

The Similarity of Siblings' Attachments to Their Mother

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Do siblings develop similar attachment relationships with their mother? Attachment theory suggests that brothers and sisters growing up in the same family are likely to relate in similar ways to their parents, at least when parental attachment representations and interactive styles remain stable across time. In the current study, sibling attachment data from three research groups (from Pennsylvania State University, Leiden University, and the University of Western Ontario) have been pooled to assemble a sufficiently large sample of observations ($N = 138$ sibling pairs) for a detailed comparison of sibling attachment relationships. Spacing between the births, differences in maternal sensitivity, and gender of siblings were examined as possible sources of concordance or nonconcordance. Attachment security (including disorganized attachment) of each sibling was assessed with the Strange Situation procedure between 12 and 14 months after birth. Maternal sensitivity was observed with the same rating scale in a laboratory play session in one of the studies and in home observations in the others. Sibling relationships were found to be significantly concordant when classified as secure/nonsecure (62% concordance, $p < .01$, 1-tailed, intraclass correlation = .23) but not when further subcategorized. Maternal insensitivity to both siblings (shared environment) was associated with concordance of sibling nonsecurity. Siblings of the same gender were more likely to form concordant relationships with their mother (68%; $p < .01$, 1-tailed, intraclass correlation = .37) than those of opposite gender. Same-sex sibling concordance was comparable to the concordance found for monozygotic twins in earlier studies. Genetic factors may, therefore, play a relatively small role in the development of attachment.

INTRODUCTION

Do siblings develop the same attachment relationship with their mother? Common sense and the subjective parental experience suggest they would not. Parents are often astonished at the large differences in personality and behavioral styles between their own children. Behavioral genetic research has shown that these unexpected differences between biologically related siblings can be ascribed to unique aspects of the child-rearing context for each of the siblings within the same family (Plomin, 1994; Plomin & Daniels, 1987; Rowe, 1993). For example, the younger sibling is uniquely exposed to the interactions between the older sibling and the parents (Dunn, 1993).

Attachment theory, however, suggests that brothers and sisters growing up in the same family are likely to relate in similar ways to their parents, at least when parental attachment representations and parental interactive styles remain stable across time. In the basic model of the emergence of attachment relationships, a parent's representations of childhood attachment experiences shape their style of parenting behavior which, in its turn, promotes the development of a particular quality of attachment relationship (see Pederson, Gleason, Moran, & Bento, 1998, and van IJzendoorn, 1995, for preliminary support of this attachment model). Consistent with this model, a meta-analysis (van IJzendoorn, 1995) found a 75% concordance between

parental attachment representations and the quality of the infant attachment relationship. As Teti, Nakagawa, Das, and Wirth (in press) concluded, however, this substantial correspondence at the level of a parent and a single child leads to a joint probability of occurrence of the same attachment relationships for two siblings of only 56%.

From attachment theory, the same parental attachment representation would be expected to lead to similarly sensitive behavior—even if not necessarily identical behavior—toward the siblings, who, in their turn, will develop a similar attachment relationship with their parent. Central to the concept of sensitivity is the notion of interacting with a particular infant in a manner that fosters synchronous and harmonious interactions. In the case of one particular infant this may call for extensive face-to-face exchanges that are highly pleasurable, whereas for another sibling, such intense interaction may prove too arousing. The sensitive caregiver will behave differently, not identically, when interacting with two different children.

A number of studies have directly assessed the similarity of a mother's behavior in interaction with her children. Dunn, Plomin, and Nettles (1985) coded maternal behavior videotaped during feeding and free play with siblings, each at 12 months of age. They

observed significant patterns of similarity in the quality of interaction with the two siblings. In a subsequent study, Dunn, Plomin, and Daniels (1986) examined the consistency of maternal interaction with siblings at 24 months. In partial contrast to the earlier study, they found that although mothers were consistent in their affectionate and verbal responsiveness to both children, they differed in the amount of controlling behavior directed toward the two children. The authors also observed that maternal behavior with each child showed substantial variance from sample to sample. Although patterns of interaction displayed by mothers with each sibling were significantly related, the effect sizes were modest; that is, a mother's interactive behavior with different children diverged substantially.

Only a few studies of attachment relationships in siblings have been conducted in the past decades, and some did not focus on siblings' attachments to the parent (Stewart, 1983). The pertinent studies have tended to involve rather small samples. The problem is, of course, that the time lag between the birth of the first and the second sibling is variable and often long. In their pioneering research on sibling attachment relationships, Ward, Vaughn, and Robb (1988) studied 61 sibling pairs from disadvantaged families. At 12 months of age the attachment relationship of each of the siblings was assessed with the Strange Situation procedure (Ainsworth, Blehar, Waters, & Wall, 1978). They found that 61% of the infants displayed the same category of attachment as their sibling when the relationships were classified as secure/nonsecure. The authors argued that the relatively low stability of Strange Situation classifications that has been observed in such disadvantaged populations might explain this modest level of concordance. Life stress, social support, and child gender were not associated with concordance, however. Ward et al. (1988) suggested that similarity in maternal interactive behavior accounted for some of the variability in concordance of sibling relationships but their assessment of maternal behavior was made when the children were 24 months of age, a full year following the assessment of the attachment relationship.

The results of a more recent study by McCartney and Diggins (1993) were similar. They found levels of concordance of 54% of attachment security between siblings. Nonconcordance was partially explained by differences in the siblings' temperaments, in the mothers' perceptions of their children's similarities, and in the experiences of the mothers with each child. In a third study of siblings by Teti and Ablard (1988; Teti et al., *in press*) both siblings were assessed at the same point in time and thus at differ-

ent ages with different measures: the Strange Situation for the youngest sibling and the Attachment Q-Sort (Vaughn & Waters, 1990) for the older sibling. Thirty of 47 sibling pairs appeared to be concordant (64%). When both siblings were nonsecure, their interactions with their mother were less nurturing and more hostile. Concordance was not related to the age of the siblings, nor to the gender composition of the pairs. Nonconcordance might, however, be related to the oldest sibling's experience of the birth of a younger sibling. Touris, Kromelow, and Harding (1995) found that 12 of 20 children changed attachment classification after the birth of a sibling, whereas in a control group without the birth of a sibling only 4 of 20 children were classified differently after a comparable time lag.

Twin studies provide a unique opportunity to test the similarity of siblings' attachment relationships under the condition of similar age and childrearing context. In the case of monozygotic twins, common genetic factors may further contribute to a shared environment promoting the development of concordant sibling attachment relationships with their common mother (Main, 1996; van IJzendoorn, 1995). Few studies have been performed on the attachment relationships of twins and, like studies of siblings, these have tended to involve relatively small samples. Of these studies, Minde, Corter, Goldberg, and Jeffers (1990) found the highest level of concordance in their mixed mono- and dizygotic sample of 21 premature twins: 76%. The sample was included in the Ricciuti (1992) secondary twin analysis (see following remarks). Szajnberg, Skrinjaric, and Moore (1989) studied a small sample of eight mono- and dizygotic twins and found a concordance of 63%; three of the four monozygotic twin pairs (75%) showed similar attachment relationships in the Strange Situation procedure; two of the four dizygotic twin pairs showed similar attachments to their mother (50%).

Ricciuti (1992) combined three small-sample studies of twins (Goldberg, Perrotta, Minde, & Corter, 1986; see also Goldsmith & Campos, 1990; Minde et al., 1990; Vandell, Owen, Wilson, & Henderson, 1988) to test whether attachment classifications showed genetic influence. In 27 dizygotic twin pairs Ricciuti (1992) found 78% concordance of attachment security; concordance in the 29 monozygotic twin pairs was 66%. Ricciuti (1992) concluded that in this combined sample of 56 mono- and dizygotic twins between 12 and 22 months of age, attachment security as assessed through the Strange Situation did not show genetic influence.

Finkel, Wille, and Matheny (1998) studied the similarity of attachment in twin pairs at ages 18 and 24

months with an adapted separation–reunion procedure. They found 67% concordance of security in 34 monozygotic twins but only 38% concordance in 26 dizygotic twins. This significant difference indicated only “modest rearing environment effects” (Finkel et al., 1998, p. 7). Finkel et al. (1999) report on the complete Louisville Twin Study of attachment. In 108 dizygotic twin pairs they found 48% concordance of attachment security, whereas in 99 monozygotic twin pairs they found 66% concordance. They concluded that heritability of attachment is 25% and that the remaining variance may be attributable to nonshared environmental influences. However, in contrast to the studies reviewed by Ricciuti (1992) in which the Strange Situation procedure was applied, Finkel et al. (1998, 1999) used a separation–reunion procedure originally designed for assessing temperament; this adapted attachment measure was only moderately associated with the Strange Situation procedure ($\kappa = .52$ in 32 cases, see Finkel et al., 1999). In other observational studies of same-sex monozygotic and dizygotic twins, neither variance in attachment behaviors (Lytton, 1980) nor in emotional availability (Robinson & Little, 1994) could be accounted for by genetic factors. Lytton (1980) and Robinson and Little (1994), however, did not assess attachment security.

Although siblings and twins show some concordance of attachment relationships to their biological mother, the same is true for biologically unrelated infants who are raised for a large part of the day by professional caregivers. In a study of family-based kibbutzim, Sagi et al. (1995) found concordant infant attachments to the same “metapelet” in 17 (68%) of the 25 pairs. These same pairs plus another two pairs of infants were also observed with the second metapelet, with similar results: 19 pairs (70%) were found to have the same secure or nonsecure attachment to the other metapelet. The family-based kibbutz setting allows for metapelet to be engaged with the same, unrelated infants during 50 or more hours per week in a family-like context (Aviezer, van IJzendoorn, Sagi, & Schuengel, 1994), and in this setting the relatively high concordance rate, similar to or greater in magnitude than that observed in studies of related siblings or twins, was found twice with two different caregivers. Infants in the kibbutz are not genetically related to each other nor to the metapelet, thus any observed concordance must be attributed to common experiential rather than genetic factors. In this sense, the concordance rate in the kibbutz may be considered a baseline against which twin data should be evaluated, even though the kibbutz sample is rather small and the results need to be replicated in larger groups of unrelated children and caregivers.

Unfortunately, adoption studies of attachment in biologically unrelated siblings in the same childrearing environment are still lacking.

In the current study, we pooled sibling attachment data from three research groups (from Pennsylvania State University, Leiden University, and the University of Western Ontario) to assemble a sufficiently large sample of observations for a detailed comparison of sibling attachment relationships. We compared concordance of sibling attachments with available data on twin pairs and unrelated infant pairs to explore the heritability of attachment security. We tested the hypothesis that siblings will show similar attachment relationships to their common mother and we searched for explanations of diverging attachment security within the same family.

Our main hypothesis is that the attachment security of siblings within the same family is significantly associated and that the sibling concordance rate is similar to the (monozygotic) twin concordance rate found in earlier studies. The concordance rate is not expected to be perfect because the time lag between the birth of the first and second sibling introduces the likelihood of changes in attachment representations and, in turn, interactive sensitivity of the mother, and because of measurement errors. In addition, we also expected diverging attachment relationships in some sibling pairs because of changes in the child-rearing environment. We examined the possibility that variation in the time between the births of the two siblings could account for nonconcordance. Longer time lags between the birth of the first and second sibling may be associated with diverging attachment relationships because of an increase in the probability that parental attachment representations and parental interactive style have changed.

We also tested more directly whether changes in parental sensitivity are associated with nonconcordance of sibling attachments. Because parents may change their interactive style across a period of 1 to 4 years, increases or decreases in sensitivity may explain why the second sibling shows a different attachment security. Lastly, the gender of each sibling may be an important factor in explaining nonconcordance of attachment. Although little evidence is available showing that gender of child is a relevant variable in the development of attachment (Benenson, 1996), some studies of the concepts of parental attunement, emotional availability, and mutuality have revealed substantial gender differences in parent–child interactions (Cohn & Tronick, 1983; Robinson & Little, 1994; Robinson, Little, & Biringen, 1993).

In sum, we examined the hypothesis that sibling attachments are associated and we searched for explanations of diverging attachment security within

the same family. Our study is unique not only in the relatively large number of participants recruited in three different projects and the inclusion of sensitivity assessments but also in assessing disorganized attachment (Main & Solomon, 1990) in both siblings. Disorganized attachment is considered to be the most anxious type of attachment in infancy and a risk factor in the emergence of psychopathology (van IJzendoorn, Schuengel, & Bakermans-Kranenburg, 1999). In earlier sibling and twin studies this recent attachment category has not been taken into account.

METHOD

Participants

The Leiden study. Fifty-nine sibling pairs participated in this study. The original sample of 83 mothers with a firstborn infant was recruited through city-hall records for a medium-sized city and its neighboring villages in the western part of The Netherlands. The participants came from middle-class families; mean age of the mothers was 27 years ($SD = 2.6$). In 59 families a sibling was born within a period of 5 years—after which data collection was finished. Average spacing was 37 months ($SD = 7.9$). For detailed information about this sample, see Bakermans-Kranenburg and van IJzendoorn (1993).

The Penn State study. Thirty-three sibling pairs participated in this longitudinal study. Originally, 138 middle-class and working-class European American families with firstborn sons participated. They were recruited by means of letters and follow-up phone calls after identifying birth announcements in the local newspaper. The focus of the study was on externalizing problems, which boys are more likely to show. Mean age of the mothers was 29 years ($SD = 4.2$). In 33 families a second child was born during the period of primary (i.e., firstborn-oriented) data collection and seen in the Strange Situation. Average spacing between the birth of the first and the second sibling included in this report was 29 months ($SD = 10$). For detailed information about the original sample, see Belsky, Woodworth, and Crnic (1996).

The Ontario study. The 46 mothers and their two children were recruited from families who had participated in previous studies on maternal behavior and attachment with their older child (e.g., Pederson et al., 1998; Pederson & Moran, 1996). Families were recruited for the original studies in the hospitals shortly after the infant's birth. At the time of the participation of the second child, the mean age of the mothers was 31.3 years ($SD = 4.9$ years). The median educational level was a university or college degree. The older

child was observed at home at 13 months ($SD = 1.4$ months). The average age of the older child was 43.5 months ($SD = 11.4$ months) and the average age of the younger child was 14.3 months ($SD = 1.8$ months), an average spacing of 29 months ($SD = 11.5$). Both children were observed in the Strange Situation lab procedure within 2 weeks of the home visits.

Procedure

The Leiden study. Mother and firstborn infant visited the lab at around 12 months of age to be observed in the Ainsworth Strange Situation procedure (Ainsworth et al., 1978). After this session and a coffee break we provided mother and child with new play material. We asked the mother to play with her child for 10 min as if she were at home. Interactions were videotaped. The second child was observed with the mother in the same room and with the same procedure at around 13 months of age.

The Penn State study. Visits of mother and firstborn child to the university laboratory were scheduled when the children were 12 and 18 months. The Strange Situation procedure was used to assess attachment security at both times of measurement. In the current study, we used the first assessment. The secondborn sibling was observed in the Strange Situation procedure at around 12 months of age in the university laboratory. No other assessments with the younger siblings were carried out.

The Ontario study. The same basic procedures were used for both children. At 12 to 13 months of age, the mother and child were observed at home followed by the Strange Situation within 2 weeks. The purpose of the home visit, conducted by two observers, was to observe the mother–infant interaction to get information about maternal sensitivity (see Pederson & Moran, 1995, for a more detailed description of the rationale of the home observational procedures). After the 2-hr home visit, the two observers updated their detailed case notes of the visit. They then described the mother's behavior by using the Ainsworth, Bell, and Stayton (1971) ratings of sensitivity.

Measures

Strange Situation procedure. The well-known Strange Situation procedure was used to assess infant–mother attachment security. The procedure consists of three stressful components: the infant enters with the mother an unknown laboratory playroom; a stranger comes in and tries to play with the infant; the mother leaves the room twice for a brief period. In particular, infants' behavior at reunion with the mother is essential for cod-

ing the quality of the attachment relationship. Upon reunion, secure infants (B category) seek proximity but after being cuddled or otherwise reassured, they explore the environment again. Nonsecure-avoidant infants (A category) avoid the mother and seem to remain focused on the environment, whereas nonsecure-resistant infants (C category) display attachment behavior and seek proximity, but at the same time resist contact with the mother (Ainsworth et al., 1978). Disorganized attachment (D category) can be described as the (temporary) breakdown of an otherwise consistent and organized strategy of emotion regulation. Whether secure or nonsecure, every child may show disorganization. Contradictory behavior, misdirected or stereotypical behavior, stilling and freezing during a substantial amount of time, and direct apprehension or even fear of the parent are behavioral indices of disorganized attachment (Main & Solomon, 1990). Disorganized classifications can be "forced" into one of the three major underlying A, B, or C categories. In all three studies, Strange Situations were coded by experienced coders who reached at least $\kappa = .60$ intercoder reliability on the four-way classifications.

Parental sensitivity assessment. In Leiden and Ontario, the Ainsworth 9-point sensitivity scale (Ainsworth et al., 1971) was used for both siblings. Ainsworth et al. (1971, p. 127) defined the construct of parental sensitivity as "the mother's ability to perceive and to interpret accurately the signals and communications implicit in her infant's behavior, and given this understanding, to respond to them appropriately and promptly." In fact, the construct consists of four components: parental awareness of the baby's signals and communications; parental ability to interpret accurately these signals and communications; parental ability to respond appropriately to the infant's signals; and parental ability to respond promptly. The 9-point sensitivity rating scale was based on the degree to which the four components were present during the observations of parent–infant interactions.

The scale was applied to the free-play session during the lab visit in Leiden and to the home visit in Ontario. Intercoder reliabilities for the application of the sensitivity scale to both siblings ranged from $r(19) = .77$ to $r(14) = .98$, in Leiden and $r(58) = .91$ in Ontario. In Penn State, only maternal sensitivity to the older sibling was assessed; the analyses of sensitivity in the current study were therefore based on the Leiden and Ontario samples.

RESULTS

In the first section of the Results, we present the distribution of attachment classifications for each sam-

ple and compare these with a normative distribution. In the second section, the concordance of attachment relationships between siblings is described for the entire sample, and when divided by gender. These levels of concordance are then compared with those found in samples of unrelated infants and twins. Finally, we search for explanations of patterns of concordance and nonconcordance by examining their relation to three variables: maternal sensitivity, spacing between births of the siblings, and gender. We conducted analyses of maternal sensitivity by using only the Leiden and Ontario samples because this variable was not available in the Penn State sample.

Descriptive Statistics

In Table 1, the nonforced four-way and forced three-way Strange Situation classifications for the older as well as the younger sibling are presented. Comparing the four-way samples of older siblings with the distribution of attachment classifications in 15 combined normal U.S. samples ($N = 2,104$ infants: 311 nonsecure-avoidant; 1,299 secure; 182 nonsecure-resistant; and 312 disorganized infants; van IJzendoorn et al., 1999), the multinomial tests (Kroonenberg, 1997) showed a significant standardized residual

Table 1 Sibling–Mother Attachment Classification Distributions in the Three Samples

	Ontario <i>n</i> (%)	Penn State <i>n</i> (%)	Leiden <i>n</i> (%)	Total <i>n</i> (%)
Nonforced Attachment classification				
Older sibling				
Avoidant	10 (22)	3 (9)	4 (7)	17 (12)
Secure	25 (54)	19 (58)	28 (47)	72 (52)
Resistant	8 (17)	1 (3)	16 (27)	25 (18)
Disorganized	3 (7)	10 (30)	11 (19)	24 (17)
Younger sibling				
Avoidant	7 (15)	1 (3)	4 (7)	12 (9)
Secure	24 (52)	14 (42)	37 (63)	75 (54)
Resistant	10 (22)	8 (24)	4 (7)	22 (16)
Disorganized	5 (11)	10 (30)	14 (24)	29 (21)
Forced attachment classifications				
Older sibling				
Avoidant	11 (24)	8 (24)	8 (14)	27 (20)
Secure	26 (57)	20 (61)	30 (51)	76 (55)
Resistant	9 (20)	5 (15)	21 (36)	35 (25)
Younger siblings				
Avoidant	10 (22)	1 (3)	8 (14)	19 (14)
Secure	24 (52)	17 (51)	44 (75)	85 (62)
Resistant	12 (26)	15 (46)	7 (12)	34 (25)

(after Bonferonni correction) only in the cell of non-secure-resistant Leiden children ($z = 4.82, p < .05$), who were overrepresented. Comparing the younger siblings with the normative distribution, we found significant standardized residuals for the nonsecure-resistant Ontario, $z = 3.02, p < .05$, and the nonsecure-resistant Penn State children, $z = 3.05, p < .05$, who were both overrepresented. Because the three samples were recruited in different ways in different countries and showed some differences in attachment classification distributions, outcomes of analyses on the pooled data as well as within the separate samples are reported in the next sections.

Concordance between Siblings

In Table 2 a cross-tabulation of attachment classifications of the older and the younger siblings has been presented. The Haberman's adjusted standardized residuals (Bishop, Fienberg, & Holland, 1975) indicate cells significantly deviating from expectations on the basis of the marginal distributions. According to our expectations, concordant sibling pairs, in particular secure sibling pairs, were overrepresented, both in the three-way and four-way classification distributions. Nevertheless, the levels of concordance were modest both in the case of the four-way distribution (44%, *ns*), and in the case of the three-way distribution (49%, *ns*). The cross-tabulation of disorganized versus organized attachments in oldest and youngest sibling also failed to yield a significant association, 73%; $p = .09$, intraclass correlation = .14, because of

skewed distributions. In 8 of 138 sibling pairs both siblings showed disorganized attachments.

Only the cross-tabulation of the secure/nonsecure distributions yielded a significant concordance rate of 62%, $p = .006$, one-tailed, intraclass correlation = .23, with the nonsecure group including the disorganized classifications regardless of the secondary classification. In the separate samples, the concordance rates for the Ontario, Penn State, and Leiden groups were similar: 63%, 61%, and 61%, respectively. These separate concordances were not significant. The observed concordance rate between siblings (62%) was significantly larger, $z = 2.28, p < .05$, than that to be expected by chance between randomly chosen pairs of children (52% concordance). The random concordance rate was computed on the basis of the distribution of 62% secure and 38% nonsecure infants in a combined sample of 2,104 normal U.S. participants (van IJzendoorn et al., 1999), according to the formula suggested by Teti et al. (in press): $0.62^2 + 0.38^2 = 0.52$.

To provide an optimal comparison with attachment concordance between (same-sex) monozygotic twins, the concordance of siblings of the same gender was calculated. The concordance in same-sex sibling pairs, 68%, $n = 60, p = .004$, one-tailed, intraclass correlation = .37, was higher than in sibling pairs of different gender, 56%, $n = 78, p = .20$, intraclass correlation = .12. The difference between the two correlations just failed to reach significance, $z = 1.59, p < .06$, one-tailed. The significant association between attachment security in same-sex siblings was replicated in the Penn State and Ontario samples but not in the Leiden sample.

Table 2 Cross-Tabulation of Attachments of Older and Younger Sibling ($N = 138$)

	Attachment of Younger Sibling			
	Avoidant <i>n</i> (residuals)	Secure <i>n</i> (residuals)	Resistant <i>n</i> (residuals)	Disorganized <i>n</i> (residuals)
Attachment of older sibling				
Avoidant	2 (0.5)	8 (−0.6)	3 (0.2)	4 (0.3)
Secure	5 (−0.8)	47 (2.7)	10 (−0.7)	10 (−2.1)
Resistant	5 (2.2)	9 (−2.0)	4 (0.0)	7 (0.9)
Disorganized	0 (−1.7)	11 (−0.9)	5 (0.7)	8 (1.6)
Forced attachment classification				
Avoidant	5 (0.8)	13 (−1.6)	9 (1.2)	
Secure	6 (−2.2)	54 (2.5)	16 (−1.1)	
Resistant	8 (1.8)	18 (−1.4)	9 (0.2)	
Secure/Nonsecure ^a				
	Secure	Nonsecure		
Secure	47 (2.7)	25 (−2.7)		
Nonsecure	28 (−2.7)	38 (2.7)		

^a Secure versus nonsecure concordance rate = 62%, $p < .05$.

Table 3 Attachment Concordance in Unrelated Infants, Siblings, and Twins

Study	Sample	N of Pairs	Concordance (%)	Confidence Interval (95%)
Sagi et al. (1995)	Unrelated (kibbutz)	27	70	53–87
Van IJzendoorn et al. (2000)	Siblings (different gender)	78	56	45–67
Van IJzendoorn et al. (2000)	Siblings (same gender)	60	68	56–80
Ricciuti (1992)	Twins (dizygotic)	27	78	62–94
Ricciuti (1992)	Twins (monozygotic)	29	66	49–83
Finkel, Wille, & Matheny (1999)	Twins (dizygotic)	108	48	43–61
Finkel, Wille, & Matheny (1999)	Twins (monozygotic)	99	66	57–75
Total	Siblings	138	62	54–70
Total	Twins (monozygotic)	128	66	58–77
Total	Twins (dizygotic)	135	54	46–62

In Table 3 the pertinent studies on attachment concordance in unrelated kibbutz infants, dizygotic twins, and monozygotic twins are compared with the attachment concordances found in the siblings of the current study. Comparing the overall sibling concordance of 62% ($N = 138$) with the total dizygotic twin concordance of 54% ($N = 135$), we did not find a significant difference ($z = 1.34$, *ns*). Comparing the overall sibling concordance with the total monozygotic twin concordance of 66% ($N = 128$), we also did not find a significant difference ($z = 0.68$, *ns*). The concordance of attachment between unrelated kibbutz infants was not significantly different from the concordance in siblings, either. Different genetic relatedness between the children was not associated with different attachment concordance rates; our data fail to support the idea of a genetic basis for individual differences in attachment security.

Explaining Concordance and Nonconcordance Between Siblings

Multivariate approach. Three variables were examined in an effort to explain the patterns of concordance/nonconcordance observed in this study: the change in sensitivity of the mother toward the younger relative to the older sibling; the spacing or time between the births of the two siblings; and the gender correspondence of the siblings. A 2 (Birth Order: older, younger) $\times$ 2 (Gender: same, different) $\times$ 4 (Security: both nonsecure, older sibling nonsecure and younger sibling secure, older sibling secure and younger sibling nonsecure, both secure) repeated measures ANCOVA—in which birth order is the repeated measure, gender and security the between-group factors, spacing the covariate, and sensitivity the dependent measure—was conducted to explore the associations between sensitivity, gender correspondence, birth spacing,

and attachment concordance. The children were divided into four groups on the basis of attachment correspondence: both siblings nonsecure, the older sibling secure and the younger sibling nonsecure, the older sibling nonsecure and the younger sibling secure, and both siblings secure. Results remained the same with a division of attachment concordance in three groups: both siblings nonsecure, one sibling nonsecure and the other sibling secure, and both siblings secure. For two cases, precise spacing between siblings could not be computed; analyses with means inserted for the missing values showed the same outcome as the reported analyses without the missing cases for spacing. The results of the repeated measures analysis of variance remained the same without spacing as a covariate.

In Table 4, the means and standard deviations of

Table 4 Repeated Measure Analysis of Covariance with Sensitivity as Dependent Measure, Spacing as Covariate, Birth Order as Within-Subjects Factor, and Similarity of Sibling Gender and Sibling Attachment Security as Between-Subjects Factors

Factors	<i>n</i>	Maternal Sensitivity	
		Older Sibling <i>M</i> (<i>SD</i>)	Younger Sibling <i>M</i> (<i>SD</i>)
Different gender			
Both nonsecure	12	5.4 (1.9)	4.0 (2.2)
Older nonsecure/younger secure	13	7.1 (2.0)	6.0 (2.4)
Older secure/younger nonsecure	11	7.0 (1.6)	6.2 (2.0)
Both secure	23	6.3 (1.9)	5.8 (2.0)
Same gender			
Both nonsecure	14	4.5 (2.1)	4.5 (2.5)
Older nonsecure/younger secure	11	6.4 (2.1)	5.7 (2.1)
Older secure/younger nonsecure	5	6.0 (1.7)	4.2 (2.4)
Both secure	13	6.9 (1.8)	7.1 (1.4)

maternal sensitivity to older and to younger sibling are presented for each subset of participants. Box's test of equality of covariance matrices was nonsignificant, $p = .97$, and Levene's tests of equality of error variances were also nonsignificant, $p = .87$, and $p = .69$ for sensitivity to older and younger sibling, respectively. Birth order showed a significant effect, $F(1, 93) = 7.18$, $p = .009$, $\eta^2 = .07$, on maternal sensitivity. Estimated means based on spacing as covariate for sensitivity to the older sibling and to the younger sibling were 6.2 ($SE = .21$) and 5.4 ($SE = .23$), respectively. Mothers were less sensitive in their interactions with their younger child relative to their older child, consistent with the findings of Teti, Wolfe Sakin, Kucera, and Corns (1996).

The between-subjects factor concordance of attachment security also showed a significant effect, $F(3, 93) = 6.80$, $p < .001$, $\eta^2 = .18$. More specifically, in sibling pairs in which both children were nonsecure, maternal sensitivity was significantly lower than was the case in other pairings of sibling attachment security; and this was so with respect to sensitivity to the older child and to the younger child. Contrast analysis showed that nonsecure sibling pairs were significantly different from the other sibling pairs in terms of maternal sensitivity (nonsecure pairs versus nonsecure older sib and secure younger sib: $p = .001$; nonsecure pairs versus secure older sib and nonsecure younger sib: $p = .03$; nonsecure versus secure pairs: $p < .001$), but secure sibling pairs were not significantly different from secure/nonsecure pairs. Thus, mothers involved in nonsecure relationships with both siblings tended to interact in an *insensitive* manner with both, whereas mothers in a secure relationship with one child and in a nonsecure relationship with the other child were found to interact equally sensitively with both siblings as mothers in secure relationships with both children. Maternal insensitivity thus explained a considerable part of the concordance of attachment between siblings because of its association with a nonsecure relationship with both siblings. Note that the Gender $\times$ Attachment interaction was not significant $F(3, 93) = 2.04$, $p = .11$, which means that sensitivity did not explain the difference in same-sex versus different-sex attachment concordances.

Birth spacing tended to affect the change of maternal sensitivity toward the younger sibling relative to the older: $F(1, 93) = 3.17$, $p = .078$, $\eta^2 = .03$. Maternal sensitivity to the older sibling tended to be higher for the briefer intervals, whereas maternal sensitivity to the younger sibling was highest for the longer intervals. Mothers tended to be more sensitive toward the younger sibling where the interval between siblings

had been relatively longer. Controlling for sensitivity to the older sibling, we found a significant partial correlation of $r(99) = .20$ ($p = .04$) for the association between spacing and maternal sensitivity to the younger sibling. That is, longer birth spacing was associated with higher maternal sensitivity to the younger sibling if differences between maternal sensitivity to the older sibling were taken into account.

Bivariate explorations. The multivariate analysis showed a significant effect for the association between maternal insensitivity and attachment concordance. We further explored the bivariate associations of attachment concordance with spacing and maternal sensitivity.

Spacing. Spacing between the birth of the first and the second sibling was not associated with concordance of attachment security of the siblings. To ensure that even extreme spacing (or lack thereof) had no effect on nonconcordance, we compared the most widely spaced sibs (i.e., top 25%), the least spaced sibs (i.e., bottom 25%), and those intermediately spaced (i.e., middle 50%). Once again, no significant association between attachment classifications within these spacing groups emerged (total sample: 62%; most spacing group: 63%; least spacing group: 61%; intermediate group: 60% concordance). In the three samples separately, no significant associations between spacing and concordance were found. Spacing was not related to concordance of disorganization in sibling pairs.

Sensitivity. With regard to the effect of differences in maternal sensitivity across siblings on attachment concordance or nonconcordance, note that individual differences in sensitivity were rather stable across the two siblings: Pearson $r(102) = .49$, $p < .001$. For the Leiden sample, the stability was $r(56) = .32$ ($p = .007$); for the Ontario sample the stability was $r(44) = .61$ ($p < .0001$). This finding replicates the similarity of interaction patterns between parent and siblings in the Dunn et al. (1985, 1986) studies. We did not find a significant association between the absolute difference scores for sensitivity across siblings and their attachment concordance. However, when we reconfigured the continuous difference measure so that 25% of the sample in which mother sensitivity increased the most across the oldest and youngest child (mean change: $M = 2.09$; $SD = .83$) was compared with the 25% in which it decreased the most (mean change: $M = 3.76$; $SD = .95$) and the 50% that showed the least change (mean change: $M = .73$; $SD = .62$), interesting results emerged (see Table 5).

More specifically, in the group in which maternal sensitivity increased across children, sibling attachment concordance was sizeable and significant (con-

Table 5 Change of Maternal Sensitivity and the Concordance of Sibling Attachments

Maternal Sensitivity	Attachment of Oldest Sibling	Attachment of Youngest Sibling		Total
		Insecure (res.)	Secure (res.)	
Increasing sensitivity	Insecure	6 (2.1)	6 (-2.1)	12
	Secure	2 (-2.1)	13 (2.1)	15
Stable sensitivity	Insecure	15 (1.9)	10 (-1.9)	25
	Secure	10 (-1.9)	19 (1.9)	29
Decreasing sensitivity	Insecure	6 (-0.1)	8 (0.1)	14
	Secure	4 (0.1)	4 (-0.1)	9

cordance was 70%, $p = .05$), most probably because in only a few instances did secure older siblings have nonsecure younger sibs. In the group in which maternal sensitivity remained rather similar across siblings, the association between attachment of the siblings approached significance (concordance was 63%, $p = .054$). Finally, in the group in which maternal sensitivity decreased from older to younger sibling, attachment security was not concordant. Disorganized attachment was not significantly associated with change in maternal sensitivity.

DISCUSSION AND CONCLUSIONS

The current study is unique in pooling the results of studies performed by research groups in three different countries (from the University of Western Ontario, Penn State, and Leiden), in its search for factors explaining attachment concordance or nonconcordance between siblings, and in including the disorganized attachment category. Each sibling was observed in the Strange Situation procedure between 12 and 14 months after birth. The three separate studies replicated the general finding that the attachment security of siblings is modestly concordant (62%) but that the quality of the attachment relationship diverges for many siblings, in particular when the siblings belong to a different gender. Modest attachment concordance was also found in earlier studies on siblings (Teti & Ablard, 1989; Teti et al., in press; Ward et al., 1988). In the current study we were able to examine possible factors associated with concordance or nonconcordance of sibling attachments. The most important factor is stable maternal insensitivity to both siblings, which is associated with increased concordance of attachment nonsecurity. Note that similar insensitivity to both siblings may be interpreted as part of a shared child-rearing environment.

Although sibling pairs are raised in the same family and with the same mother, two factors may contribute to the development of divergent attachment relationships. First, the birth of a sibling may constitute a life event that changes the parents' sensitivity to the second born child compared with the firstborn child. The impact of the sibling's birth on relational patterns in the family may be substantial and they may be related to the spacing between the births of the siblings (Teti et al., 1996; Touris et al., 1995). Second, maternal attachment representations may not be completely stable across the years between the birth of the first and the second sibling, and such changes may give rise to associated changes in maternal interactive behavior. Although several studies found substantial stability of AAI classifications (Bakermans-Kranenburg & van IJzendoorn, 1993; Benoit & Parker, 1994; Sagi, van IJzendoorn, Scharf, & Koren-Karie, 1994), some instability should be taken into account. This instability may affect the attachment relationship of the same mother with different siblings.

In our study, maternal insensitivity to both siblings is associated with concordance of sibling attachment nonsecurity. That is, consistent maternal insensitivity to the older as well as to the younger sibling is strongly associated with concordance of sibling attachment insecurity. Maternal sensitivity explains about 18% of our concordance measure. Furthermore, changes in maternal sensitivity are related to the nonconcordance between sibling attachments, in particular when change implies a decrease in maternal sensitivity. Stable or increasing maternal sensitivity from the first to the second sibling is associated with substantial concordance (65%), whereas decreasing sensitivity does not lead to a significant concordance rate. Note that in general maternal sensitivity decreases from the older sibling to the younger sibling, perhaps because mothers are confronted with the competing demands of responding sensitively to two children at the same time (Teti et al., 1996). Smaller birth spacing between the siblings is associated with lower maternal sensitivity to the younger sibling, but spacing does not affect the concordance between their relationships with the mother.

Our analyses of the pooled samples revealed that the concordance of attachment relationships of siblings of the same gender is considerable: In 68% of the pairs, attachment security of the siblings is the same. This pattern contrasted with the relationships of opposite-sex siblings to their common mother for whom no significant concordance was observed. Correcting the effect size for attenuation due to errors of measurement (a conservative estimate of the reliability: .90 for each of the attachment security assessments),

we find a correlation of $r(58) = .42$ between attachment security of the oldest sibling and the youngest sibling with the same gender. In previous studies the relatively small number of participating siblings may have obscured this contrast between the similarity of the maternal attachment relationships of same- and opposite-sex siblings (Teti & Ablard, 1989; Ward et al., 1988), and even in the present study the difference just failed to reach significance.

The concordance of 68% in same-sex siblings is comparable to the concordance observed in biologically unrelated kibbutz infants (Sagi et al., 1995). In this comparison, the genetic link between siblings does not increase the likelihood that they will form similar relationships with their mother. Taking this logic one step further, the 68% concordance in same-sex siblings can be viewed as a baseline against which the concordances in same-sex dizygotic and monozygotic twins should be evaluated. For monozygotic twins, a substantially higher concordance would be expected if genetics play a significant role in the development of attachment security, but in their recent study of monozygotic twins, Finkel et al. (1999) found a concordance of just 66%, essentially the same as that found in the current study. If we compute the maximum concordance between monozygotic twins, taking into account the reliability of attachment assessments, this concordance is about 80%. Comparing this maximum concordance rate in a hypothetical sample of 138 monozygotic twins with the one we observed in the current study between same-gender siblings (68%), we find a significant difference, $z = 2.27$, $N = 276$. The effect size, however, is quite small: $r(275) = .14$, $r^2 = .02$. If the concordance rate in the monozygotic twins had been 78%, the level of concordance would not have been different from that observed for the siblings in this study. These comparisons do not support the suggestion that genetic factors play an important role in the development of attachment security. They indicate instead a predominant influence of the rearing environment. This conclusion is consistent with Ricciuti's (1992) secondary analysis of twin studies that suggested that security *per se* is not genetically influenced to any large extent by genetic factors.

In their analysis of the attachment relationships of dizygotic twins, Finkel et al. (1999) found a strikingly low level of correspondence: 48%. When compared with the concordance of monozygotic twins, this low level of correspondence resulted in a significant difference between mono- and dizygotic pairs and led them to conclude that a genetic component was substantially implicated in the development of attachment security. The weak correspondence found by Finkel et al. (1999) for dizygotic twins is surprisingly

low, even compared with the concordance to be expected by chance between random pairs of children (52%). In contrast to the original Strange Situation procedure used in the Ricciuti (1992) twin studies, Finkel et al. (1999) applied an adapted separation-reunion procedure to assess attachment security, and this procedure may have contributed to the diverging outcomes. Finkel et al. (1998) report only 78% agreement, $\kappa = .52$, between their adapted separation-reunion sequence, which originally was designed for assessment of temperament, and the classic Strange Situation procedure, and they were not able to include disorganized attachment in their study. The results of the current investigation support and extend the Ricciuti (1992) findings and reopen the debate about the genetic basis of individual differences in attachment security.

We found here that similarity of gender tends to contribute to the correspondence of attachment security between the siblings within the same family. This is surprising if one considers the absence of gender differences in attachment research (Benenson, 1996). Generally, Strange Situation attachment classifications as well as maternal sensitivity ratings do not reveal gender differences. Consistent with this pattern, in our study, gender of child was not associated with maternal sensitivity or attachment classification *per se*. Despite the failure to find a relation between gender and the quality of the attachment relationship, maternal interactive behavior has been shown to be differentially related to the gender of infants (e.g., Leaper, Anderson, & Sanders, 1998). Robinson et al. (1993) found that mothers responded differentially to their sons and daughters when the interactions are observed in detail. They found some evidence for Chodorow's (1978) theory that boys are responded to more promptly and therefore gain a sense of efficacy and autonomy, whereas girls are stimulated to share affective states with the mother and to become interpersonally sensitive. Using a wider concept of maternal interactive behavior, Cohn and Tronick (1983) found related differences in interactions of mothers with their young infants. The influence of gender on the similarity of attachment security in siblings should lead to a search for gender-dependent maternal interactive behaviors that may shape their attachment relationships beyond the impact of traditional sensitive responsiveness (DeWolff & van IJzendoorn, 1997).

Note, however, that even in the absence of a tendency to respond differentially in a consistent, gender-dependent fashion to infants, a simple tendency for mothers to interact with the second child in a manner different from the first would account for the results

of the current study. That is, the relationships of same-sex siblings would tend to be more concordant than that of opposite-sex siblings if mothers were more likely to change their interactive styles when a second child's gender is different from the first child than if it is of the same gender. Whether searching for evidence of gender-dependent patterns or a simple tendency to interact differently with a second, opposite-sex child, the traditional Ainsworth-type of sensitivity assessments used in our study provided a significant but incomplete explanation of concordances and discordances of attachment security in same- and different-sex siblings.

This result may seem at odds with the basic tenet of attachment theory that portrays maternal sensitivity as the major determinant of individual variation in attachment security. Note, however, that the result is consistent with the pattern of research revealed by DeWolff and van IJzendoorn's (1997) meta-analysis—a highly significant but only modest relation between sensitivity and the security of the attachment relationship. These results suggest that maternal sensitivity as currently conceptualized and described may not provide a complete account of variations in attachment relationships nor, as we have seen here, of the concordance and nonconcordance in attachment across siblings. In this regard, drawing on evolutionary logic, Belsky (1997b) has suggested recently that presuming, as have most students of attachment (including Belsky), that all children are equally susceptible to the security-inducing effects of maternal sensitivity may be a mistake. Indeed, as he has elsewhere noted (Belsky, 1997a), it may make biological sense (from the standpoint of fostering parental reproductive fitness) for children within a family to vary in terms of their susceptibility to rearing influence.

The preceding evolutionary account need not be supported by a developmental mechanism that in any simple fashion would be viewed as genetically predetermined. In fact, the developmental mechanism could be based heavily on experiential, interactive factors and remain consistent with the broad logic of Belsky's (1997a) evolutionary account. Such an account begins with consideration of the possibility that the descriptions of interactive behavior and maternal sensitivity used in this and other studies may have failed to capture some important aspects of the meaningful variation in the experience of the siblings (see also Pederson and Moran, 1996). Although within the same family, a new child enters a distinctly different social environment than did his or her older sibling. For example, the mother has had attachment-relevant experiences with the older child that are likely to have altered her patterns of interaction and subtle aspects of her mental attachment representation from those

present in her early interaction with the older child; this may particularly be the case when the new infant is of a different gender. Furthermore, the new infant also enters an environment in which the older child is an important element, an obvious difference from the early environment of the older sibling (Dunn, 1993). Lastly, the role of the father (van IJzendoorn & DeWolff, 1997) and the marital relationship (Davies & Cummings, 1994) may change with the birth of a second child (Kreppner, Paulsen, & Schuetze, 1982).

All of these factors will tend to create distinct patterns of interaction and a unique environment for each sibling and, as a result, distinct attachment relationships (Dunn, 1993). Traditional attachment theory may have overestimated the ability or tendency of the sensitive mother to accommodate to the distinct circumstances. Instead, and in a manner consistent with Belsky's (1997a) evolutionary logic, the contrasting developmental environments of siblings may act to promote the development of distinct attachment relationships with the same mother. Perhaps the elucidation of such mechanisms will require the development of new descriptions of the naturalistic rearing environment from a family-system perspective (Cummings & Davies, 1996) and perhaps a reconceptualization of maternal sensitivity.

In conclusion, this investigation helps to illuminate the conditions under which siblings' attachments are concordant (being of the same gender; stable maternal insensitivity). Variations in maternal sensitivity to both siblings, however, were not found to be consistently associated with concordance/nonconcordance of attachment. The search for gender-specific parental interactive behaviors other than sensitivity should therefore be continued (Robinson et al., 1993; van IJzendoorn & DeWolff, 1997). The similarity of our concordance between same-sex siblings and Finkel et al.'s (1998, 1999) concordance between monozygotic twins indicates a relatively small role for a genetic component in attachment security and a rather large role for shared (maternal insensitivity) and unique (different family constellation) aspects of the rearing environment.

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REFERENCES

- Ainsworth, M. D. S., Bell, S. M., & Stayton, D. J. (1991). Infant-mother attachment and social development: "Socialisation" as a product of reciprocal responsiveness to signals. In M. Woodhead, R. Carr, & P. Light (Eds.), *Becoming a person. Child development in social context*, Vol. 1 (pp. 30-55). London: Routledge.
- Ainsworth, M. D. S., Blehar, M. C., Waters, E., & Wall, S. (1978). *Patterns of attachment: A psychological study of the Strange Situation*. Hillsdale, NJ: Erlbaum.
- Aviezer, O., van IJzendoorn, M. H., Sagi, A., & Schuengel, C. (1994). "Children of the dream" revisited: 70 years of collective early child care in Israeli kibbutzim. *Psychological Bulletin*, 116, 99-116.
- Bakermans-Kranenburg, M. J., & van IJzendoorn, M. H. (1993). A psychometric study of the Adult Attachment Interview: Reliability and discriminant validity. *Developmental Psychology*, 29, 870-879.
- Belsky, J. (1997a). Attachment, mating, and parenting. An evolutionary interpretation. *Human Nature*, 8, 361-381.
- Belsky, J. (1997b). Theory testing, effect-size evaluation and differential susceptibility to rearing influences: The case of mothering and attachment. *Child Development*, 64, 598-600.
- Belsky, J., Woodworth, S., & Crnic, K. (1996). Trouble in the second year: Three questions about family interaction. *Child Development*, 67(2), 556-578.
- Benenson, J. F. (1996). Gender differences in the development of relationships. In G. G. Noam & K. W. Fischer (Eds.), *Development and vulnerability in close relationships* (pp. 263-286). Mahwah, NJ: Erlbaum.
- Benoit, D., & Parker, K. C. H. (1994). Stability and transmission of attachment across three generations. *Child Development*, 65(5), 1444-1456.
- Bishop, Y. Y., Fienberg, S. E., & Holland, P. W. (1975). *Discrete multivariate analysis. Theory and practice*. Cambridge, MA: MIT Press.
- Chodorow, N. (1978). *The reproduction of mothering*. Berkeley, CA: University of California Press.
- Cohn, J. F., & Tronick, E. Z. (1983). Three-month-old infants' reaction to simulated maternal depression. *Child Development*, 54, 185-193.
- Cummings, E. M., & Davies, P. T. (1996). Emotional security as a regulatory process in normal development and the development of psychopathology. *Development and Psychopathology*, 8, 123-139.
- Davies, P. T., & Cummings, E. M. (1994). Marital conflict and child adjustment: An emotional security hypothesis. *Psychological Bulletin*, 116, 387-411.
- DeWolff, M. S., & van IJzendoorn, M. H. (1997). Sensitivity and attachment. A meta-analysis on parental antecedents of infant-attachment. *Child Development*, 68, 571-591.
- Dunn, J. (1993). *Young children's close relationships: Beyond attachment*. Newbury Park, CA: Sage.
- Dunn, J. F., Plomin, R., & Daniels, D. (1986). Consistency and change in mothers' behavior towards young siblings. *Child Development*, 57, 348-356.
- Dunn, J. F., Plomin, R., & Nettles, M. (1985). Consistency of mothers' behavior toward infant siblings. *Developmental Psychology*, 21, 1188-1195.
- Finkel, D., Wille, D. E., & Matheny, A. P. (1998). Preliminary results from a twin study of infant-caregiver attachment. *Behavior Genetics*, 28(1), 1-8.
- Finkel, D., Wille, D. E., & Matheny, A. P. (1999, April). *Behavior genetic analysis of the relationship between attachment and temperament*. Paper presented at the Biennial Meeting of the Society for Research in Child Development, Albuquerque, NM.
- Goldberg, S., Perrotta, M., Minde, K., & Corter, C. (1986). Maternal behavior and attachment in low-birth-weight twins and singletons. *Child Development*, 57(1), 34-46.
- Goldsmith, H. H., & Campos, J. J. (1990). The structure of temperamental fear and pleasure in infants: A psychometric perspective. *Child Development*, 61, 1944-1964.
- Kreppner, K., Paulsen, S., & Schuetze, Y. (1982). Infant and family development: From triads to tetrads. *Human Development*, 25, 373-391.
- Kroonenberg, P. M. (1997). *Multinom. Version 2*. Leiden, The Netherlands: Department of Education.
- Lalumiere, M. L., Quinsey, V. L., & Craig, W. M. (1996). Why children from the same family are so different from one another. A Darwinian note. *Human Nature*, 7, 281-290.
- Leaper, C., Anderson, K. J., & Sanders, P. (1998). Moderators of gender effects on parents' talk to their children: A meta-analysis. *Developmental Psychology*, 34(1), 3-27.
- Lytton, H. (1980). *Parent-child interaction. The socialization process observed in twin and singleton families*. New York: Plenum.
- Main, M. (1996). Introduction to the special section on attachment and psychopathology. Overview of the field of attachment. *Journal of Consulting and Clinical Psychology*, 64, 237-243.
- Main, M., & Solomon, J. (1990). Procedures for identifying infants as disorganized/disoriented during the Ainsworth Strange Situation. In M. T. Greenberg, D. Cicchetti, & E. M. Cummings (Eds.), *Attachment in the preschool years: Theory, research, and intervention* (pp. 121-160). Chicago and London: University of Chicago Press.
- McCartney, K., & Diggins, A. (1993). *Child, mother, and relationship effects in mother-child attachment*. Paper presented at the meeting of the Society for Research in Child Development, New Orleans, LA.
- Minde, K., Corter, C., Goldberg, S., & Jeffers, D. (1990). Maternal preference between premature twins up to age four. *Journal of American Academic Child and Adolescent Psychiatry*, 29(3), 367-374.
- Pederson, D. R., Gleason, K. E., Moran, G., & Bento, S. (1998). Maternal attachment representations, maternal sensitivity, and the infant-mother attachment relationship. *Developmental Psychology*, 34, 925-933.
- Pederson, D. R., & Moran, G. (1996). Expressions of the at-

- attachment relationship outside of the Strange Situation. *Child Development*, 67, 915–967.
- Plomin, R. (1994). The Emanuel Miller Memorial Lecture 1993: Genetic research and identification of environmental influences. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 35(5), 817–834.
- Plomin, R., & Daniels, D. (1987). Why are children in the same family so different from one another? *Behavioral and Brain Sciences*, 10(1), 1–16.
- Ricciuti, A. E. (1992). Child–mother attachment: A twin study. *Dissertation Abstracts International*, 54, 3364–3364. (University Microfilms No. 9324873)
- Robinson, J., & Little, C. (1994). Emotional availability in mother–twin dyads: Effects on the organization of relationships. *Psychiatry. Interpersonal and Biological Processes*, 57, 222–231.
- Robinson, J. A., Little, C., & Biringen, Z. (1993). Emotional communication in mother–toddler relationships: Evidence for early gender differentiation. *Merrill Palmer Quarterly*, 39, 496–517.
- Rowe, D. C. (1993). *The limits of family influence. Genes, experience, and behavior*. New York: Guilford.
- Sagi, A., van IJzendoorn, M. H., Aviezer, O., Donnell, F., Koren-Karie, N., Joels, T., & Harel, Y. (1995). Attachments in a multiple caregiver and multiple infant environment: The case of the Israeli kibbutzim. In E. Waters, B. E. Vaughn, G. Posada, & K. Kondo-Ikemura (Eds.), *Constructs, cultures and caregiving: New growing points of attachment theory. Monographs of the Society for Research in Child Development*, 60 (Nos. 2–3, Serial No. 244, pp. 71–91).
- Sagi, A., van IJzendoorn, M. H., Scharf, M., & Koren-Karie, N. (1994). Stability and discriminant validity of the Adult Attachment Interview: A psychometric study in young Israeli adults. *Developmental Psychology*, 30, 771–777.
- Stewart, R. B. (1983). Sibling attachment relationships: Child–infant interaction in the Strange Situation. *Developmental Psychology*, 19, 192–199.
- Szajnberg, N. M., Skrinjaric, J., & Moore, A. (1989). Affect attunement, attachment, temperament, and zygosity: A twin study. *Journal of the American Academy of Child and Adolescent Psychiatry*, 28, 249–253.
- Teti, D. M., & Ablard, K. E. (1989). Security of attachment and infant–sibling relationships: A laboratory study. *Child Development*, 60, 1519–1528.
- Teti, D. M., Nakagawa, M., Das, R., & Wirth, O. (in press). Concordance and non-concordance of child–mother attachment among infant–sibling pairs: An examination of mother–child interaction. In E. Waters, B. E. Vaughn, G. Posada, & D. M. Teti (Eds.), *Patterns of secure base behavior: Q-sort perspectives on attachment and caregiving in infancy and childhood*. Mahwah, NJ: Erlbaum.
- Teti, D. M., Wolfe Sakin, J., Kucera, E., & Das Eiden, R. (1996). And baby makes four: Predictors of attachment security among preschool-age firstborns during the transition to siblinghood. *Child Development*, 67, 579–596.
- Touris, M., Kromelow, S., & Harding, C. (1995). Mother–firstborn attachment and the birth of a sibling. *American Journal of Orthopsychiatry*, 65, 293–297.
- van IJzendoorn, M. H. (1995). Adult attachment representations, parental responsiveness, and infant attachment: A meta-analysis on the predictive validity of the Adult Attachment Interview. *Psychological Bulletin*, 117, 387–403.
- van IJzendoorn, M. H., & DeWolff, M. S. (1997). In search of the absent father. Meta-analyses on infant–father attachment. A rejoinder to our discussants. *Child Development*, 68, 604–609.
- van IJzendoorn, M. H., Schuengel, C., & Bakermans-Kranenburg, M. J. (1999). Disorganized attachment in early childhood: Meta-analysis of precursors, concomitants, and sequelae. *Development and Psychopathology*, 11, 225–249.
- Vandell, D. L., Owen, M. T., Wilson, K. S., & Henderson, V. K. (1988). Social development in infant twins: Peer and mother–child relationships. *Child Development*, 59, 168–177.
- Vaughn, B. E., & Waters, E. (1990). Attachment behavior at home and in the laboratory: Q-sort observations and Strange Situation classifications of one-year-olds. *Child Development*, 61, 1965–1973.
- Ward, M. J., Vaughn, B. E., & Robb, M. D. (1988). Social-emotional adaptation and infant–mother attachment in siblings: Role of the mother in cross-sibling consistency. *Child Development*, 59, 643–651.