

A Behavioral Genetic Analysis of Alexithymia and the Dark Triad Traits of Personality

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The present study is the first to assess phenotypic correlations between alexithymia and the Dark Triad traits of personality in a community sample, as well as the common genetic and environmental factors underlying these correlations. Participants were 232 North American adult twin pairs who completed the Narcissistic Personality Inventory, the Self-Report Psychopathy Scale, the MACH-IV, and the Toronto Alexithymia Scale. Results revealed that alexithymia correlates significantly and positively with psychopathy and Machiavellianism, and negatively with narcissism. Subsequent bivariate behavioral genetic analysis demonstrated that these phenotypic correlations were primarily attributable to common genetic and common non-shared environmental factors. The implication of these findings regarding the maladaptive functions of alexithymia within the antisocial realm of behavior and the need for replication are discussed.

■ **Keywords:** alexithymia, dark triad, antisocial behavior, twin study, behavior genetics

Alexithymia, literally meaning ‘no words for mood’ (Lesser, 1981), is a term that was first used by Sifneos (1973) to describe a group of behaviors commonly occurring together in patients suffering from psychosomatic disorders. From these early symptoms came the present definition of alexithymia, the defining features of which are difficulty in describing one’s own emotions; difficulty in identifying and distinguishing between feelings and bodily sensations that are associated with emotional arousal; poor imaginative processes; and an externally oriented cognitive style (Nemiah et al., 1976). These facets of alexithymia reflect deficits in cognitive processing and regulation of emotion (Taylor, 2000).

The operationalization of the construct has allowed for further development and understanding of alexithymia, and of its relation to other constructs, as well as emotional and physical disorders. Previous research has noted associations between alexithymia and markers of antisocial behavior, including low impulse control and social detachment (e.g., Taylor et al., 1997; Vanheule et al., 2007). Furthermore, alexithymia has exhibited a strong inverse relation with trait emotional intelligence (trait EI) — a construct that has been positively linked to mental health and inversely related to psychopathology (Baughman et al., 2011; Petrides et al., 2011). Therefore, not surprisingly, previous research has shown alexithymia to be associated with many clinical disorders such as somatoform disorders (Duddu et al., 2003), post-traumatic stress disorder (Shipko et al., 1983),

generalized anxiety disorder (Schut et al., 2001), panic disorder (Parker et al., 1993c), depression (Honkalampi et al., 2000), anorexia nervosa (Bourke et al., 1992), and substance abuse (Cecero & Holmstrom, 1997). Less, however, is known about the role of alexithymia at the subclinical level. Given the growing support for a dimensional perspective on human functioning as opposed to one focused on diagnostic categories, the extent to which alexithymia is related to subclinical antisocial traits at the phenotypic, genetic, and environmental levels is of interest. Specifically, the associations that may exist between alexithymia and the subclinical Dark Triad personality cluster show promise of yielding valuable information about the role of alexithymia in the manifestation of community-level antisocial behaviors.

The Dark Triad and Its Relations to Alexithymia

The Dark Triad — comprising narcissism, psychopathy, and Machiavellianism — is a collection of socially aversive, non-pathological, personality traits that are moderately positively correlated with one another (Paulhus &

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Williams, 2002). Narcissism is characterized by a sense of entitlement and a grandiose self-concept (Raskin & Hall, 1979); Machiavellianism is exhibited through cold and manipulative interpersonal behavior (Christie & Geis, 1970); and subclinical psychopathy is defined by low empathy and anxiety, as well as high impulsivity (Hare, 1985). All three of the Dark Triad traits are characterized by tendencies toward self-promotional behavior, emotional coldness, and aggressiveness (Paulhus & Williams, 2002).

Although some existing studies have examined the relations between elements of the Dark Triad cluster and alexithymia (e.g., Fan et al., 2011; Lander et al., 2012; Wastell & Booth, 2003), none have assessed explicitly the association between the two sets of constructs. Furthermore, until more recently (Grieve & Mahar, 2010; Wastell & Booth, 2003), many of these studies have been restricted to clinical populations (e.g., Louth et al., 1998; Raskin & Hare, 1978). Research has revealed positive associations between Machiavellianism and alexithymia (Wastell & Booth, 2003), demonstrating that Machiavellian individuals show a tendency to experience difficulty in identifying feelings and to engage in externally oriented thinking. These findings suggest that alexithymic individuals who are unable to foster emotional connection to others may not make the choice to act in a Machiavellian way. Rather, the emotional deficits resulting from alexithymia could produce this behavior (Wastell & Booth, 2003).

Among clinical samples, a general positive relation has been evident between alexithymia and psychopathy at the global and facet levels (Kroner & Forth, 1995; Louth et al., 1998). Research regarding the emotional processing deficits that occur in individuals who suffer from alexithymia and psychopathy (Kroner & Forth, 1995) demonstrates a conceptual overlap between the two constructs (Lander et al., 2012). For example, individuals scoring high on measures of alexithymia have been shown to score lower on measures of empathy (Moriguchi et al., 2007) and empathy-related behaviors (Parker et al., 1993b). Because low empathy is one of the primary defining characteristics of psychopathy (Hare, 1985), these previous findings suggest that alexithymia may be related to higher levels of psychopathy due to their common relation with low empathy. Research has further shown that both alexithymia and psychopathy are associated with difficulties in describing one's own feelings (Luminet et al., 1999), understanding emotional tones in language (Hervé et al., 2003), difficulties in interpreting facial expressions (Dolan & Fullam, 2006), and low scores on measures of trait EI (Grieve & Mahar, 2010; Malterer et al., 2008). As with empathy, these common correlates of psychopathy and alexithymia demonstrate a substantial conceptual overlap between the variables and point to a possible positive association between them.

Research has shown that, at the community level, narcissistic individuals are socially aware and able to perceive the emotions of others and their self (Veselka et al., 2012).

Narcissistic individuals tend to score high on measures of trait EI (Petrides et al., 2011) — a constellation of traits representing self-perceived emotion-related abilities (Petrides et al., 2007) — and on the facets and factors comprising this variable (Petrides et al., 2011). The positive relation that has emerged between narcissism and trait EI, and the strong inverse relation that has been demonstrated between trait EI and alexithymia (Parker et al., 2001), suggest that narcissism may correlate negatively with alexithymia.

Behavioral Genetic Analyses of the Dark Triad and Alexithymia

To date, a bivariate behavioral genetic investigation of alexithymia and the Dark Triad traits has not been conducted. Univariate behavioral genetic studies of these traits, however, do exist, and they provide valuable insight into the potential etiological factors underlying the co-occurrence of the variables in question.

Univariate behavioral genetic research conducted on the Dark Triad traits suggests that individual differences in these traits are primarily attributable to genetic and non-shared environment factors (Blonigen et al., 2005; Larsson et al., 2006; Livesley et al., 1993; Taylor et al., 2003; Vernon et al., 2008). Vernon et al. (2008) further found, however, that variation in Machiavellianism, while affected by genetic factors, was also attributable to shared environmental effects.

Very few behavioral genetic investigations of alexithymia have been conducted. However, the sparse research that does exist indicates that genetic effects play a role in the variation of this trait (Heiberg & Heiberg, 1978; Jørgensen et al., 2007; Valera & Berenbaum, 2001). Jørgensen et al. (2007) conducted the largest behavioral genetic investigation of alexithymia to date, and reported that individual differences in alexithymia were primarily attributable to genetic factors. Genetic heritability estimates of alexithymia were found to range from 0.30 to 0.33, and the remaining variance was attributed to non-shared environmental factors (0.50–0.56), and shared environmental factors (0.12–0.20). Similar results were reported by Baughman et al. (in press) in a large sample of twins in the United Kingdom.

Present Study

The goal of the present study was to conduct a preliminary investigation of the Dark Triad traits and alexithymia in order to examine potential relations between them. Pending compelling findings, the goal was then to encourage replication using larger twin samples. Phenotypic correlations between alexithymia and the Dark Triad traits were assessed to gain a clearer understanding of the unique relations that exist between the constructs at the global and factor levels. A subsequent bivariate behavioral genetic analysis of the Dark Triad and alexithymia was carried out to determine whether significant phenotypic correlations between the constructs could be attributed to common genetic and/or common environmental factors.

Significant phenotypic correlations were expected to emerge between alexithymia and all three of the Dark Triad traits due to previous research investigating the individual associations between the traits. Specifically, it was predicted that a negative correlation would emerge between alexithymia and narcissism and that positive correlations would be found between alexithymia and the Dark Triad traits of Machiavellianism and psychopathy. With regard to the bivariate behavioral genetic analysis, it was predicted that phenotypic correlations between alexithymia and the Dark Triad traits would be attributable largely to common genetic and common non-shared environmental factors, reflecting previous behavioral genetic analyses at the univariate level. Because individual differences in Machiavellianism can, in part, be accounted for by shared environmental effects (Vernon et al., 2008), it is possible that the phenotypic correlation between alexithymia and Machiavellianism may also possess shared environmental underpinnings.

Method

Participants

Participants in the present study were 193 monozygotic (MZ) twin pairs (171 female pairs, 22 male pairs) and 39 same-sex dizygotic (DZ) twin pairs (35 female pairs, 4 male pairs). All of the participants resided in North America and ranged in age from 16 to 75 years ($M = 39.27$, $SD = 15.66$). The participants represented a sample of twin pairs who were recruited from an ongoing twin study of adult personality. Each participant filled out the relevant questionnaires individually.

Materials

MACH-IV. To assess variation in Machiavellianism, the MACH-IV was employed (Christie & Geis, 1970). Higher scores on the MACH-IV indicate higher levels of manipulative interpersonal strategies and a skeptical view of other individuals. The MACH-IV is a 20-item self-report questionnaire in which participants are asked to rate how much they agree with each statement on a 5-point Likert Scale (where 1 = *disagree strongly* and 5 = *agree strongly*). For example, item 10 asks ‘The best way to handle people is to tell them what they want to hear’. The MACH-IV has been shown to be a sound measure of Machiavellianism with good psychometric properties (e.g., Paulhus & Williams, 2002; Ramanaiah et al., 1994).

Narcissistic Personality Inventory (NPI). The NPI (Raskin & Hall, 1979) measures individual differences in subclinical narcissism. Thus, higher scores on the NPI reflect the ability and desire to influence others, and a tendency to expect more from others than one is willing to give in return (Emmons, 1984). The NPI is a 40-item forced-choice self-report questionnaire. Each item of the NPI presents two self-reflective statements — a statement

highly indicative of narcissistic thoughts and feelings, and a statement reflecting non-narcissistic thoughts and feelings — and the participant must choose which statement best reflects their self. Research regarding the NPI has shown the questionnaire to have good psychometric properties and to be an accurate measure of subclinical narcissism (e.g., del Rosario & White, 2005; Emmons, 1984; Ramanaiah et al., 1994).

Self-Report Psychopathy Scale (SRP-III-R12). The SRP-III-R12 (Hare, 1985) measures individual differences in subclinical psychopathy. Higher scores on the SRP-III-R12 indicate higher levels of emotional instability, antisocial behavior, impulsivity, and interpersonal manipulation. This measure is a 62-item self-report questionnaire. It requires participants to indicate the extent to which they agree with self-reflective items on a 5-point Likert scale (where 1 = *disagree strongly* and 5 = *agree strongly*). For example, item 12 states ‘I have assaulted a law enforcement official or social worker’. Research conducted on the SRP-III-R12 has found it to be a valid measure of subclinical psychopathy with good psychometric properties (e.g., Derefinco & Lynam, 2006; Paulhus & Williams, 2002; Williams et al., 2007).

Toronto Alexithymia Scale (TAS-20). The TAS-20 (Taylor et al., 1992) measures individual differences in alexithymia via the questionnaire’s three subscales: difficulty identifying feelings, difficulty describing feelings, and externally oriented cognitive thinking (Parker et al., 1993a). Higher scores on the TAS-20 indicate higher levels of alexithymia. The TAS-20 is a 20-item self-report questionnaire that requires participants to respond to self-reflective items on a 5-point Likert scale (where 1 = *disagree strongly* and 5 = *agree strongly*). For example, item 4 states ‘I am able to describe my feelings easily’. The TAS-20 has demonstrated good psychometric properties (e.g., Bagby et al., 1994; Caretti et al., 2011).

Procedure

The current sample of twin pairs was recruited from an ongoing twin study of adult personality. Those who expressed interest in taking part in the present study after being contacted via telephone or email were sent a package via standard mail, which contained a letter of information, consent form, and all four of the included questionnaires — the MACH-IV, NPI, SRP-III-R12, and the TAS-20. A self-addressed stamped envelope was provided for participants to send back their completed package. Each individual received \$20.00 compensation upon completion and was entered into a draw to win one of ten \$100.00 prizes. Approximately 75% of the twins who were contacted agreed to take part and returned completed questionnaires. We compared these twins’ mean scores on another questionnaire (the NEO-PI-R) that they and the twins who chose not to participate had all completed some years previously, and no

TABLE 1
Descriptive Statistics for the Dark Triad Variables and the Variables Measured by TAS-20

Variables	Twin 1		Twin 2	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Dark Triad				
Narcissism ^a	0.39	0.18	0.38	0.18
Machiavellianism ^b	2.50	0.42	2.54	0.38
Psychopathy ^c	2.09	0.38	2.14	0.41
Alexithymia ^d				
DIF	13.39	5.54	13.00	5.30
DDF	11.64	4.38	11.26	4.11
EOT	18.11	4.61	18.80	4.30

Note: DIF = difficulty identifying feelings; DDF = difficulty describing feelings; EOT = externally oriented thinking.

^aMeasured by the NPI; ^bmeasured by the MACH-IV; ^cmeasured by the SRP-III-R12; ^dmeasured by the TAS-20.

significant (or large) differences were observed. As such, the twins in the present sample may be considered representative, at least in their Big 5 scores, of the larger population of twins from which they were recruited.

Analyses

Following computation of phenotypic correlations between alexithymia and each of the Dark Triad, a series of bivariate behavioral genetic analyses were performed using the Mx software package (Neale et al., 2006) to determine the extent to which the phenotypic correlations can be accounted for by common genetic and/or common environmental factors. For these bivariate analyses, we used the method of Cholesky or triangular factor analysis (Neale & Cardon, 1992) to assess the cross-correlations within twin pairs (i.e., the correlation between one twin's score on one variable with their co-twin's score on another variable). We began by fitting a full ACE model to our data to investigate potential correlated genetic (A), common environmental (C), and/or unique environmental (E) effects. Reduced models were then also tested (i.e., AE, CE) to determine if a more parsimonious model could explain the phenotypic correlations. Due to our small sample sizes we ran these bivariate models rather than one full multivariate model.

Results

Descriptive statistics for all of the assessed variables are shown in Table 1. The sample was split into two subgroups (one twin from each twin pair was randomly designated as 'Twin 1', and the other twin was labeled 'Twin 2') to allow for cross-replication of the initial findings.

Phenotypic correlations between the Dark Triad traits and alexithymia are shown in Table 2. A significant positive correlation was found between the global alexithymia score and both of the Dark Triad traits of Machiavellianism and psychopathy. Furthermore, Machiavellianism and

psychopathy showed significant correlations with all three of the underlying factors of alexithymia: difficulty identifying feelings, difficulty describing feelings, and externally oriented cognitive thinking. The aforementioned correlations were all moderate in magnitude. The highest significant correlation was between Machiavellianism and global alexithymia scores (0.28) and the lowest significant correlation was between psychopathy and externally oriented cognitive thinking (0.09). As predicted, a significant negative correlation was found between narcissism and global alexithymia scores. Narcissism also demonstrated negative correlations with two of the underlying factors of alexithymia: externally oriented cognitive thinking (-0.17) and difficulty describing feelings (-0.13). No significant correlation was found between narcissism and the alexithymia factor reflecting difficulty identifying feelings. Of the three Dark Triad traits, Machiavellianism exhibited the strongest correlations with alexithymia, although these correlations were predominantly moderate in effect.

The results of the bivariate behavioral genetic analyses are reported in Table 2. As can be seen, almost all of the phenotypic correlations between alexithymia and the Dark Triad traits can be attributed to common genetic and common non-shared environmental factors. Significant genetic correlations were noted between many of the alexithymia scales and the Dark Triad traits of narcissism and Machiavellianism. At the global level, significant genetic effects were noted between alexithymia and the Dark Triad traits of narcissism and Machiavellianism. At the factor level, phenotypic associations between alexithymia's difficulty describing feelings factor and the Dark Triad traits of narcissism and Machiavellianism were also attributable to common genetic effects. Furthermore, correlated genetic effects were noted for the association between Machiavellianism and the remaining two subscales of alexithymia: difficulty identifying feelings and externally oriented thinking. No significant genetic correlation was found between psychopathy and alexithymia at the global or factor levels.

The significant environmental correlations found between the Dark Triad traits and alexithymia were non-shared in nature. Significant non-shared environmental correlations were observed between total alexithymia scores and the Dark Triad traits of Machiavellianism and psychopathy. At the factor level, significant non-shared environmental effects accounted for the phenotypic correlations noted between Machiavellianism and all three factors of alexithymia. Furthermore, observed associations between psychopathy and the difficulty describing feelings subscale of alexithymia were accounted for by significant non-shared environmental correlations. No significant environmental correlations were found between narcissism and alexithymia at the global or the factor level. No significant shared environmental correlations were found between the Dark Triad traits and alexithymia at the global or the factor level.

TABLE 2
Phenotypic (rp), Genetic (rg), Shared Environmental (rc), and Non-Shared Environmental (re) Correlations Between the Dark Triad Traits and Alexithymia (TAS-20)

TAS-20 scales	Dark Triad measures		
	NPI	MACH-IV	SRP-III
DIF	rp = -0.03	rp = 0.24**	rp = 0.16**
	rg = -	rg = 0.33 (0.09 to 0.55)	rg = 0.18 (-0.08 to 0.42)
	rc = -0.20 (0.04 to -0.44)	rc = -	rc = -
DDF	re = -0.01 (-0.13 to 0.12)	re = 0.20 (0.06 to 0.33)	re = 0.14 (-0.01 to 0.27)
	rp = -0.13**	rp = 0.24**	rp = 0.17**
	rg = -0.32 (-0.11 to -0.53)	rg = 0.29 (0.06 to 0.50)	rg = 0.16 (-0.08 to 0.38)
EOT	rc = -	rc = -	rc = -
	re = -0.01 (-0.15 to 0.13)	re = 0.22 (0.09 to 0.35)	re = 0.17 (0.03 to 0.30)
	rp = -0.17**	rp = 0.15**	rp = 0.09*
Total	rg = -	rg = 0.15 (-0.04 to 0.33)	rg = -
	rc = -0.27 (-0.09 to -0.44)	rc = -	rc = 0.08 (-0.12 to 0.27)
	re = -0.07 (-0.19 to 0.06)	re = 0.17 (0.04 to 0.30)	re = 0.11 (-0.02 to 0.23)
	rp = -0.14**	rp = 0.28**	rp = 0.18**
	rg = -0.37 (-0.17 to -0.56)	rg = 0.34 (0.12 to 0.53)	rg = 0.21 (-0.02 to 0.43)
	rc = -	rc = -	rc = -
	re = 0.01 (-0.14 to 0.15)	re = 0.25 (0.11 to 0.38)	re = 0.16 (0.02 to 0.30)

Note: DIF = difficulty identifying feelings; DDF = difficulty describing feelings; EOT = externally oriented thinking; NPI = Narcissistic Personality Inventory.

Numbers appearing in parentheses represent the 95% confidence interval values. All correlations whose confidence intervals do not include zero are significant at the 0.05 level.

* $p < .05$; ** $p < .01$ (two-tailed).

Discussion

The results of the present study provide support for our hypotheses regarding the phenotypic correlations between the Dark Triad traits and alexithymia. As proposed, Machiavellianism and alexithymia were moderately positively correlated. The Dark Triad trait of psychopathy also demonstrated a moderate positive correlation with alexithymia, as predicted. Lastly, narcissism demonstrated a moderate negative relation with alexithymia, supporting the present study's hypothesis that higher levels of subclinical narcissism are related to lower levels of alexithymia.

Taken together with previous research, the phenotypic correlations observed in the present study have important implications for the maladaptive functions of alexithymia. Research has shown that alexithymia, and specifically difficulties in cognitively processing emotional perceptions, were associated with a broad range of psychopathologies (Grabe et al., 2004). Thus, the present study's results support the findings that aversive interpersonal styles may result from the improper use of emotions as social cues (Taylor, 2000, as cited in Wastell & Booth, 2003), as indicated by the positive relation found between alexithymia and the Dark Triad traits of Machiavellianism and psychopathy. The present research supports the role of maladaptive functions of alexithymia within the antisocial realm of behavior. However, it further clarifies this general finding by showing that particular antisocial traits, namely narcissism, are in fact related to lower levels of the aversive trait of alexithymia.

The present study's findings regarding the negative relation between narcissism and alexithymia are in line with previous research conducted on the Dark Triad traits and other trait sets (Campbell et al., 2009; Petrides et al., 2011),

in which the association between narcissism diverges from the other two Dark Triad traits — Machiavellianism and psychopathy. The negative relation between alexithymia and narcissism indicates that narcissistic individuals exhibit prosocial tendencies. Taken with previous research, this divergence of narcissism from its Dark Triad counterparts may reflect the adaptive characteristics of narcissism or demonstrate that the measure used to capture subclinical narcissism — namely the Narcissistic Personality Inventory (Raskin & Hall, 1979) — does not accurately assess subclinical narcissism. As suggested by Veselka et al. (2012), a revision of the measure may be necessary in order to capture the socially malevolent nature of the trait.

At the univariate level, previous research has demonstrated that alexithymia and the Dark Triad traits of personality are influenced most heavily by genetic factors and, to a lesser extent, by non-shared environmental factors (Jørgensen et al., 2007; Vernon et al., 2008). As hypothesized, in the present study, at the bivariate level, a similar pattern of findings was observed. The co-occurrence of alexithymia and Machiavellianism was most heavily influenced by genetic factors, and to a lesser but significant extent by non-shared environmental factors. Furthermore, phenotypic correlations between alexithymia and narcissism were attributable to common genetic factors only, with no additional contribution from common environmental effects.

Particularly interesting was the study's findings concerning psychopathy and alexithymia. Contrary to previous behavioral genetic research conducted on psychopathy at the univariate level (e.g., Blonigen et al., 2005; Larsson et al., 2006; Taylor et al., 2003), as well as published findings regarding the co-occurrence of psychopathy and

emotion-related traits (Petrides et al., 2011), the present study found no significant common genetic factors affecting the joint variation in psychopathy and alexithymia. These findings suggest that biological systems cannot account for the common occurrence of these two traits. At the same time, common shared environmental factors, such as family upbringing, also did not show themselves to have a significant impact on the co-occurrence of alexithymia and psychopathy. Consequently, although psychopathy and alexithymia have been shown to relate to each other, there does not appear to be a theoretically relevant biological or familial system that can account for this association. Rather, unique environmental effects seem particularly influential — a finding that reflects some past research showing the importance of the non-shared environment to some disorder-relevant traits as well as criminality (Plomin et al., 1994), both of which are relevant to alexithymia and psychopathy. Although no specific non-shared environmental processes have been identified in the literature as underscoring alexithymia and psychopathy, occurrences such as poor prenatal development and trauma have been implicated in the development of antisocial behavior and therefore may be worth exploring in future investigations (Plomin et al., 1994).

The present study was the first to clarify the role of alexithymia in the antisocial realm of human personality through the phenotypic, genetic, and environmental correlations observed between alexithymia and the Dark Triad traits. This study demonstrates alexithymia's possible role in the expression of Machiavellianism and psychopathy, and the inverse relation between alexithymia and narcissism. Aversive interpersonal styles have been shown to result not only from the development of pathological personalities (Wastell, 1992, as cited in Wastell & Booth, 2003) but also from the improper use of emotions as social cues (Taylor, 2000, as cited in Wastell & Booth, 2003). Clarifying the etiologies of these antisocial personality traits could provide an insight into the maladaptive functions of alexithymia and, taken along with previous research on alexithymia and mental health (Grabe et al., 2004), implicates the need for psychotherapeutic techniques involving increases in affect awareness and understanding.

The study is, of course, not without limitations. The sample size of the study was quite small, with a limited number of DZ twins (Posthuma & Boomsma, 2000, as cited in Johnson et al., 2008). Consequently, the reported patterns of genetic and environmental correlations should be interpreted with caution. With that in mind, many of the patterns of phenotypic associations that were noted were in line with previous investigations, and in many cases, behavioral genetic findings corresponded to existing etiological theories (e.g., Bezdjian et al., 2011; Vernon et al., 2008; Wastell & Booth, 2003). Consequently, the preliminary results are promising, but are also in need of replication. Furthermore, the sample contained relatively few male twin pairs. Research shows that males score higher on all three

of the Dark Triad traits (Paulhus & Williams, 2002) and meta-analyses demonstrate that alexithymia is also significantly higher in males (Levant et al., 2009). Thus, the small sample of males may have caused an underrepresentation of significant findings. Future studies may wish to examine the role of sex differences in the realm of the Dark Triad traits and alexithymia.

References

- Bagby, M., Taylor, G., & Parker, J. (1994). The twenty-item Toronto Alexithymia Scale: II. Convergent, discriminant, and concurrent validity. *Journal of Psychosomatic Research*, 38, 33–40.
- Baughman, H. M., Schermer, J. A., Veselka, L., Harris, J., & Vernon, P. A. (2013). A behaviour genetic analysis of trait emotional intelligence and alexithymia: A replication. *Twin Research and Human Genetics*. Advance online publication.
- Baughman, H. M., Schwartz, S., Schermer, J. A., Veselka, L., Petrides, K. V., & Vernon, P. A. (2011). A twin study of alexithymia and its relationships with trait emotional intelligence. *Twin Research and Human Genetics*, 14, 539–543.
- Bezdjian, S., Raine, A., Baker, L. A., & Lynam, D. R. (2011). Psychopathic personality in children: Genetic and environmental contributions. *Psychological Medicine*, 41, 589–600.
- Blonigen, D. M., Hicks, B. M., Krueger, R. F., Patrick, C. J., & Iacono, W. G. (2005). Psychopathic personality traits: Heritability and genetic overlap with internalizing and externalizing psychopathology. *Psychological Medicine*, 35, 637–648.
- Bourke, M., Taylor, G., Parker, J., & Bagby, M. (1992). Alexithymia in women with anorexia nervosa: A preliminary investigation. *British Journal of Psychiatry*, 161, 240–243.
- Campbell, J., Schermer, J., Villani, V., Nguyen, B., Vickers, L., & Vernon, P. (2009). A behavioral genetic study of the Dark Triad of personality and moral development. *Twin Research and Human Genetics*, 12, 132–136.
- Caretti, V., Porcelli, P., Solano, L., Schimmenti, A., Bagby, R. M., & Taylor, G. J. (2011). Reliability and validity of the Toronto structured interview for alexithymia in a mixed clinical and nonclinical sample from Italy. *Psychiatry Research*, 187, 432–436.
- Cecero, J., & Holmstrom, R. (1997). Alexithymia and affect pathology among adult male alcoholics. *Journal of Clinical Psychology*, 53, 201–208.
- Christie, R., & Geiss, F. (1970). *Studies in Machiavellianism*. New York: Academic Press.
- del Rosario, P. M., & White, R. M. (2005). The Narcissistic Personality Inventory: Test–retest stability and internal consistency. *Personality and Individual Differences*, 39, 1075–1081.
- Derefinco, K. J., & Lynam, D. R. (2006). Convergence and divergence among self-report psychopathy measures: A personality-based approach. *Journal of Personality Disorders*, 20, 261–280.
- Dolan, M., & Fullam, R. (2006). Face affect recognition deficits in personality-disordered offenders: Association with psychopathy. *Psychological Medicine*, 36, 1563–1569.

- Duddu, V., Isaac, M., & Chaturvedi, S. (2003). Alexithymia in somatoform and depressive disorders. *Journal of Psychosomatic Research*, *54*, 435–438.
- Emmons, R. A. (1984). Factor analysis and construct validity of the Narcissistic Personality Inventory. *Journal of Personality Assessment*, *48*, 291–300.
- Fan, Y., Wonneberger, C., Enzi, B., Greek, M., Ulrich, C., Tempelmann, C., . . . Northoff, G. (2011). The narcissistic self and its psychological and neural correlates: An exploratory fMRI study. *Psychological Medicine: A Journal of Research in Psychiatry and the Allied Sciences*, *41*, 1641–1650.
- Grabe, H. J., Spitzer, C., & Freyberger, H. J. (2004). Alexithymia and personality in relation to dimensions of psychopathology. *The American Journal of Psychiatry*, *161*, 1299–1301.
- Grieve, R., & Mahar, D. (2010). The emotional manipulation–psychopathy nexus: Relationships with emotional intelligence, alexithymia and ethical position. *Personality and Individual Differences*, *48*, 945–950.
- Hare, R. (1985). Comparison of procedures for the assessment of psychopathy. *Journal of Consulting and Clinical Psychology*, *53*, 7–16.
- Heiberg, A. N., & Heiberg, A. (1978). A possible genetic contribution to the alexithymia trait. *Psychotherapy and Psychosomatics*, *30*, 205–210.
- Hervé, H. F., Hayes, P. J., & Hare, R. D. (2003). Psychopathy and sensitivity to the emotional polarity of metaphorical statements. *Personality and Individual Differences*, *35*, 1497–1507.
- Honkalampi, K., Hintikka, J., Tanskanen, A., Lehtonen, J., & Viinamäki, H. (2000). Depression is strongly associated with alexithymia in the general population. *Journal of Psychosomatic Research*, *48*, 99–104.
- Johnson, A. M., Vernon, P. A., & Feiler, A. R. (2008). Behavioral genetic studies of personality: An introduction and review of the results of 50+ years of research. In G. J. Boyle, G. Matthews & D. H. Saklofske (Eds.), *The SAGE handbook of personality theory and assessment. Vol. 1: Personality theories and models* (pp. 145–173). Thousand Oaks, CA: Sage.
- Jørgensen, M., Zachariae, R., Skytthe, A., & Kyvik, K. (2007). Genetic and environmental factors in alexithymia: A population-based study of 8,785 Danish twin pairs. *Psychotherapy and Psychosomatics*, *76*, 369–375.
- Kroner, D., & Forth, A. (1995). The Toronto Alexithymia Scale with incarcerated offenders. *Personality and Individual Differences*, *19*, 625–634.
- Lander, G. C., Lutz-Zois, C., Rye, M. S., & Goodnight, J. A. (2012). The differential association between alexithymia and primary versus secondary psychopathy. *Personality and Individual Differences*, *52*, 45–50.
- Larsson, H., Andershed, H., & Lichtenstein, P. (2006). A genetic factor explains most of the variation in the psychopathic personality. *Journal of Abnormal Psychology*, *115*, 221–230.
- Lesser, I. M. (1981). A review of the alexithymia concept. *Psychosomatic Medicine*, *43*, 531–543.
- Levant, R. F., Hall, R. J., Williams, C. M., & Hasan, N. T. (2009). Gender differences in alexithymia. *Psychology of Men & Masculinity*, *10*, 190–203.
- Livesley, W., Jang, K., Jackson, D., & Vernon, A. (1993). Genetic and environmental contributions to dimensions of personality disorder. *The American Journal of Psychiatry*, *150*, 1826–1831.
- Louth, S. M., Hare, R. D., & Linden, W. (1998). Psychopathy and alexithymia in female offenders. *Canadian Journal of Behavioural Science/Revue Canadienne Des Sciences Du Comportement*, *30*, 91–98.
- Luminet, O., Bagby, R. M., Wagner, H., Taylor, G. J., & Parker, J. D. A. (1999). Relation between alexithymia and the five-factor model of personality: A facet-level analysis. *Journal of Personality Assessment*, *73*, 345–358.
- Malterer, M. B., Glass, S. J., & Newman, J. P. (2008). Psychopathy and trait emotional intelligence. *Personality and Individual Differences*, *44*, 735–745.
- Moriguchi, Y., Decety, J., Ohnishi, T., Maeda, M., Mori, T., Nemoto, K., . . . Komaki, G. (2007). Empathy and judging others' pain: An fMRI study of alexithymia. *Cerebral Cortex*, *17*, 2223–2234.
- Neale, M. C., Boker, S. M., Xie, G., & Maes, H. H. (2006). *Mx: Statistical modeling manual* (7th ed.). Richmond, VA: Department of Psychiatry, Medical College of Virginia.
- Neale, M. C., & Cardon, L. R. (1992). *Methodology for genetic studies of twins and families*. Dordrecht, The Netherlands: Kluwer Academic.
- Nemiah, J., Freyberger, H., & Sifneos, P. E. (1976). Alexithymia: A view of the psychosomatic process. In O. W. Hill (Ed.), *Modern trends in psychosomatic medicine* (vol. 3, pp. 430–439). London, UK: Butterworths.
- Parker, J. D., Bagby, R. M., Taylor, G. J., & Endler, N. S. (1993a). Factorial validity of the 20-item Toronto Alexithymia Scale. *European Journal of Personality*, *7*, 221–232.
- Parker, J. D., Taylor, G. J., & Bagby, R. M. (1993b). Alexithymia and the recognition of facial expressions of emotion. *Psychotherapy and Psychosomatics*, *59*, 197–202.
- Parker, J. D., Taylor, G. J., Bagby, R. M., & Acklin, M. W. (1993c). Alexithymia in panic disorder and simple phobia: A comparative study. *The American Journal of Psychiatry*, *150*, 1105–1107.
- Parker, J. D. A., Taylor, G. J., & Bagby, R. M. (2001). The relationship between emotional intelligence and alexithymia. *Personality and Individual Differences*, *30*, 107–115.
- Paulhus, D., & Williams, K. (2002). The Dark Triad of personality: Narcissism, Machiavellianism and psychopathy. *Journal of Research in Personality*, *36*, 556–563.
- Petrides, K. V., Pita, R., & Kokkinaki, F. (2007). The location of trait emotional intelligence in personality factor space. *British Journal of Psychology*, *98*, 273–289.
- Petrides, K. V., Vernon, P. A., Schermer, J. A., & Veselka, L. (2011). Trait emotional intelligence and the Dark Triad traits of personality. *Twin Research and Human Genetics*, *14*, 35–41.
- Plomin, R., Chipuer, H. M., & Neiderhiser, J. M. (1994). Behavioural genetic evidence for the importance of non-shared environment. In E. M. Hetherington, D. Reiss & R. Plomin (Eds.), *Separate social worlds of siblings: The im-*

- pact of non-shared environment on development* (pp. 1–31). Hillsdale, NJ: Erlbaum.
- Ramanaiah, N. V., Byravan, A., & Detwiler, F. R. J. (1994). Revised NEO personality inventory profiles of Machiavellian and non-Machiavellian people. *Psychological Reports*, 75, 937–938.
- Raskin, R., & Hall, C. (1979). A Narcissistic Personality Inventory. *Psychological Reports*, 45, 590–590.
- Raskin, D., & Hare, R. (1978). Psychopathy and detection of deception in a prison population. *Psychophysiology*, 15, 126–136.
- Schut, A., Castonguay, L., & Borkovec, T. (2001). Compulsive checking behaviors in generalized anxiety disorder. *Journal of Clinical Psychology*, 57, 705–715.
- Shipko, S., Alvarez, W., & Noviello, N. (1983). Towards a teleological model of alexithymia: Alexithymia and post-traumatic stress disorder. *Psychotherapy and Psychosomatics*, 39, 122–126.
- Sifneos, P. E. (1973). The prevalence of 'alexithymic' characteristics in psychosomatic patients. *Psychotherapy and Psychosomatics*, 22, 255–262.
- Taylor, J. (2000). Recent developments in alexithymia theory and research. *The Canadian Journal of Psychiatry/La Revue Canadienne De Psychiatrie*, 45, 134–142.
- Taylor, G. J., Bagby, R. M., & Parker, J. D. (1992). The revised Toronto Alexithymia Scale: Some reliability, validity, and normative data. *Psychotherapy and Psychosomatics*, 57, 34–41.
- Taylor, G. J., Bagby, R. M., & Parker, J. D. (1997). *Disorders of affect regulation: Alexithymia in medical and psychiatric illness*. New York: Cambridge University Press.
- Taylor, J., Loney, B. R., Bobadilla, L., Iacono, W. G., & McGue, M. (2003). Genetic and environmental influences on psychopathy trait dimensions in a community sample of male twins. *Journal of Abnormal Child Psychology*, 31, 633–645.
- Valera, E. M., & Berenbaum, H. (2001). A twin study of alexithymia. *Psychotherapy and Psychosomatics*, 70, 239–246.
- Vanheule, S., Desmet, M., Meganck, R., & Bogaerts, S. (2007). Alexithymia and interpersonal problems. *Journal of Clinical Psychology*, 63, 109–117.
- Vernon, P., Villani, V., Vickers, L., & Harris, J. A. (2008). A behavioral genetic investigation of the Dark Triad and the Big 5. *Personality and Individual Differences*, 44, 445–452.
- Veselka, L., Schermer, J. A., & Vernon, P. A. (2012). The dark triad and an expanded framework of personality. *Personality and Individual Differences*, 53, 417–425.
- Wastell, C., & Booth, A. (2003). Machiavellianism: An alexithymic perspective. *Journal of Social and Clinical Psychology*, 22, 730–744.
- Williams, K. M., Paulhus, D. L., & Hare, R. D. (2007). Capturing the four-factor structure of psychopathy in college students via self-report. *Journal of Personality Assessment*, 88, 205–219.