Published in final edited form as:
J Child Psychol Psychiatry. 2014 February ; 55(2): 154–161. doi:10.1111/jcpp.12132.

Punishment insensitivity and impaired reinforcement learning in preschoolers

Margaret J. Briggs-Gowan[1], **Sara R. Nichols**[2], **Joel Voss**[2], **Elvira Zobel**[2], **Alice S. Carter**[3], **Kimberly J. McCarthy**[1], **Daniel S. Pine**[4], **James Blair**[4], and **Lauren S. Wakschlag**[2]

[1]Department of Psychiatry, University of Connecticut Health Center, Farmington, CT, USA

[2]Department of Medical Social Sciences, Feinberg School of Medicine, Northwestern University, Chicago, IL, USA

[3]Department of Psychology, University of Massachusetts-Boston, Boston, MA, USA

[4]The National Institute of Mental Health, Division of Intramural Research Programs, Rockville, MD, USA

Abstract

Background—Youth and adults with psychopathic traits display disrupted reinforcement learning. Advances in measurement now enable examination of this association in preschoolers. The current study examines relations between reinforcement learning in preschoolers and parent ratings of reduced responsiveness to socialization, conceptualized as a developmental vulnerability to psychopathic traits.

Methods—157 preschoolers (mean age 4.7 ±0.8 years) participated in a substudy that was embedded within a larger project. Children completed the "Stars-in-Jars" task, which involved learning to select rewarded jars and avoid punished jars. Maternal report of responsiveness to socialization was assessed with the Punishment Insensitivity and Low Concern for Others scales of the Multidimensional Assessment of Preschool Disruptive Behavior (MAP-DB).

Results—Punishment Insensitivity, but not Low Concern for Others, was significantly associated with reinforcement learning in multivariate models that accounted for age and sex. Specifically, higher Punishment Insensitivity was associated with significantly lower overall performance and more errors on punished trials ("passive avoidance").

Conclusions—Impairments in reinforcement learning manifest in preschoolers who are high in maternal ratings of Punishment Insensitivity. If replicated, these findings may help to pinpoint the neurodevelopmental antecedents of psychopathic tendencies and suggest novel intervention targets beginning in early childhood.

Keywords

psychopathic tendencies; reinforcement learning; punishment insensitivity; low concern; early childhood; disruptive behavior; development

Correspondence: Margaret Briggs-Gowan, Department of Psychiatry, MC-1410, University of Connecticut Health Center, 263 Farmington Avenue, Farmington, CT, USA, mbriggsgowan@uchc.edu.

Conflict of interest statement: No conflicts declared.

Introduction

Psychopathy is an extreme form of antisocial behavior which often manifests in criminal, cruel behavior (Blair, 2006; Cleckley, 1976) and tends to be treatment resistant (Blair, 2013). Considerable research investigating psychopathy has used an extreme-group approach. However, other research has also supported a dimensional approach (Frick, 1998; Kotler & McMahon, 2005). This approach suggests that psychopathy consists of constituent factors (e.g., callous-unemotional traits, narcissism; Blair, 2001, 2006; Frick, 1998) that may have at least partially independent neurobiological and social-environmental risks (Blair, 2006; Frick, Kimonis, Dandreaux, & Farrell, 2003). Moreover, much of the work has concentrated on adult, adolescent, and pre-adolescent populations. Yet, most models of the disorder assume that it has earlier developmental origins (Blair, 2001; Frick & White, 2008; Kotler & McMahon, 2005). Work with young children has been relatively neglected.

A major impediment to studying young children has been that the reference to criminal activity in assessments of psychopathy (e.g., The Psychopathy Checklist-Revised, Hare, 1991) is not easily translated into developmentally meaningful terms. Further, the term "psychopathy" carries negative connotations (Kotler & McMahon, 2005). The callous-unemotional component of psychopathy has been assessed in young children (Ezpeleta, de la Osa, Granero, Penelo, & Domenech, 2013; Hyde et al., 2013; Kimonis et al., 2006; Willoughby, Waschbusch, Moore, & Proper, 2011). However, most work involved the downward extensions, with minor modifications, of assessment tools designed for older youth or adults.

A contrasting approach to the developmental translation of clinically salient phenotypes is to measure underlying processes gone awry (Wakschlag, Tolan, & Leventhal, 2010). Fundamentally, psychopathy reflects impairments in empathic concern, rule learning/ internalization, and socio-moral functioning (Blair, 2006). Development of these capacities and the internalization of social norms continue through early childhood (Kochanska & Aksan, 2006; Rhee et al., 2012). When these processes go awry, they may manifest broadly as "reduced responsiveness to socialization," and more specifically as "low concern for others" and "insensitivity to punishment." Here, these dimensions are captured with a new, developmentally-appropriate, parent-report measure that characterizes disruptive behavior along a severity continuum from "normative misbehavior" to atypical behaviors: the Multidimensional Assessment of Preschool Disruptive Behavior or "MAP-DB" (Wakschlag et al., unpublished manuscript). Low concern for others reflects a child's tendency toward insensitivity to others' feelings and thus is akin to the core callous/unemotional component of psychopathy (Frick, 1998). Examples of low concern items from the MAP-DB are: *Doesn't seem to care about pleasing others* and *Enjoys making others mad.* Insensitivity to punishment reflects a child's tendency to seem as though s/he doesn't care about punishment or to fail to demonstrate that his/her behavior is shaped by punishment. Sample items are: *Blame someone else for something s/he did wrong* and *Keep on misbehaving no matter what you do*. This construct may directly map onto computational impairments in reinforcement learning that have been studied in adolescents (Finger et al., 2008; Finger et al., 2011; White et al., 2013).

Older children and adults with psychopathic tendencies tend to have deficits in reinforcement-based decision making. These individuals tend to have difficulty extinguishing a learned response to a reward, even when the stimulus is accompanied by punishment (Blair, 2001; Mitchell, Colledge, Leonard, & Blair, 2002; Newman, Patterson, & Kosson, 1987; O'Brien & Frick, 1996). These individuals also tend to have decrements in passive avoidance learning relative to healthy individuals or individuals with other forms of psychopathology (Finger et al., 2011; Newman & Kosson, 1986; White et al., 2013). Passive

avoidance tasks assess the extent to which an individual approaches stimuli accompanied by reward and "passively" avoids stimuli that result in a punishment. Behaviorally, individuals with psychopathic traits perform more poorly during punishment contingency rounds but not in reward contingency rounds (Blair et al., 2004; Finger et al., 2011). Recent findings suggest that, although these impairments are broadly associated with psychopathic tendencies identified with multidimensional psychopathy checklists, they may not be related to the callous-unemotional component of psychopathy in particular (Finger et al., 2011; White et al., 2013).

The current study tests the hypothesis that young children manifesting reduced responsiveness to socialization, conceptualized as a behavioral vulnerability for later psychopathy, would have impairments in passive avoidance learning. We tested the hypothesis that children reported by their mothers as being high in Low Concern for others or Punishment Insensitivity on the MAP-DB have impaired passive avoidance learning.

Method

Participants

The study examines a subsample from Phase II of the Multidimensional Assessment of Preschoolers ("MAPS") Study, which recruited preschoolers from five Chicago-based pediatric clinic waiting rooms (for details see Wakschlag et al., 2012). The MAPS sample is broadly stratified by child age, sex, race/ethnicity, and poverty. Parents were eligible if they were accompanied to the clinic by their 3–5 year-old child, were the child's legal guardian, and were able to participate in English or Spanish. Of 1,830 eligible, 1,565 completed surveys (85.5%). Participants received a $20 incentive for completing the survey, with an additional $10 incentive for completing it before leaving the waiting room.

The current sub-study drew a stratified random sample (N = 416) from the survey sample. Children were eligible if their biological mother had completed the survey in English. Children were not eligible if they were reported to have significant intellectual or developmental delays (diagnosis with an Autism Spectrum disorder, currently receiving services for global cognitive delays, or language skill in the 2-year-old range on a brief language screener and receiving services). By design, the sub-study was oversampled for disruptive behavior and violence exposure. Specifically, 100% of children with disruptive behavior above the 80th percentile on the MAP-DB were sampled. The MAP-DB assesses an array of disruptive behaviors including temper loss, aggression, non-compliance, and reduced responsiveness to socialization (Wakschlag et al., unpublished manuscript, see also Measures section). Sixty-three percent of families in which mothers reported intimate partner violence (IPV) in the past year was sampled. IPV was assessed with a 4-item screener about physical violence or threat (e.g., *You or your partner pushed, grabbed or shoved each other, You or your partner threatened to hit or throw something at each other*). For children outside these strata the sampling probability was approximately 10%.

The study subsample represents the first 183 eligible participants. This sample size was deemed large enough to identify meaningful effects of moderate effect size. This subsample excludes nine children who were determined at the visit to be ineligible due to serious developmental or medical conditions or ADHD medication. These 183 children were similar to the 224 who were sampled but did not participate in terms of disruptive behavior and child age ($t = -0.93$ to 1.53, $p > .10$), and child sex, maternal education, and IPV ($\chi^2 =$ 0.00–0.02, $p > .10$), but they were more likely to be living in poverty (52.5% vs. 33.5%) or of minority ethnicity (80.9% versus 59.4%), $\chi^2 = 14.0–20.8$, $p < .001$.

Usable data for all 40 trials of the passive avoidance task were available for 157 children. Of the remaining 26 children, 11 had incomplete or entirely missing data (2 technical problems, 2 child refusals, 5 discontinuations by the child, and 2 ran out of time and did not attempt the task). Prior to analyses, data for 15 children were deemed unusable because the research assistant administering the task documented serious concerns about the quality of the data. Specifically, data were excluded for four children who were markedly ill during the testing (e.g., one child with a stomach virus fell asleep during the testing) and 11 who appeared to have serious difficulty understanding the task. Children excluded due to difficulty comprehending the task were more likely than those retained to be 3-year-olds (73% versus 24%, $\chi^2 = 10.80$, $p < .01$, and had more practice trials $t(166)=2.69$, $p < .01$. The analytic sample represented 84.9% of eligible children (157/183).

Average child age was 4.7 years (+/− 0.8, *range* = 3.3–6.6). Consistent with the oversampling strategy, 57.3% had high levels of disruptive behavior on the MAP-DB and 35.7% had intimate partner violence. Participant characteristics are presented for the full sample and across the Punishment Insensitivity and Low Concern groupings (Table 1) Modest poverty and race/ethnicity differences were observed for Punishment Insensitivity ($\chi^2 = 20.22–23.54$, $p < .01$), but not Low Concern ($\chi^2 = 0.19–6.48$, *ns*).

Procedures

Mothers and children participated in a two laboratory visit series of observational and behavioral tasks. Each visit lasted for approximately three hours. Mothers were compensated $210 for participating in these visits and were compensated for transportation expenses. Children were assessed separately from their mothers. All study procedures were approved by institutional review boards at Northwestern University and the University of Connecticut Health Center. Informed consent was obtained.

Measures

Passive avoidance task—The Stars in Jars (SIJ) task (Briggs-Gowan, Zobel, Carter, Wakschlag, & Blair, 2011) is a developmental modification of a passive avoidance task used with older individuals (Blair et al., 2004; Newman and Kosson, 1986). In this version, four different stimuli are presented to each participant 10 times in a random order (40 trials total). Two stimuli are always rewarded and two are always punished. The task is performed on a 13-inch Lenovo Think Pad X220 tablet with a touch-screen monitor. Children need to learn through trial and error to press on the rewarded stimuli and withhold pressing on the punished stimuli. The stimuli are four jars that look distinctively different in shape and color. When a rewarded jar is pressed, it opens to show a star inside and the child sees the stars piling up on the screen (see Figure 1). When a punished jar is pressed, it opens to show an empty jar and the child sees a star flying away from the screen. Wins and losses are accompanied by auditory feedback (“ding” for a win and fizzling “zzzz” for loss). Before the task begins, children are shown a star-shaped, glitter-covered box and told that it contains a prize that they will win if they do a “good job” picking the winning jars. A practice task using a different set of jars precedes the actual task. The practice trials conclude when the child responds correctly 5 times consecutively or after 36 practice trials if they did not reach basal performance (five corrects). Once practice trials are completed, the task takes approximately 5 minutes to complete. At the end of the task all children receive a small prize regardless of their performance.

Scoring yielded three scores: commission errors; omission errors; and D-prime (D′). Omission errors occur when the child erroneously fails to press a winning jar (one containing a star). Commission errors occur when the child erroneously presses a losing (empty) jar. D′ (or discrimination sensitivity) is a measure used in signal detection theory

when the separation of stimuli discrimination from decision factors is beneficial. Detection theory is a method of modeling the decision making process between different items and a person's bias to favor a certain response. detection was assessed by calculating D′ using performance measures of hit and false alarm rates (Green & Swets, 1966). A larger D′ means a better ability to distinguish the target stimuli from the non-target stimuli. These three scores were calculated for the task overall (36 trials) and within 3 blocks of 12 trials. The first 4 trials were excluded from scoring because they were the child's first exposure to each of the jars and thus should represent chance performance.

Responsiveness to Socialization—Responsiveness to Socialization was assessed with mother reports on the Low Concern and Punishment Insensitivity dimensions of the MAP-DB questionnaire (Wakschlag et al., under review; Wakschlag et al., 2012). Parents rate how often the behaviors described occurred over the previous month. *Low Concern (LC)* is rated on a six-point scale as follows: 0=Never; 1=Rarely (less than once per week); 2=Some (1–3 days of the week); 3=Most (4–6 days of the week); 4=Every day of the week; and 5=Many times each day. The original pool of *LC* items included 16 items, nine of which were retained on the final scale (e.g., *Doesn't seem to care about another person's feelings when frustrated, angry or upset; Enjoy making others mad; Act like s/he didn't care when someone was mad or upset*). One item was dropped due to reverse wording and poor loading (*Smile or look proud when praised*). Six were dropped because they did not fit the model well, typically due to a high residual correlation with another similar item, suggesting redundant content. *Punishment Insensitivity (PI)* included 7 items (e.g., *Deny s/he did something that was not allowed, Keep on misbehaving no matter what you do*). For these items, parents were instructed to indicate how their children respond when punished or disciplined, using a six-point scale: 0=Never, 1=Hardly Ever, 2=Sometimes, 3=Often, 4=Most of the time, 5=All the time. Both scales had acceptable internal consistency (α = .81 and α = .73, respectively) and test-retest reliability (ICC = .83 and .86, respectively, over a *mean* of 161.2 days, +/− 84.9). The correlation between the two scales was .62. For both scales, a 3-group categorical variable was calculated to differentiate High (≥90th percentile), Moderately High (80th–89th percentile) and Normative (<80th percentile) scores. Thresholds for these categories were defined using the normative distributions from the MAPS Phase I sample (Wakschlag et al., under review).

Covariates

Impulsivity—Child impulsivity was assessed with maternal ratings on the 10-item *Activity/Impulsivity* subscale of the Infant-Toddler Social and Emotional Assessment (ITSEA) (Carter & Briggs-Gowan, 2006). The preschool version of the ITSEA was adapted by adding items reflecting the additional developmental demands placed on this age group (e.g., *Talks a lot after being asked to be quiet; Must be reminded to wait his/her turn*) and had acceptable internal consistency in this sample (α =.80). Impulsivity was included as a potential covariate.

Temper Loss—Child temper loss was assessed with the MAP-DB *Temper Loss* dimension, which has demonstrated acceptable reliability (α =0.97. test-retest reliability = .72, *n* = 38) and validity in capturing underlying severity of problems with temper tantrums and angry mood (Wakschlag et al. 2012). Temper loss is a defining feature of preschool disruptive behavior and thus was included as a potential covariate.

Non-verbal reasoning—Child non-verbal reasoning was directly assessed with the Picture Similarities subscale of the Differential Ability Scales-Second Edition (DAS-II) (Elliott, 1983). The DAS yields scaled age-normed scores (sample *MN* = 48.89, *std* = 7.96, *n* = 133). Non-verbal reasoning was assessed as a potential covariate (as a proxy for IQ).

Analytic Plan

Due to their potential associations with task performance, child age, sex, non-verbal reasoning, impulsivity, temper loss and sociodemographic characteristics were reviewed to determine whether they should be included as covariates in models. Variables with even modest association ($p < .15$) with both task performance and either indicator of reduced responsiveness to socialization were included as covariates. All continuous variables were reviewed for outliers, which were defined as scores 3.29 standard deviations from the mean. Outliers were reined in by replacing the outlying value with the score at 3.29 standard deviations from the mean. The primary analyses consisted of three Analysis of Covariance (ANCOVA) models, conducted with PROC GLM in SAS 9.2 (SAS, 2012), which is appropriate for unbalanced designs. Each model included the Low Concern and Punishment Insensitivity grouping variables as independent variables and one task performance variable as the dependent variable (i.e., D′, omission errors, or commission errors). Models also tested for sex and sex by grouping interactions. The first block of each model included age. Impulsivity was added in a second block in order to allow examination of changes in patterns of effects once it was controlled. Several additional analyses were conducted to aid the interpretation of main effects, including linear contrasts testing for linear increases/decreases across the grouping variables, pairwise comparisons between groups, and analyses testing for differences between groups in each of the blocks of the task. To protect against chance findings due to multiple comparisons, these additional analyses were conducted only when there was a significant main effect. In addition, pairwise comparisons were adjusted for multiple comparisons with the Tukey-Kramer adjustment. A p-value of .05 was used.

Results

Outliers

Three subjects were identified as outliers on total omission errors and in Block 2. One subject was an outlier due to high non-verbal reasoning. These four data points were adjusted as described above. No other outliers were identified.

Covariates

Age correlated positively with overall task performance ($D'r = .34$, $p < .0001$), negatively with commission errors ($r = -.36$, $p < .0001$), and modestly but positively with Punishment Insensitivity ($r = .14$, $p < .10$). Girls tended to perform less well ($D'r = -.14$, $p < .10$), make more commission errors ($r = .17$, $p < .05$), and have lower levels of Punishment Insensitivity ($r = -.12$, $p < .15$). Impulsivity was not significantly associated with overall task performance ($D'r = -.08$, *ns*), but was modestly associated with omission errors ($r = -.12$, $p < .15$) and commission errors ($r = .15$, $p < .10$), as well as Punishment Insensitivity ($r = .52$, $p < .0001$) and Low Concern ($r = .41$, $p < .0001$), in correlations that accounted for age effects. Temper Loss, non-verbal reasoning and sociodemographic characteristics (poverty, race/ethnicity, single parent, and maternal education) were unrelated to task performance ($r = -.04–.07$, $F = .02$ to $.90$, *ns*) and thus were not included as covariates. Therefore, following the analytic plan, age and sex were included in all models and impulsivity was added as a covariate in the second step.

Task performance according to Punishment Insensitivity and Low Concern

The results of the D' model revealed a main effect of Punishment Insensitivity (PI), $F(2, 146) = 3.98$, $p < .02$, *partial* $\eta^2 = .052$, but not Low Concern (LC), $F(2,146) = 1.06$, *ns* (see Figure 2). The linear contrast for PI was significant, $F(1, 146) = 7.56$, $p < .01$ and pairwise comparisons revealed significantly poorer performance in the High group relative to the Normative group ($p < .02$). There was no sex effect, $F(1,146) = 1.68$, *ns*, nor were there

significant interactions between sex and PI, F(2,146) = 0.18, or LC, F(2,146) = 0.13. Similarly, for commission errors, there was a main effect of PI, F(2, 146) = 4.36, $p < .02$, *partial* $\eta^2 = .056$, but not LC, F(2,150) = 1.47, *ns* (see Figure 3). Again, the linear contrast for PI was significant, F(1,146) = 8.51, $p < .005$ and there were significantly more commission errors in the High group relative to the Normative group ($p < .02$). There was a trend-level sex effect suggesting more errors in girls, F(1,146) = 4.36, p <.06, but no significant interactions between sex and PI or LC, F(2,146) = 0.51 to 1.31.

When impulsivity was added to the D′ model, the same overall performance effect was observed. Specifically, there was a main effect of PI on D′: F(2,145) = 3.41, $p < .04$ and a significant linear contrast across PI groups, F(1,145) = 6.46, $p < .02$. There was no effect of LC, F(2,145) = 1.05, *ns*. For commission errors, the main effect of PI was no longer significant, F(2,145) = 2.58, $p < .08$ but the linear contrast remained significant, F(1,145) = 4.99, $p < .03$. As in the initial model, LC was non-significant, F(1,145) = 1.85, *ns*. There also was a sex effect indicating more errors in girls, F(1,145) =4.29, $p < .05$. There were no significant sex interactions with PI or LC, F(2,145) = 0.13 to 1.28. There were no significant associations between PI or LC and omission errors in any model (F = .02 to 0.27).

The significant overall main effects of PI on *D′* and commission errors were further examined across the three task blocks (see Figure 4 for illustration of *D′* and commission errors by task block). For *D′,* results of a repeated measures ANCOVA indicated that the PI effect was significant, F(2,150) = 4.09, $p < .02$. The block effect and the block by PI interaction were both non-significant (F=0.21 to 1.34). For commission errors, the PI effect was significant, F(2,150) = 3.63, $p < .03$, the block effect was a trend, F(2,300) = 2.40, $p < .10$, and the block by PI interaction was non-significant, F(4,300) = 0.51.

Discussion

The goal of this study was to determine whether impairments in passive avoidance learning that are known to exist in older children and adults with psychopathic traits (Finger et al., 2011; Newman & Kosson, 1986; White et al., 2013) are also evident in preschool children who, according to their mothers, show reduced responsiveness to socialization. There were three main findings: First, preschool children who were reported to be high in the punishment insensitivity component of reduced responsiveness to socialization tended to show impairments in passive avoidance learning. Second, preschool children who were reported to display low levels of concern for others did not manifest impairments in passive avoidance learning. Third, the findings were most marked for commission errors (responding to stimuli associated with punishment). They were not seen for omission errors (responding to the stimuli associated with reward). Moreover, although one study (Vitale et al., 2005) reported passive avoidance deficits in boys but not girls with psychopathic tendencies, the patterns observed here were not moderated by child sex.

The current study was thus the first to show that the decrements in passive avoidance learning that have been associated with psychopathy in older youth and adults can be identified in preschoolers with reduced responsiveness to socialization. Specifically, children who were rated as being unresponsive to punishment by their mothers had poorer overall performance (lower D-Prime) on the Stars in Jars Passive Avoidance task, as hypothesized. In line with previous research with adolescents and adults with psychopathic traits (Finger et al., 2011; Newman & Kosson, 1986), the overall poorer performance of children high in punishment insensitivity was driven by their tendency to make more commission errors than comparison children: they tended to select stimuli that resulted in loss of points. However, they performed as well as comparison children on reward trials. This specific difficulty in altering one's behavior in response to punishment, but not in

response to reward, has been observed in older individuals with psychopathic tendencies (Blair et al., 2004; Finger et al., 2011). Moreover, although there was an association with impulsivity, the relation between passive avoidance performance and punishment insensitivity was not fully explained by impulsivity.

It is rather remarkable that children's performance on a learning task was associated with maternal reports about their real-world behavior in the context of being disciplined. Moreover, in this instance, there was a tight correspondence between laboratory and clinically-rated behaviors. In both contexts, behavior represented failures in the child to respond appropriately to signals calling for a change in behavior. Typically, parent reports correlate only modestly with observational coding or teacher ratings about the same behaviors (Achenbach, McConaughy, & Howell, 1987). The ability to link the measures used in this study may reflect the fact that a narrowly-specified approach was used in which mothers' ratings on a defined set of punishment insensitivity items were linked with a very specific parameter (i.e., commission errors). From a practical perspective, these tools may offer a means of identifying a subset of young children with pervasive difficulty in altering their behavior in response to punishment, both in real-world settings and in basic learning tasks.

Low concern for others was not associated with passive avoidance learning. Interestingly, this finding is consistent with recent work in adolescents that has indicated that the severity of callous-unemotional traits is not associated with severity of passive avoidance impairment – even though such impairments are evident in individuals who are high in overall psychopathic traits (Finger et al., 2011; White et al., 2013). Clearly, the relative independence of impairments specifically linked to callous-unemotional traits (and presumably low concern, i.e., reduced responsiveness to distress cues) and those linked to punishment insensitivity will be important to document further, particularly in a developmentally sensitive manner.

Although these cross-sectional data cannot shed any light on causation, impairments in learning from punishment could have cascading effects across development. As suggested here, these effects may include difficulty altering one's behavior in response to punishment in real-world contexts, such as when being disciplined at home or in educational environments. Such impairments could have important implications for the onset of chronic and pervasive patterns of disruptive or antisocial behavior.

Several design issues highlight areas for future research. First, longitudinal investigation is essential to determine whether punishment insensitivity and difficulties in passive avoidance learning are stable across development and contribute to pathways for later antisocial and psychopathic tendencies. Longitudinal data would offer insight into whether multi-level indicators of impaired learning from punishment (parent-report, task-based) can predict the emergence or maintenance of low concern for others or persistent patterns of disruptive behavior. Second, while it is striking that learning impairment was linked with parent-reported punishment insensitivity in a non-clinical sample, replication with clinically-referred preschoolers is essential to confirm that these patterns are specific to punishment insensitivity.

Data from this study suggest that specialized cognitive training interventions (Bar-Haim & Pine, 2013) for children exhibiting punishment insensitivity may be a promising avenue. Task-based interventions that help young children develop passive avoidance skills may improve their malleability to disciplinary interventions. Such approaches may be especially effective during this developmental period of high brain plasticity. There is evidence that targeted neurocognitive interventions can be effective with preschoolers (Diamond, Barnett,

Thomas, & Munro, 2007) and can enhance the treatment responsiveness of children with callous tendencies (Dadds, Cauchi, Wimalaweera, Hawes, & Brennan, 2012). Characterizing early life vulnerabilities to antisocial and psychopathic tendencies is of particularly high public health impact as more precise characterization may provide much-needed specification for preventive interventions designed to alter the risk of a chronic antisocial pathway for this highest risk group.

Acknowledgments

This research was supported by grants from the NIMH, (R01MH082830, Wakschlag, PI; U01MH090301, Briggs-Gowan), as well as the Walden & Jean Young Shaw Foundation. We gratefully acknowledge contributions of our collaborators Seung Choi and David Henry for their contributions to modeling of the MAP-DB. We thank Jackie Kestler for her superb oversight of the MAPS study. We are also grateful to Ellen Kessel for her important role in the development and piloting of the SIJ task with preschoolers.

References

Achenbach T, McConaughy S, Howell C. Child/adolescent behavioral and emotional problems: Implications of cross-informant correlations for situational specificity. Psychological Bulletin. 1987; 101:213–232. [PubMed: 3562706]

Bar-Haim Y, Pine DS. Cognitive training research and the search for a transformative, translational, developmental cognitive neuroscience. Developmental Cognitive Neuroscience. 2013; 4:1–2. [PubMed: 23485515]

Blair RJR. Commentary: Disregard for others: empathic dysfunction or emotional volatility? The relationship with future antisocial behavior - reflections on Rhee et al. (2013). Journal of Child Psychology & Psychiatry. 2013; 24(2):167–168. [PubMed: 23194463]

Blair RJR, Mitchell DGV, Leonard A, Budhani S, Peschardt KS, Newman C. Passive avoidance learing in individuals with psychopathy: modulation by reward but not punishment. Personality and Individual Differences. 2004; 37:1179–1192.

Blair RJR. Neurocognitive models of aggression, the antisocial personality disorders and psychopathy. Journal of Neurology, Neurosurgery, and Psychiatry. 2001; 71:727–731.

Blair RJR. The emergence of psychopathy: Implications for the neuropsychological approach to developmental disorders. Cognition. 2006; 101:414–442. [PubMed: 16904094]

Briggs-Gowan M, Zobel Z, Carter AS, Wakschlag L, Blair RJR. Stars in Jars: A preschool passive avoidance task. Unpublished task. 2011

Carter, AS.; Briggs-Gowan, MJ. ITSEA Infant-Toddler Social and Emotional Assessment Examiner's Manual. San Antonio, TX: Harcourt Assessment, Inc; 2006.

Cleckley, H. The mask of sanity. St. Louis, MO: Mosby; 1976.

Dadds M, Cauchi A, Wimalaweera S, Hawes D, Brennan J. Outcomes, moderators and mediators of empathic-emotion recognition training for complex conduct problems in childhood. Psychiatry Research. 2012; 199(3):201–207.10.1016/j.psychres.2012.04.033 [PubMed: 22703720]

Diamond A, Barnett WS, Thomas J, Munro S. Preschool program improves cognitive control. Science. 2007; 318:1387–1388. [PubMed: 18048670]

Elliott, C. Differential Abilities Scales: Introductory and technical handbook. New York: Psychological Corporation; 1983.

Ezpeleta L, de la Osa N, Granero R, Penelo E, Domenech JM. Inventory of callous-unemotional traits in a community sample of preschoolers. Journal of Clinical Child and Adolescent Psychology. 2013; 42(1):91–105.10.1080/15374416.2012.734221 [PubMed: 23095075]

Finger EC, Marsh AA, Blair KS, Reid ME, Sims C, Ng P, Blair RJ. Disrupted reinforcement signaling in the orbitofrontal cortex and caudate in youths with conduct disorder or oppositional defiant disorder and a high level of psychopathic traits. The American Journal of Psychiatry. 2011; 168(2):152–162.10.1176/appi.ajp.2010.10010129 [PubMed: 21078707]

Finger EC, Marsh A, Mitchell D, Reid M, Sims C, Budhani S, Blair J. Abnormal ventromedial prefrontal cortex function in children with psychopathic traits during reversal learning. Archives of General Psychiatry. 2008; 65(5):586–594.10.1001/archpsyc.65.5.586 [PubMed: 18458210]

Frick, PJ. Conduct disorders and severe antisocial behavior. New York: Plenum Press; 1998.

Frick PJ, Kimonis ER, Dandreaux D, Farrell JM. The 4-year stability of psychopathic trains in non-referred youth. Behavioral Sciences and the Law. 2003; 21:713–736. [PubMed: 14696028]

Frick PJ, White S. Research Review: The importance of callous-unemotional traits for developmental models of aggressive and antisocial behavior. Journal of Child Psychology and Psychiatry and Allied Disciplines. 2008; 49:359–375.

Green, DM.; Swets, JA. Signal Detection Theory and Psychophysics. New York: Wiley; 1966.

Hare, RD. The Hare Psychopathy Checklist-Revised. Toronto, Ontario: Multi-Health Systems; 1991.

Hyde L, Shaw D, Gardner F, Cheong J, Dishion T, Wilson M. Dimensions of callousness in early childhood: Links to problem behavior and family intervention effectiveness. Development and Psychopathology. 2013; 25:347–363. [PubMed: 23627949]

Kimonis E, Frick P, Boris N, Smyke A, Cornell A, Farrell J, Zeanah C. Callous-unemotional features, behavioral inhibition, and parenting: Independent predictors of aggression in a high-risk preschool sample. Journal of Child and Family Studies. 2006; 15:745–746.

Kochanska G, Aksan N. Children's conscience and self-regulation. Journal of Personality. 2006; 74:1587–1617. [PubMed: 17083659]

Kotler J, McMahon R. Child psychopathy: Theories, measurement and relations with the development and persistence of conduct problems. Clinical Child & Family Psychology Review. 2005; 8:291–325. [PubMed: 16362257]

Mitchell DGV, Colledge E, Leonard A, Blair RJR. Risky decisions and response reversal: is there evidence of orbitofrontal cortex dysfunction in psychopathic individuals? Neuropsychologia. 2002; 40:2013–2022. [PubMed: 12207998]

Newman JP, Kosson DS. Passive avoidance learning in psychopathic and nonpsychopathic offenders. Journal of Abnormal Psychology. 1986; 96:252–256. [PubMed: 3745647]

Newman JP, Patterson CM, Kosson DS. Response perseveration in psychopaths. Journal of Abnormal Psychology. 1987; 96:145–148. [PubMed: 3584663]

O'Brien BS, Frick PJ. Reward dominance: Associations with anxiety, conduct problems, and psychopathy in children. Journal of Abnormal Child Psychology. 1996; 23:223–240. [PubMed: 8743246]

Rhee S, Friedman N, Boeldt D, Corle R, Hewitt J, Knafo A, Zahn-Waxler C. Early concern and disregard for others as predictors of antisocial behavior. Journal of Child Psychology & Psychiatry. 2012; 24(2):157–166.10.1111/j.1469-7610.2012.02574.x [PubMed: 23320806]

SAS. What's New in SAS® 9.3. Cary, NC: SAS Institute Inc; 2012.

Vitale JE, Newman JP, Bates JE, Goodnight J, Dodge KA, Pettit GS. Deficient behavioral inhibition and anomalous selective attention in a community sample of adolescents with psychopathic traits and low-anxiety traits. Journal of Abnormal Child Psychology. 2005; 33(4):461–470. [PubMed: 16118992]

Wakschlag L, Briggs-Gowan M, Choi S, Nichols S, Kestler J, Burns J, Henry D. Advancing a multidimensional developmental specturm approach to preschool disruptive behavior. Journal of the American Academy of Child and Adolescent Psychiatry. under revision.

Wakschlag L, Choi S, Carter A, Hullsiek H, Burns J, McCarthy K, Briggs-Gowan M. Defining the developmental parameters of temper loss in young children: Implications for developmental psychopathology. Journal of Child Psychiatry and Psychology. 2012; 53:1099–1108.

Wakschlag L, Tolan P, Leventhal B. "Ain't misbehavin": Towards a developmentally-specified nosology for preschool disruptive behavior. Journal of Child Psychology and Psychiatry. 2010; 51:3–22. [PubMed: 19874427]

White SF, Pope K, Sinclair S, Fowler KA, Brisline SJ, Williams WC, Blair RJR. Disrupted expected value and prediction error signaling in youths with disruptive behavior disorders during a passive avoidance task. American Journal of Psychiatry. 2013; 170(3):315–323.10.1111/j.1469-7610.2012.02595.x [PubMed: 23450288]

Willoughby MT, Waschbusch DA, Moore GA, Proper CB. Using the ASEBA to screen for callous unemotional traits in early childhood: Factor structure, temporal stability, and utility. Journal of Psychopathology and Behavioral Assessment. 2011; 33:19–30. [PubMed: 21483647]

Key points

- This study provides novel evidence that decrements in passive avoidance learning that have been associated with psychopathy in older youth and adults can be identified in preschoolers with reduced responsiveness to socialization.
- Preschool children with difficulty altering their behavior in response to punishment in the real-world context of parental discipline also tended to have difficulty learning from punishment in a computerized learning task.
- Young children with pervasive impairment in altering their behavior in response to punishment may be at elevated risk for developing psychopathic tendencies later in childhood.
- Specialized cognitive training interventions may be a promising avenue to improving these children's malleability to disciplinary interventions.

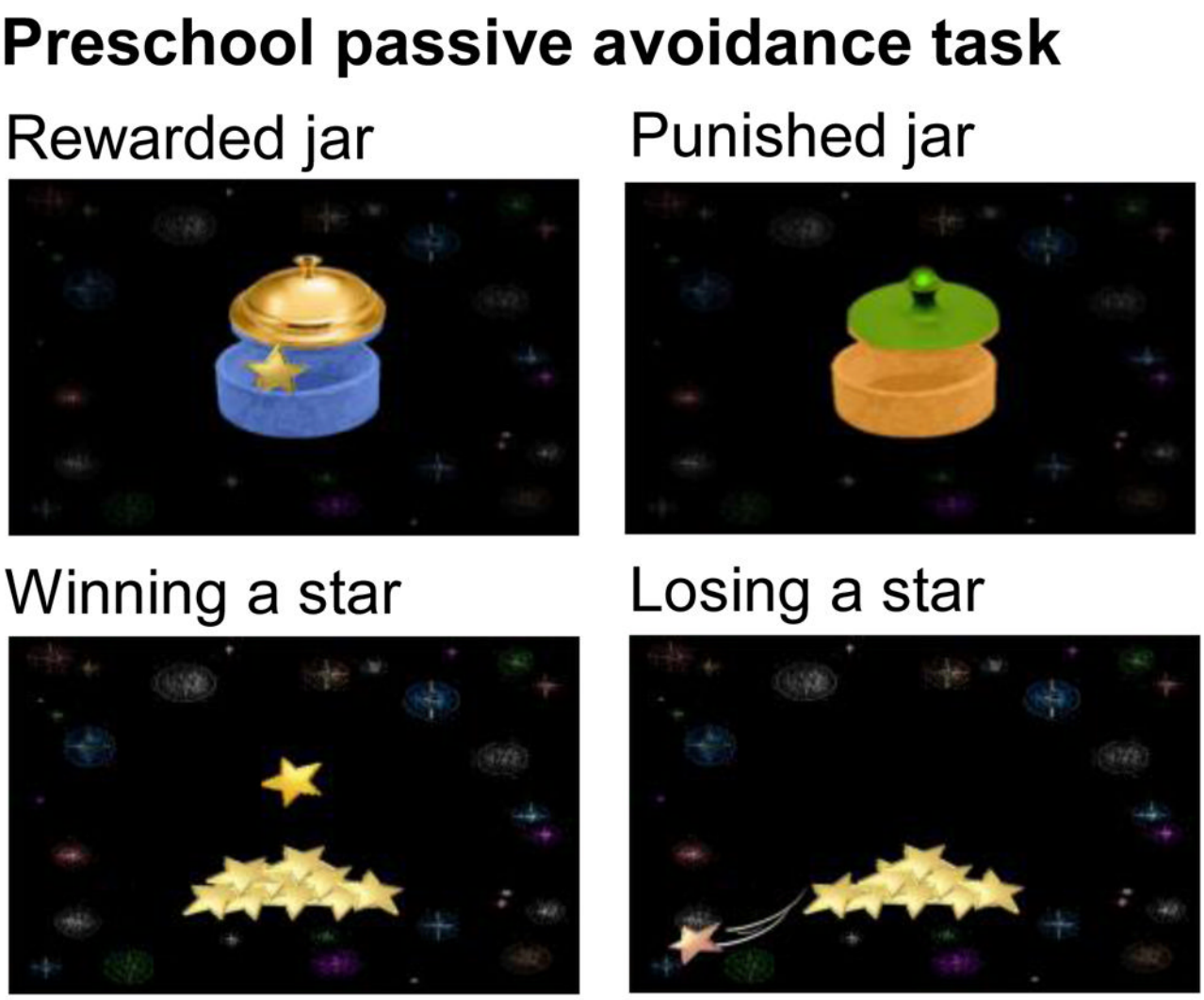

Figure 1.
Preschool passive avoidance task stimuli and feedback

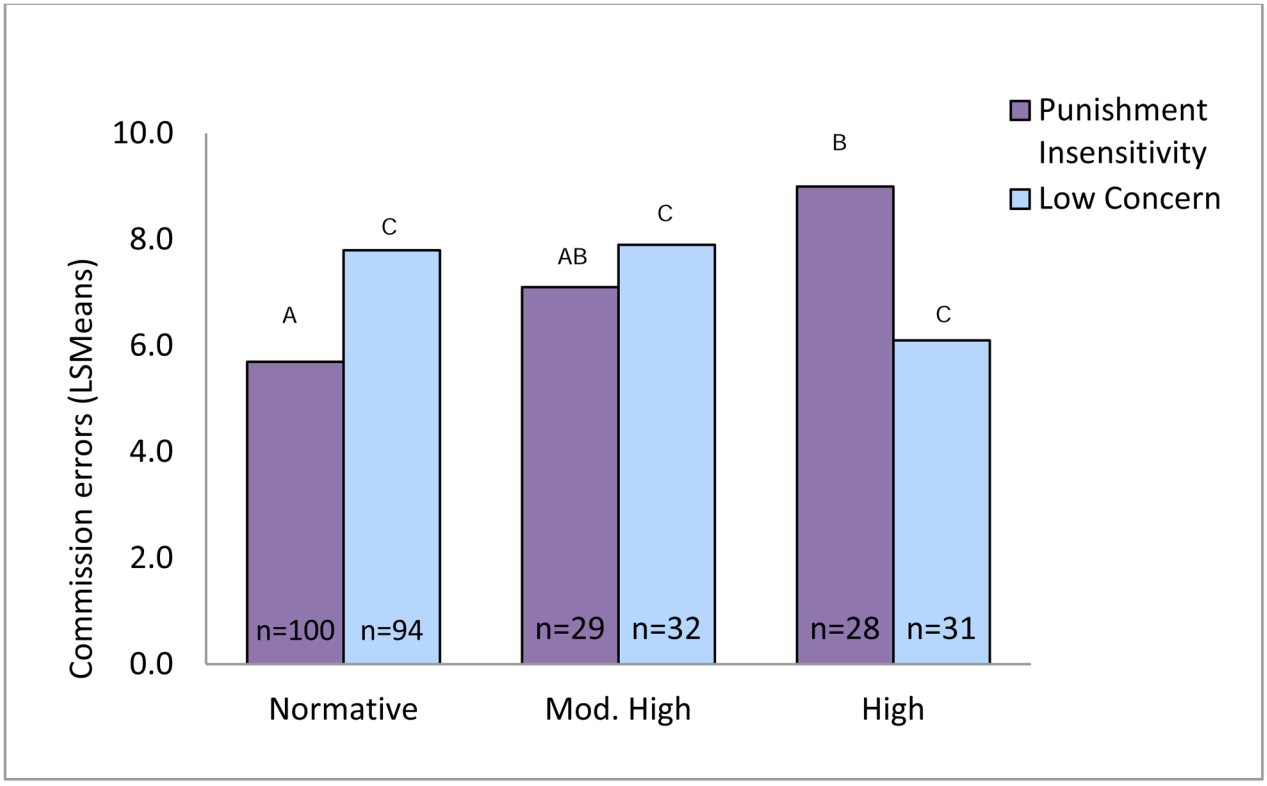

Figure 2. Discrimination sensitivity

Within grouping variables, means with different letters differ significantly ($p < .05$)

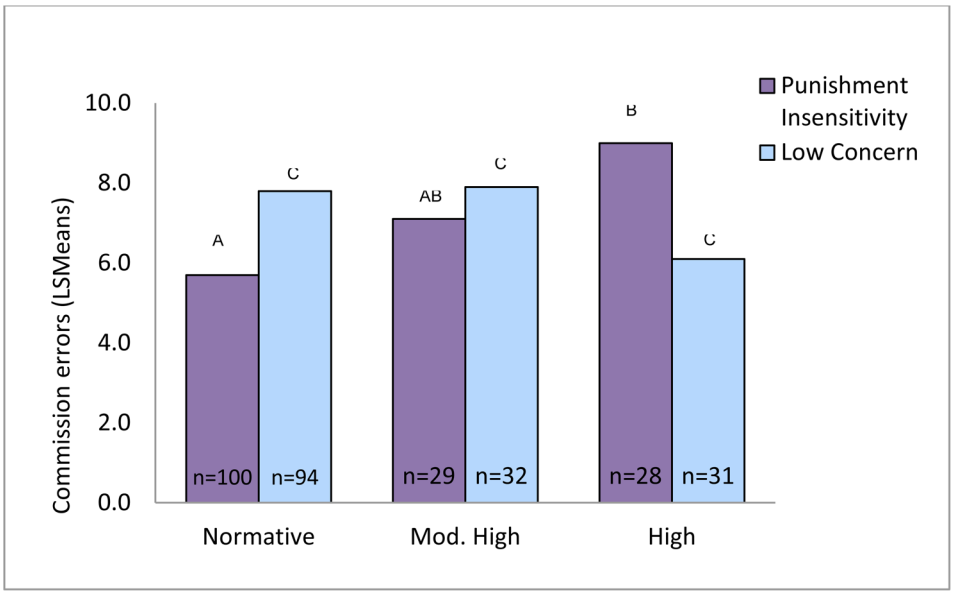

Figure 3. Commission errors

Within grouping variables, means with different letters differ significantly ($p < .05$)

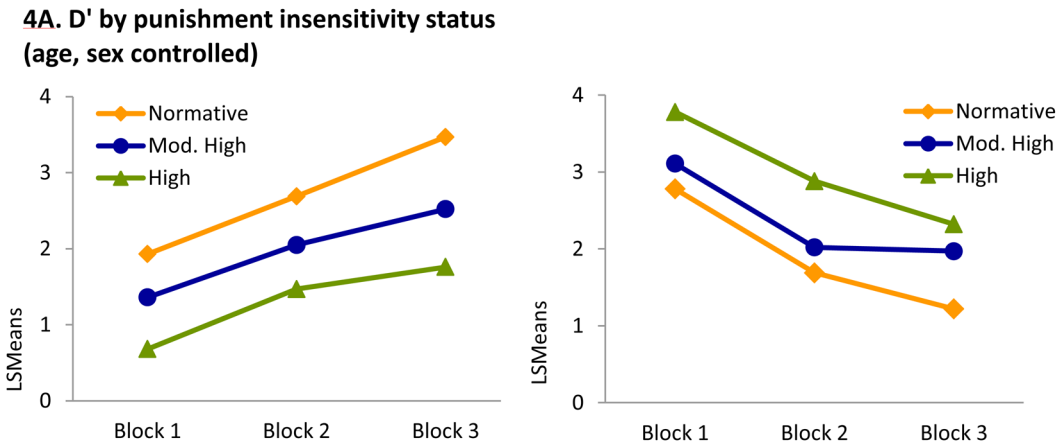

Figure 4.

D′ and commission errors across blocks by punishment insensitivity status

Table 1

Sample Characteristics

	Analyzed Sample		Punishment Insensitivity				Low Concern			
	N	%	Norm ative	Mod High	High	χ^2	Norm ative	Mod High	High	χ^2
	(N=157)		(n=100)	(n=29)	(n=28)		(n=94)	(n=32)	(n=31)	
Boys	82	52.2	47	58.6	64.3	3.2	56.4	40.6	51.6	2.4
Girls	75	47.8	53	41.4	35.7		43.6	59.4	48.4	
Ethnicity/Race										
Caucasian/White	33	21	28	17.2	0	14.9*	19.2	28.1	19.4	2.5
African American/Black	80	51	43	55.2	75		52.1	46.9	51.6	
Hispanic	42	26.8	28	27.6	21.4		26.6	25	29	
Other	2	1.3	1	0	3.6		2.1	0	0	
Maternal Education										
< HS	6	3.9	4.1	0	7.4	7.3	2.2	9.4	3.2	6.6
High school degree/GED	32	20.8	20.4	10.3	33.3		22	9.4	29	
Some education> HS	116	75.3	75.5	89.7	59.3		75.8	81.3	67.7	
Poverty status										
Non-poor	54	34.4	45	13.8	17.9	21.9***	34	46.9	22.6	7.1
Borderline poverty	22	14	17	13.8	3.6		13.8	18.8	9.7	
Poverty	81	51.6	38	72.4	78.6		52.1	34.4	67.7	
Single parent home	39	24.8	23	20.7	35.7	2.2	25.5	21.9	25.8	0.2
Two parent home	118	75.2	77	79.3	64.3		74.5	78.1	74.2	
Intimate partner violence	45	35.7	32.9	37.5	42.1	0.6	39.2	30.8	28	1.3

* p<.05,

** p<.01,

*** p<.001