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Emotion and Behavior: A General Factor of Personality From the EAS Temperament Survey and the Strengths and Difficulties Questionnaire

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The mothers of 603 pairs of 3- to 13-year-old twins in Korea completed the Emotionality, Activity, Sociability (EAS) Temperament Survey and the Strengths and Difficulties Questionnaire in reference to their twins. Principal factor analysis of the seven scales comprising these measures yielded a general factor on which all the scales had moderate to large loadings. Univariate behavioral genetic analyses showed that individual differences on this general factor could best be accounted for by additive genetic and non-shared environmental effects, with a heritability of 53%. The results strengthen the construct validity of the general factor of personality (GFP) by extracting this higher-order dimension from disparate measures, and have implications regarding social desirability criticisms applied to the GFP theory.

■ **Keywords:** general factor of personality, emotions, temperament, twin study

The proposed existence of a general factor of personality (GFP) at the apex of personality structure has received substantial research attention in the past several years. Digman (1997) was the first to challenge the irreducibility of the Big Five model — the conventional model in personality theory — by reporting that its five dimensions load onto two higher-order personality factors. Later, Musek (2007) altered this framework by extracting a 'Big One' — a single higher-order personality dimension — from his data set. Since the emergence of these seminal studies, a general personality factor has been extracted from a highly varied collection of personality measures (Rushton & Irwing, 2009a, 2009b, 2009c, 2009d; Rushton et al., 2010). It has further been argued that the super-factor may represent a heritable personality dimension, given that individual differences in the GFP are primarily attributable to genetic and non-shared environmental factors (Rushton et al., 2008; Rushton et al., 2009; Veselka et al., 2009a; Veselka et al., 2009b; Veselka et al., 2011).

Although a substantial body of research supporting the existence of a GFP exists, criticisms are not uncommon. Specifically, it has been proposed that the GFP may not be a genuine higher-order dimension, but may instead represent a statistical artifact caused by a social desirability response bias (Biesanz & West, 2004). It has also been suggested that conclusive statements about the existence of the GFP may yet be 'premature' given the insufficient amount of evidence that presently exists in support of this higher-order dimension (Loehlin & Martin, 2011). As a result, further studies of the GFP employing additional measures of personality and relevant constructs appear warranted.

Present Study

In the present study, we aim to tackle the outlined critiques pertaining to the GFP through an extension of the work by Rushton et al. (2008), who extracted a general factor from the EAS Temperament Survey (EAS) and the Prosocial Behavior scale of the Strengths and Difficulties Questionnaire (SDQ) in a Korean sample of 2- to 9-year-old children. Specifically, we seek to determine whether a general

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factor will also emerge from the EAS and the full version of the SDQ in a larger sample of Korean children spanning a broader age range.

Our inclusion of the EAS and of the SDQ is not based on any particular theoretical rationale. Rather, the intention is to group two deliberately disparate measures in a single analysis of the GFP as an empirical demonstration of its construct validity. Given that the GFP is believed to subsume all individual differences in human functioning, it should emerge even from two incongruent yet still relevant measures which assess distinct constructs. The inclusion of the two measures is also a way of introducing novel scales into discussions of the GFP. Although not entirely personality-based in nature, they are in line with scales that have been incorporated into the GFP in the past.

Given that both the EAS and the SDQ are mother-report measures, we hope we may avoid the inherently subjective nature of self-reports that has been shown to result in socially desirable responding (Hofstee, 1994). That being said, Kagan et al. (2002) have shown that parents' ratings of their children's behavior may also be influenced by social desirability, suggesting that opting for mother-report measures in the present study may not be sufficient in addressing the criticism of social desirability that is often applied to the GFP, but as Harris et al. (2007) demonstrated, caregiver ratings of children can include negative personality dimensions such as neuroticism and psychoticism.

In addition to the above, the present study includes a behavioral genetic analysis of any extracted GFP to determine whether the factor is heritable. If it is, it can be suggested that the GFP may represent a genuine, perhaps biologically based individual difference dimension, rather than an artifact of social desirability (Loehlin & Martin, 2011). Based on the results of previous studies (e.g., Rushton et al., 2008; Rushton et al., 2009; Veselka et al., 2009a, 2009b), and working under the assumption that the GFP is a valid construct, it is predicted that variance in a GFP extracted from the present data will be attributable to genetic and non-shared environmental factors.

Method

Participants

Participants in the present study were 603 twin pairs drawn from the ongoing South Korean Twin Registry (SKTR; Hur et al., 2006). The sample consisted of 255 monozygotic (MZ) twin pairs (141 male pairs, 114 female pairs), 175 same-sex dizygotic (DZ) twin pairs (111 male pairs, 64 female pairs), and 137 opposite-sex DZ twin pairs. Participants ranged in age from 3 to 13 years (Mean = 8.5 years; *SD* = 3.0 years).

Materials

EAS (Korean Version). The Korean version of the EAS Temperament Survey (EAS; Buss & Plomin, 1984) was used to measure temperament. The test consists of 20 items to which mothers of participants responded on a 5-point Likert scale (where 1 = *not very typical/uncharacteristic*, and 5 = *very typical/characteristic*). Although typically the items of the EAS can be classified into three or four scales (Plomin, 1986), analyses of the Korean version of the measure have shown that a three-factor solution provides the best fit (Cheon, 2002). These three factors are: Emotionality, Activity, and Sociability, exhibiting alpha reliabilities in the present study of 0.73, 0.73, and 0.82, respectively.

SDQ (Korean Version). The Korean version of the SDQ (Ahn et al., 2003) was used to assess individual differences in the psychological adjustment of participants via mother ratings. Mothers of participants responded to the test's 25 items via a 3-point Likert scale (where 1 = *not true*, and 3 = *certainly true*). The items typically load onto five factors — Emotional Problems, Conduct Problems, Hyperactivity/Inattention, Prosocial Behavior, Peer-Relationship Problems — the first four of which had alpha reliabilities in the present study of 0.55, 0.54, 0.75, and 0.50, respectively. A score was not created for the SDQ factor of Peer-Relationship Problems in this study. This omission was due to difficulties encountered with the interpretation of this factor, both on the part of interviewers and the respondents. As a result, the data pertaining to it were not adequate for analysis.

Procedure

Potential participants were contacted via telephone as part of the ongoing SKTR data collection. For households in which consent was obtained, Korean versions of the SDQ and the EAS were administered to mothers of participating twin pairs by telephone. To determine the zygosity of these twin pairs, mothers also responded to a zygosity questionnaire that included items regarding the physical similarities of the twins being assessed, and the frequency with which the twins were confused for one another by specific others.

Analysis

One twin in each pair of participants was randomly designated as 'Twin 1' and their co-twin was designated 'Twin 2'. Principal factor analyses were then conducted on the three EAS and four SDQ scales among all the Twin 1 (MZs and DZs combined) and all the Twin 2 (MZs and DZs combined) data separately. This was done to avoid the violation of independence that would occur if the data from both twins were used in one analysis. It also allows a cross-replication of the results to be made, although it is acknowledged that these dependent samples allow only a partial replication. Prior to performing any analyses, age and sex were regressed out of the variables.

Behavioral genetic analyses were performed using the Mx software package (Neale et al., 2006). In these analyses, we first fit a full ACE model to our data, estimating genetic (A), shared environmental (C), and non-shared environmental (E) effects. We then tested reduced AE and CE models.

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TABLE 1

Loadings of the EAS and SDQ Variables on Two Factors in the Twin 1 and Twin 2 Samples

	Twin 1		Twin 2	
	Factor I	Factor II	Factor I	Factor II
EAS Emotion	−0.51	−0.22	−0.54	−0.25
EAS Activity	0.41	−0.65	0.38	−0.52
EAS Sociability	0.44	−0.55	0.61	−0.61
SDQ Conduct	−0.54	−0.43	−0.66	−0.46
SDQ Prosocial	0.38	0.02	0.45	0.08
SDQ Hyper	−0.50	−0.41	−0.36	−0.46
SDQ Emotion	−0.35	0.09	−0.47	0.04

The model with the lowest chi-square change value relative to the chi-square of the full model, and the lowest Akaike Information Criterion (AIC) value was considered to be the best fitting.

Results

Principal factor analyses of the EAS and SDQ scales yielded two factors in both the Twin 1 and the Twin 2 samples. The first factor in each sample accounted for 22.7% (Twin 1) and 24.0% (Twin 2) of the variance and had eigenvalues of 2.21 and 2.26, respectively. The second factors accounted for 16.1% (Twin 1) and 16.4% (Twin 2) of the variance and had eigenvalues of 1.62 and 1.63, respectively. Loadings of the scales on these factors are shown in Table 1. As can be seen, all variables have moderate to high loadings on the first factor. They range (in absolute value) from 0.35 to 0.54 in the Twin 1 sample and from 0.36 to 0.66 in the Twin 2 sample. As would be expected, not all variables load on the smaller second factors and there are two loadings of essentially zero (Emotional Problems and Prosocial Behavior). The loadings on the first factor indicate that a general factor can be extracted from the EAS and SDQ variables.

Univariate behavior genetic analyses were then performed on the general factor. The full ACE model provided the best fit to the data, with $\chi^2(3) = 3.6$ and AIC = –2.4; the shared environment effect in this model, however, was not statistically significant and a reduced AE model yielded a fit that was not significantly worse than the full model and whose AIC was better ($\chi^2(4) = 4.7$, AIC = –3.2). Both the CE ($\chi^2(4) = 10.0$, AIC = +2.0) and the E only ($\chi^2(5) = 101.7$, AIC = +91.7) models were unacceptable. As such, we selected the AE model as the final model. Parameter estimates demonstrated that the additive genetic effects account for 53% of the variance and non-shared environmental effects account for 47% of the variance in the general factor.

Discussion

In the present study, we endeavored to further explore the potential existence of the GFP while simultaneously addressing some of the criticisms put forth regarding the super-factor through an extension of the study carried out by Rushton et al. (2008).

As expected from GFP theory, we extracted a first factor from the EAS and SDQ variables on which all of the variables showed moderate to large loadings. Also as expected, the EAS scales of Activity and Sociability and the SDQ Prosocial Behavior dimension loaded positively on the GFP while all the other variables loaded negatively. This pattern of loadings indicates that the GFP that we obtained reflects high levels of prosocial behavior and low levels of emotionality and conduct problems. This, in turn, indicates that our GFP is similar to those extracted from other measures of personality (e.g., Rushton et al., 2008; Rushton et al., 2009; Veselka et al., 2009a) and successfully extends the GFP to measures of temperament and behavior. The results also add to the construct validity of a general personality factor, given that this factor emerged from two deliberately disparate measures of human functioning.

In addition to extracting a GFP from the EAS and the SDQ, we also tested its heritability through behavioral genetic analyses. As predicted, individual differences on the GFP were found to be attributable to additive genetic and non-shared environmental factors. These results are consistent with the majority of the research on personality variables (Johnson et al., 2008), which, in turn, provides corroboration of the GFP. Furthermore, the substantial degree of heritability characterizing the GFP adds further support to evolutionary interpretations of the super-factor (Loehlin & Martin, 2011), and allows for the argument that the extracted dimension in the present study is a genuine construct rather than an artifact.

An evolutionary explanation for the GFP has been offered by Rushton et al. (2008) who conjectured that, like the *g* factor of cognitive ability, the GFP arose through selection for socially desirable traits that facilitate performance across a wide range of contexts. This follows a proposal by Darwin (1871) that natural selection acted directionally to endow people with more cooperative and less contentious personalities than their archaic ancestors or nearest living relatives, the chimpanzees. Rushton et al. (2008) suggested that individuals high on the GFP left more progeny, since people prefer as mates, fellow workers, and leaders those who are altruistic, conscientious, and emotionally stable. People able to cooperate in groups were also more likely to win competitions and wars.

There are some limitations to the present study that should be noted. First, although the SDQ has demonstrated good psychometric properties in previous analyses (Goodman, 2001), the scale reliabilities in the present study were quite low. As a result, the present findings may not fully capture the manner in which the SDQ fits within the GFP framework. Additionally, despite our efforts to address the criticism of socially desirability as it relates to the GFP, conclusive results were not obtained. Although the behavioral genetic approach was helpful in clarifying our findings, we

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did not directly control for social desirability in our analyses, nor did we obtain ratings from additional raters such as peers or teachers, who may be less prone to socially desirable responding (Hofstee, 1994). Further studies of the GFP should continue to directly address the criticisms of the super-factor through direct assessments of social desirability and the inclusion of new and varied measures in their analyses.

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