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A General Factor of Personality (GFP) from the Multidimensional Personality Questionnaire

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ABSTRACT

The hypothesis that a General Factor of Personality (GFP) occupies the apex of the hierarchical structure of personality was examined in the validation sample of the Multidimensional Personality Questionnaire. A maximum likelihood estimation model that went from the 11 primary traits to five higher-order traits resembling the Big Five, and from there to the Big Two (Plasticity, Stability), and from there to the Big One, provided a good fit to the data, explaining 25% of the variance in the two second-order factors. We consider the GFP from the perspective of evolutionary life-history theory.

1. Introduction

A recent hypothesis is that a General Factor of Personality (GFP) occupies the apex of the hierarchical structure of personality in the same way that *g*, the general factor of mental ability, occupies the apex in the organization of cognitive abilities. The main empirical impetus for identifying the GFP has come from the observation that the Big Five factors often correlate with each other, i.e., they are not orthogonal. When Digman (1997) examined 14 sets of inter-scale correlations from the Big Five, he found the average correlation was .26. He extracted two reliable higher-order factors: Alpha (Agreeableness, Conscientiousness, Emotional Stability) and Beta (Extraversion, Openness), which he associated with socialization processes and personal growth, respectively. Subsequently, DeYoung (DeYoung, 2006; DeYoung, Peterson, & Higgins, 2001) replicated Digman's two-factor solution and re-labeled Alpha as Stability and Beta as Plasticity.

A conceptual reason for expecting a GFP comes from evolutionary life-history theory. Building on Wilson's (1975) analysis of *r-K* reproductive strategies, which explains how animals populate islands, Rushton (1985, 1990) proposed that "one basic dimension – *K* – underlies much of the field of personality" (1985, p. 445). Rushton postulated that personality traits co-evolved with altruism, intelligence, attachment styles, growth, health, longevity, sexuality, and fecundity to form a co-coordinated suite of traits organized to meet the trials of life-survival, growth, and reproduction. Unlike conventional personality psychology, life-history theory predicts hierarchically organized traits, culminating in a single, heritable, super-factor. Traits need to be harmonized, not work independently of each other.

Research has confirmed many predictions from life-history theory (Bogaert & Rushton, 1989; Figueredo, Vásquez, Brumbach, & Schneider, 2004, 2007; Templer, 2008). For example, among university students, Bogaert and Rushton (1989) found correlations between self-reported delinquency, sex guilt, mating effort (e.g., number of sex partners), general intelligence, and an aggregate of items assessing family size, maturational speed, longevity, and altruism. Although the average correlation between single indices of *K* was low, aggregate measures were predictive of a general factor on which single items loaded an average of .31. The results held true when three separate measures of family background were statistically controlled.

Subsequently, Figueredo et al. (2004) found a substantially heritable "Super-*K*" dimension. They analyzed the National Survey of Midlife Development in the US (MIDUS), a representative sample of 50,000 households that included 309 MZ and 333 DZ twin pairs aged 25- to 74-years. They grouped 253 of 2000 questions into 30 life-history scales (e.g., quality of family relationships and altruism toward kin), medical symptoms (physical and psychological health), personality traits (the Big Five), and social background (e.g., financial security). The results showed a substantially

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heritable "Super-*K*" dimension comprising three lower-order (also heritable) factors (a lower-order *K* factor, a "co-vitality" health factor, and a general personality factor). In another analysis of the MIDUS data, Figueredo et al. (2007) replicated these findings using a sub-sample of 2095 non-twin parents who by middle-age had chosen their life niches to marry (or not), to bear and raise offspring (or not), and to create social networks. In both studies, Figueredo et al. controlled for "social privilege" by regressing out level of education, race, and family income and found it accounted for less than 10% of the variance and did not change the pattern of factor loadings.

Hofstee (2001) introduced a general "*p*-factor" (personality factor), analogous to *g* for mental ability, and suggested there had been natural selection for individuals with more socially desirable traits, such as competence, emotional steadiness, and reality-orientation. In this analysis, social desirability was much more than a mere artifact of social perception. Hofstee (2003) went so far as to dub *p*, "the Primordial One" (p. 249).

It was Musek (2007) who brought the GFP to theoretical center stage. He analyzed data from various samples across several assessment methods including the Big Five Inventory, the Big Five Observer, the Positive Affect and Negative Affect Schedule, the Satisfaction with Life Scale, the Self-Liking and Competence Scale, and the International Personality Item Pool. Musek's analyses yielded first, Digman's (1997) Big Two, followed by a higher-order factor that explained 60% of the source variance. Musek described the Big One as an optimum blend of all socially valued dimensions. Musek (2007) did not mention life-history theory but conjectured that the general factor would be "deeply embedded in our evolutionary, genetic and neurological endowment" (p. 1228).

The genetics and evolution of the GFP were discussed by Rushton, Bons, and Hur (2008) who found a GFP accounted for 56 percent of the reliable variance in the Big Five factors, the EAS temperament traits of Emotional Stability, Activity, and Sociability, and measures of prosocial behavior. The results were robust across three diverse samples – 214 university students in Canada, 322 pairs of adult monozygotic (MZ) and dizygotic (DZ) twins from the UK, and 575 pairs of 2- to 9-year-old twins from South Korea. High scorers were identified as open, conscientious, sociable, agreeable, emotionally stable, and altruistic. Analysis of the twin data showed that the GFP was present by 2- to 3-years of age, with 50% of the variance due to genetic and 50% to environmental influences.

Further support for the GFP came from two meta-analyses of Big Five correlations by Rushton and Irwing (2008). In Study 1, they used structural equation modeling (SEM) and found a GFP that explained 45% of the reliable variance in a model that went from the Big Five to the Big Two to the Big One in the 14 sets of inter-scale correlations ($N = 4496$) assembled by Digman (1997) to establish the Big Two. Higher-order Alpha was defined by Conscientiousness, Emotional Stability, and Agreeableness, with loadings of from .61 to .70, while Beta was defined by Openness and Extraversion, with loadings of .55 and .77. In turn, the GFP was defined by Alpha and Beta with loadings of .67. In Study 2, Rushton and Irving cross-validated the model finding their GFP explained 44% of the variance in a published meta-analytic data set of four alternative measures of the Big Five ($N = 4000$) by Mount, Barrick, Scullen, and Rounds (2005).

Subsequently, Rushton and Irwing (2009) found the GFP in three additional personality inventories constructed from a variety of conceptual approaches. In Study 1, a GFP explained 41% of the reliable variance in a cross-validation study of the Comrey Personality Scales ($Ns = 746$, 2097) that went from the eight primary traits to three higher-order factors (Extraversion, Conscientiousness, Empathy) and from there to the GFP. In Study 2, a GFP explained 20% of the total reliable variance in the Minnesota Multiphasic Personality Inventory-2 ($N = 2600$) in a model that went from the 10 clinical scales to four higher-order factors to two second-order factors to the Big One. In Study 3, a GFP explained 41% of the reliable variance in a bi-factor model of the Multicultural Personality Questionnaire ($N = 840$) with significant loadings on four of the five factors (Open-Mindedness, .49; Social Initiative, .36; Emotional Stability, .38; and Flexibility, .95).

In the current paper, the Multidimensional Personality Questionnaire (MPQ) provides a more stringent test of the GFP because of the research effort put into establishing its psychometric structure (Tellegen, 1982; Tellegen & Waller, 2008). It is important to examine whether the GFP can be found in a wide array of tests and conceptual approaches.

2. Method

The MPQ is a factor-analytically developed self-report instrument that measures 11 primary factors, which give rise to three and four second-order factors (Tellegen, 1982; Tellegen & Waller, 2008). The 11 primary traits are: *Wellbeing* (High scorers are happy and cheerful and feel good about themselves); *Social Potency* (High scorers are forceful and decisive and enjoy leadership roles); *Achievement* (High scorers work hard and enjoy demanding projects); *Social Closeness* (High scorers are sociable and like people); *Stress Reaction* (High scorers are tense and easily upset); *Alienation* (High scorers feel they are victims of bad luck and have been mistreated); *Aggression* (High scorers like to discomfort others); *Control* (High scorers are cautious and like to plan their activities); *Harmavoidance* (High scorers do not enjoy too much adventure); *Traditionalism* (High scorers endorse high moral standards); *Absorption* (High scorers can be absorbed in emotionally engaging sights and sounds). In the higher-order solutions, the four factors are: *Agentic Positive Emotionality* (Wellbeing, Social Potency, Achievement, Absorption); *Communal Positive Emotionality* (Wellbeing, Social Potency, Social Closeness); *Negative Emotionality* (Stress Reaction, Aggression, Alienation); and *Constraint* (Control, Harmavoidance, Traditionalism). In the three factor solution, the two factors of Agentic and Communal Positive Emotionality form (General) Positive Emotionality.

3. Results

Tables 1 and 2 give the inter-correlations among the 11 primary traits from the test manual for the validation sample of 500 college females and 300 college males (Tellegen, 1982). We averaged the values for the two sexes, and present the data both in aggregate form (see Table 1) and broken down by sex (Table 2). To test for the GFP, we performed confirmatory factor analyses on the MPQ scales using LISREL 8.72 (Jöreskog & Sorbom, 2001).

There is no fully satisfactory answer to the question of model fit (Marsh, Hau, & Grayson, 2005; Yuan, 2005). We rely partly on the simulations of Hu and Bentler (1998), Hu and Bentler (1999), which suggest the usefulness of the standardized root mean square residual (SRMSR), the root mean square error of approximation (RMSEA), and the non-normed fit index (NNFI). We adopted cut-off points of $\leqslant .05$ for the SRMSR, about .06 for the RMSEA, and $\geqslant .95$ for the NNFI, which conforms to recent recommendations based on Monte Carlo simulations (Hu & Bentler, 1998; Hu & Bentler, 1999; Schemelleh-Engel, Moosbrugger, & Muller, 2003). In order to make direct comparisons between models, we selected models with the minimum consistent Akaike information criterion (CAIC), following the recommendations of Jöreskog (1993) in addition to examining chi-square differences. Chi-square difference tests suffer many limitations so we treat these differences as indicators of comparative fit, rather than strict tests of the significance of differences.

Table 1
Correlations among the 11 scales of the Multidimensional Personality Questionnaire (averaged over gender, $N = 800$). Decimals omitted. Alpha coefficients are in diagonal.

	WB	SP	AC	SC	SR	AL	AG	CO	HA	TR	AB
Wellbeing (WB)	(89)	32	29	31	−48	−26	−19	−02	−10	09	20
Social Potency SP)		(88)	29	18	−13	06	23	−09	−14	00	22
Achievement (AC)			(84)	−05	−13	02	−06	25	−07	13	19
Social Closeness (SC)				(85)	−19	−21	−12	−05	13	09	−08
Stress Reaction (SR)					(89)	41	36	−13	06	04	.22
Alienation (AL)						(84)	37	−08	03	12	17
Aggression (AG)							(80)	−17	−15	−03	13
Control (CO)								(85)	23	21	−14
Harmavoidance (HA)									(84)	14	−27
Traditionalism (TR)										(84)	−13
Absorption (AB)											(88)

Table 2
Correlations among the 11 scales of the Multidimensional Personality Questionnaire (300 college males above diagonal; 500 college females below diagonal). Decimals omitted. Alpha coefficients are in diagonal.

	WB	SP	AC	SC	SR	AL	AG	CO	HA	TR	AB
Wellbeing (WB)	(89)	36	33	32	−47	−23	−15	04	−03	08	21
Social Potency SP)	28	(88)	29	20	−12	08	24	−01	−16	07	22
Achievement (AC)	24	29	(84)	−09	−10	03	−05	30	−03	15	29
Social Closeness (SC)	29	16	−01	(85)	−24	−24	−11	−09	10	07	−15
Stress Reaction (SR)	−48	−14	−16	−13	(89)	43	39	−13	−03	03	25
Alienation (AL)	−29	03	00	−17	38	(84)	44	−08	05	12	22
Aggression (AG)	−22	21	−06	−13	33	30	(80)	−19	−18	03	11
Control (CO)	−07	−16	20	00	−12	−08	−14	(85)	27	23	−04
Harmavoidance (HA)	−16	−11	−11	16	14	01	−12	18	(84)	17	−21
Traditionalism (TR)	09	−07	11	11	05	12	−09	18	10	(84)	−11
Absorption (AB)	19	22	09	00	18	11	15	−24	−32	−14	(88)

The analysis proceeded in three stages. Firstly, we determined the number of first-order factors underlying the MPQ; secondly, we investigated the higher-order factor structure; and thirdly, we tested the generalizability of the resulting solution. The correlational data in Table 1 were initially used to test two alternative first-order factor models, which corresponded to the three- and four-factor models specified by Tellegen and Waller (2008). As can be seen from Table 3, both of these models represented a very poor fit, according to all five summary fit indices. The implication is that more than four factors are required to fit the MPQ.

Tellegen and Waller (2008) also reported a solution in which they correlated the MPQ scales with Big Five factor scores. Thus we decided to test the fit of the MPQ scales to the Big Five, However, according to Tellegen and Waller, Alienation and Traditionalism did not load on any factor. In conformity with the definitions of these constructs, we allowed Alienation to load on the negative pole of Agreeableness, and Traditionalism to load on Conscientiousness (Costa & McCrae, 1992; Tellegen & Waller, 2008). However, the resultant model provided a poor fit to the data (χ^2 = 338.0, RMSEA = .11, NNFI = .64, SRMSR = .066). Empirically, the modification indices suggested an improvement in model fit with a loading of Well-Being on Agreeableness, Harm Avoidance on Conscientiousness, and Absorption on Emotional Stability. According to the definitions of these constructs, these loadings are consistent with the Five Factor model (Costa & McCrae, 1992; Tellegen & Waller, 2008). As Table 3 shows, this model provides close fit according to the SRMSR, moderate fit by the RMSEA, and poor fit by NNFI.

Table 3
Fit statistics for alternative first- and second-order factor models of the MPQ.

Model	χ^2	*df*	RMSEA	NNFI	SRMR	CAIC
Number of factors						
1. Tellegen's 3-factor model	541.1*	39	.130	.55	.090	748.6
2. Tellegen's 4-factor model	442.3*	36	.120	.59	.082	672.9
3. Five-factor model	215.3*	30	.088	.77	.052	491.9
4. Five-factor model +5 correlated errors	94.2*	25	.059	.90	.038	409.3
Hierarchical factor structure (lower-order factors uncorrelated)						
5. 11-factor null model	1572.2*	55	.190	.05	.180	1734.0
6. Five-factor model	655.1*	40	.130	.47	.120	757.8
7. 2nd order factor model	263.5*	35	.086	.77	.061	481.0
8. 3rd order factor model	253.2*	34	.086	.78	.059	479.1
9. 3rd order factor model with five correlated errors	116.0*	29	.061	.89	.047	400.4
Generalizability						
10. Model 9 in male sample	146.0*	29	.071	.88	.044	428.6
11. Model 9 in female sample	175.7*	29	.078	.81	.064	453.1

Note: χ^2 = Likelihood Ratio Test; RMSEA = Root-Mean-Square Error of Approximation; NNFI = Non-Normed Fit Index; SRMSR = Standardized Root-Mean-Square Residual; CAIC = Consistent Akaike Information Criterion.
* $p < .001$.

Evidently, at least one additional factor is required to satisfactorily model the covariance in the MPQ. In order to address this problem we carried out exploratory factor analyses using Mplus. However, with just 11 scales, it was impossible to find an acceptable six-factor solution. In order to solve this problem, we chose to add five correlated errors on the basis of inspection of the modification indices. This procedure is inherently unsatisfactory in that each correlated error represents additional specificity after variance due to the first five factors has been removed, i.e. the five correlated errors indicate the presence of one or more additional factors over and above the Big Five. However, we could find no more viable solution. The resultant model meets our criteria of close fit according to the RMSEA and SRMSR, those indices most sensitive to the correct specification of factor structures (Hu & Bentler, 1999), while the NNFI is in the region of acceptable fit.

In order to investigate the higher-order factor structure of the MPQ, we tested a sequence of models. To provide a baseline, we first estimated an 11-factor model in which no correlations were allowed between the factors. Second, we fitted the Five-factor model described above, but without allowing either correlations between the factors or correlated errors. Third, we added two uncorrelated second-order factors. Finally, we tested for a single third-order factor corresponding to the General Factor of Personality, the central issue for this paper. The logic of testing this sequence of nested models was that a significant chi-square difference at each stage would demonstrate the superiority of each new model over its predecessor. The validity of this procedure for choosing between nested models is long established (Jöreskog, 1993).

From Table 3, the chi-square difference for the comparison of the Five-Factor model against the null model was 917.1 (df = 15, P < .001), a substantial and significant increment in fit. Next, we added two second-order factors corresponding approximately to DeYoung's (2006) Stability and Plasticity factors, in conformity with the structure fitted to the Big Five by Rushton and Irwing (2008). This lead to a further large and significant improvement in fit ($\Delta\chi^2$ = 391.6, df = 5, P < .001). Finally, the critical test for the GFP hypothesis was whether adding a single third-order factor would also provide a significant increment in fit. In order to allow a localized just identified third-order factor, it was necessary to equate the loadings of the two second-order factors on the General Factor of Personality. Crucially, the addition of the GFP also significantly improved the model fit ($\Delta\chi^2$ = 10.3, df = 1, P < .005). However, while inspection of the absolute fit indices showed close fit according to the SRMSR, the RMSEA was indicative of only moderate fit, and the NNFI was poor. We used the solution adopted above of adding the identical five correlated errors. The resulting model evidenced close fit according to the SRMSR and RMSEA, those indices most diagnostic of the correctness of the factor structure, while the NNFI was in the region suggestive of moderate fit. The requirement for five correlated errors again indicated the presence of one or more unmeasured primary factors.

Although the above series of nested comparisons provides convincing evidence for the GFP, it is notable that the first-order 5-factor model with correlated errors (model 4 in Table 3) generally exhibits a slightly better fit than the third-order 5-factor model with correlated errors (model 9 in Table 3), with the sole exception of the consistent Akaike Information Criterion, which points to the superiority of model 9. Overall, the difference in fit between models 4 and 9 may point to a minor level of misfit in either the second or third-order factors. This misfit may be attributable to many sources of error (Jöreskog, 1993, pp. 301–302). In this instance, the multidimensional nature of the source scales is the likely explanation.

Fig. 1 presents the resulting third-order factor model. Inspection of this figure shows that the factor loadings of the GFP were estimated at .50, accounting for 25% of the variance in the two second-order factors. The factor structure of Stability conformed more or less with previous findings showing loadings on Emotional Stability, Agreeableness and Conscientiousness, although there was also an unexpected small loading on Extraversion (DeYoung, 2006; Rushton & Irwing, 2008). Intriguingly, while the loading of Plasticity on Openness-to-Experience is in conformity with previous studies, the negative loadings on Extraversion and Agreeableness were not anticipated. However, the opposite of Agreeableness is often interpreted as Independent Mindedness (Smith & Smith, 2005), so the new factor reflects quite well DeYoung's definition of Plasticity as representing, "the ability and

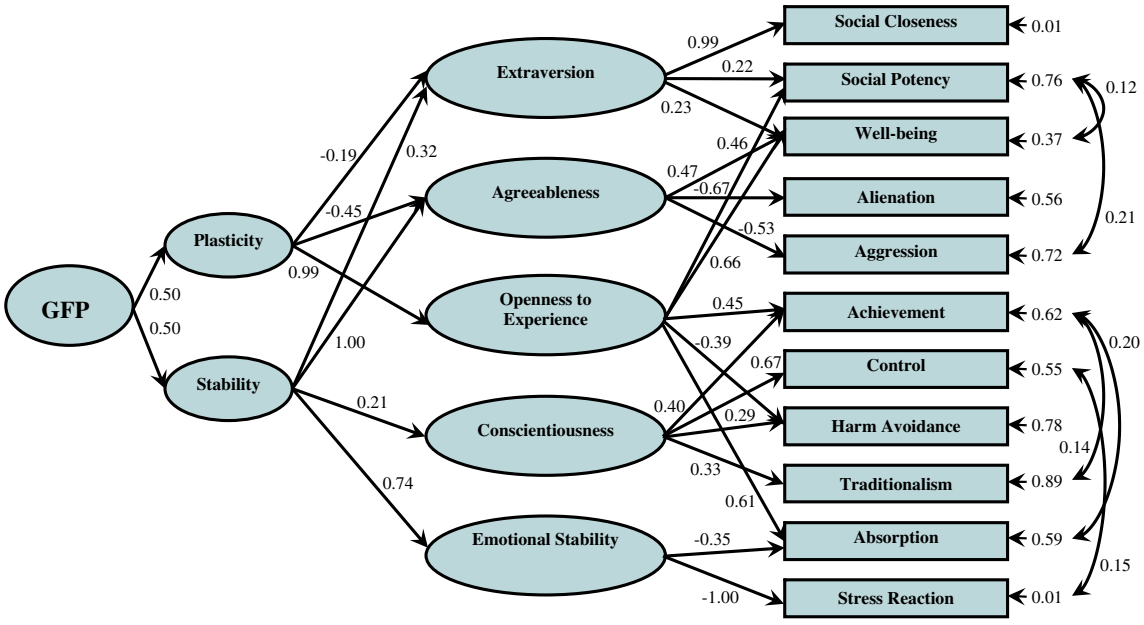

Fig. 1. MPQ third-order confirmatory common factor structure. (Ellipses enclose factors, boxes enclose indicators. Long unidirectional arrows represent factor loadings, short arrows unexplained variance, and double-headed arrows depict correlated errors. GFP = General Factor of Personality.)

tendency to explore and engage flexibly with novelty, in both behavior and cognition" (DeYoung, 2006, p. 1138).

The final step in the analysis was to test the generalizability of our preferred model by examining how well it fits the data for the males and females in our data, this time considered separately, as shown in Table 2. From Table 3, it can be seen that for the male sample the fit of our model is close according to the SRMSR, moderate to close according to the RMSEA, and just about adequate as measured by the NNFI. In fact the fit does not deviate greatly from that in the sample as a whole. However, the fit in the female sample is notably worse with the SRMSR near to the region of close fit, the RMSEA indicative of moderate fit, and the NNFI showing poor fit.

4. Discussion

The data show that a General Factor of Personality (GFP) occupies the apex of the hierarchical structure of the Multidimensional Personality Questionnaire in a re-analysis of the 11 primary scales, with five first-order and two second-order factors. The MPQ is often considered to be an excellent psychometric structure. Its structure is meaningfully complex, with a sustained effort made to cover a broad domain rather than an overly narrow area, and with much interest devoted to higher-order constructs (Tellegen & Waller, 2008). Orthogonal factor analysis was used to ensure distinctive scales, but not to force independent scales. To this extent it provided a useful test of, and positive evidence for, the GFP hypothesis.

However, in some ways, the MPQ may be regarded as a strong test for the GFP, because in common with many personality questionnaires, it was developed using exploratory rather than confirmatory factor analysis (Tellegen, 1982). Such techniques provide only weak evidence for the unidimensionality of the resultant scales (Embretson & Reise, 2000), and indeed, because the 11 scales of the MPQ are made up of 59 item clusters judged to be similar (Tellegen & Waller, 2008), it would seem that an explicit decision was made to opt for complex primary scales. Furthermore, since our preferred factor model shows six cross-factor loadings, and requires five correlated errors, the data presented here supports the multidimensionality of the MPQ scales. It is sometimes incorrectly asserted that high reliability, which is demonstrated by the MPQ scales as measured by Cronbach's alpha, is incompatible with multi-dimensionality. However, Sijtsma (2009) among others has shown that alpha and degree of multi-dimensionality are essentially unrelated. The problem that multi-dimensional scales provide for a GFP analysis is that they will bias factor loadings at each hierarchical level in unpredictable ways.

An objection which might be made to our conclusion is that our test of the GFP is incomplete since the presence of five correlated errors indicates the existence of one or more additional unmeasured factors. This argument has merit. However, we make a distinction between factors which underlie primary scales and those which are reliably measured. In the case of the MPQ, both our Mplus exploratory factor analysis and our confirmatory analyses suggest that while there are additional factors underlying the MPQ other than the Big Five, these factors cannot be reliably modeled. In other words, the choice is to test for the GFP in the MPQ broadly following our procedures, or not to test for it at all.

In addition to providing direct tests of our third-order factor model, we provided a limited test of its generalizability to the male and female samples considered separately. The model held quite well in the male sample but only moderately in the female sample. This may point to the intriguing possibility that the GFP has a slightly different structure for males and females due to different evolutionary pressures. In any case, this finding provides modest evidence for the model's generalizability. However, a stronger test of generalizability would be afforded by testing its fit in a second large population representative sample.

The magnitudes of the factor loadings of the GFP on the first-order factors of Stability and Plasticity were of moderate magnitude, accounting for 25% of the variance in these factors. Prima facie, this appears to represent only weak support for a GFP. However, we have now found a general factor in two sets of Big Five measures and several other personality scales, which provides accumulating evidence for a GFP (Rushton & Irwing, 2008, 2009; Rushton et al., 2008). The question is, if there is a General Factor of Personality, will it show in all data sets? Since there are innumerable reasons why a general factor may disappear in any given data set, such as inadequate measures, incorrect analytic techniques, sampling variability, range restriction, the presence of moderator variables, and lack of reliability, the answer to this question seems likely to be in the negative. We conclude, therefore, that the general factor of moderate magnitude found in the data presented here constitutes evidence in favor of the GFP.

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