Phenotypic and Genetic Associations Between the Big Five and Trait Emotional Intelligence

Philip A. Vernon,[1] Vanessa C. Villani,[1] Julie Aitken Schermer,[2] and K. V. Petrides[3]

[1] *Department of Psychology, University of Western Ontario, Canada*
[2] *Management and Organizational Studies, University of Western Ontario, Canada*
[3] *Department of Psychology, University College London, United Kingdom*

This study reports the first behavioral genetic investigation of the extent to which genetic and/or environmental factors contribute to the relationship between the Big Five personality factors and trait emotional intelligence. 213 pairs of adult monozygotic twins and 103 pairs of same-sex dizygotic twins completed the NEO-PI-R and the Trait Emotional Intelligence Questionnaire (TEIQue). Replicating previous non-twin studies, many significant phenotypic correlations were found between the Big Five factors — especially Neuroticism, Extraversion, and Conscientiousness — and the facets, factors, and global scores derived from the TEIQue. Bivariate behavioral genetic model-fitting analyses revealed that these phenotypic correlations were primarily attributable to correlated genetic factors and secondarily to correlated non-shared environmental factors. The results support the feasibility of incorporating EI as a trait within existing personality taxonomies.

Keywords: Trait emotional intelligence, Big Five, heritability and genetic correlations, NEO PI-R, TEIQue.

The construct of trait emotional intelligence (trait EI or trait emotional self-efficacy) comprises a constellation of emotion-related self-perceptions and dispositions (Petrides et al., 2007c). One aim of trait EI theory is to integrate the various EI models into mainstream differential psychology by emphasizing that the variables they encompass concern permutations of established personality traits, which are not amenable to genuine maximum-performance measurement.

Maximum performance measurement is sine qua non for the assessment of genuine intelligence (Jensen, 1998). However, such measurement is not achieved by current tests of ability EI, which rely on questionable scoring procedures, such as 'consensus' and 'expert' scoring. These procedures yield scores that are not only foreign to cognitive ability, but also psychologically questionable, as it is unclear whether they reflect confounding with vocabulary size (Wilhelm, 2005), or conformity to social norms (Matthews et al., 2006), or theoretical knowledge about emotions (Brody, 2004), or stereotypical judgments (O'Sullivan, 2007), or some unknown combination, or interaction, of some, or all, of these factors.

The trait emotional intelligence framework provides an operationalization of emotion-related self-perceptions that can be integrated into the mainstream taxonomies of personality (Petrides et al., 2007c). It also posits that it is these taxonomies, rather than the taxonomy of cognitive abilities (Carroll, 1993), that can provide a scientifically viable context for the ever-growing number of specious 'intelligences' (interpersonal, intrapersonal, emotional, social, and so on). In the section below we provide a brief overview of recent findings on trait EI.

Criterion and Incremental Validity of Trait EI

Reliable relationships have been established with many criteria: happiness (Chamorro-Premuzic et al., 2007), goal orientation (Spence et al., 2004), including affective decision-making (Sevdalis et al., 2007), occupational stress (Mikolajczak et al., 2007b), social network size (Austin et al., 2005), peer-popularity (Mavroveli et al., 2007) managerial level (Van der Zee & Wabeke, 2004), and emotion regulation (Mikolajczak et al., in press).

The incremental validity of trait EI vis-à-vis the Giant Three, the Big Five, and other personality variables has been demonstrated in many independent studies with dozens of criteria (e.g., Kluemper, 2008; Mikolajczak et al., 2006; Mikolajczak et al., 2007c; Petrides et al., 2004; Saklofske et al., 2003; Van der Zee & Wabeke, 2004). Overall, it seems that trait EI can predict significant amounts of variance in the presence of multiple personality dimensions, something that many other constructs do not achieve (Petrides et al., 2007b).

Received 14 March, 2008; accepted 7 April, 2008.

Address for correspondence: Philip A. Vernon, Department of Psychology, University of Western Ontario, London, Ontario, N6A 5C2, Canada. E-mail: vernon@uwo.ca

Relationships With the Big Five

Particular attention has been paid to correlations between trait EI and the Big Five, a well-established trait taxonomy positing that five basic dimensions (Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness) are necessary and sufficient to summarize individual differences in adult personality (McCrae & Costa, 1999). In general, a comprehensive trait EI inventory, such as the TEIQue, would show about 70% variance overlap with comprehensive Big Five inventories (50% with Giant Three inventories). This level of overlap provides the basis for reconceptualizing emotional 'intelligence' as a personality trait, thus connecting it to mainstream models of differential psychology (Petrides et al., 2007c; see also De Raad, 2005).

Hitherto, most studies have focused exclusively on the relationships between the Big Five and global trait EI. Two reasons for this are the wide discrepancies in the sampling domains of EI questionnaires and their erratic factor structures. The TEIQue instruments were designed to address such limitations. The full form, in particular, provides complete, one-to-one coverage of the construct's sampling domain and has a clear and stable four-factor structure. A major advantage of the TEIQue instruments is that, unlike other self-report measures of EI, they have been developed systematically (Matthews et al., 2007; Petrides et al., 2007a).

In combination with its open access provision (all forms, versions, and translations of the TEIQue are available, free of charge, for research purposes), the conceptual and psychometric advantages of the TEIQue mean that it can provide the basis for standardizing data and for delivering a reference framework for the integration of existing and future studies in the field. It is both meaningful and desirable, then, to examine at both the facet and factor levels the correlations between the TEIQue, as the dedicated operationalization vehicle of trait EI, and each of the Big Five personality dimensions. The two paragraphs that follow present a synthesis of findings from Petrides et al. (2007a, 2007b) and of unpublished datasets from the TEIQue data archives.

It has been empirically corroborated in many studies that Neuroticism and Extraversion are the strongest personality determinants of trait EI. This is in line with trait EI theory, which views the construct as encompassing the emotion-related aspects of personality, many of which have been conceptualized as constituent facets of the basic dimensions of Neuroticism and Extraversion (Watson, 2000). As would be expected, both Neuroticism and Extraversion correlate with most trait EI facets, including Assertiveness, Relationships, Self-Esteem, Self-Motivation, Social Awareness, Trait Happiness, and Trait Optimism. They also correlate with Emotionality, Sociability, and Wellbeing at the factor level and, as mentioned, with global trait EI. In addition, Neuroticism alone has been found to correlate with the facets of Emotion Regulation, low Impulsiveness, and Stress Management and the factor of Self-Control, while Extraversion alone correlates with the facets of Emotion Perception, Emotion Expression, Emotion Management, and Trait Empathy.

The other three of the Big Five show fewer and weaker correlations with trait EI variables. Thus, Agreeableness correlates with Assertiveness, Relationships, and Trait Empathy at the facet level and with Emotionality and Self-Control at the factor level. It also correlates, moderately, with global trait EI. Conscientiousness correlates with Emotion Perception, Emotion Regulation, low Impulsiveness, Self-Esteem, Self-Motivation, and Stress Management at the facet level, and with Self-Control and Well-Being at the factor level. It also correlates with global trait EI. Last, Openness-to-Experience correlates with Adaptability, Emotion Perception, Emotion Expression, Emotion Management, and Trait Empathy at the facet level, and with Emotionality and Sociability at the factor level. It too correlates moderately with global trait EI.

Behavioral Genetics of Trait EI

Behavioral genetic studies allow a determination of the extent to which individual differences in personality or other traits are attributable to genetic and/or environmental factors. Individual differences in virtually every personality trait that has been investigated have been found to be primarily attributable to a combination of genetic and non-shared environmental factors (see Johnson et al., 2008, for a recent review and meta-analysis).

Vernon et al. (in press) hypothesized that trait EI would show similar levels of genetic and environmental influences as other personality traits and conducted a family as well as a twin study to examine the heritability of the construct. The results indicated that about 40% of the variability in global trait EI scores was due to genetic factors and 60% was due to non-shared environmental factors. This is consistent with previous studies of other major personality constructs and raises the question as to whether the observed relationships between trait EI and the Big Five factors reviewed above are themselves due to a combination of correlated genetic and/or correlated environmental factors. An empirical answer to this question would constitute a crucial step forward in the effort to determine the location of trait EI in personality factor space.

The current study is especially detailed, seeking, as it does, to assess the genetic and environmental correlations of trait EI and the Big Five, both at the facet as well as at the factor level. We expected to find similar phenotypic relationships between trait EI and the Big Five as were determined in previous studies, viz., strong correlations with Neuroticism and Extraversion, and moderate correlations with Agreeableness, Conscientiousness, and Openness. Based on trait EI theory and previous research with other personality traits, we hypothesized that these phenotypic correlations will themselves be largely influenced by common genetic and common non-shared environmental factors.

Method

Participants

The sample consisted of a total of 632 adult twins residing in Canada and the United States. They comprised 213 pairs of identical or monozygotic (MZ) twins (174 female pairs and 39 male pairs) and 103 pairs of same-sex fraternal or dizygotic (DZ) twins (95 female pairs and 8 male pairs). Participants ranged between 18 and 82 years of age (M = 38.4, SD = 15.23).

Measures

Trait Emotional Intelligence Questionnaire (TEIQue v. 1.50). The TEIQue consists of 153 items, yielding scores on 15 facets, 4 factors, and global trait EI. It is predicated on trait EI theory and covers the sampling domain of trait EI comprehensively (Petrides, 2001; Petrides & Furnham, 2003). A detailed psychometric analysis of the inventory is presented in Mikolajczak et al. (2007a). Participants responded on a 7-point Likert scale, ranging from 'completely disagree' to 'completely agree'. The internal consistencies of the TEIQue variables ranged from .65 (Relationships) to .91 (global trait EI) and were statistically equivalent among the MZ and DZ twins.

NEO PI-R (Costa & McCrae, 1992). This is a widely used inventory for assessing normal adult personality on the dimensions of the Five Factor Model. It consists of 240 items, measuring six facets for each of the five basic personality dimensions. The NEO PI-R variables and factors have well-established excellent psychometric properties.

Zygosity Questionnaire (Nichols & Bilbro, 1966). This instrument comprises questions about the physical similarity of twins (e.g., in terms of height, eye color, and general appearance) and the frequency with which they are mistaken for one another by other family members and friends. It has been shown to be at least 93% as accurate as red blood cell polymorphism analyses for determining zygosity (Kasriel & Eaves, 1976).

Procedure

Participants responded to advertisements placed in newspapers in a number of large cities in Canada and the United States. At the time of their first contact, participants were provided with information about the nature of the study and what their participation would entail. If they agreed to take part, they were mailed the TEIQue, the NEO-PI-R, the zygosity questionnaire and were asked to complete these on their own and then return them in a stamped self-addressed envelope. Upon receipt of their completed questionnaires, each subject was sent $25 to compensate them for their time and their names were entered into a draw for one of ten $100 prizes.

Data Analytic Strategy

In most cases, both twins in a pair completed and returned their questionnaires. If only one twin returned their completed questionnaires, their co-twin was sent a reminder, but if this co-twin still did not return their questionnaires, then data from the pair were discarded. Most twins completed all items on both questionnaires, but in those cases where a few items were left unanswered, they were replaced with the mean.

MZ and DZ variance-covariance matrices were computed from these scores and entered into the analyses using unweighted least squares. Given the wide age range of the sample and the uneven numbers of males and females, all data were corrected for age and sex using McGue and Bouchard's (1984) regression approach prior to the main statistical analysis.

In univariate behavioral genetic model-fitting, what is referred to as a 'full model' provides estimates of the extent to which additive genetic (A), shared environmental (C), and nonshared environmental (E) factors contribute to individual differences. This full model always provides the best fit to the data, but reduced models can also be fit to see whether any of the A, C, or E factors can be dropped without a significant worsening of fit. Thus, an AE model tests whether shared environmental factors can be dropped and a CE model tests whether a purely environmental model can account for the data without a significant worsening of fit. It is also possible to fit an E only model, if only to confirm that it results in a significantly poorer fit, as is typically the case; note that an E only model could only result if there were no correlation between either MZ or DZ twins.

In bivariate or multivariate behavioral genetic model-fitting, similar ACE and reduced models can be fit which make use of MZ and DZ cross-correlations: i.e., the correlations between one twin's score on one variable and their co-twin's score on another variable. If MZ cross-correlations are greater than DZ cross-correlations this indicates that common genetic factors contribute to the covariance of the two variables and genetic as well as shared and nonshared environmental correlations can be estimated. In our analyses, we first fit full bivariate ACE models to the data and subsequently tested reduced models.

Results

We first examined MZ and DZ twin correlations and conducted univariate model-fitting on the Big Five factors, to confirm that our samples of twins would yield results comparable to those of previous behavioral genetic studies. For each of the Big Five, MZ twin correlations ranged from .46 to .65 and were approximately twice as large as DZ twin correlations. Univariate model-fitting replicated previous studies in showing that individual differences in the Big Five factors were attributable to additive genetic and nonshared environmental factors, with heritabilites ranging from .47 (Conscientiousness) to .68 (Openness). Univariate model-fitting results of the TEIQue variables and factors are reported in Vernon et al. (2008). In brief, they showed that MZ correlations were larger

than DZ correlations for all TEIQue variables (i.e., facets, factors, and global trait EI score) and that all were best fit by an AE model with heritabilities ranging from .35 (Emotionality) to .49 (Sociability).

Shown in Table 1 are the phenotypic correlations (rp) between the 20 TEIQue variables (15 facets, 4 factors, and global score) and each of the Big Five factors. Also reported in this table are the genetic (rg) and nonshared environmental (re) correlations derived from the bivariate model-fitting analyses.

As expected, at the phenotypic level we found many significant correlations between the TEIQue variables and the Big Five factors. Neuroticism correlated negatively with all TEIQue variables with the exception of the Emotion Management facet, with which it was uncorrelated. Extraversion correlated positively with all TEIQue variables with the exceptions of the Emotion Regulation and low Impulsiveness facets, with which it was uncorrelated.

Openness correlated positively with all TEIQue variables with the exceptions of the facets of Emotion Regulation, low Impulsiveness, and Stress Management, and the factor of Self-Control, with which it was uncorrelated. Agreeableness correlated positively with all TEIQue variables with the exception of the Emotion Management and Assertiveness facets, and the Sociability factor, with which it correlated negatively. In addition, it was uncorrelated with the facets of Self-Esteem and Social Awareness. Finally, Conscientiousness correlated positively with all TEIQue variables.

Some significant correlations were quite low (e.g., .08 between Conscientiousness and Emotion Management), but others were high (e.g., –.74 between Neuroticism and Self-Control and .61 between Conscientiousness and low Impulsiveness). Of the 100 phenotypic correlations shown in Table 1, 89 were significant at the .01 level and two were significant at the .05 level. In total, 52 correlations had absolute values greater than |.30|.

The results of the bivariate[1] behavioral genetic model-fitting analyses revealed that all observed phenotypic correlations can be entirely accounted for by correlated genetic and correlated nonshared environmental factors. Significant genetic correlations between the TEIQue variables and the Big Five factors ranged from |.22| (Conscientiousness and Assertiveness) to |.94| (Neuroticism and Self-Control). Significant nonshared environmental correlations ranged from |.13| (Agreeableness and Adaptability, and Conscientiousness and Emotion Management) to |.52| (Neuroticism and Stress Management). As can be determined from their 95% confidence intervals, 83 of 100 genetic correlations and 86 of 100 nonshared environmental correlations were significant at the .05 level.

Neuroticism and Extraversion had, respectively, eight and six genetic correlations with TEIQue variables at or exceeding |.60|. In contrast, Conscientiousness had only two genetic correlations exceeding |.60|, whereas Openness and Agreeableness had one each. Most genetic correlations between these three dimensions and the TEIQue were moderately strong (ranging between |.30| and |.60|).

Nonshared environmental correlations between the Big Five and the TEIQue were generally smaller than the corresponding genetic correlations. Thus, none of the non-shared environmental correlations in Table 1 exceeded .60 (the largest, between Neuroticism and Stress Management, was |.52|) and, in total, fewer than one third (32 of 100) fell in the moderate range between |.30| and |.60|. It is noteworthy that shared environmental factors did not contribute significantly to any phenotypic correlation.

Discussion

The central aim of this study was to decompose the phenotypic covariances between trait EI and the Big Five into their genetic and environmental components. Strong correlations between the constructs were observed, thus providing further support to the theoretical position that they belong within the same hierarchy (Petrides et al., 2007c). These correlations, the present findings reveal, are not random, arbitrary, or coincidental, but are largely genetically based and, thus, at odds with all self-report models that view emotional 'intelligence' as anything other than a personality trait.

Consistent with trait EI theory and the empirical literature, Neuroticism and Extraversion were the strongest correlates of trait EI, although Openness, Agreeableness, and Conscientiousness also showed numerous significant associations. Clearly, there is considerable overlap between the Big Five and trait EI, with certain phenotypic correlations (e.g., –.74 between Neuroticism and Self-Control) indicating cases where over 50% of the variance in a trait EI variable can be accounted for by another personality dimension. The fact that the overlap is only partial is due to the specificity and depth of the conceptualization of trait EI, which covers emotion-related aspects of personality in far greater detail than general Big Five models. That same fact also accounts for the incremental validity of the construct in relevant studies (Petrides et al., 2007b).

Our results demonstrate conclusively that the phenotypic associations between the Big Five and trait EI are primarily attributable to correlated genetic factors and, secondarily, to correlated nonshared environmental factors. The shared environment does not contribute at all to the phenotypic correlations. In other words, many of the genes that contribute to individual differences in the Big Five also contribute, moderately-to-substantially, to individual differences in the TEIQue facets and factors, with the greatest genetic overlap appearing with Neuroticism and Extraversion, as predicted by trait EI theory.

As with other specious intelligences (social, personal, and so on), the concept of emotional

Table 1

Phenotypic, Genetic, and Nonshared Environmental Correlations Between Trait Emotional Intelligence and the Big Five

	Neuroticism	Extraversion	Openness to Experience	Agreeableness	Conscientiousness
Trait EI facets					
Self-esteem	rp = –.48**	rp = .43**	rp = .31**	rp = .03	rp = .33**
	rg = –.60 (–.46 to –.73)	rg = .52 (.34 to .67)	rg = .46 (.30 to .60)	rg = –.01 (–.22 to .21)	rg = .43 (.23 to .60)
	re = –.38 (–.26 to –.48)	re = .36 (.25 to .47)	re = .17 (.04 to .30)	re = .06 (–.06 to .19)	re = .24 (.11 to .36)
Emotion expression	rp = –.19**	rp = .40**	rp = .32**	rp = .23**	rp = .23**
	rg = –.19 (.01 to –.37)	rg = .55 (.37 to .72)	rg = .41 (.25 to .56)	rg = .30 (.09 to .50)	rg = .26 (.05 to .45)
	re = –.20 (–.08 to –.32)	re = .28 (.16 to .39)	re = .26 (.13 to .38)	re = .18 (.06 to .30)	re = .20 (.07 to .32)
Self-motivation	rp = –.38**	rp = .28**	rp = .14**	rp = .28**	rp = .53**
	rg = –.50 (–.34 to –.64)	rg = .40 (.21 to .57)	rg = .13 (–.04 to .29)	rg = .43 (.24 to .60)	rg = .65 (.50 to .77)
	re = –.25 (–.12 to –.37)	re = .18 (.05 to .30)	re = .19 (.06 to .31)	re = .16 (.04 to .28)	re = .41 (.29 to .51)
Emotion regulation	rp = –.61**	rp = .02	rp = –.04	rp = .26**	rp = .28**
	rg = –.87 (–.77 to –.96)	rg = .01 (–.20 to .20)	rg = –.14 (–.32 to .03)	rg = .34 (.14 to .52)	rg = .24 (.04 to .41)
	re = –.34 (–.22 to –.44)	re = .03 (–.10 to .16)	re = .10 (–.03 to .23)	re = .18 (.06 to .30)	re = .31 (.19 to .42)
Happiness	rp = –.50**	rp = .44**	rp = .19**	rp = .30**	rp = .28**
	rg = –.61 (–.45 to –.74)	rg = .50 (.32 to .66)	rg = .18 (–.01 to .35)	rg = .27 (.06 to .46)	rg = .33 (.12 to .52)
	re = –.41 (–.30 to –.51)	re = .39 (.27 to .49)	re = .24 (.11 to .36)	re = .33 (.21 to .44)	re = .23 (.10 to .35)
Empathy	rp = –.20**	rp = .26**	rp = .39**	rp = .36**	rp = .27**
	rg = –.31 (–.08 to –.53)	rg = .54 (.30 to .79)	rg = .67 (.49 to .87)	rg = .57 (.34 to .81)	rg = .34 (.09 to .57)
	re = –.14 (–.01 to –.26)	re = .11 (–.02 to .23)	re = .24 (.12 to .36)	re = .26 (.14 to .37)	re = .24 (.11 to .35)
Social awareness	rp = –.37**	rp = .58**	rp = .28**	rp = .07	rp = .30**
	rg = –.44 (–.28 to –.58)	rg = .72 (.60 to .83)	rg = .34 (.19 to .48)	rg = .02 (–.19 to .21)	rg = .31 (.12 to .48)
	re = –.31 (–.18 to –.42)	re = .44 (.32 to .53)	re = .23 (.10 to .35)	re = .12 (–.01 to .25)	re = .29 (.16 to .41)
Low impulsiveness	rp = –.47**	rp = .01	rp = –.01	rp = .31**	rp = .61**
	rg = –.70 (–.56 to –.83)	rg = .01 (–.21 to .22)	rg = –.06 (–.24 to .12)	rg = .53 (.34 to .71)	rg = .78 (.65 to .88)
	re = –.26 (–.14 to –.38)	re = .01 (–.12 to .13)	re = .07 (–.06 to .20)	re = .14 (.01 to .26)	re = .46 (.35 to .56)
Emotion perception	rp = –.16**	rp = .35**	rp = .33**	rp = .20**	rp = .30**
	rg = –.28 (–.03 to –.52)	rg = .55 (.31 to .78)	rg = .43 (.22 to .63)	rg = .16 (–.09 to .46)	rg = .34 (.07 to .57)
	re = –.10 (.03 to –.22)	re = .26 (.14 to .38)	re = .32 (.20 to .43)	re = .21 (.08 to .32)	re = .30 (.18 to .42)
Stress management	rp = –.69**	rp = .19**	rp = .05	rp = .29**	rp = .31**
	rg = –.87 (–.79 to –.95)	rg = .26 (.05 to .46)	rg = –.02 (–.20 to .16)	rg = .26 (.05 to .45)	rg = .29 (.08 to .47)
	re = –.52 (–.42 to –.61)	re = .16 (.03 to .28)	re = .15 (.02 to .28)	re = .31 (.19 to .42)	re = .33 (.20 to .44)
Emotion management	rp = –.07	rp = .41**	rp = .30**	rp = –.22**	rp = .08*
	rg = –.13 (.06 to –.32)	rg = .70 (.54 to .86)	rg = .44 (.27 to .59)	rg = –.41 (–.21 to –.61)	rg = .05 (–.16 to .26)
	re = –.04 (.09 to –.16)	re = .18 (.05 to .30)	re = .16 (.03 to .28)	re = –.06 (–.18 to .07)	re = .13 (.01 to .26)
Optimism	rp = –.57**	rp = .40**	rp = .16**	rp = .35**	rp = .28**
	rg = –.78 (–.65 to –.90)	rg = .43 (.23 to .60)	rg = .10 (–.10 to .27)	rg = .51 (.31 to .69)	rg = .34 (.13 to .54)
	re = –.41 (–.30 to –.51)	re = .39 (.28 to .50)	re = .26 (.13 to .37)	re = .25 (.12 to .36)	re = .24 (.11 to .36)
Relationships	rp = –.37**	rp = .32**	rp = .19**	rp = .49**	rp = .30**
	rg = –.45 (–.24 to –.63)	rg = .44 (.21 to .64)	rg = .36 (.17 to .56)	rg = .62 (.43 to .78)	rg = .32 (.09 to .53)
	re = –.33 (–.21 to –.44)	re = .25 (.13 to .37)	re = .07 (–.06 to .20)	re = .42 (.31 to .52)	re = .28 (.15 to .39)
Adaptability	rp = –.48**	rp = .29**	rp = .26**	rp = .25**	rp = .17**
	rg = –.76 (–.62 to –.90)	rg = .48 (.29 to .67)	rg = .34 (.17 to .50)	rg = .42 (.21 to .61)	rg = .19 (–.02 to .40)
	re = –.24 (–.11 to –.36)	re = .15 (.03 to .27)	re = .22 (.09 to .34)	re = .13 (.01 to .25)	re = .16 (.03 to .28)
Assertiveness	rp = –.29**	rp = .44**	rp = .20**	rp = –.20**	rp = .23**
	rg = –.33 (–.14 to –.50)	rg = .64 (.44 to .80)	rg = .31 (.13 to .48)	rg = –.26 (–.04 to –.47)	rg = .22 (.01 to .42)
	re = –.27 (–.14 to –.38)	re = .29 (.17 to .40)	re = .10 (–.03 to .23)	re = –.14 (–.02 to –.27)	re = .23 (.10 to .35)
Trait EI Factors					
Wellbeing	rp = –.60**	rp = .49**	rp = .25**	rp = .28**	rp = .34**
	rg = –.78 (–.66 to –.89)	rg = .57 (.39 to .71)	rg = .28 (.10 to .44)	rg = .32 (.10 to .51)	rg = .43 (.23 to .61)
	re = –.46 (–.35 to –.56)	re = .44 (.33 to .54)	re = .26 (.13 to .38)	re = .26 (.13 to .37)	re = .27 (.15 to .39)
Self-control	rp = –.74**	rp = .09*	rp = .01	rp = .35**	rp = .48**
	rg = –.94 (–.87 to –1.00)	rg = .10 (–.08 to .26)	rg = –.09 (–.26 to .08)	rg = .44 (.25 to .60)	rg = .50 (.34 to .64)
	re = –.48 (–.37 to –.57)	re = .10 (–.03 to .23)	re = .14 (.01 to .26)	re = .26 (.14 to .38)	re = .46 (.35 to .56)
Emotionality	rp = –.18**	rp = .31**	rp = .29**	rp = .27**	rp = .22**
	rg = –.33 (–.13 to –.51)	rg = .61 (.42 to .77)	rg = .53 (.36 to .67)	rg = .46 (.25 to .64)	rg = .35 (.13 to .53)
	re = –.24 (–.11 to –.35)	re = .29 (.17 to .40)	re = .30 (.17 to .41)	re = .32 (.21 to .43)	re = .32 (.20 to .43)
Sociability	rp = –.30**	rp = .57**	rp = .31**	rp = –.14**	rp = .25**
	rg = –.35 (–.18 to –.50)	rg = .78 (.66 to .89)	rg = .41 (.26 to .55)	rg = –.23 (–.03 to –.42)	rg = .23 (.03 to .40)
	re = –.26 (–.14 to –.38)	re = .38 (.26 to .48)	re = .20 (.07 to .32)	re = –.05 (–.18 to .08)	re = .28 (.15 to .39)
Global trait EI	rp = –.61**	rp = .51**	rp = .32**	rp = .32**	rp = .47**
	rg = –.80 (–.69 to –.90)	rg = .69 (.53 to .82)	rg = .39 (.22 to .54)	rg = .38 (.18 to .56)	rg = .52 (.34 to .68)
	re = –.44 (–.34 to –.54)	re = .37 (.26 to .48)	re = .30 (.17 to .41)	re = .27 (.15 to .38)	re = .42 (.31 to .52)

Note: rp = phenotypic (observed) correlation; rg = genetic correlation; re = environmental correlation; numbers in brackets represent the 95% confidence interval values; *p <.05; **p < .01 (two–tailed)

'intelligence' has obvious operationalization shortcomings. Tests claiming that EI is a cognitive ability are problematic because they rely on methods ('consensus', 'expert', and 'target' scoring) that yield scores that cannot be interpreted in a straightforward manner (Brody, 2004; Freudenthaler & Neubauer, 2007; O'Sullivan & Ekman, 2005; Petrides et al., 2007a). For this reason, the overwhelming majority of the proliferating EI tests use self-report methodologies, whose psychometric properties are well understood. However, as has frequently been pointed out (e.g. Petrides & Furnham, 2003; Petrides et al., 2007c), self-report questionnaires cannot be valid indicators of intelligence, competence, or skills. This simple, yet overlooked, fact poses a threat to the validity of most current EI models and questionnaires.

In confirming that the relationships between the Big Five and trait EI are not only strong and replicable but, more important, are genetically influenced, our results constitute a step forward in the literature. One reason that they are so important is that they reveal how unlikely it is that questionnaires of EI measure some previously unknown construct outside the structural maps of psychology (usually an alleged intelligence or competency or skill). Rather, the findings of this study confirm that it is both possible and necessary to connect the construct to mainstream models of differential psychology by integrating it into the extant taxonomies of personality.

Endnote

1 We also attempted to run multivariate models incorporating all of the TEIque and Big Five variables. With few exceptions these yielded models with very poor fits, perhaps due to many of the variables demonstrating strong epistasis.

References

Austin, E. J., Saklofske, D. H., & Egan, V. (2005). Personality, well-being and health correlates of trait emotional intelligence. *Personality and Individual Differences, 38,* 547–558.

Brody, N. (2004). What cognitive intelligence is and what emotional intelligence is not. *Psychological Inquiry, 15,* 234–238.

Carroll, J. B. (1993). *Human cognitive abilities: A survey of factor-analytic studies*. New York: Cambridge.

Chamorro-Premuzic, T., Bennett, E., & Furnham, A. (2007). The happy personality: Mediational role of trait emotional intelligence. *Personality and Individual Differences, 42,* 1633–1639.

Costa, P. T., Jr. & McCrae, R. R. (1992). *The revised NEO Personality Inventory (NEO PI-R) and NEO Five-Factor Inventory (NEO-FFI) professional manual*. Odessa, FL: Psychological Assessment Resources.

De Raad, B. (2005). The trait-coverage of emotional intelligence. *Personality and Individual Differences, 38,* 673–687.

Freudenthaler, H. H., & Neubauer, A. C. (2007). Measuring emotional management abilities: Further evidence of the importance to distinguish between typical and maximum performance. *Personality and Individual Differences, 42,* 1561–1572.

Jensen, A. R. (1998). *The g factor*. Westport, Connecticut: Praeger.

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.), *Handbook of personality theory and assessment* (Vol. 1). Thousand Oaks, California: Sage Publishers, pp. 145–173.

Kasriel, J. & Eaves, L. (1976). The zygosity of twins: Further evidence on the agreement between diagnosis by blood groups and written questionnaire. *Journal of Biosocial Science, 8,* 263–266.

Kluemper, D. (2008). Trait emotional intelligence: The impact of core-self evaluations and social desirability. *Personality and Individual Differences, 44,* 1402–1412.

Matthews, G., Emo, A., Roberts, R. D., & Zeidner, M. (2006). What is this thing called emotional intelligence? In K. R. Murphy (Ed.), *A critique of emotional intelligence: What are the problems and how can they be fixed?* (pp. 3–36). Mahwah, NJ: Erlbaum.

Matthews, G., Zeidner, M., & Roberts, R. D. (2007). Emotional intelligence: Knowns and unknowns. In G. Matthews, M. Zeidner, & R. D. Roberts (Eds.), *The science of emotional intelligence* (pp. 419–474). New York: Oxford.

Mavroveli, S., Petrides, K. V., Rieffe, C., & Bakker, F. (2007). Trait emotional intelligence, psychological well-being and peer-rated social competence in adolescence. *British Journal of Developmental Psychology, 25,* 263–275.

McCrae, R. R. & Costa, P. T., Jr. (1999). A five-factor theory of personality. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality: Theory and research* (2nd ed., pp. 139–153). New York: Guildford Press.

McGue, M., & Bouchard, T. J. (1984). Adjustment of twin data for the effects of age and sex. *Behavior Genetics, 14,* 325–343.

Mikolajczak, M., Luminet, O., Leroy, C., & Roy, E. (2007a). Psychometric properties of the Trait Emotional Intelligence Questionnaire: Factor structure, reliability, construct, and incremental validity in a French-speaking population. *Journal of Personality Assessment, 88,* 338–353.

Mikolajczak, M., Luminet, O., & Menil, C. (2006). Predicting resistance to stress: Incremental validity of trait emotional intelligence over alexithymia and optimism. *Psicothema, 18,* 79–88.

Mikolajczak, M., Menil, C., & Luminet, O. (2007b). Explaining the protective effect of trait emotional intelligence regarding occupational stress: Exploration of emotional labour processes. *Journal of Research in Personality, 41,* 1107–1117.

Mikolajczak, M., Nelis, D., Hansenne, M., & Quoidbach, J. (in press). If you can regulate sadness, you can probably regulate shame: Associations between trait emotional intelligence, emotion regulation and coping efficiency across discrete emotions. *Personality and Individual Differences*.

Mikolajczak, M., Roy, E., Luminet, O., Fillée, C. & de Timary, P. (2007c). The moderating impact of emotional intelligence on the free cortisol responses to stress. *Psychoneuroendocrinology, 32,* 1000–1012.

Nichols, R. C. & Bilbro, W. C., Jr. (1966). The diagnosis of twin zygosity. *Acta Geneticae Medicae et Gemellologiae (Roma), 16,* 265–266.

O'Sullivan, M. (2007). Trolling for trout, trawling for tuna: The methodological morass in measuring emotional intelligence. In G. Matthews, M. Zeidner, & R. D. Roberts (Eds.). *The science of emotional intelligence* (pp. 258–287). New York: Oxford.

O'Sullivan, M., & Ekman, P. (2005). *Facial expression recognition and emotional intelligence*. In G. Geher, (Ed.), Measuring emotional intelligence: Common ground and controversy. Hauppauge, New York: Nova Science Publishing.

Petrides, K. V. (2001). *A psychometric investigation into the construct of emotional intelligence.* Doctoral dissertation. University College, London.

Petrides, K. V., Frederickson, N., & Furnham, A. (2004). The role of trait emotional intelligence in academic performance and deviant behavior at school. *Personality and Individual Differences, 36,* 277–293.

Petrides, K. V., & Furnham, A. (2003). Trait emotional intelligence: Behavioral validation in two studies of emotion recognition and reactivity to mood induction. *European Journal of Personality, 17,* 39–57.

Petrides, K. V., Furnham, A. & Mavroveli, S. (2007a). Trait emotional intelligence: Moving forward in the field of EI. In G. Matthews, M. Zeidner, & R. Roberts, R. (Eds.), *Emotional intelligence: Knowns and unknowns (Series in Affective Science)*.Oxford: Oxford University Press.

Petrides, K. V., Pérez-González, J. C., & Furnham, A. (2007b). On the criterion and incremental validity of trait emotional intelligence. *Cognition and Emotion, 21,* 26–55.

Petrides, K. V., Pita, R., & Kokkinaki, F. (2007c). The location of trait emotional intelligence in personality factor space. *British Journal of Psychology, 98,* 273–289.

Saklofske, D. H., Austin, E. J., & Minski, P. S. (2003). Factor structure and validity of a trait emotional intelligence measure. *Personality and Individual Differences, 34,* 707–721.

Sevdalis, N., Petrides, K. V., & Harvey, N. (2007). Predicting and experiencing decision-related emotions: Does trait emotional intelligence matter? *Personality and Individual Differences, 42,* 1347–1358.

Spence, G., Oades, L. G., & Caputi, P. (2004). Trait emotional intelligence and goal self-integration: important predictors of emotional well-being? *Personality and Individual Differences, 37,* 449–461.

Van der Zee, K. & Wabeke, R. (2004). Is trait-emotional intelligence simply or more than just a trait? *European Journal of Personality, 18,* 243–263.

Vernon, P. A., Petrides, K. V., Bratko, D., & Schermer, J. A. (in press). A behavioral genetic study of trait emotional intelligence. *Emotion.*

Watson, D. (2000). *Mood and temperament*. New York: Guilford.

Wilhelm, O. (2005). Measures of emotional intelligence: Practice and standards. In R. Schulze & R. D. Roberts (Eds.), *International handbook of emotional intelligence* (pp. 131–154). Seattle, Washington: Hogrefe & Huber.