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A Behavioral-Genetic Study of Alexithymia and its Relationships with Trait Emotional Intelligence

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The present study is the first to examine relationships between alexithymia and trait emotional intelligence (trait EI or trait emotional self-efficacy) at the phenotypic, genetic, and environmental levels. The study was also conducted to resolve inconsistencies in previous twin studies that have provided estimates of the extent to which genetic and environmental factors contribute to individual differences in alexithymia. Participants were 216 monozygotic and 45 dizygotic same-sex twin pairs who completed the Toronto Alexithymia Scale-20. In a pilot study, a sub-sample of 118 MZ and 27 DZ pairs also completed the Trait Emotional Intelligence Questionnaire. Results demonstrated that a combination of genetic and non-shared environmental influences contribute to individual differences in alexithymia. As expected, alexithymia and trait EI were negatively correlated at the phenotypic level. Bivariate behavioral genetic analyses showed that that all but one of these correlations was primarily attributable to correlated genetic factors and secondarily to correlated non-shared environmental factors.

■ **Keywords:** alexithymia, trait emotional self-efficacy, behavior genetics, TEIQue

Personality traits are relatively stable characteristics that are influenced by a combination of genetic and environmental factors. Alexithymia is a multifaceted personality characteristic, which is defined by a deficit in emotional regulation and its three factors: difficulty identifying feelings (DIF), difficulty describing feelings (DDF), and external oriented thinking (EOT; Bagby et al., 1994a). It has been linked to various physical and mental health problems such as depression and posttraumatic stress disorder (Krystal et al., 1986; Hendryx et al., 1991), as well as cancer and diabetes (Todarello et al., 1989; Abramson et al., 1991). In the past, research on alexithymia has focused on disease and disorders, with only limited emphasis on its relationships with directly relevant individual differences constructs like emotional intelligence.

Emotional Intelligence

EI is conceptually similar to alexithymia and, as such, it seems plausible that these two traits would be related. EI has received considerable attention regarding its relationship with other variables, such as psychopathy and Machiavellianism (Ali et al., 2009), life satisfaction, and interpersonal relationships (Austin et al., 2004). EI can be conceptualized as either a trait or ability (Petrides & Furnham, 2000). Given the conceptual and psychometric difficulties associated with EI ability (e.g., Fiori & Antonakis, 2011), we chose to focus specifically on trait emotional intelligence (trait EI or trait emotional self-efficacy). Trait EI is defined as a constellation of emotional self-perceptions located at the lower levels of personality hierarchies (Petrides et al., 2007).

Alexithymia and Trait EI

Previous studies looking at the relationships between alexithymia and EI have mainly assessed EI using the BarOn Emotional Quotient Inventory (EQ-i; Parker et al., 2001) and Schutte et al.'s (1998) self-report EI questionnaire that (erroneously) conceptualizes EI as an ability, and provides only partial coverage of the construct's sampling domain (Martins et al., 2010; Petrides et al., 2010). Parker et al. (2001) reported a disattenuated correlation of -.72

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between the Toronto Alexithymia Scale and the EQ-i, while Grieve and Mahar (2010) reported a moderate negative correlation between the TAS and Schutte et al.'s questionnaire. In contrast, Webb and McMurran (2008) also found a moderate relationship between the TAS and the short form of the EQ-i. Using the Trait Emotional Intelligence Questionnaire, which was also employed in our study, Pham et al. (2010) found a correlation of -.61 between alexithymia (TAS) and global trait EI in a forensic sample of criminal psychopaths, while Mikolajczak et al. (2007), in a thorough investigation of the psychometric properties of the TEIQue, also reported a negative correlation with the TAS. Other studies that have explored the relationship between trait EI and alexithymia have all reported negative correlations (Austin et al., 2004; Saklofski et al., 2003)

Behavioral-Genetic Studies of Alexithymia

To our knowledge, only three twin studies of alexithymia have been conducted. The results from Heiberg and Heiberg's (1977) study suggested that alexithymia is genetically influenced, however, their sample was limited to 33 twin pairs (15 MZ; 18 DZ), and the 8-item questionnaire that they used was not as robust as more recent measures of the construct such as the TAS (Bagby et al., 1994a).

Using the TAS, Valera and Berenbaum (2001) conducted a small (77 twin pairs in total; 45 MZ and 32 DZ pairs) adult twin study to examine the influence of genetic and environmental factors on the three facets of alexithymia. Results demonstrated that EOT is strongly influenced by genetic factors, but that DIF and DDF are influenced by shared environmental factors. This finding is anomalous in the field of behavior genetics — personality traits are more commonly influenced by a combination of genetic and non-shared environmental factors, with shared environmental factors rarely contributing to a large amount of the variance — and may in part be attributed to the small sample size.

Jorgensen et al. (2007) conducted the only large-scale twin study of alexithymia, which included 8,785 pairs of twins. Contrary to the previous two studies, results suggested that all three facets of alexithymia are strongly influenced by genetic and non-shared environmental factors, with shared environmental factors contributing only a small amount of variance. While these findings are consistent with other behavior genetic (BG) studies of individual differences in personality traits (Bouchard & McGue, 2003), they have yet to be replicated on other samples.

The Present Study

Few studies have directly examined relationships between alexithymia and trait EI; univariate BG studies of alexithymia have yielded inconsistent results; and no previous studies have looked at relationships between alexithymia and trait EI at the genetic and environmental levels. Given these points, the purposes of the present study are: (1) To contribute to the literature on the behavioral genetics of alexithymia and (2) to investigate the genetic and phenotypic relationships between alexithymia and trait EI.

Method

Participants

Participants consisted of 261 same-sex adult twin pairs, including 216 monozygotic (MZ) twin pairs (154 female pairs, 62 male pairs), and 45 dizygotic (DZ) twin pairs (24 female pairs, 21 male pairs) residing in North America. Their ages ranged from 18–72 years ($M = 31.6$, $SD = 8.4$). These twins completed the Toronto Alexithymia Scale — 20. A sub-sample of 118 MZ (65 female pairs, 53 male pairs) and 27 DZ pairs (18 female, 9 male) had previously completed the Trait Emotional Intelligence Questionnaire. Zygosity was determined using the Nichols and Bilbro (1966) zygosity questionnaire.

Measures

The Toronto Alexithymia Scale-20 (TAS-20) is a 20-item self-report questionnaire based on a 5-point Likert scale (*1 = Strongly disagree; 5 = Strongly agree*). In addition to the overall alexithymia score, the scale yields scores on three facets of alexithymia: difficulty in identifying feelings (DIF, seven items), difficulty describing feelings (DDF, five items), and externally oriented thinking (EOT, eight items). Example items for these subscales are: 'I have trouble identifying physical feelings' (DIF), 'I have trouble

TABLE 1

Phenotypic Correlations Between the TAS-20 and the TEIQue

TEIQue	TAS-20			
	DIF	DDF	EOT	Global Score
Facet				
Adaptability	-.29	-.19	-.14	-.26
Assertiveness	-.29	-.38	-.33	-.41
Emotion expression	-.30	-.53	-.37	-.48
Emotion management	-.14	-.26	-.31	-.28
Emotion perception	-.39	-.44	-.39	-.50
Emotion regulation	-.34	-.14	-.06	-.24
Impulsiveness (low)	-.40	-.25	-.27	-.39
Relationships	-.38	-.36	-.26	-.42
Self-esteem	-.31	-.31	-.32	-.39
Self-motivation	-.27	-.28	-.28	-.34
Social awareness	-.30	-.46	-.35	-.45
Stress management	-.36	-.16	-.11	-.28
Trait empathy	-.29	-.34	-.43	-.44
Trait happiness	-.34	-.20	-.12	-.29
Trait optimism	-.37	-.21	-.16	-.32
Factor				
Emotionality	-.41	-.52	-.43	-.56
Self-control	-.44	-.22	-.17	-.37
Sociability	-.30	-.44	-.40	-.46
Wellbeing	-.39	-.27	-.22	-.37
Global score				
Trait EI	-.49	-.44	-.40	-.56

Note : TEIQue = Trait Emotional Intelligence Questionnaire; EI = emotional intelligence; all correlations > .16 are significant at or beyond the .01 level.

TABLE 2

Twin Correlations and Model-Fitting Results for the TAS-20

	Correlations (r)		Parameter estimates (95% CI)	
TAS-20	MZ	DZ	a^2	e^2
Factor				
DIF	.32	.15	.33 (.20, .44)	.67 (.56, .80)
DDF	.35	.09	.35 (.23, .47)	.65 (.53, .77)
EOT	.48	.41	.50 (.39, .59)	.50 (.41, .61)
Global score				
Alexithymia	.37	.18	.39 (.26, .50)	.61 (.50, .74)

Note: TAS-20 = Toronto Alexithymia Scale; MZ = monozygotic; DZ = dizygotic; DIF = difficulty identifying feelings; DDF = difficulty describing feelings; EOT = externally oriented thinking. a^2 = additive genetic effects; e^2 = non-shared environmental effects; 95% CI = 95% confidence interval. All effects are significant at or beyond the .05 level.

communicating how I am feeling' (DDF), and 'I prefer not to analyze situations' (EOT). The TAS-20 has demonstrated good psychometric properties (Bagby et al., 1994a; Bagby et al., 1994b).

The Trait Emotional Intelligence Questionnaire (TEIQue; Petrides, 2009) is a self-report questionnaire consisting of 153 items based on a 7-point Likert scale (*1 = Completely disagree; 7 = Completely agree*). In addition to an overall global EI score, the scale also yields scores on four factors and 15 facets (see Table 1 for factors and facets). A BG investigation of the TEIQue can be found in Vernon, Petrides, Bratko, and Schemer (2008; see also Vernon et al., 2008).

Procedure

Four years previous to the present study, twins in the Western Ontario Twin Project Registry had completed the TEIQue and several other questionnaires. For the present research, these twins were contacted again by telephone or by e-mail and were invited to complete additional questionnaires. If both twins agreed to participate, they were sent a package of questionnaires including a letter of information and consent form, the TAS-20, and several other questionnaires not relevant to the present study. Participants were instructed to complete the questionnaires separately from their twin. Those who returned the questionnaires were mailed a debriefing letter along with $20 in compensation, and their names were entered into a draw to win one of ten $100 prizes. Another sample of twins completed just the TAS-20 and other questionnaires not pertinent to the present study.

Results

Phenotypic correlations between the TAS-20 and TEIQue variables are reported in Table 1. As expected, significant ($p < .05$ or beyond) negative correlations were found between all TAS-20 and TEIQue variables, with the two exceptions of EOT and emotion regulation and EOT and stress management. The zero-order correlations between alexithymia and the TEIQue factors averaged $r = .39$.

Univariate BG model-fitting analyses were conducted using the software package Mx (Neale et al., 1999). As shown in Table 2, MZ correlations for alexithymia are larger than DZ correlations for the global score and the three facets, indicating that genetic influences are present. Model-fitting results, also shown in Table 2, reveal that individual differences in all aspects of alexithymia can best be accounted for by additive genetic (a^2) and non-shared environmental (e^2) factors, with heritabilities ranging from 33% to 50%.

Bivariate BG analyses were also performed using Mx, to determine the extent to which the phenotypic correlations we observed between alexithymia and the trait EI global and factor scores (reported in Table 1) were themselves attributable to correlated genetic and/or correlated environmental factors. The results of these analyses are summarized in Table 3.

As can be seen, all phenotypic correlations can be attributed to correlated genetic and correlated non-shared environmental factors. With only one exception (EOT and self-control), genetic correlations were substantially larger than environmental correlations. Several of the genetic correlations were very large (i.e., $> .70$), with seven exceeding $> .90$. Genetic correlations between global trait EI and the three alexithymia facets were particularly strong (average genetic $r = |.84|$).

Discussion

The present study aimed to contribute to the BG research on alexithymia and to conduct a pilot study investigating its genetic and phenotypic correlations with trait EI.

As expected, individual differences in all dimensions of alexithymia were attributable to genetic and non-shared environmental influences. These results are consistent with behavioral genetic research of other personality traits (Bouchard & McGue, 2003). Jorgensen et al.'s (2007) large BG study of alexithymia also reported similar results. Although there are some reasons why it might be plausible for shared environmental factors to contribute to individual differences in alexithymia — for example, as noted by Valera and Berenbaum (2001), childhood family factors

TABLE 3

Genetic and Environmental Correlations between the TAS-20 and TEIQue in Study 2

TEIQue	TAS-20			
	DIF	DDF	EOT	Global score
Emotionality	rg = -.73 (-.42, -1.00) re = -.19 (-.01, -.36)	rg = -1.00 (-.83, -1.00) re = -.17 (-.01, -.33)	rg = -.63 (-.40, -.83) re = -.16 (.02, -.33)	rg = -.94 (-.74, -1.00) re = -.21 (-.04, -.38)
Self-control	rg = -.90 (-.59, -1.00) re = -.21 (-.04, -.38)	rg = -.36 (-.08, .07) re = -.16(-.32, .02)	rg = -.08 (-.36, .23) re = -.21 (-.04, -.37)	rg = -.54 (-.22, -.82) re = -.25(-.08, -.41)
Sociability	rg = -.67 (-.31, -1.00) re = -.11 (-.07, -.28)	rg = -1.00 (-.72, -1.00) re = -.16 (-.21, .15)	rg = -.51 (-.24, -.73) re = -.30 (-.13, -.45)	rg = -.83 (-.56, -1.00) re = -.22 (-..04, -.38)
Well-being	rg = -.86 (-.54, -1.00) re = -.12 (-.06, -.29)	rg = -.68 (-.30, -1.00) re = -.03 (-.21, .15)	rg = -.27 (-.54, .03) re = -.13 (-..30, .04)	rg = -.72(-.43, -1.00) re = -.12 (-..29, .06)
Global score	rg = -.96 (-.68, -1.00) re = -.20 (-.04, -.37)	rg = -.97 (-.68, -1.00) re = -.17 (-.01, -.34)	rg = -.48 (-.22, -.70) re = -.29 (-..09, -.42)	rg = -.93 (-.72, -1.00) re = -.27 (-.10, -.43)

Note: rg = genetic correlation; re = non-shared environmental correlation; numbers in brackets represent the 95% confidence interval values. All correlations whose confidence intervals do not include zero are significant at the .05 level.

(e.g., sense of warmth or hostility, perceived level of openness) may contribute to the development of alexithymic characteristics — neither the present study nor Jorgensen et al. (2007) reported a sizeable influence of the shared environment.

These findings suggest that it may be fruitful to try to identify biological factors that contribute to the development of alexithymia. Indeed, a review of neurobiological studies of alexithymia suggests that it is influenced by a variety of such factors, including dysfunction of the corpus callosum, the frontal lobe and prefrontal cortex, and the right hemisphere, which is involved in emotional regulation and facial expression identification (Larsen et al., 2003). Relatedly, it has been proposed that a depletion of dopamine in the prefrontal cortex may also be associated with alexithymia (Ham et al., 2005).

With only two exceptions — involving EOT, emotion regulation, and stress management – all of the correlations between alexithymia and the trait EI variables were statistically significant. Nevertheless, EOT was correlated with several trait EI facets and factors at comparable or even higher levels than with DIF or DDF.

Participants in our pilot study completed the measures of alexithymia and trait EI four years apart, which means that the observed correlations should be interpreted as lower-bound estimates. Despite our small sample of twins, in light of the strong phenotypic correlations and the large genetic overlap between alexithymia and trait EI that we observed, we can interpret the findings as supportive of the position that trait EI provides comprehensive coverage of the affective aspects of personality (Petrides et al., 2010). Other researchers have also noticed that several apparently distinct emotion-related constructs seem to be underpinned by broader dimensions (e.g., core self-evaluations; Judge & Bono, 2001), but trait EI is still broader and more basic than those constructs.

Our BG bivariate analyses revealed that the phenotypic correlations between alexithymia and trait EI are attributable primarily to correlated genetic factors, and secondarily to correlated non-shared environmental factors. Many of the genetic correlations we reported were large, suggesting that neurobiological studies of alexithymia and trait EI may identify underlying biological factors common to both. We acknowledge that our pilot study needs to be replicated but we consider the significant results that we obtained despite our small sample to be encouraging.

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