Evidence for a Heritable General Factor of Personality in Two Studies

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Two studies were conducted to see whether a general factor of personality (GFP) could be extracted from different measures of personality. Using samples of twins in both studies also allowed an assessment of the extent to which genetic and/or environmental factors contributed to individual differences in the GFPs that were found. In Study 1, principal components analysis of the Big Five personality traits in combination with four scales of mental toughness yielded a strong GFP and behavior genetic model-fitting showed that individual differences in this GFP were fully accounted for by genetic and nonshared environmental factors. In Study 2, a GFP was extracted from the Big Five traits in combination with 15 facets of emotional intelligence. Individual differences in this GFP were also fully accounted for by genetic and nonshared environmental factors. These studies add to the growing body of research demonstrating the existence of a GFP and replicate one previous report of its heritability.

Keywords: personality, general factor of personality, mental toughness, trait emotional intelligence, behavior genetics

Traditional theories of personality have typically proposed the existence of broad personality dimensions that have been considered to be largely uncorrelated (e.g., Cattell, 1946; Eysenck, 1991; Goldberg, 1990; Wiggins, 1979). However, increasing findings of redundancy and overlap between personality measures and the dimensions they assess have led researchers to begin to move toward more succinct models of personality that combine rather than separate various traits (Rushton et al., 2008). Specifically, considerable interest currently lies in the possibility of there being a general factor of personality (GFP): a super-dimension that represents the zenith of the personality hierarchy and subsumes all personality trait dimensions in a similar manner to *g* in the realm of cognitive abilities (e.g., Musek, 2007; Rushton et al., 2008). To add to this growing body of research, the first purpose of the present two studies is to determine whether the constructs of mental toughness, which represents trait resilience (Clough et al., 2001), and trait emotional intelligence (trait EI, Petrides et al., 2007) can also be integrated into the GFP, thereby empirically strengthening the validity of the super-dimension. By using samples of monozygotic (MZ) and dizygotic (DZ) twins in these studies, our second purpose is to investigate the extent to which genetic and/or environmental factors contribute to individual differences in any GFP that may be identified.

Emergence and Expansion of the General Factor of Personality (GFP)

Prior to the emergence of the GFP, researchers had proposed a variety of models of personality that offered different numbers of higher-order dimensions (e.g., Cattell, 1946; Eysenck, 1947; Wiggins, 1979) Currently, the most prominent of these models is the Big Five, which proposes that all individual differences in human personality can be accounted for by five distinct higher-order personality dimensions: extraversion, neuroticism, agreeableness, openness to experience, and conscientiousness (Goldberg, 1981). Presently, this theory offers the conventional perspective on the structure of human personality (Musek, 2007).

Researchers who have noted significant correlations between the model's five dimensions, however, have challenged its irreducibility and its position at the top of the personality hierarchy (e.g., Becker, 1999; Block, 1995; Eysenck, 1992). Using these observed correlations, two higher-order dimensions have been derived that subsume the Big Five factors. Specifically, Digman (1997) proposed the existence of superfactors Alpha and Beta, which DeYoung et al. (2001) renamed as Stability and Plasticity, respectively. Reducing these dimensions even further, Musek (2007) used factor analysis to obtain the Big One — a single general personality factor that emerged from data sampling three distinct subject groups across six measures of the Big Five factors. According to Musek, individuals high on this factor possess a blend of all positively valued personality dimensions.

Since its emergence, the existence of the Big One, re-labeled as the GFP by Rushton et al. (2008), has

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been confirmed in a number of studies drawing on diverse sample groups and a range of personality measures. Replicating the seminal work of Musek (2007), a single general factor has emerged in further studies of the Big Five factors, as measured by the NEO-PI-R, with all five factors showing significant loadings on one general factor in Canadian and Japanese populations (Rushton, Bons, Ando, Hur, Irwing, Vernon et al., in press). Other studies have identified a single general factor in analyses of more diverse personality traits assessed by a variety of measures not rooted in the Big Five model. For example, Rushton et al. (in press) found a general factor in their analysis of Cloninger's Temperament and Character Inventory (TCI), noting that this broad factor correlated highly with the general factor observed in analyses of the Big Five personality traits. This association suggests that the two measured broad factors may indeed reflect one expansive GFP. A general factor also emerged when Rushton and Irwing (in press) analyzed the Comrey Personality Scales (CPS). Their findings revealed that this scale's traits could be grouped into three broad dimensions — Extraversion, Conscientiousness, and Empathy — which subsequently exhibited moderate to large loadings on one common general factor. A general factor has also emerged in assessments of humour styles (Rushton et al., in press), and of personality and emotional disorders (Rushton & Irwing, in press), further extending the potential reach of the GFP.

Across many measures and populations, the construct of emotional stability, representing greater relaxation, lower stress and a reduced tendency to worry, has emerged as central in clarifying the nature of the GFP. In assessments of the Big Five factors, emotional stability reliably demonstrates the highest loadings on the GFP cross-culturally (Rushton et al., in press). It also exhibits an exceptionally high loading on the GFP in analyses using the Comrey Personality Scales (Rushton & Irwing, in press) and the Multicultural Personality Questionnaire (Rushton & Irwing, in press).

In an effort to account for the emergence of general factors in personality assessments, and the potential existence of a GFP, Rushton et al. (2008) suggest that a GFP may have evolutionary benefits which have been selected for over time. Citing past research on social relationships, Rushton et al. argue that there is a social preference for individuals who are agreeable, cooperative, and emotionally stable. Based on this, Rushton et al. propose that individuals who occupy the positive pole of the GFP, and who possess these valued qualities, also enjoy greater reproductive success as well as more success in competitive fields. Consequently, according to Rushton et al., the GFP is central to the evolution of personality.

Mental Toughness

The origins of mental toughness are rooted in the study of the hardy personality, as first proposed by Kobasa (1979). The hardiness construct comprises three personality dispositions: *commitment* — the tendency to involve oneself in whatever one encounters, *control* — the tendency to act and feel as though one is influential in a variety of life situations, and *challenge* — the understanding that change is normal in life (Kobasa et al., 1982). Mental toughness is a direct extension of this construct that includes the dimension of *confidence,* in addition to commitment, control, and challenge (Clough et al., 2001). Empirically, mental toughness has been linked to better coping and to increased optimism under stress, and is therefore seen as a positive trait (Nicholls et al., 2008).

Horsburgh et al. (2009) evaluated the construct of mental toughness in relation to the Big Five factors in order to determine its place in the overall framework of personality. Results indicated significant negative correlations between all four components of mental toughness and neuroticism, and significant positive correlations between the mental toughness variables and the other Big Five dimensions. Overall, the strongest association observed was between mental toughness and neuroticism, demonstrating the centrality of emotional stability to the construct. Moreover, the phenotypic correlations that Horsburgh et al. reported were primarily attributable to correlated genetic factors.

Trait Emotional Intelligence

The construct of trait emotional intelligence (trait EI or trait emotional self-efficacy) comprises a constellation of emotion-related self-perceptions and dispositions, such as self-esteem, emotion regulation, social awareness, and stress management, among others (Petrides et al., 2007). Vernon et al. (2008) reported that many facets of trait EI — as measured by the Trait Emotional Intelligence Questionnaire (TEIQue, Petrides, 2009; see also Freudenthaler et al., 2008) — were significantly positively correlated with extraversion, agreeableness, openness, and conscientiousness and significantly negatively correlated with neuroticism. As was the case with mental toughness, the significant correlations between trait EI and the Big Five that Vernon et al. (2008) reported were entirely attributable to correlated genetic and correlated nonshared environmental factors.

Present Studies

The first purpose of the present studies is to determine whether the constructs of mental toughness and trait EI can be integrated into the growing super-dimension of the GFP. In Study 1 a principal components analysis of the four dimensions of mental toughness, assessed by the MT48 (Clough et al., 2001), and the Big Five factors of personality, assessed by the NEO-PI-R, will be conducted; in Study 2 a principal components analysis of the 15 facets of the TEIQue and the Big Five factors will be conducted. Given that the GFP was initially derived from the Big Five model, which was believed to subsume all personality traits, the finding that either mental toughness or trait EI load

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on the same general factor as the Big Five would be further evidence of the existence of a broad GFP.

The second purpose of our research is to use behavioral genetic (BG) methodology to examine the extent to which genetic and/or environmental factors contribute to individual differences in any GFP that emerges from the data. Previous research has shown that genetic and nonshared environmental factors fully account for the variance in a GFP extracted from the Prosocial Scale of the Strengths and Difficulties Questionnaire and the EAS Temperament Survey among 2- to-9-year-old Korean children and in another GFP extracted from 29 personality self-rating scales among adult twins (Rushton et al., 2008). This is what has been found for virtually every personality trait that has been studied (Johnson et al., 2008) but the heritability of the GFP has to date only been examined in Rushton et al. (2008). Furthermore, the Korean study in that paper used parental ratings rather than self-reports of personality. As such, trying to replicate the contribution of genetic and nonshared environmental factors to GFPs identified among additional adult samples will make a valuable contribution to the literature.

Study 1

Method

Participants

Participants were 152 pairs of MZ and 67 pairs of same-sex DZ adult twins. There were thus 438 participants in total, comprising 30 pairs of male MZ twins, 122 pairs of female MZ twins, 8 pairs of male DZ twins, and 59 pairs of female DZ twins. Participants were recruited via newspaper and magazine advertisements from across North America and their ages ranged from 18 to 82 years (M = 23.88, SD = 6.22). Initial contact was made by the twins and they provided their contact information to become participants in an ongoing mail-based twin study. More than 95% of the twins who made initial contact subsequently agreed to take part in this study.

Measures

Twins completed the 240-item NEO-PI-R which uses a 5-point Likert scale to assess the Big-5 factors of personality: extraversion (E), neuroticism (N), openness to experience (O), agreeableness (A), and conscientiousness (C). In our sample, internal consistency reliabilities of the scales are: N .86, E .76, O .73, A .77, and C .83.

They also completed the MT48: a 48-item questionnaire that assesses mental toughness on a five point Likert scale. The MT48 provides an overall score for mental toughness as well as scores for each of four subscales of mental toughness: challenge, commitment, confidence, and control (Clough et al., 2001). Example items of the scales are: Challenges usually bring out the best in me (challenge), I do not usually give up under pressure (commitment), I am generally confident in my abilities (confidence), and I generally feel in control (control). In our sample, the internal consistencies of these scales range from .74 (challenge and control) to .92 (overall mental toughness).

Finally, twins completed a 16-item zygosity questionnaire (Nichols & Bilbro, 1966), which asks questions about their physical similarity (e.g., height, eye color, and general appearance) and the frequency with which they are mistaken for one another by other family members and friends. This questionnaire has been shown to be at least 93% as accurate as red blood cell polymorphism analyses for determining zygosity (Kasriel & Eaves, 1976).

Procedure

Participants were mailed a letter of information, a pencil, a self-addressed and stamped envelope, as well as a package of questionnaires and instructions. They were asked to complete the questionnaires at their own pace, in the privacy of their own homes, and separately from their twin. All participants who returned their packages were sent debriefing forms outlining the details of the study, were thanked for their participation, and were compensated for their time.

Analyses

Most twins completed all of the items on all of the questionnaires but occasionally an item was left blank. Missing data were replaced with the average of the Likert scale. For the purposes of this study, the 48 items of the MT48 were converted into four scores: challenge, commitment, control, and confidence. The 240 items of the NEO-PI-R were converted into five scores, one for each factor of personality.

For the principal components analyses, one member of each MZ and DZ twin pair was arbitrarily designated as 'twin-1' and their co-twin was designated 'twin-2'. Subsequently, data from all the twin-1s (MZs and DZs combined: total N = 219) and from all the twin-2s (MZs and DZs combined) were subjected to separate principal components analyses using SPSS. This procedure avoids violating the assumption of independence and also permits a cross-replication of the factor(s) obtained from the two sets of twins.

For the BG analyses, Pearson correlations were computed separately among MZ and DZ twins on the factor(s) extracted in the principal components analyses. Univariate BG model fitting was carried out using the software package Mx (Neale et al., 2006). Mx uses structural equation model fitting to estimate the extent to which genetic (A), shared environmental (C), and nonshared environmental (E) factors contribute to individual differences. Although reduced models (for example, AE, CE, and E only) can also be fit, Sullivan and Eaves (2002) strongly argue that in analyses based on discrete traits, estimates from the full ACE model will be more accurate, and that attempts at reporting reduced models result in oversimplification of the models, rather than a more parsimonious and accurate representation of the data.

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Table 1

Unrotated Factors Extracted From the NEO and MT48 in Study 1

Variable	Twin-1 I	Twin-1 II	Twin-2 I	Twin-2 II
N	–0.77	0.3	–0.71	0.33
E	0.55	0.48	0.48	0.52
O	0.25	0.7	0.21	0.79
A	0.38	–0.56	0.37	–0.5
C	0.66	–0.31	0.54	–0.27
Challenge	0.78	0.19	0.76	0.26
Commitment	0.81	0.09	0.82	0.08
Control	0.86	–0.08	0.86	–0.15
Confidence	0.87	0.07	0.89	0.02

Results

Horsburgh et al. (2008) reported the correlations between the four MT48 variables and the five NEO factors in their Table 3. To summarize, all but one of these 20 correlations were significant, ranging from .06 to .64 in absolute values.

Shown in Table 1 are the results of the principal components analyses among the twin-1 and twin-2 data. In both analyses, two factors with eigenvalues greater than 1 were extracted but the first factor in each analysis accounts for the majority of the variance: 47.6% among the twin-1 data and 44.3% among the twin-2 data (the second factors account for 14.3% and 15.7% of the variance among the twin-1 and twin-2 data, respectively). As can be seen in Table 1, all nine variables from the MT48 and the NEO load on the first factor, with loadings ranging from .25 to .87 among the twin-1 data and from .21 to .89 among the twin-2 data. In both analyses, the first factors receive their highest loadings (greater than .45) from the four MT48 variables, neuroticism, conscientiousness, and extraversion. Openness has the lowest loadings and agreeableness has moderate loadings on both of the first factors. The two sets of first-factor loadings are very consistent (Spearman's rho = 1.0, $df = 7$, $p < .01$), thus showing excellent cross-replication of a GFP.

The correlation between MZ twins on the first unrotated (GFP) factor was .55 and between DZ twins was .19. Although the MZ correlation is more than twice as large as the DZ correlation we did not attempt to estimate dominance genetic effects due to the lack of power arising from our relatively small samples (Martin, Eaves, Kearsey, & Davies, 1978). Instead, a full ACE model was fit which showed that additive genetic (53%) and nonshared environmental factors (47%) fully account for individual differences in the GFP.

Discussion

In two samples, a GFP was extracted from a combination of five factors from the NEO and four scales from the MT48. The pattern of loadings on these GFPs was very similar, representing high scores on mental toughness, extraversion, and conscientiousness and low scores on neuroticism. Univariate BG analyses found that individual differences in the GFP were fully attributable to genetic and nonshared environmental factors, replicating the only previous BG studies of GFPs (Rushton et al., 2008). Even though we did not attempt to fit a model with dominance effects — due to the low power in our sample — it was nonetheless the case that MZ correlations for our GFP were more than twice as large as DZ correlations which is suggestive of genetic dominance. This, in turn, supports Rushton et al's (2008) suggestion that the GFP has been under recent natural selection, as would be expected for a trait bestowing fitness in a Darwinian sense.

Study 2

Method

Participants

Participants were 213 pairs of MZ and 103 pairs of same-sex DZ adult twins. There were thus 632 participants in total, comprising 39 pairs of male MZ twins, 174 pairs of female MZ twins, 8 pairs of male DZ twins, and 95 pairs of female DZ twins. Participants were recruited in the same manner as the twins in Study 1 and their ages ranged from 18 to 82 years ($M = 38.4$, $SD = 15.23$).

Measures

Twins completed the 240-item NEO-PI-R and the same zygosity questionnaire that was used in Study 1. In addition, the Study 2 participants completed the 153-item TEIQue which yields scores on 15 facets, 4 factors, and global trait EI. For the purposes of this study only the scores on the 15 facets were used; higher-order scores could not have been entered into the analysis since they would create linear dependencies. Participants responded on a 7-point Likert scale, ranging from *Completely disagree* to *Completely agree*. In our sample, the internal consistencies of the TEIQue facets ranged from .65 (Relationships) to .90 (Emotion expression) and were statistically equivalent among the MZ and DZ twins.

Procedure

Participants were sent a package of questionnaires including the NEO-PI-R and TEIQue questionnaires. The same procedure was followed as in Study 1.

Analyses

As in Study 1, for the principal components analyses, one member of each MZ and DZ twin pair was arbitrarily designated as 'twin-1' with their co-twin designated 'twin-2'. Subsequently, twin-1 data (MZs and DZs combined: total $N = 316$) and twin-2 data (MZs and DZs combined) were subjected to separate principal components analyses using SPSS.

For the BG analyses, as in Study 1, Pearson correlations were computed separately among MZ and DZ

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Table 2

First Unrotated Factors Extracted From the NEO and TEIQue in Study 2

Variable	Twin-1	Twin-2
N	–0.69	–0.65
E	0.58	0.53
O	0.33	0.35
A	0.42	0.35
C	0.58	0.48
Self esteem	0.74	0.73
Emotion expression	0.64	0.61
Self-motivation	0.69	0.63
Emotion regulation	0.58	0.54
Happiness	0.77	0.72
Empathy	0.63	0.59
Social awareness	0.69	0.73
Impulsivity (low)	0.59	0.49
Emotion perception	0.63	0.64
Stress management	0.69	0.63
Emotion management	0.39	0.39
Optimism	0.77	0.74
Relationships	0.73	0.64
Adaptability	0.6	0.64
Assertiveness	0.48	0.55

twins and univariate BG model fitting was carried out using the software package Mx (Neale et al., 2006).

Results

Vernon et al. (2008) reported the correlations between the 15 TEIQue facets and the five NEO factors in their Table 1. To summarize, all but eight of these 75 correlations were significant, ranging from .01 to .69 in absolute values.

Shown in Table 2 are the first unrotated factors extracted from the twin-1 and twin-2 data. Among the former, four factors with eigenvalues greater than 1 emerged but the first factor, with an eigenvalue of 7.72 and accounting for 38.6% of the variance, clearly dominates the others (factor 2 has an eigenvalue of 2.56 and accounts for 12.9% of the variance). Similarly, among the twin-2 data, five factors with eigenvalues greater than 1 emerged but the first factor, with an eigenvalue of 7.03 and accounting for 35.2% of the variance, clearly dominates the others (factor 2 has an eigenvalue of 2.72 and accounts for 13.6% of the variance).

As can be seen in Table 2, all 20 variables from the TEIQue and the NEO load on the first factor, with loadings ranging from .32 to .77 in the twin-1 data and from .35 to .74 in the twin-2 data. Among the twin-1s, only two variables (openness from the NEO and emotion management from the TEIQue) have loadings less than .40; among the twin-2s, three variables (openness and agreeableness from the NEO and emotion management from the TEIQue) have loadings less than .40. Among both sets of twins, a majority of the variables have loadings of .60 or higher, providing strong evidence for a GFP. The pattern of loadings in both sets of twins is also very similar (Spearman's rho = .92, df = 18, p < .0005), providing excellent cross-replication.

The correlation between MZ twins on the first unrotated (GFP) factor in Study 2 was .46, while between DZ twins it was .23. A full ACE model was fit which showed that additive genetic (46%) and nonshared environmental factors (54%) fully account for individual differences in the GFP.

Discussion

In two samples, a GFP was extracted from a combination of five factors from the NEO and 15 facets from the TEIQue. As in Study 1, the pattern of loadings on these GFPs was very similar and the factors again appear to represent a cluster of desirable personality traits: i.e., high scores on emotion-related traits — especially self esteem, happiness, optimism, and relationships — coupled with high extraversion and conscientiousness and low scores on neuroticism. Also replicating Study 1, univariate BG analyses found that individual differences in the Study 2 GFP were fully attributable to genetic and nonshared environmental factors, although in the Study 2 sample there was little indication of non-additive genetic effects because the MZ correlation was not more than twice as large as the DZ correlation.

General Discussion

In two studies, evidence for the existence of a general factor of personality was obtained. In Study 1, the GFP represented high mental toughness, extraversion, and conscientiousness and low neuroticism. In Study 2, the GFP represented high trait EI, extraversion and conscientiousness, and low neuroticism. Thus, in both studies, the GFP represents a cluster of desirable personality traits that have likely been subjected to natural selection and which, in combination, contribute to emotional stability.

Evidence for a genetic contribution to individual differences in the GFP was also obtained in both studies. The pattern of MZ and DZ twin correlations in Study 1 suggested that nonadditive (dominance) effects might be operating — a result that would be in accord with the only previous behavioral genetic studies of the GFP (Rushton et al. 2008). Our Study 2 indicated that only additive genetic factors were operating but, in both studies, our samples were too small to permit the proper detection of dominance effects. What can be concluded is that, in accordance with virtually all previous BG studies of personality, individual differences in the GFP are fully accounted for by genetic and nonshared environmental factors.

The inclusion of mental toughness in the GFP further supports the evolutionary theory put forth by Rushton et al. (2008), which suggests that the positive pole of the GFP comprises traits that allow for social acceptance and dominance in competition. Mental

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toughness, by definition, facilitates both as it implies a confident and well-adapted individual who functions well under stress. Rushton et al. (2008) also proposed that high scores on the GFP might be associated with higher levels of trait EI and that this too would be consistent with Darwin's idea that the expression of emotion is an evolutionary adaptation that contributes to survival.

Beyond providing support for Rushton et al.'s (2008) aforementioned hypothesis, our findings also provide a very clear illustration of how the concept of trait EI is integrated into established personality hierarchies. Previous research (e.g., Petrides et al., 2007) has determined with precision the construct's location in personality factor space and concluded that the range of attributes that have collectively and variously been described as emotional 'intelligence,' emotional 'literacy,' 'emotional competence,' etc. are, in fact, permutations of established personality traits. The current results fully corroborate this position because if EI was anything other than a personality trait, it would not have been possible for a general factor to emerge from such an analysis.

Moreover, it is significant that the TEIQue in this context yields results similar to those obtained with a variety of longstanding personality inventories (e.g., Cloninger's Temperament and Character Inventory, Comrey Personality Scales, and the MMPI) because this constitutes further, if indirect, evidence that it too assesses personality characteristics (see also Vernon et al., 2008). But it is the emergence of a strong, replicable, and heritable general factor of personality, derived from different instruments and in different twin datasets, which is of particular interest in this paper. Future research may fruitfully employ multitrait-multimethod approaches to replicate and extend these findings, but it should also address as a priority the nature and practical importance of the general factor of personality.

References

Becker, P. (1999). Beyond the Big Five. *Personality and Individual Differences, 26,* 511–530.

Block, J. (1995). A contrarian view of the five-factor approach to personality description. *Psychological Bulletin, 117,* 187–215.

Cattell, R. B. (1946). *Description and measurement of personality*. New York: World Book.

Clough, P., Earl, K., & Sewell, D. (2001). Mental toughness: The concept and its measurement. In I. Cockerill (Ed.), *Solutions in Sport Psychology* (pp. 32–42). London: Thomson.

DeYoung, C. G., Peterson, J. B., & Higgins, D. M. (2001). Higher-order factors of the big five predict conformity: Are there neuroses of health? *Personality and Individual Differences, 33*, 533–552.

Digman, J. M. (1997). Higher-order factors of the Big Five. *Journal of Personality and Social Psychology, 73,* 1246–1256.

Eysenck, H. J. (1947). *Dimensions of personality.* London: Routledge & Kegan Paul.

Eysenck, H. J. (1991). Dimensions of personality: 16, 5, or 3? Criteria for a taxonomic paradigm. *Personality and Individual Differences, 12,* 773–790.

Eysenck, H.J. (1992). Four ways five factors are not basic. *Personality and Individual Differences, 13,* 667–673.

Freudenthaler, H. H., Neubauer, A. C., Gabler, P., & Scherl, W. G. (2008). Testing the Trait Emotional Intelligence Questionnaire (TEIQue) in a German-speaking sample. *Personality and Individual Differences, 45,* 673–678.

Goldberg, L. R. (1981). Language and individual differences: The search for universals in personality lexicons. *Journal of Personality and Social Psychology, 59,* 1216–1229.

Goldberg, L. R. (1990). An alternative description of personality: The Big Five factor structure. *Journal of Personality and Social Psychology, 59,* 1216–1229.

Horsburgh, V. A., Schermer, J. A., Veselka, L., & Vernon, P. A. (2009). *Personality and Individual Differences, 46,* 100–105.

Johnson, A. M., Vernon, P. A., & Feiler, A. R. (2008). Behavioral genetic studies of personality: An introduction and review of the results of 50+ years of research. In G. J. Boyle, G. Matthews, and D. H. Saklofske (eds.), *Personality theory and assessment, Vol. 1.* London: Sage.

Kasriel, J., & Eaves, L. (1976). The zygosity of twins: Further evidence on the agreement between diagnosis by blood groups and written questionnaire. *Journal of Biosocial Science, 8,* 263–266.

Kobasa, S. C. (1979). Stressful life events, personality, and health: An inquiry into hardiness. *Journal of Personality and Social Psychology, 37*, 1–11.

Kobassa, S. C., Maddi, S. R., & Kahn, S. (1982). Hardiness and health: A prospective study. *Journal of Personality and Social Psychology, 42,* 168–177.

Martin, N. G., Eaves, L. J., Kearsey, M. J., & Davies, P. (1978). The power of the classical twin study. *Heredity, 40,* 97–116.

Musek, J. (2007). A general factor of personality: Evidence for the Big One in the five-factor model. *Journal of Research in Personality, 41,* 1213–1233.

Neale, M. C., Boker, S. M., Xie, G., & Maes, H. H. (2006). *Mx: Statistical modeling manual* (7th ed.). Richmond, VA: Department of Psychiatry, Medical College of Virginia.

Nichols, R. C., & Bilbro, W. C. Jr. (1966). The diagnosis of twin zygosity. *Acta Genetica et Statistica Medica, 16,* 265–275.

Nicholls, A. R., Polman, R. C. J., Levy, A. R., & Backhouse, S. H. (2008). Mental toughness, optimism, pessimism, and coping among athletes. *Personality and Individual Differences, 44,* 1182–1192.

https://doi.org/10.1375/twin.12.3.254 Published online by Cambridge University Press

Petrides, K. V. (2009). *Technical manual for the Trait Emotional Intelligence Questionnaire (TEIQue)*. London: London Psychometric Laboratory.

Petrides, K. V., Pita, R., & Kokkinaki, F. (2007). The location of trait emotional intelligence in personality factor space. *British Journal of Psychology, 98*, 273–289.

Rushton, J. P., Bons, T. A., Ando, J., Hur, Y. M., Irwing, P., Vernon, P. A., et al. (in press). A General Factor of Personality from Multitrait–Multimethod Data and Cross National Twin Studies.

Rushton, J. P., Bons, T. A., & Hur, Y. M. (2008). The genetics and evolution of the general factor of personality. *Journal of Research in Personality, 42*, 1175–1185.

Rushton, J. P., & Irwing, P. (in press). A General Factor of Personality in the Comrey Personality Scales, the Minnesota Multiphasic Personality Inventory-2, and the Multicultural Personality Questionnaire. *Personality and Individual Differences*.

Sullivan, P. F., & Eaves, L. J. (2002). Evaluation of analyses of univariate discrete twin data. *Behavior Genetics, 32*, 221–227

van der Zee, K., Thiis, M., & Schakel, L. (2002). The relationship of emotional intelligence with academic intelligence and the Big Five. *European Journal of Personality, 16*, 103–125.

Vernon, P. A., Villani, V. C., Schermer, J. A., & Petrides, K. V. (2008). Phenotypic and genetic associations between the Big Five and trait emotional intelligence. *Twin Research and Human Genetics, 11*, 524–530.

Wiggins, J. S. (1979). A psychological taxonomy of trait-descriptive terms: The interpersonal domain. *Journal of Personality and Social Psychology, 37*, 395–412.

https://doi.org/10.1375/twin.12.3.254 Published online by Cambridge University Press