Twin Research and Human Genetics
Volume 15 ▌ Number 4 ▌ pp. 491–495 ▌ © The Authors 2012 ▌ doi:10.1017/thg.2012.28

Genetic Correlations Among Facets of Type A Behavior and Personality

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The purpose of this study was to examine the phenotypic, genetic, and environmental relationships between multiple dimensions of Type A behavior and personality. Adult twins ($N = 247$ pairs) completed a self-report personality measure and a work style questionnaire that measured six facets of Type A behavior: impatience, anger, work involvement, time urgency, job dissatisfaction, and competitiveness. Univariate results suggest that only the job dissatisfaction facet of Type A behavior was explained by non-genetic (environmental) factors. Multivariate results suggest that all of the genetically determined facets of Type A behavior show some correspondence with at least one of the personality factors found in the study, suggesting that some of the phenotypic (observed) relationships could be due to common genetic factors.

■ **Keywords:** Type A behavior; omnibus personality; genetic correlations.

The present study was designed to further expand on the understanding of the relationship between Type A behavior and personality by examining the correlations found between the two domains at both the phenotypic and the genetic and environmental levels. Type A behavior pattern was originally proposed as a unidimensional psychological construct that predicted coronary heart disease (Jenkins, 1966; Rosenman et al., 1968). A number of dimensions of personality have consistently been found to be related to Type A behavior, including: aggression, impatience, time pressure, and competitiveness (Anderson & Meininger, 1993; Begley & Boyd, 1985; Jackson & Gray, 1990; Lundberg, 1982; May & Kline, 1987). Eysenck and Fulker (1983) further suggest that the measurement of Type A behavior alone might be superfluous, as it may be explained through some combination of other personality dimensions. Along similar lines, some researchers have stated that Type A behavior appears to be heritable only due to the fact that certain underlying components of Type A behavior are heritable, such as loudness of speech, competition for control, and potential for hostility (Matthews & Krantz, 1976; Matthews et al., 1984). This suggests that the characterization of Type A behavior as a unidimensional trait ignores potentially interesting variability within the construct (Anderson & Meininger, 1993; Leak & Flotte, 1987; Lundberg, 1982; May & Kline, 1987; Tett et al., 1992).

An early study of the heritability of a multidimensional Type A construct used three descriptors of Type A behavior (pressure, hard-driving, and ambitious) and concluded that there is a heritable component to all of these factors (Pedersen et al., 1989). Although Pedersen et al. (1989) did not directly measure personality, the authors examined similarities within the trait descriptors and concluded that general Type A behavior and feelings of time urgency are similar to neuroticism, while ambition and hard-driving competition are similar to extraversion. In a similar study, Sims et al. (1991) concluded that while all facets of Type A behavior show some heritability, hard-driving competition is the most highly heritable facet of the construct.

While past research has found some relationships between Type A behavior pattern and personality dimensions (e.g., from the Big Five model of personality), the question has not been addressed as to the degree to which these observed (phenotypic) relationships may be due to common genetic and/or environmental factors. The present study examines the phenotypic, genetic, and environmental

RECEIVED 20 October 2011; ACCEPTED 1 February 2012.

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relationships between multiple dimensions of Type A behavior and personality. Given previous research that has suggested a genetic basis for both personality (e.g., Johnson et al., 1998, 2004; Vernon et al., 1999) and Type A behavior pattern (Pedersen et al., 1989; Sims et al., 1991), analyses with genetically informative data (i.e., a sample of twins) will provide further insights into Type A behavior and the possible genetic and/or environmental basis for the phenotypic relationships found between personality and Type A behavior.

Method

Participants

Participants were part of a large behavior genetic investigation, spanning multiple personality constructs (Johnson et al., 1998; Johnson et al., 2004; Vernon et al., 1999). The subjects were 247 adult twin pairs: 183 pairs of monozygotic (MZ) twins (149 female pairs, mean age = 45.1 years, *SD* = 16.5; 34 male pairs, mean age = 45.1 years, *SD* = 15.8), and 64 same-sex dizygotic (DZ) twin pairs (55 female pairs, mean age = 42.8 years, *SD* = 17.6; 9 male pairs, mean age = 33.9 years, *SD* = 8.9).

Materials and Procedure

Twin pairs were recruited through newspaper advertisements and by word of mouth through local multiple birth associations. Participants were mailed a questionnaire package that included two self-report personality questionnaires: the Survey of Work Styles (SWS) (Jackson & Gray, 1990), and the Personality Research Form (PRF) (Jackson, 1987).

The SWS is a 96-item profile measure of six components of the Type A behavior pattern, each containing 16 unique items (Jackson & Gray, 1990). For each of the items, individuals were asked to indicate their degree of agreement with a statement using a 5-point scale. The six facets of Type A behavior measured by the SWS are: Impatience (intolerance of time delays); Anger (predisposition to being antagonized); Work Involvement (preoccupation with work, to the exclusion of recreation); Time Urgency (tendency to work in a hurried fashion, and demonstrating a preoccupation with deadlines); Job Dissatisfaction (negative affect concerning one's current occupation); Competitiveness (tendency to strive to defeat others, even in non-competitive situations). The SWS also produces a 'Scale A' score containing the items most highly correlated with the Rosenman Structured Interview (Rosenman et al., 1975). The reliabilities for the SWS scales are reported to be quite high, ranging from 0.73 to 0.86 (Jackson & Gray, 1990).

The PRF is a 352-item personality inventory that requires individuals to make 'me' and 'not me' decisions on statements about their personality. Twenty trait scores may be calculated from the PRF, and the measure has been shown to represent a sizable proportion of the total domain of personality (Jackson, 1987). The 20 traits are: abasement, achievement, affiliation, aggression, autonomy, change, cognitive structure, defendence, dominance, endurance, exhibition, harm avoidance, impulsivity, nurturance, order, play, sentience, social recognition, succorance, and understanding.

Participants also completed a zygosity questionnaire (Nichols & Bilbro, 1966), which has a reported accuracy of 93% in comparison with the results of blood-typing (Kasriel & Eaves, 1976).

Results

Preliminary Analyses

Means were computed for each raw scale based on the whole sample and within each kinship group. A one-way analysis of variance was performed on each variable to compare the means between kinship groups, using each member of each twin dyad as an independent replication. None of the variables demonstrated a significant mean difference between MZ and DZ twins, and tests for heterogeneity of variance indicated that there were no significant differences in variance between kinships.

As was demonstrated by McGue and Bouchard (1984), the presence of age and sex effects on a trait score can seriously bias estimates of genetic and environmental components. To avoid these confounds, corrections for age and sex effects were made by computing completely standardized residual scores from the multiple regression of each score on age and sex. All further analyses are based on these residual scores.

Factor Analyses

The factor structure of the PRF for this sample has been reported previously (Johnson et al., 2004). Although the PRF was never designed to measure the 'Big Five' personality factors, five factors were found to best fit the present data and resembled the Big Five model. The commonly used Big Five factor labels were used to describe the extracted factors, including: conscientiousness, extraversion, low agreeableness (disagreeableness), neuroticism, and openness to experience. Computation of factor scores was conducted using the regression method, in which factor loadings act as weights in the scale aggregates.

Univariate Genetic Analyses

Univariate genetic analyses for the scales of the SWS, and the five factors derived from the PRF, were conducted using Mx (Neale, 1997). For all variables, a full ACE model was fit first, to determine the proportion of variance that is attributable to additive genetic effects (A), common environmental effects (C), and specific environmental effects (E). This full model was then systematically decomposed into two models, AE and CE, comprising only two sources of variation each. The final model fit to the data was an E model, in which specific environmental variance is the only source of variation. To determine which model

https://doi.org/10.1017/thg.2012.28 Published online by Cambridge University Press

TABLE 1
MZ and DZ Correlations and Genetic Analyses

	MZ	DZ	a^2	c^2	e^2	AIC
Type A personality dimensions						
			(95% CI)	(95% CI)	(95% CI)	
Anger	0.33	0.25	0.35 (0.22–0.47)	—	0.65 (0.53–0.78)	−6.99
Impatience	0.35	0.25	0.36 (0.23–0.47)	—	0.64 (0.53–0.77)	−6.91
Competitiveness	0.53	0.37	0.53 (0.42–0.62)	—	0.47 (0.38–0.58)	−5.18
Time Urgency	0.38	0.15	0.37 (0.25–0.49)	—	0.63 (0.51–0.75)	−6.18
Work Involvement	0.46	0.14	0.45 (0.34–0.56)	—	0.55 (0.44–0.66)	−7.12
Job Dissatisfaction	0.10	0.30	—	0.15 (0.02–0.27)	0.85 (0.73–0.98)	−5.02
Scale A	0.31	0.35	—	0.32 (0.20–0.43)	0.68 (0.57–0.80)	−5.98
Big Five personality dimensions						
Conscientiousness	0.48	0.16	0.48 (0.33–0.62)	—	0.52 (0.42–0.62)	−6.67
Extraversion	0.66	0.22	0.64 (0.50–0.80)	—	0.36 (0.29–0.44)	−2.37
Disagreeableness	0.49	0.22	0.48 (0.34–0.62)	—	0.52 (0.42–0.62)	−6.38
Neuroticism	0.56	0.06	*0.55 (0.41–0.74)*	—	*0.45 (0.38–0.58)*	*3.88*
Openness to Experience	0.69	0.26	0.68 (0.54–0.84)	—	0.32 (0.26–0.39)	0.04

Note: Estimates are based on reduced best-fitting models. Estimates indicated in italics represent a poor fit to the data.

afforded the 'best fit' to the data, the chi-square value and the Akaike Information Criteria (AIC) were computed and compared for all models. Maximum-likelihood estimates resulting from this analysis were squared to produce estimates of the variance due to each of the model effects (Neale & Maes, 1998). These univariate results are presented in Table 1. All models presented in this table represent a good fit to the data. Only two variables, Job Dissatisfaction and Scale A, were best fit by models of determination that did not include genetic effects. Accordingly, Job Dissatisfaction and Scale A were excluded from the multivariate genetic analyses.

Multivariate Genetic Analyses

Genetic and environmental contributions to the relationships between dimensions of Type A behavior, and the five personality factors, were identified through the use of bivariate Cholesky decomposition. Variable pairs were fit with both an ACE and an AE model, and the model with the lowest AIC was considered to be the best fit to the data (Neale & Maes, 1998). In all cases, AE models demonstrated better fit to the data. All bivariate correlations (zero-order phenotypic, genetic, and environmental) between the Type A behaviors and the personality factors are presented in Table 2. The bivariate genetic and environmental correlations reported in this table were also computed using Mx. Correlations in bold are significant at $p < .05$.

Three out of the five genetically determined facets of Type A behavior pattern (anger, competitiveness, and impatience) showed significant phenotypic correlations with the personality factor of disagreeableness, and each of these relationships had a significant amount of shared genetic variability. Similarly, conscientiousness demonstrated a significant negative phenotypic correlation with anger, and positive correlations with competitiveness and work involvement. Among these phenotypic correlations, however, only the correlations between conscientiousness and anger and work involvement were significantly determined by shared genetic factors. Extraversion was found to have significant negative correlations with the Type A facets of time urgency and work involvement, at both the phenotypic and genetic levels.

Discussion

The purpose of the present study was to examine the heritability of Type A behavior patterns, as well as to look at the relationship between Type A behavior and personality, at the observed (phenotypic), genetic, and environmental levels. The results of this study suggest that Type A behavior pattern shows significant heritability for the majority of its sub-facets, with estimates of genetic determination ranging from 35% to 53%. Job Dissatisfaction failed to show any significant genetic determination and also showed very little effect from common environment (15%). This finding is not surprising in that the degree of satisfaction with a job tends to be more specific to a situation and is not as global as other measures of job attitudes, such as organizational commitment (Moorhead et al., 2000). The present results also suggest that there is no heritable component to a variable comprised of items that match the Rosenman Structured Interview, a finding that agrees with earlier behavior genetic studies that failed to demonstrate significant genetic determination of unidimensional measures of coronary prone behavior (Matthews et al., 1984; Rahe et al., 1978).

The findings in this study that are of primary interest are the relationships between Type A behaviors and personality. The facets of Type A behavior pattern presented herein show significant correlations with Conscientiousness, Disagreeableness, and Extraversion, with the most substantively significant correlations demonstrated with

https://doi.org/10.1017/thg.2012.28 Published online by Cambridge University Press

TABLE 2

Bivariate Correlations [Phenotypic, Genetic (r_g), and Environmental (r_e)] Between Type A Facets and the Big Five Factors

	Phenotypic	r_g (95% CI)	r_e (95% CI)	AIC
Bivariate correlations with Anger				
Conscientiousness	**−0.15**	**−0.26 (−0.51 to –0.01)**	−0.01 (−0.15 to 0.13)	−18.68
Extraversion	0.02	−0.05 (−0.26 to 0.16)	0.07 (−0.07 to 0.21)	−19.13
Disagreeableness	**0.38**	**0.51 (0.29 to 0.69)**	**0.37 (0.24 to 0.48)**	−18.03
Neuroticism	0.07	−0.02 (−0.25 to −0.22)	0.05 (−0.09 to 0.19)	−8.04
Openness to Experience	−0.04	−0.08 (−0.29 to 0.12)	0.03 (−0.11 to 0.17)	−14.32
Bivariate correlations with Competitiveness				
Conscientiousness	**0.14**	0.12 (−0.09 to 0.31)	**0.12 (−0.02 to 0.26)**	−20.42
Extraversion	−0.01	−0.09 (−0.26 to 0.09)	0.03 (−0.11 to 0.17)	−17.08
Disagreeableness	**0.45**	**0.68 (0.52 to 0.83)**	**0.23 (0.10 to 0.36)**	−14.91
Neuroticism	0.07	0.02 (−0.18 to 0.21)	0.06 (−0.08 to 0.21)	−4.43
Openness to Experience	0.06	0.02 (−0.15 to 0.20)	0.12 (−0.02 to 0.26)	−7.02
Bivariate correlations with Impatience				
Conscientiousness	0.06	−0.03 (−0.29 to 0.21)	0.12 (−0.02 to 0.25)	−18.63
Extraversion	−0.07	−0.17 (−0.38 to 0.04)	0.00 (−0.14 to 0.14)	−19.22
Disagreeableness	**0.41**	**0.64 (0.44 to 0.82)**	**0.29 (0.16 to 0.41)**	−7.23
Neuroticism	0.03	0.07 (−0.16 to 0.30)	−0.08 (−0.21 to 0.07)	−11.92
Openness to Experience	0.04	−0.04 (−0.25 to 0.16)	**0.18 (0.04–0.31)**	−16.49
Bivariate correlations with Time Urgency				
Conscientiousness	0.03	0.06 (−0.18 to 0.31)	0.01 (−0.13 to 0.15)	−20.04
Extraversion	**−0.12**	**−0.32 (−0.51 to -0.11)**	0.02 (−0.12 to 0.16)	−13.84
Disagreeableness	0.04	0.21 (−0.04 to 0.46)	−0.09 (−0.22 to 0.05)	−12.29
Neuroticism	0.03	*0.10 (−0.13 to 0.33)*	*−0.03 (−0.17 to 0.11)*	*−2.73*
Openness to Experience	**0.20**	**0.28 (0.08 to 0.47)**	0.14 (0.00 to 0.27)	−5.26
Bivariate Correlations with Work Involvement				
Conscientiousness	**0.30**	**0.36 (0.14 to 0.54)**	**0.26 (0.12 to 0.38)**	−22.23
Extraversion	**−0.14**	**−0.22 (−0.39 to -0.02)**	−0.09 (−0.23 to 0.05)	−10.37
Disagreeableness	−0.01	−0.11 (−0.33 to 0.11)	0.06 (−0.09 to 0.19)	−12.91
Neuroticism	0.03	0.13 (−0.08 to 0.34)	0.00 (−0.14 to 0.14)	−13.00
Openness to Experience	0.06	0.06 (−0.13 to 0.24)	0.06 (−0.08 to 0.20)	−7.75

Note: Significant correlations are indicated in bold. All models were best fit with an AE biometric Cholesky model.

Disagreeableness. All of the genetically determined facets of Type A behavior show some correspondence with one of these three personality traits, at both the phenotypic and genetic level. Contrary to the predictions of Eysenck and Fulker (1983), however, these findings do not suggest that Type A behavior pattern is determined solely by personality variation -– percentage of variance in common between personality factor scores and Type A behavior pattern ranges from 1.44% to 20.25% for phenotypic variation, and 4.84% to 46.24% for genetic variation. The present findings suggest that Type A behavior pattern may represent a cluster of behavioral traits that are not subsumed by personality. Alternatively, different personality dimensions (not the ones measured in the present study) may have a larger variance overlap with Type A characteristics. Future research might focus on the identification of specific personality characteristics that show strong phenotypic and genetic correlations with Type A behaviors.

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https://doi.org/10.1017/thg.2012.28 Published online by Cambridge University Press

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