Research Article

Mate Choice and Friendship in Twins

Evidence for Genetic Similarity

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ABSTRACT—*This study examined the genetic and environmental contribution to people's preference for spouses and friends to be similar to themselves. In their responses to 130 personality, attitude, and demographic questions, 174 pairs of monozygotic (MZ) twins resembled each other (r = .53) more than did 148 pairs of dizygotic (DZ) twins (r = .32), 322 pairs of spouses (r = .32), and 563 pairs of best friends (r = .20). It was not previously recognized that spouses and friends are as similar as DZ twins. MZ twins also chose spouses and best friends more similar to their co-twins' friends and spouses than did DZ twins (mean rs = .22 vs. .14). The twins' preference for spouses and friends similar to themselves was about 34% due to the twins' genes, 12% due to the twins' common environment, and 54% due to the twins' unique (nonshared) environment. Similarity to partners was more pronounced on the more heritable items than the less heritable items. It is concluded that people are genetically inclined to choose as social partners those who resemble themselves at a genetic level.*

As the English language makes obvious, "likeness goes with liking." Similarity, whether actual or perceived, is one of the most important variables in all of social psychology, influencing interpersonal processes from attraction to grouping and from persuasion to prejudice. People's preference for their social partners to be similar to themselves is usually attributed to cultural and cognitive factors, such as being raised in a particular way or confirming one's judgments about the world. Evolutionary factors may also be at work through genes and sexual imprinting (Bereczkei, Gyuris, & Weisfeld, 2004; Rushton, 1989a).

In a study of 1,000 sexually interacting couples of northern European appearance (judged by photographs), couples who produced a child together were 52% similar with respect to 10 blood groups, whereas those who did not were only 44% similar (Rushton, 1988). Another study found that an optimal amount of similarity is not 100%. Women prefer the scents of men with genes somewhat similar to their own—not those of men with genes nearly identical or with genes totally dissimilar to their own (Jacob, McClintock, Zelano, & Ober, 2002). Each woman's choice was based on the human leukocyte antigen (HLA) gene sequence—the basis for personal odors and olfactory preferences—inherited from her father, but not her mother. In a third study, people rated the attractiveness of faces of the opposite sex, including of their own faces morphed to look like a face of the opposite sex. Both men and women rated their own morphed faces as the most attractive, even though they did not recognize the photos as images of themselves (Penton-Voak, Perrett, & Pierce, 1999). In yet another study, people said they trusted a stranger's face more when it had been morphed with their own than when it was unchanged (DeBruine, 2002). Familiarity was ruled out as an explanation of the results by using morphs of celebrities; only self-resemblance mattered.

The evidence that people tend to be similar to their spouses and friends is pervasive (Rushton, 1989a). The correlations are greatest on sociodemographic variables such as age, ethnicity, and educational level ($r = .60$), next largest for opinions and attitudes ($r = .50$), and then for IQ and cognitive ability ($r = .40$). The correlations are smallest, but still significant, for personality traits ($r = .20$) and physical characteristics ($r = .20$). Even marrying across ethnic lines may "prove the rule." In Hawaii, men and women who married cross-ethnically were more similar in personality to their spouses than were those who married within their group, suggesting that couples "make up" for ethnic dissimilarity by choosing spouses more similar to themselves in other respects (Ahern, Cole, Johnson, & Wong, 1981).

A genetic contribution to the preference for between-spouse similarity is implied by the finding that within sets of homogeneous traits, similarity is more pronounced on those more heritable. In the case of physical attributes, Russell, Wells, and

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Rushton (1985) found spousal similarity was greater on more heritable features such as middle-finger length (80% heritable) than on less heritable ones such as upper-arm circumference (50% heritable). For personality and leisure-time pursuits, Rushton and Russell (1985) found spousal similarity greater for more heritable items such as enjoying reading (41% heritable) than for less heritable items such as having many different hobbies (20% heritable). In cognitive ability, Rushton and Nicholson (1988) found spousal resemblance was most marked on the more heritable of 15 subtests from the battery of tests used in the Hawaii Family Study of Cognition and 11 subtests from the Wechsler Adult Intelligence Scale. Spouses who are similar on the most heritable traits report greater marital satisfaction than spouses who are similar on less heritable traits (Russell & Wells, 1991).

In a study of friends and acquaintances, Rushton (1989b) compared long-term (nonhomosexual) male friends of European ancestry with respect to the same 10 blood groups used in the study of sexual partners (Rushton, 1988). Friends were significantly more similar (54%) than random pairs drawn from the same sample (48%). They were also more similar on a wide range of physical, personality, and social attitude measures, and similarity was more pronounced on the more heritable attitudes, such as agreement with the death penalty (51% heritable), than on the less heritable attitudes, such as agreement with Bible truth (25% heritable). Tesser (1993) extended these results to liking in acquaintances by manipulating people's beliefs about how similar they were to other people on attitudes preselected as being either high or low in heritability. He found that people liked others more when they were similar on more heritable attitudes than when they were similar on less heritable attitudes.

Twin and adoption studies also suggest the preference for similarity is heritable. Rowe and Osgood (1984) analyzed data from 530 adolescent monozygotic (MZ) twins (who share 100% of their genes) and dizygotic (DZ) twins (who share 50% of their genes) and found antisocial behavior was about 50% heritable. Moreover, the correlation of .56 between an individual's degree of delinquency and that of his friends was mediated genetically, with adolescents disposed to delinquency being genetically inclined to seek out as friends other adolescents who were similarly inclined. In a study of 396 siblings from both adoptive and nonadoptive homes, Daniels and Plomin (1985) found that whereas the friends of biological siblings resembled each other, those of adoptive siblings did not.

Not all twin studies have concluded that resemblance is due to genetic preferences. Lykken and Tellegen (1993) reported a study of 901 pairs of married twins and 1,052 of their spouses. A number of their findings favored a genetic preference for similarity: (a) Spouse pairs resembled each other on 88 out of 88 variables (personality, social attitudes, religiosity, and leisure-time interests), (b) these variables were moderately to substantially heritable, (c) the spouses of MZ twins rated their spouse's friends as more similar to themselves than did the spouses of DZ twins (44% vs. 30%), and (d) the spouses of MZ twins liked their

spouse's co-twin more than did the spouses of DZ twins (39% vs. 25%). However, Lykken and Tellegen were more impressed that (a) difference scores between the spouses of MZ twins were no smaller than those between the spouses of DZ twins and hardly larger than those for random pairs (the correlation equivalents were .14 vs. .11 vs. 0.00, respectively) and (b) MZ twins did not like their co-twin's spouse more than did DZ twins (39% vs. 37%).

The present study of twins, spouses, and friends used model-fitting procedures to examine genetic and environmental hypotheses about the basis for social assortment. Model fitting gives more accurate estimates of genetic and environmental influence than do difference scores or correlations because model fitting takes more of the variance into account (Plomin, DeFries, McClearn, & McGuffin, 2001). Our raw data were the variances and covariances between and within twin pairs. The between-pairs mean squares reflect both pair resemblances and pair differences, and the within-pairs mean squares reflect pair differences. We tested several non-mutually exclusive hypotheses about why partners resemble each other.

METHOD

Questionnaires assessing demographic, attitudinal, and personality information were mailed to approximately 1,400 twin pairs from the adult twin register at the University of London Institute of Psychiatry. Each twin received three questionnaires, one for him- or herself, one for the twin's spouse, and one for the twin's same-sex best friend. These were marked "Twin," "Same-Sex Friend (Non-Relative)," and "Spouse." About 480 twins responded. One year later, a follow-up questionnaire was mailed to those twins who had not responded but whose co-twin had, increasing the sample size nearly 25%. Each respondent was instructed to complete the questionnaire independently. Twins were to return a best friend's and a spouse's questionnaire along with their own in a prestamped, addressed envelope.

Each twin's questionnaire contained 236 items; the questionnaires for the friends and spouses contained 152 items. For the present study, we analyzed responses to the 130 items common to twins, friends, and spouses. These items assessed physical characteristics (height and weight; 2 items); demographic background, such as educational level (3 items); social attitudes, such as political affiliation (3 items); and 122 items from the Personality Research Form (PRF; Jackson, 1974) and the Eysenck Personality Questionnaire (EPQ; Eysenck & Eysenck, 1975) measuring the scales of Autonomy and Cognitive Structure (from the PRF) and Extraversion, Neuroticism, Psychoticism, and Lie (from the EPQ).

The present study is based on the returns from 322 twin pairs: 174 MZ pairs (131 sister pairs, with 232 best friends and 145 spouses; 43 brother pairs, with 71 best friends and 44 spouses) and 148 DZ pairs (82 sister pairs, with 149 best friends and 87 spouses; 28 brother pairs, with 47 best friends and 16 spouses; 38 opposite-sex

pairs, with 64 best friends and 30 spouses). The returns were complete for both friends in 140 pairs of MZ twins and 118 pairs of DZ twins, and for both spouses in 73 pairs of MZ twins and 50 pairs of DZ twins. The return rate, degree of greater response from women than men and from MZ twins than DZ twins, and representativeness of the general population are comparable to what has been found in previous studies with this register and other volunteer twin samples (Rushton, Fulker, Neale, Nias, & Eysenck, 1986).

RESULTS

Missing data (less than 2% of the items) were replaced using the sex-specific item mode for the entire sample comprising all twins, spouses, and friends combined ($N = 1,529$). Respondents' ages ranged from 18 to 75 years, with a mean of 32 years. Respondents came from mostly middle- and upper-middle-class family backgrounds, had some postsecondary education, and enjoyed an above-average level of income and residence. The means, standard deviations, and internal consistencies of the personality scales (Cronbach's α) were similar to those in previously published studies with this register (mean α across all items = .73). For 488 of the twins, 8-year test-retest correlations on the four EPQ scales ranged from .51 to .71 ($ps < .01$).

Table 1 reports the similarity correlations on 14 variables for the MZ twins ($r = .53$) and DZ twins ($r = .32$), including opposite-sex pairs and after adjusting for the effects of age and sex. The simplest hypothesis about partner selection is that partners will be similar. Our results are consistent with the literature in that the age- and sex-adjusted correlations for all 322 spouse-spouse pairs ($r = .32$), 563 friend-friend pairs ($r = .20$), and 290 spouse-friend pairs ($r = .31$) were higher for sociodemographic and social attitude variables (mean r across all relationships =

.38) than for personality variables (mean $r = .17$). The mean level of similarity in friends was significantly higher than zero and significantly lower than the mean level of similarity in spouses or in DZ twins ($ps < .05$). The MZ and DZ twins did not differ in how similar they were to their respective partners. Also shown in Table 1 are simple heritabilities calculated by doubling the difference between the MZ and DZ twins. These values are typical of those reported in the literature (Bouchard & Loehlin, 2001; Plomin et al., 2001).

To test whether social assortment is a heritable tendency, we compared the MZ and DZ twins for the following cross-twin similarities: Twin 1 and Twin 2's spouse, Twin 1 and Twin 2's friend, Twin 1's spouse and Twin 2's spouse, Twin 1's friend and Twin 2's friend, and Twin 1's spouse and Twin 2's friend. These relationships were all higher for the MZ than for the DZ twins ($rs = .17$ vs. .09, .23 vs. .17, .23 vs. .14, .22 vs. .18, and .17 vs. .08, respectively), giving simple heritabilities of 16, 12, 18, 8, and 18%. Because the MZ and DZ cross-twin multivariate genetic analysis was limited by the phenotypic correlation of .32 for spouses and .20 for friends (mean $r = .26$), the bivariate heritability averaged 31% in spouses and 21% in friends.

We also used structural equation models to test genetic and environmental hypotheses with the 14 variables taken together as a latent trait of similarity. Models were fit to the age- and sex-corrected variance-covariance matrices using the computer program AMOS 4.01 (Arbuckle, 1999). We partitioned the total phenotypic variance into three sources: V(A), additive genetic effects; V(CE), the common environment shared by a pair of twins, also known as the between-families environmental variance; and V(E), the unique, nonshared environment, or that portion of the environment that is specific to each twin in a pair. By definition, MZ twins have a coefficient of relatedness of 1.00 and DZ twins of .50.

TABLE 1

Similarity Correlations (and Heritabilities) for Twin Pairs, Spouses, and Friends

| | Correlations | | | | |
Variable	Monozygotic twins (174 pairs)	Dizygotic twins (148 pairs)	Spouses (322 pairs)	Friends (563 pairs)	Heritability (%)
Height	.89	.52	.21	.04	74
Weight	.80	.49	.25	.08	62
Education	.79	.69	.55	.56	20
Occupation	.23	.24	.74	.21	0
Income	.11	.18	.43	.17	0
Political views	.58	.34	.60	.36	48
Altruism	.38	.30	.22	.16	16
Religion	.51	.42	.41	.20	18
Extraversion	.51	.18	.06	.10	66
Psychoticism	.50	.26	.25	.15	48
Neuroticism	.56	.11	.01	.09	90
Lies	.53	.16	.24	.19	74
Cognitive structure	.58	.33	.29	.32	50
Autonomy	.43	.33	.15	.17	20
Average	.53	.32	.32	.20	42

TABLE 2

Model-Fitting Results for the 14 Measures in Table 1

Comparison	Number of pairs	Parameter estimate (%)			Chi-square goodness of fit			
		Additive genetic effects (A)	Common environmental effects (C)	Specific environmental effects (E)	ACE model ($df = 3$)	AE model ($df = 4$)	CE model ($df = 4$)	E model ($df = 5$)
Twin 1 and Twin 2's spouse	322	13	7	80	40.89*	41.02	41.25	51.23
Twin 1 and Twin 2's friend	563	30	0	70	98.16*	98.16*	105.23	129.49
Twin 1's spouse and Twin 2's spouse	123	29	28	43	3.3*	4.6	5.3*	13.2
Twin 1's friend and Twin 2's friend	258	35	0	65	2.7*	2.7*	8.0	22.5
Twin 1's spouse and Twin 2's friend	290	17	9	74	40.2*	43.6	40.2*	66.70

*Best-fitting model determined by $\Delta\chi^2$ (difference) test, $p < .05$.

Table 2 shows the results of the model-fitting analyses. For the comparisons of Twin 1 and Twin 2's spouse and Twin 1 and Twin 2's friend, we found that between 13 and 30% of the variance was due to additive genetic variance, less than 10% was due to the common environment, and 70 to 80% was due to each twin's specific environment. We found similar results for the spouse-spouse, friend-friend, and spouse-friend comparisons—that is, 17 to 35% of the variance was due to genetic effects, 10 to 30% to common environment, and 40 to 75% to chance effects. Correcting for unreliability by dividing the A and C components by Cronbach's alpha gave the following values for all relationships combined: A = 34%, C = 12%, and E = 54%. Because the ACE and AE models gave better fits than those without the A component, we concluded that some of the variance was due to genetic influence. Similarly, because the ACE and CE models gave better fits than those without the C component, we concluded that some of the variance was due to common environmental influences. We also tested a nonadditive (genetic dominance) model, but it did not provide a better fit than the additive (nondominance model).

To explore further whether the preference for similarity in social partners is genetically influenced, we examined whether the assortment was more pronounced on the more heritable than on the less heritable of the 130 items. We calculated the simple heritabilities for all items making up the traits in Table 1 (following Neale, Rushton, & Fulker, 1986). Both spouse-spouse ($r = .17, p < .05$) and friend-friend ($r = .20, p < .05$) similarities were greater on more heritable items, such as "being a talkative person" (50% heritable), than on less heritable items, such as "having many different hobbies" (20% heritable). When we aggregated over both partners combined (friends and spouses), the value of r was .22, $p < .01$.

DISCUSSION

The present study first replicated the well-established finding that MZ twins (who share 100% of their genes) are nearly twice as similar in personality and social attitudes as DZ twins (who share 50% of their genes; see Table 1). This result suggests at least moderate heritability for these characteristics. The study also replicated the finding that spouses and best friends resemble each other on these traits. The resemblance of spouses and friends apparently falls between the resemblances of full-siblings (e.g., DZ twins, as in Table 1) and half-siblings (who would show approximately half the degree of resemblance found for DZ twins). The magnitude of these spousal and friendship correlations is higher than a previous estimate of the resemblance between spouses and friends, which was on the order of the correlations between cousins and half-cousins (based on studies of assortative mating in animals; Rushton, 1989a).

The present study also found that the friends and spouses of MZ twins were more similar to each other than were those of DZ twins. MZ twins chose partners more similar to those of their co-twins than did DZ twins. Both correlational and model-fitting analyses showed that at least 10 to 30% of the variance in partner choice is due to genetic factors, at least 10% is due to shared environmental factors, and the remaining 60% is due to unique or chance environmental events. Correcting the figures for measurement error raised the genetic contribution to 34% and the common environmental component to 12% and reduced the chance factors to 54%. The genetic contribution to social assortment may not be surprising given that MZ twins are more similar than DZ twins in almost every preference that has been investigated, including choice of wardrobe, job, and vacation (Bouchard & Loehlin, 2001; Lykken & Tellegen, 1993). From arrays of possible alternatives, people seek those compatible with their genotypes (Scarr, 1996). People prefer their own kind—extraverts favor extraverts; traditionalists, traditionalists. That partner similarity is most pronounced on the more heritable of items from homogeneous arrays suggests that the preference is finely tuned.

Genetic similarity theory provides an evolutionary explanation of why people resemble their friends and spouses. This extension of Hamilton's (1964) inclusive fitness theory goes beyond the kin

group to include spouses (who are typically not genetically related), friends, and fellow ethnics (Rushton, 1989a; Rushton, Russell, & Wells, 1984; Salter, 2003). If you like, become friends with, come to the aid of, and mate with those people who are genetically most similar to yourself, you are simply trying to ensure that your own segment of the gene pool will be safely maintained and eventually transmitted to future generations. Hamilton's parameters for inclusive fitness are mainly applied to the evolution of altruism and nepotism in immediate kin in those species—ants, bees, or naked mole rats, for example—in which individuals have no offspring and exist only to nurture other relatives (Hauber & Sherman, 2001). Yet if genes can ensure their own survival by leading people to help family members, with whom they share genes, then genes can also ensure their survival by leading people to help *any* organism with whom they share genes.

The model-fitting analyses found that some variance in partner choice is due to the effects of common family environment. Similarity in lifestyle preferences, including religious and political values acquired from parents, may be sought in partners. There is evidence that human preference for facial features can be acquired through sexual imprinting on opposite-sex parents (Bereczkei et al., 2004). Animal studies likewise show that familiarity and proximity can modify innate preferences for individuals that smell, look, or behave like self, mother, or father (Hauber & Sherman, 2001). Two main mechanisms of "kin recognition" have been identified: (a) *location* ("if it's in your nest, it's yours") and (b) *self-referent phenotype matching* ("look for physical features that are similar to self"). Most phenotype matching depends on a mix of inherited and learned constraints.

Up to two thirds of the variance in this study was due to unique environmental effects. This is a residual term composed of many sources, including measurement error and various kinds of genetic and environmental interactions. It also includes chance factors, such as being in the right place at the right time. Similarity, of course, is only one of many criteria people use in choosing social partners. Physical appearance, status, control of resources, reciprocity, location, and family situation all provide constraints and exert influence as well.

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