

Being Opposite: Is There Advantage for Social Competence and Friendships in Being an Opposite-Sex Twin?

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A recent large-scale study of Finnish adolescent twins (Pulkkinen et al., 2003) reported that individuals from opposite-sex twin pairs were more socially adaptive than individuals from same-sex pairs or singletons. This finding raised questions about the social learning effects of being an opposite-sex twin. The current article predicted on the basis of this finding, and evidence from singleton populations, that having an opposite-sex twin would yield social advantage. It sought to examine the social competencies of opposite-sex twins and compare them with same-sex twins and singletons. The study focused on the preschool years (age 3 to 6), a period in which the majority of children encounter their first large group, nonfamilial social experiences. The study obtained reports from parents and teachers of children aged 3 to 6 years: 72 children (36 pairs) who were dizygotic opposite-sex twins (DZOS), 50 children (25 pairs) who were dizygotic same-sex twins (DZSS), and 85 singletons of the same age and sex as the twins, who had at least one sibling. Reports were made using standardized measures of social competencies, behavior problems, language development and friendships. The main effects found were of differences in social competency between twins and singletons. Twins had lower social competency scores. No differences between same-sex and opposite-sex twins were found. The findings did not support the hypothesis of social advantage for opposite-sex twins in early childhood.

Twin studies have more commonly focused on same-sex pairs. The contrast of monozygotic (MZ) and dizygotic (DZ) same-sex pairs is a key design used to understand the relative contribution of genetics and environment on behavior. Such designs control the effects of gendered expectations and behavior in the social environment and allow a focus on individual psychological traits. In contrast, the comparison of same-sex and opposite-sex pairs provides unique insight into the effects of sex (biology) and gender (social environmental effects of sex) on social relationships, social learning and social behavior. To date

there are only a few studies which have specifically focused on the effects of being an opposite-sex twin. Yet, emerging literature indicates that a life-long relationship and shared environment, both prenatal and postnatal, with a child of the opposite sex may have enduring effects on social behavior.

One recent large-scale study of Finnish adolescent twins (Pulkkinen et al., 2003) reported that individuals from opposite-sex twin pairs were more socially adaptive than individuals from same-sex pairs or singletons. This finding raised questions about the social learning effects of being an opposite-sex twin. Are opposite-sex twins consistently more socially adaptive? That is, can the Pulkkinen et al. (2003) finding be replicated in different samples? If opposite-sex pairs are more socially adaptive, what are the mechanisms by which this comes about? What are the developmental trajectories of social learning in opposite-sex twins compared with same-sex twins and singleton children? The current study focused on the first of these questions. It aimed to examine the social competencies, behaviors and friendships of children in opposite-sex twin pairs during early childhood and contrast them with those of DZ same-sex pairs to examine whether the effects of 'being opposite' found by Pulkkinen et al. (2003) in a sample of adolescents were discernable at an earlier point in life. Comparison with a sample of singletons, all having a sibling, was also undertaken to contrast *twin* (i.e., twins vs. singletons) effects from *twin type* (i.e., opposite- vs. same-sex) effects.

Being Opposite

Twinning presents a unique social situation that affects social experience and development (Rutter & Redshaw, 1991; Thorpe et al., 2003). Being a child in an opposite-sex twin pair presents still further

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differences in experience, related to sex and gendering, which have the potential to influence social learning, social competencies and social behavior. These effects derive from both biological and social exposures.

Being Opposite and Biological Exposure

Perhaps the greatest research focus on opposite-sex twins is that which centers on the effects of the prenatal environment. A series of studies have examined the effects of hormonal exposures *in utero* on early social behavior. Specifically, it is hypothesized that female twins' exposure to their brothers' androgens will masculinize their behavior. This hypothesis has been tested by comparing same-sex and opposite-sex twins on a range of behaviors and using a variety of samples, both child and adult. The results of these studies are not consistent however, and on balance, suggest that the biological environment alone does not account for differences in social behaviors.

The most consistent finding for an effect of being an opposite-sex female twin is differences in neurological patterning. Cohen-Bendahan et al. (2004) report significant differences in cerebral lateralization patterns, with opposite-sex female twins having more masculine patterns than same-sex females. Similarly, McFadden (2002) reports that females from opposite-sex pairs have masculinized patterns of auditory evoked potentials compared with same-sex females. The authors of both these papers attribute differences to testosterone exposure *in utero*.

Reported differences in brain patterning do not appear to translate into differences in gendered behavior, however. Of the studies examining preference for gendered play, the majority report that the play of opposite-sex twins is sex-typical (i.e., males undertake masculine play and girls feminine play) and comparable to that of same-sex twins. Only one study, Dawood (2001) reports sex-atypical play effects for opposite-sex twins, and this is likely to be an artefact of study design. The results derive from adult twins' reports of their own childhood play and are, therefore, retrospective and of questionable reliability. In contrast several studies (e.g., Campagnola, 1995; Henderson & Berenbaum, 1997; Rodgers et al., 1998) report sex-appropriate play among opposite-sex twins. Further studies of the gender attitudes among adult (Rose et al., 1994) and adolescent (Rose, 2002) twins reports no difference between same-sex and opposite-sex females. Loehlin and Martin (2000) report no differences between opposite-sex and same-sex twins on two scales of gendered attitudes in a sample of adults, but report that females from opposite-sex twin pairs had higher scores on willingness to break rules than same-sex female twins. Cohen-Bendahan et al. (2005) report that testosterone levels in same-sex and opposite-sex twin girls did not differ and that these levels were not systematically related to behavioral traits. In this study of 13-year-old twins, females from opposite-sex pairs were more masculine in their patterns of aggression. Though the authors suggest there are biological

explanations for their finding, a more likely explanation for differences observed in opposite-sex twins may be one of social learning.

Being Opposite and Social Exposure

Having a same-aged, opposite-sex sibling exposes each twin to unique social learning experiences. Two distinct sets of circumstances associated with being an opposite-sex twin give access to alternative social models. First, being opposite provides an intimate and continuous relationship with a child of the opposite sex. Being opposite provides unfettered access to an opposite-sex peer and rich opportunity for social learning, both direct and vicarious. Second, being opposite gives access to a broader social pool of children of the opposite sex via the co-twin's friends.

Being Opposite and Social Learning

Evidence from two sources suggests that opposite-sex twins have higher levels of social competence than same-sex twins or singletons. Pulkkinen et al.'s (2003) study of Finnish adolescents is a powerful study in that its findings of higher social adaptivity in opposite-sex twins is based on a large sample and reports from subjects who were blind to the study's purpose. The classic twin study of Koch (1966) also indicates that being opposite has advantage for social adaptivity. In this study of 90 twin pairs aged 5 to 7 years, opposite-sex children who had a good relationship with their co-twin were rated as more popular with peers. This study provides a smaller yet consistent finding to that reported by Pulkkinen et al. (2003). To date there is no study of social adaptability of twins in the early childhood period, a gap this article seeks to address. More importantly, the mechanisms that might explain any social advantages of being opposite have not been explored. Available literature comes primarily from studies of opposite-sex sibling and peer relations among singletons. These studies suggest that being opposite may promote development of social understanding by accelerating acquisition of *Theory of Mind* (ToM; Cassidy et al., 2005) and by modifying the social learning environment (Colwell & Lindsey, 2005).

ToM is the ability to understand the mind of another and take their perspective. This ability is the foundation of socially adaptive behavior. It typically emerges at between 2 and 3 years and continues to develop throughout the early childhood period. There is considerable variability in the rate of acquisition of ToM. A great deal of research in the field of ToM has been directed to identification of experiences that influence the acquisition of the cognitive processes that allow social understanding. One key finding to emerge from the literature is that having siblings provides experiences that accelerate the acquisition of ToM (e.g., Cutting & Dunn, 1999). Children without siblings tend to be slower in acquiring ToM than those with siblings, because siblings provide experiences that challenge the child's own perspective and provide different perspectives and models of thinking (Cutting & Dunn, 1999; Perner et al., 1994; Peterson, 2000).

A recent study of the influence of the effects of siblings on the development of ToM reported an opposite-sex effect in which children who had opposite-sex siblings had higher levels of functioning on measures of ToM than did those with same-sex siblings (Cassidy et al., 2005). Two explanations were given for this finding. First, it was suggested that opposite-sex minds are 'more different' and therefore provoked more challenge to the child's own perspective. Second, the difference in minds increased the need for parent discussion and explanation of perspective. This study included a sample of twins. The twin group in contrast to singletons evidenced no advantage of having a sibling. The authors believe this is because the twin children's minds were not sufficiently different. The composition of the twin group is not fully described but would appear to be totally or primarily comprised of same-sex pairs. The authors, based on their findings of opposite-sex sibling advantage, recommend a study of opposite-sex twin pairs. This paper is pertinent to the study of social adaptability in twins in that it suggests opposite-sex twins would have more advanced development of ToM than same-sex twins and consequently more socially adaptive behavior. The current study while not measuring theory of mind compares socially adaptive behavior of dizygotic opposite-sex twins (DZOS) twins with their same-sex counterparts during early childhood when ToM develops.

The notion that juxtaposition of children of different sex acts as a stimulus for development, proposed by ToM research, might also apply to other developmental domains. Of particular interest are gross motor development, where males typically are advantaged in comparison with females, and language and social skills development, where females are typically advantaged compared with males. Two key questions emerge: 1. Does having a more skilled co-twin accelerate the skill development of the less skilled? and 2. Do higher levels of competence in motor, language and social skills increase social adaptability and peer response to twin children?

Evidence from the play literature does not suggest that there would be an advantage for female children from opposite-sex pairs accruing advancement of their motor development. Studies of play suggest that girl twins are more likely to engage in sex-typical play characterized by less physical activity (Colwell & Lindsey, 2005). Further, research evidence suggests that engagement in sex-atypical play (e.g., more physical games for girls) has a negative impact on peer evaluation. There is little evidence of the effect of being opposite on language and social skills. A study comparing language development of twins with that of close spaced singletons (Thorpe et al., 2003) did not report on differences between same-sex and opposite-sex pairs in language skills, but suggests siblings affect the language environment provided by parents. In this study, qualities of parental interaction explained the difference in language development between twins and singletons. One explanation given for the advantage of twins over

singletons in early language development in this study was that the presence of a more linguistically skilled sibling increases the level of sophistication of language used by a parent and thereby promoted language development. To date there are no studies comparing the social competencies of same-sex and opposite-sex twins in early childhood. This study sought to compare performance of same-sex and opposite-sex twins on measures of language and social competencies and social behavior.

Being Opposite and Social Access

The effects of being opposite can extend beyond the context of the family. Research evidence suggests that type of twin (MZ, DZ same-sex [DZSS] and DZOS) is systematically associated with a child's access to a social pool. Thorpe and Gardner (2006) examined size and quality of friendship pool among a sample of 30 primary school-aged twin pairs. They reported that while the number of friends did not vary, the degree to which friends were shared was systematically related to twin type. MZ twins were found to share half their friends, DZ same-sex twins about a quarter and opposite-sex twins less than 5%. In interviews, the children from opposite-sex pairs indicated they had close relationships with their co-twin and saw them as a 'friend', but did not play with them in the context of school where gender-based play was the norm. Because the social pool of opposite-sex pairs was bigger, having less shared and more unique individuals, the potential exposure of each child to the opposite sex in an out of school context (e.g., friend invited to play at home) presents the possibility of exposure to other models of children of the opposite sex. To date there is not specific data on the extent to which this happens or its effect on development. The current study, following Thorpe and Gardner (2004), compares the size and composition of the friendship pool of same-sex and opposite-sex twins and examines the association of friendship with social skills.

In sum, there is evidence from a variety of sources which suggests that being an opposite-sex twin might bestow advantage in social cognition and social behavior. The current article predicted on the basis of this finding, and evidence from singleton populations, that having an opposite-sex sibling would yield social advantage. The current article, by contrasting same-sex and opposite-sex pairs, aimed to identify whether reports of social advantage found in adolescence could also be found in early childhood. The study contrasted the performance of same-sex and opposite-sex twins on measures of language, behavioral problems, social competence and friendships, deriving from parent and teacher report. It also provides singletons comparisons.

Method

Participants

Respondents were parents and teachers of 72 children who were DZOS twins (36 pairs) and 50 children who were DZSS twins (25 pairs). The participating families

were recruited with the assistance of the Australian Multiple Birth Association (AMBA) who advertised the study via their national network of local clubs and their email contact list. Some families also heard of the study via national radio (Australian Broadcasting Commission) and volunteered to participate directly to the research team. All participating twin children attended a group early education setting (preschool, kindergarten, day care). Additionally, 85 singleton children were recruited as comparisons. These children attended the same educational settings as the twin children and were recruited via the parents and teachers of these centers. The aim was to recruit one singleton for every participating twin child, however only 85 of the 122 singleton families (70%) returned full data sets. In recruitment of singleton comparisons, it was specified that they should be of the same age and sex of a nominated twin and, to control for family size effects, have at least one sibling. The sample was balanced for the sex of the children: DZOS (36 male, 36 female), DZSS (22 male, 28 female), singletons (43 male, 42 female); and did not differ in age: DZOS ($M = 4.40$ years, $SD = 0.73$ years), DZSS ($M = 4.67$ years, $SD = 0.93$ years), singletons ($M = 4.76$ years, $SD = 0.94$ years).

Measures

Family and child development background. Data were obtained using two versions of a questionnaire, one for completion by parents of twins and the other for parents of singletons. The questionnaire for parents of twin children obtained data on the family background, twin zygosity, each twin child's development, twin relationship and experience. It included an embedded standard index of physical similarity that was the basis for determining zygosity in same-sex pairs. Such measures have been shown to have high reliability when validated against genotypic data (Peters et al., 1998; Sarna et al., 1978). The singleton version of the questionnaire was an abbreviated form of the twin questionnaire seeking data on the family background, the target child's development and relationships.

Social competency and behavior. The Preschool and Kindergarten Behavior Scales — Second Edition (PKBS-2; Merrell, 2002) was completed by the parent and teacher of each participating child. This measure comprises two scales, a 34 item social skills scale, and a 42 item problem behavior scale. The social skills scale has three subscales: social co-operation, social interaction and social independence. Data deriving from the PKBS-2 indicate sound reliability and validity (Merrell, 2002; Riccio, 1995).

Language competency. This was assessed using the upward extension of the MacArthur Communicative Development Inventories (MCDI; Dionne et al., 2003). This measure assesses vocabulary, syntax and language complexity for children in the age range 0 to 6 years. The original version of the MCDI has been shown to have sound reliability and validity (Fenson et al., 1991). The current upward extension has also been shown to

have sound predictive validity (e.g., Eley et al., 1999, Thorpe et al., 2003). A four-item parent administered test of children's expressive language function (describing, categorising, explaining and making sentences) was included. Parents recorded their children's responses to these items and the coding of responses was undertaken by the research team.

Representation of friendship size and pattern of friendship. For each child the parent completed the Friendship Sticker Task (Thorpe, 2003). This measure gathered information about the number and proximity of children's friendships. Parents were required to place a sticker per friend on the page, at a distance that represented the closeness of the child's friendship to that friend. Variables derived from this measure include the number of friends, number of shared friends, sex of friends in the friendship pool, and closeness of twins to each other. The Friendship Sticker Task has been shown to be an effective and valid measure for obtaining data on young children's friendships (Thorpe, 2003). Concurrent measure comparisons between parent, teacher and child indicate considerable overlap. However, validation of children's friendships at these young ages is difficult, and the fluidity of friendships (e.g., Hartup, 2000) will affect measurement test-retest reliability. In previous studies of twin samples, the measure has demonstrated results consistent with the theoretical prediction of an association between phenotypic similarity and shared friendships (Thorpe & Gardner, 2004).

Procedure

Parents of twins were mailed a package containing separate data envelopes:

- *1 x Parent of twins pack:* this comprised study information and consent package, the questionnaire for parents of twins, two PKBS-2 forms, two language development report forms, and two friendship representation sticker tasks.
- *2 x Parent of singleton pack:* this comprised information and consent package, a questionnaire for parents of singleton children, a copy of the PKBS-2 scale, a language development report form, and a friendship representation sticker task.
- *1 x Teacher pack:* this comprised information and consent package, four copies of the PKBS-2 to be completed for each twin and their nominated singleton comparisons.

The parents of twins completed the family and developmental background questionnaire, and for each child, the PKBS-2, language development measure, and a friendship sticker task. These parents then nominated a singleton child who met recruitment criteria. The parents of singleton children completed the family and developmental background questionnaire, the PKBS-2, language development and friendship sticker task. Teachers completed the PKBS-2 measure of social competence and behavior difficulties for both

twins and their comparison singletons. Teacher and parent reports were returned to researchers via prepaid postal packages.

Analyses

Analytic strategy involved two stages. First, to assess if opposite-sex pairs showed evidence of advantage, examination of any differences on social competency, friendships and behavior measures between same-sex and opposite-sex twin pairs was undertaken. To place this in the context of population developmental trends, comparison was also made with a sample of singletons of the same age and sex, all of whom had a sibling. Second, ANCOVA analyses were used to examine the contribution of twin type and the sex of the child to social skill development (co-operation, interaction, independence and friendship). The models entered language and behavioral problems as covariates. In all analyses, to deal with the issue of interdependence of

twin samples, the sample was split by randomly selecting a single twin from each pair. Analyses were run for each separate sample and in all cases results were in the same direction.

Results

Table 1 presents the mean, standard deviation and range of scores for all measures.

Social Co-Operation

This measure assesses children's ability to comply with adult instruction and compromise with peers. Items are primarily loaded to co-operation with adults rather than peers. The distribution of scores by sex and status (same-sex twin, opposite-sex twin and singleton) suggests that girls have higher scores than boys. The range of scores between twins and singletons is comparable. One notable finding is that the teacher's rating of co-operation for same-sex male

Table 1

Mean Scores, Standard Deviations and Range for Measures of Social Competence, Friendships, Language Development and Behavioral Problems

Sex	DZSS			DZOS			Singleton		
	<i>M</i>	<i>SD</i>	Range	<i>M</i>	<i>SD</i>	Range	<i>M</i>	<i>SD</i>	Range
Social Co-Operation — parent rating									
Boys	30.24	(4.37)	24–36	29.39	(4.60)	21–36	29.51	(4.83)	13–36
Girls	31.73	(3.86)	24–36	31.75	(4.15)	22–36	30.82	(3.51)	20–36
Social Co-Operation — teacher rating									
Boys	33.89	(3.57)	21–36	30.11	(4.86)	19–36	30.29	(5.51)	13–36
Girls	31.55	(4.99)	19–36	32.46	(3.49)	25–36	30.65	(5.42)	17–36
Social Interaction — parent rating									
Boys	27.53	(4.29)	18–33	27.14	(3.55)	21–33	27.40	(4.23)	16–33
Girls	28.50	(3.33)	21–33	27.36	(3.56)	19–33	29.03	(4.20)	15–33
Social Interaction — teacher rating									
Boys	25.89	(3.98)	15–31	23.79	(6.24)	9–31	25.34	(5.02)	13–33
Girls	24.41	(7.84)	8–33	24.86	(7.40)	7–33	26.26	(6.43)	7–33
Social Independence — parent rating									
Boys	29.12	(3.62)	20–32	28.21	(3.33)	19–33	29.80	(2.82)	24–33
Girls	28.82	(3.33)	20–33	28.43	(3.66)	18–33	30.06	(18–33)	18–33
Social Independence — teacher rating									
Boys	28.77	(3.23)	22–33	27.04	(4.93)	15–33	28.77	(3.06)	22–33
Girls	28.45	(4.24)	20–33	27.68	(4.69)	15–33	28.68	(4.11)	15–33
Number of Friendships ^a									
Boys	7.18	(2.68)	4–12	5.89	(3.00)	1–12	8.90	(3.17)	3–16
Girls	6.91	(2.49)	3–14	6.00	(2.61)	1–11	9.35	(4.39)	2–20
Language Development ^a									
Boys	67.06	(12.46)	44–79	61.46	(14.92)	32–87	68.54	(12.31)	35–88
Girls	73.91	(10.92)	53–88	64.21	(15.02)	27–87	69.68	(16.75)	39–89
Problem Behavior — parent-rated									
Boys	38.82	(17.09)	10–67	35.86	(18.54)	3–76	35.03	(15.65)	8–72
Girls	32.14	(15.24)	13–70	28.25	(17.69)	0–61	34.15	(17.17)	0–82
Problem Behavior — teacher-rated									
Boys	17.77	(19.39)	1–78	24.36	(16.60)	0–59	25.91	(21.22)	1–83
Girls	25.77	(20.76)	0–67	16.50	(13.73)	0–58	23.15	(19.01)	0–64

Note: Means and standard deviations are based on raw scores. Range of Social Co-Operation = 0–36; range of Social Interaction = 0–33; range of Social Independence = 0–33; range of Language Development = 0–90; range of Problem Behavior (parent- and teacher-rated) = 0–126.

a = Rated by parents only.

twins is higher than for opposite-sex twins, singletons, or even same-sex girls, and contrasts markedly with parent rating. Tests of significance indicate that teachers rate same-sex twins significantly higher on social co-operation than singletons, $t(1,158) = 2.86, p = .01$.

Social Interaction

This measure assesses children’s ability to gain and maintain acceptance and friendship with others, and is particularly focused on peer relations. The distribution of scores suggests that parents rate children higher than teachers do in this domain, and that overall, girls score higher than boys. Scores of twins and singletons are closely comparable. There were no significant differences between groups in this domain.

Social Independence

This measure assesses behaviors which are important in the achievement of independence and which primarily relate to conduct with peers. In this domain, no sex differences were evident. Opposite-sex twins had lower mean scores compared with singletons, particularly for parent ratings. Further, opposite-sex boys had the lowest mean scores. No statistical differences were found between boys and girls or between same-sex versus opposite-sex twins. However, parents, $t(1,192) = 3.45, p < .01$, and teachers, $t(1,164) = 2.54, p = .04$, both rated opposite-sex pairs as having lower levels of social independence than singletons.

Friendships

Singletons were found to have significantly more friends than opposite-sex twins, $t(1,143) = 4.35, p < .01$. There was a trend in which same-sex twins had more friends than opposite-sex twins, though this was not significant. There were however, significant differ-

ences in the number of friends who were shared (same sex = .39, opposite sex = .22). Tests of difference indicate that same-sex twins shared significantly more of their friends than opposite-sex twins, $t(1,106) = 6.8, p < .01$. Figure 1 shows the proportion of male and female friends by twin status and sex. While males have more male friends and females more female friends, there were no differences according to whether twins were the same or opposite sex, indicating a preference for same-sex play regardless of twin type.

Language Development

Results indicate that girls score consistently higher, particularly same-sex twin girls. In addition, mean scores were lowest for opposite-sex twins though not statistically significant.

Behavior Problems

Results indicate that parents and teachers consistently rate girls as having less behavioral problems than boys across twin and singleton groups, with the exception of teacher ratings of same-sex twins. Teachers rated same-sex boys as having fewer problems than same-sex girls. In the comparison of teacher ratings of same- and opposite-sex twins, an interaction approached significance ($p = .065$), with female same-sex twins rated as having more behavioral problems than female opposite-sex twins.

Table 2 presents correlations for both teacher and parent ratings on each of the six developmental outcomes measured. The patterns of association for teacher and parent ratings were similar. As might be anticipated, the subscales of social competency (co-operation, interaction and independence) were all significantly positively associated. The social competency

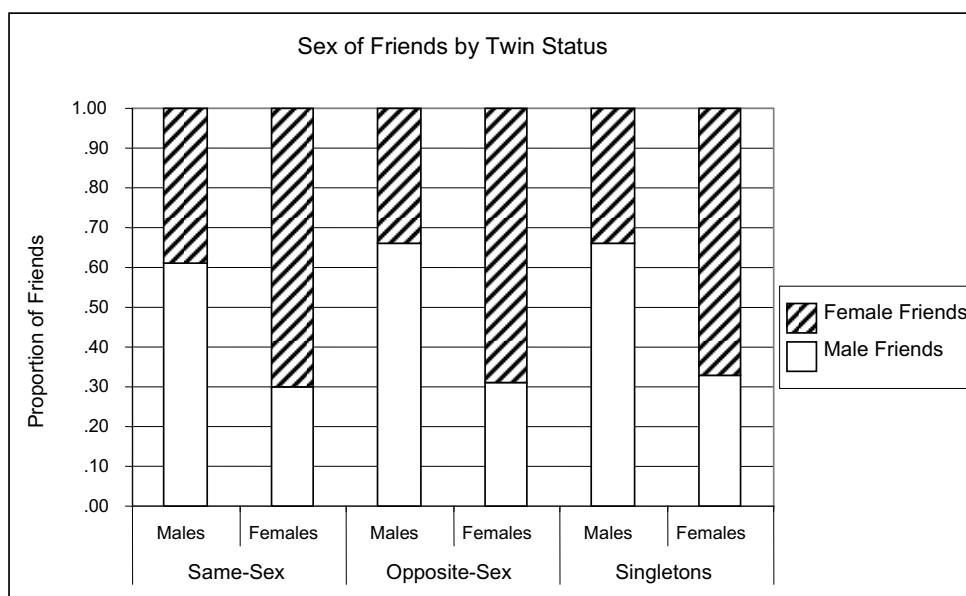


Figure 1
Proportion of male and female friends by twin status and sex.

Table 2

Pooled Within-Group Correlations for Dependent Variables and Covariates

Variable	1	2	3	4	5	6
Parent-rated variables						
1. Social Co-Operation	—	.44**	.35**	.15*	-.49**	.38**
2. Social Interaction		—	.64**	.34**	-.23**	.35**
3. Social Independence			—	.37**	-.31**	.28**
4. Number of Friendships ^c				—	-.09	.32**
5. Problem Behavior ^a					—	-.21**
6. Language Development ^d						—
Teacher-rated variables ^c						
1. Social Co-Operation	—	.50**	.48**	.09	-.77**	.31**
2. Social Interaction		—	.71**	.28**	-.33**	.24**
3. Social Independence			—	.16*	-.43**	.16*
4. Number of Friendships ^c				—	.07	.32**
5. Problem Behavior ^b					—	-.15
6. Language Development ^d						—

Note: a = Parent-rated Problem Behavior; b = teacher-rated Problem Behavior; c = Number of Friends (parent-rated only); d = Language Development (parent-rated only).

* $p < .05$; ** $p < .01$.

subscales were also significantly positively associated with language development, and significantly negatively associated with behavior problems. Behavior problems and language development were negatively associated, suggesting children with poor language were more likely to have behavior problems, though this effect was modest and was nonsignificant for teacher ratings. Interestingly, the number of friendships was associated (positively) with language development but not with ratings of behavior problems.

ANCOVA analyses were undertaken for the dependent variables: teacher- and parent-rated social co-operation, social independence and social interaction and parent report of friendship. Language development and problem behaviors were the covari-

ates. The focus was on any effects of twin status (Twinship) or Twinship \times Sex interactions. There were no significant main effects of Twinship or Sex, nor any significant Twinship \times Sex interactions for parent-rated Social Co-Operation, or for parent- and teacher-rated Social Interaction.

Two differences between same-sex and opposite-sex twins (i.e., twin type effects) emerged from the data. Both related to the social co-operation variable. Parents rated opposite-sex girls as higher in social co-operation than same-sex girls, $t(1,114) = 2.36$, $p = .02$. We further investigated this result as group means were similar. There were no differences when a simple ANOVA was conducted. The differences derived from adjustments of the mean due to the covariates, with same-sex girls scoring higher on language development and problem behavior than opposite-sex girls. Teachers rated same-sex boys as higher in social co-operation than opposite-sex boys, $t(1,89) = 2.69$, $p < .01$. No other differences between same-sex and opposite-sex twins (twin type effects) were found.

All other significant effects were of twin-singleton differences (i.e., twin effects).

There was a significant twin-singleton main effect for teacher-rated Social Co-Operation, $F(2,158) = 4.12$, $p = .02$, as presented in Table 3. Pairwise comparisons with a Bonferroni adjustment revealed that teachers rated same-sex twins significantly higher on social co-operation than singletons, $t(1,158) = 2.86$, $p = .01$.

There was a significant twin-singleton main effect for parent-rated Social Independence, $F(2, 192) = 6.24$, $p < .01$, as presented in Table 4. Pairwise comparisons with a Bonferroni adjustment revealed parents rated singletons significantly higher on social independence than opposite-sex twins, $t(1,192) = 3.45$, $p < .01$. There was also a significant twin-singleton main effect for teacher-rated Social Independence, $F(2,164) = 3.44$, $p = .04$, as presented in Table 5. Pairwise comparisons with a Bonferroni adjustment revealed teachers rated singletons higher on social independence than opposite-sex twins, $t(1,164) = 2.54$, $p = .04$.

Table 3

Analysis of Covariance for Teacher-Rated Social Co-Operation

Source	df	F	p	η^2
Teacher-rated Social Co-Operation				
Problem Behavior ^a	1	231.12	.00**	.59
Language	1	17.68	.00**	.10
Twinship	2	4.12	.02*	.05
Sex	1	0.30	.59	.00
Twinship \times Sex	2	1.26	.29	.02
Error	158	(8.46)		

Note: Values in parentheses represent mean square errors.

a = Teacher-rated Problem Behavior.

* $p < .05$; ** $p < .01$.

Table 4

Analysis of Covariance for Parent-Rated Social Independence

Source	df	F	p	η^2
Parent-rated Social Independence				
Problem Behavior ^a	1	19.75	.00**	.09
Language	1	9.70	.00**	.05
Twinship	2	6.24	.00**	.06
Sex	1	1.11	.29	.01
Twinship \times Sex	2	0.82	.44	.01
Error	192	(9.74)		

Note: Values in parentheses represent mean square errors.

a = Parent-rated Problem Behavior.

* $p < .05$; ** $p < .01$.

Table 5
Analysis of Covariance for Teacher-Rated Social Independence

Source	df	F	p	η^2
Teacher-rated Social Independence				
Problem Behavior ^a	1	40.57	.00**	.20
Twinship	2	3.44	.04*	.04
Sex	1	0.01	.91	.00
Twinship \times Sex	2	0.25	.78	.00
Error	164	(13.52)		

Note: Values in parentheses represent mean square errors.

a = Teacher-rated Problem Behavior. Language was not a significant covariate.

* $p < .05$; ** $p < .01$.

Table 6
Analysis of Covariance for Number of Friendships

Source	df	F	p	η^2
Number of Friendships				
Language ^a	1	19.78	.00**	.09
Twinship	2	13.07	.00**	.12
Sex	1	0.09	.77	.00
Twinship \times Sex	2	0.54	.58	.01
Error	191	(9.61)		

Note: Values in parentheses represent mean square errors.

a = Parent-rated Problem Behavior was not a significant covariate.

* $p < .05$; ** $p < .01$.

There was a significant twin-singleton main effect for Number of Friends, $F(2,191) = 13.07$, $p < .01$, as presented in Table 6. However, Levene's test of homogeneity of variance was breached ($p = .01$), thus this main effect needs to be interpreted with caution. A nonparametric test of difference (Kruskal Wallis) confirmed a significant overall difference between the Twinship groups, $\chi^2(2,198) = 24.37$, $p < .01$. Thus, pairwise comparisons with a Bonferroni adjustment were undertaken using separate error terms. These comparisons revealed that parents rated singletons as having significantly more friends than opposite-sex twins, $t(1,143) = 4.80$, $p < .01$.

Discussion

This study aimed to establish whether being an opposite-sex twin yields advantage in social competence. Based on studies from singleton populations and evidence from older twin populations, we hypothesized that the unique experience of sharing a social environment with a same-aged, but opposite-sex sibling might promote social development. The study's focus was children of 3 to 6 years as there is little data regarding this period in early childhood, which marks for many the beginning of large group social experiences and

the need for greater social adaptation. All children in this study regularly attended large group settings. We aimed to assess whether the finding of social advantage found in adolescence (Pulkkinen et al., 2003) and early to middle childhood (Koch, 1966) were also evident during the preschool period. A number of studies on the development of singleton children suggest that having an opposite-sex sibling promotes social development. We sought to identify whether there were similar advantages for social competence for opposite-sex twins.

This study's main aim was to examine any differences in social behavior between opposite-sex and same-sex twins. Our findings did not provide any consistent evidence of difference between same-sex or opposite-sex twins, as predicted by studies of older twins and studies of social development in singletons. Two differences emerged in social co-operation but the ratings between teachers and parents were not consistent. Given the small sample size these findings need to be treated with caution.

However, in comparing twins with singletons, we found a mild advantage of singletons over twins in early social development. This was evident in social independence, where opposite-sex twins scored significantly lower than singletons, in parent rating of behavioral problems, where same-sex males scored higher than singleton males, and in the number of friendships, where both same- and opposite-sex twins had smaller friendship pools than singletons. There were no differences in the amount of same-sex friends between twin groups or singletons, but consistent with previous findings (Thorpe & Gardner, 2006), opposite-sex twins were found to share less friends than same-sex twins.

Our results suggest that, in the early childhood period, there is no social advantage to being opposite. It may be that at this point in development, where same-sex peer interactions are normative, having a same-aged but opposite-sex sibling has no effect or is a disadvantage. Though no consistent statistical differences between same-sex and opposite-sex twins emerged, opposite-sex pairs had lower mean levels of social independence and fewer friends. Further, there is no evidence of a within opposite-sex pair advantage. Girls and boys in opposite-sex pairs performed more poorly on language measures than either same-sex twins or singletons. Further, girls in opposite-sex pairs were rated as having fewer behavior problems than same-sex girls or singletons, while their twin brothers were comparable to singleton and same-sex male counterparts. Our sample size was not large and may not have had sufficient statistical power to detect some differences. It did not have the statistical power of the large Finnish study conducted in adolescence. Nevertheless, the direction of findings suggests that a larger sample would not show social advantage.

Our study was based on parent and teacher report measures. There are two important implications of

this approach. First, it contrasts with the results of the Pulkkinen et al. (2003) study that used peer report. The use of parent and teacher report is a common and valid research method, commonly used with young children. Our results suggest that, from the observations by adults, opposite-sex children do not have an advantage in social competence; however, it may be that adult representation of social competency does not match those of peers. Future studies should incorporate peer response and observational data. The data collection method adopted by Pulkkinen et al. (2003) was of peer response, and future research adopting the same method in the early year period may yield similar findings of social advantage in opposite-sex twins. It may also be that standard measures do not allow the understanding of process in peer interaction, and if we seek to examine the origins of greater adaptivity evidenced later in twin children's lives it may be that such methods would provide greater insight. Second, the peer report method requires scrutiny. There may be bias in peer report of twin children's social competence even if subjects are blind to the purpose of the study. Twin status cannot be obscured. Further, when ratings are done of both sexes, by both sexes, it is likely that opposite-sex twins have greater familiarity with members of the opposite sex via sibling contact.

The finding of no advantage for opposite-sex twins may be specific to the early years. It may be that learning from opposite-sex peers occurs later or may become more evident at a later life stage, when opposite-sex relationships are normative. This study highlights the need for longitudinal studies of twin children's social development including an examination of opposite-sex twins. Such data would not only inform understanding of twin children's development, but may also inform understanding of process in social development for all children. Longitudinal studies would demonstrate the trajectories of social development of opposite-sex twins and underlying mechanisms. If as Pulkkinen et al. (2003) suggest, opposite-sex twin children are more socially competent, identifying the etiology of this effect has potential to inform and direct intervention with those who have poor social competency, both twin and singleton.

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