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Genetic Underpinnings of Callous-Unemotional Traits and Emotion Recognition in Children, Adolescents, and Emerging Adults

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Abstract

Background.—Callous-Unemotional (CU) and psychopathic traits are consistently associated with impaired recognition of others' emotions, specifically fear and sadness. However, no studies have examined whether the association between CU traits and emotion recognition deficits are due primarily to genetic or environmental factors.

Methods.—The current study used data from 607 Caucasian twin pairs ($N = 1,214$ twins) to examine the phenotypic and genetic relationship between the Inventory of Callous-Unemotional Traits (ICU) and facial emotion recognition assessed via the laboratory-based Facial Expression Labeling Task (FELT).

Results.—The uncaring/callous dimension of the ICU was significantly associated with impaired recognition of happiness, sadness, fear, surprise, and disgust. The unemotional ICU dimension was significantly associated with improved recognition of surprise and disgust. Total ICU score was significantly associated with impaired recognition of sadness. Significant genetic correlations were found for uncaring/callous traits and distress cue recognition (i.e., fear and sadness). The observed relationship between uncaring/callous traits and deficits in distress cue recognition was accounted for entirely by shared genetic influences.

Conclusions.—The results of the current study replicate previous findings demonstrating impaired emotion recognition among youth with elevated CU traits. We extend these findings by replicating them in an epidemiological sample not selected or enriched for pathological levels of

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CU traits. Furthermore, the current study is the first to investigate the genetic and environmental etiology of CU traits and emotion recognition, and results suggest genetic influences underlie the specific relationship between uncaring/callous traits and distress cue (fear/sadness) recognition in others.

Keywords

Callous unemotional traits; Psychopathy; Genetics; Twins; Emotion recognition

The ability to understand someone else's emotional state via his or her facial expression is an important part of social communication (Andrew, 1963). Specific emotions are associated with characteristic facial expressions across many human cultures and non-human primates (Andrew, 1963; Darwin 1872/1965; Izard, 1994). Observing emotion laden facial expressions elicits specific patterns of neural activity in regions such as the amygdala and insula (e.g., Adolphs, 2002; Fusar-Poli et al., 2009). An impaired ability to recognize emotions has been implicated in several psychiatric disorders, including impaired fear and sadness recognition in individuals with callous-unemotional (CU) and/or psychopathic traits (for a review see Marsh & Blair, 2008).

CU traits are a set of characteristics that reflect reduced emotionality including reduced empathy for others, remorse, emotional expression, and concern about one's own performance (Frick, Ray, Thornton, & Kahn, 2014). These emotional traits are a part of the larger construct of psychopathic traits, which also include specific interpersonal (e.g., egocentrism, manipulation) and antisocial (e.g., impulsivity, aggression) behaviors (Hare & Neumann, 2005; Salekin, 2017). CU traits significantly predict disruptive behavior (Fowles & Dindo, 2009; Frick & Morris, 2004) and are associated with specific neurobiology (Blair, 2013). Recent work has indicated a considerable genetic contribution to CU traits (Viding & McCrory, 2012). However, no research to date has examined whether the correlation between CU traits and emotion recognition is due to underlying genetic or environmental factors.

Emotion recognition impairments can be either general or emotion specific. For example, individuals showing high neuroticism show a general emotion recognition deficit (Rappaport et al., in press). In contrast, individuals with elevated depression symptoms demonstrate impaired recognition of happiness (e.g., Rappaport et al., under review) and are most likely to identify (or misattribute) the emotion of sadness (e.g., Dalili, Penton-Voak, Harmer, & Munafò, 2015; Mandal & Bhattacharya, 1985). Individuals with elevated CU and/or psychopathic traits show some indications for general expression recognition impairment but this impairment is particularly marked for distress cues (i.e., expressions of fear and sadness; Dawel, O'Kearney, McKone, & Palermo, 2012; Marsh & Blair, 2008; Wilson, Juodis, & Porter, 2011).

CU traits show moderate to large heritability (40–78%) depending on the assessment method used (for a review see Viding & McCrory, 2012). When assessed via the Inventory of Callous Unemotional Traits (ICU; Frick, 2004) heritability estimates range between 39–46% (Mann, Briley, Tucker-Drob, & Harden, 2015; Moore et al., 2017). Only two studies to date have examined the heritability of emotion recognition. In the first study of facial emotion

recognition in children (N = 250 pairs of 10 year-old twins) a single genetic factor explained 17–20% of the variance in the recognition of five emotions (happiness, sadness, fear, disgust, and anger). The remaining variance was due to unique environmental factors that were common to all emotions as well as emotion-specific (Lau et al., 2009). In the largest study of facial emotion recognition etiology our group found higher heritability estimates (34–57%) than did Lau et al. (2009) for the recognition of Ekman's six universal emotions (happiness, sadness, fear, disgust, anger, and surprise; Ekman & Friesen, 1976); our study included a sample of over 600 twin pairs aged 9–20 years old (Rappaport et al., in press). Most genetic variance was due to a genetic factor common to all emotions, though additional genetic components were responsible for happiness, fear, surprise, and disgust.

Clarifying genetic contributions to CU traits is complicated by measurement issues. The ICU is comprised of three subscales including callousness, which reflects a lack of empathy (e.g., “shows no remorse when he/she has done something wrong”); uncaring, which reflects a lack of caring about the feelings of others/one's own performance (e.g., “apologizes to persons he/she has hurt” – inversely scored); and unemotionality, which reflects reduced emotional expression (e.g., “does not show emotions”). Moreover, the unemotional subscale may be distinct from the uncaring and callous subscales (e.g., Hawes et al., 2014; Henry, Pingault, Boivin, Rijdsdijk, & Viding, 2016; Houghton, Hunter, & Crow, 2013; Moore et al., 2017). Scores on the unemotional ICU subscale are consistently less strongly related to externalizing constructs such as antisocial behavior, delinquency, aggression, and psychopathy than scores on the uncaring or callous subscales (e.g., Kimonis et al., 2008; Kimonis, Branch, Hagman, Graham, & Miller, 2013; Waller et al. 2014). Moreover, uncaring and callousness and are often reported as highly correlated with one another (e.g., Henry et al., 2016; Moore et al., 2017) and may reflect a single dimension that only appears as distinct due to differences in the wording polarity (Hawes et al., 2014; Ray, Frick, Thornton, Steinberg, & Cauffman, 2015); the callous subscale consists primarily of positively worded items while the uncaring subscale consists entirely of negatively worded items. The only study to examine the heritability of individual ICU items reported a general factor with a moderate heritability (i.e., of 58%) and two residual genetic factors; one relating to combined uncaring/callous items (70% heritability) and the other unemotional items (79% heritability; Henry et al., 2016). In short, variance in the unemotional subscale is largely accounted for by a specific set of genetic variants that do not contribute to the etiology of uncaring or callous traits (Henry et al., 2016), further suggesting that uncaring/callous and unemotional traits are separate constructs.

As of yet, no study has yet examined the genetic overlap of CU traits with emotion recognition, representing a substantial gap in the current literature. The current study had three aims. First, to replicate previously observed correlations between CU traits and emotion recognition deficits in a large sample (N = 1,214) of child, adolescent, and emerging adult twins. Second, to examine the genetic and environmental correlations between CU traits and emotion recognition. Third, to combine the results from the previous two aims to determine the proportion of any significant phenotypic correlations that are due to the shared genetic and/or environmental etiology that is common to CU traits and emotion recognition deficits.

Methods

Participants

Participants were drawn from two epidemiological twin samples from the Mid-Atlantic region of the US. The Juvenile Anxiety Study (JAS) included non-Hispanic Caucasian twin pairs aged 9–14 ($N = 398$ twin pairs). The Adolescent and Young Adult Twin Study (AYATS) included Caucasian twin pairs aged 15–20 ($N = 334$ twin pairs). Only individuals who completed required assessments (see materials section below) were included in the current analyses. The combined analytic sample consisted of 1,214 individuals (607 twin pairs; MZ pairs = 251; DZ pairs = 356), was 54.0% female, and had a mean age of 14.1 years ($SD = 3.2$ years, range = 9.1 – 20.8 years). Participants were excluded from the studies if they were intellectually disabled, had an autism spectrum disorder diagnosis, had experienced a psychotic episode, were currently using anxiolytic or antidepressant medication, or had been diagnosed with any medical condition which might have adversely impacted participants' safety or ability to complete the study, including aspects of the study not described here (Carney et al., 2016; Cecilione et al., 2018).

Procedure

Twins were recruited by the Mid-Atlantic Twin Registry (Lilley & Silberg, 2013) and then assessed at one of two sites: The Virginia Institute for Psychiatric and Behavioral Genetics at Virginia Commonwealth University (Richmond, VA) and the National Institute for Mental Health (Bethesda, MD). Participants completed a wide range of self-report measures and laboratory tasks as part of the two larger studies on the heritability of potential endophenotypes for internalizing disorders (Carney et al., 2016; Cecilione et al., 2018). Participants under age 18 provided assent; a parent or legal guardian provided informed consent for themselves and their children. Participants 18 years of age or older provided informed consent. When parents accompanied their adult children and completed the parent portion of the study, they also provided informed consent. All procedures were approved by the Institutional Review Board of Virginia Commonwealth University.

Materials

Zygosity.—Zygosity was determined from standard questions about physical similarity between twins (Nichols and Bilbro, 1966; Peeters et al., 1998), answered by a parent or legal guardian. For a subset of twin pairs in AYATS ($N = 82$ twin pairs), zygosity was verified using an assay of single nucleotide polymorphisms, and this molecular-derived zygosity metric was highly concordant with the self-report algorithm-assigned zygosity ($\kappa = 0.95$). For a subset of JAS ($N = 42$ twin pairs), the self-report algorithm-assigned zygosity agreed highly with zygosity from placental/DNA testing reported by parents ($\kappa = 1.00$).

Inventory of Callous-Unemotional Traits (ICU).—A parent or legal guardian completed the ICU, a 24-item measure assessing traits relating the affective dimension of psychopathy including callousness, carelessness, and emotionless (Frick, 2004; Kimonis et al., 2008). Item responses are ranked on a 4-point Likert scale, from 0 (not at all true) to 3 (definitely true). The self-report ICU has demonstrated good test-retest reliability, internal consistency and convergent validity (Feilhauer, Cima, & Arntz, 2012; Kimonis et al., 2008).

Traditionally, the ICU is split into three subscales described as callous, uncaring, and unemotional. However, some studies have found a high correlation between the uncaring and callous dimensions (e.g., Henry et al., 2016; Moore et al., 2017). Importantly, the correlation between the uncaring and callous dimensions is .94 in the JAS sample (Moore et al., 2017) and .91 in the AYATS sample. Therefore, all ICU analyses in the current study were split into uncaring/callous and unemotional dimensions in addition to the total scale.

In the current analytic sample the mean for the total ICU scale was 20.4 ($SD = 9.1$). The means for the uncaring/callous and unemotional subscales were 15.3 ($SD = 7.6$) and 5.1 ($SD = 3.0$), respectively. Table 1 describes ICU item wording and subscale description.

Facial Expression Labeling Task (FELT).—FELT data was collected for a total of $N = 1,316$ participants. The FELT presents participants with images reflecting Ekman's six fundamental emotions (i.e., happiness, anger, sadness, fear, disgust, and surprise) via a computer monitor. All images were of Caucasian adults (50% female) drawn from well-validated images in the Pictures of Facial Affect Series (Ekman & Friesen, 1976). Photos displaying each target emotion were morphed with a photo of the same face displaying a neutral expression in 10 different gradients from 0% to 100% of the target emotion to produce a total of 60 unique images (6 emotions $\times$ 10 morph gradients). Participants viewed a fixation cross for 250ms before seeing each image for 500ms and indicating the depicted emotion out of the 6 possible emotion options. Each image was presented at 6 trials for a total of 360 trials, in randomized order. The task took approximately 15 minutes to complete. This task demonstrates high test-retest reliability among adult (Adams et al., 2015) and child samples (Cecilione et al., 2017).

For each participant, the unbiased hit rate (UBHR) was computed for each emotion at each morph gradient. UBHR, the product of raw accuracy (i.e., the number of trials correct divided by the total number of trials for an emotion) and differential accuracy (i.e., the number of trials correct divided by the number of times an emotion was endorsed), adjusts for the association between raw accuracy and the potential tendency to see a specific emotion. UBHR was further adjusted for guessing by subtracting $1/6$ and arcsin transformed to improve normality. Average UBHR was then computed across all morph gradients for each emotion, which demonstrated high test-retest reliability in the present sample (Cecilione et al., 2017). Participants were removed based on observations noted by research assistants who were unaware of other study data. Approximately 7.75% ($N = 102$) of the sample was removed due to poor compliance with, or difficulty attending to, the FELT, leaving an analytic sample of $N = 1,214$. Those individuals who were removed from the sample for non-compliance did not differ significantly from the analytic sample on unemotional traits. However, they did score significantly higher on uncaring/callous traits ($B = 3.08$, $p = .001$).

Detailed descriptions of the FELT as used in the current samples have been reported previously, as has the calculation procedure for the UBHR (e.g., Cecilione et al., 2017; Rappaport et al., in press).

Data Analysis

Pearson's product-moment correlations were used to evaluate associations between ICU total and subscale sum scores and UBHR for individual FELT emotions. Correlations were computed within biometrical structural equation models to adjust for statistical nonindependence of observations (familial clustering) and to estimate the genetic correlation between ICU subscale sum scores and recognition of individual FELT emotions. For variables with significant phenotypic and genetic correlations, the proportion of each phenotypic correlation attributable to shared additive genetic effects was calculated using the formula

$$\sqrt{A_1 * rG * \sqrt{A_2} / rP}$$

where A_1 = the heritability of phenotype 1, A_2 = the heritability of phenotype 2, rG = the genetic correlation of phenotypes 1 and 2, and rP = the phenotypic correlation of phenotypes 1 and 2. All analyses were computed within the R statistical environment (R Core Team, 2014) using the OpenMx package (Boker et al., 2014).

Results

Phenotypic Associations

Table 2 displays the phenotypic correlations between parent-report ICU and individual FELT emotions. The uncaring/callous subscale demonstrated small but significantly negative correlations with recognition of happiness ($r = -.06, p = .01$), sadness ($r = -.12, p = .001$), fear ($r = -.08, p = .05$), surprise ($r = -.07, p = .05$), and disgust ($r = -.10, p = .01$). Conversely, there was a small positive correlation between the unemotional subscale and recognition of surprise ($r = .07, p = .05$) and disgust ($r = .10, p = .01$). The total ICU scale demonstrated a small but significant negative correlation with the recognition of sadness ($r = -.09, p = .001$).

Based on recent research suggesting the relationship between CU and emotion recognition may be moderated by trauma history (Dadds, Kimonis, Schollar-Root, Moul, & Dawes, 2018; Meffert et al., 2018) we performed a series of post-hoc analyses testing for potential interactions between ICU dimensions and trauma history (total and interpersonal) in predicting recognition of the 6 core emotions. Two interactions were marginally significant, but did not survive correction for multiple testing. This indicates that in our sample, the relationship between emotion recognition and CU traits is not moderated by trauma history.

Genetic and Environmental Correlations

Genetic contributions to uncaring/callous traits were significantly correlated with genetic contributions to the recognition of sadness ($rA = -0.41, p = .05$), and fear ($rA = -0.33, p = .05$; see Table 3). Transformation of these genetic correlations reveals that the phenotypic correlation between uncaring/callous and sadness recognition attributable to genetic effects is $-.13$, and the phenotypic correlation between uncaring/callous and fear recognition attributable to genetic effects is $-.12$. These estimates are slightly higher than the total phenotypic correlations reported in Table 2 due to the very small positive contributions

(although statistically non-significant) to the correlations from environmental influences. Therefore, for all intents and purposes, the small phenotypic correlations between the uncaring/callous subscale and sadness/fear recognition reported above are due entirely to genetic effects.

There is no evidence of correlation between the genetic contributions to the unemotional subscale or total ICU scale and recognition of any emotion, which suggests that small phenotypic correlations (see Table 2) are not due to genetic effects. There were no significant environmental correlations of ICU total or subscales with FELT emotions.

Discussion

This study replicates previous evidence of emotion recognition deficits among individuals with elevated CU and/or psychopathic traits and extends this field by demonstrating that there are genetic influences shared between uncaring/callous traits and distress cue recognition. Using a large ($N = 1,214$) sample of child, adolescent, and emerging adult twins, we examined both the phenotypic and genetic associations between recognition of six core emotions (happiness, sadness, fear, surprise, anger, and disgust) and two dimensions of CU traits (uncaring/callous and unemotional). Uncaring/callous traits were associated with a slight decrease in recognition of happiness, sadness, fear, surprise, and disgust. Unemotional traits were associated with a slight increase in recognition of surprise and disgust. Total ICU score was associated with a slight decrease in recognition of sadness. Correlated genetic influences account for the entirety of the small association between uncaring/callous traits and impaired recognition of fear and sadness in others.

The first aim of the current study was to replicate previous evidence that individuals with CU and/or psychopathic traits display deficits in emotion recognition. In our sample, uncaring/callous traits were associated with small but significant deficits in the recognition of 5 of the 6 assessed emotions: surprise ($r = -.07$), fear ($r = -0.08$), happiness ($r = -.10$), disgust ($r = -.10$), and sadness ($r = -.12$). Similar findings of a more general deficit in emotion recognition have been reported for psychopathic individuals (Dawel et al., 2012). Our results further suggest that unemotional traits are associated with a small but significant increase in the recognition of surprise and disgust ($r = .07$ and $r = .10$, respectively). These specific results require further replication before firm conclusions can be drawn, particularly given the questionable performance of the unemotional subscale to predict associated psychopathology (e.g. Kimonis et al., 2008; Kimonis et al., 2013; Waller et al. 2014), as well as the distinction that has recently been drawn between the unemotional and uncaring/callous dimensions (e.g., Hawes et al., 2014; Henry et al. 2016; Houghton et al., 2013; Moore et al., 2017).

The second aim of the current study was to elucidate the extent to which genetic and/or environmental factors account for the observed phenotypic associations between CU traits and emotion recognition. Our results revealed an emotion-specific negative genetic correlation between the uncaring/callous subscale and recognition of fear and sadness ($r_A = -.33$ and $r_A = -.41$, respectively). This supports a specific relationship between uncaring/callous traits and impaired recognition of fear and sadness in others (e.g., Marsh & Blair,

2008). Expressions of fear and sadness serve as distress cues, and individuals less aware of these distress cues in others are theorized to therefore feel less guilt and empathy (the core features of CU traits; Blair, 1995).

The third and final aim of the current study was to determine the proportion of the phenotypic associations that are due to shared etiology common to CU traits and emotion recognition deficits. Our results suggest that the small phenotypic correlations between the uncaring/callous scale and decreased fear and sadness recognition are due entirely to shared genetic influences. These results lend credence to the unique biological underpinnings that the emotions of fear and sadness have in the emotional repertoire of callous-unemotional individuals.

Deficient recognition of others' distress may interfere with social learning and moral development, which produce some key characteristics observed in CU and/or psychopathic individuals (Blair, 1995). Theory suggests that this deficit occurs at the anatomical level by dysfunction within the amygdala and connected regions (for a review see Blair, 2013). The amygdala is critical for learning the value of representations communicated via social and non-social stimulus-reinforcement learning (Everitt, Cardinal, Parkinson, & Robins, 2003; LeDoux, 2000). Individuals with the emotional deficits associated with CU traits show reduced amygdala responses when viewing the emotions of fear and sadness in others (e.g., Jones, Laurens, Herba, Barker, & Viding, 2009; Marsh et al., 2008; Viding et al., 2012). As such, genetic associations observed in the current study may index molecular genetic mechanisms relevant to amygdala processing/activation. Thus, molecular genetic variants may be partially responsible for amygdala dysfunction, which in turn leads to decreased recognition of distress cues and increased uncaring/callous traits.

Limitations and Future Directions

Findings from the current study should be interpreted in light of several limitations. First, further work is needed to generalize the present results to other populations. That is, our sample was relatively homogenous, consisting of Caucasian twins between the ages of 9–20. Therefore, future research should examine and replicate the current findings in people of diverse ancestry and age. Although the use of a twin sample likely doesn't affect generalizability, there is a small possibility that experiences unique to being a twin may affect either CU traits or emotion recognition.

Second, our sample is likely downwardly biased in terms of uncaring/callous traits due to the removal of about 8% of the sample that complied poorly with the FELT task. These removed individuals scored significantly higher on the uncaring/callous subscale, and removal of these individuals reduced uncaring/callous variance in the current sample. Despite this limitation there were still significant findings for uncaring/callous traits, indicating the relationship between this subscale and emotion recognition may actually be stronger than reported in the current analyses.

Third, although the present sample size is large, we remain underpowered to detect all but very large effects for age and sex moderation on the genetic covariance between CU traits and emotion recognition (Verhulst, 2017). Therefore, age and sex moderation of heritability

and genetic covariance were not examined in the current study. These limitations are mitigated by the fact that sex-differences in emotion recognition, while sometimes observed in adulthood, do not appear to extend downward to childhood and adolescence (for a review see McClure, 2000). Furthermore, in Marsh & Blair's (2008) meta-analysis of psychopathic traits and emotion recognition, no significant moderation effects of sex or age were found. Although future studies should examine how age and sex influence the genetic covariance of CU traits and emotion recognition, increasingly large twin samples are needed for the necessary statistical power to broach these questions.

Lastly, although we report several significant phenotypic and genetic correlations, the effect sizes for the phenotypic correlations between CU traits and with emotion recognition were small. Although this does limit the possible clinical significance of the present findings, results should be interpreted within a larger body of research that consistently indicates deficits in emotion recognition among individuals with elevated CU and/or psychopathic traits, specifically impaired recognition of fear and sadness. Further, small effect sizes are sensible given the use of a general population sample (i.e., not selected or enriched for externalizing, behavioral, or emotional disorders). In fact, the use of a general population sample is a considerable strength; results suggest a continuous relationship between CU traits and emotion recognition even within an epidemiological sample not selected or enriched for pathological levels of CU or psychopathic traits. As such, the present results suggest subtle impaired emotion recognition at even low to moderate levels of CU traits.

Conclusion

Facial emotion recognition is an important aspect of social communication which appears to be deficient in individuals with CU or psychopathic traits. This deficit is most often observed as a decreased recognition of distress cues (i.e., fear and sadness) in others. The present study replicates previously reported impaired recognition of distress cues and indicates that uncaring/callous traits are more generally associated with a slight recognition impairment for fear, sadness, happiness, sadness, surprise, and disgust. Furthermore, impaired recognition of fear and sadness among youth elevated on uncaring/callous traits is accounted for entirely by shared genetic influences. Despite several limitations, the present study is the first to describe the genetic relationship between emotion recognition and CU traits. Moreover, these results indicate this relationship is observed in normative (i.e., epidemiological) populations, and is accounted for entirely by genetic effects.

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Key Points

- Callous-unemotional (CU) and psychopathic traits are consistently associated with impaired recognition of others' emotions, specifically distress cues (i.e., fear and sadness).
- The current study is the first to examine whether the association between CU traits and emotion recognition is due primarily to genetic or environmental effects.
- The uncaring/callous dimension of the ICU was significantly associated with impaired recognition of happiness, sadness, fear, surprise, and disgust.
- The unemotional ICU dimension was significantly associated with improved recognition of surprise and disgust.
- The observed relationship between uncaring/callous traits and deficits in distress cue recognition (i.e., fear and sadness) was accounted for entirely by shared genetic influences.

Table 1.

ICU Item Wording and Factor Structure

Item #	Item Wording	Uncaring/Callous Subscale	Unemotional Subscale
1	Expresses his/her feelings openly. *		X
2	Does not seem to know "right" from "wrong".	X	
3	Is concerned about schoolwork. *	X	
4	Does not care who he/she hurts to get what he/she wants.	X	
5	Feels bad or guilty when he/she has done something wrong. *	X	
6	Does not show emotions.		X
7	Does not care about being on time.	X	
8	Is concerned about the feelings of others. *	X	
9	Does not care if he/she is in trouble.	X	
10	Does not let feelings control him/her.	X	
11	Does not care about doing things well.	X	
12	Seems very cold and uncaring.	X	
13	Easily admits to being wrong. *	X	
14	It is easy to tell how he/she is feeling. *		X
15	Always tries his/her best. *	X	
16	Apologizes ("says he/she is sorry") to persons he/she has hurt. *	X	
17	Tries not to hurt others' feelings. *	X	
18	Shows no remorse when he/she has done something wrong.	X	
19	Is very expressive and emotional. *		X
20	Does not like to put the time into doing things well.	X	
21	The feelings of others are unimportant to him/her.	X	
22	Hides his/her feelings from others.		X
23	Works hard on everything. *	X	
24	Does things to make others feel good. *	X	

* Indicates item is reverse coded

Table 2.

Phenotypic Correlations Between ICU and FELT

	Total ICU Scale	Uncaring/Callous Subscale	Unemotional Subscale
Emotion	<i>r</i> (95% CIs)	<i>r</i> (95% CIs)	<i>r</i> (95% CIs)
Anger	−0.04 (−0.11, 0.02)	−0.06 (−0.13, 0.00) [^]	0.04 (−0.03, 0.10)
Happiness	−0.06 (−0.13, 0.01) [^]	−0.10 (−0.16, −0.03) [*]	0.05 (−0.01, 0.12)
Sadness	−0.09 (−0.16, −0.03) ^{**}	−0.12 (−0.19, −0.05) ^{**}	0.02 (−0.05, 0.09)
Fear	−0.05 (−0.11, 0.02)	−0.08 (−0.14, −0.01) ⁺	0.05 (−0.02, 0.12)
Surprise	−.03 (−0.10, 0.03)	−0.07 (−0.13, 0.00) ⁺	0.07 (0.01, 0.14) ⁺
Disgust	−0.05 (−0.12, 0.01)	−0.10 (−0.16, −0.03) [*]	0.10 (0.03, 0.16) [*]

[^]
p .10,⁺
p .05,^{*}
p .01,^{**}
p .001,^{***}
p .0001

Table 3.Genetic Correlations (r_A) Between ICU and FELT

	Total ICU Scale	Uncaring/Callous Subscale	Unemotional Subscale
Emotion	r (95% CIs)	r (95% CIs)	r (95% CIs)
Anger	-0.26 (-0.78, 0.06)	-0.32 (-0.85, 0.01) [^]	0.15 (-0.43, 0.65)
Happiness	-0.19 (-0.53, 0.09) [^]	-0.22 (-0.57, 0.07)	0.05 (-0.58, 0.47)
Sadness	-0.38 (-0.78, 0.01) [^]	-0.41 (-0.81, -0.06) ⁺	-0.04 (-0.62, 0.39)
Fear	-0.28 (-0.74, 0.02) [^]	-0.33 (-0.78, -0.01) ⁺	0.05 (-0.63, 0.45)
Surprise	-0.17 (-0.69, 0.09)	-0.21 (-0.76, 0.05)	0.10 (-0.61, 0.43)
Disgust	-0.31 (-0.91, 0.04) [^]	-0.34 (-0.88, 0.02) [^]	0.03 (-0.97, 0.42)

[^]
p .10,⁺
p .05,^{*}
p .01,^{**}
p .001,^{***}
p .0001