



Beyond the Big Five: The Dark Triad and the Supernumerary Personality Inventory

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The Dark Triad of personality, comprising Machiavellianism, narcissism, and psychopathy, was investigated in relation to the Supernumerary Personality Inventory (SPI) traits, because both sets of variables are predominantly distinct from the Big Five model of personality. Correlational and principal factor analyses were conducted to assess the relations between the Dark Triad and SPI traits. Multivariate behavioral genetic model-fitting analyses were also conducted to determine the correlated genetic and/or environmental underpinnings of the observed phenotypic correlations. Participants were 358 monozygotic and 98 same-sex dizygotic adult twin pairs from North America. As predicted, results revealed significant correlations between the Dark Triad and most SPI traits, and these correlations were primarily attributable to common genetic and non-shared environmental factors, except in the case of Machiavellianism, where shared environmental effects emerged. Three correlated factors were extracted during joint factor analysis of the Dark Triad and SPI traits, as well as a heritable general factor of personality — results that clarified the structure of the Dark Triad construct. It is concluded that the Dark Triad represents an exploitative and antisocial construct that extends beyond the Big Five model and shares a theoretical space with the SPI traits.

■ **Keywords:** personality, Dark Triad, Supernumerary Personality Inventory, behavioral genetics

Antisocial and socially aversive personality traits — stable human characteristics that do not comply with established social and ethical codes and norms (Hott, 1979) — have been subject to extensive research, first in clinical samples (e.g., Macaskill, 1980; Raskin & Hare, 1978), and later in community populations (e.g., Moore & Katz, 1995; Takahashi, 2007). In these latter community-based studies, three traits in particular have received considerable attention: Machiavellianism, as exhibited through cold and manipulative behaviors (Christie & Geis, 1970), narcissism, as defined by excessive self-love and unrelenting feelings of superiority (Raskin & Hall, 1979), and psychopathy, as characterized by high thrill-seeking behaviors paired with diminished empathy (Hare, 1985).

Most recently, Machiavellianism, narcissism, and psychopathy have been grouped together into a single construct, labeled the Dark Triad by Paulhus and Williams (2002), who first reported strong associations between these subclinical traits. Since this initial analysis, several studies have confirmed the existence of this Dark Triad construct (e.g., Jakobwitz & Egan, 2006; Lee & Ashton, 2005; Vernon et al., 2008b). Despite evidence validating

the Dark Triad, however, it remains enigmatic, particularly given its uncertain place in personality theory. Specifically, the Dark Triad has shown inconsistent correlations with the Big Five model (e.g., Lee & Ashton, 2005; Vernon et al., 2008b) — the conventional framework of personality. These inconsistencies suggest that the Dark Triad may lie outside the realm of the Big Five structure, although no evidence has yet been provided to support this notion. The inconsistencies also make it difficult to further explore the Dark Triad because it has not shown reliable correlations with available models, and has therefore not progressed as far as it might have in its development as a personality construct.

With the recent development of the Supernumerary Personality Inventory (SPI) by Paunonen (2002), which

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measures 10 traits that lie beyond the Big Five model (conventionality, seductiveness, manipulateness, thriftiness, humorousness, integrity, femininity, religiosity, risk-taking, egotism) it may now be possible to elaborate upon our understanding of the Dark Triad traits. Specifically, the purpose of the present study is to clarify the nature of the Dark Triad construct by identifying the SPI traits with which it correlates. Further, by assessing the strength of these correlations, and determining the extent to which phenotypic correlations between the Dark Triad traits and the SPI traits are attributable to common genetic and/or environmental factors, the present study also aims to establish whether the Dark Triad has empirical ties to a model that lies beyond the Big Five.

Relations Between the Dark Triad Traits and the Traits Measured by the SPI

Several SPI traits, when examined individually, have exhibited correlations with all three Dark Triad variables. Specifically, narcissism, psychopathy, and Machiavellianism have all shown positive associations with seductiveness (e.g., Foster et al., 2006; Grann, 2000; McHoskey, 2001; Wilson et al., 1998), manipulateness (e.g., Austin et al., 2007; Paulhus & Williams, 2002; Shepperd & Socherman, 1997; Watson et al., 1984), risk-taking or the related concept of sensation-seeking (e.g., Emmons, 1981; Rim, 1966; Vitacco & Rogers, 2001), and egotism (e.g., Paulhus & Williams, 2002). They have all further correlated negatively with integrity (e.g., Ashton et al., 2000; Blair et al., 2008).

In addition to these common correlates, the Dark Triad traits have also exhibited unique patterns of correlations with other variables presently subsumed by the SPI. For instance, both Machiavellianism and narcissism have shown positive associations with femininity (e.g., Jackson et al., 1992; Nigro & Galli, 1985). Furthermore, Machiavellianism alone has correlated positively with a preference for conservative values focusing on the maintenance of tradition, which can be seen as a representation of SPI's conventionality dimension (e.g., Krampen, 1980; Shafiq, 1982; Stone & Russ, 1976), and only narcissism has shown negative relations with religiosity (e.g., Ghorbani et al., 2004) and with thriftiness (Rose, 2007). Lastly, all three Dark Triad traits have exhibited varied correlations with different humor styles — ways in which humor is produced and understood (Martin et al., 2003). Specifically, while psychopathy and Machiavellianism have shown significant positive correlations with the negative humor styles representing approaches to humor that are either harmful to others (aggressive) or to the self (self-defeating), narcissism has correlated positively with the positive humor styles (Veselka et al., 2010). These latter two styles are more prosocial in nature, allowing for the facilitation of interpersonal bonds (affiliative) or for the maintenance of a more optimistic perspective on life (self-enhancing).

Behavioral Genetic Analyses of the Dark Triad and SPI Traits

Twin studies have been used in the assessment of Dark Triad traits to determine the extent to which variance in these traits is affected by genes and/or the environment. Behavioral genetic assessments of psychopathy, narcissism, and Machiavellianism have suggested that variance in the occurrence and stability of these traits can be accounted for by both genetic and non-shared environmental factors (e.g., Blonigen et al., 2006; Larsson et al., 2006; Livesley et al., 1993; Taylor et al., 2003; Vernon et al., 2008b). Correlations between the three Dark Triad traits have also been shown to be moderate (Paulhus & Williams, 2002), although Vernon et al. (2008b) did report a non-significant correlation between Machiavellianism and narcissism.

To date, there have been no behavioral genetic investigations carried out on all of the variables measured by the SPI. However, some univariate behavioral genetic investigations or assessments of heritability have been conducted on select traits that are presently subsumed by the SPI. Results from these investigations offer initial evidence about the etiology of the ten traits that have supposedly evaded conventional personality models.

Past twin studies have noted that genetic and non-shared environmental effects primarily account for individual differences in conventionality (e.g., Bouchard et al., 2003; Hatemi et al., 2007), seductiveness as derived from studies of sociosexuality (Bailey et al., 2000), manipulateness (Larsson et al., 2006), humorousness (Vernon et al., 2008a), femininity (e.g., Loehlin et al., et al., 2005; Mitchell et al., 1989), and risk-taking (e.g., Anokhin et al., 2009; Stoel et al., 2006). In addition to these genetic and non-shared environmental effects, shared environmental influences have also been found to underlie variance in religiosity (e.g., Bradshaw & Ellison, 2008; D'Onofrio et al., 1999). The traits of thriftiness, integrity, and egotism (in a non-narcissistic context) have not been exposed to behavioral genetic investigation.

Present Study

The purpose of the present study is to gain a greater understanding of the nature of the Dark Triad, and of its place in the overall framework of human personality by examining its association with the SPI, which has been developed to measure 10 personality traits that exist beyond the Big Five structure. Correlations between the Dark Triad and SPI variables will be examined to broaden our understanding of the Dark Triad construct, and to determine whether the Dark Triad measures and the SPI tap related personality dimensions. Multivariate behavioral genetic analysis will be conducted to determine whether observed phenotypic correlations between the Dark Triad variables and the variables measured by the SPI are attributable to common genetic and/or common environmental factors — results that would further tie together the SPI and the Dark Triad traits. Lastly, a principal factor analysis

will be carried out with the Dark Triad traits and the SPI traits to assess whether these traits load on common factors, and to determine whether the factors reflect the three Dark Triad dimensions of Machiavellianism, narcissism, and subclinical psychopathy. This analysis will also be helpful in determining whether a heritable General Factor of Personality (GFP) can be extracted from the Dark Triad and SPI traits, such as has been reported in previous studies involving different personality traits (e.g., Figueredo & Rushton, 2009; Rushton, et al., 2009; Veselka et al., 2009a; Veselka et al., 2009b).

Method

Participants

Participants in the present study were 358 monozygotic (MZ) twin pairs (250 female pairs, 108 male pairs), and 98 same-sex dizygotic (DZ) twin pairs (65 female pairs, 33 male pairs). Participants were between 17 to 92 years ($M = 41.42$, $SD = 17.54$) and resided in Canada and the United States. They completed the necessary questionnaires individually. Over 95% of the participants who were invited to participate in the study filled out and returned their completed questionnaires.

Materials

MACH-IV. Individual differences in Machiavellianism were measured via the MACH-IV (Christie & Geis, 1970), in which higher scores represent higher levels of Machiavellianism as defined by manipulative interpersonal strategies and a skeptical view of others. The MACH-IV consists of 20 items, each of which is presented as a single statement to participants. To respond to the items, participants were asked to indicate the extent to which they agreed with each statement on a 5-point Likert Scale (where 1 = *Disagree strongly* and 5 = *Agree strongly*). The MACH-IV has good psychometric properties (e.g., Paulhus & Williams, 2002; Ramanaiah et al., 1994)

Narcissistic Personality Inventory (NPI). Individual differences in narcissism were measured using the NPI (Raskin & Hall, 1979) in which higher scores represent higher levels of narcissism. The NPI consists of 40 forced-choice items. For each item, participants were presented with two self-reflective statements representing divergent views on a single topic. To complete each item, participants were asked to select the statement that best described them. The NPI has demonstrated sound psychometric properties (e.g., Emmons, 1984; Mullins & Kopelman, 1988; Paulhus & Williams, 2002; Raskin & Terry, 1988).

Self-Report Psychopathy Scale (SRP-III-R12). The 62-item SRP-III-R12 (Hare, 1985) was employed to assess individual differences in sub-clinical psychopathy. Higher scores on the SRP-III-R-12 represent higher levels of sub-clinical psychopathy. Each item of the SRP-III-R12

presents a self-reflective statement. Participants were asked to respond to each item by indicating the extent to which they agree with it via a 5-point Likert Scale (where 1 = *Disagree strongly* and 5 = *Agree strongly*). The SRP-III-R12 has demonstrated good psychometric properties (e.g., Derefinco & Lynam, 2006; Williams et al., 2007; Paulhus & Williams, 2002).

Supernumerary Personality Inventory (SPI). The SPI (Paunonen, 2002) was designed to measure individual differences in 10 traits (see Table 1) that are commonly excluded from conventional models of personality factors (Paunonen & Jackson, 2000). Higher scores on the SPI subscales indicate higher levels of the specific trait being measured. The test consists of 150 items, with 15 items measuring each of the supernumerary traits. Participants responded to each item by indicating the extent to which they agreed with it using a 5-point Likert Scale (where 1 = *Disagree strongly* and 5 = *Agree strongly*). Psychometric data available for the SPI are sound (e.g., Paunonen, 2002; Paunonen et al., 2003).

Procedure

Participants for the present study were initially recruited via newspaper advertisements in 2006. Individuals who expressed an interest in participating via telephone or e-mail were given further details about the study. Those who agreed to participate were sent a package through standard mail containing the SPI as well as other ques-

TABLE 1

Supernumerary Personality Inventory (SPI) Scales and Descriptions

Scale name	Description of high scorers
Conventionality	Desires to maintain traditions, customs, and personal habits; is opposed to radical change and innovation
Seductiveness	Engages in behaviors intended to attract the romantic or sexual interest of others; may employ flirty or charming behavior
Manipulativeness	Is skillful at influencing people's actions, cognitions, and emotions; attempts to use others to achieve own goals
Thriftness	Expend resources only when necessary and not on personal gratification, is not given to extravagance
Humorousness	Readily able to arouse laughter and amusement in others; recognizes, points out, and reacts to the humor in situations
Integrity	Adheres to known standards of behavior and expects the same from others; values honesty and fairness
Femininity	Engages in behaviors defined by culture as primarily feminine (e.g., submissiveness, sympathy, tenderness)
Religiosity	Is spiritual; exercises faithful devotion to some ultimate reality, deity, or higher power
Risk-Taking	Willingly exposes self to situations involving risk, danger, or chance of loss; is positively aroused by risky behavior
Egotism	Has sense of superiority over others; has exaggerated sense of self-importance and drive to satisfy own self-interests

Note: From *Design and Construction of the Supernumerary Personality Inventory*, by S. V. Paunonen, 2002, p. 6. Adapted with permission of the author.

tionnaires not relevant to the present investigation. The following year, a subset of these twins was invited to complete the MACH-IV, NPI, SRP-III, as well as additional measures not pertinent to the present report. When participants completed the questionnaires, they mailed them back using provided self-addressed stamped envelopes. For participating in each mail-out, participants received \$20.00, and were entered in a draw to win one of ten \$100.00 prizes.

Analysis

Although most of the participants filled out all items on the four questionnaires, on rare occasions an item was left blank. In such instances, the missing data were replaced with the average of the relevant Likert Scale. Further, for the purpose of analysis, the items on the SPI were converted to ten scores, reflecting the ten dimensions measured by the inventory. The remaining questionnaires yielded one general score each, reflecting the three Dark Triad traits.

Prior to analysis, one twin from each twin pair was randomly designated as Twin 1, and the other twin was designated as Twin 2. Principal factor analyses with oblimin rotation were conducted separately on the Twin-1 and Twin-2 samples. This approach was required given that the analyses we performed require observations to be independent of one other. The procedure also allowed for a cross-replication of the results, although we acknowledge that this cross-replication is not independent. The oblimin rotation in the present analysis was selected over the Varimax rotation in light of the many intercorrelations anticipated and previously reported between the traits of interest.

Behavioral genetic analyses were carried out using the complete twin pairs. Prior to these analyses, we assessed whether the Dark Triad and SPI variables varied as a function of either age or sex. As expected, correlational results showed that males and younger participants scored significantly higher on the Dark Triad variables, and on such SPI variables as seductiveness and manipulateness. Alternatively, females and older participants scored significantly higher on such SPI variables as conventionality and integrity. Given these findings, all data were corrected for age and sex using the age-sex adjustment approach developed by McGue & Bouchard (1984).

Because it is recommended that before examining overlapping genetic and/or environmental factors between traits their distinct heritabilities should be known (Plomin, 1986), univariate behavioral genetic analyses of the Dark Triad and SPI were first conducted. A further univariate behavioral genetic analysis was also carried out on the factors extracted during factor analysis in order to gauge their heritability.

Multivariate behavioral genetic analyses were then performed using the Mx software package (Neale et al., 2006). In these analyses, MZ and DZ cross-correlations are

computed, and the method of Cholesky or triangular decomposition is applied (Neale & Cardon, 1992). In the present study, we first fit a full ACE model to our data, estimating correlated genetic (A), shared environmental (C), and non-shared environmental (E) effects, and then tested reduced AE and CE models. Models with the lowest chi-square change value relative to the chi-square of the full model, and the lowest AIC value were considered to be the best fitting.

Results

Univariate Behavioral Genetic Analyses of the Dark Triad and SPI

The results of the univariate behavioral genetic analyses of the Dark Triad and SPI traits are reported in Table 2. These results include the MZ and DZ twin correlations, as well as genetic and environmental parameter estimates derived from the analyses. Given the lack of power associated with the present study's sample, dominance genetic effects were not estimated (Martin et al., 1978).

Although Vernon et al. (2008b) have already conducted a univariate behavioral genetic analysis of the Dark Triad traits, we decided to reassess the results using our present (substantially larger) sample. Twin correlations for the Dark Triad traits indicated some genetic influence for both narcissism and psychopathy. For Machiavellianism, the MZ and DZ twin correlations were identical. Subsequent model-fitting results revealed that, indeed, individual differences in narcissism and psychopathy were entirely attributable to genetic and non-shared environmental effects. In contrast, individual differences in Machiavellianism were accounted for by shared and non-shared environmental factors.

More consistent results were found in the univariate behavior genetic analyses of the SPI variables. Specifically, twin correlations for all of the variables indicated some genetic influence, as all of the MZ correlations were larger than the DZ correlations. Model-fitting results further revealed that individual differences in all SPI traits, with the exception of seductiveness and manipulateness, were entirely attributable to genetic and non-shared environmental effects. For the remaining SPI traits, non-shared environmental factors accounted for most of the observed individual differences. Shared environmental factors did not make a significant contribution to the variance in any of the SPI variables.

Phenotypic, Genetic, and Environmental Correlations Between the Dark Triad and SPI

Correlations between the MACH-IV, NPI, SRP-III-R12, and SPI are reported in Table 3. All of the Dark Triad traits showed significant positive correlations with the SPI traits of seductiveness, manipulateness, humorousness, risk-taking, and egotism. All of the Dark Triad traits further exhibited significant negative associations with the SPI

TABLE 2

Twin Correlations and Parameter Estimates for the Dark Triad and SPI Variables, and the Factors Derived from the Principle Factor Analysis

Variables	Correlations (<i>r</i>)		Parameter estimates (95% CI)		
	MZ	DZ	<i>a</i> ²	<i>c</i> ²	<i>e</i> ²
Dark Triad Variables					
Narcissism	.66	.41	.40 (.10-.69)	.24 (.00-.52)	.36 (.30-.43)
Machiavellianism	.44	.44	.01 (.00-.39)	.44 (.08-.52)	.55 (.47-.64)
Psychopathy	.58	.36	.34 (.01-.62)	.22 (.00-.54)	.44 (.37-.52)
SPI Variables					
Conventionality	.50	.27	.44 (.08-.57)	.06 (.00-.39)	.50 (.43-.58)
Seductiveness	.54	.47	.25 (.00-.58)	.30 (.00-.55)	.45 (.38-.52)
Manipulativeness	.52	.43	.20 (.00-.56)	.32 (.00-.55)	.48 (.41-.56)
Thriftiness	.57	.11	.56 (.38-.62)	.00 (.00-.16)	.44 (.38-.52)
Humorousness	.61	.14	.60 (.43-.66)	.00 (.00-.16)	.40 (.34-.47)
Integrity	.60	.47	.30 (.03-.63)	.31 (.00-.56)	.39 (.33-.46)
Femininity	.65	.44	.34 (.06-.67)	.30 (.00-.56)	.36 (.31-.42)
Religiosity	.78	.53	.48 (.26-.79)	.30 (.00-.52)	.22 (.18-.26)
Risk-taking	.61	.46	.35 (.08-.65)	.26 (.00-.52)	.39 (.33-.45)
Egotism	.60	.24	.60 (.37-.66)	.00 (.00-.21)	.40 (.34-.47)
Factors					
1st unrotated factor	.69	.54	.27 (.01-.64)	.42 (.06-.67)	.31 (.26-.38)
Factor I	.67	.40	.44 (.10-.71)	.22 (.00-.54)	.34 (.28-.41)
Factor II	.65	.37	.52 (.16-.71)	.13 (.00-.47)	.35 (.29-.43)
Factor III	.62	.58	.11 (.00-.46)	.51 (.18-.67)	.38 (.31-.46)

Note: *a*² = additive genetic effects; *c*² = shared environmental effects; *e*² = non-shared environmental effects; CI = confidence interval. All effects whose confidence intervals do not include zero are significant at the .05 level.

variables of thriftiness, integrity, and femininity. The SPI trait of religiosity correlated significantly and negatively with Machiavellianism and psychopathy, but was unrelated to narcissism. SPI's conventionality dimension was not associated with any Dark Triad traits. Particularly strong associations were those between the Dark Triad traits and the SPI variables of seductiveness, manipulativeness, risk-taking, and low integrity.

Multivariate behavioral genetic analyses were carried out to determine the extent to which the obtained phenotypic correlations between the Dark Triad and SPI variables are attributable to the same genetic and/or environmental effects (see Table 3). Findings revealed that phenotypic correlations between the Dark Triad trait of narcissism and the SPI variables were entirely accounted for by common genetic and common non-shared environmental factors, with no additional contribution from correlated shared environmental influences. This pattern of results was predominantly true for the Dark Triad variable of psychopathy as well, although it bears noting that correlated shared and non-shared environmental effects underlie the relations between psychopathy and the SPI variables of manipulativeness and integrity. Most of the phenotypic associations between Machiavellianism and the SPI traits were accounted for by correlated shared and non-shared environmental factors. This was true for the relations between Machiavellianism and conventionality, seductiveness, manipulativeness, integrity, femininity, and religiosity. The remaining associations were accounted for

by common genetic and common non-shared environmental effects.

Principal Factor Analysis Using the Dark Triad and SPI Variables

A principal factor analysis was conducted to determine whether a three-factor structure reflecting the three Dark Triad traits could be extracted from the SPI and Dark Triad variables (see Table 4). The analysis was carried out both to further establish an association between the SPI and the Dark Triad traits and also to determine whether a GFP could be extracted from the data prior to rotation. This analysis yielded a first factor accounting for 30.0% of the variance in the Twin-1 sample, and 29.2% of the variance in the Twin-2 sample. With one exception, all of the traits exhibited strong loadings (> |.35|) on this first factor in both samples. The one exception was the SPI trait of conventionality, which had more moderate loadings. The obtained loadings were relatively consistent across the Twin-1 and Twin-2 samples, suggesting good cross-replication, keeping in mind the non-independence of the samples. Univariate behavioral genetic analyses of this extracted factor revealed that individual differences in this general factor were attributable to genetic, shared, and non-shared environmental factors (see Table 2).

Following the initial factor extraction, the factors were subjected to an oblimin rotation, which yielded three oblique factors in both samples (see Table 4). The first rotated factor (Factor I) had high loadings from the Dark Triad trait of narcissism and the SPI variables of seduc-

TABLE 3

Phenotypic, Genetic, Shared Environmental, and Non-Shared Environmental Correlations with Confidence Interval Values Between the Dark Triad Traits and the SPI Traits

SPI Variables	Dark Triad Variables		
	Narcissism	Machiavellianism	Psychopathy
Conventionality	rp = -.02 rg = -.01 (-.14 to .13) rc = — re = -.09 (-.20 to .02)	rp = -.02 rg = — rc = -.14 (-.32 to .04) re = .10 (-.01 to .20)	rp = -.04 rg = -.06 (-.23 to .10) rc = — re = .03 (-.08 to .14)
Seductiveness	rp = .41* rg = .44 (.33 to .55) rc = — re = .36 (.26 to .46)	rp = .32* rg = — rc = .55 (.41 to .68) re = .14 (.03 to .24)	rp = .45* rg = .55 (.42 to .65) rc = — re = .35 (.24 to .44)
Manipulativeness	rp = .43* rg = .45 (.34 to .56) rc = — re = .47 (.38 to .56)	rp = .48* rg = — rc = .62 (.49 to .73) re = .35 (.25 to .44)	rp = .52* rg = — rc = .64 (.52 to .74) re = .39 (.30 to .48)
Thriftiness	rp = -.22* rg = -.35 (-.21 to -.48) rc = — re = .01 (-.10 to .12)	rp = -.16* rg = -.24 (-.08 to -.40) rc = — re = -.07 (-.18 to .04)	rp = -.24* rg = -.40 (-.25 to -.54) rc = — re = -.05 (-.16 to .07)
Humorousness	rp = .27* rg = .34 (.21 to .46) rc = — re = .16 (.05 to .27)	rp = .15* rg = .23 (.07 to .38) rc = — re = .03 (-.09 to .14)	rp = .32* rg = .39 (.25 to .51) rc = — re = .19 (.08 to .30)
Integrity	rp = -.27* rg = -.36 (-.24 to -.48) rc = — re = -.13 (-.02 to -.24)	rp = -.52* rg = — rc = -.72 (-.62 to -.82) re = -.31 (-.22 to -.40)	rp = -.59* rg = — rc = -.74 (-.64 to -.82) re = -.39 (-.30 to -.48)
Femininity	rp = -.11* rg = -.21 (-.08 to -.34) rc = — re = .08 (-.04 to .19)	rp = -.24* rg = — rc = -.36 (-.21 to -.50) re = -.11 (-.01 to -.21)	rp = -.43* rg = -.56 (-.44 to -.67) rc = — re = -.18 (-.07 to -.29)
Religiosity	rp = -.04 rg = -.06 (-.18 to .07) rc = — re = -.08 (-.19 to .03)	rp = -.28* rg = — rc = -.42 (-.29 to -.54) re = -.14 (-.04 to -.24)	rp = -.16* rg = -.17 (-.04 to -.29) rc = — re = -.19 (-.07 to -.30)
Risk-taking	rp = .22* rg = .26 (.12 to .38) rc = — re = .17 (.06 to .28)	rp = .20* rg = .19 (.04 to .34) rc = — re = .17 (.06 to .28)	rp = .40* rg = .42 (.28 to .54) rc = — re = .34 (.23 to .43)
Egotism	rp = .52* rg = .60 (.49 to .69) rc = — re = .38 (.27 to .47)	rp = .13* rg = .25 (.10 to .40) rc = — re = -.01 (-.13 to .10)	rp = .22* rg = .30 (.16 to .44) rc = — re = .12 (.01 to .23)

Note: * $p < .01$, two-tailed.

rp = phenotypic correlation. rg = genetic correlation. rc = shared environmental correlation. re = non-shared environmental correlation. Numbers appearing in parentheses represent the 95% confidence interval values. All correlations whose confidence intervals do not include zero are significant at the .05 level.

tiveness, manipulativeness, low thriftiness, humorousness, and egotism. It accounted for 30.9% of the variance in the data in the Twin-1 sample, and 30.1% in the Twin-2 sample. The second rotated factor (Factor II), accounting for 8.4% of the variance in the data in the Twin-1 sample, and 8.2% in the Twin-2 sample, exhibited high loadings from only three variables, all of which were measured via the SPI: conventionality, religiosity, and low risk-taking. Finally, the third rotated factor (Factor III) showed particularly strong factor loadings from the Dark Triad traits of Machiavellianism and psychopathy, as well as from the SPI traits of manipulativeness, low integrity, and low femininity. This factor accounted for 5.9% of the variance in the data in the Twin-1 sample, and 5.4% in the Twin-2 sample. Univariate behavioral genetic analyses of these

three factors revealed that individual differences in Factors I and II were entirely attributable to genetic and non-shared environmental factors, while individual differences in Factor III were accounted for by shared and non-shared environmental factors (see Table 2).

Phenotypic, genetic, and environmental correlations between the rotated factors are reported in Table 5. Factors I and III show a strong positive phenotypic correlation which is entirely attributable to correlated environmental factors. Factors II and III show a moderate negative (as would be expected) phenotypic correlation and have a large genetic and small nonshared environmental correlation. Factors I and II are also negatively correlated (as would be expected), and this phenotypic correlation is attributable to significant correlated genetic factors.

TABLE 4

Factor Loadings of the Dark Triad and SPI Variables across Both Twin Samples Before and After Oblimin Rotation

	Twin-1 Sample			Twin-2 Sample				
	1 st Unrotated	Oblimin Rotated			1 st Unrotated	Oblimin Rotated		
		I	II	III		I	II	III
Dark Triad								
Narcissism	.57	.71	.02	-.09	.54	.61	.04	.00
Machiavellianism	.60	-.02	.06	.71	.58	-.09	.05	.77
Psychopathy	.77	.16	.05	.76	.74	.16	-.07	.64
SPI								
Conventionality	-.16	.01	.80	.20	-.20	.04	.67	.12
Seductiveness	.75	.59	-.14	.18	.75	.68	-.11	.14
Manipulativeness	.76	.59	.12	.34	.77	.47	.16	.53
Thriftiness	-.46	-.42	.02	-.05	-.43	-.39	.04	-.03
Humorousness	.56	.42	-.10	.12	.53	.45	-.24	-.02
Integrity	-.73	-.17	.09	-.61	-.77	-.20	.10	-.63
Femininity	-.47	.04	.08	-.50	-.45	.06	.31	-.35
Religiosity	-.36	.02	.45	-.18	-.40	-.00	.46	-.16
Risk-Taking	.56	.14	-.46	.24	.61	.25	-.54	.13
Egotism	.58	.79	.05	-.14	.49	.68	.14	-.05

Discussion

The present study had two central goals: to expand upon the definition of the Dark Triad as a construct and to determine its association with the SPI traits in order to better situate it within the framework of human personality. At all levels of analysis, results clarified the socially aversive nature of the Dark Triad construct, and demonstrated the Dark Triad's place with the SPI traits in a theoretical framework of personality that lies beyond the conventional Big Five.

Univariate Behavioral Genetic Analyses of the Dark Triad and SPI

Results from the univariate behavioral genetic analyses of the Dark Triad and SPI traits revealed that, for the most part, individual differences in the variables comprising the two collections of traits were primarily attributable to genetic and non-shared environmental factors. In this regard, both sets of traits behaved like other personality traits in univariate behavioral genetic investigations. As such, it can be argued that the Dark Triad and SPI represent valid dimensions of individual differences in personality.

One notable exception to this general pattern of results was the Dark Triad variable of Machiavellianism, individual differences in which were accounted for exclusively by shared and non-shared environmental factors. While these results were unexpected, they are in accordance with learning theories of Machiavellianism, which suggest that individuals scoring high on this trait learn to be socially manipulative through their families. In particular, two theories have been proposed to describe the manner in which Machiavellian tendencies are transmitted and reinforced. According to the standard socialization hypothesis (e.g., Kraut & Price, 1976; Ojha, 2007), children acquire

TABLE 5

Phenotypic, Genetic, Shared Environmental, and Non-Shared Environmental Correlations with Confidence Interval Values Between the Factors Obtained After Oblimin Rotation

	Factor I	Factor II
Factor II	rp = -.16 rg = -.36 (-.24 to -.48) rc = — re = -.04 (.07 to -.16)	
Factor III	rp = .48 rg = — rc = .70 (.61 to .77) re = .47 (.38 to .55)	rp = -.33 rg = -.51 (-.39 to -.61) rc = — re = -.15 (-.04 to -.26)

Note: rp = phenotypic correlation. rg = genetic correlation. rc = shared environmental correlation. re = non-shared environmental correlation. Numbers appearing in parentheses represent the 95% confidence interval values. All correlations whose confidence intervals do not include zero are significant at the .05 level.

the skills and ideology necessary for successful manipulation by observing and mimicking their parents. As a result, Machiavellianism is deemed to be the result of modeling. Alternatively, the reciprocation hypothesis (Christie & Geis, 1970) posits that low-Machiavellian parents reinforce their children's manipulative behaviors by succumbing to them, thereby encouraging the further development of Machiavellian tendencies. This latter hypothesis refers to a form of conditioning, and has been tested in both child and adult samples (e.g., Branginsky, 1970; Rai & Gupta, 1989). Although empirical evidence exists in support of both theories, neither has yet emerged as dominant.

Given that variation in most personality traits is primarily attributable to at least some genetic factors (Plomin & Daniels, 1987), the principal role of the shared environment in influencing individual differences in

Machiavellianism is an interesting finding. It is possible that the reported results represent a genuine effect, as described by the theories above. This notion stems from studies reporting that the shared environment has a significant effect on variation in conduct disorders (e.g., Rhee & Waldman, 2002) and some specific cognitive abilities (e.g., Bouchard & McGue, 1981). Over the course of its development, Machiavellianism has been defined as both an antisocial personality variable (e.g., Paulhus & Williams, 2002) and as a form of interpersonal intelligence (e.g., Wilson et al., 1996), making it relevant to both of these exceptions to the classic personality trait. Of course, further empirical analyses are necessary before it can be concluded that Machiavellianism can be incorporated into either of these frameworks.

Relations Between the Dark Triad and SPI and Their Potential Common Etiology

Phenotypic correlations between the Dark Triad and SPI traits revealed many significant relations. Specifically, all of the Dark Triad traits correlated positively with the SPI traits of seductiveness, manipulateness, humorousness, risk-taking, and egotism, and negatively with thriftiness, integrity, and femininity. Previous studies assessing the Dark Triad traits individually have reported similar findings (e.g., Ashton et al., 2000; Austin et al., 2007; Foster et al., 2006; Vitacco & Rogers, 2001) and these and our results help to better define the Dark Triad and to establish its place within the framework of the SPI, and thus beyond the Big Five.

Narcissism, by definition, involves a grandiose self-concept, which is maintained by interpersonal manipulation. That is, narcissistic individuals may use exploitativeness as an ego-maintenance strategy, because it allows them to feel superior to others (Emmons, 1984). Given these tendencies, it is not surprising that we found narcissism to be correlated strongly with such SPI traits as egotism, manipulateness, and low integrity. Further, narcissistic individuals tend to seek out the company of others to create a status of popularity for themselves (Back et al., 2010) — a status that may further feed their self-perception of superiority. Traits such as SPI's humorousness and low thriftiness may prove helpful in securing this desired popularity (Foster et al., 2009; Veselka et al., 2010).

Machiavellianism involves the achievement and maintenance of power at the expense of others (Christie & Geis, 1970). This form of ruthless power-seeking implies the use of unprincipled tactics, and helps to contextualize the correlations noted in the present study between Machiavellianism and the SPI traits of manipulation, seduction, low integrity, and risk-taking. To create an illusion of power, Machiavellian individuals may further resort to excessive spending of money (Tang & Chen, 2008), which is reflected in the correlation we found between Machiavellianism and low thriftiness. To maintain power, humorousness, particularly of the aggressive

or bullying nature (Veselka et al., 2010) may also be used by Machiavellian individuals as a way of elevating their sense of self while demeaning others.

Lastly, psychopathy is characterized by high risk-taking and shallow affect (Hare, 1985), which suggests that psychopathic individuals may readily engage in manipulation, seduction, and high-risk activities because they do not experience the remorse often associated with these antisocial behaviors (Fowles, 1988). As a result, the low integrity that characterizes their behavior may stem from a lack of conscience-based arousal. Their use of humor, often aggressive in nature (Veselka et al., 2010), and their liberal spending may also stem from their inherent thrill-seeking and/or low empathy.

Multivariate behavioral genetic analyses of the associations between the Dark Triad traits and the variables measured by the SPI yielded some interesting findings. In line with our predictions, the phenotypic correlations between narcissism and the SPI, and between psychopathy and SPI were primarily accounted for by correlated genetic and correlated non-shared environmental factors. These results indicate that there may be a considerable overlap in the genes influencing the co-occurrence of these traits. These genetic effects lend support to biologically based theories pertaining to the Dark Triad traits of narcissism and psychopathy, and suggest that the traits may emerge from underlying susceptibility genes, the effects of which have physical consequences that may eventually lead to the manifestation of these antisocial behaviors (Emmons, 1987; Fowles, 1988).

In addition to these genetic effects, we also noted the effects of shared environmental influences on the manifestations of the Dark Triad and SPI traits. Such environmental correlations suggest that family-based experiences affect the joint emergence of some of the Dark Triad and SPI traits. These shared effects were especially notable in the phenotypic correlations between Machiavellianism and the SPI. Over half of these correlations were attributable to common shared and non-shared environmental factors. Although perhaps unusual, this pattern of results is unsurprising given the importance of the shared environmental effects that we observed on Machiavellianism at the univariate level.

Principal Factor Analysis: Fitting the Dark Triad and SPI Traits into a Personality Framework

Principal factor analysis yielded one general factor with moderate to strong loadings from all of the Dark Triad and SPI traits. Subsequent behavioral genetic analyses revealed that individual differences in this factor were attributable to genetic, shared, and non-shared environmental factors. Thus, we were able to extract a heritable GFP from the data, which mirrors the results of previous behavioral genetic studies on this general factor (e.g., Veselka et al., 2009a; 2009b). This finding lends support to the notion of an overarching general factor of personality,

which may have important evolutionary implications (Rushton & Erdle, 2010).

Three rotated factors were also extracted, which confirm the link between the Dark Triad and SPI, and clarify the relations between these variables. The first rotated factor represents Narcissism, given its strong loadings from Dark Triad's narcissism, as well as from SPI traits that have been shown to characterize narcissism, such as egotism, seductiveness, and manipulateness (e.g., Foster et al., 2006; Raskin & Hall, 1979). The second rotated factor represents Tradition, as it is defined by traits that are not typically associated with antisocial Dark Triad behaviors, including conventionality, religiosity, and low risk-taking (e.g., Watson et al., 2004). The third rotated factor represents Unemotionality, given its loadings from the Dark Triad's psychopathy and Machiavellianism — both traits that comprise interpersonally cold and manipulative behaviors (e.g., Christie & Geis, 1970; Hare, 1985) — in addition to SPI's manipulateness, low integrity, and masculinity.

The correlations we found between the three oblique factors are helpful in illustrating the socially aversive nature of the three Dark Triad traits, while confirming the associations between them. Specifically, the strong relation observed between the Narcissism and Unemotional factors reflects the findings of previous studies that have reported correlations between the three Dark Triad traits (e.g., Jakobwitz & Egan, 2006; Lee & Ashton, 2005; Paulhus & Williams, 2002), and adds further evidence in support of the existence of a valid Dark Triad construct comprising interrelated antisocial traits. Furthermore, the negative correlations between the Traditional factor and the two Dark Triad factors create a dichotomy between conservative, moral-based behaviors and the socially manipulative behaviors characteristic of the Dark Triad dimensions.

Univariate behavioral genetic results for the three rotated factors reveal that individual differences in the Narcissism and Traditional factors were entirely attributable to genetic and non-shared environmental effects. Individual differences in the Unemotional factor showed no significant genetic component and were entirely attributable to shared and non-shared environmental effects. These results echo our univariate behavioral genetic results with the Dark Triad traits: specifically, while narcissism was found to be a heritable trait, the etiology of Machiavellianism (which loads heavily on the Unemotional factor) stemmed from familial influences. Our bivariate behavioral genetic results showed genetic influences contributing to the correlations between Tradition and both Narcissism and Unemotionality. The correlation between these latter factors was itself entirely attributable to correlated environmental factors, reflecting the strong influence of environmental factors that we observed on Unemotionality.

In conclusion, the present study is the first to assess the Dark Triad in conjunction with the SPI traits and we have

done this at both the phenotypic and the genetic and environmental levels. Our results suggest that a refinement of the current framework of personality should be undertaken which takes into account the variety of antisocial traits that exist in human populations and which lie beyond the Big Five factors.

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