Genetic and Environmental Links between Children's Temperament and their Problems with Peers

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ABSTRACT

Peer relationships become central to children's development as they develop social skills and theory of mind in their early development. We investigated the role of temperament in children's peer problems. Mothers of three-year-old twins (N=759 pairs) rated their children's temperament using the EAS scale (1) and children's peer problems using the Strengths and Difficulties Questionnaire (2). Children's peer problems were positively associated with their negative emotionality, and related negatively to their sociability and activity level. Genetics contributed to individual differences in temperament and peer problems, with peer problems substantially heritable (44%). The remaining variance is attributed to environmental factors. Genetic factors largely mediated the correlations between peer problems and temperament. The findings point to the importance of children's temperamentally-based characteristics in their social development.

Peer relationships become important as children develop social skills and theory of mind in early development (3). Substantial individual differences in children's social skills are observed by the third year of life, and peer problems observed in the first years of life are related to social and emotional problems in later ages (4). Peer problems are characterized by children's reduced ability to relate to other children in a positive and satisfactory way. These problems may be manifest in a child's avoidance of the company of other children, or in a negative attitude or rejection by other children.

PEER PROBLEMS AND TEMPERAMENT

Research has identified numerous predictors of children's peer problems. For example, experience with attachment figures (5), and some child personal characteristics, such as aggression and prosocial behavior, predict peer problems (6). We studied the role of *temperament,* early emerging (and arguably biologically based) individual differences in emotional and physiological reactivity and regulation (1), in children's peer problems. These differences, observable as early as during the fetal period (7), are expressed in traits such as negative and positive emotionality, activity level, sociability and shyness (1, 8).

Research found a relationship between temperament and social behavior. For example, difficult temperament in infancy is related to children's externalizing behavior (9) and negative or little affect in toddlers relates to less empathy (10). Empathy and externalizing problems are factors that can influence the quality of children's social relationships. Research reported relationships between temperament and peer problems, suggesting that early temperament (e.g., shyness) can predict peer problems at a later age (11, 12). For example, reticent children with higher scores in mother-reported social fears at 14 and 24 months tended to have low levels of social behavior with unfamiliar peers at 4 years (12). Our study adds a genetic and environmental perspective to the peer problems-temperament relationship. Specifically, we investigate the relationships, at the phenotypic level, between children's peer problems, on the one hand, and three temperamental dimensions, on the other hand: Negative emotionality, sociability and activity level. We then investigate the genetic and environmental contributions to these phenotypic relationships.

Negative emotionality indicates an individual ten-

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dency to experience distress, ranging from lack of reaction to extreme, uncontrolled emotional responses to negative events (13). Children who become upset quickly will find it hard to play or maintain relationships with other children. Therefore, we expected a positive relationship between children's negative emotionality and their peer problems.

Sociability refers to children's enjoyment of interpersonal contexts (13). Children who enjoy the presence of other children are expected to look for the company of others and therefore are more likely to initiate and maintain close relationships, in comparison to children who prefer to be alone. Therefore, children's sociability was hypothesized to relate negatively to their peer problems.

Activity level is composed of vigor and tempo, ranging from lethargy to an extreme push of energetic response (13). Active and energetic children create more opportunities for contacts as opposed to children who are more passive and less dynamic. Although there is no direct evidence for the role of activity level in peer problems, there is some evidence that inhibitory control relates positively to social competence (14). Thus, extremely active children may have problems relating to their peers; for example, children with an attention-deficit hyperactivity disorder (ADHD) are more likely than other children to suffer from peer problems as adolescents (15). On the other hand, the play patterns of young children require at least a moderate degree of activity in order to engage with other children. Therefore, we are not proffering a specific hypothesis for the direction of the relationship between activity levels and peer problems.

GENETIC AND ENVIRONMENTAL EFFECTS ON PEER PROBLEMS AND TEMPERAMENT

We approach the issue of genetic and environmental contributions to individual differences using the twin design, comparing monozygotic (MZ) twins, who share all of their genes, with dizygotic (DZ) twins, sharing 50% of their genes. Assuming that twins of both types similarly share their environments, higher similarity in MZ versus DZ twins indicates genetic influence. Similarity beyond this genetic effect is attributed to the environment shared by twins, and further differences between twins are ascribed to non-shared environment or to measurement error (16).

Research has found both genetic and environmental contributions to individual differences in temperament (17, 18). For example, genetic factors were found for activity level in different contexts (19). Similarity in temperament is substantially higher for MZ twins than for DZ twins, indicating heritable effects (e.g., 20, 21).

Genetic factors were found to be significant in peer problems as well (11, 22), affecting both peer rejection (3) and popularity (23). In a study using the Strengths and Difficulties Questionnaire (SDQ) (2), heritability for seven-year-old British twins was estimated as accounting for 56-57% of individual differences in parent-reported peer problems, and at 37-76% for teacher-reported problems (24).

THE CURRENT STUDY

In this study we ask three main questions: (a) What are the relationships between temperament and peer problems? (b) What are the relative contributions of genetics and the environment to individual differences in temperament and peer problems? (c) What are the genetic and environmental contributions to the relationship between temperament and peer problems? We answer these questions with mother report data from a sizeable sample of MZ and DZ three-year-old twins. Although parental reports may be biased due to parental perceptions and beliefs, they provide an efficient way to obtain estimates of genetic and environmental influences from a large community sample. Other data collection methods, such as behavioral observations, may be less biased. However, they are based on relatively brief time frames and lack the "long time frames within a context of what is likely to be meaningful in the child's life" (25, p. 1450).

METHOD

PARTICIPANTS

Families in this study were participants in the Longitudinal Israeli Study of Twins (LIST) (26, 27). All Jewish families identified as having twins by the Israeli Ministry of the Interior were contacted by mail close to the twins' third birthday. Mother report data from 754 twin pairs born in 2004 and in early 2005 were available for this report. In addition, father reports were available from a small sample of 44 twin pairs (32 of which overlapping with the twins rated by their mothers) who participated in lab assessments of empathy at the age of 3.5 years (28). Twin zygosity was assessed through a parent questionnaire of physical similarity, which has been shown to be over 95% accurate when compared to DNA testing (29). The sample included 162 monozy-

Table 1. *Means (and Standard Deviations) of Scores on Peer Problems and Temperament.*

	Peer problems	Negative emotionality	Sociability	Activity
MZM (N=86)	3.68	15.40	15.92	20.44
	(1.60)	(4.51)	(2.51)	(2.91)
DZM (N=139)	3.70	15.52	15.68	20.09
	(1.27)	(4.29)	(2.57)	(3.12)
DZO-boys (N=151)	3.99	15.89	15.47	20.11
	(1.66)	(4.50)	(2.68)	(3.54)
MZF (N=79)	3.62	16.29	15.89	19.83
	(1.28)	(6.42)	(2.67)	(3.23)
DZF (N=157)	3.66	15.59	15.46	19.36
	(1.41)	(4.21)	(2.79)	(3.13)
DZO-girls (N=148)	3.58	15.12	15.72	19.84
	(1.36)	(4.12)	(3.02)	(3.29)

Note. MZM=monozygotic males; DZM=dizygotic males; MZF=monozygotic females; DZF=dizygotic females; DZO=dizygotic opposite sex twins. Sample sizes refer the number of individuals for which means were computed (one twin per pair selected randomly).

gotic, 294 dizygotic same-sex, and 298 opposite-sex twin pairs (Table 1).

MEASURES

Peer problems were assessed with the Peer Problems subscale of the 25-item SDQ (2), which measures peer problems, emotional symptoms, conduct problems, hyperactivity/inattention and prosocial behavior, with five items for each subscale. This measure is widely used for screening, longitudinal monitoring of therapeutic effects, and scientific research (e.g., 30). In this report, only the peer problem scale was used. One item, "Rather solitary, tends to play alone," was judged to be too similar in content to the sociability items described below, and was therefore dropped for current purposes. In a factor analysis all items loaded (.44 or more in absolute value) on a first factor, accounting for 33% of the variance. The scores on the four items were summed to a single peer problems score.

Temperament was rated by parents using the EAS Temperament Survey (1) which assesses children's negative emotionality, activity level, sociability and shyness. For current purposes, we did not use the shyness scale because of the strong conceptual overlap between shyness and peer problems. A Multidimensional Scaling analysis of the three EAS scales showed clear distinctions between the items of each subscale. Nevertheless, one sociability item was dropped because it appeared close to the negative emotionality items, which can be attributed to its focus on negative feelings ("When alone, child feels isolated").

ANALYSES

Descriptive analyses included mean comparison of peer problems and temperament scores across zygosity and sex, and correlations between peer problems and temperament. In addition, we regressed peer problems on the temperament measures to test their relationships simultaneously. Twin correlations for all five zygosity groups (male and female MZ and DZ, and opposite-sex DZ pairs) were calculated for each variable.

Model-fitting analyses. We analyzed a bivariate genetic model, including peer problems and each temperament measure using Mx (31), using variance-covariance matrices from both twins within a pair, the models estimate the variance components and correlations across individuals (capitalizing on genetic differences between different types of pairs).

For each variable separately, variance components were estimated for additive genetic influence (A, correlating 1.0 and .5 for MZ and DZ twins, respectively), shared or common environment (C correlating 1.0 for both MZ and DZ pairs), and non-shared environment and error (E), which include any environmental effect not shared by twins, such as differential parental treatment, unique to each member of a twin pair and therefore correlating 0 for all twins. Model fitting can also be used to assess sex differences in ACE parameters (*sex-limitation* models; 32, 33). Basically, we looked for (a) qualitative sex differences as assessed by $r_g o$ (overlap of genetic influences on male and female behavior) smaller than .50, (b) quantitative sex differences in ACE parameters (e.g., differences in heritability), and (c) phenotypic variance differences between the sexes.

In addition to estimating variance components for each variable separately, this correlated factors model (32) specifies correlated genetic, shared environmental and non-shared environmental effects that influence both peer problems and temperament. The extent that the MZ cross-trait (peer problems and temperament) cross-twin correlation exceeds the DZ cross-trait twin correlation indicates the degree of genetic overlap between the two traits weighted by the square roots of heritabilities of the two traits. This genetic contribution to the phenotypic correlation between the traits includes the genetic correlation, indicating the extent to which the genetic influences on peer problems over-

lap with the genetic influences on temperament regardless of the heritabilities of the two traits. Similarly, the correlation between shared environmental influences on peer problems and temperament and the non-shared environment correlation (the extent to which the non-shared environmental influences on the two traits overlap) are estimated. Bivariate heritability, i.e., the proportion of the phenotypic covariance between two variables attributed to genetic covariance between them, is the product of the genetic path coefficient influencing each variable and the genetic correlation between them, divided by the total phenotypic correlation between the variables. Bivariate shared and non-shared environmental contributions to variance and covariance between the two variables are similarly estimated. Together, bivariate heritability, shared and non-shared environmental effects sum to the total phenotypic correlation.

RESULTS

AVERAGE DIFFERENCES

Table 1 presents the means and standard deviations of all study variables, separately for each zygosity group. Because twin scores are not independent, of each other, for mean comparisons only the scores of one twin per pair were used. A set of analyses of variance tested for sex and zygosity differences, separately for each variable, using a 2 (male vs. female) X 3 (monozygotic, dizygotic, same-sex, and dizygotic, opposite-sex) design. No effects for sex, zygosity or their interaction were found.

PEER PROBLEMS AND TEMPERAMENT: PHENOTYPIC RELATIONSHIPS

Table 2 presents the correlations among twins' scores on peer problems and temperament. separately for each zygosity group. Cross-twin same-trait correlations are printed in boldface type on the diagonals of each zygosity group. Same-twin cross-trait correlations appear below the diagonals, and cross-twin cross-trait correlations above them.

Using data from a single twin randomly selected from each pair, across gender and zygosity, peer problems correlated positively with negative emotionality, as hypothesized, r =.12, p < .001. Also as hypothesized, sociability related negatively to peer problems, r = -.25, p < .001. Finally, activity level related negatively to peer problems, r = -.22, p < .001. As Table 2 shows, most of the correlations were in the same direction in the different zygosity groups, although six of the 15 correlations were not significant (this was true mainly for the smaller monozygotic subsamples). As an exception, the positive correlation between negative emotionality and peer problems was not found among dizygotic male twins.

Table 2. *Twin Correlations for Peer Problems and Temperament*

	Peer problems	Negative emotionality	Sociability	Activity
Monozygotic male twins				
Peer problems	**.92****	.22*	-.11	-.22*
Negative emotionality	.18	**.59****	.01	.01
Sociability	-.06	.06	**.62****	.23*
Activity	-.22*	-.02	.38**	**.68****
Dizygotic male twins				
Peer problems	**.66****	.08	-.16	-.20*
Negative emotionality	-.03	**.21***	.13	.05
Sociability	-.32**	-.02	**.21***	-.01
Activity	-.09	-.10	.48**	-.03
Monozygotic female twins				
Peer problems	**.88****	.08	-.24*	-.21
Negative emotionality	.07	**.43****	.05	.09
Sociability	-.22	.03	**.76****	.26*
Activity	-.28*	.03	.37**	**.66****
Dizygotic female twins				
Peer problems	**.68****	.15	-.04	.18*
Negative emotionality	.22**	**.34****	-.08	.00
Sociability	-.34**	-.13	**.28****	-.06
Activity	-.26**	-.05	.42**	**-.06**
Dizygotic Opposite-sex twins				
Peer problems	**.68****	.15**	-.11	-.13*
Negative emotionality	.14*	**.38****	.02	-.04
Sociability	-.25**	-.02	**.21****	.04
Activity	-.25**	.03	.41**	**.05**

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Note. Cross-twin same-trait correlations are printed in boldface type and appear on the diagonals. Within-twin correlations appear below the diagonals, and cross-twin correlations above it.

Because two of the temperament dimensions interrelated (sociability and activity level, r = .42, p < .001), we ran a multiple regression analysis to examine the joint predictive contributions of the different temperament dimensions to peer problems. All three temperament variables had independent contributions, as indicated by their significant relationships with peer problems when entered together in the regression analysis: nega-

tive emotionality, $\beta = .11$, $t = 3.10$, $p < .005$; sociability, $\beta = -.20$, $t = 5.14$, $p < .001$; activity level, $\beta = -.14$, $t = 3.57$, $p < .001$; Adjusted $R^2 = .09$.

The father subsample enabled a small-scale replication of the main phenotypic findings. First, positive correlations were found between mothers' and fathers' reports on all study variables: peer problems, $r = .56$, $p < .001$; negative emotionality, $r = .52$, $p < .005$; sociability, $r = .39$, $p < .05$; activity, $r = .52$, $p < .005$. Second, using father reports alone, the relationships between peer problems and temperament were replicated for negative emotionality although with the small sample size this effect was not significant, $r = .21$, *ns*. Moreover, as with the mother reports, peer problems correlated negatively with sociability, $r = -.60$, $p < .001$, and activity level, $r = -.37$, $p < .05$.

To see whether the same results could be obtained with different informants, we correlated mother-rated peer problems with father-rated temperament. The results were replicated for sociability, $r = -.36$, $p < .05$, and activity, $r = -.39$, $p < .05$, though insignificantly so for negative emotionality $r = .08$, *ns*. Similar findings, though weaker and not significant with this sample size, were found when we correlated father-rated peer problems with mother-rated sociability, $r = -.13$, *ns*, and activity, $r = -.20$, *ns* < .05, but not negative emotionality, $r = -.01$, *ns.*

GENETIC AND ENVIRONMENTAL EFFECTS ON PEER PROBLEMS AND TEMPERAMENT

To examine genetic and environmental influences on peer problems and temperament, we began by comparing MZ and DZ twin correlations (shown in boldface type in Table 2). For all study variables, MZ correlations were larger than DZ correlations, indicating genetic influence. MZ correlations were less than 1.0, indicating influence of non-shared environment and measurement error. For peer problems, and for girls' negative emotionality, DZ correlations were greater than half the MZ correlations, indicating shared environmental influence. For sociability and activity, DZ correlations were lower than half the MZ correlations, indicating no shared environmental influences on these variables. Table 3 presents the estimates of the relative contributions of genetics and the environment to individual differences. The models fit the data moderately well, as indicated by root mean square error of approximation (RMSEA) coefficients between .02 and .08.

Regarding *peer problems*, constraining r_gO to equal .50 for DZ opposite-sex (DZO) twins as for DZ same-sex twins did not affect model fit ($\chi^2(df=1) = 0$, *ns*). Equating ACE parameters for males and females did not worsen model fit ($\chi^2(df=3) = 0.17$ *ns*. We therefore estimated ACE parameters jointly for boys and girls. Heritability accounted for 44% of individual differences in *peer problems*, and the remaining 56% were accounted for by both the shared (46%) and the non-shared environment and error (10%).

A different picture emerged for *negative emotionality*. Constraining r_gO to.50 for DZO twins again did not affect model fit ($\chi^2(df=1) = 0$, *ns*). Dropping the genetic effect that was estimated at 0.06 for girls did not worsen model fit either and a model with no heritability for girls and setting r_gO at .00 was preferred, ($\chi^2(df=2) = 1.75$ *ns*). Because of the sex differences in heritability, we estimated different ACE components for boys and girls, as noted in Table 3.

Constraining r_gO in *sociability* and *activity* to.50 for DZO twins did worsen model fit (sociability, $\chi^2(df=1) = 3.98$, $p < .05$; activity, $\chi^2(df=1) = 7.82$, $p < .01$); r_gO was thus unconstrained and estimated at .28 for sociability and .14 for activity. Equating ACE parameters for males and females, and dropping the shared environment effect (estimated at 0.00) did not worsen model fit (sociability, $\chi^2(df=3) = 1.28$ *ns;* activity, $\chi^2(df=3) = 2.07$ *ns* . We therefore estimated ACE parameters jointly for boys and girls. Heritability accounted for 70% of individual differences in sociability and 53% in activity, with the remaining variance accounted for by the non-shared environment and error.

Table 3. *Estimates of Variance Components (and 95% Confidence Intervals) Accounting for Individual Differences in Peer Problems and Temperament*

Variable	Heritability				Shared environment				Non-shared environment and error			
Peer problems	.44	(.33	-	.57)	.46	(.34	-	.56)	.10	(.08	-	.12)
Negative emotionality (boys)	.55	(.41	-	.66)	.00	(.00	-	.00)	.45	(.34	-	.59)
Negative emotionality (girls)	.00	(.00	-	.00)	.28	(.17	-	.39)	.72	(.62	-	.83)
Sociability	.70	(.62	-	.76)	.00	(.00	-	.00)	.30	(.24	-	.38)
Activity	.53	(.39	-	.65)	.00	(.00	-	.00)	.47	(.36	-	.61)

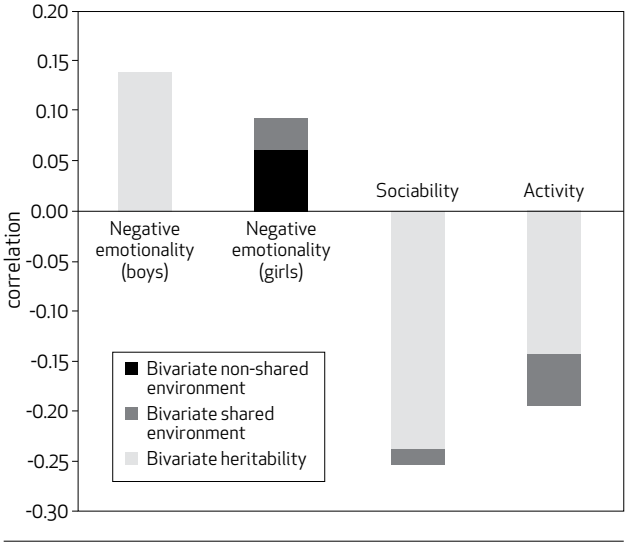
GENETIC AND ENVIRONMENTAL EFFECTS ON THE PEER PROBLEMS – TEMPERAMENT RELATIONSHIP

Cross-twin/cross-trait correlations indicate whether there is genetic or environmental influence on the *relationship* between temperament and peer problems. As shown in Table 2 (above the diagonals), the cross-twin/cross-trait correlations between peer problems and temperament tended to be stronger for MZ twins than for DZ twins, indicating a genetic influence common to peer problems and to temperament. One exception concerns the relationship between girls' negative emotionality and their peer problems, which was similar for MZ and DZ twins, indicating a shared environment effect accounting for the relationship. Model-fitting analyses decomposed these phenotypic correlations into their genetic and environmental components by analyzing the variance-covariance matrices for peer problems and temperament.

Table 4 presents estimates for the genetic and environmental correlations between peer problems and the temperament measures. Estimates for negative emotionality are presented separately for girls and boys because of the results of the sex limitation analyses described above. Figure 1 presents the correlations between peer problems and temperament. Each correlation is depicted according to the relative contributions of bivariate heritability, bivariate shared environment effects, and bivariate non-shared environment to the correlations between temperament and peer problems.

The negative correlations between sociability and activity and peer problems were accounted for by bivariate heritability and to a lesser extent by bivariate non-shared environment and error. A more complex picture emerged for negative emotionality. The positive correlation with boys' peer problems was fully accounted for by the genetic correlation between peer problems and negative emotionality. In contrast, girls' negative emotionality was not estimated as being substantially influenced by heritability. Its moderate relationship with peer problems was accounted for mainly by the bivariate shared environment.

Figure 1. *Decomposing the Relationships between Peer Problems and Temperament to their Genetic and Environmental Components*



DISCUSSION

Children's temperament has meaningful associations with their peer relationships problems. Children characterized by negative emotionality and low sociability and activity level tended to have greater peer problems. Importantly, all the three temperament variables had independent contributions to peer problems. Further research should address how temperament dimensions interact with each other and with additional factors in accounting for children's peer problems. For example, sociability refers to children's enjoyment of interpersonal contexts, and thus relates to lower peer problems. However, a child can be highly sociable but lack the social competence needed to fulfill this motivational goal. Perhaps, due to high levels of negative emotionality as our results show.

Table 4. *Genetic and Environmental Correlations (and 95% Confidence Intervals) between Peer Problems and Temperament*

Variable correlating with peer problems	Genetic correlation				Shared environment correlation				Non-shared environment correlation			
Negative emotionality (boys)	.28	(.13	-	.45)	.00	(.00	-	.00)	.00	(.00	-	.00)
Negative emotionality (girls)	.00	(.00	-	.00)	.17	(-.06	-	.40)	.12	(-.04	-	.27)
Sociability	-.43	(-.54	-	-.32)	.00	(.00	-	.00)	-.09	(-.24	-	.07)
Activity	-.30	(-.44	-	-.17)	.00	(.00	-	.00)	-.23	(-.39	-	-.05)

GENETIC AND ENVIRONMENTAL EFFECTS ON PEER PROBLEMS AND TEMPERAMENT

Peer problems showed strong familial influences, consisting of both genetic (44%) and shared environmental (46%) effects. The shared environment effects may indicate the role of parental behavior. A meta-analysis has shown that the quality of the child-mother attachment was related positively to peer relations (34). Interventions involving the promotion of secure attachment considering also children's temperament might prove helpful in the reduction of peer problems. Parents' monitoring and guidance in their children's relationship may also be important, and especially likely at the young age of three. By age seven, shared environmental influences on peer problems diminish in importance (24). Although a decline in the importance of the shared environment has been observed for other traits as well (e.g., prosocial behavior, 35), peer problems may be especially affected by the life transitions associated with moving from preschool to school, as the social environment of children becomes increasingly diverse with age, leaving less room for familial environmental influences.

Sociability, activity, and peer problems. Genetic effects account for most of the variance in activity level (53%) and sociability (70%), replicating past findings of temperament heritability (36). The higher MZ twin correlations indicate heritable effects. However, the DZ correlations are much lower than could be expected based on the 50% shared genetic heritage of DZ twins. This could indicate that the MZ correlation is so much higher because parents of MZ twins inflate their similarity, because there is a non-additive genetic effect, or because there are contrast effects, reducing DZ twin similarity. Research by Saudino et al. (24) indicates that the third possibility is the correct one.

Negative emotionality and peer problems. Negative emotionality presents a complex set of findings, as it was substantially heritable in boys but not in girls. We are not aware of other studies showing no heritability for girls' negative emotionality. One study that tested for sex limitation did not find sex differences in the genetic and environmental influences on negative emotionality with a French twin sample (37). The different gender patterns may be culture-specific, but we would like to await a replication before speculating on the reasons for this finding.

Bivariate genetic and environmental effects. At the phenotypic level, children who are active and very sociable have less peer problems. The bivariate genetic analyses traced most of this association to overlapping genetic influences. Because peer problems involve both the child and other children (the peers), the genetic effects on peer problems may actually reflect a gene-environment correlation in which the child's genetically-influenced temperament elicits peer reactions associated with the child's genotype (38).

The bivariate non-shared environment effects also accounted for a small proportion of the phenotypic correlation between peer problems and temperament. These effects may reflect differences in the environments children encounter. For example, one of the twins, due to having exclusively experienced a certain life event, may have become less sociable and subsequently developed more peer problems. Another possibility is that parental differential treatment accounts for the subtle differences making twins different on both peer problems and temperament (39).

STRENGTHS AND LIMITATIONS

The use of a large community sample is a methodological strength of this study. It enabled detecting the modest phenotypic correlations between different dimensions of temperament and peer problems and assessing the genetic and environmental contributions to these modest phenotypic correlations.

The reliance solely on parental reports is a limitation. Parent reports were moderately positively correlated with teacher reports on children's peer problems (24). Modest phenotypic correlations in activity and sociability (but not negative emotionality) were also found between teacher and tester ratings (36), indicating that no two sources of information are in perfect agreement. In future research, multiple rater scores from different contexts should be obtained and compared for better understanding the processes involved in temperament and peer problems.

CONCLUSION

We found meaningful relationships between temperament and children's peer problems. Bivariate heritability largely accounted for these effects. Our findings point to the importance of temperament and genetics in the social development of children. The findings indicate that temperament dimensions should be taken into account while building peer problem interventions. In addition, beside genetic factors, non-shared environmental influence (e.g., the environment in different classes at school) should be taken also into consideration.

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