ARTICLE PREPRINT

Are Callous-Unemotional Traits Associated with Differential Response to Reward Versus
Punishment Components of Parent-Training? A Randomized Trial

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Abstract

Relatively poor treatment outcomes have been reported for children with conduct problems and high levels of callous-unemotional (CU) traits (e.g., a lack of guilt, a lack of empathy, shallow affect), yet the mechanisms underlying this effect are poorly understood. Recently, growing evidence of aberrant reward/punishment processing in children with CU traits has suggested that punishment-based parenting strategies may be less effective among children with high levels of CU traits. Using a randomized controlled trial (RCT) design we conducted an experimental test of whether CU traits are associated with differential response to reward versus punishment components of evidence-based parent-training interventions for conduct problems. Parents of children ($n = 74$) aged 3 to 8 years were randomized to either five weeks of reward-based or five weeks of punishment-based parenting strategies, after which time each received the alternative intervention. Contrary to predictions, neither type nor dosage of parent training strategies was found to moderate the relation between CU traits and treatment response. Implications for the treatment of conduct problems in children with high levels of CU traits, and research into mechanisms of behavior change, are discussed.

Keywords: callous-unemotional traits, behavioral parent training, disruptive behavior, parenting, conduct problems

Introduction

Children with persistent conduct problems are among the most common referrals to child and adolescent mental health services, and are at high risk for a range of adverse outcomes later in life (Erskine et al., 2013; Kim-Cohen, et al., 2003; Romeo, Knapp & Scott, 2006). Models of conduct problems have evolved considerably in recent years, as increasing evidence indicates that these children may follow risk pathways that diverge markedly from one another (Klahr & Burt, 2014; Rowe, Costello, Angold, Copeland, & Mauhan, 2010). One particularly influential approach to conceptualizing this heterogeneity is based on the subtyping of children with conduct problems into those with high versus low levels of callous-unemotional (CU) traits. Indeed, it is this model that forms the basis for the most significant revisions to the diagnostic criteria for disruptive behavior disorders in recent years (Frick, Ray, Thornton, & Kahn, 2014). Theoretically, the core features by which CU traits have been defined (e.g., a lack of guilt, a lack of empathy, and shallow affect) correspond to the affective component of psychopathy, although the extent to which childhood CU traits predict adult psychopathy has been subject to limited research (Hawes, Byrd, Waller, Lynam & Pardini, 2017). Nonetheless, among children and adolescents with conduct problems, those with high levels of CU traits exhibit a particularly severe and chronic trajectory of antisocial behavior, beginning early in life (Longman, Hawes, & Kohlhoff, 2016).

The importance of CU traits has also been emphasized in the clinical literature concerning poor treatment response. Parenting interventions based on social learning theory conceptualizations of family risk processes have proven to be highly effective, particularly in early-to-middle childhood (Comer, Chow, Chan, Cooper-Vince & Wilson, 2013; Eyberg, Nelson, & Boggs, 2008; Michelson, Davenport, Dretzke, Barlow & Day, 2013). However, there is now considerable evidence that children and adolescents with high levels of CU traits benefit less, on average, from such interventions than do their low-CU peers. In a recent

review of treatment outcome research involving parent-training components, CU traits were found to either predict or moderate outcomes in 9 out of 11 studies (Hawes, Price & Dadds, 2014). Importantly, findings do not suggest that children with CU traits are untreatable, but rather that the outcomes seen for these children typically fall short of the typical gains achieved with evidence-based interventions. For example, Hawes, Dadds, Brennan, Rhodes, and Cauchi (2013) found that while children with high levels of CU traits were twice as likely as low-CU children to retain diagnosable levels of Oppositional Defiant Disorder (ODD) six months following parent training, most high-CU children nonetheless shifted out of the diagnostic range. Such conclusions are consistent with broader reviews of the literature that have included older children and services delivered in forensic settings. For example, Frick et al. (2014) identified 20 studies that compared clinical or forensic outcomes of youths with conduct problems with and without elevated levels of CU traits, 18 (90%) of which reported that youths with high levels of CU traits showed poorer outcomes than did those without high levels.

Theoretical explanations for this reduced response to existing treatments, and recommendations for improving treatment outcomes for this putative subgroup, have focused largely on neurocognitive evidence that the development of children with high levels of CU traits may be shaped by somewhat unique risk processes (Herpers, Scheepers, Bons, Buitelaar, & Rommelse, 2014; Wilkinson, Waller, & Viding, 2016). Evidence regarding reward and/or punishment processing has been particularly influential in this regard. A recent review of this evidence by Byrd, Loeber, and Pardini (2014) concluded that children and adolescents with high levels of CU traits appear to be characterized by punishment insensitivity and difficulties suspending reward-seeking behaviors when faced with a high probability of punishment. At the same time, however, they highlighted that research into such effects remains limited, and that findings have often been mixed. For example, the

extent to which responsiveness to reward is associated with CU traits (Veroude et al., 2016) or conduct problems more broadly (Murray et al., 2017) is somewhat unclear. Additionally, while multiple studies have found the limit-setting procedure of time-out to be less effective for children with high versus low levels of CU traits (e.g., Hawes & Dadds, 2005; Haas et al., 2011), it remains unclear whether high-CU children respond to the procedure with under-arousal (Hawes & Dadds, 2005) or over-arousal (Haas et al., 2011).

Findings of such deficits have been demonstrated using paradigms based on behavioral risk-taking (e.g., Blair, Colledge, & Mitchell, 2001; Fairchild et al., 2009), psychophysiological responsiveness to cues of impending punishment (e.g., Fung et al., 2005), and passive avoidance learning (e.g., Vitale et al., 2005). Similarly, an fMRI study of youth with ODD/CD found that those with CU traits exhibited dysfunction in regions of the ventromedial prefrontal cortex associated with reinforcement processing, when engaging in behavior that was previously rewarded but then punished (Finger et al., 2008).

Such evidence has focused growing attention on the components of evidence-based behavioral parent-training programs, which target reinforcement and punishment to varying degrees. Parenting interventions typically commence with a reward-focused (*reinforcement-based*) skills-training component to increase parental positive reinforcement of desirable child behavior, followed by a discipline-focused (*punishment-based*) component in which parents are trained to use immediate, consistent, non-forceful consequences (e.g., time-out) to set limits on negative behavior (see Kaminski et al., 2008). Based on theories of reward-dominance/punishment insensitivity in children with CU traits, researchers have begun to investigate how children with conduct problems and CU traits respond to specific parent-training components. Hawes and Dadds (2005) found the level of CU traits to be negatively associated with expressions of negative affect among clinic-referred boys disciplined with time-out, and with parent ratings of the effectiveness of time-out. Conversely, boys with

higher levels of CU traits were found to be just as responsive to positive reinforcement strategies as those with lower levels of CU traits. Kimonis, Bagner, Linares, Blake, and Rodriguez (2013) reported somewhat analogous findings when examining mid-treatment measures of conduct problems collected immediately following the completion of an initial reward-based parenting component, versus those collected following the completion of a second discipline-focused component. CU traits were not associated with conduct problems following the reward-based parenting component, but *were* upon completion of the discipline component.

The above findings have lent support to the thesis that aberrant processing of punishment cues among children with CU traits interferes with their response to the core limit-setting components of social learning based interventions for conduct problems. Furthermore, this perspective has been influential in informing novel interventions aimed at better targeting the unique reward/punishment processing of children with CU traits. These interventions have involved a decreased emphasis on punishment for misbehavior, and enhanced reward-based strategies for increasing positive reinforcement and positive parenting (Frederickson, Jones, Warren, Deakes, & Allen, 2013; Kimonis & Armstrong, 2012; Miller et al., 2014). Although RCT evidence is not yet available for these programs, pilot studies have been promising. In the most carefully controlled such study, Miller et al. (2014) compared four variations of a behavioral summer camp program comprising a standard behavioral intervention, a modified “low punishment” intervention, a modified “high-reward” intervention, and a condition that combined these modified interventions. Using a single-case design involving children ($N = 11$) with conduct problems and high levels of CU traits, partial support was found for the hypothesis that these children would demonstrate less negative behavior while receiving the modified programs relative to standard treatment (Miller et al., 2014).

In summary, neurocognitive evidence of aberrant reward/punishment processing in children with CU traits has offered an appealing account for the poor treatment outcomes often seen in these children. However, direct tests of this account remain extremely limited. With respect to parent-training interventions, this has been restricted to case-study research (Kimonis & Armstrong, 2012) and correlational data in a non-randomized trial (Hawes & Dadds, 2005). We are aware of no studies in which an experimental (RCT) design has tested whether CU traits are associated with differential response to the specific reinforcement versus punishment components that are core to evidence-based parent-training interventions for conduct problems.

The aim of the present study was to examine whether children with CU traits are more responsive to parenting strategies based on positive reinforcement than those based on punishment contingencies. Families of 3- to 8-year-old children were randomized to two parent-training conditions that varied the order of 5-week punishment-focused and reward-focused modules. One condition (Reinforcement First) began with five weeks of reinforcement strategies and ended with five weeks of punishment strategies and the other condition (Punishment First) reversed that order. Three questions were posed concerning how CU traits predict children's responses to the two parent-training module orders.

Question 1: Do children with high versus low levels of CU traits respond differentially to the punishment-based component of behavioral parent training in the short term? To answer this question, we examined CU traits as moderators of treatment effects (i.e., change in conduct problems; CPs) indexed immediately following either five weeks of punishment-based treatment strategies or reward-based treatment strategies. It was hypothesized that high-CU children would show less improvement in their conduct problems following five weeks of punishment-based strategies than following five weeks of reinforcement-based strategies, whereas low-CU children would respond comparably to both.

Question 2: Do children with high levels of CU traits show greater overall change in CPs following a course of parent training that involves a higher dose of punishment than reinforcement, than one involving a higher dose of reinforcement than punishment? Given that the first component of treatment (either reinforcement or punishment-based depending on randomization) continued to be implemented following the introduction of the second, this meant that participants were essentially randomized to either a condition that involved 10 weeks of punishment-based strategies and five weeks of concurrent reward-based strategies, or 10 weeks of reward-based strategies and five weeks of punishment-based strategies. As such, we examined this question by testing whether CU traits moderated associations between treatment condition and post-treatment change in CPs. It was hypothesized that high-CU children would show less change in CP following the high-punishment dose treatment condition than the high-reward dose condition, whereas low CU children would not differ between these conditions.

Question 3: Do children with high levels of CU traits show greater symptom rebound (i.e., increases in CPs following intervention termination) following a high punishment dose of parent training than a high-reinforcement dose? This question builds on the previous question by examining change across a longer time scale. It was hypothesized that high-CU children would show better maintained treatment gains following a high-reinforcement dose of parent training than a high-punishment dose, whereas low CU children would show comparable symptom rebound across these conditions.

Method

Participants

Participants for this study were recruited from New York City public schools and through the website of a large New York City hospital at which the parent-training sessions were held. To be included in this study, parents had to have a child between the ages of 3 and

8 and agree with the statement, “I am having trouble handling my child’s behavior.” There were no diagnostic exclusions and no clinical cutoffs for level of conduct problems.

As shown in Figure 1, 74 families participated in the present study. Fifty families had one parent who participated, while 24 families had two parents who participated. Child/family was the unit of analysis ($N = 74$; 47 boys and 27 girls). Dual-reporter averages of child behavior scores were computed for children with two participating parents. The mean child age was 5.71 years ($SD = 1.49$). With respect to ethnicity, 10 children (14%) were identified as Hispanic or Latino, 3 (4%) as Asian, 8 (11%) as Black or African American, 44 (59%) as White, 6 (8%) as Other, and 3 (4%) children’s ethnicities were not reported. Seventy-six percent of parents were married and cohabiting and 4% were unmarried but cohabitating; the remaining parents were single/never married (9%), divorced (7%), separated (3%), or widowed (1%). The mean parent age was 43.13 years ($SD = 6.71$); 88% had obtained a college degree. The median annual household income range was \$100,000-149,999, which, per the 2012 Statistical Abstract, published by the U.S. Census Bureau to define social and economic conditions in the United States, is considered middle class for New York City families with children and two working adults (Statistical Abstract, 2012).

Procedure

Interested parents were called by the first author to verify that they had a child between the age of 3 and 8, were having trouble handling their child’s behavior, could pay the reduced fee for parent-training sessions (\$40 per family for each training session), and were available during the next scheduled parent-training group series. Eligible parents were asked to complete pre-treatment (week 0), mid-treatment (week 5), post-treatment (week 10), and follow-up (week 34) questionnaire assessments. All assessments were completed at the hospital in the presence of the first author. After completing the pre-treatment assessments (at which time parents did not know to what condition they had been assigned), parents in this

cross-over design were informed of their random assignment to one of two groups: Reinforcement First ($n = 41$; coded 1 for data analysis) and Punishment First ($n = 33$; coded 2). Treatment began about two weeks after parents completed the pre-treatment assessment. A block randomization procedure was employed such that once the first ten parents completed pretest measures, a coin was flipped to determine whether that first group would receive the Reinforcement First or the Punishment First treatment. At that point, the first group was closed to new parents and the second set of approximately ten parents was assembled and received the opposite sequence from the first group. This process of alternating between Reinforcement first and Punishment first was continued for the duration of the study. Groups did not always begin with ten parents due to slow recruitment periods (e.g. December holidays), which resulted in unequal sample sizes. Each parent was paid \$30 each time they completed one of the four assessments.

Intervention. Both groups of parents participated in 10 weeks of group parent training using the *Incredible Years* BASIC Parent Training Program (Webster-Stratton, 1984). The main goals of the intervention are to reduce disruptive behavior problems and improve parent-child relationships. A problem-solving format is utilized in which parents identify goals, assess possible barriers, and evaluate potential solutions (Webster-Stratton, 2011). The *Incredible Years* program has been evaluated extensively, including in at least 12 randomized trials conducted by the author and colleagues. These replications have shown that the intervention leads to parents' increased use of praise, reduced use of criticism and negative commands, more effective limit-setting, and the replacement of physical discipline techniques such as spanking with non-physical techniques (Webster-Stratton & Reid, 2006). Sessions were held weekly, and were approximately 2 hours long.

Conditions. Two different orders of intervention content were evaluated herein. In the Reinforcement First condition, parents spent 5 weeks learning reinforcement techniques,

followed by 5 weeks learning punishment techniques. In the Punishment First condition, this order was reversed. Training in reinforcement parenting skills consisted of one week of the use of child directed play, two weeks of training in using praise, and two weeks of training in the use of tangible rewards. Training in punishment skills consisted of one week of learning how to use effective commands, one week of learning to ignore minor misbehavior, two weeks of training in time-out, and one week of training in the use of consequences and the removal of privileges.

Training and treatment fidelity. The first author, two postdoctoral fellows, and two advanced doctoral students in clinical psychology facilitated the intervention sessions. Before co-leading any sessions, the postdoctoral fellows and doctoral students were trained by the first author, who is certified as an *Incredible Years* provider. Each group leader completed a checklist at the end of each session that listed goals for that session. These checklists were compared after each session and discrepancies were addressed with further training. The checklist is based on an outline detailing the schedule for each session, and contains items such as “review parents’ goals” and “practice child-directed play concepts” (Webster-Stratton, 2011). The first author watched videotapes of each session, and met with the facilitators regularly for supervision. Treatment fidelity per these checklists was roughly equivalent for the two types of training, with group leaders reporting that they adhered to 96.5% of checklist items during discipline-focused sessions and 94.9% of checklist items during reinforcement-focused sessions.

Measures

Child conduct problems. The New York Parenting Rating Scale – Early Childhood Version (NYPRS; Brotman et al., 1995) is a 35-item parent-report measure used to assess symptoms associated with oppositional defiant disorder (e.g., “loses temper”), conduct disorder (e.g., “physically cruel”), and positive peer relations (e.g., “helpful to others”). The

NYPRS has been shown to be responsive to intervention (Brotman, Kamboukos & Theise, 2008; Ensink, Robertson, Zissis, Leger, & de Jager, 1997). Test-retest reliability over a 6-month period exceeded .73 (Brotman et al., 1995). Items are scored on a scale ranging from 0 = “*not at all*” to 3 = “*very much*”. After reverse scoring the six positive peer relations items, a total score was computed for each parent (Cronbach’s α s = .891 and .761 for mothers and fathers, respectively). Mothers’ and fathers’ scores were averaged for children with two participating parents. The mean item level score at baseline on the NYPRS in the current sample was .86 (SD = .36) which corresponds to a description of “somewhat true” on a scale that ranges from 0 = not at all to 4 = very much. Nonclinical children average in the .3-.4 range on these items (Miller, 2005). Although the Early Childhood Version of the NYPRS has been validated with preschoolers and the mean age of the present sample was 5, we thought it a better match for the sample we collected than the almost identical version of the NYPRS for older children, which has a number of more severe items (e.g. sexual misbehavior).

CPs slope operationalizations. Questions 2 and 3 involved linear and quadratic slopes of child conduct problems (CPs) as independent and/or dependent variables. Following Rogosa, Brandt, and Zimowski (1982), the slopes were the least-squares estimates of the linear and/or quadratic slopes of each outcome across the pre-, mid-, and post-treatment assessments (Q2; labeled “slope 1”) or across the pre-, mid-, and post-assessments, as well as the follow-up assessment (Q3; labeled “slope 2”). The scores measured the mean rate of change per week (linear slope) and week-squared (quadratic slope) in the level of CPs. To illustrate, the mean linear slope across the pre- (week 0), mid- (week 5), and post-treatment (week 10) assessments was -0.95 (Table 1). Thus, the average child’s CPs on the NYPRS-P decreased by approximately 0.95 points per week over the 10-week intervention period.

Although modern analytic methods such as multilevel growth curve modeling have generally supplanted this approach of directly calculated slopes, preliminary attempts using these approaches resulted in model nonconvergence due to low variance of the slope parameters. Thus, the Rogosa et al. (1982) approach was adopted instead.

Callous and unemotional traits. The parent report version of the Inventory of Callous and Unemotional Traits (ICU; Essau, Sasagawa, & Frick, 2006) was used to assess the child's level of CU traits. The ICU Full scale was found to correlate highly with the Empathy and Positive Affect scales of the Bar-On Emotional Quotient Inventory (EQI; Bar-On & Parker, 2000), indicating that high scores on the ICU are associated with less empathy and less positive affect on the EQI (Kimonis et al., 2008). Its 24 items (e.g., “seems very cold and uncaring”) are rated on a four-point Likert-type scale, from 0 = *not at all true* to 3 = *definitely true*. A total score was computed for each parent's reports (α s = .855 and .838 for mothers and fathers, respectively). Mothers' and fathers' scores were averaged for children with two participating parents.

Analytic Strategy

Analyses were conducted in a generalized estimating equation framework (GEE; Hanley, Negassa, & Forrester, 2003). The selected GEE models utilized a robust estimator to handle the distributional nonnormality in the dependent variables (CPs scores were positively skewed; CPs slopes were negatively skewed) and adjusted SEs for the nesting of parents within the 11 intervention groups. Despite using a robust estimator, GEE is not impervious to leveraging cases. Two cases were substantial outliers on CPs linear slope 2; 1 case was an outlier on the quadratic slope 2 of CPs. These cases were Winsorized (Wilcox, 2005) to reduce their influence while maintaining the rank ordering of all cases in their respective distributions.

R^2 is undefined in GEE models. Thus, a parallel set of ordinary least squares (OLS) regression models were estimated to provide effect size estimates; rough estimates that should be interpreted with caution as the data do not meet the distributional and independence assumptions of OLS. We express these effect sizes as R^2 change due to the addition of the key predictor (e.g., Group $\times$ CU Traits) in a hierarchical OLS regression model.

CPs data were unavailable for 9 children at the mid-treatment, 8 children at the post-treatment, and 18 children at the follow-up assessments. Missing data were estimated via Bayesian multiple imputation (Enders, 2010) with Mplus version 7.3 software (Muthén & Muthén, 1998-2012). Twenty data sets were generated with imputed values for missing data. The estimates (B s and SE s) from the GEE models were combined via Rubin's rules (Schafer & Olsen, 1998). $N = 74$ for all presented analyses. All children whose parents attended an intervention session were included in the present analyses. Parents learned of their group assignments upon attending the first session, thus potential selection effects were mitigated.

Compliance with Ethical Standards

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study. The authors declare that they have no conflicts of interest.

Results

Descriptive statistics for, and bivariate associations (Spearman's ρ due to the aforementioned distributional nonnormality) among, study variables are presented in Table 1.

Preliminary Analyses

Although the present focus is on moderated intervention effects, interpretation of those effects is enhanced by examining the baseline equivalence of the intervention groups as well as the main effects of intervention and time.

Baseline equivalence of groups. Using independent measures *t*-tests for continuous variables and Fisher's exact tests for categorical variables, the two groups were compared on eight demographic variables (child age, gender, and ethnicity, mean parental age and education, household income, number of children in the household, and parental marital status). None of these comparisons were statistically significant, $ps > .103$. Moreover, as reported in Table 1, pre-treatment child CPs or CU traits were not significantly associated with group assignment, suggesting that random assignment to conditions was effective. As reported in an on-line supplement to this article, additional analyses indicated that ADHD symptoms also did not significantly differ by group.

Intervention main effects. The three dependent variables (DVs) under study were mid-intervention CPs, as well as the linear and quadratic slopes of CPs. Each was regressed on treatment group. There was no evidence that the dose of intervention modules affected change in CPs (Table 2).

In model ME1 (main effect 1), mid-treatment CPs scores were regressed on pre-treatment CPs and group. The pre-treatment CPs term was included to isolate pre- to mid-treatment change in CPs, following the logic of the traditional ANCOVA approach to change. The group effect was nonsignificant (OLS R^2 change = .001).

In model ME2, the linear slope of CPs across the pre-, mid-, and post-treatment assessments (linear slope 1) was regressed on pre-treatment CPs and group. The pre-treatment CPs term was included to avoid confounding the slopes and initial levels of CPs. The Spearman's ρ s of pre-treatment CPs and their slopes were significantly negative, perhaps

reflecting regression to the mean (e.g., those with high baseline CPs scores tending to drift downward toward the mean). The group effect was nonsignificant (OLS R^2 change = .002).

In model ME3, the quadratic slope of CPs across the pre-, mid-, and post-treatment, as well as the follow-up assessments (quadratic slope 2) was regressed on the linear slope of CPs across the same period (linear slope 2), as well as pre-treatment CPs and group. The linear slope term was included as an independent variable to isolate variance in the dependent variable that is due to curvilinear, rather than linear, change in CPs. The group effect was nonsignificant (OLS R^2 change = .006).

Time main effects. Table 1 reveals steadily decreasing mean CPs across the pre-, mid-, and post-treatment assessments and near zero change between the post-treatment and follow-up assessments. Relative to the M and SD at the pre-treatment assessment, $ds = 0.47$, 0.74 , and 0.74 for improvements in CPs at the mid-treatment, post-treatment, and follow-up assessments, respectively. A GEE model with CPs as the DV, time as the IV, and adjusting for nesting of parents in intervention group was computed to test for the equivalence in CPs means, irrespective of condition, over the four waves of assessment. The mean time effect across imputations was Wald $\chi^2(3) = 74.44$. Although pooled p -values cannot be computed for this test statistic (i.e., using Rubin's rules to combine the results across the 20 imputed data sets), $p < .001$ within each imputed data set, supporting the nonequivalence of CPs means over time.

Q1: Do children with high versus low levels of CU traits respond differentially to the punishment-based component of behavioral parent training in the short term? Mid-treatment CPs scores were regressed on pre-treatment CPs and CU traits (mean centered), group, and a Group $\times$ CU Traits interaction term. The Group $\times$ CU Traits interaction was not statistically significant, thus there was no evidence that differential short-term treatment response depended on CU traits (OLS R^2 change = .002) (Table 3).

Q2: Do children with high levels of CU traits show greater overall change in CPs following a course of parent training that involves a higher dose of punishment than reinforcement, than one involving a higher dose of reinforcement than punishment?

The linear slope of CPs across the pre-, mid-, and post-treatment (linear slope 1) was regressed on pre-treatment CPs and CU traits (mean centered), group, and a Group $\times$ CU Traits interaction term. The Group $\times$ CU Traits interaction was not statistically significant, thus there was no evidence that differential overall treatment response depended on CU traits (OLS R^2 change = .005).

Q3. Do children with high levels of CU traits show greater symptom rebound (i.e., increases in CPs following intervention termination) following a high punishment dose of parent training than a high-reinforcement dose?

The quadratic slope of CPs across the pre-, mid-, and post-treatment, as well as the follow-up assessments (quadratic slope 2) was regressed on the linear slope of CPs across the same period (linear slope 2), as well as pre-treatment CPs and CU traits, group, and a Group $\times$ CU Traits interaction term. The Group $\times$ CU Traits interaction was not statistically significant, thus there was no evidence that CU traits caused symptom rebound differently for the two treatment orders (OLS R^2 change = .011).

Discussion

Developmental models of CU traits have often emphasized characteristics that are thought to reflect aberrant reward/punishment processing (Frick, et al., 2014; Herpers et al., 2014; Wilkinson, Waller, & Viding, 2016), and previous research with clinical samples has provided some support for the model that children with CU traits are more responsive to parenting strategies based on positive reinforcement than on punishment contingencies (e.g., Hawes & Dadds, 2005). Despite the far-reaching implications of this prediction for treatment and prevention in this high-risk population, it has not previously been tested under experimental conditions. The present study provided the first such test of this model, using an RCT in which families were initially randomized to either five weeks of reward-focused or five weeks of punishment-focused behavioral parent training. The overarching hypothesis was that CU traits would moderate the differential effects of parent training that focused more on reward versus punishment. The interaction of CU traits with intervention focus was investigated first by examining conduct problems following receipt of either five weeks of reward-focused or punishment-focused parent training. While overall, CPs across groups decreased substantially from pretest to the five-week point, contrary to our hypothesis, CU traits did not predict differential responses to the two treatment conditions five weeks into treatment (Question 1). Next investigated was the interaction of CU traits and intervention focus in relation to *longer-term change* in CPs, over the full course of the intervention and months after it had ended. Here too, while overall CPs across groups were significantly lower at posttest and at follow-up than at pretest, demonstrating the efficacy of the interventions, CU traits did not predict *differential* treatment response in CPs assessed at post-treatment, following ten weeks of intervention (Question 2) or at a six-month follow-up (Question 3). We note that, although the present sample size was small, CU traits explained virtually zero

variance in differential treatment response to the two conditions. Accordingly, the lack of statistically significant findings cannot be attributed to low statistical power.

Although there are no similar RCTs against which to compare the findings of the present study, these findings were surprising given previous research on reward dominance in children and adolescents with CU traits. This previous work has found that children with higher levels of CU traits tend to exhibit diminished reactivity to aversive or emotionally charged stimuli, leading to poor responsiveness to punishment (Frick et al., 2014). In previous intervention research, parents' reports of the effectiveness of various treatment components indicated that punishment-focused discipline (e.g., time-out) was less effective for boys with high, stable levels of CU traits (Hawes & Dadds, 2005; Hawes & Dadds, 2007). Similar findings have been reported in recent school-based research in which boys' CU traits were associated with punishment insensitivity in terms of response to teachers' discipline-focused strategies, independent of conduct problem severity (Allen, Morris, & Chhoa, 2016).

There are various explanations as to why our results were inconsistent with the model suggested by this previous work. One reason for the lack of a significant moderating effect is that the two intervention conditions in the present study may have been more similar than was intended. Despite efforts to not promote reinforcement when teaching punishment-related strategies and vice versa, the concepts inevitably comingled. For example, parents were trained in the most established routine for time-out, in which child compliance to an initial limit-setting command is met with positive reinforcement in the form of praise. Similarly, when parents were taught child directed play as part of the reinforcement-focused condition, they were taught to ignore minor misbehavior and even to terminate the play session for more serious misbehavior, such as physical aggression. It is difficult to construe how to completely disentangle reinforcement and punishment strategies while retaining the core features of a parent-training intervention based on social learning theory. In addition to

the “crosspollination” of reinforcement and punishment strategies, the teaching of some fundamental parenting skills that don’t fall neatly under the headings of reinforcement or punishment may have further muddled the distinction between the two sets of parenting skills. For example, parents were taught to give effective commands during the five weeks that were considered “punishment focused.” Clearly, there is no argument to make that effective commands act as punishers of undesirable child behaviors.

Second, although previous reviews of the literature have found that most studies that have investigated CU traits in relation to treatment outcomes have reported that these traits predict or moderate treatment response, this has not been true of all studies (Frick et al., 2014; Hawes, Price & Dadds, 2014). Given the small number of studies that have not reported any evidence associating CU traits with poor treatment outcomes, it has been difficult to identify common methodological features of such studies. One such feature, however, may be the use of a sample that includes subclinical presentations of conduct problems (e.g., Hyde et al. 2013), as was the case in the present study (Brotman, et al., 2005; Dawson-McClure, et al., 2015; Miller, et al., 1995). Although our participants were recruited based on parental difficulties managing child behavior, inclusion criteria were not applied with respect to diagnostic severity. Similarly, exclusion criteria were not applied to comorbid problems, such as developmental disabilities or low IQ. It is possible that significant associations between response to distinct treatment components and CU traits may only be apparent in samples with more severe levels of conduct problems or CU traits.

One of the goals of this study was to shed light on how to tailor interventions to better target “the unique emotional, cognitive, and motivational styles of children and adolescents with elevated CU traits” (Frick, et al., 2014, p. 45). One idea proposed has been to manipulate existing parent-training protocols to focus more on reward strategies for children with high levels of CU traits, as some have suggested (e.g., Miller et al., 2014; Oxford, Cavell, &

Hughes, 2003). Modifying existing evidence-based treatments for children who exhibit CU traits has become a priority for researchers given the stability of CU traits and their unique predictive associations with later behavior problems (Waller, et al., 2016). However, it is not clear from our results that variations in the delivery of components within existing programs may be a useful strategy. That is, children with higher levels of CU traits did not derive greater benefit from a higher dose of reinforcement strategies. At the same time, however, our findings regarding established reward/punishment-based strategies do not preclude the possibility that children with CU trait may respond differentially to parent-training components involving novel reward/punishment-based processes.

Clinical Implications

The broader evidence base regarding aberrant learning processes associated with CU traits that informed the formulation of our research question and design suggest other directions for translational research and clinical practice. Regarding clinical practice in particular, clinicians should be sensitive to the risks inherent in altering evidence-based parent-training interventions for disruptive behavior in children who exhibit high levels of CU traits, given the relative paucity of research in this area as well as the inconsistent results described above. The main risk is that adjusting interventions to tailor them for children high in CU traits may lead to lower fidelity to research tested treatments, making the overall treatment *less* effective for these children. However, one potential path may be to redesign the punishment/discipline strategies typically used in traditional BPT interventions, instead of adjusting the relative ‘dose’ by which they are conventionally delivered. For example, given the reward-dominant/punishment-insensitive learning style that appears to characterize children with high levels of CU traits, parents might learn to better utilize the motivation for reward that is present in these children. This can be accomplished by limiting the child’s access to tangible rewards when they misbehave. Research on the concept of a Deferred

Time-Out (DTO; Kunkle & Ortiz, 2016; Warzak & Floress, 2009) where a parent does not interact with their child or provide them access to rewards of pleasurable activities until they serve their time out may prove useful with children high in CU traits, as it capitalizes on motivation to be rewarded while at the same time providing parents with a means to avoid coercive escalation.

Another possible adjustment to clinical practice relates to the interplay between attention, emotion, and learning processes, as informed by findings that children with high levels of CU traits exhibit diminished arousal from impending punishment (e.g., Fanti, Panayiotou, Lazarou, Michael, & Georgiou, 2016), as well as poor recognition of emotional cues (Dawel, O’Kearney, McKone, & Palermo, 2012) and reduced attention to emotionally-salient cues, such as the eye regions of faces, which may play a key role in communicating information about punishment-related contingencies during parent-child interactions (Dadds et al., 2014).

This work suggests that clinical strategies for promoting emotional engagement between children with CU traits and their parents may be a useful adjunct to traditional parent training interventions (e.g. Dadds, et al., 2012). Healthy patterns of emotional engagement in early attachment relationships are thought to play a critical role in the development of conscience, empathy, and social competence, whereas impairments in the mechanisms that govern attention to emotional cues may undermine the emergence of these capacities by depriving the child of critical information about the consequences of his or her behavior on others (see Skuse, Morris, & Lawrence, 2003). For children with high levels of CU traits, the apparent failure of these mechanisms in early periods of development has therefore been proposed to result not only in disruptions to the parent-child relationship, but to initiate a series of cascading errors affecting the development of empathy and social functioning (Dadds, Jambrak, Pasalich, Hawes, & Brennan, 2011). As such, clinicians may wish to teach

parents to “emotionally engage” children with high levels of CU traits by employing a brief series of structured in-vivo parent-child interactions focused on the promotion of shared eye-contact (Dadds & Hawes, 2006). It has been proposed that the remediation of deficits in reciprocal eye contact may improve the effectiveness of parent-training interventions for CPs among young children with high levels of CU traits through several mechanisms, including enhancing the potential for parental responses to function as motivating rewards for prosocial behavior and increasing the child’s attention to the emotional content of parental instructions.

More work must be done to develop and test theoretically derived adaptations of treatments to groups who tend to respond idiosyncratically or less well on average. Such adaptations may constitute the most promising method to continue to improve the efficacy of psychosocial treatments aimed at disruptive behavior in young children.

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Table 1

Bivariate Associations and Descriptive Statistics

	1	2	3	4	5	6	7	8
1. CPs at pre-treatment	-							
2. CPs at mid-treatment	.74***	-						
3. CPs at post-treatment	.65***	.84***	-					
4. CPs at follow-up	.38**	.60***	.68***	-				
5. CPs linear slope 1	-.51***	-.07	.23	.26*	-			
6. CPs linear slope 2	-.45***	-.16	.02	.52***	.61***	-		
7. CPs quadratic slope 2	-.37**	-.16	-.01	.48***	.46***	.93***	-	
8. CU traits at pre-treatment	.59***	.43***	.49***	.31*	-.23	-.17	-.10	-
9. Group	-.14	-.13	-.11	-.03	.12	.09	.06	-.20
<i>M</i>	30.09	24.13	20.78	20.70	-0.95	-0.33	-0.03	22.79
<i>SD</i>	12.64	11.50	11.28	13.01	0.99	0.64	0.07	8.78
Minimum	6.00	6.00	3.00	4.50	-4.60	-2.30	-0.33	2.00
Maximum	61.00	62.00	52.00	67.00	1.40	0.91	0.04	38.00

Note. Coefficients are Spearman's ρ ; all figures are pooled across 20 imputations using Rubin's rules; slope 1 denotes slopes calculated across pre-, mid-, and post-treatment assessments; slope 2 denotes slopes calculated across pre-, mid-, post-treatment, and follow-up assessments; Group is coded 1 = Reinforcement First and 2 = Punishment First; CPs are conduct problems; CU is callous unemotional.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 2

Generalized Estimating Equation Models for Intervention Main Effects

Model	Dependent Variable/ Independent Variables	<i>B</i>	<i>SE</i>	<i>p</i>	95% CI	
					Low	High
ME1	DV: Conduct Problems at mid-treatment					
	Intercept	4.006	-	-	-	-
	Conduct Problems at pre-treatment	0.679	0.101	<.001	0.481	0.876
	Group	-0.675	2.279	.767	-5.142	3.792
ME2	DV: Conduct problems linear slope 1					
	Intercept	0.103	-	-	-	-
	Conduct problems at pre-treatment	-0.036	0.011	.001	-0.057	-0.015
	Group	0.077	0.251	.760	-0.416	0.570
ME3	DV: Conduct problems quadratic slope 2					
	Intercept	-0.001	-	-	-	-
	Conduct problems at pre-treatment	4.17×10^{-4}	4.72×10^{-4}	.378	-0.001	0.001
	Conduct problems linear slope 2	0.099	0.017	<.001	0.065	0.132
	Group	-0.009	0.010	.354	-0.030	0.011

Note. *B*, *SE*, *t*, and *p* are pooled across 20 imputations using Rubin's rules; slope 1 denotes unstandardized slopes calculated across pre-, mid-, and post-treatment assessments; slope 2 denotes unstandardized slopes calculated across pre-, mid-, post-treatment, and follow-up assessments; DV is dependent variable; Group is coded 1 = Reinforcement First and 2 = Punishment First; CU is callous unemotional.

Table 3

Generalized Estimating Equation Models for the Main and Interactive Effects of CU Traits

Research		95% CI				
Question	Dependent Variable/Independent Variables	<i>B</i>	<i>SE</i>	<i>p</i>	Low	High
1	DV: Conduct problems at mid-treatment					
	Intercept	2.922	-	-	-	-
	Conduct problems at pre-treatment	0.715	0.130	.416	0.460	0.969
	Group	-0.927	2.278	<.001	-5.393	3.538
	CU traits at pre-treatment	0.083	0.311	.684	-0.528	0.693
	Group × CU Traits	-0.120	0.173	.791	-0.459	0.219
2	DV: Conduct problems linear slope 1					
	Intercept	0.250	-	-	-	-
	Conduct problems at pre-treatment	-0.041	0.012	.476	-0.065	-0.018
	Group	0.111	0.267	.001	-0.412	0.635
	CU traits at pre-treatment	-0.009	0.052	.676	-0.110	0.092
	Group × CU Traits	0.015	0.027	.866	-0.038	0.067
3	DV: Conduct problems quadratic slope 2					
	Intercept	0.001	-	-	-	-
	Conduct problems at pre-treatment	3.05×10^{-04}	0.001	.566	-0.001	0.001
	Conduct problems linear slope 2	0.099	0.016	<.001	0.067	0.130
	Group	-0.009	0.011	.402	-0.030	0.012
	CU traits at pre-treatment	0.003	0.002	.088	0.000	0.006
	Group × CU Traits	-0.002	0.001	.157	-0.004	0.001

Note. *B*, *SE*, *t*, and *p* are pooled across 20 imputations using Rubin's rules; slope 1 denotes unstandardized slopes calculated across pre-, mid-, and post-treatment assessments; slope 2 denotes unstandardized slopes calculated across pre-, mid-, post-treatment, and follow-up assessments; Group is coded 1 = Reinforcement First and 2 = Punishment First; CU is callous unemotional.

Figure 1. CONSORT diagram.