Phenotypic and Genetic Relations Between the HEXACO Dimensions and Trait Emotional Intelligence

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The present study investigated the location of trait emotional intelligence (trait EI or trait emotional self-efficacy) within the context of the HEXACO model — a more comprehensive personality framework than the conventional Big Five structure. A total of 666 MZ and 526 DZ adult twin pairs from the United Kingdom completed the short form of the Trait Emotional Intelligence Questionnaire (TEIQue-SF) and the short form of the HEXACO Personality Inventory (HEXACO-60). Many significant phenotypic correlations between the TEIQue-SF and the HEXACO-60 were obtained, which were strongest for HEXACO Extraversion, and weakest for HEXACO Honesty–Humility. As was expected, Emotionality was the only HEXACO dimension to correlate negatively with TEIQue-SF scores. Bivariate behavioral genetic analyses revealed that all phenotypic correlations were attributable to common genetic and common nonshared environmental factors. The study confirms the validity of trait EI as a constellation of emotional self-perceptions located at the lower levels of personality.

Keywords: Trait Emotional Intelligence, HEXACO Model of Personality, General Factor of Personality, behavioral genetics

Trait emotional intelligence (trait EI) is a personality construct defined as a collection of emotional dispositions and self-perceptions that are typically measured via self-report (Petrides et al., 2007). Recently, Veselka et al., (2009) extracted a single general factor of personality (GFP) from the six dimensions of the HEXACO model of personality (Honesty–Humility, Emotionality, Extraversion, Agreeableness, Conscientiousness, Openness to Experience) and the four factors of trait emotional intelligence (well-being, self-control, emotionality, sociability). They noted moderate to high loadings on the GFP by all variables with the exception of HEXACO's Honesty–Humility

factor, which yielded more modest loadings. The presence of this common factor suggests that significant correlations should exist between the HEXACO dimensions and the trait EI factors, although no research hitherto has investigated this. The first aim of the present study is to extend the research of Veselka et al. (2009), by determining the extent to which the HEXACO dimensions and trait EI factors are correlated. By using samples of twins, a second aim of our study is to assess the extent to which any phenotypic correlations are attributable to common genetic and/or common environmental factors.

Personality Correlates of Trait Emotional Intelligence

Although no existing literature has investigated correlations between trait EI and the HEXACO model, studies have looked at associations between trait EI and the Big Five factors. These studies are relevant to the present report because five of the HEXACO factors are conceptually similar to those of the Big Five model. It is only the Honesty–Humility factor, representing traits such as sincerity and fairness, which does not have a Big-Five analogue (Lee & Ashton, 2004).

In an early investigation, Saklofske et al. (2003) noted significant correlations between overall trait EI and each of the Big Five. Extraversion showed the highest association with trait EI ($r = .51$), while Neuroticism was the only dimension to correlate negatively with global trait EI. Elaborating on these findings, Vernon et al. (2008b) assessed the relations between the Big Five dimensions and trait EI, as measured by the Trait Emotional Intelligence Questionnaire (Petrides, 2009), which provides comprehensive coverage of the sampling domain of the construct. The only

correlation that did not reach significance in their study was that between Openness to Experience and Self-Control. All trait EI factors were negatively associated with Neuroticism, and positively associated with the other four of the Big Five. Freudenthaler et al. (2008) replicated these findings using a German-speaking sample, although they reported fewer significant correlations than did Vernon et al. (2008b), possibly due to their smaller sample size. Further replication of these findings was obtained in two Dutch samples analyzed in Petrides, Vernon, Schermer, Ligthart, Boomsma, and Veselka (under review).

The HEXACO dimension of Honesty-Humility has not yet been assessed in relation to trait EI. However, research exists which may shed light on potential correlations between these two constructs. In particular, there is evidence of an association between wellbeing and low materialistic greed (e.g., Kashdan & Breen, 2007), between self-control and fairness (e.g., Mead et al., 2009), between emotionality and modesty (e.g., Watson & Morris, 1991), and between sociability and low honesty (e.g., Lee & Ashton, 2004) — results that indirectly link the trait EI factors to aspects of HEXACO's Honesty–Humility domain. In addition, the Honesty–Humility dimension loads on the same GFP as do the four trait EI factors (Veselka et al., 2009), which is further evidence of the link between the constructs.

Behavioral Genetic Investigations of Trait Emotional Intelligence

A univariate behavioral genetic analysis of trait EI was carried out by Vernon et al.(2008a). Using both a family and a twin design, the authors concluded that individual differences in trait EI at the facet, factor, and global levels are mainly attributable to additive genetic and unique environmental factors. These findings are in accordance with investigations of other major personality domains, and were taken as further evidence in support of conceptualizing trait EI as a personality construct. At the bivariate level, Vernon et al. (2008b) investigated the extent to which phenotypic correlations between trait EI and the Big Five can be accounted for by correlated genetic and/or correlated environmental factors. They concluded that genetic and nonshared environmental effects explain their phenotypic correlations with the Big Five domains. These findings suggest that the Big Five factors and trait EI share some of the same underlying genetic and environmental determinants.

To date, behavioral genetic studies of trait EI have not included personality models other than the Big Five. It remains unknown if the HEXACO dimensions and the trait EI factors share a common underlying etiology, although the work of Vernon et al. (2008b) does suggest the existence of common genetic and environmental determinants, given that the Big Five factors are similar to five of the six HEXACO dimensions. In addition, after extracting a GFP from the trait EI factors and the HEXACO dimensions, Veselka et al. (2009) noted that individual differences in it were attributable to genetic and nonshared environmental effects. However, given that no direct bivariate behavioral genetic studies of the HEXACO model and trait EI exist, their likely common etiology has yet to be verified.

Present Study

The purpose of the present study was to examine the interrelationships between the HEXACO model and trait EI at both the phenotypic and the genetic level. Based on prior research, negative correlations were expected between the four trait EI factors and the HEXACO dimension of Emotionality, while positive associations were expected between the other variables. More specific predictions based on previous findings with the Big Five were hindered by the fact that the Emotionality and Agreeableness dimensions in HEXACO are not equivalent to Neuroticism and Agreeableness in the Big Five model (Lee & Ashton, 2006; p. 183). Indeed, the zero-order correlations between Emotionality and Neuroticism can be as low as .40 (Ashton & Lee, 2009). Correlations between Honesty–Humility and trait EI were expected to be small, based on Veselka et al.'s (2009) finding that the Honesty–Humility dimension had the lowest loading on the GFP extracted from a combined HEXACO and TEIQue-SF dataset.

With regard to the bivariate behavioral genetic analyses, correlated genetic and correlated non-shared environmental factors were expected to account for any phenotypic correlations observed in the present study. This prediction applies especially to the HEXACO dimensions corresponding to the Big Five (see also Vernon et al., 2008b). Although the Honesty–Humility dimension has not yet been assessed with reference to trait EI in a behavioral genetic context, correlations between it and the four trait EI factors are also expected to be accounted for by correlated genetic and nonshared environmental factors, in line with results involving other higher-order personality dimensions (e.g., Vernon et al., 2008b).

Method

Participants

A total of 1,192 twin pairs took part in the present study: 666 monozygotic (MZ) twin pairs (606 female pairs, 61 male pairs) and 526 same-sex dizygotic (DZ) twin pairs (485 female pairs, 41 male pairs). They were between 19 and 86 years of age (M = 60.15, SD = 12.08), and were part of a continuing research programme carried out by the Department of Twin Research and Genetic Epidemiology (DTR) at King's College London in England. This department sends out yearly questionnaires to approximately 9,000 twin pairs. The zygosity of these twin pairs is determined via genome scans (100% accuracy), DNA tests (99.5% accuracy), or by twins' responses to items on the Peas in the Pod zygosity questionnaire (95% accuracy). Participants do not receive compensation for their participation.

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Materials

Trait Emotional Intelligence Questionnaire-Short Form (TEIQue-SF; Petrides, 2009; Sevdalis et al., 2007). This is a 30-item questionnaire designed to measure global trait EI. A priori factor scores can also be derived by applying the scoring key of the full form, although these tend to have lower reliabilities. The TEIQue-SF does not yield scores on the 15 trait EI facets, but in addition to measuring global trait EI it also yields scores on four other factors: Wellbeing, Self-control, Emotionality, and Sociability. For a detailed investigation of the TEIQue-SF via Item Response Theory, see Cooper and Petrides (under review).

HEXACO-60. Individual differences in the six personality dimensions comprising the HEXACO model were assessed via the 60-item HEXACO Personality Inventory (Ashton & Lee, 2009). Ten items assessed each of the higher-order dimensions. This measure required participants to respond to self-reflective items using a 5-point Likert scale where 1 = *Strongly disagree* and 5 = *Strongly agree*.

Procedure

In November 2008, about 9,000 individual twins received a package of questionnaires via standard mail, which contained the HEXACO-60 in addition to several other questionnaires that are not relevant to the present study. About 56% of the twins originally contacted returned their completed packages. Of them, 3012 pairs (837 MZ pairs, 669 DZ pairs) were complete same-sex twin pairs. Two years prior to this mail-out, the distributed questionnaire package included the TEIQue-SF. A total of 666 MZ twin pairs and 526 DZ twin pairs completed this measure as well as the HEXACO-60. Twins completed the questionnaires in their own time at their homes, and returned them to the DTR.

Analysis

Most of the twin pairs completed all items on the TEIQue-SF and the HEXACO-60. However, rare instances (< 1%) did occur in which an item was left blank. We replaced these missing data with the mean of the Likert scale used. Prior to analysis, all obtained data were corrected for sex and age using the regression approach proposed by McGue and Bouchard (1984).

We carried out the bivariate behavioral genetic analyses using the Mx software package (Neale et al., 2006). These analyses compute MZ and DZ cross-correlations, (the correlations between one twin's score on one variable and their co-twin's score on another variable), and then apply the method of Cholesky or triangular decomposition (Neale & Cardon, 1992). In our analyses, we first fit full bivariate ACE models to our data to estimate correlated genetic (A), shared environmental (C), and nonshared environmental (E) effects. We then tested reduced AE and CE models. Best-fitting models were those with the lowest chi-square change value relative to the chi-square of the full model, and the lowest AIC value. For each of the reported correlations in Table 2, an AE model yielded the best fit, leading to estimates of genetic (r_g) and non-shared environmental (r_e) correlations.

Results

Internal consistency coefficient alphas for the HEXACO and trait EI scales are shown in Table 1. These range between .66 to .77 for HEXACO and between .66 to .89 for trait EI. These reliabilities, and the fact that the questionnaires were completed two years apart, should be kept in mind when considering the correlations that we report next.

Phenotypic correlations (r_p) between HEXACO and trait EI are shown in Table 2. Of 30 correlations, 27 were significant at the .01 level. Significant positive correlations were noted between the HEXACO dimensions of Extraversion, Conscientiousness, and Openness and all of the TEIQue-SF variables, while significant negative correlations were found between HEXACO Emotionality and all TEIQue-SF variables with the exception of the latter's own Emotionality factor to which it was orthogonal. HEXACO's Honesty–Humility and Agreeableness showed significant negative correlations with all TEIQue-SF variables with the exception of Sociability. Overall, the strongest correlations were obtained with Extraversion (ranging from .38 to .59) and the weakest correlations were obtained with Honesty–Humility (ranging from .01 to .13), with the remaining HEXACO dimensions in between.

Results from the bivariate model-fitting are also reported in Table 2. As can be seen, all of the phenotypic correlations between HEXACO and the TEIQue-SF were entirely explained by common genetic (r_g) and common nonshared environmental effects (r_e). Significant genetic correlations were found between HEXACO's Emotionality, Extraversion, Conscientiousness, and Openness and all TEIQue-SF

Table 1

Internal Consistency (Coefficient Alpha) Values for the HEXACO and Trait EI Variables

HEXACO dimensions	Alpha
Honesty–humility	.66
Emotionality	.73
Extraversion	.77
Agreeableness	.74
Conscientiousness	.72
Openness	.75
Trait EI factors	**Alpha**
Wellbeing	.77
Self-control	.67
Emotionality	.66
Sociability	.70
Global trait EI	.89

Table 2

Phenotypic (rp), Genetic (rg) and Environmental (re) Correlations with Confidence Interval Values between the HEXACO Dimensions and the Factors Measured by the Trait Emotional Intelligence Questionnaire-Short Form

HEXACO Factors	TEIQue-SF Factors				
	Wellbeing	Self-control	Emotionality	Sociability	Global trait EI
Honesty–humility	rp = .08*	rp = .12*	rp = .13*	rp = .01	rp = .12*
	rg = .11 (–.03 to .25)	rg = .10 (–.05 to .23)	rg = .30 (.16 to .45)	rg = .01 (–.14 to .15)	rg = .18 (.04 to .30)
	re = .05 (–.02 to .12)	re = .11 (.04 to .18)	re = .04 (–.03 to .11)	re = .01 (–.07 to .07)	re = .08 (.01 to .14)
Emotionality	rp = –.22*	rp = -.40*	rp = .01	rp = –.27*	rp = –.28*
	rg = –.33 (–.21 to –.43)	rg = –.52 (–.42 to –.61)	rg = .11 (–.02 to .30)	rg = –.42 (–.31 to –.52)	rg = –.34 (–.23 to –.44)
	re = –.12 (–.05 to –.18)	re = –.30 (–.24 to –.36)	re = –.06 (–.13 to .01)	re = –.15 (–.08 to –.21)	re = –.21 (–.14 to –.28)
Extraversion	rp = .53*	rp = .38*	rp = .39*	rp = .52*	rp = .59*
	rg = .79 (.71 to .86)	rg = .70 (.60 to .80)	rg = .59 (.48 to .69)	rg = .82 (.74 to .90)	rg = .88 (.82 to .95)
	re = .35 (.29 to .41)	re = .15 (.08 to .21)	re = .26 (.19 to .32)	re = .31 (.25 to .37)	re = .36 (.30 to .42)
Agreeableness	rp = .20*	rp = .26*	rp = .21*	rp = –.01	rp = .22*
	rg = .37 (.24 to .49)	rg = .41 (.29 to .53)	rg = .22 (.08 to .35)	rg = –.06 (–.20 to .07)	rg = .29 (.17 to .41)
	re = .07 (.01 to .14)	re = .15 (.08 to .21)	re = .19 (.12 to .26)	re = .01 (–.07 to .07)	re = .14 (.08 to .21)
Conscientiousness	rp = .18*	rp = .21*	rp = .22*	rp = .26*	rp = .30*
	rg = .33 (.20 to .46)	rg = .32 (.18 to .44)	rg = .46 (.33 to .60)	rg = .48 (.36 to .61)	rg = .51 (.39 to .62)
	re = .09 (.02 to .16)	re = .14 (.07 to .20)	re = .08 (.01 to .15)	re = .12 (.05 to .18)	re = .16 (.09 to .23)
Openness	rp = .14*	rp = .11*	rp = .23*	rp = .19*	rp = .22*
	rg = .15 (.05 to .24)	rg = .12 (.02 to .22)	rg = .34 (.24 to .44)	rg = .27 (.17 to .37)	rg = .26 (.17 to .35)
	re = .11 (.04 to .18)	re = .08 (.01 to .16)	re = .12 (.05 to .20)	re = .11 (.04 to .18)	re = .15 (.07 to .22)

Note: *$p < .01$; numbers appearing in brackets represent the 95% confidence interval values. All genetic and environmental correlations whose confidence intervals do not include zero are significant at the .05 level.

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

variables, with the exception of the latter's Emotionality factor, as well as between Agreeableness and all TEIQue-SF variables except Sociability. Additional significant genetic effects were observed between Honesty–Humility and the Emotionality and global trait EI scores of the TEIQue-SF. These correlations ranged from |.12| (Openness and Self-Control) and |.88| (Extraversion and global trait EI).

Nonshared environmental correlations were generally much smaller than their genetic counterparts, although all but five were statistically significant. These correlations ranged from |.07| (Agreeableness and Wellbeing) to |.36| (Extraversion and global trait EI).

Discussion

The present study contributes to the literature investigating the location of trait EI within various personality hierarchies and extends recent research on the General Factor of Personality (Rushton et al., 2009; Vaselka et al., 2009). Specifically, phenotypic correlations between the HEXACO model and trait EI were explored, and the correlated genetic and/or environmental factors underlying these associations were assessed. Through these analyses, our study successfully situated trait EI within the broader HEXACO structure, while clarifying the etiology underlying the relations between their respective factors. These results add further support to the notion that broad personality dimensions and trait EI factors exist within the same hierarchy (Petrides et al., 2007). This is only the second study to have considered the etiology of the

extensive overlap between trait EI and the higher-order personality dimensions (see also Vernon et al., 2008).

In line with our hypotheses, results yielded numerous significant phenotypic correlations between the HEXACO and trait EI variables. These correlations may be underestimates, given that the two measures were administered two years apart. In accordance with past literature assessing the Big Five's Neuroticism in conjunction with trait EI (e.g., Vernon et al., 2008b), HEXACO's analogous dimension of Emotionality showed significant negative correlations with all trait EI variables with the exception of the TEIQue-SF's own Emotionality factor. The generally low value of these correlations and the lack of association with the Emotionality factor of the TEIQue-SF, confirms that the HEXACO dimension is only loosely related to traditional Neuroticism (see also Lee & Ashton, 2006). In particular, the exclusion of anger and the inclusion of sentimentality in HEXACO Emotionality serve to attenuate correlations with trait EI. Overall, these findings echo the results in Veselka et al. (2009), who found that the HEXACO dimension of Emotionality was the only factor to load negatively on a GFP extracted from a joint HEXACO-60 and TEIQue-SF dataset.

As far as the other four of the Big Five are concerned, results were in line with our hypotheses and the existing literature. Thus, Extraversion exhibited high phenotypic correlations with all trait EI variables, which accords well with Veselka et al. (2009), who

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showed that this HEXACO dimension had the highest loading on their dataset's GFP.

The remaining HEXACO dimensions with Big Five analogues correlated moderately and positively with trait EI, suggesting that individuals with higher trait EI scores are generally more agreeable, conscientious, and open than those with lower scores (see also Petrides & Furnham, 2001; Rushton et al., 2009).

The HEXACO dimension of Honesty–Humility, which does not have a Big-Five analogue, showed lower correlations with the TEIQue-SF than other HEXACO dimensions, which confirmed our predictions based on the work of Veselka et al. (2009), who reported that the Honesty–Humility dimension had the lowest loading on their GFP. To begin to understand the reasons behind these smaller phenotypic correlations, it is informative to consider the traits that define the Honesty–Humility dimension. These traits — sincerity, fairness, greed avoidance, and modesty — possess positive and negative poles that create a dichotomy between those who endorse and/or engage in dishonest and manipulative behaviors and those who do not (Lee & Ashton, 2004). How this variable should correlate with trait EI is unclear for two interesting reasons. First, from the HEXACO perspective, the sixth dimension appears to be an amalgamation of two rather different psychological constructs. It is as straightforward to imagine individuals who are honest, but hubristic, as it is to imagine others who are dishonest, but humble. This creates an ambiguity in the interpretation of correlations between this HEXACO dimension and criteria. The second reason has to do with trait EI and concerns the fact that individuals with high scores have a proclivity toward hubris and positive self-presentation, which they may or may not admit to when faced with transparent questionnaire items, such as those in HEXACO Honesty–Humility.

With regards to our behavioral genetic analyses, all of the phenotypic correlations that we obtained were attributable to correlated genetic and correlated nonshared environmental factors, as predicted. These findings indicate that not only are the HEXACO and trait EI factors related, but that these relations stem from common underlying etiological effects. These findings echo those of Veselka et al. (2009), who noted that individual differences on a GFP extracted from the HEXACO-60 and TEIQue-SF were accounted for by genetic and nonshared environmental factors. In addition, the present study also adds to the existing personality literature by demonstrating that the HEXACO dimensions behave similarly to the more established higher-order dimensions of the NEO model (e.g., Vernon et al., 2008b).

The present study has elaborated on research initially carried out by Veselka et al. (2009) by clarifying the relations between the HEXACO model of personality and trait EI. In doing so, we situated trait EI within a more comprehensive personality framework than the conventional Big Five model. We also explored the etiology of their phenotypic correlations, showing that these arise from a combination of genetic and unique environmental effects, without any influence from the shared environment.

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