Journal of Research in Personality 45 (2011) 44–49

Contents lists available at ScienceDirect

Journal of Research in Personality

journal homepage: www.elsevier.com/locate/jrp

The general factor of personality: Questions and elaborations

John C. Loehlin [a,*], Nicholas G. Martin [b]

[a] University of Texas at Austin, USA
[b] Queensland Institute of Medical Research, Brisbane, Australia

ARTICLE INFO

Article history:
Available online 18 November 2010

Keywords:
General factor of personality
Social desirability
Items vs. scales
Twins
Rushton
Eysenck Personality Questionnaire
Cloninger's Tridimensional Personality Questionnaire
Heritability
Non-additive genetic variance

ABSTRACT

Predictions from Rushton's theory that a general factor of personality (GFP) has evolved based on effective social participation were examined in two large samples of adult Australian twins (5834 and 3672 individuals) and their relatives (8303 and 2677). General factors based on items and scales were compared to each other, across two different questionnaires, and between adults and adolescents. Behavior-genetic analyses based on the twin samples tested predictions comparing GFPs to scales with the GFP partialled out. Some support was found for Rushton's theory, but the GFP was only marginally more heritable than the GFP-free scales and was not especially marked by the expected non-additivity of its genetic variance; moreover, the adult and adolescent GFPs showed substantial differences.

1. Introduction

Rushton and his colleagues, following Musek (2007), have proposed that a single higher-order factor may be found for personality measures, analogous to the *g* factor for measures in the cognitive ability domain (Rushton, in press; Rushton, Bons, & Hur, 2008; Rushton & Irwing, 2009a, 2009b, 2009c; Rushton et al., 2009). Such a general factor of personality (GFP) displays at its high end traits conducive to effective social participation, and at its low end traits indicative of difficulties in social interaction. In terms of the Big Five, higher scores on the GFP tend to go with higher scores on Agreeableness, Conscientiousness, Extraversion, and Openness, and lower scores on Neuroticism (Musek, 2007).

Rushton et al. (2008) suggested that a GFP has emerged during human evolution because of selection of humans to function effectively in social groups. A rival interpretation of the general factor that is often found in personality questionnaires or ratings is that it represents a relatively superficial "social desirability" dimension, the tendency of individuals to mark questionnaire items in a generally more or less favorable direction (Edwards, 1957). Such differences might reflect differences in self-esteem, one's own view of oneself, or in impression management, the desire to make a favorable impression on others (Uziel, 2010). Especially in the context of rating others, this is often referred to as a "halo effect", a tendency to exaggerate the uniformity of favorable or unfavorable traits of the ratee.

There has been a good deal of recent research focused specifically on the Big Five personality traits, to ascertain whether the observed correlations among them are due to substance or artifact. The criteria used to distinguish substance from artifact have included stability over time, consistency of self- and peer-reports, genetic influence, extensions to psychopathology, and correlations with independent measures of particular artifacts (e.g., Anusic, Schimmack, Pinkus, & Lockwood, 2009; Biesanz & West, 2004; DeYoung, 2006; Kandler, Riemann, Spinath, & Angleitner, 2010; Markon, Krueger, & Watson, 2005; McCrae et al., 2008; Riemann & Kandler, 2010). The different authors have differed somewhat in how the Big Five scale intercorrelations should be parsed into higher-order components, or indeed whether they reflect true second-order factors at all, or stem from the loading of lower-order facets on more than one of the Big Five dimensions (e.g., Ashton, Lee, Goldberg, & de Vries, 2009). However, the majority conclude that both psychological substance and psychometric artifact are involved, and that the scale intercorrelations are not, at the one extreme, solely a function of social desirability, nor, at the other, the consequence of a single substantive causal factor.

The present study will not focus on measures of the Big Five traits, and it will employ only a limited strategy—namely, a behavior-genetic analysis based on self-report data from two questionnaires. Thus it will not resolve all the questions arising in the Big Five studies. Nevertheless, it can address some of the issues raised by Rushton's hypothesis that a general factor of personality exists, and exists for evolutionary reasons.

* Corresponding author. Address: Psychology Department, University of Texas, 1 University Station A8000, Austin, TX 78712-0187, USA.
E-mail address: loehlin@psy.utexas.edu (J.C. Loehlin).

0092-6566/$ - see front matter © 2010 Elsevier Inc. All rights reserved.
doi:10.1016/j.jrp.2010.11.008

Under Rushton's interpretation, a GFP should show a substantial degree of genetic determination. In the case of a social desirability factor as a purely psychometric phenomenon, one would be less likely to make such a prediction.

Moreover, if the GFP represents the result of directional selection for traits conducive to effective social participation, one would predict it to have a substantial proportion of its genetic variation non-additive, i.e., dependent on gene combinations, rather than on the cumulative effect of individual genes. This is because additive genetic variation tends to be reduced more rapidly under selection than does non-additive genetic variation, due to the more direct association of the individual genes with the trait. Personality traits independent of the GFP might still show non-additive genetic variation to some extent due to stabilizing selection against extremes, but it should be less marked than for the GFP, which has (according to the theory) been subject to strong directional selection throughout much of human evolutionary history.

Existing data from the Australian twin studies can be used to evaluate the above hypotheses concerning the GFP. In two samples of adult twins and samples of relatives of these twins, respondents filled out questionnaires that included short versions of the Eysenck Personality Questionnaire (EPQ) and Cloninger's Tridimensional Personality Questionnaire (TPQ). There is evidence that these two questionnaires cover some common ground, but also to some extent assess distinct dimensions (Heath, Cloninger, & Martin, 1994). Therefore, it is of interest to see how highly a GFP derived from the EPQ correlates with one derived from the TPQ. Under Rushton's theory, such correlations should be fairly high (although probably not unity, because in neither case would one expect measurement of the GFP to be perfect). A social desirability theory should also predict a positive correlation, since such a tendency would be expected to be operative during the filling out of both questionnaires.

Because two of the Australian samples consist of twins, we can also estimate the extent to which the genes contribute to an obtained general factor, as well as the extent to which the effects of the genes involved are non-additive. Moreover, we can compare these results to results from scores on personality measures independent of the GFP—the scales of the two questionnaires after partialling out the GFP.

Another Australian twin sample consisted of adolescent twins (aged 12–16). They received only the Eysenck questionnaire, and in a different version, but they permit further evaluation of the generality of the results. Will the GFP at adolescence be essentially similar in content to the GFP in adulthood? Will it also be distinctively marked by non-additive genetic variance?

2. Materials and methods

2.1. Samples

The first sample consisted of adult twins, aged 24–88, who had in 1980 responded to a mailed questionnaire, and in 1988 were sent by mail a 16-page follow-up questionnaire that contained, among a variety of other topics, a section marked "Personality I" containing 55 EPQ items and one called "Personality II" containing 54 TPQ items. Responses to both sets of items were provided by 5834 individuals.

The second twin sample consisted of additional Australian twins who had been too young in 1980 to receive the original questionnaire, but in 1989 were mailed a similar 16-page questionnaire that contained both the EPQ and the TPQ items, although in a somewhat different order and context. Their ages when tested ranged from 17 to 29. In total, 3638 individuals completed both sets of items (Gillespie, Johnstone, Boyce, Heath, & Martin, 2001).

The twins in both samples were asked to supply the names and addresses of relatives to whom a briefer version of the questionnaire could be sent. The questionnaire mailed to relatives included both the EPQ and TPQ items. Relatives of the first twin sample who filled out the questionnaire describing themselves included 8303 parents, spouses, siblings, and adult offspring, in the age range 18–96; the second sample provided 2677 parents, spouses, and siblings, aged 18–82.

A fifth sample consisted of adolescent twins and some siblings close to them in age who came to the laboratory to be tested three times, at ages 12, 14, and 16. Not all participated on all three occasions: 1099 individuals were tested at age 12, 881 at age 14, and 852 at age 16, on a battery that included the Junior Eysenck Personality Questionnaire (JEPQ).

A small fraction (about 0.6%) of the individuals in these various samples appear more than once in the data (an individual could be a twin as well as a relative or spouse of a twin, for example). However, the slight degree of redundancy thereby introduced should not present problems for the analyses to be reported in this paper.

2.2. Questionnaires

The mailed questionnaires covered various health and lifestyle topics. They varied somewhat in length (9–16 pages) and content, but all included a number of questions related to socioeconomic background, to health matters including alcohol use and smoking, and to personality and attitudes—including the Eysenck and Cloninger items on which our present analyses focus. The Eysenck items were from the 48-item EPQ-R-S (Eysenck, Eysenck, & Barrett, 1985), with the addition of 7 impusiveness items since the extraversion items in the EPQ-R-S only assess the sociability subfactor. There were 54 TPQ items (18 for each of the Harm Avoidance, Novelty Seeking and Reward Dependence scales) selected by Dr. Cloninger from the full Tridimensional Personality Questionnaire (Cloninger, Przybeck, & Svrakic, 1991), and as described in Heath et al. (1994).

2.3. Missing data and scale scores

If a respondent omitted more than 25% of the items from the Eysenck or Cloninger questionnaire, that questionnaire was excluded from further analysis. Otherwise, missing items were simply scored as "don't knows" for the purposes of the factor analyses. The scale scores had been obtained by a slightly more complex procedure. Again, a scale was scored as missing if 25% or more of the responses to items on the scale were missing. Otherwise, missing items were replaced by the mean response to that item for the sample as a whole.

2.4. Analyses

Rushton and his colleagues have usually provided a hierarchical series of factor analyses concluding with a single factor at the top. This is partly because their analyses often started from published scales and their intercorrelations. We will consider the GFP as the first principal component of a given pool of items, or of a set of scales based on those items. The obtained components were reflected as necessary for consistency across analyses.

After obtaining scores on GFPs for the EPQ and TPQ items, a mean of the two was taken as the best estimate of the overall GFP (As a check, a GFP was derived in an alternate way for the adult twin samples, via a factor analysis of the combined Eysenck and Cloninger items. The two methods provided virtually identical GFPs, as represented by correlations of .999 and .989 in the two samples). The original estimate was regressed from the scale scores on each of the two inventories, leaving residual scores for the four Eysenck and three Cloninger dimensions that were independent of the GFP.

The GFP and these residual scores were then subjected to model-fitting analyses based on the correlations between the twins in monozygotic (MZ) and same-sex dizygotic (DZ) pairs. The model that was fit depended on whether the DZ correlation exceeded half the MZ correlation. If it did, a model assuming additive genetic variance, shared environmental variance, and nonshared environmental variance was fit to the data. If the DZ correlation was less than half the MZ correlation, a model assuming additive genetic variance, non-additive genetic variance, and nonshared environmental variance was used.

The question arose as to how to model the non-additive genetic variance. It has been fairly traditional among behavior geneticists to model non-additive genetic variance as purely due to genetic dominance, ignoring possible effects of genetic epistasis. However, as Eaves (1988) points out, this sometimes leads to implausible results, such as negative estimates of additive genetic variance. In a study of fingerprint patterns, in which data were available for a number of different family relationships, a model involving just additive and epistatic effects, with no contribution from dominance, provided the most satisfactory fit (Heath, Martin, Eaves, & Loesch, 1984). Some have proposed that non-additive genetic effects on complex human behavioral traits may chiefly reflect epistasis involving large numbers of genes, a view labeled emergenesis (Lykken, 1982). With twin data alone, one cannot distinguish empirically between various sources of non-additive genetic variance, but for our purposes it is not necessary to do so. Different models lead to quantitatively different estimates of non-additive genetic variance, but these tend to behave comparably across traits, and thus are equivalent for the questions we are addressing. In the tables, we report results for a model in which the non-additive genetic variance is assumed to be epistatic in origin, but this is mainly for convenience, and to avoid the awkwardness of a negative estimate of variance that occurred under a pure dominance model.

For the adolescent sample, if the JEPQ was taken more than once, the mean of an individual's responses to items or scale scores was used. As previously noted, GFPs based on the Cloninger questionnaire were not available for this group.

3. Results and discussion

First, how do items and scales compare as a basis for GFPs? In some ways, this is not a very crucial question, for, as the top rows in Table 1 show, GFPs obtained in the two ways were in good agreement across the four samples, with correlations mostly in the .80–.90 range, perhaps a little higher for the TPQ, but substantial for both questionnaires.

However, if one takes the agreement between GFPs from the two questionnaires as an indication of their merit in assessing a common GFP, the next rows in Table 1 suggest that the GFPs from the items have a clear advantage: their agreement between questionnaires approaches a correlation of .8 (correlations in the range .746–.795), whereas the corresponding agreement based on scales is closer to .6 (correlations of .545–.643).

The remaining rows in Table 1 describe some general characteristics of the samples: the young adult twins were mostly in their 20 s, and the other three were reasonably similar and more widely spread in age, with means in the 40 s. As is typical of volunteer samples, there were more females than males, although the difference was fairly slight in the samples of relatives.

Tables 2 and 3 describe the nature of these general personality factors: Table 2 for the Eysenck item and scale GFPs, Table 3 for those from the Cloninger questionnaire. Items with an absolute loading above .4 on the item GFPs are shown, as well loadings for the four Eysenck and three Cloninger scales. (The items are not given in full in the tables, but a few words characterizing each are provided.)

Clearly, the Eysenck GFP from items in Table 2 is marked by social confidence at the high end and insecurity and social diffidence at the low. The Cloninger GFP high end is also marked by confidence; the low end by social withdrawal and by worry. A difference is that the Eysenck GFP loads more of the high-end items and the Cloninger GFP loads more of the low-end items; however, as was seen in Table 1, the two are in good overall agreement (correlations in the .75–.80 range across the four samples). Also shown in the tables are general factors from the scales of the two inventories. The Eysenck scales marking the high end are Psychoticism and Extraversion, those marking the low end are Neuroticism and Lie. Since Lie was originally intended as a scale to screen out responders who were trying to give an exaggeratedly good

Table 1
Agreement of general factors of personality (GFPs) from items and scales of two personality questionnaires in four Australian adult samples.

Scale	Adult twins	Young adult twins	Relatives of (1)	Relatives of (2)
Correlation of item and scale GFPs				
For EPQ	.876	.831	.785	.821
For TPQ	.877	.918	.898	.915
Correlation of EPQ and TPQ GFPs				
From scales	.615	.643	.545	.634
From items	.795	.792	.746	.793
Ns from	5753	3581	8183	2624
To	5834	3672	8303	2677
Mean age	41.94	23.24	45.08	41.19
Range of ages	24–88	17–29	18–96	18–82
% Females	65.6	60.7	52.3	54.2

Note: EPQ = Eysenck Personality Questionnaire; TPQ = Cloninger Tridimensional Personality Questionnaire. Column 1 = 1988 follow-up of 1981 sample; column 2 = 1989 study of twins too young for 1981 study; columns 3 and 4 = relatives of twins in studies 1 and 2 (parents, siblings, spouses in both, adult offspring also in 3).

Table 2
General factor of personality (GFP) from Eysenck Personality Questionnaire items and scales in four Australian samples (loadings on 1st principal components).

Item/scale	Adult twins	Young adult twins	Relatives of (1)	Relatives of (2)
Items				
45 Can get a party going	.608	.632	.650	.653
42 Get life into dull party	.607	.624	.647	.630
51 Thought lively	.591	.612	.667	.629
11 Let self go at party	.575	.531	.587	.570
7 Rather lively	.542	.540	.585	.567
32 Act first with new friends	.529	.555	.562	.560
43 Like to mix with people	.508	.507	.495	.543
15 Enjoy new people	.465	.446	.450	.473
3 Talkative	.447	.509	.537	.479
44 Like to act quickly	.443	.440	.482	.492
56 Happy-go-lucky	.419	.418	.399	.414
50 Like excitement	.412	.432	.482	.418
20 Feelings easily hurt	−.404	−.370	−.173	−.301
46 Embarrassment lasts	−.446	−.446	−.288	−.406
26 Nervous	−.449	−.415	−.290	−.400
28 Worrier	−.465	−.418	−.253	−.376
41 Mostly quiet with others	−.599	−.639	−.637	−.614
21 Keep in background	−.658	−.670	−.661	−.669
Scales				
Psychoticism	.603	.646	.698	.705
Extraversion	.706	.679	.589	.645
Neuroticism	−.611	−.521	−.195	−.417
Lie	−.244	−.430	−.644	−.479

Note: Column 1 = 1988 follow-up of 1981 sample; column 2 = 1989 study of twins too young for 1981 study; columns 3 and 4 = relatives of twins in studies 1 and 2. Items included if absolute loading $\geqslant$.400 in any of the four studies; item numbers are as in study 1 (items abbreviated).

Table 3
General factor of personality (GFP) from Cloninger Personality Questionnaire items and scales in four Australian samples (loadings on 1st principal components).

Item/scale	Adult twins	Young adult twins	Relatives of (1)	Relatives of (2)
Items				
106 Confident, sure of self	.587	.584	.576	.600
83 Relaxed with strangers	.470	.442	.462	.492
57 Confident in bad situations	.416	.478	.435	.464
102 Get over embarrassment	.396	.471	.372	.454
99 Confident and energetic	.379	.398	.374	.398
62 Relaxed and carefree	.358	.385	.340	.406
107 Stay detached from others	−.402	−.320	−.393	−.388
64 Stop because worried	−.402	−.396	−.360	−.396
85 Think long before deciding	−.415	−.393	−.429	−.432
61 Worried things may worsen	−.434	−.427	−.431	−.507
81 Slow to embrace the new	−.450	−.386	−.447	−.458
105 Prefer not to "open up"	−.473	−.392	−.452	−.440
98 Hard to adjust to changes	−.492	−.473	−.450	−.478
79 Avoid where strangers are	−.555	−.508	−.521	−.556
66 Worried doing unfamiliar	−.579	−.604	−.543	−.579
69 Worried, when others not	−.618	−.570	−.576	−.623
75 Shy meeting strangers	−.619	−.607	−.582	−.587
78 Avoid meeting strangers	−.650	−.621	−.616	−.623
67 Worried, others not very	−.652	−.625	−.620	−.660
Scales				
Harm Avoidance	−.674	−.761	−.655	−.734
Novelty Seeking	.751	.728	.763	.748
Reward Dependence	.579	.446	.566	.495

Note: Column 1 = 1988 follow-up of 1981 sample; column 2 = 1989 study of twins too young for 1981 study; columns 3 and 4 = relatives of twins in studies 1 and 2. Items included if absolute loading ⩾.400 in any of the four studies; item numbers are as in study 1 (items abbreviated).

Table 4
General factor of personality (GFP) from Junior Eysenck Personality Questionnaire items and scales for Australian adolescent twins (aged 12–16). Loadings on 1st principal component.

Item/scale	Loading
Items	
49 Often feel fed-up	.517
14 Many things annoy	.510
22 Life very dull	.481
18 Felt miserable for no reason	.461
39 Get into many fights	.445
23 Often get into quarrels	.436
66 Mind wanders while working	.431
62 Sometimes feel life not worth living	.430
53 Difficulty sitting still	.426
6 Easily bored	.419
34 Tired for no reason	.417
7 Enjoy hazardous practical jokes	.405
11 Have broken rules at school	−.404
16 Have taken something of another's	−.418
20 Have pretended not hear being called	−.437
4 Have been greedy	−.441
78 Throw paper on floor	−.487
Scales	
Psychoticism	.837
Extraversion	.215
Neuroticism	.350
Lie	−.844
Correlation of item and scale GFPs	.872
Number of individuals	1413

Note: If JEPQ taken more than once, mean response and mean age used. Items included if absolute loading ⩾.400. Items abbreviated.

impression, one might argue that on a social desirability interpretation of the GPF it ought to load higher than it does, and that Psychoticism should load negatively. The item-based GFP suggests, however, that the principal contrast on the factor is between exuberant sociability and social constraint.

The general factor from the Cloninger scales loads Novelty Seeking (and secondarily, Reward Dependence) at the high end, and Harm Avoidance at the low end. It could be interpreted as a general approach-avoidance dimension, although the item-level analysis suggests a substantial social component to this.

Although there are minor differences in loading across the four samples of Australian adults, on the whole the level of agreement is quite good for both scales and items—particularly at the level of detail exemplified by the item loadings.

Table 4 asks whether the same GFP is found among adolescents as among adults.

The answer is that on the whole it is not. The Junior Eysenck questionnaire contains items that differ somewhat from those in the adult version, but they are intended to assess the same dimensions. For the scales, the GFP still loads Psychoticism positively and Lie negatively, but more extremely so, whereas the Extraversion and Neuroticism scales have dropped to fairly low loadings, and the latter has shifted its loading from negative to positive. At the item level, the GFPs look quite different from those in the adult samples. Sociability, self-confidence, and anxiety have virtually disappeared: the high end is marked by hostility and bad moods, the low end by the admission of minor social misdeeds (all five of the items are ones scored on the Lie scale). The factor would seem to have dubious credentials as a social desirability dimension, since both extremes might be regarded as socially undesirable, although in different ways. One possibility is to consider the factor (reversed) as reflecting good emotional adjustment: reporting an absence of major problems, but freely admitting minor deviance. And, of course, one should not take the term "Psychoticism" too seriously. It dates back to the origins of the scale in distinguishing psychotics from normals, but in the general population the scale probably reflects mildly psychopathic trends, not uncommon in the teen-age population.

Finally, we consider the genetic evidence regarding the GFP, based on the three twin samples. Is the GFP heritable, and if so, is a substantial portion of the genetic variance non-additive? In these respects, how does it compare to scales that have had the GFP removed from them? Table 5 shows genetic analyses for the three samples: for the GFPs, and for the scale scores with the GFP removed by regression. Only same-sex DZ pairs are included, to avoid inflating the non-additive genetic estimate by way of a lowered DZ correlation resulting from either genetic sex-limitation or environmental factors such as less overlap of peer groups for unlike-sex pairs.

As seen in column A, additive genetic variance, the GFP is substantially heritable in all three samples, although in the first twin sample a couple of the residualized scales are as high or slightly higher. In the far right column, showing the proportion of the genetic variance that is non-additive, this proportion is either on the whole fairly comparable to the proportions for typical residual scales (in the case of adult twins) or is less (for young adult twins). For both samples, the residual Psychoticism and Lie scales were estimated as having a shared environmental component, although it was smaller than the additive genetic one. Shared environmental effects were not obtained for the residual TPQ scales, whose DZ correlations were always less than half the MZ ones, leading to an estimate of non-additive genetic variance.

The adolescent analysis again turned out somewhat differently—perhaps not too surprising, since the GFP was different for this sample. The GFP had a relatively large genetic component, and only the Extraversion scale was estimated to have a non-additive contribution.

Table 5
Genetic analysis of the GFP and scales from which the GFP has been removed, in three Australian twin samples.

Measure	Twin correlations		Variance components				% Non-additive
	MZ	DZ	A	C	I	E	
Adult twins							
GFP	.478	.162	.324		.154	.522	32.2
P_{res}	.341	.212	.258	.083		.659	
E_{res}	.417	.168	.336		.081	.583	19.4
N_{res}	.391	.176	.352		.039	.609	10.0
L_{res}	.378	.257	.242	.136		.622	
HA_{res}	.273	.096	.192		.081	.727	29.7
NS_{res}	.370	.109	.218		.152	.630	41.1
RD_{res}	.361	.157	.314		.047	.639	13.0
N pairs	1316–1342	744–765					
Young adult twins							
GFP	.465	.182	.364		.101	.535	21.7
P_{res}	.391	.227	.328	.063		.609	
E_{res}	.364	.100	.200		.164	.636	45.1
N_{res}	.370	.126	.252		.118	.630	31.9
L_{res}	.396	.255	.282	.114		.604	
HA_{res}	.311	.011	.022		.289	.689	92.9
NS_{res}	.360	.130	.260		.100	.640	27.8
RD_{res}	.363	.132	.264		.099	.637	27.3
N pairs	697–724	467–480					
Adolescent twins							
GFP	.571	.305	.532	.039		.429	
P_{res}	.388	.307	.162	.226		.612	
E_{res}	.558	.216	.432		.126	.442	22.6
N_{res}	.456	.268	.376	.080		.544	
L_{res}	.414	.324	.180	.234		.586	
N pairs	331	262					

Note: DZ pairs, same-sex only. Age, age^2, sex, age × sex, age^2 × sex removed from twin correlations by regression. A = additive effects of genes, C = effects of shared environment, I = non-additive genetic effects (modeled as epistasis involving multiple genes), E = residual, including nonshared environment and measurement error. % Non-additive = percent of genetic variance that is non-additive. Subscript *res* refers to residualized scales, i.e., scales from which the GFP has been removed by regression.

4. General discussion

Where do these various results leave us with respect to the interpretation of a general factor of personality? First we did find a substantial general factor, and it was consistent across two personality questionnaires in four large samples of Australian adults. Second, agreement across the two items sets was appreciably higher for a GFP derived from the items than one from scales based on the items. One might interpret this as favoring a social desirability interpretation, if one assumes that social desirability is more clearly a characteristic of specific traits and behaviors than of broader personality dimensions. On the other hand, the strongly social content of the obtained GFP is consistent with the notion that it was evolved in a context of effective social participation.

The results from the heritability analysis are somewhat mixed. The GFP did show a substantial degree of heritability, not expected of a measure of purely psychometric origin. However, it was not much more heritable than some of the personality measures that excluded it, and its genetic variance was not especially marked by the non-additivity expected from an evolutionary history of strong directional selection.

The results from the adolescent sample raise additional questions. Why were they so different? Is it the difference in items between the junior and adult versions of the EPQ? This hardly seems likely, in view of the good agreement among the adults for GFPs derived from two different item sets. Or have adolescents and adults been selected for different traits at different ages? This is an interesting possibility, and doubtless there would have been at least some differences, but one might suppose that 12- to 16-year-olds in prehistoric times would have been subjected to many of the same selective pressures as adults, and that these would have included pressures for effective social participation. A social desirability interpretation fares even worse, as a dimension with socially undesirable responses marking both ends presents serious difficulties for such a view.

Perhaps the safest conclusion at this point is that any conclusion as to what GFPs "really" are is premature, and that the various hypotheses need to be explored more fully. For example, a study in which the same individuals were measured as adolescents and adults would be informative as to the differences in GFPs at the different ages. GFPs derived from broader ranges of items might be instructive concerning the importance of content. It would be advantageous to incorporate the Big Five studies' use of self- and peer-ratings to distinguish between various kinds of rating artifacts. For testing hypotheses about directional versus stabilizing selection, populations with varying degrees of inbreeding would be useful.

And finally, what happens to the genetic analysis of a GFP if social desirability is removed or balanced out from the scales or items involved (*cf.* Bäckström, Björklund, & Larsson, 2009; Erdle, Gosling, & Potter, 2009; Peabody, 1967)? Or would this be throwing out the baby with the bathwater? In any event, it is clear that many possibilities for further investigation remain.

Acknowledgment

We thank Scott Gordon for the scoring of the Eysenck and Cloninger scales in the four adult samples.

References

Anusic, I., Schimmack, U., Pinkus, R. T., & Lockwood, P. (2009). The nature and structure of correlations among Big Five ratings: The Halo-Alpha-Beta model. *Journal of Personality and Social Psychology, 97*, 1142–1156.

Ashton, M. C., Lee, K., Goldberg, L. R., & de Vries, R. E. (2009). Higher order factors of personality: Do they exist? *Personality and Social Psychology Review, 13*, 79–91.

Bäckström, M., Björklund, F., & Larsson, M. R. (2009). Five-factor inventories have a major general factor related to social desirability which can be reduced by framing items neutrally. *Journal of Research in Personality, 43*, 335–344.

Biesanz, J. C., & West, S. G. (2004). Towards understanding assessments of the Big Five: Multitrait-multimethod analyses of convergent and discriminant validity across measurement occasion and type of observer. *Journal of Personality, 72*, 845–876.

Cloninger, C. R., Przybeck, T. R., & Svrakic, D. M. (1991). The Tridimensional Personality Questionnaire: US normative data. *Psychological Reports, 69*, 1047–1057.

DeYoung, C. G. (2006). Higher-order factors of the Big Five in a multi-informant sample. *Journal of Personality and Social Psychology, 91*, 1138–1151.

Eaves, L. J. (1988). Dominance alone is not enough. *Behavior Genetics, 18*, 27–33.

Edwards, A. L. (1957). *The social desirability variable in personality assessment and research*. New York: Dryden Press.

Erdle, S., Gosling, S. D., & Potter, J. (2009). Does self-esteem account for the higher-order factors of the Big Five? *Journal of Research in Personality, 43*, 921–922.

Eysenck, S. B. G., Eysenck, H. J., & Barrett, P. (1985). A revised version of the Psychoticism scale. *Personality and Individual Differences, 6*, 21–29.

Gillespie, N. A., Johnstone, S., Boyce, P., Heath, A. C., & Martin, N. G. (2001). The genetic and environmental relationship between the interpersonal sensitivity measure (IPSM) and the personality dimensions of Eysenck and Cloninger. *Personality and Individual Differences, 31*, 1039–1051.

Heath, A. C., Cloninger, C. R., & Martin, N. G. (1994). Testing a model of the genetic structure of personality: A comparison of the personality systems of Cloninger and Eysenck. *Journal of Personality and Social Psychology, 66*, 762–775.

Heath, A. C., Martin, N. G., Eaves, L. J., & Loesch, D. (1984). Evidence for polygenic epistatic interactions in man? *Genetics, 106*, 719–727.

Kandler, C., Riemann, R., Spinath, F. M., & Angleitner, A. (2010). Sources of variance in personality facets: A multiple-rater twin study of self-peer, peer–peer, and self–self (dis)agreement. *Journal of Personality, 78*, 1565–1594.

Lykken, D. T. (1982). Research with twins: The concept of emergenesis. *Psychophysiology, 19*, 361–373.

Markon, K. E., Krueger, R. F., & Watson, D. (2005). Delineating the structure of normal and abnormal personality: An integrative hierarchical approach. *Journal of Personality and Social Psychology, 88*, 139–157.

McCrae, R. R., Yamagata, S., Jang, K. L., Riemann, R., Ando, J., Ono, Y., et al. (2008). Substance and artifact in the higher-order factors of the Big Five. *Journal of Personality and Social Psychology, 95*, 442–455.

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.

Peabody, D. (1967). Trait inferences: Evaluative and descriptive aspects. *Journal of Personality and Social Psychology, 7*, 1–18.

Riemann, R., & Kandler, C. (2010). Construct validation using multitrait-multimethod-twin data: The case of a general factor of personality. *European Journal of Personality, 24*, 258–277.

Rushton, J. P. (in press). The general factor of personality, normal and abnormal. In T. Chamorrow-Premuzic, A. Furnam, S. von Stumm (Eds.), *Handbook of individual differences*. London: Wiley-Blackwell.

Rushton, J. P., Bons, T. A., Ando, J., Hur, Y.-M., Irwing, P., Vernon, P. A., et al. (2009). A general factor of personality from multitrait-multimethod data and cross-national twins. *Twin Research and Human Genetics, 12*, 356–365.

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*, 1173–1185.

Rushton, J. P., & Irwing, P. (2009a). 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, 46*, 437–442.

Rushton, J. P., & Irwing, P. (2009b). A general factor of personality in 16 sets of the Big Five, the Guilford-Zimmerman Temperament Survey, the California Psychological Inventory, and the Temperament and Character Inventory. *Personality and Individual Differences, 47*, 558–564.

Rushton, J. P., & Irwing, P. (2009c). A general factor of personality (GFP) from the Multidimensional Personality Questionnaire. *Personality and Individual Differences, 47*, 571–576.

Uziel, L. (2010). Rethinking social desirability scales: From impression management to interpersonally oriented self-control. *Perspectives on Psychological Science, 5*, 243–262.