Maternal Attention-Directing Strategies and Infant Focused Attention During Problem Solving

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Forty-nine mother–infant dyads participated in the study. Mothers were observed during free play with their infants to assess their attention-directing strategies. Assessments were made when infants were 10 and 18 months. Whereas consistently high levels of maintaining over time were modestly associated with better infant focused attention at 18 months, consistently high levels of redirecting were moderately associated with poorer infant focused attention at 18 months. Additionally, more focused attention was associated with higher Bayley scores at both ages. Although the direction of effects could not be determined, the findings suggest links between maternal attention-directing strategies (maintaining and redirecting) during play and infant attentional abilities during problem solving.

Infants vary tremendously in their attentional abilities over the 2 years of life. In their thorough account of the development of attention in infancy and early childhood, Ruff and Rothbart (1996) described the emergence of two distinct systems over the first year of life. The first to emerge is the orienting system, which is involuntary and reactive; its activation depends on stimulus characteristics such as novelty.
and intensity and reflects a passive form of attention. The duration of oriented attention is considered invariant across individuals and ages, and not related to the novelty or complexity of a stimulus (Richards, 1985; Richards & Casey, 1992). Its frequency, however, wanes with age during the first 2 years of life. The second system involves higher level controls that emerge between 9 and 18 months. In contrast to oriented attention, this system is under voluntary control and involved in gathering information, acting on the information, and progressing toward a goal. Focused attention and sustained attention are familiar terms that are at times used interchangeably for this component in the developmental literature (e.g., Ruff, 1990). We prefer to use the term focused attention over sustained attention for this emerging function because it is consistent with the adult literature in which Mirsky (1996), for example, defined focus as the individual’s capacity to inhibit responses to distracting peripheral stimuli and concentrate attentional resources on a task; and he defined sustain as the capacity to stay on task in a vigilant manner for an extended period of time.

The development of focused attention in infancy includes increases in the frequency and duration of episodes with age (Ruff & Lawson, 1990). Research over the last decade has shown that the social environment plays a supportive role in the development of focused attention. Brofenbrenner and Ceci’s (1993) biocological model of human development provides a framework within which to appreciate the importance of social support for infant development, and in this case, the development of focused attention. These authors proposed that constitutionally based developmental potentials for competence are not actualized in a simple manner such as maturation; they require “intervening mechanisms that connect the inner with the outer in a two-way process that occurs not instantly but over time” (Brofenbrenner & Ceci, 1993, p. 317). Moreover, these socially based mechanisms or proximal processes are most effective when they occur regularly over prolonged periods of time.

One way in which caregivers connect the inner with the outer is the engagement of joint attention. By the end of the first year improved attentional abilities allow infants to coordinate with an adult their visual attention on external objects and events (Bakeman & Adamson, 1984; Scaife & Bruner, 1975). Infant–caregiver joint attention episodes involve infant self-regulatory capacities such as maintenance and shifting of focused attention and caregiver characteristics such as the tendency to follow or redirect the infant’s line of regard during social interactions. Previous research suggests that joint attention is important for developmental outcomes, and in particular, language development (Bruner, 1975; Smith, Adamson, & Bakeman, 1988; Tomasello, 1995). In addition to this body of literature, other studies have examined relations between these maternal attention-directing strategies in the context of free play and infants’ subsequent duration of focused attention as an outcome.

Maternal attention maintaining, attempts of a mother to follow her infant’s already established focus on an object in the immediate environment, has been
examined with normal infants (Findji, 1993; Saxon, Frick, & Colombo, 1997; Tamis-LeMonda, & Bornstein, 1989, 1990, 1993), preterm and full-term infants (Landry, Garner, Swank, & Baldwin, 1996; Lawson, Parrinello, & Ruff, 1992), and high- and low-medical-risk infants (Landry & Chapeski, 1988; Smith et al., 1996). Mothers do this by asking questions, giving directives, describing qualities of an object, naming the object, pointing, demonstrating unique features of an object, and other physical manipulations that encourage the infant's attention to the object in hand. Researchers have considered these maternal interventions as a form of scaffolding (Wood, Bruner, & Ross, 1976) specific to the development of attentional abilities (Findji, 1993, 1998; Landry et al., 1996). Maternal maintaining could also be seen as an operationalization of sensitive responsiveness in the sense that this strategy involves “prompt, contingent, and appropriate behaviors” (Bornstein & Tamis-LeMonda, 1989, p. 50). Moreover, these behaviors are more likely to emerge during play than within other care-taking contexts such as feeding (Findji, 1993). Maintaining, then, is how a caregiver establishes joint attention (Collis & Schaffer, 1975).

Studies have further shown that individual differences in maternal encouragement of attention are positively related with individual differences in duration of infant focused attention observed during play in the laboratory (Landry & Chapeski, 1988; Lawson et al., 1992) and in the home (Findji, 1993; Findji, Pêcheux, & Ruel, 1993; Pêcheux, Findji, & Ruel, 1992). Furthermore, Findji (1993) investigated concurrent relations between maternal encouragement of infant attention to objects and infant focused attention when infants were 5 and 8 months old and found a moderate-sized positive correlation at 5 months, but not later, between the number of occurrences in which the infant focused attention and the number of times that mothers encouraged infants' attention to objects. A limitation of this work is its focus on the first year of life. Investigations of a relation between maternal maintaining of infant attention and later infant focused attention during the second year of life has yet to be conducted. This study is an attempt to fill this gap.

How might maternal attention-maintaining behaviors exert their influence on infant attention? Smith et al. (1996) suggested that an attention-maintaining strategy helps the infant cope more effectively with the level of stimulation provided. Maternal demonstrations of object manipulation may enhance infants’ curiosity, motivation to explore, and ability to regulate attention. Perhaps then, it is to the extent that maintaining occurs over time that the external strategies demonstrated by the mother become internal strategies that the infant brings to other situations that place demands on the attentional system. Thus, maintaining may be related to the infant’s developing capacity for longer bouts of focused attention.

In contrast to attempts to maintain infant attention during free play, mothers may also attempt to redirect attention from that which the infant is already engaged to another object of interest to the mother. This strategy is likely to place greater demands in the infant’s emerging attentional capacities. Rather than
following the infant’s self-selected interest and supporting attentional focus on the chosen object, this strategy involves an attempt to make the infant disengage, shift, and refocus attention on a new object. Thus, it is the infant who establishes joint attention when redirecting is employed by a caregiver.

Several studies have examined relations between redirecting and infant play and attention skills. Landry et al. (1996), for instance, found that across three groups of infants (full-term, medically high risk, and medically low risk) during the first year of life, the complexity of infant play did not increase when mothers attempted to redirect their infant’s attentional focus, but did increase when mothers attempted to maintain their infant’s attention. Negative relations between redirecting and focused attention have been documented with Down syndrome and premature infants as well (Landry & Chapieski, 1989). Perhaps also, to the extent that redirecting occurs over time, the infant may be denied demonstrations of external strategies to regulate attention and involvement in situations that promote cognitive development. Thus, redirecting may not be related to the infant’s developing capacity for longer bouts of focused attention.

In summary, studies examining relations between maternal attention-directing strategies and infant focused attention in the context of joint attention have produced consistent results; they report that greater amounts of maternal maintaining are associated with better immediate focused attention in healthy infants over the first year of life and beyond. Previous studies that examined relations between maternal redirecting and infant focused attention are fewer in number, yet suggest that redirecting is more demanding on the infant’s attentional system and is unlikely to facilitate the development of focused attention.

The purpose of this study is to extend past findings and examine relations between maternal attention-directing strategies during play and measures of infants’ emerging capacities to persist in focused attention during test taking at 10 and 18 months. In accordance with our previous description of focused attention as a concentration of attentional resources on a task, we proposed to measure focused attention during a developmental assessment, in particular the Bayley Scales of Infant Development, because it presents tasks that are developmentally appropriate for infants at different ages across the first 2 years of life, therefore offering the researcher a set of valid tasks at each age that vary in difficulty. It will be recalled that competence on a Bayley task is judged by whether the infant completed it as demonstrated. It is a qualitative assessment—yes she was able to do it and given credit or no she was not. Whereas there is a minimal amount of persistence on a task that is necessary to complete it and show competence, the judgment of competence does not take into consideration processes such as focused attention that are employed to achieve success. We are not the first to use the Bayley as a context for the assessment of infant attention; Matheny (1989) employed Infant Behavior Record (IBR) scores to assess infant attention and other temperament dimensions in the Louisville Twin Study. The primary limitations of the IBR are its
impressionistic nature and ordinal scale properties. An improvement in measure-
ment precision would be the use of an interval scale such as duration of time. In
support of our measurement strategy we found that other investigators also em-
ployed duration of time during problem solving for the assessment of infant and
toddler attentional persistence (e.g., Kasari, Sigman, & Yirmiya, 1993; Sigman,
Cohen, Beckwith, & Topinka, 1987; Silverman & Gaines, 1996).

Based on a review of the literature we hypothesized:

1. Greater amounts of maternal maintaining will be associated with greater
   amounts of infant focused attention during problem solving.
2. Greater amounts of maternal redirecting will be associated with less fo-
   cused attention during problem solving.
3. The higher accumulation of maintaining over time will be associated with
   more focused attention at 18 months.
4. The higher accumulation of redirecting over time will be associated with
   less focused attention at 18 months.
5. Higher levels of focused attention will be associated with better mental
   test scores.

METHOD

Participants

The participants in this study were 49 infant–mother pairs enrolled in a longi-
tudinal study of infant temperament that spanned from birth to 30 months. The
sample’s demographic characteristics at birth were as follows: mean maternal
age, 29.24 (SD = 4.79), mean number of maternal years of education, 15.23
(SD = 2.31), mean infant birth weight, 7.89 lb. (SD = 0.83), and mean infant
gestational age, 39.78 weeks (SD = 1.41). There were more girls (28) than boys
(21). The majority of mothers were White and held occupations reflective of
the middle class.

Procedure and Measures

This study employed a repeated-measures longitudinal design that spanned
8 months. At 10 and 18 months, mothers brought their infants to the university
laboratory where a free-play interaction and an administration of the Bayley
Scales of Mental Development were videotaped. Mothers were instructed to sit
in the middle of a carpeted floor and play with their infant in any manner desired for
5 min. A basket of age-appropriate toys was placed on the floor. The Bayley Scales
of Infant Development (Bayley, 1969) were administered in every instance by the same researcher who was trained by Cynthia Stifter to a high degree of reliability. The experimenter sat at a table opposite the mother who held the infant on her lap.

**Maternal behavior.** Maternal behaviors were coded from videotapes of free play in 5-sec intervals with a paper-and-pencil method. After viewing each interval, a trained observer recorded whether one of the following mutually exclusive categories of behavior derived from Landry and Chapieski (1989) was exhibited: (a) maintain—The mother made a verbal, nonverbal, or verbal and nonverbal attempt to maintain the infant’s attention to an object with which the infant was already visually, physically, or visually and physically engaged; (b) redirect—The mother made a verbal, nonverbal, or verbal and nonverbal attempt to direct the infant’s attention toward another object while the infant was already visually, physically, or visually and physically engaged with a different object. The interval was left blank when neither was observed. A limitation of employing time sampling is that it is likely to result in an overestimate of time spent in a particular behavior. However, overestimates were minimized in this study to the extent that behaviors were operationalizations of continuous processes and the coding interval was brief. Two observers met and discussed the coding of 10 mothers for training purposes. Following training, 5 (10%) additional mothers were coded independently by each observer to establish reliability. The mean \( \kappa \) coefficients for maintaining were .76 at 10 months and .75 at 18 months. The mean \( \kappa \) coefficients for redirecting were .68 at both 10 and 18 months. Scores for maintaining and redirecting were the percentage of 5-sec intervals coded for those behaviors.

**Infant behavior.** A quantitative measure, the duration of infant focused attention, was assessed with the Bayley during two nonverbal tasks that differed in difficulty at each age. These differences are reflected in the age at which an infant can complete the task successfully according to test norms. Infant focused attention was assessed at 10 months during (a) the cubes in a cup task, in which the 9.4-month-old infant is typically able to place a set of small cubes into a cup; (b) the spoon and cup task, in which the 9.7-month-old infant is typically able to place the spoon in the cup and stir. It was assessed at 18 months during (a) the tower of cubes task, in which the 16.7-month-old infant is usually able to build a tower with up to five cubes; and (b) the blue puzzle, in which the 19.3-month-old can place two round and two square pieces in correct spaces. Additionally, these four tasks were selected for inclusion in analyses from among a larger set that were coded because all are nonverbal and allowed observers to train to reliability. Infant behavior was coded from videotapes with the Observational Coding System Toolset Version 2.6 (Triangle Research Collaborative, 1997) computer coding system. This software allowed for the continuous coding of specific behaviors and measurement in seconds. A Bayley Mental Development Index (MDI) was calculated for each child.
In the context of play, Ruff (1986) operationally defined focused attention as the co-occurrence of looking and fingering, rotating, or manipulating an object for the purpose of exploration while the infant maintained an intent facial expression. In the context of test taking, we defined focused attention as the co-occurrence of looking and fingering, rotating, or manipulating test materials for the purpose of attempting to complete a Bayley task as previously described. Both definitions suggest that the infant is engaged in concentrated attention. Two observers were employed to code the duration of focused attention during each task and at each age. Following extensive training, reliability was established by comparing observers’ codes from approximately 10% (5) of the participants. The mean $\kappa$ for the reliability sample at 10 months was .88 for the cubes task and .90 for the cup and spoon task. The mean $\kappa$ for the reliability sample at 18 months were .91 for the tower and .82 for the blue puzzle.

Proportion scores were employed because the length of time spent on each task was not fixed but varied with each child’s unique response. The start of each task was defined as the moment the materials were placed in front of and within grasp of the infant following the examiner’s demonstration. The removal of the materials following the infant’s last attempt defined the end of the task. The completion of the task or an attempt immediately followed by a lack of interest in continuing to work toward a solution qualified as the infant’s last attempt. Proportion scores were averaged at each age to form a general level of focused attention.

RESULTS

Results of statistical analyses are presented in the following manner. Correlation coefficients were calculated to test hypothesized directions of relations. We will adopt Cohen’s (1988) conventions throughout our description of results in which $r = .10$ is considered small, $r = .30$ medium, and $r = .50$ large. The maternal measures are presented first and followed by descriptive statistics for the infant measures. Results of hypothesis testing are presented throughout and employ the hypothesis number as a reference. Table 1 lists the means and standard deviations for the maternal and infant measures employed in this study.

Maternal Measures

All mothers employed both attention-directing strategies during their play with infants on both occasions of measurement. As shown in the upper portion of Table 1, mothers on average spent twice as much of their time attempting to maintain (about 40%) their 10-month infant’s attention during play than attempting to redirect it (about 20%), and this difference was statistically significant, $F(1, 48) = 37.54,$
Recall that the percentages are somewhat inflated due to the sampling method, so we suggest that it is more accurate to think of all percentages as best estimates. A similar pattern was observed at 18 months wherein mothers spent about 45% of their play time maintaining and about 20% redirecting, \( F(1, 48) = 43.00, p < .0001 \). Although there was no empirical support for the long-term stability of maintaining, \( r(49) = .21, p = .14 \), the data suggested modest long-term stability for redirecting, \( r(49) = .37, p < .05 \). Maintaining and redirecting were negatively correlated at approximately the same level at each age, \( r(49) = -.39, p < .05 \) at 10 months and \( r(49) = -.38, p < .05 \) at 18 months. This was a likely outcome given that both behaviors were employed by mothers and coded in sequence as they appeared. It will be recalled that although parallel-processing measures (e.g., behavior and accompanying affect) can be associated in both directions, the measurement of serial processes as employed in this study allows for an association in a negative direction only.

**Infant Measures**

One gets the impression from a visual examination of the lower half of Table 1 that younger infants spend most of their time doing things other than engaging in focused attention, whereas older infants are capable of much more engagement, but the level depends on the nature of the task. The increase in focused attention across ages was statistically significant, \( F(1, 48) = 269.17, p < .001 \). Moreover, greater amounts of focused attention were utilized during the more difficult than the less difficult task at 18 months, \( F(1, 48) = 59.95, p < .001 \), but not earlier. This 18-month finding parallels results of experiments conducted by Oakes and Tellinghuisen (1994), which demonstrated that the duration of infant focused attention was greater for complex objects than simple ones because the objects employed in the blue puzzle task were clearly more complex than the set of identical

<table>
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<th>Means and Standard Deviations for Maternal and Infant Measures</th>
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Note: F.A. = focused attention.
cubes used to build a tower in the easier task. Regarding individual differences over time, there was weak evidence for stability in infant focused attention over the 8-month testing interval; the correlation of .18 was not statistically significant. Similarly, Bayley MDI scores evidenced only a modest level of stability, \( r(48) = .27, p < .07 \).

Figure 1 is presented as a visual guide to tests of Hypotheses 1 and 2. Each bidirectional line is marked with the expected direction of association in parentheses and the sample correlation coefficient. Solid lines signify statistically significant correlations. We now turn to direct tests of hypotheses. Hypothesis 1: Is more maintaining associated with more focused attention? The answers are no at both ages as seen by the dotted lines linking maintaining and focused attention in Figure 1. Hypothesis 2: Is more redirecting associated with less focused attention? The answers are no at age 10 months and yes at age 18 months as seen by the dotted and solid lines linking redirecting and focused attention. To address Hypothesis 3 that the higher accumulation of maintaining over time would be associated with more focused attention at 18 months, we calculated a composite score by summing maintaining at both ages \( M = 86.84, SD = 28.05 \). As seen in Figure 2, consistently high levels of maintaining were modestly associated with better focused attention \( r(49) = .31, p < .05 \). A composite score for redirecting was similarly calculated \( M = 39.29, SD = 21.29 \) to address Hypothesis 4. Was the higher accumulation of redirecting over time linked with less focused attention at 18 months? The answer was yes as shown in Figure 3, \( r(49) = -.45, p < .001 \). Lastly, we found support at both ages for our final hypothesis that greater focused attention would be associated with higher MDI scores, as shown in Figures 4 and 5, \( r(48) = .30 \) and \( r(48) = .41 \), respectively.

**DISCUSSION**

This longitudinal study attempted to extend previous research by investigating associations between maternal attempts to maintain or redirect infant attention.
during play and the infant’s ability to engage in focused attention for the purpose of problem solving when the mother’s influence is minimized. Overall we found that more maintaining was modestly linked with more focused attention, more redirecting was modestly linked with less focused attention, and more focused attention predicted better MDI scores.

We may only speculate why no concurrent relations between maternal maintaining and any infant attention measures were found. Considering that Ruff and Rothbart (1996) suggested that the second, higher order control system that underlies focused attention emerged between 9 and 18 months, the approximate ages...
at which our observations were made, it may be that we examined this relation too early in infancy as our infants were likely to vary in the emergence of this system. Perhaps an examination of this relation at 24 months, when we may have greater certainty that the second attentional system had emerged, might have born a pattern of results consistent with our hypothesis. This indeed might be the case given the finding by Bakeman and Adamson (1984) that collaborative joint attention was more prominent in later infancy. An alternative speculation is based on the methodological limitations of our analyses. Simply stated, our results may reflect the possibility that the relation between maternal maintaining of infant attention during play and infants’ more independent use of focused attention in other

FIGURE 4 Scatter plot of focused attention and MDI at 10 months, \( r(48) = .30 \).

FIGURE 5 Scatter plot of focused attention and MDI at 18 months, \( r(48) = .41 \).
contexts may be nonlinear. Perhaps a minimal amount of consistent maternal encouragement of attention over an extended period of time is all that is needed for the infant to realize his or her age-dependent potential for focused attention, and beyond this point higher levels of maternal maintaining may be functionally equivalent. It will be recalled that a higher accumulation of maintaining was modestly related to longer focused attention at 18 months despite the lack of concurrent relations. This suggests that the combination of behavioral data from repeated assessments over time may be a more robust predictor than a single assessment. Taken together these findings imply that the strength of the relation between greater maintaining and better infant focused attention may be tenuous.

The pattern of relations involving redirecting suggests that an environment characterized by high levels of redirecting may provide fewer opportunities to support the development of focused attention than one with lower levels, and that this dimension may be more stable over infant development than maintaining. Recall that all mothers employed both maintaining and redirecting as strategies, and that, in general, higher levels of one strategy were related to lower levels of the other. Perhaps higher levels of redirecting alter the infant’s expectations about what the mother is going to do next to the degree that when the mother subsequently attempts to maintain the infant’s attention to something in hand, the infant is unable to focus and maintain interest. Yet, the average amount of time mothers spent redirecting during play at both ages (about 20%) was equal to approximately half of the time mothers spent maintaining. How then could a maternal behavior that typically accounts for so little of the total play time be associated with infant attention?

One possibility is that redirecting’s nonsupportive influence might be echoed and added to by other behaviors in other mother–infant contexts that stem from the same set of maternal attitudes and beliefs about their infants. Perhaps, for example, mothers who showed higher levels of redirecting view their infants as more dependent and less competent, and intrusively assert their presence in the interaction without taking into account their infants’ individual preferences for certain objects during play or interest and activities in other situations. In line with this speculation is the finding of Landry et al. (1996), from their study of 6-month-old full-term, medically high-risk, and low-risk infants, that mothers who reported being less sensitive to their child’s integrity as a person and individual needs, as evidenced by lower scores on the Concepts of Development Questionnaire, demonstrated more redirecting and less maintaining during play. Moreover, Matas, Arend, and Sroufe (1978) reported that children classified as insecurely attached demonstrated less persistence in independent problem solving than securely attached children. The development of the infant’s curiosity, motivation to explore, and sense of attachment security may suffer at the cost of intrusive interactions such as redirecting that occur frequently over time, and constrain the infant’s ability to readily engage and persist in independent problem solving when the mother’s influence is minimal.
This study had several strengths and limitations. The longitudinal repeated measures design was a strength that distinguishes it from previous research. Moreover, the use of a composite score from multiple samplings of behavior over time provided a slightly stronger estimation of relations than provided by concurrent data alone. Sample size and power to detect relations are limitations that all studies face. Given our sample size of 49 and an \( \alpha \) of .05, we estimated our odds of detecting a statistically significant population correlation of .30 to be 57% or a little better than 50–50 (Cohen & Cohen, 1983). Despite this limitation, a consistent pattern of medium-sized relations emerged linking greater maternal redirecting with poorer infant focused attention.

How do we interpret these findings when nonexperimental procedures were employed and directions of effects cannot be determined? The answer is cautiously. One interpretation is that mothers who employ higher levels of redirecting are simply responding to and anticipating their infants’ lack of attentional skills, and mothers who employ greater amounts of maintaining are responding to their infants’ capacity for better regulation of attention. In summary, mothers are shaping their behavior in response to individual differences in infant attentional abilities. Indeed, as suggested by Bell (1971) and demonstrated by Collis and Schaffer (1975), the infant may at times be the driving force in social interactions. This interpretation seems most salient throughout development in extreme cases of developmental disorders such as autism, which evidence impairment in joint attention skills that evoke particular response strategies from caregivers. Alternatively, individual differences in maternal characteristics might outweigh infant characteristics in determining attention-directing strategies. Perhaps some mothers are simply better at playing with their infants than others and are more skilled at monitoring their infants’ activities, and subsequently establishing and maintaining joint attention episodes. One maternal characteristic that may be important for determining consistency in use of a particular infant attention-directing strategy is the presence of dysphoric symptoms. For example, Goldsmith and Rogoff (1997) reported that mothers of 18- to 30-month-old infants with high Beck Depression Inventory (BDI) scores engaged in less coordinated joint attention than did mothers with low BDI scores. Although the study of Goldsmith and Rogoff did not employ the same coding scheme as this study, dysphoric mothers are likely to have attention impairments and consequently have difficulties maintaining an attentional focus, make more frequent shifts in their attention to other objects, and engage in more redirecting than maintaining. Perhaps, then, it is primarily in atypical populations of infants or caregivers that direction of effects can be clearly discerned.

In conclusion, the results of this study suggest that understanding of the development of infant focused attention may be improved by examining the consistency of caregiver attention-directing strategies during play.
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