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Personality similarity in unrelated look-alike pairs: Addressing a twin study challenge

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ABSTRACT

Numerous twin studies have demonstrated genetic influence on personality traits, yet twin methods continue to be challenged. A common misconception is that monozygotic co-twins' personality resemblance results from similar treatment by others, due to their matched physical appearance. The present study brings unique evidence to this question by assessing the similarities in personality and self-esteem of 23 pairs of unrelated look-alike individuals. Intraclass correlations for the Big Five personality traits (r_is = −.27 to .29) and the Rosenberg Self-Esteem Scale (r_i = −. 03) demonstrated little within-pair resemblance. It is concluded that (1) MZ co-twins' personality similarity mostly reflects their shared genes, and (2) reactive gene-environment correlation best explains MZ co-twins' similar treatment by others.

1. Introduction

Twin studies have proliferated, addressing the origins of intelligence (Johnson, Bouchard, & McGue, 2007), personality (Jang, Livesley, Ando, et al., 2006) and voting behaviors (Fowler, Baker, & Dawes, 2008). Greater resemblance between monozygotic (MZ) than dizygotic (DZ) co-twins demonstrates genetic influence on virtually all measured traits (Segal, 2012). However, MZ co-twin resemblance is never perfect, a finding largely explained by nonshared environmental influences (events producing differences between relatives). Modest contributions to behavior from shared environmental effects (events producing similarities between relatives) have been found for childhood IQ (Segal, McGuire, Havlena, Gill, & Hershberger, 2007), juvenile delinquency (Rowe, 1994) and vocational interests (Betsworth et al., 1994). However, a significant finding over the last three decades is that shared environments have little effect on most behavioral traits measured during adulthood (Plomin, 2011).

A recurrent criticism is that MZ twins are alike behaviorally because people treat them alike, due to their matched physical appearance (Joseph, 2001; Palmer, 2011). An opportunity to revisit the question of whether physical resemblance eventuates in personality and self-esteem similarity was offered by unrelated individuals who look physically alike (U-LAs).

1.1. Personality

Twin studies have demonstrated genetic influence on personality traits. The Multidimensional Personality Questionnaire (MPQ) scales yielded a mean heritability of .46 (r_i = .33–.56), based on 74 pairs of MZ twins raised apart (MZA) (Bouchard, 2007); the MZA intraclass correlation directly estimates heritability. A remarkable finding is that MZA twins are as similar as MZT twins across most personality traits, showing that personality similarity resides mostly in shared genes, not shared environments (Bouchard, 2007). An MPQ study of 165 MZT and 352 DZT twin pairs yielded a mean heritability estimate of .44 (.35–.54) (Finkel & McGue, 1997), nearly identical to the .46 value based on MZA twins.

Twin studies have also examined the origins of personality traits comprising the five-factor model (Riemann, Angleitner, & Strelau, 1997; Yamagata et al., 2006). The Big Five traits include Neuroticism, Extraversion, Agreeableness, Openness and Conscientiousness. Model-fitting procedures using data from adult twin pairs have yielded trait heritabilities ranging from .42 to .56 (Riemann et al., 1997). Reared apart twin studies have also found genetic influence on the Big Five personality traits. Analyses of various subsets of twins from the Minnesota Study of Twins Reared Apart and the Swedish Adoption Twin Study of Aging yielded mean MZA correlations of .28 to .56 and mean DZA correlations of .11 to .18 across the five factors (Bouchard, 1993).

1.2. Self-esteem

Heritable effects on self-esteem have been demonstrated by studies of adolescent and adult twins and siblings. McGuire et al.

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(1999), using the Harter Self-Perception Profile, found that genetic influence rose from .16 to .60 between the ages of 13.6 and 16.2 years. Kamakura, Ando, and Ono (2007), using a Japanese translation of the Rosenberg Self-Esteem Scale (RSES), showed that genetic influence increased from .31 to .49 between the ages of 19.8 and 21.1 years. This increase was explained by the possibility that genetic effects underlying different facets of self-concept become more evident as young people acquire greater control over their environment. Environmental events unique to each pair member, possibly associated with peer networks and/or social activities, also appear to be important.

A longitudinal study of self-esteem among young and middle-aged adult female twins from the Virginia Twin Registry, also using the RSES, yielded heritabilities of .40 at time 1 and .36 at time 2 (16 months later). A repeated measurement model estimated that the heritability of self-esteem was .52 (Roy, Neale, & Kendler, 1995). A subsequent self-esteem study from the Virginia group reported heritabilities of .32 for females and .29 for males (Kendler, Gardner, & Prescott, 1998), with negligible shared environmental effects.

In summary, self-esteem appears to have meaningful genetic effects that vary across the life span. The question of what is inherited remains, but relevant factors may reside in personality and temperamental traits. Another relevant body of research, the reported associations between physical attractiveness and personality traits, is reviewed below.

1.3. Physical attractiveness and personality

A sizable literature supports the existence of stereotypes linking greater physical attractiveness with more desirable social and personality traits (Dion, Berscheid, & Walster, 1972; Langlois & Stephan, 1981). The reverse association, namely that more favorably depicted individuals are perceived as more physically attractive than those depicted unfavorably, has also been demonstrated (Gross & Crofton, 1977). A recent meta-analytic study also linked greater physical attractiveness with more favorable personality attributes in children and adults, but could not examine a possible causal link between treatment by others and personality (Langlois et al., 2000).

A somewhat different picture emerges in studies using self-ratings of personality and others' perceptions of attractiveness. A meta-analysis of seventy-eight experiments discerned no meaningful relationships between physical attractiveness and self-rated personality traits, such as sociability and dominance (Feingold, 1992). In contrast, self-rated physical attractiveness correlated positively, but modestly, with extraversion ($r = .25$) and self-esteem ($r = .32$). A more recent study found that the effects of the Big Five personality traits on social status were independent of attractiveness (Anderson, John, Keltner, & Kring, 2001). Other investigators identified facial symmetry as a possible correlate of personality, especially for Openness, Extraversion and Agreeableness, but did not find the predicted positive associations between them (Fink, Neave, Manning, & Grammer, 2005).

This work must be reconciled with the twin studies cited above because genetic explanations of MZ twins' behavioral similarity are still challenged. Despite evidence against causal connections between treatment and personality, critics argue that similar looking people are treated alike, such that MZ twins' similar treatment—not their similar genes—explains their behavioral resemblance.

1.4. Challenges to twin studies

Nisbett (2009) recently faulted genetic findings from MZA twin studies, asserting that they are alike behaviorally "because they look so much alike or have other characteristics in common that tend to elicit the same sorts of behavior from other people" (p. 27). Based on this belief, critics reason that MZ twins' genetic identity has little effect on their similar behaviors, relative to their appearance.

A number of studies have addressed this misconception and have found it wanting. Loehlin and Nichols (1976) showed that MZ twins treated alike were not more similar in personality than those treated differently. Plomin, Willerman, and Loehlin (1976) found that frequently confused twins were rated less similar behaviorally by their parents than twins who looked less alike. Rowe, Clapp, and Wallis (1987) showed that twins remain alike in personality even after controlling for their degree of physical attractiveness. Twins' behavioral resemblance is also consistent with their true, rather than perceived, zygosity (Goodman & Stevenson, 1989; Kendler, Neale, Kessler, Heath, & Eaves, 1993). Recent studies have generally concurred with these findings (Cronk, Slutske, Madden, Bucholz, & Heath, 2002). However, despite the supporting evidence, misconceptions persist, a situation warranting new attempts at resolution.

U-LAs parallel MZA twins due to their matched appearance and separate rearing, but lack a genetic link. If, as twin research critics have argued, physical appearance triggers certain classes of treatment by others, then the personality similarity of U-LAs should approach that of MZ twins, or at least DZ twins. The U-LA vs. DZ contrast may be especially revealing because DZ twins look less alike then U-LAs, but share 50% of their genes, on average. Alternatively, if shared genes underlie MZ co-twins' matched behaviors, then U-LAs should show little or no personality or self-esteem resemblance.

2. Materials and methods

2.1. Participant sample

U-LA pairs were identified initially by the French Canadian portrait photographer, François Brunelle. Brunelle has been creating black and white photographs of these rare dyads for many years as part of his "I'm Not a Look-Alike!" project. U-LAs are identified through the media and via his web site where potential participants can register (Brunelle, 2012). Photographs of two U-LA pairs are displayed in Fig. 1A and B.

In winter 2010, questionnaire booklets (described below) were mailed to potential participants. Completed forms were received from 23 complete pairs and two incomplete pairs. (Approximately one-third of the U-LA pairs participated, a proportion that may offer an interesting advantage as explained in the discussion below.) The final sample included 24 males and 24 females distributed across 11 same-sex male pairs, 12 same-sex female pairs, and two incomplete male pairs. The mean age of the 48 participants was 46.21 (SD = 13.96) and ranged between 16 and 84 years. The mean age difference between the members of the 23 complete pairs was 6.65 years (SD = 5.63) and ranged from 0 to 20 years. The interval between the time of their meeting at the photo session and participation in the study was 8.98 years (SD = 7.82) and ranged from 0 to 40 years.

Most participants were married or in a significant relationship (73%), while the remainder were divorced, single or in other social situations (e.g., both divorced and in a relationship). The majority had completed pre-college or university studies (81.2%), while the remainder had completed primary and secondary education programs. Most individuals were employed (85%), although several were unemployed, retired or attending school. Most pair members did not have personal contact with one another (56.5%) or met only one time per year, on average, or less (17.4%). Similarly, most U-LAs did not communicate either by telephone or e-mail (67.4%), and only a minority (17.4%) were in contact one time per month, or more. Individuals in slightly over half the pairs (56.5%) lived in the same city.

Fig. 1. (A) U-LA Female Pair. Photo Credit: François Brunelle. (B) U-LA Male Pair. Photo Credit: François Brunelle.

2.2. Materials

Questionnaires were prepared at California State University, Fullerton, and forwarded to M. Brunelle who made them available to participants. The packet included an informed consent letter, a personal background sheet, the Questionnaire de Personnalite (PfPI), the Rosenberg Self-Esteem Scale (RSES), and a Social Relationship Inventory (not considered here). Forms were printed in French because participants resided in various cities in the French-speaking region of Canada.

The PfPI Questionnaire de Personnalite au Travail (Personality for Professionals Inventory) includes 200 items that yield 21 personality dimensions (e.g., sensitivity and assertiveness) and the Big Five personality scales (Stability [reverse of neuroticism], Extraversion, Openness, Agreeableness and Conscientiousness) (Rolland & de Fruyt, 2009). Correlations between the PfPI's five factor model scores and the corresponding NEO-PI-R domains are Stability: $r = -.82$, Extraversion: $r = 88$, Openness: $r = .83$, Agreeableness: $r = .84$ and Conscientiousness: $r = .92$, based on a sample of 348 respondents.

The Rosenberg Self-Esteem Scale is a ten-item form developed at the University of Maryland (Rosenberg, 1989). It includes five positively worded items and five negatively worded items rated by respondents on a 1 (strongly agree) to 4 (strongly disagree) scale. This form has been translated into many languages.

3. Analysis

The resemblance of the U-LA pairs was assessed by intraclass correlations, which express the proportion of shared variance, together with 95% confidence intervals. The sample size offered limited power, so an initial decision was made to set the statistical significance level at $p < .10$. However, the results were virtually the same at the more stringent level of $p < .05$, so that value was applied throughout the present study. All personality and self-esteem data were age- and sex-corrected prior to analysis according to the methods of McGue and Bouchard (1984), using the data from all participants. This procedure controlled for the possibility of some within-pair resemblance due to similarities in these measures.

4. Results

4.1. PfPI

Age and sex showed negligible to modest size correlations with the Big Five personality scales with none reaching statistical significance (age: r = −.08 to .23; sex: $r = -.26$ to .16, n [individuals] = 48). Within-pair age differences showed little to modest association with the intra-pair personality score differences

Fig. 1. *(continued)*

($r = -.14$ to .31), but none were statistically significant. The interval between pair members' meeting and study participation also showed little relationship with their personality score differences, with the exception of Extraversion ($r = -.40$, $p < .06$) and Agreeableness ($r = .52$, $p < .01$). However, the former correlation was in a counterintuitive direction, such that a longer interval was

Table 1
U-LA intraclass correlations and 95% confidence intervals for the PfPI's dimensional personality scales.

n (Pairs)	U-LA 23	Dimensional scales (95% confidence interval)
Sensitivity	.09	(−.32, .47)
Self-confidence	.20	(−.22, .55)
Susceptibility to stress	.02	(−.38, .42)
Frustration tolerance	−.22	(−.57, .20)
Enthusiasm	−.07	(−.46, .34)
Sociability	.10	(−.31, .48)
Energy	−.20	(−.55, .22)
Assertiveness	−.01	(−.41, .39)
Innovation-oriented & creativity	−.30	(−.62, .11)
Intellectual vs. action-oriented	−.24	(−.58, .18)
Self-reflection	.02	(−.38, .42)
Openness to change	−.18	(−.54, .24)
Competitiveness	−.05	(−.44, .36)
Being other-oriented	.10	(−.31, .48)
Trusting others	−.29	(−.62, .12)
Willingness to accommodate	−.34	(−.65, .07)
Systematic and organized approach	.23	(−.19, .58)
Self-discipline	.33[a]	(−.08, .64)
Self-control	.10	(−.31, .48)
Motivation to perform	.00	(−.40, .40)
Proactiveness	−.03	(−.42, .37)

[a] $p < .06$.

Table 2
U-LA intraclass correlations and 95% confidence intervals for the PfPI's Big Five personality factors and comparison with reared apart and reared together twins.

	Big five personality factors				
	U-LA	MZA	MZT	DZA	DZT
n (Pairs)	23	113	652	75	558
Stability	−.06 (−.45, .35)	0.54 (.40, .66)	0.47 (.41, .53)	0.27 (.05, .47)	0.15 (.07, .23)
Extraversion	−.07 (−.46, .34)	0.51 (.36, .63)	0.53 (.47, .58)	−.03 (−.20, .25)	0.17 (.09, .25)
Openness	−.27 (−.60, .14)	0.6 (.47, .71)	0.43 (.37, .49)	0.31 (.09, .50)	0.18 (.10, .26)
Agreeableness	−.13 (−.50, .28)	0.51 (.36, .63)	0.42 (.35, .48)	0.1 (−.13, .32)	0.18 (.10, .26)
Conscientiousness	0.29 (−.12, .62)	0.5 (.35, .63)	0.57 (.52, .62)	0.09 (−.21, .37)	0.35 (.28, .42)
Mean	−.05[a,b]	.53[a]	.48[b]	0.15	0.2

Note: Data on the MZA, MZT, DZA and DZT twin pairs are from Bouchard (1993). The personality inventories are the Multidimensional Personality Questionnaire and California Psychological Inventory (weighted means).

[a] Mean $MZAr_i$ and $MZTr_i$ > Mean $ULAr_i$.

[b] $p < .01$.

Table 3
U-LA intraclass correlations and 95% confidence intervals for the Rosenberg Self-Esteem Scale and comparison with reared together twins.

Sample *n* (pairs)	Self-esteem r_i	(95% Confidence interval)
U-LA 23	−.03	(−.42, .37)
MZ male 859	.30	(.24, .36)
MZ female 500	.35	(.27, .42)
DZ male 658	.11	(.03, .18)
DZ female 356	.16	(.06, .26)
DZ male–female1,420	.13	(.08, .18)

Note: The twin data are from Kendler, Gardner, and Prescott (1998).

associated with a smaller within-pair difference in behavior; the latter correlation most likely reflects small sample fluctuation.

Intraclass correlations for the twenty-one dimensional scales and the Big Five personality trait scales are summarized in Tables 1 and 2. None of the dimensional scales yielded a significant intraclass correlation, while the intraclass correlation for Self-Discipline was marginally significant ($p < .06$). The generally greater magnitude of the major trait correlations reflects the greater reliability of these composite scales, relative to the dimensional scales that compose them. Previously published correlations for the Big Five traits, based on samples of adult MZ and DZ twins reared apart (MZA and DZA) and together (MZT and DZT), are provided for comparative purposes.

The U-LA major scale intraclass correlations were uniformly low, ranging from $r_i = -.27$ (Openness) to .29 (Conscientiousness), with a mean of −.05. None reached statistical significance, although the correlation for Conscientiousness approached significance ($p < .08$); Conscientiousness was the only major scale that would have been statistically significant at $p < .10$. In contrast, the MZA correlations for the Big Five personality factors ranged from $r_i = .50$ to .60, with a mean of .53 (Bouchard, 1993). The correlations for the MZT twins and for the DZA and DZT twin pairs in which the co-twins do not look as alike as U-LAs, were also higher than those of the U-LAs; the only exception was the DZA vs. U-LA correlation for Conscientiousness, but the difference was not statistically significant. The mean correlations for all twin groups exceeded the mean correlation for the U-LAs, but the differences were only significant with reference to the MZA and MZT twin pairs.

4.2. Rosenberg self-esteem scale

The items of the Rosenberg Self-Esteem Scale were coded to yield scores ranging from 0 to 30. The mean score, based on the 23 complete U-LA pairs and members of the two incomplete pairs, was 24.42 (SD = 4.79) and ranged between 11 and 30. Scores of 15–25 are reflective of normal self-esteem. Age showed a significant positive correlation with self-esteem ($r = .35$, $p < .05$), indicating that older individuals had higher self-esteem scores than younger individuals. Sex was negatively, but not significantly, correlated with self-esteem ($r = -.17$), such that males obtained slightly higher self-esteem scores than females. The intra-pair difference in age showed a significant positive correlation with the intra-pair difference in self-esteem score ($r = .52$, $p < .01$), while a negligible correlation was found between the time from meeting to participation and the intra-pair difference in self-esteem ($r = -.04$). All data were age- and sex-corrected prior to analysis as indicated.

The self-esteem intraclass correlation of $r_i = -.03$ ($n = 23$) was non-significant, and considerably lower than the values reported in a previous study of adult twins that also used the RSES. Specifically, the U-LAs showed considerably less resemblance than the male and female MZ twin pairs, and somewhat less than the DZ same-sex and opposite-sex pairs. These findings are compared in Table 3.

5. Discussion

The present study began by identifying a common criticism of twin research, namely that MZ co-twins' matched physical appearance is responsible for their behavioral resemblance, due to their similar treatment by others. The lack of statistical evidence that physically similar people match in personality and self-esteem challenges that claim. If matched physical appearance contributes significantly to the behavioral resemblance between two people, then the U-LAs should have been more alike than the DZA and DZT twins who look much less alike. However, both DZ twin groups showed greater resemblance than the U-LAs, consistent with genetic influence on behavior. In addition, U-LA pair members' age differences were not associated with the personality differences between them.

It is worth mentioning another common criticism of volunteer twin research, namely that the most physically and behaviorally similar pairs are those most likely to participate. Such samples may increase the size of the correlations, especially among DZ twin pairs. However, if the variance of the dependent measure matches the variance of the reference sample, or the MZ-DZ variances do not differ, then the statistics are likely to be representative (Lykken, McGue, & Tellegen, 1987). Nevertheless, it is possible to suppose that the most similar U-LA pairs did agree to take part in the present study. Even though more than half the pair members did not pursue their relationship beyond the single photo session, perhaps those who perceived that they were very similar were more inclined to engage in research than those who did not. To the extent that this was true then the generally negligible personality and self-esteem intraclass correlations represent the upper limit for behavioral resemblance between U-LAs. In fact, the true degree of U-LA resemblance in personality and self-esteem might actually be lower.

The late behavioral geneticist David Rowe (1994) asserted that similar treatment cannot make people alike in psychological traits if that treatment does not causally affect biological functions underlying broad traits: "Personality and temperament reside in the brain, not in a face" (p. 48). Researchers identify reactive (evocative) gene-environment correlation (G-E*r*) as a more scientifically sound explanation of MZ twins' similar treatment by others. Reactive GE correlation occurs when individuals elicit certain classes of responses from others, based on their genetic proclivities. When parents provide sports opportunities to athletically talented children or teachers offer advanced math classes to quantitatively minded students they are exemplifying reactive G-E*r*. Ironically, this process is what Nisbett was describing despite his critical view of twin studies.

There were limitations to the present study. The findings should be viewed cautiously until additional cases are assessed, given the limited statistical power. The randomness of the U-LA pairs is also reasonable to question. Friends show positive assortment on age ($r_i = .56$), and political views ($r_i = .42$) (Bahns, Pickett, & Crandall, 2011), but less on physical traits such as height ($r_i = .04$) and weight ($r_i = .08$) (Rushton & Bons, 2005). Some might argue that U-LAs may share genes (albeit, not by descent) relevant to selected physical features that could be linked to other physical and/or personality traits. However, the present study and previous twin studies did not support associations between appearance and personality; the U-LAs' matched physical traits may possibly be linked to different gene combinations. Additionally, the ULAs were not attracted to each other as friends, but were identified by others. They may not be truly random pairs, but this should not have undermined the study's aims and outcomes.

It is possible that unknown features of pair members' different rearing situations and/or social environments overrode any behavioral similarities between them, but this seems unlikely. In fact, for

participants in the Minnesota Study of Twins Reared Apart, (1) differences between twins in their accounts of their rearing environments were not related to their differences in personality (Krueger, Markon, & Bouchard, 2003), and (2) any co-twin resemblance in home features contributed little to their behavioral resemblance (Bouchard, Lykken, McGue, Segal, & Tellegen, 1990; Segal, 2012). The lack of contact between most pair members cannot explain their lack of behavioral resemblance because varying degrees of contact contributed little to the resemblance between MZA twins in the Minnesota study. Nevertheless, the U-LAs constitute a unique data set that yielded early findings that should interest twin and personality researchers.

6. Conclusions

Two conclusions can be drawn from the present study. First, it appears that MZ co-twins' personality similarity mostly reflects their shared genes. Second, reactive gene-environment correlation may best explain MZ co-twins' similar treatment by others.

A theoretically ideal, albeit practically difficult, analysis of physical and behavioral similarity would involve "U-LATs"–unrelated look-alike, same-age individuals raised together. Virtual twins (VTs or same-age unrelated individuals), composed mostly of individuals in middle childhood, show little resemblance in IQ (.28), relative to MZT (.86), DZT (.60) and full sibling pairs (.47), and little agreement in other measures (Segal, McGuire, & Hoven Stohs, 2012). Most pair members look quite different physically, and some come from different ethnic backgrounds. However, a sufficiently large sample of the subset of look-alike VT pairs (i.e., U-LATs) might go beyond the present study in disconfirming the supposed association between physical similarity and behavior in MZ twins.

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