Sensitivity to Parenting in Adolescents with Callous/Unemotional Traits: Observational and Experimental findings

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Abstract

Children and adolescents with callous-unemotional (CU) traits have been distinguished as a subset of individuals with disruptive behavioral disorders who may be less sensitive to parenting influence; we test this hypothesis using multiple methods and assessment paradigms. 271 adolescents (mean age 12.6 years) from three samples at elevated risk for disruptive behavior disorders were studied. Symptoms of callous-unemotional (CU) behavior were derived from standard questionnaire; assessments of behavioral adjustment were derived from clinical interview with parent, and parent-, teacher-report, and self-report questionnaire. Parent-child relationship quality was based on observational assessments in which adolescent and parent behaviors were rated in three interaction tasks: a) low conflict planning task; b) problem-solving conflict task; c) puzzle challenge task; parent interview and parent- and child-report questionnaires of parenting were also assessed. Results indicated that the associations between parent-child relationship quality and behavioral adjustment were comparable in adolescents with and without CU traits. More notably, observational data indicated that adolescents with elevated CU traits showed comparatively greater within-individual variability in observed angry/irritable behavior across interaction tasks, suggesting greater sensitivity to and emotional dysregulation in challenging interpersonal contexts. The findings suggest that adolescents with CU are not less sensitive to parental influence and may in contrast show greater context-sensitive disturbances in emotional regulation. The results have implications for family-based assessment and treatment for adolescents with disruptive behavior disorders.

Key words: disruptive behavior disorders, callous-unemotional traits, emotional regulation, parent-adolescent observations, within-individual variability

Sensitivity to Parenting in Adolescents with Callous/Unemotional Traits: Observational and Experimental findings

The presence of callous-unemotional (CU) traits is a specifier for Conduct Disorder in DSM-5 because of the considerable research literature identifying psychological and biological distinctions of children with CU traits (P. J. Frick, Ray, Thornton, & Kahn, 2014) and mounting evidence that this subset of children has a particularly severe and persistent disturbance (McMahon, Witkiewitz, Kotler, & Conduct Problems Prevention Research, 2010; Pardini & Fite, 2010). In terms of clinical and public health significance, one of the more striking hypotheses about young people with CU traits is that they may be less – or differentially – susceptible to caregiving influence. The current study builds on and extends this hypothesis using extensive observational data and multiple methods and assessment paradigms.

Evidence suggesting that children and adolescents with CU traits may be less sensitive to caregiving influence derives from three lines of evidence. One indirect line of evidence is the strong genetic influence on CU traits (Blonigen, Hicks, Krueger, Patrick, & Iacono, 2006; Larsson, Andershed, & Lichtenstein, 2006; Tuvblad, Wang, Bezdjian, Raine, & Baker, 2015) and the finding that, among those children with disruptive behavioral disorders, there may be a stronger genetic component in the subset with CU traits (Viding, Jones, Frick, Moffitt, & Plomin, 2008). More direct evidence derives from studies showing that CU traits moderate associations between a range of parenting dimensions and behavioral adjustment. For example, in a sample of 9-10 year-olds, Yeh and colleagues (Yeh, Chen, Raine, Baker, & Jacobson, 2011) found that children's reporting of both positive and negative parenting were more strongly associated with self-reported reactive aggression in children with low versus high levels of psychopathic traits. A study of young clinic-referred children (Pasalich, Dadds, Hawes, &

Brennan, 2011) found that coercive parenting was more strongly associated with conduct problems in children with low compared with elevated levels of CU; other studies suggest that disciplinary practices may be more weakly associated with behavioral problems in children with elevated CU traits (Oxford, Cavell, & Hughes, 2003; Wootton, Frick, Shelton, & Silverthorn, 1997). A third line of evidence is from intervention studies showing that CU traits may be associated with weaker perceived response to punishment such as time-out (Hawes & Dadds, 2007), and that children with elevated CU traits may be less responsive to intervention (Spain, Douglas, Poythress, & Epstein, 2004).

The hypothesis that children and adolescents with CU traits are less sensitive or susceptible to parental influence has attracted considerable momentum because it may translate into a clinical and developmental context those distinguishing neurocognitive and affective features of CU, including insensitivity to punishment cues (Fisher & Blair, 1998), poor emotion recognition (Blair, Colledge, Murray, & Mitchell, 2001), decreased fearfulness (Barry et al., 2000; Viding et al., 2012), low physiological arousal (Loney, Butler, Lima, Counts, & Eckel, 2006), reduced fear and disturbances in amygdala activation when processing fearful expressions (Marsh et al., 2008), and pre-attentive fear-recognition deficits (Sylvers, Brennan, & Lilienfeld, 2011). It is not yet clear how or if these neurocognitive characteristics link with quality of parent-child relationships, but these findings imply that parenting experiences may be differently perceived by children with and without CU traits.

However, not all studies support the hypothesis that children and adolescents with elevated CU traits are less sensitive to parenting influence. For example, CU traits have been reliably associated with caregiving experiences (Pardini, Lochman, & Powell, 2007; Waller et al., 2012); furthermore, not all studies find that the associations between parenting and child

behavioral adjustment are moderated by CU, e.g. (Waller et al., 2014), or that CU traits moderate treatment response to intervention (Kolko & Pardini, 2010). More notable contrary findings include the observation that caregiving quality predicts CU stability (P. J. Frick, Kimonis, Dandreaux, & Farell, 2003); parental warmth may have a stronger association with problem behavior in children with elevated levels of CU traits (Kroneman, Hipwell, Loeber, Koot, & Pardini, 2011); and children with CU traits may be more sensitive to coercive parenting for proactive aggression (Yeh et al., 2011). These findings are significant in raising an alternative hypothesis that children with CU traits may, in certain circumstances, show *greater* sensitivity or responsiveness to caregiving.

The inconsistent pattern of results so far reported may indicate no robust overall effect. Nonetheless, the hypothesis holds substantial implications for understanding the social mechanisms of psychopathy and its assessment and treatment, thereby underscoring the need for further research on this hypothesis.

Deciphering whether or not children and adolescents with CU traits are differentially sensitive to parental influence compared with those without CU traits has been difficult to resolve because of the variation in operationalizing "sensitivity." We extend prior research by operationalizing "sensitivity" in several ways. First, consistent with prior research, we test the robustness of associations between CU traits and parent-child relationship quality, and the extent to which CU traits moderate the prediction from caregiving to behavioral adjustment. For these analyses we rely on data from multiple sources to address concerns about shared method variance that may confound results.

An alternative and more novel method exploits the power of a within-subject design to examine adolescents' behavior with parents across interaction contexts which vary in

interpersonal and parenting demands. In the current study, adolescent behavior toward the parent was assessed in the standard "hot topic" problem-solving conflict interaction (Hetherington & Clingempeel, 1992) as well as in two alternative settings: a low-conflict "plan a holiday" task and a mildly challenging puzzle task which was not relationship conflict-focused. This experimental manipulation varies the interpersonal stress and is analogous to studies of mood induction and emotional regulation (Musser et al., 2011) and with prior research on disruptive behavioral disorders across interpersonal settings (Wakschlag et al., 2008). Observed behaviors indicating anger/irritability and warmth/engagement were coded in each of the three settings by raters blind to all clinical and diagnostic data. If adolescents with CU show less sensitivity to caregiving, then we might expect less variability in behavior across setting compared with adolescents without CU, e.g., because of a lack of arousal or reduced ability to attend and respond to the caregiver across low- and high-conflict settings. The contrary hypothesis is that difficulty in emotional regulation, amplified in a conflict setting, and coupled with deficits in empathy or emotional understanding required in problem-solving negotiations, may make problem-solving negotiation tasks comparatively more frustrating for adolescents with elevated CU traits. If that were so, then adolescents with elevated CU traits might be most distinguishable, in terms of their angry/irritable behavior, in the problem-solving interaction. We test this novel hypothesis.

Method

Participants

The sample for the current study is composed of adolescents drawn from three independent samples; the three samples were pooled to improve statistical power and because identical procedures and methods were used to assess psychopathology and adolescent-parent

interactions. The first is a high-risk clinic sample which included youths aged 9-17 years who were referred to mental health clinics in South London and Sussex aged 3-7 years because of antisocial behavior (Scott, Spender, Doolan, Jacobs, & Aspland, 2001); 107 of 141 original families were successfully followed-up in adolescence. The second is a moderate risk community sample, which was composed of youths aged 9-13 years who were originally studied as part of a treatment trial aged 4-6 years because of elevated conduct problems (Scott et al., 2010); 102 of 128 families in the original study were successfully followed-up in adolescence. A third sample is a foster sample recruited via Social Services' computerized records from the Children's Services Departments of two London boroughs (Joseph, O'Connor, Briskman, Maughan, & Scott, 2014)[1]. Families were eligible to take part in the study if the adolescent had been living in the family for at least 5 months (to allow for adjustment to the new placement), was aged 10-16 years, and not in kinship care. One hundred and sixty four families fulfilled inclusion criteria and were contacted by letter via Children's Services; 62 families consented to take part in the study. The main reasons for refusal to take part in the study were imminent placement breakdown (10%), lack of interest (13%), foster parent concern that participation might adversely affect the child (16%), and lack of time to participate (13%); 16% of carers gave no reason for not participating. Sample characteristics are provided in Table 1 for the total sample and for each at-risk/clinic sample.

All adolescents did not have recognized developmental delay and were fluent in English. Written consent from mother and assent from the child was obtained; the study was approved by the local research ethics committee. Parents were paid £20 for participation; adolescents were paid £10.

[1] A sample of normal-risk community sample of adolescents was recruited as a comparison sample for the foster care sample; however, none of the normal-risk community adolescents exhibited elevated levels of callous-unemotional symptoms and so they were not included in the current analyses.

Procedures

Adolescents and parents were visited in the home by two research assistants. The interviewers first obtained consent from the parent and adolescent and then administered interview and questionnaire assessments to collect demographic, psychosocial, and psychiatric data; the observational assessment was conducted early in the course of the home visit. For the observational assessment, parents and adolescents were asked to complete three observational tasks which were chosen to simulate differential levels of conflict and interpersonal demands. The first was a planning task in which the parent and adolescent were asked to plan an imaginary family holiday for £500; the task, which lasted 5 minutes, was administered as a low-conflict task. The second task, designed to evoke high interpersonal conflict, was the standard "hot topic" problem-solving interaction in which the parent and adolescent were asked to discuss and resolve the two most common sources of relationship conflict that were identified from a questionnaire assessment (Hagan, Hollier, O'Connor, & Eisenberg, 1992); participants were instructed to spend 5 minutes on each conflict topic. The third task consisted of a 5-minute puzzle task in which the parent and adolescent were asked to solve a challenging magnetic puzzle with minimal direction or explanation; this interaction was designed to be challenging but did not target interpersonal conflict. The tasks were delivered in this order for all participants. For each task, the research assistant briefly introduced the task and then left the room. All interactions were videotaped for later coding (see below).

Measures

Callous-Unemotional traits. Callous-Unemotional (CU) traits were assessed from parent reports on the Antisocial Process Screening Device (APSD) (P. J. Frick, & Hare, R.D., 2001). The APSD and the CU subscale in particular have been extensively validated in

developmental and clinical research (P. J. Frick & Viding, 2009; Sylvers et al., 2011; van Zwieten et al., 2013), and have been shown to predict subsequent outcomes, e.g., (Wymbs et al., 2012), including the prediction to adult arrests, e.g.,(McMahon, Witkiewitz, & Kotler, 2010). Given the focus on CU in research on sensitivity or susceptibility to parenting influence, analyses below focus on the CU scale; select analyses of the total scale are reported as supplementary. Internal consistency of the 6-item parent-reported CU scale was .75; the average inter-item correlation was .33. Categorical assessments of CU have used several cut points to indicate severe disturbance on the 6-item (12 point) scale; a score of 7 or greater (Barry et al., 2000), which corresponds to the 90th percentile in a normative sample (P. J. Frick, & Hare, R.D., 2001), is used for descriptive purposes (Table 1) or for illustrative purposes (Figure 1; see below). The APSD also includes two additional scales, Narcissism and Impulsivity, which are moderately-highly correlated with the CU scale (r's >.6); these dimensions have attracted substantially less attention than the CU scale in the literature on sensitivity to caregiving and are therefore not the target of analyses below.

Disruptive and antisocial behavior. Disruptive behavior was measured using multiple methods and sources. Diagnostic symptoms and diagnosis of disruptive behavior were derived from the Child and Adolescent Psychiatric Assessment (CAPA; DSM-IV version), a semi-structured diagnostic interview with parents (Angold & Costello, 2000). Interviewers were extensively trained by the instrument developers. We focus on ODD in the analyses (see Table 1); the rate of diagnosed CD was too low for meaningful analyses. Mean intra-class correlation reliability on 20 ODD cases was 0.85 (range 0.78-0.93).

In addition, parents and teachers completed the Strengths and Difficulties Questionnaire (SDQ), a widely used brief symptom measure with considerable reliability and clinical validity

(A. Goodman & Goodman, 2009; R. Goodman & Scott, 1999). Analyses focus on the conduct problems scale. In addition, the SDQ has a Psychopathy scale (need help on filling this in; is this the 6-item scale from moran et al JAACAP 2009); items are: ?..... The correlation between the SDQ Psychopathy scale and the APSD CU scale was $r(235) = .81$, $p<.001$. We include in the supplementary analyses section select analyses using this alternative scale to examine the robustness of the pattern of findings on CU.

The Self-Report Delinquency instrument (Mcara, 2005; Smith, 2003) is a widely-used measure assessing adolescent reports of antisocial acts at home (6 questions, e.g., staying out late) and at school (10 questions, e.g., skipping school) plus substance abuse (8 questions). In the current paper we focus on the delinquency volume scale, which provides a broad index of self-reported delinquent acts across setting. Anything to add here???

Observed adolescent-parent interaction quality. Parent and adolescent behaviors in the three interactions were coded using a global observational coding system with an extensive history in family research (Hagan et al., 1992; Hetherington & Clingempeel, 1992; Scott, Briskman, Woolgar, Humayun, & O'Connor, 2011). Specific global codes were warmth/support, communication, assertiveness, involvement, anger/rejection, and coercion. Each dimension was coded on a 5-point Likert scale that best reflected the participant's overall behavior in each interaction task. Reliability of the parent and adolescent ratings was made by two researchers who were trained in the system and were blind to all identifying information and other data. Consistent with prior studies (Hagan et al., 1992), a factor analysis led to two factors: a Warmth/Engagement positive factor comprised warmth/support (reliability by intraclass correlation: parent 0.82, child 0.84), communication (0.81, 0.80), assertiveness (0.92, 0.53) and involvement (0.75, 0.74); an Angry/Irritable negative factor comprised anger (0.75, 0.71) and

coerciveness (0.67, 0.70).

Parenting measures from interview and questionnaire. The Five Minute Speech Sample (FMSS) is a widely-used interview measure of parenting in which parents are asked to discuss the child for 5 minutes (Caspi et al., 2004; Scott et al., 2011). Positive and negative expressions of emotional tone are independently rated. ICC reliability for two coders on 20 interviews was .92 for negative comments and .93 for positive comments; analyses below focus on the ratio of positive to negative comments.

Questionnaire measures of parenting from child and parent self-report were based on the Alabama Parenting Questionnaire, a widely-used measure with demonstrated reliability and validity (P.J. Frick, Christian, & Wootton, 1999). We focused on the subscales that index parenting dimensions most often included in research on children and adolescents with CU traits, specifically, the Poor Monitoring, Inconsistent Discipline and Positive subscales.

Covariates. Psychosocial and socio-demographic covariates included adolescent gender and age, study membership (dummy coded for each of the three samples), child ethnicity (coded minority/non-minority), maternal education (dichotomized according to whether or not the mother left formal school at age 16 years), history of parenting intervention, single-parent status, qualification for free school meals, and family income. We also include adolescent self-reports of depressive symptoms using the Moods and Feelings Questionnaire, a widely used index of depressive symptoms with considerable evidence of reliability and validity (Angold et al., 1995)

Data analysis

We first report descriptive data on the study variables across samples. The first set of analyses to test the sensitivity to parental influence hypothesis examines bivariate associations between CU traits and relationship quality measures across multiple methods; disruptive

behavior is included as a covariate to discern if there are associations particular to CU unconfounded by general conduct problems. The second set of analyses uses a regression model to test the hypothesis that CU traits moderate the associations between parenting and conduct problems. The primary outcome variables are disruptive behavior according to parent and teacher reports and adolescent self-reported delinquency; adolescent gender, age, maternal education, and sample are included as covariates in the regression analyses on an *a priori* basis. For the above analyses, the key observational measure of parenting is the problem-solving interaction because that is the standard observational methodology; we also consider measures of parenting from parent interview and parent- and child-reported questionnaires. For the third, more novel set of analyses to examine the sensitivity to parental influence hypothesis we examine within-individual variability in observed adolescent behavior across the three interaction tasks using repeated measures MANOVA. In this analysis task is a within-subject variable; between-subjects factors include CU traits and the same set of covariates that we used in the regression analyses. A statistical interaction between task and CU traits indicates that CU is differentially associated with observed adolescent behavior across the three interaction contexts. Given the prior clinical research focus on anger, irritable, and dysregulated behavior, we target observed adolescent angry/irritable behavior, but we also report analyses for warmth/engaged positive behavior and for parent behavior. All nalyses testing the hypothesis that adolescents with CU traits may be less or differentially susceptible to caregiving influence are based on the continuous measure of CU; only for descriptive (Table 1) or illustrative (Figure 1) purposes do we report findings using a dichotomized measure of CU.

Results

Of the 271 adolescents included in the study, any observational data were available on 228 (84%). The sample on whom we did not obtain observational data were older (13.23 years [SD=1.96] versus 12.44 years [1.95, $p<.05$]; missing observational data was also more common in the clinic-referred (19.6%) and community (17.6%) samples than the foster care sample (6.5%), $p<.05$. However, absence of observational data was not associated with parent-reported ODD from interview, parent-reported CU symptoms, or parent or teacher reports of conduct problems on the SDQ; neither was missing observational data associated with child ethnicity or key socio-demographic risks such as maternal education.

Sample descriptive data (Table 1) indicate that children all three samples are at high psychosocial risk and exhibit comparatively high rates of clinical disturbance. Differences across study or sample membership were detected for several socio-demographic factors; therefore, study membership is considered as a covariate alongside adolescent age and gender and maternal education. None of the other covariates listed above was reliably associated with outcomes in the analyses below after controlling for study sample, adolescent age and sex, and maternal education.

Are CU traits reliably associated with parenting and parent-child relationship quality?

Table 2 shows the bivariate associations between CU traits and parent-child relationship quality across multiple methods; also provided is the association after controlling for parent-reported conduct problems. Results indicate generally modest effect sizes but consistent associations across multiple methods. Importantly, multiple measures of parent-child relationship quality remain significantly associated with CU traits even after accounting for conduct problems (although the magnitude of effect size is reduced), implying a robust and particular association between parenting measures and CU traits. In Appendix I we provide an

extended correlation matrix between parent-child relationship quality measures and CU and conduct problem scales.

Do CU traits moderate the associations between caregiving and conduct problems?

Table 3 reports results from regression models in which CU is examined as a moderator of the association between parent-child relationship quality and disruptive behavioral problems. Given the extensiveness with which parent-child relationship quality and conduct problems were measured, there are many possible moderation models that could be analyzed. Models results from key measures of disruptive behavior and from alternative measures of parenting are provided in Table 3 (results from all models are available from the authors). After controlling for adolescent gender and gender, maternal education, and sample, there was comparatively little evidence that CU traits moderated the association between parenting and disruptive behavior. Moreover, of the few interactions that were detected, the majority suggested that the association between parenting and disruptive behavior was stronger in adolescents with elevated CU traits. For example, for the model predicting teacher-reported conduct problems, we obtained a significant interaction between observed maternal Warmth/Engaged and Adolescent CU traits ($b = -1.06$, $p<.01$; Table 3). Follow-up analyses using the categorical cut-off for CU traits (for illustrative purposes) indicated that the association between observed maternal Warmth/Engaged behavior and teacher-reported conduct problems was significantly stronger among those high on CU traits ($r(26) = -.39$) than among those low on CU traits ($r(138)$ -.15), controlling for adolescent age, gender, sample, and maternal education. Of the three other significant interactions, only one (predicting adolescent Self-Reported Delinquency from parent-reported Poor Monitoring, Table 3) indicated that the association between parenting and adolescent behavioral adjustment was significantly weaker in individuals with high ($r(36) = .19$) versus low

(r(174) =.27) CU traits, after controlling for adolescent age, gender, sample, and maternal education. That is, only four interactions were detected, and in three of these the association between parenting and adolescent behavioral adjustment was stronger among those adolescents with elevated CU traits.

Do adolescents with elevated CU traits show sensitivity to parent-child interaction context?

Appendix II displays correlations between parent and adolescent behavior across the three interaction tasks. Table 4 displays the means (SD) in adolescent and parent behavior across the three interaction tasks, from which effect sizes may be derived. For adolescents, there was a significant within-subjects or task effect on Angry/Irritable behavior ($F(2,218)=51.00, p<.001$); means (SD) across the three settings indicate that Angry/Irritable behavior was significantly greater in the problem-solving task than the planning task ($t(221)=7.80$, $p<.001$) and puzzle task ($t(221)=10.24$, $p<.001$), which did not differ from each other ($t(221)=1.65$, $p<.01$). The tendency for the problem-solving interaction to evoke more angry/irritable behavior from adolescents was notable: the effect size difference in adolescent angry/irritable behavior between the problem-solving and planning task was nearly ¾ of a standard deviation (.72). In contrast, there was not a task effect on observer-rated adolescent Warmth/Engagement behavior across task ($F(2,218)=.33$).

A novel approach to testing the sensitivity hypothesis is to examine if adolescents with elevated CU traits also show variability in their behavior across parent-adolescent interaction task which vary in challenge or interpersonal "press." For this analysis, we extended the repeated measures analysis of variance model to include CU traits as a between-subjects predictor of observed adolescent behavior; also included as covariates were adolescent gender and age, maternal education, and sample. For adolescent Angry/Irritable behavior, results

indicated a significant main effect of CU ($F(1,189) = 5.17$, $p<.05$), which was qualified by a CU X task interaction ($F(2,188) = 4.28$, $p<.05$). The interaction indicated that the association between CU and adolescent Angry/Irritable behavior was most notable in the problem-solving task. This is illustrated in two ways. First, Figure 1 displays the means in adolescent Angry/Irritable behavior across task according to CU (a dichotomous score of CU based on a cut-off score of 7 on the CU scale from the APSD is used for illustrative purposes). The difference between high CU and low CU adolescents in angry/irritable behavior was substantially greater in the problem-solving interaction. Thus, the effect sizes (difference in means/pooled SD) were .36 in the problem-solving task, .18 in the planning task, and .08 in the puzzle task. Alternatively, the correlation between CU traits (as a continuous measure) and adolescent Angry/Irritable behavior was significantly stronger in the problem-solving task ($r= .23$, $p<.01$) than the planning ($r = .08$, ns) or puzzle ($r = .06$, ns) tasks controlling for covariates; the difference in correlations was statistically significant using Meng et al.'s (Meng, Rosenthal, & Rubin, 1992) method for comparing dependent correlations. This within-subjects or cross-task effect was particular to adolescent Angry/Irritable behavior. For adolescent Warmth/Engaged behavior there was not a significant CU X task interaction ($F(2,188) = .53$, ns). There was a main effect of CU traits on adolescent Warmth/Engaged behavior ($F(1,189) = 7.87$, $p<.01$), indicating that adolescents with CU traits did display less Warmth/Engaged behavior with the parent – to an equal extend across all interaction tasks.

The observation that CU traits were associated with greater within-person or cross-setting variation in Angry/Irritable behavior was particular to the adolescent and was not found in parents. That is, for parent behavior, there was neither a significant main effect of CU nor a CU X task interaction for maternal Angry/Irritable behavior or Warmth/Engaged behavior. Maternal

behavior varied across task, but this variation was unrelated to adolescent CU traits. Specifically, an overall repeated measures effect for Angry/Irritable behavior ($F(2,218) = 20.51$, $p<.001$) was accounted for by greater Angry/Irritable behavior in the problem-solving task than in the Planning task ($t(221) = 3.86$, $p<.001$) and in the Puzzle task ($t(225) = 6.13$, $p<.001$), which did not differ from each other ($t(221) = 1.53$). Maternal Warmth/Engaged behavior did differ across task ($F(2,218) = 71.93$, $p<.001$): mothers were rated as more warm/engaged in the Problem-Solving task than in the Planning task ($t(225) = 5.09$, $p<.001$) and Puzzle task ($t(221) = 12.14$, $p<.001$); levels of Warmth/Engagement were also higher in the Planning task than in the Puzzle task ($t(221) = 7.82$, $p<.001$).

Supplementary analyses

We did not observe that the findings reported above were substantively different across the three samples of adolescents, i.e., we did not obtain evidence that study membership moderated the findings reported above. Neither did we find that adolescent gender reliably moderated the above findings.

A second series of analyses were undertaken to examine the robustness of the findings on CU. We focus these analyses on the repeated measures analyses assessing adolescent behavior across the three interaction settings because this is the most novel contribution of this research. First, we re-ran the repeated measures analyses with CU from the APSD scale including adolescent self-reported depressive symptoms on the MFQ to test if the emotional regulation indexed by depression accounted for the CU effect on adolescent angry/irritable behavior. It did not. The CU x task interaction in the repeated measures MANOVA was unchanged; and depressive symptoms was not a significant main effect and there was not a significant interaction between depressive symptoms and task in predicting adolescent angry/irritable behavior.

Second, we re-ran all analyses using the total score of the APSD, which provides a broader measure of psychopathy. The findings mirrored those using the more specific CU scale. Specifically, for adolescent Angry/Irritable behavior, the main effect of total scale APSD was qualified by a APSD X task interaction ($F(2,188) = 4.05$, $p<.01$). (Findings using the regression analyses using the APSD total scale were also comparable to the findings reported above using the more narrow CU scale; details available from the authors.)

Third, as further test of the robustness of the CU effect, we re-ran the models above using the alternative measure of CU from SDQ need guidance here. For this alternative measure of CU, repeated measures analyses (using the same covariates in the analyses of the APSD CU scale) indicated an interaction between SDQ CU symptoms and task, ($F(2,190) = 3.58$, $p<.05$). Follow-up correlation analyses indicated that adolescent SDQ CU traits were significantly associated with Angry/Irritable behavior in the problem-solving task ($r= .23$, $p<.01$) but not in the planning ($r = .10$, ns) or puzzle ($r = .12$, ns) tasks after controlling for covariates. And, as with the APSD CU scale, we found no evidence that the association between SDQ CU traits and adolescent Warmth/Engagement or parent behavior varied across task.

Discussion

There is considerable clinical and theoretical interest in the possibility that a subset of children and adolescents may be comparatively unresponsive to parenting influences. CU has been proposed as one feature that may distinguish these individuals. The current paper provided multiple tests of that hypothesis in an adolescent sample enriched for CU traits. We found little support for the hypothesis that adolescents with CU traits would be less responsive to caregiving

than adolescents without CU traits: a) reliable associations between CU traits and caregiving were found across multiple methods; b) moderation analyses indicated that adolescents with CU traits were not less but perhaps more sensitive to caregiving influences; and, most notably, c) adolescents with CU traits exhibited greater reactivity or within-individual variability in angry/irritable behavior across interaction tasks, with elevations most notable in the high conflict problem-solving interaction.

Before discussing the implications of the study, we first note several limitations. First, the study was composed of cross-sectional data from three pooled samples of adolescents; it is not clear how well these findings may generalize to other samples. Second, we did not have specific affective, cognitive or physiological markers of CU or age of onset, which may be an important subtyping factor (Hyde, Burt, Shaw, Donnellan, & Forbes, 2015). Another limitation is that we did not analyze specific speech content of the interactions so that, for example, we are unable to determine if the comparatively greater anger/irritability in the problem-solving task among adolescents with CU was accompanied by more or less emotional language. Also, although there is considerable validity data supporting the use of even brief observational assessments (including results from the current study), child behavior assessed from the three assessment settings used in this study can provide only a partial picture of child behavioral functioning. Finally, outcomes other than conduct problems might be moderated by adolescent CU traits; our focus on conduct problems reflects the focus in virtually all of the previous studies (although we note that analyses of other measures of adjustment, e.g., peer relationship quality, yielded no robust evidence of a CU moderation effect; details available from the authors). Set against these limitations are several strengths of the study, including detailed observational methods using multiple interaction settings, clinical diagnostic interviews, parent and teacher

reports of disruptive behavior, a sample enriched for disruptive behavior and CU traits, and replication across alternative measures of CU traits.

Across the whole sample, the problem-solving interaction was more likely to elicit angry/irritable behavior in adolescents. But the most novel finding in this study was that the problem-solving interaction was significantly more likely to elicit angry/irritable behavior in adolescents with elevated CU traits. That is, rather than appear (more) disengaged or unresponsive to the interaction setting that most closely approximated a parenting task, adolescent with elevated CU traits were instead more angry and irritable than were adolescents low on CU traits. There are several possible explanations for this. It may be that deficits in recognizing fear and empathy in adolescents with CU traits resulted in greater anger/irritability in the problem-solving setting because of the increased frustration resulting from negotiating and resolving a problem. Related to this explanation is the finding of increased frustration-induced reactive aggression in individuals with CU (Blair, Peschardt, Budhani, Mitchell, & Pine, 2006). Alternatively, it may be that the problem-solving interaction was particularly effective at evoking proactive, strategic anger in CU adolescents in order to shape the direction of the problem-solving discussion. Whether or not the dyads in which the adolescent had elevated CU traits were less successful in resolving the nominated problems is not clear. Notably, adolescents with elevated CU traits did not elicit significantly more anger/irritability or less warmth/engagement from parents in the problem-solving setting, suggesting that parents of CU adolescents did not find the problem-solving interaction significantly more aversive than parents of non-CU adolescents.

Neurocognitive features of individuals with elevated CU traits are often interpreted to suggest a broad-based, generalized behavioral disturbance. What we found was that adolescents

with elevated CU traits were instead significantly more sensitive to situational demands and changing contexts; that is, the disturbance, in terms of angry/irritable behavior, was context-sensitive. This observation, which was replicated across measures of CU and the broader construct of psychopathy, underscores the need to consider social and interactional context in developing models for understanding and testing behavioral disturbance and for more routinely incorporating context in clinical assessment – even where the disturbance is presumed to display trait-like stability. An example of variation in behavioral symptoms across assessment context has been offered by Wakschlag and colleagues for conduct disorder (Wakschlag et al., 2008); they found that problems in behavioral regulation in interactions with busy examiner were more predictive of disruptive behavior 1 year later than behavior in alternative observational settings. Another example was provided by Klein and colleagues, who found that intra-individual variability in response best differentiated ADHD from non-clinic youths (Klein, Wendling, Huettner, Ruder, & Peper, 2006).

The finding that adolescents with elevated CU traits exhibited comparatively greater variability across task – implying greater sensitivity to parenting and interaction context – is consistent with correlation analyses showing that CU traits were robustly associated with parenting measures across a range of methods and regression analyses suggesting that adolescents with CU traits may be more sensitive to parenting influence (although there was a general lack of CU traits moderating the association between parenting and adolescent disruptive behavior). These findings are, however, contrary to some prior studies. Perhaps the strongest contrast to previous studies is that we found no consistent evidence that CU traits moderated the association between parental discipline and conduct problems. There may be methodological factors that may have biased some prior reports, e.g., such as those in which parents provided

information on parenting and child outcomes and CU traits. Many prior studies were also conducted on younger children. On the other hand, some of the moderation effects detected in this study are consistent with the literature. Specifically, consistent with (Pasalich et al., 2011), we found that adolescents with elevated CU traits were more sensitive to the protective effects of parental warmth/engagement as rated by observers in relation to teacher-rated conduct problems (Table 3).

Quite how these observational findings fit with the substantial set of neuropsychological findings is not yet clear. On one hand, reviews of the neurocognitive and affective responses in individuals with CU (Dawel, O'Kearney, McKone, & Palermo, 2012; Herpers, Scheepers, Bons, Buitelaar, & Rommelse, 2014) indicate that the most reliable deficits are in response to and processing of fear and sadness; evidence of other disturbances has been reported but seem less robust. In contrast, the affective challenges in the parent-child problem-solving task tend not to elicit these affects but rather anger and frustration, and particularly the regulation of those emotions – that it why this paradigm has been so central to developmental and clinical studies of disruptive behavior for decades, e.g., (Patterson, 1982). Adolescent behavioral and brain responses to a dynamic, problem-solving task with the parent may not be expected to mimic the kinds of deficits observed in imaging or neurophysiological paradigms used to date. The implication is that findings from imaging and neuropsychological assessments offer only a partial guide for behavioral and brain reactions in intimate interpersonal contexts.

Research suggests that there may be several kinds of factors, some of which may be connected to CU, that may moderate the association between parenting and child adjustment. For example, Kochanska (Kochanska, 1991) found that children's fearfulness moderated the impact of maternal socialization practices in predicting self-regulation and conscience

development. Other studies suggest that there may be genetic or temperamental characteristics influencing sensitivity to socializing contexts (Belsky & Pluess, 2009). And, child characteristics that predict variation in response to psychological intervention are now regularly reported (Cleveland et al., 2015; Scott & O'Connor, 2012; van Ijzendoorn & Bakermans-Kranenburg, 2015). Collectively, these studies underscore the value in identifying traits that moderate parenting influence beyond CU traits in order to contribute to a broader debate about susceptibility to environmental context (Ellis, Boyce, Belsky, Bakermans-Kranenburg, & van Ijzendoorn, 2011).

Applications

The matter of cross-informant and cross-context discrepancies in child and adolescent behavior has received extensive research attention (De Los Reyes, Henry, Tolan, & Wakschlag, 2009). Particular emphasis has been on parent and teacher reports of child and adolescent behavioral and emotional problems (Achenbach, McConaughy, & Howell, 1987), but there are many other examples, such as variability in children's behavior across different family constellations (Deal, Hagan, Bass, Hetherington, & Clingempeel, 1999; Smetana, Abernethy, & Harris, 2000; Stroud, Meyers, Wilson, & Durbin, 2014). One common approach to managing this within-individual variation in behavior is to aggregate behavior across settings to construct a more reliable index of behavior. That supposes that the behaviors across contexts are equally informative; this may not be so. Disruptive behavior, in particular, shows considerable variability across setting and time (Achenbach et al., 1987; Dirks, De Los Reyes, Briggs-Gowan, Cella, & Wakschlag, 2012); this can be experimentally elicited with clinical observational assessment (De Los Reyes et al., 2009).

Findings from the current study imply that behavior in the problem-solving conflict task may be most informative for distinguishing adolescents with CU traits. Other studies have also shown that (the same) behavior may carry a different clinical meaning according to the context in which it is assessed. For example, in their study of children with ADHD, Barkley et al (Barkley, 1989) reported that differences between clinic and non-clinic groups are more evident in structured settings; Webster-Stratton found correspondence in conduct problems at home and clinic to be strongest for unstructured settings (Webster-Stratton, 1985); furthermore, a recent parenting RCT demonstrated that improvements in some behavioral aspects of parenting were more apparent in less structured than more structured tasks (O'Connor, Matias, Futh, Tantam, & Scott, 2013). Problems in applying analogue behavior observations to clinical practice have been discussed for some time (Mash & Foster, 2001). Research that assesses variability in behavior across different contexts and with varying demands provides useful directions for improving the evidence-based (observational) assessment methods and for illuminating social mechanisms of behavioral disturbance.

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Table 1. Sample characteristics: Means (SD) or percentages (n) across sample.

	Total	Clinic-referred	High-risk community	Foster	F/Chi-square (df)
	n=271	n=107	n=102	n=62	
Child age	12.56 (1.97)	13.26 (1.81)[a]	11.04 (.89)[b]	13.86 (1.95)[a]	79.95 (2,268)***
Child gender (male)	68% (184)	76% (81)[a]	69% (70)[a,b]	53% (33)[b]	8.93 (2)*
Maternal education§	40% (109)	53% (52)[a]	37% (37)[b]	32% (20)[b]	7.95 (2)*
Minority status	34% (86)	17% (16)[a]	41% (101)[b]	47% (29)[b]	19.75 (2)***
Single-parent status	34% (92)	42% (45)	29% (30)	27% (17)	5.22 (2)
ODD diagnosis	17% (44)	27% (28)[a]	10% (10)[b]	10% (6)[b]	12.43 (2)**
APSD CU	4.26 (2.46)	5.36 (2.42)[a]	2.82 (1.97)[c]	4.46 (2.02)[b]	31.49 (2,232)***
APSD CU 7%	19%	30%	7.1%	15%	18.09 (2)***

Note: The F/chi-square tests the hypothesis that the variable is not significantly different across the three samples. Means or percentiles not sharing a superscript are significantly different from each other at $p<.05$ in post hoc analyses using Bonferroni correction. § percent (n) who left school by age 16 years. Three of the above measures had missing data: for ODD, n=262; for APSD, n=235; for mother-reported minority status, n=257. * $p<.05$, ** $p<.01$, *** $p<.001$.

Table 2. Associations between Parent-Child Relationship Measures and Adolescent CU Traits

	CU Traits	
	r	Adjusted[a]
Observational data		
Parent behavior		
Angry/Irritable	.12	.13
Warmth/Engaged	-.11	-.03
Adolescent behavior		
Angry/Irritable	.28***	.19**
Warmth/Engaged	-.22**	-.16*
Parent Interview		
Positive comments	-.38***	-.19**
Negative comments	.40***	.15*
Pos/Neg ratio	-.41***	-.23***
Questionnaire		
Adolescent report		
Poor monitoring	.24***	.12
Inconsistent discipline	.16*	.07
Positive parenting	-.16*	-.14*
Parent report		
Poor monitoring	.31***	.11
Inconsistent discipline	.19**	-.05
Positive parenting	-.22***	-.27***

Note: [a] controlling for parent reported conduct problems on the SDQ. * p<.05, ** p<.01, *** p<.001.

Table 3. Regression Analyses Testing CU Moderation of Parent-Child Relationship Measures on Conduct Problems

	Parent SDQ conduct		Parent CAPA ODD symptoms		Teacher SDQ conduct		Adolescent SRD	
	B SE	b	B SE	b	B SE	b	B SE	b
Observational data								
Maternal behavior								
1. Warmth/Engaged	.00 (.34)	.00	-.03 (.30)	-.01	.49 (.42)	.15	-.58 (2.47)	-.03
Adolescent CU traits	.75 (.29)	.78*	.61 (.25)	.80	1.24 (.34)	1.34***	-1.67 (2.09)	-.30
Interaction	-.05 (.07)	-.21	-.08 (.07)	-.42	-.25 (.09)	-1.06**	.39 (.54)	.28
2. Angry/Irritable	-.40 (.44)	-.12	-.08 (.39)	-.03	-.08 (.57)	-.02	1.34 (3.13)	.08
Adolescent CU traits	.48 (.13)	.50***	.29 (.12)	.38*	.12 (.17)	.13	.50 (.95)	.09
Interaction	.06 (.09)	.13	.02 (.08)	.04	.12 (.11)	.26	-.49 (.60)	-.20
Questionnaire: parent report								
3. Poor monitoring	.08 (.05)	.22	.03 (.05)	.10	.02 (.06)	.06	1.35 (.33)	.66***
Adolescent CU traits	.46 (.10)	.49***	.36 (.10)	.46***	-.09 (.14)	-.10	1.04 (.75)	.20
Interaction	.00 (.01)	.06	.00 (.01)	-.10	.02 (.01)	.49*	-.14 (.06)	-.54*

4. Positive parenting	.10 (.08)	.14	-.02 (.07)	-.03	.15 (.10)	.23	.24 (.54)	.07
Adolescent CU traits	.66 (.29)	.70*	.02 (.26)	.02	.54 (.36)	.58	.64 (1.91)	.13
Interaction	-.01 (.01)	-.10	.02 (.01)	.42	-.01 (.02)	-.25	-.54 (.10)	-.18
Adolescent Questionnaire								
5. Poor monitoring	.00 (.04)	.00	-.01 (.04)	-.03	.02 (.05)	.07	.62 (.27)	.34*
Adolescent CU traits	.42 (.09)	.44***	.25 (.08)	.33**	.25 (.11)	.27*	.48 (.66)	.09
Interaction	.01 (.01)	.21	.01 (.01)	.13	.00 (.01)	.03	-.08 (.05)	-.29
6. Positive parenting	.03 (.06)	.05	-.05 (.05)	-.13	.04 (.07)	.07	-.56 (.42)	-.20
Adolescent CU traits	.61 (.20)	.65**	.16 (.18)	.20	.23 (.25)	.25	-1.81 (1.42)	-.34
Interaction	.00 (.01)	-.08	.01 (.01)	.23	.00 (.01)	.06	.10 (.08)	.32
Maternal Interview								
7. FMSS Positive/Negative	-.09 (.07)	-.11	-.01 (.06)	-.02	.07 (.10)	.07	-.58 (.45)	-.14
Adolescent CU traits	.54 (.08)	.56***	.39 (.07)	.48***	.32 (.10)	.32**	-.70 (.50)	-.14
Interaction	-.03 (.02)	-.11	-.06 (.02)	-.24**	-.06 (.03)	-.19	.21 (.14)	.15

Note: Results from 7 separate regression models for four outcome measures of adolescent conduct/disruptive according to parent, teacher and adolescent self-report; estimates are reported for only the measure of parenting, adolescent CU traits, and the interaction from each model. Models control for child age and gender, sample, and parent education. FMSS Positive/Negative is the ratio of positive to negative comments on the five minute speech sample. * $p<.05$, ** $p<.01$, *** $p<.001$.

Table 4. Means (SD) of Adolescent and Parent Behavior Across Interaction Tasks

	Planning	Problem-Solving	Puzzle	F(2,218)	p
Child Warmth/Engaged	2.86 (.81)	2.82 (.89)	2.85 (.71)	.33	.72
Child Angry/Irritable	1.27 (.59)[a]	1.82 (.93)[b]	1.34 (.63)[a]	51.00	<.001
Mother Warmth/Engaged	3.60 (.73)[a]	3.80 (.74)[b]	3.22 (.78)[c]	71.93	<.001
Mother Angry/Irritable	1.20 (.55)[a]	1.49 (.79)[b]	1.27 (.60)[a]	20.51	<.001

Note: Means not sharing a superscript are significantly different from each other at $p<.05$.

Appendix I. Correlations Between Parent-Child Relationship Measures and Conduct Problems and CU Traits

	CU	Parent Reported Conduct	ODD	Teacher Reported Conduct	Adolescent Reported Delinquency
Observational data					
Parent behavior					
Angry/Irritable	.12+	.03	.00	.22**	-.03
Warmth/Engaged	-.11	-.13+	-.10	-.24***	.20
Adolescent behavior					
Angry/Irritable	.28***	.21***	.25***	.28***	.04
Warmth/Engaged	-.22**	-.14+	-.14*	-.22**	-.03
Parent Interview					
Positive/Negative					
Comment Ratio	-.41***	-.39***	-.34***	-.17*	-.08
Questionnaire					
Adolescent report					
Poor monitoring	.24***	.26***	.12	.20**	.24***
Inconsistent discipline	.16*	.17*	.08	.06	.11+
Positive parenting	-.16*	-.08	-.07	.01	-.10
Parent report					
Poor monitoring	.31***	.37***	.14*	.28***	.31***
Inconsistent discipline	.19**	.37***	.36***	.15*	.10
Positive parenting	-.22***	-.03	.05	.06	-.02

Note: + p<.10, * p<.05, ** p<.01, *** p<.001.

Appendix II. Correlations Between Adolescent and Parent Behavior Across Tasks

	1	2	3	4	5	6	7	8	9	10	11	12
Child Behavior												
1. Angry/Irritable Planning	1.0											
2. Angry/Irritable Problem-Solving	.51	1.0										
3. Angry/Irritable Puzzle	.39	.37	1.0									
4. Warmth Planning	-.38	-.24	-.08	1.0								
5. Warmth Problem-Solving	-.31	-.38	-.18	.67	1.0							
6. Warmth Puzzle	-.35	-.31	-.35	.51	.59	1.0						
Parent behavior												
7. Angry/Irritable Planning	.14	.04	.07	-.01	-.04	-.05	1.0					
8. Angry/Irritable Problem-Solving	.01	.28	.05	.02	-.10	-.07	.54	1.0				
9. Angry/Irritable Puzzle	.00	-.02	.19	.05	-.04	-.16	.47	.31	1.0			
10. Warmth Planning	-.08	-.02	.06	.45	.42	.37	-.30	-.20	-.14	1.0		
11 Warmth Problem-Solving	-.11	-.15	-.05	.37	.49	.42	-.33	-.48	-.26	.68	1.0	
12. Warmth Puzzle	-.19	-.12	-.23	.26	.29	.54	-.20	-.26	-.29	.55	.57	1.0

Note: Correlations ≥ +/- .23 are significant at p<.001; correlations ≥ +/- .18 are significant at p<.01; correlations ≥ +/- .14 are significant at p<.01.

Figure 1. Adolescent Angry/Irritable Behavior Across Task According to CU