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Families by Adoption and Birth: II. Mother-Infant Cognitive Interactions

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Abstract

Adopted children are more likely to develop learning and school adjustment problems than are their non-adopted peers, despite the fact that learning potential appears to be comparable in the two groups. In an effort to explain this phenomenon, the present study examined cognitive behavior repertoires in healthy 5-month-old first infants and their mothers during their normal daily routine in families by adoption and by birth. Two areas of functioning, vocal/verbal communication and exploration, were examined. Infants and mothers in both groups were similar in the frequency and ranking of a full array of age-appropriate cognitive behaviors. Both groups of babies experienced rich and comparable opportunities for the development of language competence. In the exploratory realm, group differences emerged for some infant measures; infants by birth were in an alert state and mouthed objects more than infants by adoption. Examination of the linkages among infant behaviors and between mothers and infants suggested that, while mothers by birth and adoption provided comparable opportunities for exploration, infants by birth were engaging in exploratory behavior to a somewhat greater extent.

Adoption is clearly in the best interests of children who would otherwise lack a stable, supportive home (Hoksbergen, 1999; Sharma, McGue, & Benson, 1998). Adopted children also fare better in terms of measured intelligence and school achievement than biological siblings and peers who grow up in the adopted child's birth environment or children who have lived in foster homes or institutional settings (Bohman & Sigvardsson, 1990; Palacios & Sanchez-Sandoval, 2003; Tizard, 1977). Nonetheless, a certain percentage of children who are adopted struggle in school despite their aptitude, a phenomenon common enough to have been labeled the "adoption décalage" (van IJzendoorn, Juffer, & Poelhuis, 2005). In the cognitive realm, although community samples of adopted children are found to have intelligence comparable to that of their school classmates, some may evidence lower school achievement, delays in language development, and a higher incidence of learning problems requiring referral for remediation (Brodzinsky, Schechter, Braff, & Singer, 1984; Brodzinsky & Steiger, 1991; Miller, Fan, Christensen, Grotevant, & van Dulmen, 2000; van IJzendoorn et al., 2005; Wierzbicki, 1993).

Why this happens is not well understood. It has been speculated that the increased incidence of cognitive problems in adopted children may be linked to heredity and pre-adoption experiential factors (Brodzinsky, Radice, Huffman, & Merkler, 1987; Plomin & DeFries, 1985). Institutional rearing is known to have enduring negative effects on children's cognitive development, especially for those adopted after the age of 6 months (Castle, Groothues,

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Bredenkamp, Beckett, O'Connor, Rutter, & the E.R.A. Study Team, 1999; Morison & Ellwood, 2000; O'Connor, Rutter, Beckett, Keaveney, Kreppner, & the E.R.A. Study Team, 2000). Children for whom adoption plans are made may be more likely to have been born to parents with cognitive, learning, or behavioral handicaps that, if genetically linked, they could inherit. To the extent that a pregnancy is unintended, prenatal care may also have been less than adequate. From a different perspective, it has been proposed that adoptive family members experience significant losses and that inadequate resolution of the grieving process can result in adjustment problems (Brodzinsky, 1990). It is possible that adopted children who have a difficult time coping with these adoption issues may be less able to deal successfully with the demands inherent in the school setting (Maughan, Collishaw, & Pickles, 1998; van IJzendoorn et al., 2005).

The benefits of adoptive placement have been discussed in terms of the favorable demographic characteristics of adoptive families, especially as these compare to the adoptee's family of origin (Bohman & Sigvardsson, 1990; Fergusson, Lynskey, & Horwood, 1995; Palacios & Sanchez, 1996). Adoptive parents tend to be older, well-educated, and of a relatively high socioeconomic status, with the associated advantages that these confer (Brodzinsky, 1997; Hoksbergen, 1999; Morison & Ellwood, 2000; Stams, Juffer, Rispens, & Hoksbergen, 2000; Verhulst & Versluis-Den Bieman, 1992). In the Colorado Adoption Project, in which samples of adopted children and matched controls were followed longitudinally, matched samples of adoptive and birth families provided very comparable environments to their children at 12 and 24 months of age (Plomin & DeFries, 1985).

There is evidence that aspects of the early home environment, including parenting behavior, are linked to measures of adopted children's cognitive abilities. Beckwith (1971) found that adopted infants' Cattell intelligence scores and Gesell gross motor scores were positively related to the amount of physical and verbal contact with mother, opportunity to explore the house, and experience with people other than mother. Yarrow and his colleagues found that aspects of early maternal care by adoptive mothers were related both to their infants' developmental level in the middle of the first year of life (Yarrow, 1963) and to IQ at age 10 (Yarrow, Goodwin, Manheimer, & Milowe, 1973). At 6 months of age, the amount of achievement and social stimulation provided by mother, and the degree to which that stimulation was matched to the baby's individual capacities, were both highly related to measures of IQ as assessed by the Gesell and Cattell scales as well as to measures of exploratory, manipulative behavior. At age 10, WISC Total IQ was significantly related to the following aspects of maternal behavior in infancy: amount of physical contact with the infant, appropriateness of stimulation, responsiveness to the infant's attempts at communication, extent to which the infant was treated as an individual, depth of mother's emotional involvement, and amount of positive affect expressed to the baby. Hardy-Brown, Plomin, and DeFries (1981) found positive relations between aspects of maternal verbal interaction and infant communicative performance at 1 year of age in an adoptive sample. Coon, Fulker, DeFries, and Plomin (1990) found positive relations between aspects of the home environment measured from infancy through age 7 and children's cognitive development at the latter age. In middle childhood, Maughan et al. (1998) found that family SES, material circumstances, educational environment of the home, and parental interest in education predicted reading competence and general cognitive ability levels in adopted and birth children in middle childhood; furthermore, adopted and birth children in comparable family environments did not differ in their cognitive performance. Duyme (1988) examined the relation between social class of adoptive families and school failure rate of their children in late adolescence. Failure rates were negatively correlated with the social class rating of the adoptive father, and, within all but the highest social class level, adopted and birth children were equivalent in terms of school success.

There is little evidence in the existing literature that adopted children, compared to children born to their parents, exhibit deficits in cognitive functioning during the early years. Greenbaum and colleagues reported that, compared to infants by birth, adopted newborns had superior scores on the Brazelton neonatal exam (Greenbaum, Auerbach, Guttman, Kela, Arbel, Margolin, & Frankel, 1982). In the Colorado Adoption Project no important group differences emerged on measures of communicative competence or mental and motor development at 1 or 2 years (Plomin & DeFries, 1985). Singer, Brodzinsky, Ramsay, Steir, and Waters (1985) reported that adopted and birth toddlers received comparable scores on the Bayley Scales of Infant Development between 13 and 18 months of age. It remains an open question why these well-functioning young children should be at risk for developing difficulties when they begin school. In the present investigation, we attempt to provide another perspective on this question by examining aspects of parent-child interaction in the cognitive realm early in the life of children by adoption and by birth.

The present study is part of a larger longitudinal investigation of the correlates of normative development in healthy children starting in early infancy. A group of adoptive families was matched with a group in which children were being reared by their biological parents. All infants were first children for their parents, thereby controlling for effects of parental experience. The two groups of families were matched as closely as possible in terms of infant gender, maternal age, educational level, extent of employment, and family SES, thereby providing important methodological controls. All parents were married and cohabiting, and all family members were healthy at the time of data collection. The samples of adoptive and birth families were both characterized by excellent conditions within which to foster the positive growth and development of a first child. Mothers and infants were observed in the home environment during their typical daily routine when the infant was healthy and awake, yielding a sample of data representative of the dyad's behavior and interaction as it had developed over the first few months of family life.

Consistent with the literature that suggests that adoption is a risk factor for the development of cognitive problems, we focused on measures that index exploratory behavior and language development in infancy. Measures of infant behavior, maternal behavior, and maternal provisioning of the inanimate manipulable environment were examined. We compared groups by adoption and by birth on mean levels of infant and maternal behavior; on the correlational structure of infant and, separately, of maternal behavior (coherence); and on correlations between infant and maternal behavior (correspondence).

Based on existing research, we did not expect to find mean differences between dyads by adoption and by birth for any infant or maternal behavioral measures. We were unable to make informed predictions with respect to coherence and correspondence, given the paucity of behavioral research comparing adoptive and birth dyads in early infancy. Most of the studies examining adopted mother-infant interaction either do not include a control group of children by birth (e.g., Beckwith, 1971; Yarrow, 1963) or do not report details of observational data that were collected (e.g., Singer et al., 1985).

In overview, this paper examines aspects of cognitive behaviors of mothers and their first infants at age 5 months in families by adoption and by birth. Families were selected to represent optimal circumstances for the establishment of a healthy, nurturing childrearing environment. Naturalistic data were collected in the home environment and were representative of the interaction patterns that had developed for mother-infant dyads over the early months of family life.

Method

Participants

Seventy-four mothers (37 women who had adopted and 37 women who had given birth) and their first children (21 males and 16 females in each group) comprised the sample. All parents were European American, married, and living together at the time of data collection. Adoptive mothers were recruited through local adoption agencies and adoptive family support groups in a major metropolitan East coast area. Mothers by birth were recruited using a mailing list of families in the same geographic area. Each mother by birth was selected to match an adoptive mother in terms of age, highest level of education attained, hours per week of employment outside of the home when the infant was 5 months old, and family socioeconomic status as measured by the Hollingshead (1975) Four-Factor Index of Social Status (Bornstein, Hahn, Suwalsky, & Haynes, 2003). The demographic characteristics for both groups of infants and mothers are presented in Table 1.

All infants were observed when they were approximately 165 days old (*SD* = 7.4). All birth infants went home from the hospital with their mothers, and, on average, adopted infants arrived home on the 21st day after birth (*SD* =36.29, *range* = 1 – 129 days). There was, therefore, a significant difference between the two groups in the number of days infants had spent with their mothers prior to data collection. Among adopted infants, days living with mother ranged from 34 to 191 days at the time of the observation. There was also a difference between the two groups in birth weight, with birth infants weighing on average 445 g more than adopted infants. At birth, 89.2% (*N* = 33) of children were term, and all were healthy at the time of the study (none of four preterm children emerged as a univariate or multivariate outlier, so all were retained). There was no difference in mothers= reports, on a summary rating, of their infants' overall level of adjustment during the first month at home. However, on a check list, birth mothers reported more specific behavioral difficulties (such as frequent crying and excessive eating) during that time. There was no difference in mothers= ratings of the child=s physical health status since birth, $\chi^2(1, N = 72) = .001$, *ns*. Adoptive and birth mothers did not differ in their timing of the infant's naps and meals; both groups reported that naps and meal times occurred on infant demand.

In the adoptive group, 31 infants were adopted domestically, either privately or through licensed agencies. Of 6 international adoptions, 4 infants were born in Asia, 1 in Latin America, and 1 in Eastern Europe. All adoptive parents were unrelated to the baby placed with them. The mean age at arrival for domestic placements was 8.3 days (*SD* = 10.4); for international placements, 89.5 days (*SD* = 46.7). Preliminary analyses revealed no differences between domestic and international placements on any behavioral indicators, and data were collapsed for all analyses. Thirty-eight percent of adoptive parents were present at the birth of their infant.

Exact matching of birth mothers with adoptive mothers on all variables was not possible. On average, adoptive mothers were nearly 2 years older, a marginal difference. The two groups did not differ in level of education or family SES. Adoptive mothers also averaged nearly 3 more years of employment prior to the arrival of their infant. At the time of data collection, however, there was no difference in extent of maternal employment; 22 adoptive mothers and 21 birth mothers worked outside of the home, $\chi^2(1, N = 43) = .81$, *ns*. Among mothers who were employed, there was no difference in number of hours worked. Both groups reported a relatively high and equal level of satisfaction with their employment/homemaker role balance. They also did not differ in the type or quality of childcare arrangements used while they worked.

As expected, adoptive mothers reported a greater number of pregnancy losses and more difficulty in becoming parents than did birth mothers. At the time of data collection, 87% of adoptive mothers reported that they had no concerns about the finalization of the adoption.

Adoptive and birth mothers did not differ in their perceptions of the supportiveness of their husbands or extended family; however, adoptive mothers reported that they found community resources more helpful than did birth mothers. Prior to their baby=s arrival, 68% of adoptive parents attended parenting classes versus 25% of birth parents, $\chi^2(1, N = 74) = 13.93$, $p < .001$.

Procedure

Mothers and infants were visited once at home by a single observer at 5 months, and an hour-long videorecord of naturally occurring mother-infant interaction was filmed. Prior to the visit, the mother was mailed a questionnaire designed to obtain information about herself, her infant, the baby=s father, the adoption or birth, support networks for parenting, and the history of maternal employment and associated substitute childcare.

To assure that mothers' and children's behaviors were representative, and as a check against threats to validity, at the conclusion of the home visit the mother and the observer independently evaluated the mother-infant interaction in the observation by marking a series of 8-point (*range* = 0 to 7) graphic rating scales, randomly ordered with respect to valence but recoded in ascending order. Adoptive and birth mothers rated themselves as having engaged in typical behavior, $M = 4.49$, $SD = 1.87$, and $M = 4.97$, $SD = 1.87$, $t(67) = 1.08$, *ns*, respectively. Adoptive and birth mothers also reported their children as having engaged in typical behavior, $M = 5.42$, $SD = 1.91$, and $M = 5.50$, $SD = 1.62$, $t(67) = 0.17$, *ns*. Both groups rated themselves as being comfortable being videorecorded, $M = 4.57$, $SD = 1.70$, and, $M = 5.29$, $SD = 1.36$, $t(67) = 1.94$, *ns*. The filmer rated both groups of mothers as being relaxed during the observation, $M = 5.15$, $SD = 1.73$ and $M = 5.42$, $SD = 1.58$, $t(64) = 0.67$, *ns*.

Behavioral Variables

The first 50 min of each videorecord were coded using mutually exclusive and exhaustive coding systems and real-time observation coding procedures (Bakemann & Gottman, 1997). The infant measures represent key developmental tasks and performance competencies that are critical to successful adaptation of the infant around the middle of the first year of life. Maternal measures encompass the primary parenting tasks and performance competencies required of the mother of a young infant. For behaviors that were continuously coded, interobserver reliability was measured using Cohen=s (1960Cohen=s (1968) Kappa (κ) and percent agreement (%); coders were trained to achieve, and then monitored to maintain, acceptable levels of agreement, as indexed by κ ∃.60 and percent agreement (%) ∃80% (Hartmann & Pelzel, 2005). For behaviors that were time-sampled, the intra-class correlation (ρ^2) was used, with acceptable levels of agreement being ρ^2∃.80.

Raters were blind to parenting status in most cases. All mothers and all but 5 adopted infants were European-American. The videorecords of both adoptive and control families were randomly distributed throughout a larger sample of 350 dyads. In the case of the 6 international adoptions, 4 (Asian) infants looked clearly different from their mothers, and 2 (European and Hispanic) were not obviously different. To further address the possibility of coder bias, these 6 cases were examined. None was found to be a statistical outlier.

Infant behaviors—Nine behaviors were included in the infant cognitive grouping. *Alert expression* is the mean standard aggregate of the number of times and total duration that the infant=s facial expression indicated interest, concentration, staring, or wide-eyed alertness (κ = .66, *%* = 87). *Non-distress vocalization* is the mean standard aggregate of the number of times and total duration the infant expressed any positively or neutrally toned vocalization (κ = .62, *%* = 95). *Look at object* is the mean standard aggregate of the number of times and total duration the infant looked at any discrete object or body part other than a face (κ = .72, *%* = 87*). Touch object* (κ = .63, *%* = 88) is the mean standard aggregate of the number of times and

total duration the infant actively and purposefully handled an object by grasping it and moving it or by directly exploring the object using the palm or fingers of the hand (e.g., patting, rubbing, etc.). *Mouth object* is the mean standard aggregate of the number of times and total duration a discrete object other than a bottle or pacifier came into contact with the infant=s mouth (κ = . 74, % = 95). *Extent of exploration* is the mean standard aggregate of the variety, density, and consistency of objects mouthed or touched (ρ^2 = .96). *Efficiency of exploration* is the mean standard aggregate of the proportion of variety, density, and consistency of objects mouthed or touched (ρ^2= .96). *Balance* (ρ^2 = .87) is the mean highest level of the infant=s ability to attain and maintain a sitting position, ranging from level 1 (sits with rounded back and unsteady head when fully supported) to level 8 (rotates from prone position to a balanced sitting position without assistance). *Movement* (ρ^2 = .99) is the mean highest level of deliberate, unassisted movement, ranging from level 1 (infant lifts legs up when supine) to level 11 (infant actively creeps across the room).

Mother behaviors—Nine behaviors were included in the maternal cognitive grouping. *Speech to child* (κ = .71, % = 89) is the mean standard aggregate of the number of times and total duration the mother spoke to the infant. *Imitation* is the mean standard aggregate of the number of times and total duration the mother attempted to imitate the infant=s non-distress or distress vocalization (κ = .39, % = 99). *Direct attention to object* is the mean standard aggregate of the number of times and total duration the mother physically moved the infant or an object so that the infant could see or touch it, or verbally referred to an object related event or activity (κ = .71, % = 92). *Quantity of objects* is the mean standard aggregate of the variety, density, and consistency of toys, books, and small household objects that were within the infant=s reach (ρ^2 = .92). *Quality (responsiveness) of objects* is the mean standard aggregate of the number and proportion of highly responsive objects within reach of the infant (ρ^2 = .81). *Encourage balance* is the mean proportion of consecutive 10-min intervals in which the mother physically or verbally encouraged the infant to sit or stand (ρ^2 = .88). *Encourage movement* is the mean proportion of consecutive 10-min intervals in which the mother physically or verbally encouraged the infant to roll, crawl, or step (ρ^2 = .86). *Broadcast sounds* is the mean aggregate of the proportion of time in which a television, radio, phonograph, tape, CD, or adult musical instrument was audible (ρ^2 = .98). *Household sounds* is the mean aggregate of the proportion of time in which indoor mechanical noise (e.g., dishwasher, hair dryer, etc.) or any other previously uncategorized sound was audible (ρ^2 = .37). All infant behaviors met and surpassed acceptable levels of interrater reliability. All maternal bΩehaviors, save two, met acceptable levels of agreement. The low κ for mother=s imitation of infant vocalizations is due to the infrequency of this behavior. The low ρ^2 for household sounds is due to the difficulty of coding this variable from videorecords.

Results

Preliminary Analyses: Infant Gender, Infant Awake, and Mother in View

At the univariate level, all variables were examined separately for nonnormalcy, heterogeneity of variance, presence of outliers, influential cases, and the need for transformation (Fox, 1997). Multivariate outliers were identified using a modification of the SPSS multivariate outlier screening procedure developed by Cook and Weisberg (1994). The assumption of equivalence of dispersion matrices was evaluated using *Box=s M*, and bivariate relations were examined graphically for nonnormality and/or influential cases.

For infant cognitive behaviors, problems of nonnormalcy and influential outliers were resolved with log transformations for non-distress vocalizations and movement, cube root transformations for balance, and square transformation for alert expression. For maternal cognitive behaviors, problems of nonnormalcy were resolved with log transformations for

encourage attention to object, encourage balance, quality of objects, and household noise; cube root transformation for imitation; cube transformation for broadcast noise; and reciprocal transformation for encourage movement.

Infant gender—Effects of gender were tested at the multivariate and univariate levels, all *ps* > .05. For both mother and infant cognitive behaviors, no gender effects were found at the multivariate level; however, gender differences emerged at the univariate level, and they are described in the results.

Infant awake—Infants in both groups were awake for virtually the entire observation session: On average, adopted infants were awake 99.2% of the session, and birth infants 99.7% of the session, $t(72) = .94$, *ns*.

Mother in view—The two groups were also similar in terms of the amount of time mothers were in view of their infants: 95.0% of the observation session on average for adoptive mothers, and 95.7% for birth mothers, $t(72) = .48$, *ns*.

Analytic Plan

Analysis of infant and mother behaviors followed three main paths. First, we explored similarities and differences in infant and mother behaviors between adoptive and birth families. *Group differences* were evaluated using both multivariate and discriminate function analyses with follow-up univariate tests of the dependent variables.

Second, separately for each group, we explored relations among infant behaviors and relations among maternal behaviors. *Coherence* refers to the covariation of behaviors within an individual; so, for example, if mothers who feed their babies more also bathe them more, feeding and bathing would cohere into a positive manifold of routine care. Coherence is indexed statistically by the correlation coefficient of the two behaviors.

Finally, we explored relations between infant and maternal behaviors. *Correspondence* refers to the significant covariation between two individuals; so, for example, if mothers who encourage their babies more to look at them have babies who do look at them more, encouraging and paying attention would correspond in the dyad. Correspondence is indexed statistically by the correlation coefficient of the two behaviors. Between-group comparisons of correlations were made wherever appropriate.

Group Comparisons of Cognitive Behaviors

Infant behaviors—Table 2 shows, separately for adoptive and birth groups, rate of occurrence and proportion of the hour for the cognitive behavior indicators, mean highest rate scores for balance and movement, and mean standard scores for extent and efficiency of exploration. For both groups, alert expression, non-distress vocalization, and look at objects had the highest rates of occurrence, followed by touching and mouthing objects. Alert expression dominated the infant=s hour, followed by looking at objects and touching objects.

Table 2 also presents the means and standard deviations of the infant cognitive behaviors, separately for each group. In a multivariate test of variance, Bartlett=s test of sphericity indicated sufficient correlation among the cognitive indicators to justify a multivariate approach, $\chi^2(1, N = 74) = 119.83$, $p < .001$. A test of the dependent variables, considered simultaneously, was significant, $F(9,59) = 3.86$, $p = .001$, $\eta^2_p = .37$, with a moderately large percentage of the variance in the discriminate function variate (37%) attributable to the group difference (Cohen, 1988). Evaluating the *SDFC*s suggested that look at object, alert expression, and touch object contributed more than did the other indicators (*SDFC*s =.86, −.76, and −.49,

respectively). Alert expression ($r = -.48$), mouth object ($r = -.33$), and touch object ($r = -.30$) were moderately correlated with the variate.

Follow-up univariate ANOVAs of the dependent variables confirmed that birth infants displayed significantly longer alert expression than adopted infants, $F(1,67) = 8.92$, $p < .004$, $\eta^2_p = .12$. Birth infants also spent significantly more time mouthing objects, $F(1,67) = 4.41$, $p < .04$, $\eta^2_p = .06$.

A gender difference emerged at the univariate level for movement, with female infants displaying a higher level than males, $F(1,67) = 5.53$, $p < .02$, $\eta^2_p = .08$.

Mother behaviors—Table 3 shows, separately for adoptive and birth groups, rates of occurrence and proportion of the hour for the cognitive behavioral indicators, mean standard scores for quantity and quality of objects provided, and mean proportion scores for encouragement of gross motor skills and auditory context. For both groups, speech to infant had the highest rate of occurrence and duration, followed by direct attention to objects, and imitation. Mothers in both groups spent relatively little time encouraging their children's balance or movement competence.

Table 3 also presents the means and standard deviations of the maternal cognitive behaviors, separately for each group. In a multivariate test of variance, Bartlett=s test of sphericity indicated sufficient correlation among the cognitive indicators to justify a multivariate approach, χ^2 (1, N = 72) = 89.55, $p < .001$. A test of the dependent variables considered simultaneously was not significant, F (9,64) = .55, *ns*, $\eta^2_p = .11$, with a small percentage of the variance in the discriminate variate (11%) due to group differences. There were no significant differences in any of the indicators at the univariate level.

Coherence among Infant and among Mother Cognitive Behaviors

Coherence among infant behaviors—Table 4 shows correlations among infant cognitive behaviors, separately for the adoptive and birth groups. Correlations among behaviors ranged from small to large. For the adoptive group only, there was a large negative correlation between alert expression and movement, and a moderate negative correlation between non-distress vocalization and efficiency of exploration. For the birth group only, there was a moderate negative correlation between alert expression and efficiency of exploration, a moderate positive correlation between touch object and movement, and a large positive correlation between extent of exploration and movement, with a significant difference between groups, $z = 2.17$, $p < .05$. For both groups, there were moderate to large positive correlations between look at object and touch object (with a significant difference between groups, $z = 2.57$, $p < .01$), look at object and extent of exploration, touch object and extent of exploration, and extent and efficiency of exploration.

Coherence among mother behaviors—Table 5 shows the correlations among maternal cognitive behaviors, separately for the adoptive and birth groups. For the adoptive group only, there was a moderate negative correlation between quality of objects and encourage movement. For the birth group only, there was a moderate positive correlation between speech to infant and imitation; a large positive correlation between encourage attention to objects and quality of objects; and a moderate negative correlation between quantity of objects and encourage movement and between quantity of objects and broadcast sounds. For both groups, there was a large positive correlation between encourage attention to objects and quantity of objects.

Correspondence Between Infant and Mother Cognitive Behavior

Table 6 shows correlations among infant and maternal cognitive behaviors. For the adoptive group only, there were moderate positive correlations between alert expression and encourage movement; non-distress vocalization and imitation; look at object and direct attention to object; touch object and direct attention to object; and efficiency of exploration and encourage movement. There was also a moderate negative correlation between balance and direct attention to object; and a moderate positive correlation between balance and broadcast sounds (with a significant difference between groups, $z = 2.43$, $p < .05$). For the birth group only, there were moderate negative correlations between non-distress vocalization and household sounds, extent of exploration and encourage movement, and extent of exploration and broadcast sounds. There was a moderate positive correlation between movement and quantity of objects and a large negative correlation between movement and encourage movement. For both groups, there was a moderate to large positive correlation between look at object and quantity of objects, and between touch object and quantity of objects. There were also large positive correlations between extent of exploration and direct attention to objects and between extent of exploration and quantity of objects.

Discussion

Two areas of functioning in the cognitive sphere, vocal/verbal communication and exploration, were examined in adoptive and birth mothers and infants. Measures used to index the two different realms were largely unrelated to each other, both within the person and within the dyad, indicating that, in early infancy, the two areas function independently. The language environment appears to be very similar in adoptive and nonadoptive homes early in the first year. Infants in the two groups did not differ in the extent to which they vocalized, nor did adoptive and birth mothers direct differing amounts of speech to their babies. Frequency and duration of maternal speech and infant vocalization were independent for both groups. There were no differences in the ambient noise levels in the two groups of homes. The few differences that did occur--the two measures of mother language, speech to child and imitation, were positively linked in families by birth only; maternal imitation was positively correlated with infant vocalization in adoptive dyads only; and ambient sounds were negatively correlated with infant vocalizations in birth homes only—must be viewed with caution, given the very infrequent occurrence of imitation and the difficulties in coding imitation and household sounds. Overall, these results suggest that, compared with babies by birth, adopted infants in the home setting experience rich and comparable opportunities for the development of language competence.

In the area of exploration, we found no differences in mean levels of maternal behavior. Group differences did emerge for 2 infant measures. Infants by birth were in an alert state more often and mouthed objects more. Three additional infant measures--touch object, extent of exploration, and movement—approached significance, with birth infants exhibiting higher mean levels on all three. Taken together, these results suggest that, by the middle of the first year, mothers by adoption and birth are providing comparable exploratory environments for their babies, but that infants by birth may be exploring to a somewhat greater extent.

With respect to within-person behavioral organization, there were few significant correlations among behaviors for either group of mothers, while both similarities and differences in the organization of infant behavior repertoires were found. Three measures of exploratory behavior —look at object, touch object, and extent of exploration—were strongly intercorrelated for both groups of babies. By the middle of the first year of life, healthy infants are coordinating a behavioral repertoire in the service of exploration of the environment outside of the dyad. Our data suggest that, under optimal conditions, this important developmental task, which sets the stage for the acquisition of a broad range of cognitive competencies, occurs regardless of

whether or not infants are adopted. Differences in the patterns of coherence for adopted and birth infants were also found. For birth infants only, movement was positively related to both touch object and extent of exploration, suggesting that these babies were actively involved in creating opportunities for exploration. Comparable relations for adopted infants approached zero.

Considering the links between maternal and infant behavior, mothers who provided more opportunities for exploration had infants who explored more; that is, the coordination of maternal and infant behavior conducive to promoting growth in the exploratory realm was present in both types of families at a developmentally appropriate age. Together with the finding that the two groups of mothers were comparable in the (wide) variety and (high) quality of toys they provided to their babies, these data paint a very reassuring picture. Beyond supporting the literature that suggests that adoptive parents provide enriched, stimulating environments to their children, our findings begin to demonstrate that the opportunities provided by those advantaged environments are, in fact, being utilized by adopted infants and their mothers. In a meta-analysis of studies of cognitive behavior, van IJzendoorn et al. (2005) found that the adoption décalage, the discrepancy between aptitude and achievement often found in adopted samples at school age, was not evident for children adopted during the first year of life and suggested that early adoption may be a protective factor for cognitive performance. Our data lend support to this conjecture.

An interesting hint of difference in interaction patterns of adopted and birth dyads also emerged. For dyads by birth only, mothers encouraged their infants to practice gross motor movement skills inversely to both the baby's level of ability and to the extent that the baby explored. Furthermore, again for birth infants only, those with a more advanced ability to move through space came into contact with a wider variety of inanimate objects. This pattern of relations, when combined with the trends that we found toward higher mean levels of, and stronger correlations among, exploratory measures for infants by birth, suggests the possibility that the two groups of dyads differ in the extent to which infant exploration is being actively encouraged. Even though mothers in both types of families provide a stimulating variety of toys and other materials for their infants, they may differ in their attitudes about exploration, leading to different behavioral emphases. Attachment theory posits two complementary aspects of the attachment figure's role: a haven of safety which the child trusts and to which s/he can retreat when danger threatens, and a secure base from which the child can venture forth to explore and master the wider world (Ainsworth, 1991). Both types of parenting support are critical for a baby's healthy development, and parents must strike a balance between these two aspects of their role. Although adoptive mothers recognize the importance of giving their baby interesting toys to play with, it may be difficult for them to actively encourage their long-awaited infants to "move out" from the dyad (both literally and figuratively) so soon after arriving home. Hoopes (1982), interviewing adoptive parents and matched controls 6 months after the arrival of a new baby, found that adoptive mothers scored higher on a rating of fostering dependency. In that same study at 5 years of age, although birth and adoptive parents did not differ in their ratings (i.e., perceptions) of their children, experimenters rated adopted children as significantly more fearful, less attentive and willing to do tasks, and less confident in their own ability than children born to their parents.

There is considerable room for variation in behavioral expression within the limits of what is considered to be adaptive. It seems possible that small differences in normative behavioral emphasis in families by adoption and by birth could cumulate over children's early years to yield, on average, observable differential outcomes on some measures of child functioning (Abelson, 1985; Bornstein & Sawyer, 2006). Close investigation of dynamics within the adoptive family is long overdue and should yield valuable insights into whether or not subtle

patterns of parent-child interaction unique to adoptive families occur. Findings in the present study indicate the merit of pursuing this line of research.

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Table 1

Demographic Characteristics of Adoptive and Birth Samples

	Adoptive (*N*=37)		Birth (*N*=37)					
	M	***SD***	***M***	***SD***	***t***	***df***	***p*≤**	**η^2p**
Infant								
Age (days)	165.49	8.99	163.51	5.41	1.14	59.03[a]	*ns*	.02
Days with mother since Birth	144.27	36.53	163.51	5.41	3.17	37.58[a]	.002	.12
Birth weight (g)	3213.57	595.53	3658.24	497.05	3.49	72	.001	.14
Newborn adjustment Scale (1–5)	1.59	.96	1.95	1.10	1.46	72	*ns*	.03
Neonatal number of Difficulties (0–10)	.72	.78	1.66	1.00	4.41	69	.001	.22
Schedule	5.53	.91	5.19	1.37	1.24	71	*ns*	.02
Mother								
Sociodemographic variables								
Age (at birth)	36.30	4.55	34.50	3.52	1.91	72	.06	.05
Education (Hollingshead)	6.49	.73	6.49	.69	.00	72	*ns*	.001
SES (Hollingshead)	58.49	6.58	59.28	6.08	.54	72	*ns*	.004
Years employed prior to infant arrival	14.11	5.26	11.89	4.28	1.99	72	.05	.05
Hours of employment per week**	29.27	12.23	35.14	8.47	1.82 [a]	41	ns	.07
Context variables								
Satisfaction with role Balance (1–5)	4.00	.94	4.09	1.00	.38	69	*ns*	.002
Childcare: Quality	4.14	2.99	4.37	3.05	.32	68	*ns*	.001
Childcare: Type*	1.83	1.13	1.74	.87	.36	68	*ns*	.002
Pregnancy losses	1.08	1.40	.31	.76	2.86	69	.01	.11
Difficulty becoming a Parent (1–5)	3.76	1.57	2.34	1.24	4.23	70	.001	.20
Social Support: Spouse	3.30	.53	3.15	.93	.84	72	*ns*	.01
Social Support: Extended family	1.53	.95	1.76	1.00	1.00	72	*ns*	.01
Social Support: Community	2.13	.73	1.72	.77	2.36	72	.02	.07

[a]Adjusted for unequal variance.

*For ease of interpretation, data shown based on standardized scores.

** Includes only mothers who work.

Table 2

Descriptive Statistics for Infant Cognitive Behaviors and Adoptive-Birth Group Differences

	Adoptive			Birth						
Behaviors	***M***	***SD***	***N***	***M***	***SD***	***N***	***F***	***df***	***p*≤**	**η^2p**
Alert expression: Mean *z* score	3.88	1.04	37	4.50	1.16	37	8.92	67	.004	.12
Frequency: Rate per hour	102.02	43.16	37	135.37	34.54	37				
Duration: Proportion of hour	.75	.11	37	.73	.09	37				
Non-distress vocalization: Mean *z* score	3.89	1.92	37	4.19	1.73	37	1.13	67	*ns*	.02
Frequency: Rate per hour	140.41	74.74	37	150.13	73.54	37				
Duration: Proportion of hour	.08	.06	37	.09	.05	37				
Look at object: Mean *z* score	4.36	1.55	37	3.90	1.51	37	1.45	67	*ns*	.02
Frequency: Rate per hour	153.91	43.79	37	139.01	42.90	37				
Duration: Proportion of hour	.35	.12	37	.33	.13	37				
Touch object: Mean *z* score	3.20	1.50	37	3.99	1.60	37	3.64	67	*ns*	.05
Frequency: Rate per hour	60.80	32.48	37	88.74	42.33	37				
Duration: Proportion of hour	.25	.13	37	.26	.13	37				
Mouth object: Mean *z* score	3.47	1.48	37	4.46	1.90	37	4.41	67	.04	.06
Frequency: Rate per hour	30.46	19.70	37	48.75	30.09	37				
Duration: Proportion of hour	.10	.07	37	.12	.08	37				
Extent of exploration: Mean *z* score	2.64	.82	37	2.93	.99	37	2.91	67	*ns*	.04
Variety	7.86	3.58	37	8.43	4.26	37				
Density	1.38	.60	37	1.67	1.00	37				
Consistency	6.65	1.99	37	7.43	2.12	37				
Efficiency of Exploration: Mean *z* score	3.39	.92	37	3.47	.75	37	.25	67	*ns*	.004
Percentile: Variety	.78	.18	37	.78	.16	37				
Percentile: Density	.64	.18	37	.63	.17	37				
Percentile: Consistency	.88	.14	37	.92	.11	37				
Balance: Mean *z* score	2.83	1.19	37	2.51	.74	35	.60	67	*ns*	.01
Movement: Mean *z* score	1.70	.85	35	2.06	1.11	36	3.43	67	*ns*	.05

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Table 3

Descriptive Statistics for Mother Cognitive Behaviors and Adoptive-Birth Group Differences

	Adoptive		Birth					
Behaviors	***M***	***SD***	***M***	***SD***	***F***	***df***	***p*≤**	**η^2p**
Speech to child: Mean *z* score	4.45	1.69	4.83	1.90	.80	72	*ns*	.01
Frequency: Rate per hour	327.03	118.09	357.92	124.95				
Duration: Proportion of hour	.27	.12	.28	.14				
Imitation: Mean *z* score	2.06	1.58	2.84	2.23	3.08	72	*ns*	.04
Frequency: Rate per hour	4.15	6.08	8.04	9.88				
Duration: Proportion of hour	.002	.003	.003	.004				
Direct attention to object: Mean *z* score	3.71	1.68	3.77	1.94	.01	72	*ns*	.001
Frequency: Rate per hour	37.24	21.22	40.57	23.77				
Duration: Proportion of hour	.12	.08	.11	.09				
Quantity of objects	2.84	.75	3.11	.98	1.09	72	*ns*	.02
Variety	10.19	4.18	10.92	5.08				
Density	2.23	.96	2.78	1.88				
Consistency	17.54	1.94	8.08	1.96				
Quality of objects	2.57	.88	2.43	.81	.52	72	*ns*	.001
Total responsiveness	9.38	1.17	9.07	1.20				
Number of highly responsive objects	1.27	1.33	1.24	1.12				
Percentage of highly responsive objects	.13	.13	.12	.10				
Encourage balance	.22	.18	.26	.16	1.29	72	*ns*	.02
Physical encouragement to sit	.39	.32	.47	.27				
Physical encouragement to stand	.28	.33	.32	.28				
Verbal encouragement to sit	.12	.18	.13	.16				
Verbal encouragement to stand	.09	.15	.10	.19				
Encourage movement	.03	.05	.04	.05	.40	72	*ns*	.01
Physical encouragement to roll	.05	.14	.05	.11				
Physical encouragement to crawl	.02	.07	.01	.03				
Physical encouragement to step	.01	.03	.02	.07				

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Table 4

Coherence Among Infant Cognitive Behaviors

Behaviors	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1 Alert expression		.07	.18	.15	.04	.04	−.32*	−.09	−.31
2 Non-distress vocalization	−.03		−.02	.00	.05	−.04	−.09	.06	.04
3 Look at object	.31	−.11		**.79*****	.26	.54***	.26	−.16	.23
4 Touch object	−.14	−.01	**.42****		.17	.61***	.30	−.19	.37*
5 Mouth object	.10	−.03	.22	.13		.26	.01	.15	−.07
6 Extent exploration	−.13	−.30	.48**	.51***	.23		.35*	.04	**.55*****
7 Efficiency exploration	.14	−.35*	.21	.23	.06	.47**		−.01	.27
8 Balance	−.01	−.13	−.10	−.21	−.25	−.21	−.03		.12
9 Movement	−.50**	.13	−.29	.09	−.04	**.08**	−.07	.04	

Note. The correlation coefficients of Birth group (N = 37) are presented above the diagonal, and the correlation coefficients of Adoptive group (N = 37) are presented below the diagonal. Bold numbers indicate correlations that differ significantly between the two groups.

* p # .05;

** p # .01;

*** p # .001

Table 5

Coherence Among Mother Cognitive Behaviors

Behaviors	1	2	3	4	5	6	7	8	9
1 Speech to child		.40*	.27	−.08	.13	.17	.22	.32	−.02
2 Imitation	−.01		.08	−.05	−.07	−.15	.06	−.10	−.03
3 Encourage attention to object	.19	.10		.52**	.53***	.19	−.22	−.17	−.01
4 Quantity of objects	−.11	.08	.57***		.20	.05	−.44**	−.35*	−.19
5 Quality of objects	.01	−.16	.20	−.02		.29	−.22	.14	−.10
6 Encourage balance	−.06	.01	.31	.19	−.01		−.12	−.12	−.20
7 Encourage movement	−.07	−.09	−.01	−.19	−.48**	.02		.21	.30
8 Broadcast sounds	−.16	−.11	−.12	−.01	−.15	.20	−.17		−.11
9 Household sounds	−.29	.23	−.04	−.03	−.10	−.17	.14	.13	

Note. The correlation coefficients of Birth group (N = 37) are presented above the diagonal, and the correlation coefficients of Adoptive group (*N* = 37) are presented below the diagonal.

* *p*# .05;

** *p*# .01;

*** *p*# .001

Table 6

Correspondence Between Infant and Mother Cognitive Behaviors in Adoptive and Birth Samples

		Mother Behaviors								
Infant Behaviors		**Speech to child**	**Imitation**	**Direct attention to object**	**Quantity of objects**	**Quality of objects**	**Encourage balance**	**Encourage movement**	**Broadcast sounds**	**Household Sounds**
Alert expression	Adoptive	.16	.07	−.03	−.22	−.01	.05	.33*	−.01	−.15
	Birth	.13	.14	.30	.17	.23	−.26	.09	.07	.07
Non-distress vocalization	Adoptive	−.12	.39*	−.09	−.16	.07	.19	−.11	−.08	.10
	Birth	−.23	.08	−.04	.01	−.19	.16	.06	−.30	−.33*
Look at object	Adoptive	−.01	−.28	.37*	.40*	.18	.14	.16	.18	−.04
	Birth	−.09	−.17	.26	.48**	−.03	−.03	−.12	−.00	−.05
Touch object	Adoptive	.02	−.02	.34*	.45**	.19	.01	−.20	.00	−.21
	Birth	−.09	−.24	.30	.52***	−.01	−.02	−.14	−.04	.01
Mouth object	Adoptive	.28	.09	.01	.17	−.06	.08	.08	.05	.15
	Birth	.17	.30	.15	.28	−.27	.25	.03	−.28	−.10
Extent exploration	Adoptive	−.01	−.08	.58***	.89***	−.04	.14	−.05	−.03	−.08
	Birth	−.09	−.09	.51***	.91***	.12	.03	−.34*	−.37*	−.08
Efficacy exploration	Adoptive	.18	−.24	.26	.04	−.06	−.03	.34*	−.20	−.08
	Birth	−.14	−.16	.04	−.04	−.20	.03	.11	−.21	.22
Balance	Adoptive	−.13	−.13	−.33*	−.21	−.24	.15	.11	.34*	−.08
	Birth	.10	.23	.05	.05	.26	.23	−.13	−.24	.21
Movement	Adoptive	−.27	−.25	−.24	.10	.09	−.04	−.28	.06	−.14
	Birth	−.13	.03	.19	.47**	.00	−.13	−.54***	−.18	−.15

Note. Bold numbers indicate correlations that differ significantly between the two groups.

* *p*# .05;

** *p*# .01;

*** *p*# .001