procedure originally designed by Ainsworth and Wittig (1969) to assess individual differences in the one-year-old's ability to use the mother as a secure base from which to explore. It consists of eight episodes and lasts approximately twenty minutes. In the first episode, the mother carries her infant into a comfortably furnished laboratory room with an attractive selection of toys, and places the infant in the center of the room by the toys. She then sits in her chair, ostensibly reading a magazine. In this episode, and throughout

the Strange Situation, the mother is told not to initiate interaction with the infant, but to respond to infant bids for attention as she might at home. The first episode ends after three minutes with the entry of a female stranger into the room. The stranger sits quietly for a minute, talks to the mother for a minute, and then attempts to interest the baby in play for a minute. The mother then leaves the room, so that the infant is alone with the stranger. Whenever the mother is out of the room, she watches the procedure through a one way mirror; at her discretion the separation episodes may be shortened if the infant is distressed. The stranger is trained to comfort the baby should she cry, but, if the baby is not upset, to allow the baby to play or explore. After baby and stranger have been together for 3 minutes (less if the episode is shortened) the mother returns, and the stranger leaves. Three minutes of mother and infant reunion are followed by the mother's departure and three minutes (shortened if necessary) of the infant being alone in the room. The stranger enters, and after three minutes (again, shortened if necessary) the mother returns for the final 3 minute reunion episode.

In standard procedure, the entire situation is videotaped, and the infant classified on the basis of

her pattern of behavior into one of three major types of attachment. Infant behavior toward the mother and the stranger is coded on 7 point scales describing proximity-seeking, contact maintenance, contact resistance and proximity avoidance. In the most frequent pattern of attachment (60-70%) seen as reflecting a secure attachment, the infant is able to explore the surroundings before separation from the mother, seeks contact or proximity with her on reunion, and is able to return to play by the end of the reunion episodes. There are two patterns of behavior seen as reflecting anxious attachment. Roughly 20% of the infants seen in the Strange Situation are classified as 'anxious-avoidant'. Although they explore the surround in the first episodes, and may continue to do so in separations, they tend to avoid the mother on her return, by turning away or moving away from her. A somewhat smaller proportion (around 10%) are classified as anxious-resistant. Typically, they show impoverished exploration even in the mother's presence, before the stress of separation. They are usually extremely distressed by separation, but on reunion with the mother mix proximity seeking with contact resistance--tantrumming, pushing proffered toys away, and the like, giving the impression of anger and ambivalence.



Classification of infants for data analysis were done by a Ph.D. psychologist trained by Ainsworth's group, since the author was not blind to other measures used in the investigation. To assess reliability, all infants were also classified by the author; agreement was over 85%.

## C H A P T E R   I I I

### RESULTS:   INDIVIDUAL DIFFERENCES

This chapter is divided into two sections. The first compares the accuracy of prediction from the two methods used (discrete frequencies versus patterns of behavior) at three ages, 3 6 and 9 months. The second concerns the actual differences in response at 3, 6 and 9 months of infants classified as securely or anxiously attached to the mother at one year of age.

#### Comparison of two methods of prediction at three ages.

Infant pattern of response at 6 months was the most accurate predictor of the infant's quality of attachment at one year of age; it was far more accurate than either patterns at 3 or 9 months or frequencies or incidence of discrete behaviors at any of the three ages. Two methods were used to compare predictions made from frequency data with prediction from categorical data. The first is better suited to categorical data; the second to frequency data. Table 3 shows the results of the first method of comparison. The table presents the increment above base rate prediction provided by the classification of infant pattern of response and by the

Table 3

Increment Gained Over Base Rate  
Prediction by Two Methods

| Infant Age | Occurrence of Specific Behaviors    |                                  |     | Classification of Pattern |
|------------|-------------------------------------|----------------------------------|-----|---------------------------|
|            | Look at <u>M</u><br>and<br>Vocalize | Look at <u>M</u><br>and<br>Smile | Cry |                           |
| 3 Months   | .25                                 | .25                              | 0   | .17                       |
| 6 Months   | .40                                 | 0                                | 0   | .80                       |
| 9 Months   | 0                                   | 0                                | 0   | 0                         |

Note: All values shown are for  $L_B$ , the Goodman Kruskall Index of Predictive Association. Prediction is from earlier (3, 6 or 9 month) response to the still-face mother to quality of attachment as secure versus anxious at one year.

discrete behaviors treated as categorical (occurrence/non-occurrence). Base rate refers to the proportion of infants classified as securely versus anxiously attached at one year of age. One can assume, drawing on data from over 300 infants in five independent samples, that 60 to 70% of all one-year-olds will be classified as secure in the attachment relationship (Ainsworth, et al., 1978, Vaughn, Waters, Egeland and Sroufe, 1980). With no predictor variable, the best prediction is that every infant will be classified as securely attached.

The index used in Table 3 is the Goodman-Kruskall



Index of Predictive Association,  $L_B$  (Hays, 1973, Castellan, 1979). This index measures the gain in accuracy of prediction from an antecedent variable (A) to an outcome category above base rate prediction. It may vary from 0 to 1, and is 0 only if the predictor classification does not better than the base rate. It is 1 if there is complete predictability and is zero if the predictor classification and outcome are independent, although a value of 0 for  $L_B$  does not imply independence. The general form of the index ( $\lambda$ ) is

$$\frac{P [\text{Error}] - P [\text{Error} | A]}{P [\text{Error}]}$$

Table 3 shows the  $L_B$  index derived from the 6 month-old infants pattern of response to the mother's still-face is .80, indicating a major increment in prediction to attachment classification at one year of age. Vocalization at 6 months is the next most accurate predictor, with an index of .40 showing a moderate reduction of erroneous prediction. Minor increments in prediction are afforded by two discrete behaviors at 3 months, smiling and vocalization ( $L_B = .25$  for each), and by the 3 month old's pattern of response ( $L_B = .17$ ). Neither pattern of response nor occurrence of discrete behaviors at 9 months adds to base rate predic-

tion. Thus, as expected, the 6 month old's pattern of response is the most accurate predictor of attachment classification at one year of age.

To aid in assessing the predictive utility of discrete behaviors when treated as continuous variables, point-biserial correlations were computed for each of the discrete behaviors (see Table 4). Only frequency of vocalization at 6 months of age was significantly related to later attachment classification as secure or anxious ( $t$ , 2-tailed, 15 df = 2.63),  $p < .05$ ; the proportion of error variance accounted for is not substantial when compared to reduction in error afforded by the classification of pattern of response at 6 months.

Differences in infant response related to attachment classification. This section presents results on the response of infants at each age, with special reference to differences in the response of 6 month-olds, whose pattern of behavior was highly predictive of one year outcome, and the other two age groups, 3 and 9 month olds, whose behavior was less predictive. Table 5 summarizes the data discussed.

Three-month old's behavior. At three months of age, infants who were later classified securely attached

Table 4  
Prediction from Frequency of Discrete Behaviors

| Infant Age | Behavior                            |                                  |                 |
|------------|-------------------------------------|----------------------------------|-----------------|
|            | Look at <u>M</u><br>and<br>Vocalize | Look at <u>M</u><br>and<br>Smile | Cry             |
| 3 Months   | .33 <sup>a</sup>                    | .20                              | -- <sup>b</sup> |
| 6 Months   | .49                                 | .37                              | -- <sup>c</sup> |
| 9 Months   | .24                                 | .21                              | .31             |

<sup>a</sup> Values shown are for point-biserial correlation coefficients

<sup>b</sup> Only 2 infants, both classified secure at one year, cried

<sup>c</sup> Only 3 infants, all classified secure at one year, cried

<sup>d</sup> Prediction is from earlier (3, 6 or 9 month) response to the still-faced mother to quality of attachment as secure versus anxious at one year of age.

were more responsive to the still-faced mother than were infants judged to be anxiously attached at one year of age. Those classified secure at one year were more likely than those classified anxious to vocalize (Fisher's Exact Test,  $p < .05$ ). None of those later classified anxious smiled while 6 of the 9 later seen as secure did so (Fisher's Exact Test,  $p < .05$ ). While the modal response (6 of 9) of infants later classified secure was Pattern 1, Positive Elicits, 2 of 9 did no eliciting (Pattern 3) and one only made fussy or crying



Table 5

Earlier Response to the Still-Faced Mother of Infants  
Differing in Quality of Attachment at One Year

|                    | Discrete Behaviors     |           |                     |           |                   |           | Pattern of Behavior               |                                   |                             |
|--------------------|------------------------|-----------|---------------------|-----------|-------------------|-----------|-----------------------------------|-----------------------------------|-----------------------------|
|                    | Look at M and Vocalize |           | Look at M and Smile |           | Look at M and Cry |           | Pattern 1:<br>Positive<br>Elicits | Pattern 2:<br>Negative<br>Elicits | Pattern 3:<br>No<br>Elicits |
|                    | Frequency              | Incidence | Frequency           | Incidence | Frequency         | Incidence |                                   |                                   |                             |
| 3 MONTHS           | M                      | SD        | M                   | SD        | M                 | SD        |                                   |                                   |                             |
| Secure<br>(N = 9)  | 3.72 (3.02)            | .78*      | 2.05 (2.99)*        | .67*      | 1.05 (2.07)       | .22       | 6                                 | 1                                 | 2                           |
| Anxious<br>(N = 4) | 1.75 (2.04)            | .25       | 0                   | 0         | 0                 | 0         | 1                                 | 0                                 | 3                           |
| 6 MONTHS           |                        |           |                     |           |                   |           |                                   |                                   |                             |
| Secure<br>(N = 12) | 3.50 (2.85)*           | .83*      | 1.14 (1.48)         | .43       | 1.77 (3.21)       | .25       | 10                                | 2                                 | 0                           |
| Anxious<br>(N = 5) | .50 (1.0)              | .20       | .10 (.04)           | .20       | 0                 | 0         | 1                                 | 0                                 | 4                           |
| 9 MONTHS           |                        |           |                     |           |                   |           |                                   |                                   |                             |
| Secure<br>(N = 14) | 2.46* (2.13)           | .71       | 1.61 (2.16)         | .50       | 2.71* (3.76)      | .57       | 10                                | 3                                 | 1                           |
| Anxious<br>(N = 5) | 1.30 (1.6)             | .60       | .70 (.75)           | .60       | 6.00 (5.87)       | .80       | 2                                 | 3                                 | 0                           |

Note: Means and standard deviations are shown for rows labelled 'frequency'. Incidence refers to the proportion of the attachment group (secure versus anxious) showing the behavior. For patterns of behavior, the cross-classification is shown.

\*  $p < .05$ ; Fisher's Exact Test for incidence, Median test for frequency

elicits (Pattern 2). The modal response (3 of 4) of infants later classified anxious was Pattern 3 (No Elicits), while 1 made positive elicits to the still-faced mother (Pattern 1).

Six-month-old's behavior. Whereas for the 3-month-olds, frequencies of discrete behaviors appeared to be more revealing than did classification of patterns of behavior, for 6-month-olds the pattern of response yielded clear differences between those later classified secure and those later classified anxious in the attachment relationship. The only significant differences to emerge from the frequency data at 6 months were that infants later classified secure were more likely to vocalize (Fisher's Exact Test,  $p < .05$ ) and vocalized more frequently (Median test,  $p < .05$ ) than did those classified as anxiously attached at one year of age.

As with the 3-month-olds, the modal pattern of response for 6-month-olds later classified secure was Pattern 1, Positive Elicits (10 of 12), while the modal pattern for those later classified anxious was Pattern 3, No Elicits (4 of 5). However, of the 6-month-olds, only one later classified anxious mobilized elicits of any sort, while all of those later classified secure did so.

Nine-month-old's behavior. Nine-month-olds who were classified securely attached at one year vocalized more frequently to the still-faced mother than did 9 month-olds later classified as anxiously attached (Median test,  $p < .05$ ). Those classified as anxiously attached at one year cried more frequently than 9 month-old infants later classified as securely attached (Median test,  $p < .05$ ).

The modal pattern of response for 9 month-old infants later classified secure was, as with 3 and 6 month-olds, Pattern 1, Positive Elicits (10 of 14). However, for infants later classified anxious, the modal pattern of response was Pattern 2, Negative Elicits (3 of 5), with close to an equal number (2 of 5) showing positive elicits (Pattern 1).



## C H A P T E R   I V

### RESULTS:   NORMATIVE RESPONSE TO STILL-FACED MOTHER AT 3, 6 AND 9 MONTHS

This chapter presents developmental trends and sex differences in infant response to the still-faced mother at 3, 6 and 9 months. No specific hypotheses were advanced, as these data were provided to fill a void in the literature and to aid in interpreting results on individual differences. Results are summarized for the frequency and incidence of discrete behaviors and for the distribution of patterns of behavior for both sexes at each age.

Frequency of discrete behaviors. The frequencies of discrete behaviors in response to the still-faced mother were similar at 3, 6 and 9 months for boys and girls. Three separate 2 (sex) by 3 (age) analyses of variance showed no significant main effects and no significant interactions for the frequency of smiles, vocalizations and neutral monitors. Appendix 2 contains the summary tables for these analyses of variance. No analysis of the frequency of crying was done, because its incidence was low (see following section).

Incidence of discrete behaviors. Results on the incidence of discrete behaviors in response to the still-faced mother showed sex differences at 3 and 9, but not at 6 months, and suggested that 9 month olds as a group were more responsive to the mother's still face than were younger infants. Table 6 presents the incidence of smiles, vocalizations, cries and neutral monitors for each sex at each age. There are no age or sex differences in the incidence of neutral monitors or vocalizations; at each age virtually all infants looked at the mother with a neutral expression, and the majority vocalized while oriented toward her.

There were significant age and sex differences in crying and smiling. As a group, 9-month-olds were more likely to cry than were 6-month-olds ( $\chi^2$ , 1 df = 5.44,  $p < .05$ ). At 3 months, just over half of the girls (7 of 13) cried, while none of the 13 boys cried (Fisher's exact test,  $p < .05$ ). At 9 months, the majority of boys (11 of 13) smiled, but just under half (6 of 13) of the girls smiled (Fisher's exact test,  $p < .05$ ).

Patterns of response. Examination of the distribution of patterns of response to the still-faced mother again shows few changes with age, but reflects a tendency for 9 month-olds to be more responsive and for 3 month-old

Table 6

Incidence of Discrete Behaviors in Response  
to the Still-Faced Mother at Three Ages

| Behavior                      | 3 months |                 | 6 months |     | 9 months |                 |
|-------------------------------|----------|-----------------|----------|-----|----------|-----------------|
|                               | N        | %               | N        | %   | N        | %               |
| <u>Look at M and smile</u>    |          |                 |          |     |          |                 |
| Boys <sup>a</sup>             | 7        | 54              | 8        | 62  | 11       | 85 <sup>b</sup> |
| Girls                         | 8        | 62              | 6        | 46  | 6        | 46              |
| Total                         | 15       | 53              | 14       | 57  | 17       | 65              |
| <u>Look at M and vocalize</u> |          |                 |          |     |          |                 |
| Boys                          | 10       | 77              | 11       | 85  | 11       | 85              |
| Girls                         | 10       | 77              | 8        | 62  | 9        | 69              |
| Total                         | 20       | 77              | 19       | 73  | 20       | 77              |
| <u>Neutral Monitor</u>        |          |                 |          |     |          |                 |
| Boys                          | 13       | 100             | 13       | 100 | 12       | 92              |
| Girls                         | 13       | 100             | 13       | 100 | 13       | 100             |
| Total                         | 26       | 100             | 26       | 100 | 25       | 96              |
| <u>Cry</u>                    |          |                 |          |     |          |                 |
| Boys                          | 0        | 0               | 2        | 15  | 7        | 54              |
| Girls                         | 7        | 54 <sup>b</sup> | 3        | 23  | 6        | 46              |
| Total                         | 7        | 27              | 5        | 19  | 13       | 50 <sup>c</sup> |

<sup>a</sup> N = 13 for each sex at each age

<sup>b</sup> Significant sex difference

<sup>c</sup> Incidence significantly greater than 6 month olds



Table 7  
Age and Sex Distribution Patterns of Response to Still-Faced Mother

|                   |        | Pattern 1<br>Positive Elicits | Pattern 2<br>Negative Elicits | Pattern 3<br>No Elicits |
|-------------------|--------|-------------------------------|-------------------------------|-------------------------|
| 3 Months          | Male   | 6                             | 0                             | 7                       |
|                   | Female | 9                             | 2                             | 2                       |
|                   | Total  | 15                            | 2                             | 9                       |
| 6 Months          | Male   | 9                             | 1                             | 3                       |
|                   | Female | 7                             | 3                             | 3                       |
|                   | Total  | 16                            | 4                             | 6                       |
| 9 Months          | Male   | 11                            | 2                             | 0                       |
|                   | Female | 8                             | 4                             | 1                       |
|                   | Total  | 19                            | 6                             | 1                       |
| Total (over ages) |        | 50                            | 12                            | 16                      |

Note: N = 13 for each sex at each age

boys to differ from 3 month old girls. Table 7 presents the age and sex distribution of patterns of response to the still-faced mother. The modal pattern of response for each age and sex, with the exception of 3 month-old boys, is Pattern 1, Positive Elicits. Just over half (7 of 13) of the 3 month-old boys were classified as fitting Pattern 3, No elicits. The change in distribution of patterns with age is not significant ( $\chi^2$ , 4df = 8.65,  $p < .08$ ).

Summary. In summary, infants responded similarly to the still-faced mother at 3, 6 and 9 months. Virtually all looked at her, and most vocalized; close to half smiled at each age. At 3 and 9 months, but not at 6 months, there were sex differences in infant response, with boys tending to be less responsive at 3 and more responsive at 9 months. Overall, 9 month olds were more responsive to the still-face.

## C H A P T E R    V

### DISCUSSION

This study addressed two major questions. First, it compared the accuracy of prediction to one year adaptation from three ages (3, 6 and 9 months) and by two methods (coding discrete frequencies of behaviors versus classifying patterns of behavior). Second, the study provided normative data on the response of 3, 6 and 9 month-old infants to the still-faced mother, both to fill lacunae in the literature and to aid interpretation of the data obtained concerning prediction. This chapter first discusses the comparison of the two methods and three ages used for prediction, then turns to the sex differences found in infant response found at 3 and 9 months, and concludes with a consideration of the still-face procedure as a 6-month competence assessment.

Comparison of methods and ages. The results of this study suggest that the power of the still face procedure to discriminate individual differences rests on its age-appropriate use and on the use of classifications of patterns of behavior. Like the Ainsworth

Strange Situation, the still-face procedure tends to obscure individual differences when it is used with infants too young, who do not all appear to be sufficiently engaged in the developmental issue tapped, or with infants too old, who appear to be more uniformly competent in the task. Also like the Ainsworth Strange Situation, even when used age-appropriately, classification of patterns of behavior are more predictive than are frequencies of discrete behaviors. In the data reported here, this was largely due to the fact that when coding patterns of behavior, certain behaviors (for example, smiling and non-fussy vocalizing) were treated as equivalent. The results of this study, then, support the Waters and Sroufe (Note 2) suggestion that age-appropriate patterns of behavior are more powerful than counts of discrete behaviors in assessing individual adaptation: the 6 month-old's pattern of response was a more accurate predictor than frequency counts or incidence of discrete behaviors at the same age, and was far more accurate than patterns or frequencies at the other two ages.

Nonetheless, data derived from frequency counts revealed relationships which would not have been found if only the classification of patterns of behavior had been used. Infants classified as secure in the attach-



ment relationship at one year were more positive in response to the still-faced mother at 3 months; they were more likely to smile and vocalize than were infants later classified as anxiously attached. At nine months, those later seen as anxious in the attachment relationship cried more frequently in response to the still-faced mother than did infants subsequently classified as securely attached; those classified as secure vocalized more frequently. Both sets of results are consistent with the literature on the antecedents of individual differences in quality of attachment reviewed in Chapter I (Blehar, Lieberman and Ainsworth, 1977, Ainsworth, Note 6, Ainsworth, et al., 1978, see Waters, Noyes and Ricks, in press, for a review).

Sex differences. None of the published studies on infant response to the still-faced mother have examined sex differences in infant response; none have included infants over 5 months of age. The finding of significant sex differences at 3 and 9, but not at 6 months, in this study, warrants further investigation. Certainly it suggests that future studies of mother-infant face-to-face interaction should examine sex differences. In the absence of directly relevant literature, the interpretations advanced here are speculative.

In this study, 3 month old girls were more likely than boys of the same age to cry in response to the still-faced mother. One interpretation is suggested by studies showing that parents interact in a purely social way more frequently with young girls than with young boys (Beckwith, 1972, Clarke-Stewart, 1973, Klein and Durfee, 1978, Lewis, 1972). It may be that females greater experience in social interaction and/or maturational advance makes the still-face procedure more salient, hence, more upsetting than for boys. Alternatively, since boys respond positively as much as girls of this age, it may be that girls are more easily stressed by the procedure (Tronick, Note 8).

The fact that 9 month old boys were more likely than 9 month old girls to smile in response to the still-face appears to be inconsistent with recent literature suggesting that sex differences in responsivity in the second half of the first year favor girls (Gunnar and Donahue, 1980). More fine-grained analysis of this point would be useful.

Toward a 6 month competence assessment. The results of this study pertaining to prediction of individual differences can only be interpreted with caution, as the number of infants seen in follow-up visits at one year

was relative small (13 of 26 initially seen at 3 months, 17 of the 26 first seen at 6 months, and 19 of the 26 initially seen at 9 months). However, the pattern of results of this study, in conjunction with research on antecedents of attachment and work on the still-face procedure's concurrent validity suggests that the infant's pattern of response to the still-faced mother merits further investigation as a 6-month competence assessment.

First, the results reported here show that at 6 months, infants who responded with elicits, whether positive or negative, were likely to be classified as securely attached at one year, in contrast to infants who responded with no elicits.

Second, there are a number of reasons to think Pattern 3 (No elicits) maladaptive at 6 months. Provence and Lipton (1963) view failure to signal an adult when stressed as a sign of developmental deviance. The infant's attachment to an adult is strongly related to the adult's responsivity to infant signals; a secure attachment is thought to reflect the infant's confidence in the attachment figure's responsive availability (Ainsworth, Bell and Stayton, 1972, Ainsworth, et al., 1978, Sroufe, 1978, 1979, Sroufe and Waters, 1978). The 6-month-olds in this study who failed to elicit the

mother behaved as if either lacking confidence in the caretaker's responsiveness, or as if they had grown used to the sort of maternal behavior shown in the still-face. The impression gained from reviewing the tapes was that most of the 6 month old infants who made no elicits were quite distressed. In spite of signs of tension, seen in wary faces, clenched hands and labored breathing, they did not mobilize signalling.

Third, data from other aspects of the same longitudinal investigation reported in this study show that maternal sensitivity in the episode of normal play preceding the still-face is related to the infant's response to the still-face at 6 months, and to the quality of the infant's attachment to the mother at one year. Mothers of infants who made positive elicits were rated significantly higher on a scale of sensitivity than were mothers of infants who made no elicits; mothers of infants who made only negative elicits fell in between on the scale, differing significantly from neither of the other two groups. These results support the classifications of infant responses to the still-faced mother.

Further research on the still-face procedure as a 6 month competence assessment would logically involve replicating the work reported here, with a larger sample



of infants, and investigating the test-retest stability of the infant's pattern of response to the still-face.

## NOTES

1. Using similarly more sophisticated models and methods, others have demonstrated continuity in older childhood (Block and Block 1980) and adult development (Epstein 1980).
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APPENDIX 1:

CODING SYSTEM FOR INFANT RESPONSE TO STILL FACE



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Coding Still-face

1. On your sheet, mark the following across top columns.

Column

1. S#, name
  2. Tape #
  3. Meter begins
  4. Meter ends
  5. LAM + game = looks at M and starts game
  6. LAM + voc = looks at M and vocalizes
  7. LAM + smile = looks at M and smiles
  8. Neutral monitor = looks at M with neutral expression
  9. LAM + cry = looks at M and cries
  10. LAW + cry - looks away and cries
  11. Other: (Spit-up (vomit), heavy breathing, hiccough)
  12. Pattern (See sheets 2 and 3)
2. Look at tape once or twice then code above as you look at it slowly. Select pattern.
  3. Write ALL problems on problem cards. If you find a particular tape difficult, do not code it.

## Still-face Patterns

### Pattern

- 1 The baby does at least one positive elicit. Positive elicits are defined as full orientation toward the mother while (1) vocalizing (non-crying vocalizations, (2) smiling or (3) initiating a game. (The latter is probably rare and should be carefully checked against first normal sequence.)

### Pattern

- 2 Negative elicits only  
Baby does no positive elicits. S/he does, however look at M, and vocalize but these are fussy or crying vocalizations.

### Pattern

- 3 No elicits  
Baby looks at M neutrally, and looks away; there are neither positive nor negative elicits.

3a Baby does not cry during entire 2 minutes

3b Baby eventually fusses or cries but does so without looking at mother

APPENDIX 2:  
ANALYSES OF VARIANCE SUMMARY TABLES

## 1. VOCALIZATIONS

| Source      | SS    | df | MS  | F   |
|-------------|-------|----|-----|-----|
| Sex         | .06   | 1  | .06 | .11 |
| Age         | .52   | 2  | .26 | .46 |
| Interaction | .54   | 2  | .27 | .96 |
| Error       | 40.18 | 72 | .56 |     |
| Totals      | 41.30 | 77 |     |     |

## 2. SMILES

| Source      | SS    | df | MS  | F   |
|-------------|-------|----|-----|-----|
| Sex         | .21   | 1  | .21 | .39 |
| Age         | .18   | 2  | .09 | .04 |
| Interaction | .41   | 2  | .20 | .39 |
| Error       | 37.98 | 72 | .53 |     |
| Totals      | 38.71 | 77 |     |     |

## 3. NEUTRAL MONITORS

| Source      | SS    | df | MS  | F    |
|-------------|-------|----|-----|------|
| Sex         | .64   | 1  | .64 | 1.88 |
| Age         | .86   | 2  | .43 | 1.26 |
| Interaction | .82   | 2  | .41 | 1.20 |
| Error       | 24.86 | 72 | .34 |      |
| Totals      | 27.19 | 77 |     |      |

Note: Analyses were done on transformed data ( $x^1 = x + .5$ ), since standard deviations were large (Myers, 1972). The means, across age and sex, for these behaviors, are as follows: smiles 1.6, vocalizations 2.4 and neutral monitors 4.7.







