

Chinese Twin Children Reared Apart and Reunited: First Prospective Study of Co-Twin Reunions

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China's one-child policy led to the abandonment of tens of thousands of infants. Included among these children were twins who were adopted and reared separately. Since 2006, 10 reunited twin sets participated in the first prospective study of twins reared apart. This exploratory study reports a qualitative analysis of the children's reactions to their first meeting with, and departure from, their co-twin. The majority of twins 18 months of age and older displayed strong attraction upon first meeting. Leave-taking included sadness, but responses varied across pairs. Theoretical interpretations of the findings and implications for parenting reared-apart adopted twins are provided.

KEYWORDS *Chinese twins, adoption, reunions, departures, social relationships*

Internationally adopted twins from China allow behavioral investigation at several levels. First, it is possible to use twin designs to assess genetic, environmental, and developmental influences on physical characteristics, behavioral traits, and social interactions. Second, it is possible to apply adoption research designs to assess phenotypic similarities among nonbiological family members living together and biological family members living apart. Third, it is possible to examine the effects of cross-cultural adoption on educational performance and behavioral adjustment. The present paper examines social interactions among young Chinese twins reared apart and meeting for the first time.

The study of twins reared apart from infancy is an informative variant of the classic twin design. Monozygotic (MZ or identical) twins raised separately

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reveal how different rearing environments affect gene expression. Dizygotic (DZ or fraternal) twins raised separately are a useful control group and provide information on other developmental interactions (Segal, 2000).

The relevant scientific literature includes seven studies of separated twins (Newman, Freeman, & Holzinger, 1937; Shields, 1962; Juel-Nielsen, 1965; Langinvainio, Koskenvuo, Kaprio, & Sistonen, 1984; Pedersen, McClearn, Plomin, & Friberg, 1985; Bouchard, Lykken, McGue, Segal, & Tellegen, 1990; Hayakawa, Shimizu, Kato, Onoi, & Kobayashi, 2002), as well as several case reports (e.g., Muller, 1925; Sudarsky, Myers, & Walse, 1983; Segal et al., 1990). Genetic effects are indicated across virtually all measured cognitive, personality, and health-related traits, although the degree of genetic influence is trait-specific (Segal, 2000).

Previous reared-apart twin studies have mostly included twins who were reunited as adults. Childhood factors associated with the twins' similarities, differences, and relationship qualities in adulthood were therefore obtained retrospectively from the twins via interviews, questionnaires, and life history documents. Very few of the twins' parents and teachers were alive at the time of assessment and could not be consulted. *The present study of Chinese twin children is thus the first prospective developmental assessment of twins separated in infancy, i.e., before 2 years of age.* The first report from this ongoing project focuses on the twins' reactions to their first reunion with, and first departure from, their co-twin.

PRESENT STUDY: GOALS AND DIRECTIONS

China's one-child policy, first implemented in 1979–1980 and still in effect, was intended to check population growth by limiting urban families to one child and rural families to two (Evans, 2000; Segal, 2005). An unintended consequence of this policy was the international adoption of abandoned children, most of whom were female. Approximately 4,500 Chinese children received United States visas in 2001 (*New York Times*, 2003); included among them were twins, some adopted by separate families.

The separate rearing of adopted Chinese twins came to the attention of the first author in 2001, in an inquiry from a parent who had adopted a single female twin (Segal, 2005). The purpose of her communication was to obtain information about parenting a separated twin and arrange DNA testing for zygosity diagnosis. This mother was aware of several other separated sets, as well as a web site (www.sisterfar.com) that was established to assist families raising Chinese twins and siblings adopted apart. A formal study of these twins began at California State University, Fullerton (Twin Studies Center) in 2006.

The present exploratory study provides descriptive features (e.g., time together in China; age at reunion) for 10 pairs of separated twins, 5 MZ and

5 DZ. This is followed by a qualitative analysis of the twins' responses to their first reunions with, and departures from, their co-twin.

Developmental Features of Children's Social Interactions

Comprehensive literature reviews of children's early peer interactions and relationships were published by Rubin, Bukowski, and Parker (1998, 2006). The first year is marked by intentional behaviors directed toward play partners (e.g., physical gestures), peer observation, and reactions to their partner's behavior. The second year includes longer and more complex social exchanges, often in the form of games. Turn-taking and social coordination are observed during this time, and conflict is increasingly initiated.

Ross and Lollis (1989) noted that more positive social interactions (e.g., reciprocal exchanges) tend to characterize familiar play partners, aged 20 to 30 months, as compared with those who are less familiar. This observation is especially relevant to the present study, given that the aim is to assess the responses of young twins meeting for the first time. Specifically, the reared-apart twins are less familiar with one another than they are with their other peers and playmates. By the age of 3, children are capable of more elaborate play, such as shared symbolic meaning (Howes, 1988; Goncu, Patt, & Kouba, 2002). Older preschoolers engage in longer play sequences than 3-year-olds and can agree on rules, roles, and play themes (Goncu, 1993).

It is important to recall that the present sample included transracially adopted children from China. The relevant literature on cross-cultural differences in social behavior between Chinese and western children was, therefore, examined.

Cross-Cultural Differences in Children's Social Behavior

Dependence, inhibition, and self-restraint are valued among children in China (Ho, 1986; also see Hur, 2009). Such behaviors are thought to be important for peer acceptance and friendship formation in that culture. In contrast, extraversion and assertiveness may help individuals adapt to contemporary American society (Sloan, 1996). A recent meta-analysis indicated increases in extraversion over time among U.S. men and women of college age (Twenge, 2001).

The cross-cultural developmental literature also provides evidence of temperamental differences between Chinese and Caucasian children. Specifically, Chinese infants appear more consolable and less changeable than Caucasian infants (Freedman, 1974; Kagan, 2007). Six- and 7-year-old Chinese children show greater negative affect than surgency and effortful control, while Caucasian children show greater surgency and effortful control than

negative affect (Ahadi, Rothbart, & Ye, 1993). These findings are consistent with the interactive effects of biology and socialization.

Most twins in the present study spent a little over one year in China prior to adoption. They had been variously placed in orphanages and/or foster families soon after birth. The extent to which they were exposed to Chinese cultural norms is uncertain; consequently, assessing sociocultural effects on the twins' social behaviors is beyond the scope of the present report.

Twin Relations

Vandell, Owen, Wilson, and Henderson (1998) found no difference between twins' social interactions with their co-twin and with an unfamiliar peer during the first year. In contrast, interaction occurred more frequently between co-twins than between twins and unfamiliar peers during the second year. Zygosity and sex effects on social interaction were not examined in that study. Other work has shown that 20-month-old MZ twins were less responsive to strangers in need than were DZ twins (Zahn-Waxler, Robinson, & Emde, 1992), a finding replicated in a more recent analysis (Knafo et al., 2009). This finding is consistent with MZ twins' greater involvement with one another than with others, relative to DZ twins.

Studies of twin children in early and middle childhood demonstrate greater closeness and cooperation between MZ than DZ co-twins. An overlooked study by Von Bracken (1934) showed that MZ twins performed arithmetic and coding tasks in more coordinated fashion when working in close proximity versus isolation. In contrast, DZ twins either competed or showed no motivation to perform when together. Segal (1984, 1997, 2002) observed greater cooperation and success by MZ than DZ twin pairs during joint puzzle completion. Danby and Thorpe (2006) observed greater compatibility between young MZ than DZ co-twins. Foertsch, McGuire, Segal, and Baker (2009) found that MZ twins characterize their relationship as closer than both DZ twins and virtual twins (same-age unrelated siblings).

The three early monozygotic reared-apart (MZA) twin studies included a total of 76 pairs. The investigators did not systematically assess the nature of the twins' relationship with one another, although biographical information was provided in 54 of the case histories appended to the quantitative findings. (Twenty-two pairs either had missing information or were difficult to judge.) The striking finding is that 40 of 54 pairs (nearly 75%) developed close relations with one another following reunion (Segal, Hershberger, & Arad, 2003). This finding is consistent with studies of social relatedness among reared-together pairs (see Segal, 2000; Segal, & Marelich, 2011).

The only formal study of social relatedness in reared-apart twins reported greater closeness and familiarity between adult MZ than DZ co-twins (Segal et al., 2003). This same pattern emerged between co-twins versus

the unrelated siblings with whom the twins were raised. These findings are consistent with those from studies of twins reared together. Explanations for these behaviors span a range of theoretical perspectives. Evolutionary psychological theory focuses on mechanisms underlying associations between genetic relatedness and social affiliation (Buss, 2004). Hamilton (1964) proposed that natural selection favors alleles predisposing individuals to act in ways favoring the transmission of those alleles into future generations. Socially based theories of twin relations emphasize the effects of rearing practices and societal expectations (Siemon, 1980). MZ twins' behavioral resemblance and social closeness is thought to reflect social processes such as mutual identification, complementarity, and reactions of others that foster feelings of oneness (i.e., twinning reactions). Social and evolutionary theories are not incompatible, but instead represent different levels of interpreting behavior.

The present sample was too small to systematically compare social behaviors by zygosity, although this analysis will be conducted as the sample size increases. A testable hypothesis would be that MZA twins (who share 100% of their genes) should be more cooperative and caring toward one another than DZA twins (who share 50% of their genes, on average, by descent). The present data were, however, inspected for suggestive trends.

The present research was guided by a developmental perspective such that twins were organized according to their age at first reunion. Based on the increased social complexity of children's behavior during the second year of life (Rubin et al., 2006), the pairs were organized into two age groups. The first group included twins reunited before 18 months of age, and the second group included twins reunited at 18 months or older. It was hypothesized that:

- (1) Older twins would show greater interest in, and attraction to, their co-twin than younger twins at their first meeting.
- (2) Older twins would show greater sadness and distress at their first departure than younger twins.

METHODS

Identification of Reared-Apart Twins

Six twin pairs were identified when parents of one co-twin in each pair contacted the principal investigator (NLS) as a result of an Internet search. These parents were interested in obtaining information about the rearing of young separated twins. Two additional pairs were identified through newspaper articles describing the twins' reunion. Two other pairs were self-referrals based on information about research at the California State University Twin Studies

Center. The present report is based on data from 20 children representing 10 reared-apart twin pairs.

Procedures

PARENT PACKETS

Parents received a packet of materials to complete and return to the investigators by mail. The packet included forms requesting information about the family's background (e.g., parental age, education, occupation, reasons for adoption, other siblings in the family), the twin child's early life circumstances (e.g., age at adoption, health history) and the twin child's life history events (e.g., twins' rearing circumstances before adoption, twins' meetings since adoption).

The following time and contact measures were calculated, based on these background data: time together in China (in days), age at separation (in days), age at adoption (in years), age at first reunion (in years), and length of first reunion (in days). Occasional missing data were provided by the co-twins' family. Parents also provided descriptions of twins' reactions upon meeting with, and departing from, their co-twin for the first time. Direct observations of twins' reunions and departures by research staff, in addition to parental reports, would have been desirable. Unfortunately (with two exceptions), the twins' reunions occurred prior to their identification by the investigators. In one exceptional case, the twins' distance from California precluded the possibility of direct study. In the second case, the first author was present at the twins' reunion, but not at the departure as discussed below.

Parents (mostly mothers) also completed the following forms for their children: Child Behavior Checklist (Achenbach, 2000/2001), Adjective Checklist (describing their child) (Gough & Heilbrun, 1983), medical and dental forms, twin relationship survey, and school history questionnaire. Twins' teachers completed the Teacher Report Form for twins attending school (Achenbach, 2000/2001). Analyses of these data will be presented in subsequent reports from this study.

ZYGOSITY DETERMINATION

Zygoty was established by DNA testing conducted by genetics laboratories in North America (8 pairs) and in Europe (1 pair). DNA analysis typically involves co-twin comparison of 13 to 15 short tandem repeat markers. This process allows MZ twinning to be established with virtual certainty, while DZ twinning can be established with varying degrees of probability in the absence of DNA samples from the biological parents (Segal, 2000). All

families but one completed DNA testing prior to participating in the study and provided copies of reports. The single pair that did not undergo DNA testing was assigned as MZ by a physical resemblance questionnaire and inspection of photographs.

Complete concordance for tested markers confirmed monozygosity in 4 cases. In the other 5 cases, full sibship and half-sibship indices yielded probabilities of relatedness ranging from .24 to .96 and .85 to .99, respectively; these pairs were assigned as DZ. (The single opposite-sex pair was assigned as DZ, based upon the sex difference.) Parents also completed a standard physical resemblance questionnaire (Nichols & Bilbro, 1966) that assigns zygosity with 95% accuracy, as assessed against serological data. (This form was modified slightly, given the twins' separate rearing status.) Results from this questionnaire agreed with the DNA findings in all cases, with one exception. One physically similar pair was identified as DZ by the DNA test and MZ by the questionnaire; the final assignment for this pair was determined by the DNA test.

IQ TESTING

Local examiners, who were unfamiliar with the goals of the study or with the children's life circumstances, administered the age-appropriate version of the Wechsler Intelligence Scale to each child. Each co-twin was tested by a separate examiner. The mean interval between testing for co-twins in the 10 pairs was 10.20 days ($SD = 6.48$) and ranged from 2 to 25 days. Every protocol was reviewed for scoring accuracy upon receipt.

Participants: Age at Assessment and Pair Sex

Age at assessment was defined as the age of the child on the day of IQ testing. The mean age at assessment was 5.56 years ($SD = 2.39$) and ranged between 3.19 to 10.82 years. In several cases the twins had been assigned different birth dates. This is due to the fact that they were found apart from their co-twins and their age was estimated by Chinese adoption officials. Nineteen of the 20 children were female, while the single male twin was from the opposite-sex pair. These data are summarized in Table 1.

Families: Descriptive Characteristics

The twins were adopted by two-parent families in North America except for one child being raised by a single mother and another being raised in Northern Europe. Most twins are being raised by Caucasian parents with three exceptions: one mother is half-Chinese, another mother is half-Hispanic,

TABLE 1 Age at Assessment for Chinese Reared-Apart Twins

Measure	Mean	(SD)	Range
Age (years) ^a	5.56	(2.39)	3.19–10.82
MZ	5.60	(3.08)	3.19–10.82
DZ	5.53	(1.60)	3.26–7.82
Test interval (days) ^b	10.20	(6.48)	2–25
MZA	6.00	(3.81)	2–10
DZA	14.40	(5.98)	11–25

Note. MZA: monozygotic reared apart; DZA: dizygotic reared apart.

N = 10 pairs (5 MZA, 5 DZA). All pairs were same-sex female, with the exception of one opposite-sex DZ pair.

^aIndividual data; ^bpair data.

and both parents in one family are Hispanic. One twin lives in a bilingual family in which both English and Spanish are spoken, and another twin converses with her Chinese grandmother in Mandarin.

The twins' rearing parents were mostly older, well-educated, and employed in professional, managerial, or technical occupations, as is characteristic of adoptive mothers and fathers (Stoolmiller, 1999). The mean Hollingshead (Hollingshead, 1975) socioeconomic status rating was 1.83 (*SD* = 0.86). Mothers' and fathers' mean ages were 43.42 (*SD* = 3.99) and 45.68 (*SD* = 5.60), respectively. More than 85% of both mothers and father were Caucasian, with the remainder distributed among mixed and Hispanic backgrounds. More than 65% of both mothers and fathers identified as Christian, while the rest identified as Unitarian, Jewish, Buddhist, other, or unaffiliated. The co-twins' families lived 1,292.64 (*SD* = 1,421.81) miles from one another, with a range of 27 to 5,000 miles; co-twins living in the United States and Europe explain the large range. Information about the twins' biological families was unknown.

Primary reasons for adopting included infertility (44.4%), desire for another child (33.3%), previous loss of a child (11.0%), humanitarian concerns (5.6%), and other circumstances (5.6%). Data were unavailable in two cases.

Assessing the Quality of the First Meeting and Departure

The quality of the first meeting was organized into three categories, based on parents' description of the co-twins' ease of interactions, physical closeness, and social involvement; data for two parents were missing. Levels of attraction and interest were indexed by twins' verbal and visual exchanges and physical interactions upon first meeting. The three categories were (1) *high*: intense attraction and interest in one another (e.g., smiling, hugging), (2) *moderate*: not immediately drawn to or focused on each other (e.g., somewhat withdrawn; generally quiet, but interested), and (3) *low*: little

attraction or interest in one another (few verbal exchanges; no physical interactions). The reunion of one pair was filmed by the British Broadcasting Corporation for a program, *The Secret Life of Twins*, that aired in the United Kingdom on September 30, 2009. The first author was present at this initial meeting.

The tone of the departure was organized into three categories, also based on each parents' description of the co-twins' behaviors, emotions, and remarks upon leaving; data for two parents were missing. The three categories were (1) *high*: intense reactions (e.g., tears, protests), (2) *moderate* (e.g., some expressions of sadness), and (3) *low* (e.g., very withdrawn, little response).

Three advanced undergraduate psychology students (two female and one male) judged the meeting and departure quality for each twin on the basis of the parents' descriptions. Judges were blind to the age and zygosity of the pairs and to the purpose of the analysis. Pearson's correlations between the different pairs of judges ranged between .71 and .81 (meetings) and .87 and .96 (departures). Thus, the ratings appear to be reliable. The unit of analysis was the mean of the three judges' ratings. Descriptions provided by the co-twins' parents did not differ significantly as assessed by the Wilcoxon signed-ranks test (reunions: $Z = -.74$, ns; departures: $Z = -.14$, ns).

It was expected that meeting and departure quality would themselves be correlated. That is, twins who displayed attachment and attraction upon meeting should show sadness and distress upon departure. A significant, albeit moderate, correlation between these measures was obtained ($r = .47$, $p < .05$).

RESULTS

IQ Findings

The mean IQ score for the 20 twin children was 109.50 ($SD = 13.75$) and ranged from 89 to 137. This average score places the twins at two-thirds of a standard deviation above the population mean. Their above-average intellectual level and the fact that their families volunteered for research participation suggest that the twins are generally well-functioning. One child who scored within the low average range was 3 years old at the time of testing, an age at which IQ stability has not yet been achieved.

Twins' Reunions

The twins' mean age at reunion was 2.98 years ($SD = 1.72$) and the length of the first meeting was 3.5 days ($SD = 2.30$). These data are summarized in Table 2.

TABLE 2 Separation and Contact Measures for Twins Reared Apart ($N = 10$ pairs)

	Time Together In China ^a (Days)	Age at Separation (Days)	Age at Adoption (Years) ^b	Age at First Reunion (Years)	First Meeting Length ^c (Days)
Mean	84.35	59.20	1.15	2.98	3.50
(SD)	(184.31)	(177.06)	(0.54)	(1.72)	(2.30)
Range	1–563	1–563	0.63–2.34	1.03–6.20	0.50–6.50

Note. ^aThe time together in China exceeded age at separation when twins had contact before or after adoption.

^bIndividual data ($N = 20$).

^cThe second reunion day was used for one pair, due to one twin's illness on the first day. Four hours or more was counted as one day; less than four hours was counted as a half-day.

Associations Between Meeting Quality and Time/Age Variables

The quality of the first meeting between co-twins was more favorable for those meeting after 18 months, compared with those meeting before 18 months ($r = -.45$, $p < .06$, $n = 18$). Those who were older at their reunion displayed greater intensity and focus on their co-twin than those who were younger, a finding that approached statistical significance. No associations were found between the quality of the first meeting and its length ($r = .38$, $n = 18$) or the quality of the first meeting and the twins' age at adoption ($r = -.07$, $n = 18$).

Reactions to Meeting

TWINS REUNITED BEFORE 18 MONTHS

Members of three MZA pairs showed few observable reactions to meeting their co-twins for the first time. Twins in one pair spent considerable time staring at one another, and twins in another pair hugged briefly. Reactions of children in this group were generally characterized as "neutral."

TWINS REUNITED AT OR AFTER 18 MONTHS

This group included 7 twin pairs (2 MZA and 5 DZA). A recurrent theme was an immediate rapport between the twins upon first meeting. Twins were described as "connected at the hip," "like little magnets," and "totally focused on each other." One twin showed greater immediacy in response to her twin than to any other child. These strong attractions characterized 5 out of the 7 pairs in this age group. Children in the other 2 pairs (one same-sex and the other opposite-sex) were initially shy and curious, but eventually warmed up to their twin.

One series of observations exemplifies the behaviors of the 5 twin pairs who showed a strong social connection. The twins were MZA and 22 months old at the time of reunion:

“... what struck all of us was that they were actually playing *with* each other. ... They shared, comforted one another when they got hurt, pointed interesting things out to each other. It was remarkable. ... When the girls stood beside one another or sat on the floor, they invariably scooted toward one another to get as close as possible. ... The girls really conversed. They understood everything each said to the other and responded to questions posed by the other.”

“Their voices sound the same. ... They sit with their feet crossed the same way when they’re in their car seats. They both like to balance on one leg while extending the other behind them. ... They have the same off-balanced run. They both wiggle the same way when they are happy with what they are eating.”

BBC footage of one pair’s reunion confirms the parents’ reports and the first author’s impressions of the meeting quality, but also demonstrates the inhibiting effects of a camera. One twin’s response was apparently restrained by the media presence. “She was very excited in the car, but paralyzed in a way by the camera ... her emotions could not come out.” When the filming terminated, she relaxed and focused exclusively on her twin. These data are summarized in Table 3.

Twins’ Departures

ASSOCIATIONS BETWEEN REACTIONS TO DEPARTURE AND TIME/AGE-RELATED VARIABLES

The tone of the departures between co-twins was more distressing for those meeting after 18 months as compared with those meeting at younger ages ($r = -.73$, $p < .001$, $n = 18$). Older twins displayed more intense reactions and greater upset upon leaving their co-twin than younger twins. However, no associations were found between the twins’ departure reactions and meeting length ($r = -.05$, $n = 18$) or between departure reactions and age at adoption ($r = -.15$, $n = 18$).

TWINS REUNITED AT YOUNGER THAN 18 MONTHS

Children’s reactions to leaving their twin were described as “neutral,” i.e., neither positive nor negative.

TABLE 3 MZA and DZA Twins' Meeting and Departure Reactions

Before 18 Months of Age		
MZA	Meeting	Departure
Pair A-1	2.00	3.00
Pair A-2	3.00	3.00
Pair B-1	1.67	2.00
Pair B-2	1.67	3.00
Pair C-1	3.00	3.00
Pair C-2	2.67	3.00
At 18 Months and Older		
MZA	Meeting	Departure
Pair C-1	1.00	1.33
Pair C-2	2.33	1.00
Pair D-1	1.00	2.67
Pair D-2	—	—
DZA	Meeting	Departure
Pair A-1	1.00	1.00
Pair A-2	1.00	1.00
Pair B-1	2.00	2.33
Pair B-2	1.67	3.00
Pair C-1	—	—
Pair C-2	1.00	1.00
Pair D-1	2.00	3.00
Pair D-2	2.00	2.33
Pair E-1	1.00	3.00
Pair E-2	1.00	2.00

Note. MZA: monozygotic reared apart; DZA: dizygotic reared apart.

Meeting: 1 = high (strong attraction); 2 = moderate (shy, warmed up); 3 = low (little attraction).

Departure: 1 = high (grief); 2 = moderate (sad, but accepting); 3 = low (no reaction).

TWINS REUNITED AT AGE 18 MONTHS OR OLDER

Twins in the high category (both members of 2 pairs) displayed “grief,” “sadness,” “tears,” and “tantrums” upon departure. They could not be comforted until plans were made for the next reunion. Departing from the co-twin was often a more unsettling event than leaving a friend.

A moderate response included some expressions of sadness at the end of the meeting, but without making a distinction between the co-twin and another child who was present. Members of 3 complete pairs and one individual twin showed either no emotional reaction, withdrawal, and/or hugging with no visible emotional reaction. Curiosity as to the whereabouts of the co-twin was sometimes expressed after departure. The only MZA twin in the low category was 22 months of age.

ZYGOSITY AND MEETING/DEPARTURE REACTIONS

Older MZA and DZA twins showed strong attraction for one another at their first meeting, but no discernible group trend was detected. DZA twin departures appeared somewhat more variable than the MZA twin departures. These data are summarized in Table 3.

DISCUSSION

The present paper was the first to examine the nature and quality of the reactions of young Chinese twins when meeting and leaving their co-twin for the first time. The sample, while modest in size, is unique in that separated twins have never been followed prospectively.

Guided by the developmental literature, the twins were organized into those who met before and after 18 months of age. As hypothesized, younger twins did not show a marked social connection to one another, given their cognitive, social, and emotional stages of development. However, nearly two-thirds of the older twins showed strong attraction to and interest in their co-twin upon first meeting. The first hypothesis was therefore supported. In contrast, sadness and distress were less clearly reflected by the older twins' behavior upon departure. Thus, these results were not fully consistent with the second hypothesis.

Children's responses were not typical of their customary social interactions, as reported by their parents. Specifically, the twins showed a more immediate rapport with and a greater attraction to each other than to their other peers. The older twins' preference for one another is consistent with Vandell et al.'s (1998) observations that twins in the second year interact more frequently with their co-twin than with unfamiliar play partners.

The bases of most twins' close social connections to one another are of interest. It may be that perceptions of behavioral and/or physical similarities provide cues to relatedness, triggering feelings of attraction between individuals, as suggested by evolutionary theorizing (Freedman, 1979; Segal et al., 2007). A growing literature shows that phenotypic similarities contribute to the attraction between spouses and friends (Plomin, DeFries, McClearn, & McGuffin, 2001; Rubin, Lynch, Coplan, Rose-Krasnor, & Booth, 1994). In other words, the observed similarities are present at the start of the relationship. It is also conceivable that parents encouraged their child's enthusiasm for meeting their co-twin as the time approached. However, such an explanation seems unlikely, given parents' surprise at the immediate rapport shown by some pairs. In addition, twinning reactions would have little relevance when twins meet for the first time.

It is expected that the MZA twins will be more likely than the DZA twins to maintain their initial co-twin attraction over time. This finding would

be consistent with evolutionary reasoning about the genetic bases of social attraction. At the proximal level, twins who form closer social bonds are likely to maintain more frequent communication with one another over time. The quality of the co-twins' relations will be assessed further as the sample size increases and development proceeds.

The twins' reactions to departing from their co-twins were somewhat variable. It is possible that some children did not understand that they were to be separated from their twin sibling for an extended period (i.e., until their families were able to bring them together again). This may explain the modest (albeit significant) correlation between reactions to meeting and leaving. However, some parents have indicated delayed reactions from their children (e.g., verbal expressions of missing the twin) displayed several days after the departure.

There is reason to believe that similar findings would be observed in twins from different backgrounds and populations. Studies of young Asian twins' behavioral resemblance have yielded heritability estimates similar to those based on western populations (see Hur, 2009). A comparable study of cooperation and competition among twins in Singapore (Loh & Elliot, 1998) replicated results reported by Segal (1984, 1997). Specifically, MZ twins showed greater cooperation than DZ twins when reward equality was uncertain.

LIMITATIONS

The present analysis focused on the twins' reactions at only two specific points in time: their first meeting and their first departure. The extent to which the twins' initial reactions characterize their current and future relationship with one another is uncertain. In addition, the small sample size suggests cautious generalization of the findings to the larger Chinese twin population.

The twins were relatively young at their first meeting; the mean age at reunion was 2.98 years. Longer observation periods at older ages and over extended meeting times would be desirable; such data are being gathered from the families. Furthermore, the present study relied on parental descriptions of twins' first meetings and departures. Direct observation of these events by research staff would have provided an additional measure of the twins' behaviors against which to assess the parents' reports. However, as indicated, most reunions took place prior to identification of the pairs and their recruitment for the project.

SUMMARY

In summary, the majority of older twins (age 18 months and older) expressed intense emotional reactions when first meeting with their co-twin.

This finding is consistent with what is known about the social behaviors and interactions of young children at different levels of development. Few pairs showed the restraint and inhibition suggested by Chinese cultural norms. However, it is beyond the scope of the present study to draw definitive conclusions as to how the twins' behaviors may have been mediated by socialization processes specific to Chinese and western cultures.

Future Research Directions

Future papers from this prospective study will focus on the nature and origins of the twins' physical, behavioral, and social characteristics. An increased sample size will enable twin group comparisons of resemblance in intelligence and personality, as well as further comparison of responses to meetings and departures. An analysis of how twins' personality and temperament may affect the twin relationship is also of interest; some children may feel attracted to their twin but may be somewhat undemonstrative. Twins' self-report data concerning their relationship with their twins are also being gathered from older pairs and will be an informative supplement to the material presented in the present report.

Practical Implications

The present study underlined the immediate rapport and closeness established by the older reunited twins. In addition, earlier work has shown that twins not reunited until adulthood experience sadness and regret at having missed childhood contact with their twin (Segal, 2000). These findings, and the emotional distress triggered by the twins' first separation, should guide parental planning for the future. Parents are encouraged to provide opportunities for reared-apart twins and siblings to meet when possible; understandably, arranging meetings can be difficult when families reside far apart from one another. In such circumstances, contact between twins and siblings can be assisted by telephone, e-mail, Webcam, and/or texting. Extended dual-family vacations that children help plan can allow them the necessary time to develop their bonds and ease the stress of separation. Parents also need to balance these concerns with the interests of other children in the family, both adopted and non-adopted.

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