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Mother-Infant Socioemotional Contingent Responding in Families by Adoption and Birth

Joan T. D. Suwalsky,
Child and Family Research, *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, National Institutes of Health, Department of Health and Human Services

Linda R. Cote,
Department of Psychology, Marymount University, Child and Family Research, *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, National Institutes of Health, Department of Health and Human Services

Marc H. Bornstein,
Child and Family Research, *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, National Institutes of Health, Department of Health and Human Services

Charlene Hendricks,
Child and Family Research, *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, National Institutes of Health, Department of Health and Human Services

O. Maurice Haynes, and
Child and Family Research, *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, National Institutes of Health, Department of Health and Human Services

Roger Bakeman
Department of Psychology, Georgia State University

Abstract

Contingencies of three maternal and two infant socioemotional behaviors that are universal components of mother-infant interaction were investigated at 5 months in 62 mothers (31 who had adopted domestically and 31 who had given birth) and their first children (16 males in each group). Patterns of contingent responding were largely comparable in dyads by adoption and birth, although the two groups of mothers responded differentially to the two types of infant signals. Mothers in both groups were more responsive than infants in social and vocal interactions, but infants were more responsive in maternal speech-infant attention interactions. Family type x Gender statistical interactions suggested a possible differential role of infant gender in establishing mother-infant contingencies in families by adoption and birth.

Address correspondence to: Joan T. D. Suwalsky, Child and Family Research, *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, 6705 Rockledge Drive, Suite 8030, Bethesda MD 20892-7971 USA, Telephone: 301-496-6876, Fax: 301-496-2766, Joan_Suwalsky@nih.gov.

Keywords

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Responsive parenting involves establishing of patterns of parent-child interaction characterized by sensitivity, mutual coordination, and turn-taking (Ainsworth, Bell, & Stayton, 1974; Fogel, 1993; Stern, 1985). Behaviors that are especially salient in these exchanges early in the first year of an infant's life are visual attention and nondistress vocalization for the baby and visual attention, speech, and touch for the mother (Feldstein, Jaffe, Beebe, Crown, Jasnow, Fox, & Gordon, 1993; Rutter & Durkin, 1987; Van Egeren, Barratt, & Roach, 2001). From birth, infants signal their needs and mothers respond (Ainsworth et al., 1974; Bornstein, 1989; Bowlby, 1969; Stern, 1985). As early as 2 months of age, infants can discriminate between mother and stranger based on the similarity of their styles of responding to the baby (Bigelow & Rochat, 2006), and they become increasingly sensitive to familiar contingency levels across the first half of the first year (Bigelow, 1998; Watson, 1985). As a new mother cares for her very dependent baby and as the baby experiences her ministrations, a pattern of behavioral adaptation between them emerges, and they develop a degree of responsive contingency as a dyad that is characteristic of both partners and consistent across contexts (Bigelow & Rochat, 2006; Van Egeren et al., 2001).

A number of specific socioemotional behavioral contingencies have been reported in mothers and infants in the first 6 months, all in samples of dyads in which the infant was born to the mother. Mothers respond when their infants look at them or vocalize by encouraging social interaction (Bornstein, Cote, Haynes, Suwalsky, & Bakeman, 2011; Bornstein & Manian, 2011; Cote, Bornstein, Haynes, & Bakeman, 2008) and by speaking to the baby (Bornstein & Manian, 2011; Van Egeren et al., 2001). For their part, young infants have been shown to respond to maternal encouragement of social interaction by looking at mother (Bornstein et al., 2011; Cote et al., 2008), and they respond to maternal speech by vocalizing and by looking (Van Egeren et al., 2001). By 5 months of age infants actively participate in turn-taking exchanges (Belsky, Gilstrap, & Rovine, l984; Bornstein & Tamis-LeMonda, 1990; Kaye & Fogel, 1980). Comparable patterns of mutual contingent responding have been identified in mothers and infants in multiple cross-cultural samples (Bornstein et al., 2011; Cote et al., 2008), suggesting that the synchronous meshing of core sets of infant and maternal behaviors is a universal component of early human development. Parental responsiveness to infant signals has been theorized to facilitate the development of a sturdy sense of self in the baby (Stern, 1985) and has been linked to a broad spectrum of positive developmental outcomes for children in social development, cognitive growth, intellectual achievement, and behavioral adjustment (Ainsworth et al., 1974; Beckwith, Rodning, & Cohen, 1992; Bornstein, 2002; Bornstein, Tamis-LeMonda, & Haynes, 1999; Coates & Lewis, 1984; Goldstein, Schwade, & Bornstein, 2009; Gunnar, 1980; van IJzendoorn, Dijkstra, & Bus, 1995; van IJzendoorn, Juffer, & Poelhuis, 2005; Watson, 1985).

Adoption may pose risks for the establishment of sensitive responsiveness between mother and baby to the extent that responsiveness depends on shared genetics. In addition, the

circumstances that often surround the adoption of an infant may adversely influence the manner in which a mutually adapted relationship between mother and baby develops. The process of adopting a child is often lengthy and arduous and is commonly associated with significant stress for prospective adopters (Brodzinsky, 1997; Daly, 1988). These levels of stress may interfere with a parent's self-confidence, competence, and ability to respond sensitively to a new baby (Kirk, 1985; March & Miall, 2000). Parents in Western cultures have typically been defined as those who give birth to a child (Evan B. Donaldson Adoption Institute, 1997; Leon, 2002), and adoptive parents may encounter negative attitudes or a lack of social support from family or friends that also undermine their sense of confidence as they start their journey as parents. Finally, an infant who has been made available for adoption may not arrive in the adoptive home for some weeks or months after birth, and multiple caregivers may have been involved in his or her care to that point. The early separation of adoptive mother and baby as well as the number of changes in caregivers, when they occured, and how those caregivers differed in their styles of responding to the baby can all complicate the process of establishing dyadic synchrony once the baby is adopted.

Adoption after 6 months of age has been shown to be associated with a heightened risk for later adjustment difficulties (Gunnar, van Dulmen, & the International Adoption Project Team, 2007; Rutter, Sonuga-Barke, Beckett, Castle, Kreppner, Kumsta, Schlotz, Stevens, & Bell, 2010; Verhulst, Althaus, & Versluis-den Bieman, 1990). However, in a study of infants both before and after the transition from a foster to an adoptive home, Yarrow and colleagues (Yarrow, 1963; Yarrow & Goodwin, 1973; Yarrow, Goodwin, Manheimer, & Milowe, 1973; Yarrow & Klein, 1980) found evidence of immediate disturbances in adjustment at all ages (6 weeks to 12 months). On assessments of adaptation to feeding and sleep routines, emotional responses, disturbances in social behavior, and changes in developmental level, between 11 and 60 percent of infants showed some evidence of disturbance when the transition occurred earlier than 6 months of age. The degree of disturbance at the time of transition was related, at least in part, to differences in qualitative dimensions (e.g., immediacy of response, emotional involvement, sensitivity, individualization of response) of the care provided by foster and adoptive mothers. A decrease in the quality of care was associated with greater disturbance in the infant, and an increase in quality appeared to attenuate the baby's negative reactions. None of 10 assessed dimensions of care was correlated between foster care and adoptive settings, graphically illustrating the lack of environmental continuity associated with adoptive placement to which infants must often adjust.

Contingent responsiveness, the topic of this investigation, has not been studied in adoptive families, but several investigations have assessed maternal sensitivity in adoptive families more globally. As originally conceptualized and measured by Ainsworth et al. (1974), maternal sensitivity encompasses several "responsive" components: awareness and accurate perception of infant signals, appropriateness of response, and timing (promptness) of response. It was assessed using a detailed 9-point rating scale that was scored based on observing naturalistic mother-infant interaction in the home setting. By contrast, behavioral contingency, as assessed in the present study, captures the elements of awareness and timing of mothers' overt responses to their infants' signals. It is a tool that can be applied to

naturalistic behavior streams to understand more precisely some central components of maternal sensitivity. In a prospective longitudinal study of first-time Israeli parents by adoption and by birth, couples were interviewed before the arrival of the infant, and the family was visited at home when the infant was 3–4 weeks old (Greenbaum, Auerbach, & Guttman, 1989; Greenbaum, Auerbach, Guttman, Kela, Arbel, Margolin, & Frankel, 1982). The two groups of parents differed in some aspects of their styles of interaction with the baby, with adoptive parents being less responsive to the baby's positive social behavior in a play situation. In a prospective longitudinal study of Dutch adopted children placed before 6 months of age, ratings of adoptive mothers' sensitivity during free play with the baby at 6 and 12 months of age were found to be comparable to those of normative samples of mothers by birth (Juffer, Hoksbergen, Riksen-Walraven, & Kohnstamm, 1997; Juffer & Rosenboom, 1997). Sensitivity of adoptive mothers in infancy was uniquely predictive of better social and cognitive development in their children at age 7 (Stams, Juffer, & van IJzendoorn, 2002) and was indirectly associated with better social development in adolescence through its relations with social development in middle childhood (Jaffari-Bimmel, Juffer, van IJzendoorn, Bakermans-Kranenburg, & Mooijaart, 2006).

Yarrow (1963) reported relations between a variety of aspects of (foster and adoptive) maternal care in the first 6 months and infant capacities at 6 months. Comparisons with families by birth were not included. Maternal emotional involvement, sensitivity, adaptation to the individuality of the infant, acceptance, and immediacy of response to infant expressions of need were strongly correlated with the infant's capacity to cope with stress (i.e., to maintain equilibrium and avoid behavioral disorganization when under stress). Aspects of maternal parenting assessed in infancy (responsiveness to infant attempts to communicate, appropriateness of stimulation, and individualization of the infant by mother) were also positively related to intelligence (WISC IQ) test scores and to several measures of personal-social development for children at age 10 years, although significantly only for boys (Yarrow et al., 1973).

This small literature suggests that adoptive mothers can interact in a sensitive fashion with their young infants. It further suggests that sensitive responding to the signals of very young adopted infants is associated with later indices of healthy functioning. Although ratings of sensitivity of maternal behavior capture important qualitative aspects of interaction sequences, they do not assess specific behavioral linkages involved. Likewise, correlations provide some insight into behavioral structure, but they do not directly measure contingency in mother-infant interaction. Frequencies of mother and child behavior may be correlated across an observation, but correlations do not reveal whether the behaviors of the two partners are coordinated in real time, nor do they inform with respect to which partner initiates and which responds. One mother-infant dyad may engage in high levels of social interaction relative to another mother-infant dyad, but this does not necessarily mean that their behaviors occur contingently. Contingency analyses, the subject of this investigation, add important quantitative information about qualitative aspects of interaction. Investigations directed to processes known to support healthy child development (such as contingent responsiveness) begin to anchor our understanding of how adoption serves the best interests of the child.

The present study had the goal of directly examining patterns of contingent responding in the socioemotional sphere in adoptive mother-infant dyads at 5 months of age and comparing them to patterns in dyads by birth. By the middle of the first year of life, infants engage in a rich array of social interactions with familiar caregivers, with both partners soliciting and responding to social overtures from the other. In this investigation, we focused on behaviors that are fundamental components of those early interactions—visual attention to mother and nondistress vocalization for infants, and encouragement of attention to mother, social play, and speech to the baby by mother.

We compared well-matched non-clinical samples of adoptive and birth mothers, and we controlled for variables on which the two groups differed. Most research that has examined sequences in mother-infant interaction has used time-sampling coding techniques and has looked at co-occurrence in the sequence of infants' and mothers' behaviors without regard to the timing of those behaviors. Other studies have coded durations of interactions, without regard to how long it takes the partner to respond to a behavior and thus become involved in the interaction. Here, we coded the onset and offset times of infants' and mothers' behaviors separately to the nearest .1 s, which allowed us to examine the sequence of infants' and mothers' behaviors with regard to the timing of their interactions and permitted a more detailed look at mother-infant interaction. We used sequential analysis, a dynamic approach to the study of mother-infant interactions that more closely approximates causal interpretation than standard statistical techniques (Bakeman & Gnisci, 2005; Bakeman & Gottman, 1997). Additionally, we used a within-dyad design, which allowed us to determine which partner initiated the interaction (Fogel, 1982; Gottman & Ringland, 1981) and whether the initiator role varied across behaviors and family groups. Infants influence mother-infant interaction and mother-infant relationships more generally (Bell, 1979; Rheingold, 1969; Schaffer, 1977).

Based on the fact that our sample of adopted babies was healthy and had been placed in the adoptive home prior to 6 months of age, we expected that patterns of contingent responding would be similar in adoptive and birth dyads. We also expected that our results would conform to other reports using birth samples of healthy infants: (1) maternal encouragement of attention and infant visual attention to mother would be contingently associated regardless of whether mother or infant initiated the interaction; (2) maternal speech and infant visual attention would be contingently linked for both mother-infant and infant-mother exchanges; and (3) maternal speech and infant vocalization would be contingently associated regardless of who initiated the exchange.

Methods

Participants

Sixty-two mothers (31 who had adopted domestically and 31 who had given birth) and their first children (16 males in each group) made up the samples. All parents were European American, married, and cohabiting when data were collected. Adoptive mothers were recruited through adoption agencies and adoptive family support groups in a major U.S. East coast city. Mothers by birth were recruited using a mailing list of new mothers in the same geographic area. Mothers by birth and adoption were matched to the degree possible on

demographic characteristics, extent of maternal employment, aspects of the birth or adoption, and social support (see Table 1). Volunteers were accepted into the study on a continuing basis as long as they met initial demographic/matching criteria. The two groups were equivalent in terms of maternal age, level of maternal education, family SES, and years of employment prior to the baby's arrival. At the time of data collection, 20 adoptive mothers and 19 birth mothers worked outside of the home, $\chi^2(1, N = 62) = 0.07$, *ns*. Among employed mothers, there was no group difference in the number of hours worked, and the two groups reported equally high levels of satisfaction with their employment/homemaker role balance. Mothers by adoption and by birth also did not differ in the type or quality of childcare arrangements used while they worked.

Not unexpectedly, adoptive mothers reported more fertility problems, more pregnancy losses, and greater perceived difficulty in becoming parents than did mothers by birth, but, at the time of data collection, few worried that the adoption of their child would not be finalized (another significant source of stress for adoptive parents). The groups did not differ in their perceptions of the supportiveness of their husbands, extended family members, or their community. Prior to the baby's arrival, many more adoptive (65%) than birth (26%) parents attended parenting classes, $\chi^2(1, N = 62) = 938$, $p < .01$, likely because the adoption process required it.

Infants were observed at home at approximately 164 days of age (*SD* = 6.75). All birth infants went home from the hospital with their mothers. All infants in the adoptive group were adopted domestically, either privately or through licensed agencies. None of the adopted infants was biologically related to the parents with whom they were placed. Forty-seven percent of adoptive parents were present at the birth of the infant. On average, adopted infants arrived in the adoptive home at 7.17 days of age (*SD* = 10.32, *range* = 0–36 days). Thus, the two groups of babies had spent differing amounts of time with their mothers prior to data collection. Adopted infants had lived with mother between 122 and 191 days at the time of the visit. The two groups also differed in birth weight, with birth infants weighing 263 g more than adopted babies on average. Most infants (97%) were born at term (data for two participants were missing or the mother reported that she did not know), and all were healthy at the time of the study. Birth mothers rated their infants' overall level of adjustment during the first month at home as more difficult than did adoptive mothers, and they reported more specific behavioral difficulties (such as frequent crying) during that month. (It is possible that these group differences indicate more about the mothers than about the infants, as adoptive mothers may tend to idealize the adjustment period of a long-awaited, "precious" baby (Levy-Shiff, Goldshmidt, & Har-Even, 1991). On a dichotomous variable (presence/absence of serious illness since birth), mothers in the 2 groups reported their infants' physical status to be equivalent and healthy, $\chi^2(1, N = 60) = .95$, *ns*. Adoptive and birth mothers also did not differ in scheduling infants' naps and meals (both were provided on demand).

Procedure

Mother/infant dyads were observed at home for 1 hour by a female filmer, and a videorecord of naturally occurring mother-infant interaction was made. Each mother also completed a

questionnaire, providing information about herself, her infant, the baby's father, the adoption or birth, support networks for parenting, her employment, and associated childcare.

At the end of the home visit, mother and filmer independently rated maternal and infant behavior during the visit 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. Both groups of mothers rated their own behavior as typical, adoptive $M = 4.48$, $SD = 1.94$, and birth $M = 4.96$, $SD = 1.91$, $t(55) = 0.94$, *ns*. Adoptive and birth mothers also reported that the babies behaved in typical fashion, $M = 5.55$, $SD = 1.84$, and $M = 5.57$, $SD = 1.60$, $t(55) = 0.04$, *ns*, respectively. The filmer rated both groups of mothers as being relaxed during the observation, $M = 5.19$, $SD = 1.59$ for adoptive, and $M = 5.33$, $SD = 1.62$ for birth, $t(52) = 0.34$, *ns*.

Behavioral Coding

The first 50 min of each videorecord were coded using mutually exclusive behavior categories for mothers and for infants. Mother and infant behaviors were coded independently by coders trained to achieve and maintain acceptable levels of agreement, as indexed by kappa (κ) $\geq .60$ and percent agreement (%) $\geq 80\%$ (Cohen, 1960, 1988; Hartmann, Pelzel, & Abbott, 2011). Coders were blind to the birth/adoptive status of dyads.

Onsets and offsets of 3 maternal and 2 infant behaviors were recorded to the nearest .1 s to generate timed event-sequential data for use with sequential analysis software, (GSEQ; Bakeman & Quera, 2009) The 3 maternal behaviors were: *mother encourages attention to herself* (Encourage: mother physically and/or verbally attempts to draw the infant into face-to-face interaction with herself, $\kappa = .68$, % = 95), *social play* (Play: mother directs high intensity verbal or physical behavior to the infant for the purpose of amusing the infant, such as to elicit smiles, laughter, or motoric excitement, $\kappa = .71$, % = 98), and *speech to infant* (Speak: mother uses adult-directed speech with normal intonation patterns or child-directed speech marked by short sentences, repetition, and higher and more variable intonation (i.e., "motherese"), $\kappa = .71$, % = 89). The 2 infant behaviors were: *infant look at mother* (Attend: infant looks at mother's face, $\kappa = .74$, % = 96) and *nondistress vocalization* (Vocalize: infant vocalizes in a positive or neutral tone, $\kappa = .62$, % = 95). All 5 behaviors met and surpassed acceptable levels of interrater reliability.

Data Reduction

To investigate family differences in mother-infant interaction, scores for 6 pairs of sequential variables (3 maternal variables x 2 infant variables) were computed following procedures described in Bakeman, Deckner, and Quera (2005) and Yoder and Tapp (2004). The 12 variables are shown in Table 2. Short-hand labels make their discussion more comprehensible and indicate the behavior of the initiator (mother or infant) first, followed (after a hyphen) by the behavior of the respondent (infant or mother). Previous researchers (Gratier, 2003; Van Egeren et al., 2001) have determined that 2- or 3-s time periods capture contingencies for most mother and infant interactions in naturalistic settings (Table 2). Because vocal interactions involve turn-taking, we looked at whether the partner's behavior occurred following the partners' vocalization, rather than during the vocalization.

Separately for each dyad, time units were tallied in 2-by-2 tables for each behavioral sequence, and an odds ratio (OR) was computed for each table. The OR is a descriptive measure of effect size (Bakeman et al., 2005). ORs > 1 indicate that bouts of the target behavior were more likely to begin within the time windows we specified than at other times, whereas ORs = 0–1 indicate less likelihood. More concretely, an OR of 2.00 for *mother-initiated person-directed interaction* (Encourage-Look) means that the odds of the infant looking at the mother within 3 s of the onset of mother encouraging the infant to look at her are 2.00 times greater when the mother is encouraging the infant to look at her than when she is not. If fewer than 5 occurrences of a given behavior were observed, we regarded the value of the OR as missing for that dyad because there was not a sufficient sample of that behavior from that dyad to draw conclusions about behavioral contingency (Bakeman et al., 2005). There were no differences between the adoptive (11.5%) and birth (14.9%) groups in terms of the percentages of data that were considered insufficient. Values for ORs were computed using the Generalized Sequential Querier program (Bakeman & Quera, 2009).

Analytic Plan

Because the distribution of ORs is known to be positively skewed (i.e., ORs range from zero to positive infinity with a mean of 1; Wickens, 1993), OR data were transformed and/or outliers were excluded to normalize the distributions (as recommended by Fox, 1997; Tabachnick & Fidell, 2007). First, 1-sample *t*-tests were performed separately for each family group to determine whether pairs of behaviors were significantly contingent (i.e., whether the ORs differed significantly from 1); effect sizes for these analyses were Cohen's *d* (Table 3). Then, multivariate analyses of variance (MANOVAs) were performed to investigate family differences. The MANOVAs had 1 between-subjects factor (Family) and 1 within-dyad factor (Initiator) with 2 levels (mother, infant). We selected a within-dyad design for sequential analyses because this allowed us to determine which partner initiates the interaction (Fogel, 1982; Gottman & Ringland, 1981) and whether the pattern was universal or varied between family groups. Multivariate *Fs* are reported; all pairwise comparisons were *t*-tests with Bonferroni's correction ($p < .05$). Partial eta squared (η^2_p) was used as an effect size for the MANOVAs, where $\eta^2_p \approx .01$ is interpreted as a small effect, $\eta^2_p \approx .06$ as a medium effect, and $\eta^2_p \approx .14$ as a large effect (Cohen, 1988). Gender was screened as a factor in the MANOVAs; it was included only if the gender main effect or any interactions involving gender produced a significant effect (it was included in only one analysis – vocal interactions -- below). All sociodemographic variables listed in Table 1 were screened as covariates. To be used as covariates in the MANOVAs, the sociodemographic variables had to correlate significantly ($p < .05$) with the dependent variables (DVs), and covariates were only used if there were significant differences between family groups. Whenever covariates or gender were used, they are mentioned below.

Power Analysis

Very few differences in mother-infant interactions between adoptive and birth dyads were found. A post hoc power analysis was computed to determine whether sample sizes provided sufficient power to detect between-group effects in a MANOVA design with one between-subjects factor with two levels and two dependent variables. With $\alpha = .05$, and *N*s

ranging from 42 to 62, the power estimates ranged from .87 to .96 for an effect size of .40, and the power estimates ranged from .48 to .65 with an effect size of .25 (Faul, Erdfelder, Lang, & Buchner, 2007), indicating excellent power to detect large effects and low to moderate power to detect medium between-subject effects.

Results

Contingency of Mother and Infant Socioemotional Behaviors

Vocal-attention interactions (Speak-Attend, Attend-Speak) were significantly contingent for both groups whether mothers or infants initiated them, and infant-initiated vocal interactions (Vocalize-Speak) were also significantly contingent for both groups with moderate to large effect sizes (Cohen's $d \geq .62$). These results mean that mothers in both groups responded to their infants' looking at them and nondistress vocalizations by talking to their infants, and infants responded to their mothers' vocalizations by looking at their mothers. Two pairs of behaviors were contingent for one group but not the other: Attend-Encourage (contingent for adoptive only) and Vocalize-Encourage (contingent for birth only). The remaining pairs of behaviors were not contingent for either group: Encourage-Attend, Play-Attend, Attend-Play, Encourage-Vocalize, Play-Vocalize, Vocalize-Play, Speak-Vocalize.

Family-type, Gender, and Initiator Differences in the Contingency of Mother and Infant Socioemotional Behaviors

Person-directed interactions—The main effect of Initiate was significant with a medium effect size, F (1 , 48) = 4.46, $p < .05$, $\eta^2_p = .09$. Mothers were more likely to encourage their infants to look at them in response to their infant looking at them than vice versa (Attend-Encourage > Encourage-Attend).

Social play-attention—No significant family-type or initiator effects were found for the contingency of mother social play (Play) and infant look at mother (Attend).

Speak-attention—The main effect of Initiate was significant with a medium effect size, F (1, 52) = 7.05, $p = .01$, $\eta^2_p = .12$. Infants were more likely to respond to their mothers' talking to them by looking at their mothers than vice versa (Speak-Attend > Attend-Speak).

Encouragement of attention-nondistress vocalization—No significant family-type or initiator effects were found for the contingency of mothers' encouragement of their infants to look at them (Encourage) and infants' nondistress vocalizations (Vocalize).

Social play-nondistress vocalization—No significant family-type or initiator effects were found for the contingency of mother's social play (Play) and infants' nondistress vocalization (Vocalize).

Vocal interactions—The Initiate main effect was significant with a large effect size, F (1, 58) = 17.36, $p < .001$, $\eta^2_p = .23$. Mothers were more responsive to their infants' nondistress vocalizations than infants were to mothers' speech (Vocalize-Speak > Speak-Vocalize). There was also a significant Family-type x Gender interaction with a large effect size, F (1,

58) = 9.47, $p < .01$, $\eta^2_p = .14$. Pairwise comparisons indicated that, when the infant was a girl, vocal interactions were more contingent for birth dyads than for adoptive dyads; this difference held when the number of neonatal difficulties and social support from a spouse were controlled (separately). In addition, for adoptive dyads only, mother-infant vocal interactions were less contingent when the infant was a girl than when the infant was a boy. Putting the two effects together, it appears that, when mothers and babies are interacting vocally, adopted girls are responded to less contingently than are the other 3 groups of babies.

Discussion

The central purposes of this study were to examine patterns of mother-infant socioemotional contingency in adoptive families with a first infant placed early in the baby's first year of life and to compare them to patterns being established in dyads in which the baby had been born to the mother. We speculated that some genetic or social conditions surrounding the adoption of an infant could interfere with the expression of sensitive responsiveness in adoptive mothers. The results suggest, however, that adoptive and birth dyads were largely equivalent with respect to the presence (3 behavior sets) or absence (7 behavior sets) of contingency in their interactions. As expected, in the behavior sets for which contingency was found for both groups, the results are congruent with the larger literature: Adoptive and birth mothers responded contingently by speaking to their babies both when the infants looked at them and when they vocalized (Bornstein & Manian, 2011; Van Egeren et al., 2001). Similarly, both groups of infants looked at their mothers contingently when mothers spoke to them (Van Egeren et al., 2001). These results suggest that, when healthy infants are placed in adoptive homes early in the first year of life, behavioral contingencies fundamental to adaptive early mother-infant interaction are likely to be established. These findings also converge with a developing literature that suggests that adoption before 6 months of age tends not to be associated with (appears to buffer against) negative behavioral outcomes for the child (Palacios & Brodzinsky, 2010; Rutter, Beckett, Castle, Colvert, Kreppner, Mehta, et al., 2009). The present study advances this literature by focusing for the first time on an area of infant-mother interaction dynamics, viz., contingent responsiveness, known to be linked to favorable developmental outcomes in children. The establishment of very early patterns of sensitive responding in the adoptive dyad may be one of the mechanisms that helps to buffer against negative behavioral reactions and outcomes in adopted children (Bimmel, Juffer, van IJzendoorn, & Bakermans-Kranenburg, 2003; van London, Juffer, & van IJzendoorn, 2007). Focused investigation of the development and characteristics of contingent responding in adoptive dyads in which babies "come home" after 6 months of age is needed to extend and further explore the important issue of adoptive timing.

Five of 12 behavior pairings were contingent for one or both groups of dyads, with 4 of the 5 being contingencies involving maternal responsiveness to infant signals. In agreement with other studies, we found that mothers were more responsive than infants in person-directed (Bornstein et al., 2011; Cote et al., 2008) and vocal interactions (Van Egeren et al., 2001), meaning that infants influence these kinds of exchanges. Although mothers are the more mature partner in the dyad (Kochanska & Aksan, 2004), these findings highlight the fact that infants also influence mother-infant interactions and mother-infant relationships more

generally. Mothers and infants are primed to respond to specific types of behaviors in their partners (Bornstein, 2006). Early in an infant's life, behavioral sequences that bind mother and infant are critical for effective maternal monitoring of the infant and for infant survival. Our data demonstrate that, even without the benefit of a genetic tie, adopted babies can and do elicit contingent behavioral responses from mothers who are effectively monitoring them (Leon, 2002). Such sensitive responsiveness is considered to be essential for the development of healthy attachments between mother and child (Ainsworth et al, 1974; Bowlby, 1969).

That said, adoptive and birth mothers differed somewhat in the infant signals to which they responded, with adoptive mothers being more responsive to infant visual attention to them and mothers by birth being more responsive to infant vocal signals. Examination of our data revealed no differences between adoptive and birth dyads in the raw frequencies of any of the component behaviors; the two groups of babies looked at their mothers and vocalized nondistress equivalently, and both groups of mothers equally encouraged infants to attend to them. Rather, it is the ways in which maternal and infant behaviors were linked that differed. Why might this be so? One possibility is that the two groups of mothers monitor their infants differently. Hoopes (1982) reported that adoptive parents were more protective than parents by birth when their children were 6 months old, a finding interpreted by the author as suggesting greater parental anxiety in adoptive families. If adoptive mothers are more anxious, they may stay closer to their babies, monitor them especially closely, and be more likely to notice and respond to non-audible signals from the infant such as looks. Another possibility is that infant visual attention to mother is particularly compelling for adoptive mothers, eliciting efforts from them to sustain en-face interaction. In this sample, adoptive mothers reported that the time that elapsed between the decision to start a family and the arrival of the baby in the home was slightly over 4 years on average, substantially longer than the 21 months reported by parents by birth. Adoptive mothers also perceived the process of becoming a parent as being more difficult. These "precious" infants may elicit differential maternal proximity or types of attention from adoptive mothers. For example, Suwalsky et al. (2008) reported that adoptive mothers fed and patted their infants more than did birth mothers and speculated that close, nurturing interactions may be particularly satisfying for adoptive mothers.

Our analyses also revealed two unexpected family-type by gender effects. Within the adoptive sample, vocal interactions were more contingent between mothers and sons than between mothers and daughters, while contingencies for mother-son and mother-daughter dyads were the same in families by birth. Of possible relevance here are studies suggesting that, starting at birth, male infants have more difficulty maintaining affective regulation than do female infants (Brazelton, Kozlowski, & Main, 1974; Feldman, Brody, & Miller, 1980), and that mother-infant behavioral coordination is (by some measures) greater with sons than with daughters (Weinberg, Tronick, Cohn, & Olson, 1999), possibly because mothers are responding to their sons' need for increased regulatory support (Golombok & Fivush, 1994). It is possible that the transition to the adoptive home is more difficult for male than for female infants, eliciting more or closer maternal vocal "support" for boys by adoptive mothers, and resulting in greater vocal contingency for adoptive mother-son dyads than for mother-daughter dyads.

In a second family-type by gender effect, mother-daughter vocal exchanges were less contingent in adoptive dyads than in dyads by birth, whereas mother-son exchanges were equivalent in the two groups. To our knowledge, gender effects have not been reported in studies of early mother-infant interaction in adoptive families although reports of adjustment at older ages suggest that adopted girls tend to have fewer problems than adopted boys and to be closer in adjustment levels to nonadopted peers than are boys (Sharma, McGue, & Benson, 1996; Stams, Juffer, Rispens & Hoksbergen, 2000; Verhulst et al, 1990). Our data suggest a less optimal pattern of early vocal interactions in mothers with adopted girls than with boys and appear, at face value, to be at odds wtih that literature. The possible existence of early gender effects warrants replication and follow-up. If confirmed, they could point to an (undoubtedly complex) mechanism by which patterns of family interaction with sons vs daughters are set in motion differently in families by adoption and by birth.

We cannot generalize the results of this study beyond the limits inherent in our samples. In adoption research, interpretation of results can be constrained by two types of sample variability, both of which must be addressed. First, because building a family through adoption and by giving birth involve inherently very different processes, the characteristics of families in the two groups inevitably differ in some respects. Adoptive families also differ among themselves depending on the specific adoption experiences they have had. Heterogeneity within adoptive samples makes comparisons across studies difficult and also clouds the meaning of behavioral comparisons with families by birth. In the present study, we sought to address both types of sampling issues. Dyads by adoption and by birth were all selected to represent optimal conditions for establishing a healthy mother-infant relationship, and the two groups of dyads were more carefully matched than is usually the case (Table 1). Adoptive families were similar in terms of the type of adoption (all adopted domestically), nuclear family organization (wife, husband, firstborn), and the timing of the placement (all occurred immediately or very soon after the baby's birth). The results, however, cannot be generalized to other types of adoptions (e.g., those that occurred after 6 months of age, or single-parent or international adoptions).

In summary, adoption and birth are very different routes to parenthood, with characteristics that have the potential to differentially influence the establishment of infant-mother contingency in early dyadic exchanges, a critical aspect of dyadic functioning that is associated with positive developmental outcomes for children. On the whole, our data provide clear and reassuring evidence that, when adoption occurs early and under favorable conditions, adoptive dyads develop patterns of contingent responding very similar to those set up in (closely matched) dyads by birth. Differences in contingent responding between adoptive and birth dyads were limited to interactions that were initiated by the infant, with some evidence that the two groups of mothers differed in the types of infant signals to which they responded. Finally, the results also hint at infant gender as a possible factor operating differently in the two types of families when vocal contingencies are being established. These data deepen our understanding of one set of critical mechanisms operating in early mother-infant interactions in adoptive families. To the extent that we can identify processes that serve to protect the well-being of adopted children, it may be easier to effect changes in policies that currently allow infants to spend prolonged, potentially damaging periods in foster or institutional care prior to adoptive placement.

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Highlights

Contingencies of three maternal and two infant socioemotional behaviors that are universal components of mother-infant interaction were investigated at 5 months in 62 mothers (31 who had adopted domestically and 31 who had given birth) and their first children (16 males in each group).

Patterns of contingent responding were largely comparable in dyads by adoption and birth, although the two groups of mothers responded differentially to the two types of infant signals.

Mothers in both groups were more responsive than infants in social and vocal interactions, but infants were more responsive in maternal speech-infant attention interactions.

Family type x Gender statistical interactions suggested a possible differential role of infant gender in establishing mother-infant contingencies in families by adoption and birth.

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Table 1

Sociodemographic Characteristics of Adoptive and Birth Samples

	Adoptive (*n*=31)		Birth (*n*=31)		
	M	***SD***	***M***	***SD***	**Group comparisons**
Infant					
Age (days)	164.81	7.82	163.55	5.55	t (60) = .73, *ns*, d = .19
Days with mother since birth	157.77	11.24	163.55	5.55	t (60) = −2.57, p < .05, d = .66
Birth weight (g)	3355.81	455.10	3618.52	514.48	t (60) = −2.13, p < .05, d = .55
Newborn adjustment [b]	1.48	0.93	2.03	1.14	t (60) = −2.08, p < .05, d =.54
Number of neonatal difficulties [c]	0.68	0.70	1.62	0.94	t (58) = −4.42, p < .001, d = 1.16
Infant schedule [d]	5.57	0.90	5.35	1.20	t (59) = .78, *ns*, d = .20
Mother					
Sociodemographic variables					
Age (at birth)	36.60	4.71	34.55	3.73	t (60) = 1.90, *ns*, d = .49
Education (Hollingshead) [e]	6.45	0.72	6.52	0.68	t (60) = −.36, *ns*, d = .09
SES (Hollingshead)	59.56	5.79	60.29	5.16	t (60) = −.52, *ns*, d = .13
Years employed before infant's arrival	14.48	5.43	12.03	4.64	t (60) = 1.91, *ns*, d = .49
Hours of employment/wk at 5 mos [f]	28.40	12.49	35.16	8.93	t (37) = −1.94, *ns*, d = .64
Context variables					
Satisfaction with role balance [g]	4.10	0.94	4.00	1.02	t (57) = .38, *ns*, d = .10
Childcare: Quality [h]	1.98	1.18	1.79	0.89	t (57) = .71, *ns*, d = .19
Childcare: Type [i]	4.62	2.99	4.67	3.13	t (57) = −.06, *ns*, d = .15
Fertility problem [j]	0.93	0.26	0.24	0.44	t (45.49) = 7.34, p < .001, d = 2.18 [a]
Pregnancy losses [k]	1.20	1.47	0.34	0.81	t (45.54) = 2.77, p < .01, d = .82 [a]
Difficulty becoming a parent [l]	3.58	1.63	2.34	1.32	t (56.84) = 3.24, p < .01, d = .86 [a]
Social support: Spouse [m]	3.34	0.51	3.16	.99	t (44.57) = .89, *ns*, d = .27 [a]
Social support: Extended family [n]	1.51	0.79	1.55	0.81	t (60) = −.21, *ns*, d = .05
Social support: Community [o]	2.08	0.65	1.77	0.81	t (60) = 1.69, *ns*, d = .44

Note. Group comparisons were performed on transformed means as necessary; in only one case (social support from the community) were *t*-test results different with transformed and untransformed data; thus, all data in the table (*M, SDs*) and *t*-tests are presented using untransformed data. (Support from the community differed significantly for the two groups when transformed data were used, $t(60) = 2.43$, $p < .05$, $d = .63$; this difference was marginally significant when untransformed data were used.)

[a] Adjusted for unequal variance.

[b] Maternal report of baby's difficulty "settling in" during the first month at home using a 5-point scale (1=*Very easy*, 5=*Very difficult*).

[c] Mean of maternal report of presence (1)/absence (0) of adjustment difficulty in the first month in 10 areas (e.g., feeding, sleeping).

[d] Sum of 2 3-point scales; higher score indicates that scheduling was more dictated by infant demand (range=2–6).

[e] 7-point Hollingshead (1975) education scale (1=*Less than 7th grade*, 6=*College or university graduate*, 7=*Graduate professional training*).

[f] Includes only those mothers who were working at that time.

[g] Five-point scale of maternal satisfaction with balance of parent/employed worker roles (1=*Very dissatisfied*, 5=*Very satisfied*).

[h] Number of disruptions in childcare during the first 6 months.

[i] The sum of weighted scores for the different types of childcare used in the first 6 months; A higher score is less optimal. For ease of interpretation, data shown are based on standardized scores.

[j] Maternal report of presence (1)/absence (0) of fertility problems during the effort to start a family.

[k] Maternal report of number of pregnancies that did not result in a live birth.

[l] Maternal report of perceived difficulty becoming a parent on a 5-point scale (1=*Very easy and not frustrating*, 5=*Very difficult and frustrating*).

[m] Maternal report of spouse's helpfulness to her in her role as a parent (0=*Little or no help*, 4=*Very helpful*).

[n] Mean maternal report of helpfulness to her in her role as a parent by maternal grandmother, paternal grandmother, and other relatives (0=*Little or no help*, 4=*Very helpful*).

[o] Mean maternal report of helpfulness to her in her role as a parent by friends, organized groups, pediatrician, and others (0=*Little or no help*, 4=*Very helpful*).

Table 2

Sequential Measures of Mother-infant Interaction

Sequential Measure	Operational Definition
Person-directed Interactions	
Encourage-Attend	The likelihood that an infant responds by looking at mother within 3 s of the onset of mother encouraging infant to look at her
Attend-Encourage	The likelihood that a mother responds by encouraging her infant to look at her within 3 s of the onset of the infant looking at her
Social Play	
Play-Attend	The likelihood that an infant responds by looking at mother within 3 s of the onset of maternal social play
Attend-Play	The likelihood that mother responds by engaging in social play within 3 s of the onset of the infant looking at her
Vocal/Attention	
Speak-Attend	The likelihood that an infant responds by looking at mother within 3 s of the onset of the mother speaking to infant
Attend-Speak	The likelihood that a mother responds by talking to the infant within 3 s of the onset of the infant looking at her
Attention/Nondistress Vocalization	
Encourage-Vocalize	The likelihood that an infant responds by vocalizing nondistress within 3 s of the onset of mother encouraging the infant's attention to her
Vocalize-Encourage	The likelihood that a mother responds by encouraging the infant to look at her within 3 s of the onset of the infant vocalizing nondistress
Social Play/Nondistress Vocalization	
Play-Vocalize	The likelihood that an infant responds by vocalizing nondistress within 3 s of the onset of maternal social play
Vocalize-Play	The likelihood that a mother responds by engaging in social play within 3 s of the onset of the infant vocalizing nondistress
Vocal Interactions	
Speak-Vocalize	The likelihood that an infant responds by vocalizing nondistress within 2 s of the offset of mother speaking to the infant
Vocalize-Speak	The likelihood that a mother responds by speaking to the infant within 2 s of the offset of the infant vocalizing nondistress

Table 3

Contingency of Mother-Infant Interactions

Behaviors	Adoptive	Birth
Person-directed interactions		
Encourage-Attend	t (24) = 1.72, *ns*, d = .34	t (24) = 0.25, *ns*, d = .05
Attend-Encourage	t (24) = 3.59, p = .001, d = .72	t (24) = 1.25, *ns*, d = .25
Social play		
Play-Attend	t (21) = −1.38, *ns*, d = .29	t (19) = −1.70, *ns*, d = .38
Attend-Play	t (21) = −0.28, *ns*, d = .06	t (19) = −0.89, *ns*, d = .20
Vocal/attention interactions		
Speak-Attend	t (26) = 6.51, p < .001, d = 1.25	t (26) = 3.98, p < .001, d = .77
Attend-Speak	t (26) = 6.14, p < .001, d = 1.18	t (26) = 4.09, p < .001, d = .79
Attention/nondistress vocalization		
Encourage-Vocalize	t (28) = 0.68, *ns*, d = .13	t (28) = 0.83, *ns*, d = .15
Vocalize-Encourage	t (28) = −0.61, *ns*, d = .11	t (28) = 2.05, p = .05, d = .38
Social play/nondistress vocalization		
Play-Vocalize	t (25) = 0.35, *ns*, d = .07	t (22) = 1.07, *ns*, d = .22
Vocalize-Play	t (25) = −1.14, *ns*, d = .22	t (22) = 1.45, *ns*, d = .30
Vocal interactions		
Speak-Vocalize	t (30) = −0.35, *ns*, d = .06	t (30) = 1.37, *ns*, d = .25
Vocalize-Speak	t (30) = 3.46, p < .01, d = .62	t (30) = 4.49, p < .001, d = .81

Note. All values denote M (SD). One-sample t-tests compared the odds ratio in that cell to 1.00 (modified for transformations).