Can a Laboratory Measure of Emotional Processing Enhance the Statistical Prediction of Aggression and Delinquency in Detained Adolescents with Callous-Unemotional Traits?

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Abstract

In this cross-sectional study, we investigated whether the combination of the presence of callous-unemotional (CU) traits and emotional deficits to distressing stimuli, assessed by a computerized dot-probe task, enhanced the statistical prediction of aggression and delinquency in a sample of 88 detained and predominantly African-American (68%) adolescents (*Mn age* = 15.57; *SD* = 1.28). Overall, self-reported CU traits were associated with self-report measures of aggression and delinquency, but not with official records of arrests. However, there was an interaction between CU traits and emotional deficits for predicting self-reported aggression, self-reported violent delinquency, and a record of violent arrests. Youth high on CU traits and who showed a deficit in their responses to visual depictions of distress showed the highest levels of aggression and violent delinquency.

Key Words: callous-unemotional traits, emotional processing, aggression, violence, delinquency

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The constellation of affective (e.g., lack of guilt and empathy), interpersonal (e.g., narcissism; conning and manipulativeness), and behavioral (e.g., irresponsibility; impulsivity) traits associated with psychopathy has proven to designate an important subgroup of adult offenders (Cooke & Michie, 1997; Skeem, Mulvey, & Grisso, 2003). In particular, these traits have consistently predicted risk for reoffending in adult samples, with meta-analyses showing weighted correlations between psychopathic traits and general reoffending ranging from .21 to .27 and between psychopathic traits and violent reoffending ranging from .26 to .27 (Gendreau, Goggin, & Smith, 2002; Hemphill, Hare, & Wong, 1998; Walters, 2003). There is growing evidence that at least one component of psychopathy, callous-unemotional (CU) traits (e.g., a lack of guilt and empathy; poverty in emotional expression), may also designate an important and particularly severe subgroup of antisocial youth (see Frick, 2006; Frick & Marsee, 2006 for reviews). For example, Frick and Dickens (2006) reviewed 24 published studies using 22 independent samples that have shown that the presence of CU traits designates a particularly severe and aggressive group of antisocial youth in both adjudicated (e.g., Kruh, Frick, & Clements, 2005) and non-adjudicated (e.g., Frick, Cornell, Barry, Bodin, & Dane, 2003) samples, and predicts future aggressive and violent behavior in adjudicated (e.g., Vincent, Vitacco, Grisso, & Corrado, 2003) and non-adjudicated (e.g., Frick, Stickle, Dandreaux, Farrell, & Kimonis, 2005) adolescents.

Despite these promising findings that CU traits may designate a particularly severe and aggressive group of antisocial youth, there are important limitations to this body of research. First, the meta-analyses in adult offending samples and the extensions to samples of youth

suggest that, while CU traits are a significant predictor of future offending, there is still quite a bit of variance in offending risk not explained by measures of these traits. Second, a number of researchers have raised concerns about measuring these traits in adolescent samples, where some level may be developmentally normative (Edens, Skeem, Cruise, & Cauffman, 2001; Seagrave & Grisso, 2002). Third, there have been concerns about methods for assessing CU traits that rely either solely (Munoz & Frick, in press) or in part (Forth, Kosson, & Hare, 2003) on self-report and, as a result, are subject to either intentional or unintentional reporter biases (Lee, Vincent, Hart, Corrado, 2003). Fourth, the majority of research on the predictive utility of psychopathy in adults and CU traits in children has been conducted with primarily Caucasian samples (see Douglas, Vincent, & Edens, 2006; Frick & Dickens, 2006 for reviews of the adult and child literature, respectively). The few studies that have utilized samples with significant minority representation in both adult (Richards, Casey, & Lucente, 2003) and adolescent (Hicks, Rogers, & Cashel, 2000; Kruh et al., 2005) offending samples have shown comparable associations between CU traits and severity of offending. However, there is also evidence that measures of these traits may show differences at both item and scale level across ethnic groups (Cooke, Kosson, & Michie, 2001; Skeem, Edens, Camp, & Colwell, 2004). Also, some of the correlates to CU traits have not generalized across ethnic groups (Kimonis, Frick, Fazekas, & Loney, 2006; Lorenz & Newman, 2002).

As a result of these issues, there have been attempts to enhance risk assessment in adolescent samples by using methods that combine measures of CU traits with other dimensions of risk (Borum, Bartel, & Forth, 2005). Unfortunately, these attempts have not included laboratory paradigms that assess how the adolescent processes emotional stimuli. This could be particularly important for a number of reasons. Specifically, deficits in how persons with CU

traits process emotional stimuli have been consistently documented in both adults (see Patrick, 2006 for a review) and youth (Frick & Dickens, 2006 for a review) using a number of different paradigms. For example, using a lexical decision task administered by computer, Loney, Frick, Clements, Ellis, and Kerlin (2003) reported that offending adolescents high on CU traits showed differences in their responses to words with negative emotional valence compared to those who were not high on these traits. Blair and colleagues have reported that youth with CU traits show impairments in recognizing both sad and fearful facial expressions and vocal tones administered using several different computer paradigms (Blair, Colledge, Murray, & Mitchell, 2001; Stevens, Charman, & Blair, 2001). Additionally, Kimonis et al. (2006) reported that youth high on CU traits and aggression show reduced attentional orienting to pictures involving distressing content (e.g., persons or animals in pain) on a computerized dot-probe task.

As a result of these findings, deficits in the processing of emotional stimuli, and in particular the processing of emotionally distressing stimuli, have played a major role in many recent etiological theories of psychopathic traits in adults (Blair, Peschardt, Budhani, Mitchell, & Pine, 2006; Patrick, 2006) and CU traits in children and adolescents (Frick & Morris, 2004; Frick, 2006). For example, many theories have suggested that moral emotions develop through a conditioning process involving repeated pairings of the child's transgressions and the parent's affective response (Kochanska, 1993). Through this process, future transgressions become conditioned to elicit emotions of fear and guilt in the child. Cleckley (1982) proposed that because individuals with psychopathy do not experience normal internal affective states, they do not learn to associate these negative states with related markers (i.e., angry parental response, victims distress cues). Further, Blair (1995) proposed that this emotional experience functions as

an innate mechanism ("violence inhibition mechanism") that is responsible for inhibiting a person's ongoing aggressive behaviors when confronted with distress cues of others.

Based on this research, there is a theoretical reason to suggest that measures of emotional processing of distressing stimuli may enhance the prediction of measures of aggression and violence in youth with CU traits. Also, the inclusion of laboratory paradigms in an assessment battery may help to overcome the biases and inaccuracies that are associated with measures that rely on the self-report of the person being assessed. Further, laboratory paradigms that focus on the underlying temperamental risk may also help to overcome concerns about the use of measures that focus solely on behaviors that may be common to some degree in normal developing samples of youth. Finally, the use of laboratory measures of emotional processing may be helpful to overcome some of the concerns about potential bias in the behavioral referents to CU traits in ethnic minority samples.

As noted previously, there have been some differences noted in the overall rate of CU traits (Skeem et al., 2004) and in the relation between certain items and the overall construct (Cooke et al., 2001) between Caucasian and African-American samples. These findings have led some researchers to suggest that the meaning of the items on CU scales may be different for some African-American and Caucasian individuals (Sullivan & Kosson, 2006). For example, some degree of callousness may be adaptive if a person experiences high rates of prejudice and discrimination but this may not be indicative of an overall deficit in conscience development for these individuals. Further, the association between the emotional processing deficit and CU traits has not been as strong in African-American samples of adults (Lorenz & Newman, 2002) and youth (Kimonis et al., 2006). This latter finding suggests that there may be less concordance between CU traits and emotional processing deficits in African-American samples. As a result,

the combination of high rates of CU traits and emotional deficits may be particularly important for designating those African-American individuals that may be at risk for severe aggressive and violent behavior.

Based on these considerations, the primary aim of the current investigation was to test the hypothesis that a laboratory measure of emotional attentiveness to distressing stimuli would enhance the prediction of aggressive and violent behavior provided by a self-report measure of CU traits in a sample of detained adolescents. Importantly, the current study was a cross-sectional study and thus, the term "prediction" refers to statistical prediction and not temporal prediction. Also, the sample used in the current study was ethnically diverse and included predominantly African-American youth (68%). Measures of general delinquency were also collected to determine if the enhanced prediction afforded by the laboratory measure of emotional processing was specific to aggression and violence. Further, aggression and delinquency were assessed using both self-report and official records to determine if associations were similar across different methods of assessments.

Methods

Participants

Participants were 88 detained 13 to 18-year old boys (M = 15.57; SD = 1.28) housed at a juvenile detention center in a moderate sized metropolitan city in the southeastern United States. The sample consisted of 60 African American (68%), 20 Caucasian (23%), 4 Hispanic (5%), 2 Native American (2%), and 2 boys classified as "Other" (2%) based on the boy's self-classification. The 88 participants were a subset of 102 boys who provided assent to participate and whose parents also provided consent. Thirteen boys were excluded from the study because they showed impaired verbal abilities (scores below 66) on the Peabody Picture Vocabulary

Test-Third Edition (PPVT-III; Dunn & Dunn, 1997), making it unclear if they could understand the study questionnaire, and another boy was unable to complete questionnaires. The mean PPVT score of the final sample fell approximately one standard deviation below average at 85.6 (*SD* = 13.5). Each youth's address was used to obtain the median family income for their neighborhood from the United States Census 2000, which ranged from $19,768 to $80,895 with a mean of $38,001 (*SD* = $13,301). Of the 88 boys, 19% (*n* = 17) were currently on psychotropic medications, 51% (*n* = 45) had a history of special education placement, and 69% (*n* = 61) had received some type of mental health care according to the youth's self report. Based on their institutional records, the youths' current offenses included property (41%), violent (31%), drug (11%), status (9%), and other types (8%; e.g., weapon, resisting an officer).

Procedures

A staff member from the detention center contacted the parents or legal guardians of all youth and informed them of a study being conducted by researchers at a local university and asked permission to forward their phone number to the researchers. They were informed that their child's participation in the project would in no way influence his treatment at the detention center or his legal standing in the adjudication process. Those parents who agreed to be contacted by the researchers were phoned and had the study procedures explained to them. As approved by the host university's Institutional Review Board and the director of the detention center, parents or legal guardians who agreed to have their child participate were asked to have the consent process tape-recorded and were subsequently mailed a copy of the consent form for their records. Of the 126 parents contacted, nine parents declined to have their child participate.

Youth whose parents provided consent were met in a private room at the detention center and were asked to assent to participate. Ten youth declined participation. Five additional youth

were released from the facility before youth assent could be obtained. Each youth participating in the study was individually administered a demographic interview followed by a questionnaire requiring him to report on his ethnicity. The youth then completed the computerized emotional pictures dot-probe task described below, followed by the PPVT-III. Later in the day, and at least half an hour following the initial session, boys were escorted in groups to a larger visitor's room (groups ranged from one to four youth), where they were read questionnaires by a researcher, with an assistant available to help answer participant questions and to ensure that each participant was working independently and completed every item. The group was then given their choice of refreshments as compensation (i.e., soft drink and candy bar).

Measures

Callous-Unemotional Traits. CU traits were assessed using the 24-item Inventory of Callous-Unemotional Traits (ICU; Frick, 2004). The ICU was developed using items from the Callous-Unemotional scale of the Antisocial Process Screening Device (APSD; Frick & Hare, 2001), which is a widely used scale to assess these traits in children and adolescents. However, the self-report CU scale from the APSD has demonstrated only moderate internal consistency in past studies (e.g., Loney et al., 2003; Pardini, Lochman, & Frick, 2003), which is likely due to its small number of items (n = 6) and three-point rating system. The ICU was designed to overcome these psychometric limitations. The four items from the APSD CU scale that loaded consistently on this factor in clinic and community samples (Frick, Bodin, & Barry, 2000) were expanded to include three similar positively worded items and three similar negatively worded items. These 24 items were then put on a four-point Likert scale from 0 (Not at all true) to 3 (Definitely true).

The construct validity of the ICU was supported in a large community sample (n = 1443) of 13 to 18 year-old non-referred German adolescents (774 boys and 669 girls; Essau, Sasagawa,

& Frick, in press), as well as an American sample (n = 248) of male and female juvenile offenders (188 boys, 60 girls) between the ages of 12 and 20 (Kimonis, Frick, Skeem, Marsee, Cruise, Munoz, & Aucoin, 2006). In both samples, items showed overall loadings on a general factor and the total scale showed adequate internal consistency (α of .77 and .81). The total score also showed expected associations with aggression, delinquency, conduct disorder, personality traits (e.g., sensation seeking, Big Five dimensions), emotional reactivity, and psychosocial impairment (Essau et al., in press; Kimonis, Frick, Skeem, et al., 2006). Consistent with these past studies, two items (i.e., 2 and 10) were deleted due to low corrected item-total correlations. The remaining 22 items were summed for a total score, which had an internal consistency of α = .73 in the current detained sample.

Aggression. Participant's self-report of aggression was measured using the *Peer Conflict Scale (PCS; Kimonis, Marsee, & Frick, 2004).* The PCS was developed to improve upon existing measures for assessing aggression by measuring four dimensions (i.e., reactive overt, proactive overt, reactive relational and proactive relational) and including a sufficient number of items (n=10) for each, while also limiting items to acts of harming another person. Items were pooled from multiple aggression scales (Bjorkqvist, Lagerspetz, & Osterman, 1992; Brown, Atkins, Osborne, & Milnamow, 1996; Crick & Grotpeter, 1995; Dodge & Coie, 1987; Galen & Underwood, 1997; Little, Jones, Henrich, & Hawley, 2003) and redundant items and items that weren't clearly related to harming others were deleted. These items were reviewed to ensure that the wording was simple and developmentally appropriate. Only the scales measuring overt aggression (total overt, proactive overt, and reactive overt) were used in the current study. The total overt aggression score consisted of 20 items and the proactive overt (e.g., "I start fights to get what I want") and reactive overt aggression (e.g., "When I am teased, I will hurt someone or

break something") scores each consisted of 10 items. Items were rated on a 4-point Likert scale from 0 ("Not at all true") to 3 ("Definitely true"). The scales demonstrated adequate internal consistency with coefficient alphas ranging from .76 for proactive aggression to .89 for total aggression in this detained sample.

Delinquency. Participant's self-report of delinquency was measured using the *Self-Reported Delinquency Scale (SRD; Elliot & Ageton, 1980)*. The SRD scale assesses the number of crimes committed by the youth by listing 36 questions about illegal juvenile acts selected from a list of all offenses reported in the Uniform Crime Report with a juvenile base rate of greater than 1% (Elliott & Huizinga, 1984). For each question the youth is asked to respond with a "yes" or "no" regarding whether he has ever done the behavior. Consistent with past uses of the scale (Krueger, Schmutte, Caspi, Moffitt, Campbell, & Silva, 1994), a total delinquency composite was created by summing the number of delinquent acts committed (with a possible range of 0-36). In addition to the total delinquency score, the current study used the 7-item property offenses subscale (e.g. "have you ever purposely damaged or destroyed property belonging to school?"), the 8-item violent offenses subscale (e.g., "have you ever been involved in gang fights?"), the 9-item drug offenses subscale (e.g. "have you ever sold hard drugs such as heroine, cocaine, and LSD?") and the 4-item status offenses subscale (e.g. "have you ever taken a vehicle for a ride without the owners' permission?"). Internal consistencies for these scales are reported in Table 1.

Legal History. Following completion of the study, information about each youth was obtained from the youth's detention center files. Chart information included the youth's current charge, the number of prior arrests, and whether the youth had a history of violent arrests. Prior

arrests ranged from 0 to 28 and 59% of youth had either a current arrest for a violent offense or a history of at least one violent arrest.

Emotional Processing of Distressing Stimuli. The Emotional Pictures Dot-Probe task (Kimonis, Frick, Fazekas et al., 2006) is designed to be an indirect indicator of emotional reactivity by tapping the preconscious mechanisms responsible for discriminating and directing attentional resources toward biologically relevant stimuli (Ohman, 1993). It was selected as the measure of emotional processing for several reasons. First, the use of pictorial stimuli are likely to evoke stronger emotional reactions and don't require a minimal level of reading ability, as would be the case for lexical decision tasks used in past studies (Loney et al., 2003). Second, compared with psychophysiological measures, the dot-probe task provides a low-cost (i.e., requiring only a computer to administer) and noninvasive method for measuring emotional experiences. Third, the task takes only about 10 to 15 minutes to administer. All of these features make this task more useful than alternatives in many clinical settings.

The emotional pictures dot probe task used in the current study was developed using primarily slides taken from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 1997). These slides were carefully selected to tap distressing (e.g., crying child), positive (e.g., puppies), and neutral emotional content (e.g., fork) and had been validated in previous studies with children and adolescents (Blair, 1999; McManis, Bradley, Berg, Cuthbert, & Lang, 2001). Because the number of neutral and distressing images was not sufficient for dividing the slides into neutral, distress and positive categories, additional slides (distress n = 19; neutral n = 42) were added that directly matched the IAPS slide content. For example, additional slides of a crying child were added to the existing IAPS slides of crying children. This expanded

content was validated and evaluated for acceptability by parents and youth in an independent sample (Kimonis, Frick, Fazekas et al., 2006).

The dot probe task consisted of one block of practice stimuli (16 picture pairs) followed by four test blocks of picture pairs, each containing 24 picture pairs. Each picture pair presentation consisted of three sequential and non-overlapping components: (1) a 500 millisecond fixation cross appearing in the center of the screen, (2) a 250 millisecond simultaneous presentation of two picture stimuli that are centered and located immediately above and below the location of the fixation cross, and (3) an asterisk (i.e., dot probe) appearing in either the top or bottom picture location. The objective of the task is to select a key on the keyboard that corresponds to the location on the screen (up or down) where the dot-probe appears, as quickly as possible. The time between when the probe appears and the youth presses the corresponding key to its location is recorded in milliseconds and used for the calculation of facilitation indices (described below). If no key is pressed within 5000 milliseconds, the response is recorded as incorrect. Consistent with past uses of the task, incorrect responses were not included in the calculation of facilitation indices as they reflect that the participant was not paying attention to a specific stimulus pair. Also, response times less than 100 milliseconds were not included in calculations because they were considered to be outliers resulting from program error.

The picture pairs represented one of three potential picture pairings: neutral-neutral, distress-neutral, and positive-neutral. The number and location of picture stimuli were counterbalanced across test trials in order to assure an equal number of emotional and neutral stimuli appearing in both top and bottom locations across the 4 blocks of test stimuli. Additionally, there were an equal number of emotional and neutral stimuli that were replaced

versus not replaced by a dot probe stimulus. The primary dependent measure for the current study is an attentional facilitation index calculated by subtracting the average latency to responding to dot probes replacing distress picture stimuli from the average latency to responding to dot probes replacing neutral stimuli in the various neutral-neutral picture pairings. To control for potential location effects the following formula was used to calculate the facilitation indices (MacLeod & Mathews, 1988): Facilitation = 1/2 x [(Neutral Only/Probe Up - Distress Up/Probe Up) + (Neutral Only/Probe Down - Distress Down/Probe Down)]. The facilitation index for positive emotion slides was calculated in the same way and was included to compare participants on their processing of two distinct types of emotional stimuli.

Given that the emotionality of picture stimuli is generally thought to facilitate allocation of attention, the normative response is to respond more quickly to probes replacing distressing images because a person's attention selectively orients to the distressing image (Vasey, Daleidon, Williams, & Brown, 1995; Vasey, El-Hag, & Daleidon, 1996). This normal response pattern would result in an overall shorter mean response time to distressing pictures, indicated by higher scores on the facilitation index. Facilitation scores that fell more than three standard deviations above or below the mean were eliminated from analyses (n = 2). The internal consistency of emotional attentiveness indices for each picture category (i.e., distress, positive) was adequate with α = .74 for emotional attentiveness to distress pictures and α = .81 for emotional attentiveness to positive pictures (see Table 1).

Results

Prior to addressing the primary study hypothesis, the psychometric properties of (Table 1) and correlations between main study variables and demographic variables (Table 2) were examined. For the emotional pictures dot-probe task, the mean emotional attentiveness to distress

images was –2.16ms (*SD* = 49.74) and the mean emotional attentiveness to positive images was 2.76ms (*SD* = 49.15). These distributions from the dot-probe task suggest that, on average, participants showed a typical response pattern to the positive stimuli, being somewhat quicker to recognize probes following positive emotional stimuli (Kimonis, Frick, Fazekas et al., 2006). However, this detained sample overall did not show the normative pattern for faster recognition of probes following distress pictures. As shown in Table 2, demographic variables were generally not associated with the predictor variables (CU traits, emotional attentiveness indices) and aggression. Thus, they were not used as covariates in subsequent regression analyses. However, older boys tended to show more total, drug, and status delinquency. Also, receipt of mental health services was related to a greater number of prior arrests. Higher verbal ability (PPVT) and higher median family income were associated with greater total, property, drug, and status delinquency. Importantly, Caucasian youth in this sample showed greater levels of each type of delinquency (total, property, drug, and status), with the exception of violent delinquency.

Correlations among the predictor and outcome variables are provided in Table 3. CU traits were not significantly associated with emotional attentiveness indices in this primarily African-American sample. However, as expected from past research, CU traits were significantly positively associated with proactive, reactive, and total aggression, and all types of self-reported delinquency. None of the main study variables were associated with prior arrests or a history of violent arrests based on the participant's institutional files. Emotional attentiveness indices were generally uncorrelated with outcome variables, with two exceptions. Number of prior arrests and reactive aggression, controlling for proactive aggression, were significantly positively associated with emotional attentiveness to positive pictures (r = .23; p < .05 and sr = .27; p < .05,

respectively). These findings suggest that boys who are reactively aggressive or who have experienced a greater number of prior arrests show greater attention to positive pictures.

To determine whether the relationship between CU traits and outcome variables differed across levels of emotional attentiveness to distress stimuli, a series of two-step hierarchical multiple regression analyses were conducted. For these regression analyses, all predictors were centered by subtracting the sample mean from each participant's score. In Step 1, the dependent variable was regressed onto the predictors, CU traits and emotional attentiveness to distress. In Step 2, a multiplicative interaction term was entered into the equation to test for the interaction between CU traits and emotional attentiveness to distress. These analyses utilized OLS regression for continuous dependent variables and logistic regression for the dichotomous history of violent arrests variable.

In the logistic regression analysis, neither main effect was significant but there was a significant interaction between CU traits and emotional attentiveness for predicting violent arrests ($OR = 1.00$, $p < .05$). The estimated odds ratio for emotional attentiveness scores of -50 (approximately 1 *SD* below mean), 0 (approximate mean), and 50 (approximately 1 *SD* above mean) were computed. The results of these computations suggest that, at an emotional attentiveness score of –50, a one unit increase in CU traits increased the probability of having a current or prior violent arrest by 12%. In contrast, the probability increased by only 1% at an emotional attentiveness score of 0 and decreased by 8% at a score of +50.

For the remaining continuous dependent variables, the results of the OLS regression analyses are reported in Table 4. For the self-report of aggression and delinquency, there were significant main effects for CU traits but not emotional attentiveness to distressing pictures. However, this main effect was moderated by a significant interaction between CU traits and

emotional attentiveness to distress pictures in predicting total aggression (R^2 change = .06, p < .05), proactive aggression (R^2 change = .07, p < .01), and violent delinquency (R^2 change = .05, p < .05). The interaction for predicting reactive aggression (R^2 change = .04, p = .06) approached significance. Also, although there were no significant main effects, there was a significant interaction in the regression equation predicting the number of prior arrests (R^2 change = .08, p < .01).

The forms of these interactions were tested using the post-hoc probing procedure recommended by Holmbeck (2002). In this procedure, the regression equation from the full sample is used to calculate predicted values of the dependent variable of interest (i.e., aggression, delinquency, arrests) at high (1 SD above the mean) and low levels (1 SD below the mean) of the two predictors (i.e., CU traits and emotional attentiveness to distress). Post-hoc probing was used to determine if the associations between CU traits and the outcome variables were significant at either of the two levels of emotional attentiveness to distress pictures by computing the simple slopes (i.e., standardized beta) and testing these for significance (Holmbeck, 2002).

The results of this post-hoc probing are summarized in Figures 1 and 2. As represented in Figure 1, these analyses revealed different associations between CU traits and proactive aggression at low versus high levels of emotional attentiveness to distress. This pattern was similar for total aggression and for violent delinquency, although only the graph for proactive aggression is provided in this figure. As predicted, at low levels of emotional attentiveness to distress there was a positive association between CU traits and total aggression (Std. Beta = .54, p < .001), proactive aggression (Std. Beta = .51, p < .001), and self-reported violent delinquency (Std. Beta = .41, p < .01). That is, boys high on CU traits that were also low on emotional attentiveness showed the greatest levels of aggression and violent delinquency. However, the

associations between CU traits and aggression scores at high levels of emotional attentiveness to distress were not significant (Std. Beta = .04, -.07, and -.05 for total aggression, proactive aggression, violent delinquency, respectively).

The form of the significant interaction for predicting prior arrests is presented in Figure 2 and was quite different from what was reported for the self-report measures of aggression and violence. At low levels of emotional attentiveness to distress, there was a positive association between CU traits and prior arrests. However, unlike for the self-report measures, this was not significant (Std. Beta = .15). However, at high levels of emotional attentiveness to distress there was a significant negative association between CU traits and prior arrests (Std. Beta = -.44, $p <$ .05). That is, when predicting prior arrests, boys high on emotional attentiveness and low on CU traits showed the greatest number of arrests.

Discussion

The results of the current cross-sectional study suggest that scores on a computerized dot-probe task, that assesses an emotional deficit in response to distress stimuli, adds to the statistical prediction of aggression and violence in a sample of detained adolescents when combined with a measure of CU traits. Specifically, youth with CU traits who showed reduced attentiveness to distressing pictures on the dot-probe task showed the highest levels of aggression, especially proactive aggression, and violent delinquency. These results are consistent with many theories of moral development, which suggest that negative internal affective experiences function to inhibit aggressive behaviors (Blair, 1995; Kochanska, 1993). As such, cues (e.g., angry parental response, victim's distress cues) that would typically inhibit ongoing aggressive behavior by initiating a negative internal state in the child become ineffective in these youth, leading to higher rates of aggression and violence.

These results also suggest that within a group of detained adolescents with a large percentage of minority youth, youth who score high on CU traits constitute a somewhat heterogeneous group. That is, overall there was no association between CU traits and deficits in emotional processing. However, the combination of CU traits and deficits in emotional processing seemed to designate a group of youth who show a much higher rate of aggression and violence. This was not only the case for self-report measures of aggression but this interaction was also evident when predicting past violent arrests based on institutional records. Unfortunately, the small number of Caucasian youth precluded testing whether this finding was unique to the African-American participants. However, these findings would be consistent with some suggestions that items on measures of CU traits may have different meaning for some minority individuals (Sullivan & Kosson, 2006) and our results suggest that this may be the case for those with CU traits who do not show the emotional deficits to distressing stimuli. Further, these results are also consistent with conceptualizations of secondary psychopathy, suggesting that there may be some individuals who show high rates of CU traits but who may not show the temperamental deficits in emotional reactivity and for whom CU traits are more related to environmental risk factors (Poythress & Skeem, 2005; Skeem, Poythress, Edens, Lilienfeld, & Cale, 2003).

An unexpected finding of the current study was that, although youth high on CU traits with low emotional attentiveness reported the greatest levels of aggression and violent delinquency, they did not show the highest rates of prior arrest. Rather, it was the youth that were *low* on CU traits with *heightened* emotional attentiveness (i.e., hypervigilance to distress pictures) that showed the greatest number of arrests. Because this pattern was not predicted, any interpretations are post-hoc and need to be replicated before any conclusive statements can be

made. However, they are consistent with the theory that the majority of youth who show serious antisocial behavior do not show CU traits (Frick, 2006). Further, those without CU traits often show heightened emotional reactivity, indicating problems in the regulation of emotion, leading to impulsive and poorly regulated behaviors (Frick & Morris, 2004). It may be that, because the aggressive and antisocial acts for this group of youth are impulsive and often committed in the context of high emotional arousal, they may be more likely to be caught for these acts, leading to a greater number of arrests.

All of these results need to be interpreted in light of a number of limitations in this study. First, the correlational design prevents any firm conclusion about the direction of causation among the variables used in the study. For example, as noted previously, youth with CU traits show histories of significant aggression (Frick et al., 2003) and violence (Kruh et al., 2005). Rather than the CU traits being causal, the aggression and violence could lead these youth to become desensitized to the cues of distress in others. While not conclusively addressing the issue of causation, prospective designs would provide better clues as to the temporal ordering of variables by showing whether emotional deficits combined with CU traits predict future aggressive and violent behaviors. Second, the current sample was predominately African-American. Although this allowed us to examine the importance of emotional processing deficits in the association between CU traits and aggression in this understudied group, it may also limit the generalizability of the findings to other samples with different ethnic compositions. Further, as noted above, there were not sufficient numbers of participants of other ethnicities to determine if the findings were unique to the African-American participants. Third, it is also important to recognize that the dot-probe paradigm is not a direct index of emotional responsiveness, since a number of cognitive, affective, and motoric processes are operating between the child's

perception of the pictorial stimuli and his or her motoric response concerning the location of the dot (Vasey et al., 1996).

Within the context of these limitations, the results of the current study highlight the importance of assessing emotional deficits in youth with CU traits when considering their risk for aggression and violent behavior. Specifically, while CU traits alone seem to be important for identifying antisocial youth who may be at risk for serious aggressive and violent behavior in many samples (see Frick & Dickens, 2006), this prediction may be enhanced by including laboratory tasks that assess emotional processing deficits. Thus, in addition to improving our assessment of CU traits themselves, these results support the importance of combining tests to enhance the validity of any assessment of these traits. Such an approach recognizes the limitations inherent in any single measure of a construct (Kamphaus & Frick, 2005). Also, the use of a laboratory measure of emotional processing utilizes basic research on potentially important causal processes to guide the development of such a battery (Frick, 2000). Finally, these results suggest that CU traits, like many problems in adjustment, likely come about through many different processes and that further testing of the different causal pathways to these traits may help to guide interventions designed to treat antisocial youth who show them (Frick, 2006).

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Table 1
Distributions of main study variables

	Mean	(SD)	Range	Skewness	Kurtosis	Alpha
Psychopathic Traits						
CU	23.23	(7.85)	1 – 41	-.22	-.04	.73
Aggression						
Total	13.09	(9.27)	0 – 40	1.00	.85	.89
Proactive	2.60	(3.38)	0 - 15	1.80	3.05	.76
Reactive	10.49	(6.63)	0 – 29	.58	-.28	.86
Delinquency						
Total	13.10	(6.65)	3 – 27	.39	-.92	.87
Property	4.67	(2.67)	0 – 10	-.03	-1.07	.73
Violent	2.49	(1.67)	0 – 7	.75	-.25	.64
Drug	3.28	(2.49)	0 – 9	.37	-.96	.83
Status	1.20	(1.03)	0 – 4	.48	-.61	.42
Chart Review						
Prior arrests	6.01	(5.50)	0 – 28	2.03	4.90	
Emotional Attentiveness						
Distress	-2.16	(49.74)	-110 – 152	.61	1.32	.74
Positive	2.76	(49.15)	-137 – 161	.67	1.89	.81

Note: CU = Callous-Unemotional Traits.

Table 2
Correlations between main study variables and demographic variables

Variables	Age	Meds	Mental Health	PPVT	Income	Race
Psychopathic Traits						
CU	.06	-.06	-.08	.00	.14	-.08
Aggression						
Total	.07	-.11	.08	.01	.09	-.17
Proactive	.13	-.10	.00	.01	-.06	-.13
Reactive	.03	-.11	.11	.02	.16	-.17
Delinquency						
Total	.22*	-.04	.01	.29**	.21*	-.36**
Property	.05	.01	.08	.37***	.22*	-.29**
Violent	.06	.01	.00	-.07	-.01	.03
Drug	.32**	-.06	.03	.26*	.26*	-.45***
Status	.21*	-.07	-.08	.23*	.21*	-.37**
Chart Review						
Prior arrests	-.09	.07	.37***	-.18	-.02	-.03
Violent arrests	.17	.06	.10	.02	-.03	-.19
Emotional Attentiveness						
Distress	-.03	-.07	-.04	.04	.04	.01
Positive	-.17	-.04	.05	-.14	-.01	.07

Note: CU = Callous-Unemotional Traits; Meds = Taking psychotropic medication; Mental Health = Receipt of mental health services; Race was coded as 0 for Caucasian and 1 for African American; Violent arrests indicate either a current or past violent arrest and was coded as 0 for none and 1 for at least one current or past violent arrest; * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 3: Correlations among main study variables

	CU	1.Total Agg	2.Pro Agg	3.Rea Agg	4.Total Del	5.Prop Del	6.Vio Del	7.Drug Del	8.Stat Del	9.Arr	10.Vio Arr	11.EA DIS
1	.36***	*										
2	.30** (.09)	.85***	*									
3	.29** (.20[a])	.96***	.68***	*								
4	.37***	.55***	.50*** (.20)	.52*** (.31**)	*							
5	.32**	.30**	.25* (.06)	.29** (.19)	.84***	*						
6	.24*	.51***	.60*** (.44***)	.41*** (.07)	.69***	.47***	*					
7	.33**	.46***	.34*** (-.06)	.47*** (.42***)	.81***	.50***	.39***	*				
8	.24*	.48***	.47*** (.30**)	.43*** (.09)	.70***	.50***	.38***	.53***	*			
9	-.05	.15	.15 (.10)	.14 (.05)	.02	.06	.13	-.08	-.07	*		
10	.08	.05	.12 (.17)	.00 (-.11)	.11	-.02	.09	.19	.10	.39***	*	
11	.05	.07	.06 (.02)	.07 (.09)	-.06	-.01	-.10	-.06	.00	.14	.00	*
EA POS	-.06	.15	.08 (-.15)	.17 (.27*)	-.12	-.08	-.01	-.17	-.18	.23*	-.03	.30**

Note: CU = Callous-Unemotional Traits; Pro = Proactive; Agg = Aggression; Rea = Reactive; Del = Delinquency; Prop = Property; Vio = Violent; Stat = Status; Arr = Arrests; EA DIS = Emotional attentiveness to distress pictures; EA POS = Emotional attentiveness to positive pictures; Violent arrests indicate either a current or past violent arrest and was coded as 0 for none and 1 for at least one current or past violent arrest; Correlations in the body of the table are zero-order correlations, except for correlations in parentheses which are partial correlations controlling for the overlap between reactive and proactive aggression; *$p < .05$; **$p < .01$; ***$p < .001$; [a]$p = .06$.

Table 4: Hierarchical regression analyses testing for the interaction between CU traits and emotional attentiveness to distress

	Model 1			*Model 2*				
	CU Std. Beta	**EA Dis.** Std. Beta	**R^2 /**	**CU** Std. Beta	**EA Dis.** Std. Beta	**CU x EA Dis.** Std. Beta	**R^2**	**R^2-change**
Total Overt Aggression	.36***	.06	.13	.29**	.07	-.25*	.19	**.06***
Proactive Overt	.30**	.05	.09	.22*	.06	-.28**	.16	**.07****
Reactive Overt	.35***	.05	.13	.29**	.07	-.20[a]	.16	.04[a]
Total Delinquency	.38***	-.08	.15	.35***	-.07	-.12	.16	.01
Property	.32**	-.03	.10	.33**	-.03	.01	.10	.00
Violent	.24*	-.11	.07	.18	-.10	-.22*	.12	**.05***
Drug	.34***	-.07	.12	.31**	-.07	-.10	.13	.01
Status	.25*	-.01	.06	.22*	.00	-.13	.08	.02
Chart Variables								
Prior arrests	-.07	.14	.03	-.15	.16	-.29**	.10	**.08****

Note: CU = Callous-Unemotional Traits; EA Dis. = Emotional attentiveness to distress pictures; All predictors were centered using the sample mean prior to entering them into the regression analyses. * $p<.05$; ** $p<.01$; *** $p<.001$; [a]$p = .06$.

Figure Caption

Figure 1: Interaction between callous-unemotional (CU) traits and emotional attentiveness to distressing stimuli in predicting proactive aggression.

Figure 2: Interaction between callous-unemotional (CU) traits and emotional attentiveness to distressing stimuli in predicting prior arrests.

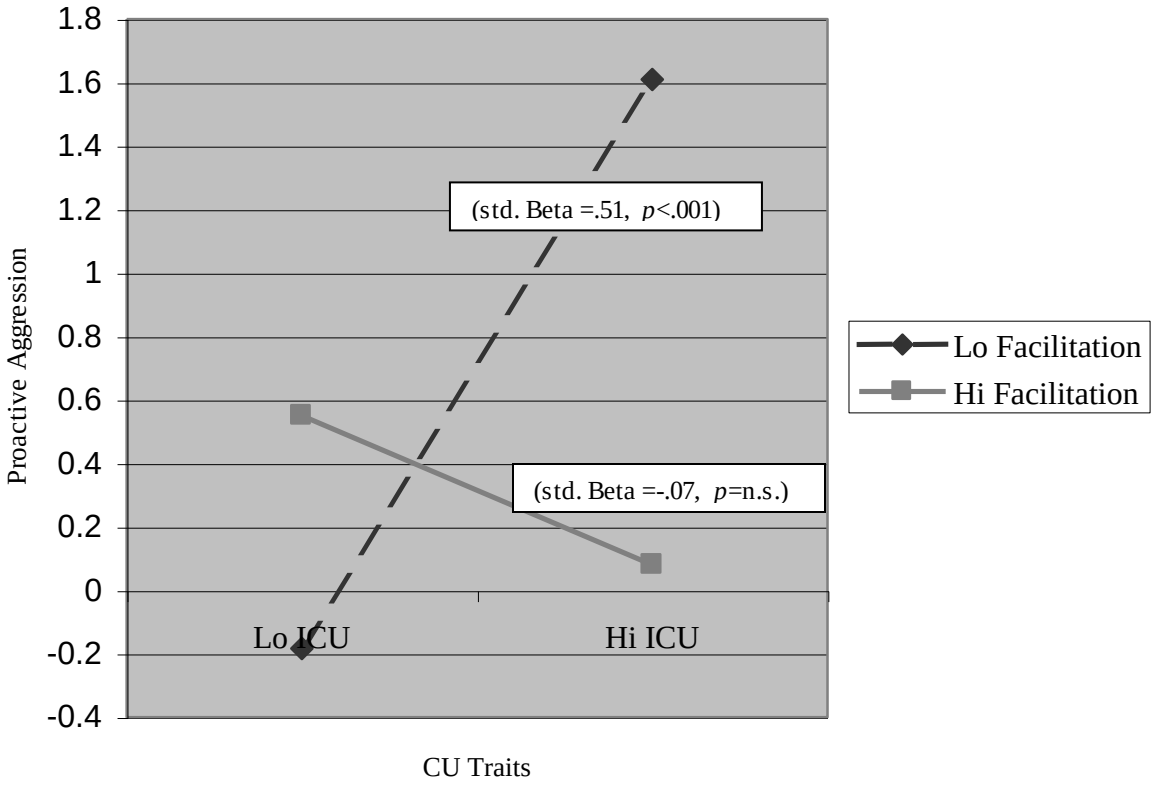
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
Proactive Aggression
(std. Beta =.51, p<.001)
(std. Beta =-.07, p=n.s.)
Lo ICU
Hi ICU
CU Traits
Lo Facilitation
Hi Facilitation

Figure 1

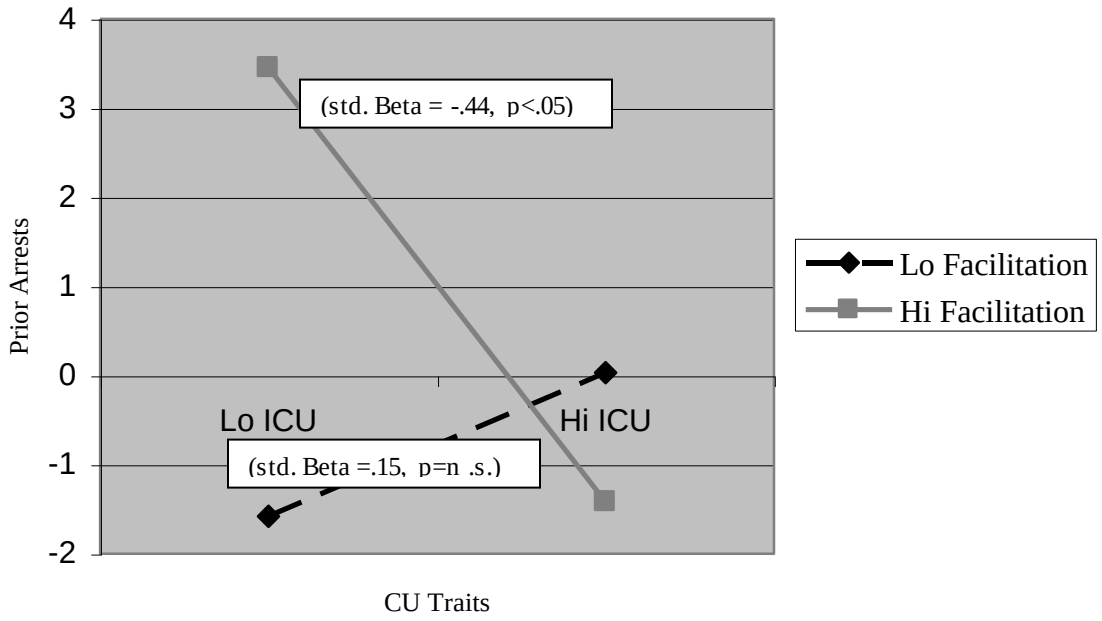
4
3
2
1
0
-1
-2
Prior Arrests
(std. Beta = -.44, p<.05)
Lo ICU
Hi ICU
(std. Beta =.15, p=n .s.)
CU Traits
Lo Facilitation
Hi Facilitation

Figure 2