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Reward Dominance Among Children with Disruptive Behavior Disorders

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Investigated was a deficit in avoidance learning in situations of competing rewards and punishments in boys with behavior disorders. This learning style has been found to differentiate adults with psychopathy and controls and has been labeled "reward dominance." The present study investigated the reward dominance paradigm in a group of 9- to 13-year-old boys with disruptive behavior disorders (N = 21) and a normal control group (N = 22). Subjects played four computer games programmed to provide the subject with a steadily decreasing ratio of rewards to punishments. Although the groups did not differ initially on the number of trials played, significant group differences emerged when measures of anxiety were included in the analysis. That is, boys with disruptive behavior disorders played more trials (reward dominance) only when the effect of anxiety was controlled. These findings are consistent with Gray's biobehavioral theory of personality and are also consistent with research indicating that anxiety is an important marker for a distinct subgroup of children with behavior problems.

KEY WORDS: avoidance learning; reward dominance; disruptive behavior disorders; Gray's theory.

INTRODUCTION

One of the most intriguing and troubling characteristics of people who display chronic patterns of antisocial behavior is the apparent failure to learn from punishment. Studies by Newman and colleagues (Newman,

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1980; Newman & Kosson, 1986; Newman, Patterson, & Kosson, 1987; Newman, Widom, & Nathan, 1985; Widom & Newman, 1985) have shown that psychopaths exhibit deficits in avoidance learning only under conditions of competing rewards and punishment, a pattern which has been labeled "reward dominance." Reward dominance refers to the strong effects of reward relative to punishment.

In a study which exemplifies reward dominance, Newman *et al.* (1987) used a computerized card game in an adult prison sample. On each trial, the subject chose either to view the next card or to stop playing. The subjects began with a pot of money, and with each "winning" card, the subject won money; "losing" cards resulted in monetary loss. The computer was programmed so that the probability of viewing a winning card dropped from 90% in the first 10 trials to 0% in the last 10 trials. The authors' reported that prisoners diagnosed as psychopathic chose to view significantly more cards and won less money than nonpsychopathic control prisoners. However, group differences disappeared when a visual display of cumulative response feedback was combined with a forced 5-sec pause between opportunities to respond. The authors concluded that the pause interrupted the response set of the experimental group and increased their use of visual feedback.

Although Newman's work has been confined to adults with psychopathy, the reward dominance paradigm has been extended to antisocial adolescents in two studies. Scerbo *et al.* (1990) tested the theory of reward dominance in 40 adolescents (mean age, 15.8 years) residing in a group home for juvenile offenders. These authors examined general learning during a discrimination task, which included learning of correct approach responses, as well as correct avoidance responses. Although the results across learning tasks were not consistent, the authors reported that adolescents with psychopathic features made fewer omission errors, which the authors attributed to their greater attention to reward cues. In a second study, Shapiro, Quay, Hogan, and Schwartz (1988) studied reward dominance in a small sample ($n = 19$) of adolescents in a school for severely emotionally disturbed youths. Nine subjects were rated by teachers as exhibiting significant antisocial behaviors and 10 subjects were used as a comparison group. Like adults with psychopathy, antisocial adolescents showed a reward dominance style relative to the control group on Newman's card game.

A recent study has even extended the reward dominance paradigm to elementary school-aged children (Daugherty & Quay, 1991). Using a modification of Newman's card playing task, these authors compared five groups of children from a regular school sample classified according to teacher ratings on the Revised Behavior Problem Checklist (RBPC; Quay

& Peterson, 1987). The five groups included children rated as having conduct problems (CD; $n = 10$), a group of children rated as having attention problems (ADD; $n = 9$), a group with CD and ADD (CD/ADD; $n = 10$), a group with anxiety/withdrawal problems (A/W; $n = 9$), and a normal control group (NC; $n = 15$). Consistent with past findings, both CD groups (CD and CD/ADD) differed from the NC group on the reward dominance task by having a higher mean number of trials on the task. Further, the two CD groups had significantly more trials than the A/W group.

Based on these studies, it appears that the concept of reward dominance may be extended from adults with psychopathy to children and adolescents with severe conduct problems. Such an extension of this paradigm is theoretically important because it is consistent with the comprehensive biobehavioral theory of personality proposed by Jeffrey Gray (1970, 1982, 1987). Gray's theory builds on earlier work by Eysenck (1957, 1967) and proposes that both normal behavior and abnormal behavior have their roots in the relative balance of two separate neurological systems. The behavior inhibition system (BIS) inhibits reward-seeking behavior in the presence of cues for punishment or frustrative nonreward. The behavioral activation system (BAS) responds to signals of reward and nonpunishment, controls increases in behavior after positive reinforcement, and mediates both active avoidance and escape of punishment (Gray, 1982). Because the BIS and the BAS are antagonistic systems, Gray's theory implies that it is the strength of the BAS *relative* to the BIS that leads a person with psychopathic features to focus on short-term rewards without fear of punishment. Behaviorally, this would be consistent with the reward dominance paradigm.

Because of the theoretical significance of Newman's reward dominance paradigm, the purpose of this study is to investigate this concept further in children. Daugherty and Quay (1991) extended the paradigm to elementary school-aged children in a predominantly Hispanic community sample. However, it is unclear how applicable these results would be to children with more severe behavior problems and children of different ethnic backgrounds. Also, in our study we test whether or not the presence of a salient cue and/or a forced pause moderates reward dominance in children. Newman *et al.* (1987) reported that providing a cue alone did not change the response style of adults with psychopathy but that a combination of a cue and a forced pause reduced the reward dominance style. Unfortunately, Newman *et al.* (1987) failed to test a pure pause condition (i.e., pause without a cue), leaving it unclear whether it was the pause or the combination of cue and pause which led to the improved performance. None of the prior studies on youths tested the potential moderating effects of a cue and/or a forced pause on the reward dominance style, despite the fact that such moderators could provide clues to intervention strategies for children with the reward dominance style.

In addition, no study of reward dominance in youth has used criteria from the Diagnostic and Statistical Manual of Mental Disorders, Third Edition Revised (DSM-III-R; American Psychiatric Association, 1987), to define conduct problems. Past studies also failed to test whether or not reward dominance is specific to subgroups of children with behavior disorders, which could provide clues to which children are at greatest risk for exhibiting psychopathy in adulthood (Robins, 1966). One potentially important method for dividing children with disruptive behaviors is grouping them according to the presence of anxiety (see Lahey, Loeber, Quay, Frick, & Grimm, 1992). Studies have shown that children with conduct problems who show a comorbid anxiety disorder are different behaviorally (Walker *et al.*, 1991) and on physiological markers (McBurnett *et al.*, 1991) from children with pure behavior disorders. Taking anxiety into account is especially important in studying the reward dominance paradigm given (1) the integral role of anxiety in Gray's theoretical model as a behavioral marker of the BIS and (2) the importance of anxiety in understanding adult psychopathy (Harpur, Hare, & Hakstian, 1989). Therefore, in this study we have used DSM-III-R definitions of disruptive behavior disorders and have conducted analyses which control for anxiety to test explicitly the importance of this variable for understanding reward dominance in our sample.

METHOD

Subjects

Subjects were 43 boys between 9 and 13 years of age, with a mean age of 11.21 years (SD = 0.99). The racial composition of the sample was 56% White, 42% African-American, and 2% American Indian. Subjects were recruited to form two groups for analyses: a group of children with disruptive behavior disorders (BD) and a normal control (NC) group. Table I provides descriptive information on the two groups. The two groups did not differ on either age or racial composition.

The BD group was recruited from three mental health agencies and the juvenile court system, as well as by announcements in a local newspaper. Recruitment notices requested participation of boys within the appropriate age range who "had a history of conduct problems and/or aggression" to participate in a study of learning styles. Prospective subjects were screened for cognitive deficits and psychosis by file review or administration of the Kaufman Brief Intelligence Test (K-BIT; Kaufman & Kaufman,

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Table I. Descriptive Statistics on the Behavior Disorders (BD) and the Normal Control (NC) Groups

Measure	BD (n = 21)	NC (n = 22)	Statistical test
Demographic information			
Mean age	11.06	11.40	$t(41) = -1.46$, p = ns
Race (% White/% African-American)	0.39/0.57	0.68/0.32	$\chi^2(1, n = 43) = 3.37$, p = ns
Group validity (CBCL-91 raw scale scores)			
Aggression	17.83	5.86	$t(41) = 5.53$, $p < .0001$
Delinquency	6.67	1.16	$t(41) = 4.74$, $p < .0001$
Attention problems	10.50	2.64	$t(41) = 6.40$, $p < .0001$

1990). All BD subjects had to have documented in their case file a recent intelligence score above 85 or they were given the K-BIT. Any subject scoring below 85 was not included in the sample. Also, subjects had to meet criteria for either attention-deficit hyperactivity disorder (ADHD), oppositional defiant disorder (ODD), or conduct disorder (CD; American Psychiatric Association, 1987) using a procedure described later.

As a result of these procedures, 21 subjects were included in the BD group. Fourteen subjects came from the three local mental health agencies; six subjects from an alternative school for children with behavior problems; seven subjects from a residential treatment facility for seriously emotionally disturbed children, and one subject from a state psychiatric inpatient facility. One subject each met inclusionary criteria from the juvenile court system and from newspaper announcements. The remaining five subjects were initially recruited from regular school classrooms for inclusion in the NC group. However, they were included in the experimental group, after they were found to meet diagnostic criteria for one or more of the disruptive behavior disorders. However, this change in classification was made without knowledge of the child's performance on the dependent variable.

The normal control group was recruited from a local public school, selected because it provided a racially and socioeconomically diverse student population. All subjects volunteered and received parental permission to participate in a study of children's learning style. The student could not ever have been seen by a mental health specialist, nor could he ever have received special education services. Initially, 27 children met this criteria. However, five children met our criteria for a disruptive behavior disorder described below and were placed in the BD group, leaving 22 boys in the control group.

Diagnosis of Children

The experimental group was formed by including any subject who had symptoms consistent with DSM-III-R criteria for CD, ADHD, and/or ODD, based on combined reports of parent and teacher on the DBD rating scale. The DBD rating scale is a 36-item checklist containing questions assessing each of the DSM-III-R symptoms for the disruptive behavior disorders (Pelham, Gnagy, Greenslade, & Milich, 1992). It is frequently used in research to approximate DSM-III-R diagnoses for school-age children, and evidence for its reliability and validity is available (see Pelham *et al.*, 1992). Any symptom marked as being a problem "pretty much" or "very much" by either parent or teacher was judged to be present. Cutoffs for each diagnosis were based on the application of strict DSM-III-R diagnostic criteria so that eight symptoms of ADHD, five symptoms of ODD, and three symptoms of CD were required for inclusion in the BD group.

As a result of this procedure, 10 (48%) boys in the experimental group met the criteria for CD, 14 (67%) met the criteria for ODD, and 17 (81%) met the criteria for ADHD. As expected from past research (see Hinshaw, 1987), there was a high degree of overlap in the diagnoses of children in the experimental group. Eighty percent of the subjects with CD also met the criteria for ODD. The same percentage of the CD group also met the criteria for ADHD. Only one subject was classified with "pure" CD. Among the boys who met the criterin for ADHD but not CD, 56% also were classified as having ODD. Only five subjects were classified with a "pure" ADHD diagnosis. The overlap of diagnoses in our BD group is similar to that found in other clinic samples (Lahey *et al.*, 1990; Spitzer, Davies, Barkley, & Costello, 1991; Walker *et al.*, 1991).

Raw scores on the scales of the parent version of the Child Behavior Checklist (CBCL-91; Achenbach, 1991) were used as a validity check for the classification of the BD and NC groups. The results of *t* tests comparing the mean raw scores of the two groups on the Delinquency, Aggression, and Attention Problems scales are reported in Table I. The two groups differed significantly on each of these scales, providing support for the validity of the grouping procedure. Not only were the mean scores of the experimental group higher than those of the control group on each scale, but the mean scores of the experimental group were clinically elevated in comparison to the CBCL-91 nationwide normative sample, corresponding to *T* scores above 70 for attention problems and delinquency and above group, leaving 22 boys in the

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Reward Dominance Task

A computerized task was designed to measure reward dominance according to Newman's paradigm and similar to the procedure employed by Daugherty and Quay (1991). However, the task was modified to include two within-subjects conditions, which varied the presence of a cue and a forced 5-sec pause. To maximize motivation for points, prior to playing the computer games subjects were allowed to view three prize boxes. Each box had the range of point totals needed to earn a prize. The most appealing and expensive prizes were contained in a box requiring almost-optimal performance across all games, so that subjects would be motivated to maximize their performance. The lowest prize box contained only stickers. Subjects were instructed that they could stop at any time and exchange their points for a prize.

Following the viewing of prizes, each subject was instructed to play four simple games on a computer. Each game was set up in the same manner: A stimulus (card, door, box, or person with a fishing pole) appeared on the screen and the child chose whether to press a key to view what was on the other side of the card (behind the door, under the box, or on the fishing pole) or to press a key to stop the game and receive the points earned to that point. In each game, there was a successful outcome (happy face, plus sign, hidden object, or fish), which resulted in a 1-point gain, and an unsuccessful outcome (sad face, minus sign, empty box, no fish), which resulted in a 1-point loss. Each child began each game with 50 points, and a point was added or taken away based on the outcome of each trial. Over 100 trials, the percentage of rewarded outcomes per 10 trials dropped from 90% to 0%. Data about each child's performance were recorded automatically by computer. The number of trials played in each game was used as the dependent variable in all analyses, consistent with past research (Newman *et al.*, 1987).

The two within-subject conditions (Cue vs. No Cue and Pause vs. No Pause) were counterbalanced across the four stimulus games. In the Cue condition (C), a tally of the child's points was displayed on the screen and continuously updated as the games proceeded. In the No-Cue condition (NC), the child was shown a tally of points before the game began but received no cumulative feedback on the point totals during the game and was aware only of the outcome of each trial that was played. In the Pause condition (P), a 5-sec pause occurred between the outcome of each trial and the child's next opportunity to respond. In the No-Pause condition (NP), the subject was still not allowed to respond continuously (i.e., hold the key down to allow continuous playing) and a 1-sec pause was imposed. The games always appeared in the same order (card, door, box, fishing). However, the order of presentation of the conditions was counterbalanced in the Latin squares design described in Table II.

Procedure

For each child who participated, informed consent was obtained from the parent or guardian, and assent was obtained from the child. Parents and teachers of each child who returned the consent form were asked to complete the DBD checklist and each parent completed the CBCL-91. All subjects completed the task in a quiet office with the experimenter present. The games were presented via an IBM-compatible computer and Magnavox monochrome monitor.

RESULTS

Within-Subjects Manipulation

Prior to the between subjects comparisons, several checks of our within-subjects conditions (Pause/No Pause, Cue/No Cue) were conducted. First, the number of trials and the number of points that were earned were compared across the games regardless of the order of the within-subjects conditions. The results of this check are provided in Table III. There were no systematic changes in the number of trials or in the number of points earned across games. This finding is important because it indicates that

Table II. Orders of Presentation of the Cue (C) and Pause (P) Conditions

Order	Type of stimulus			
	Card	Door	Box	Fishing
1	NC/NP	NC/P	C/NP	C/P
2	C/P	NC/NP	NC/P	C/NP
3	C/NP	C/P	NC/NP	NC/P
4	NC/P	C/NP	C/P	NC/NP

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Box	Fishing
C/NP	C/P
C/P	C/NP
C/NP	NC/P
P	NC/NP

Table III. Performance on Reward Dominance Task across Games and Order

Performance measure	Mean (SD)			
	Game 1, card	Game 2, door	Game 3, box	Game 4, fishing
Number of trials	57.6 (28.3)	67.2 (24.7)	64.1 (22.0)	69.3 (21.8)
Number of points	60.3 (8.7)	59.2 (9.9)	61.2 (8.70)	59.5 (10.0)
	Order 1 (n = 9)	Order 2 (n = 9)	Order 3 (n = 12)	Order 4 (n = 12)
Number of trials (across all 4 games)	314.8 (73.4)	240.2 (79.8)	245.58 (57.3)	241.25 (40.6)
Number of points (across all 4 games)	217.4[a] (36.7)	241.11[ab] (19.3)	247.58[b] (20.0)	250.1[b] (14.9)

Note. Numbers reflect the mean (SD) number of trials and points across type of stimulus (game), which was presented in an invariant order, and across order of presentation of the within-subjects conditions, which were counterbalanced across games using a Latin Squares design. There was a significant effect for order on mean number of trials [$F(3,38) = 3.12$, $p < .05$] and on mean number of points [$F(3,38) = 3.99$, $p < .01$]. There were no differences in pairwise comparisons using Tukey's procedure across mean trials, although there were differences across mean number of points, with significant differences designated by different subscripts.

the subjects did not simply "learn the task" across the trials, which supports the integrity of our within-subjects manipulation.

A 4 (Order) × 2 (Group) analysis of variance was conducted to test for the presence of order effects and/or an interaction between group and order. A significant effect for the order of presentation of the within-subjects conditions on the number of trials [$F(1,42) = 3.12$, $p < .05$] emerged from these analyses. Although pairwise comparisons using Tukey's procedure did not reveal statistically significant differences between means, the overall main effect appeared to be due to more trials for subjects with Order 1 than for subjects receiving other orders. This contention is supported by the findings that subjects in Order 1 earned significantly fewer points. The means and standard deviations for number of trials and number of points across each order are reported in Table III. Order 1 had the NP/NC condition first. Thus, subjects who began the task without either a cue or a pause were less responsive to subsequent cues in late games. However, there was no order × group interaction.

The computer task was administered prior to determining diagnostic status of the subjects and prior to determining other inclusionary criteria.

Whereas this methodology helped to reduce the possibility of experimenter bias, it prevented the order of presentation from being counterbalanced across final groups. Therefore, in all subsequent analyses order was used as a covariate to statistically control for the effects of this variable.

BD vs. NC Comparison

The main analysis was a 2 (Group) × 2 (Cue/No Cue) × 2 (Pause/No Pause) mixed ANCOVA, with order as the covariate, and using total trials on the computer task as the dependent variable. The main effect for Cue was not significant [$F(1,40) = .2445$, p = ns], and the main effect for Pause also failed to reach significance [$F(1,40) = .7949$, p = ns]. Most importantly, the predicted main effect for group membership failed to reach significance [$F(1,40) = 1.82$, p = ns] and there were no significant interactions. The least-squares mean numbers of trials (adjusted for the covariate order) across groups and each within subjects condition are presented in Table IV. Under each condition the subjects in the BD group had a higher mean number of trials than the NC group, although this difference was not large enough to reach statistical significance.

Controlling for Significant Levels of Anxiety

Based on Gray's model, which would predict that anxiety would enhance the response to punishment, we divided the groups based on elevations on a measure of anxiety: the parent-completed CBCL-91 Anxiety/Depression (AD) Scale (Achenbach, 1991). Because the BD group as a

Table IV. Mean Number of Trials Across Groups Reported Separately for Each Within-Subjects Condition

Condition[a]	BD (n = 21)	NC (n = 22)
NC/NP	73.51 (20.07)	64.65 (26.28)
NC/P	56.77 (26.22)	49.94 (23.95)
C/NP	77.26 (15.67)	74.85 (22.24)
C/P	60.98 (23.99)	50.47 (26.71)

Note. Numbers are mean number of trials expressed as least-squares mean, adjusted for the covariate order, followed by the standard deviation in parentheses. C, Cue; P, Pause.

whole was rated as significantly more anxious than the control group [$F(1,42) = 9.60$, $p < .01$], it was possible that the effect of anxiety on task performance masked differences between the groups.

We divided the sample into anxious and nonanxious subjects, based on a cutoff of 2 standard deviations above the mean on the AD scale based on the normative sample of the CBCL-91 (Achenbach, 1991). This division resulted in 35 nonanxious subjects and 8 anxious subjects. A 2 (group) × 2 (cue) × 2 (pause) × 2 (anxiety) mixed ANCOVA revealed a significant main effect for group [$F(1,38) = 5.23$, $p < .03$]. As predicted, children in the BD group had significantly more trials than children in the NC group *when anxiety was included as a factor*. It is interesting to note that under each condition anxious subjects had fewer trials than nonanxious subjects, although this effect was not large enough to reach statistical significance [$F(1,38) = 2.94$, $p < .09$]. There were no significant effects for the within-subjects conditions, nor were there significant interactions. However, one should be cautious in interpreting the nonsignificant between-group interaction (Group × Anxiety) due to the small number of anxious subjects, which likely led to insufficient power to detect interactions.

Separating ADHD from the BD Group

There is a growing body of evidence that children with ADHD without cooccuring conduct problems (i.e., ODD and CD) may differ from children with conduct problems in many clinically important ways (see Hinshaw, 1987). Therefore, all analyses were repeated with the five subjects with ADHD alone eliminated from the BD group, leaving 16 subjects with conduct problems. This exclusion made minimal differences in the pattern of results. In the mixed ANCOVA including anxiety as a factor, the effect of group (i.e., conduct problem diagnosis) approached significance [$F(1,33) = 3.80$, $p < .06$], whereas it was significant when the ADHD children were included. However, the effect size remained virtually unchanged, indicating that the change in significance level was due mainly to a loss of power resulting from the smaller sample size.

DISCUSSION

The primary purpose of the present study was to test further the reward dominance paradigm in young children with disruptive behavior disorders. Analyses comparing the behavior disorders (BD) and the normal control (NC) groups did not support our hypothesis that the performance of these groups would differ on a reward dominance task. Although the mean number of trials was in the expected direction (the BD group showing greater number of trials than the NC group), this difference was not statistically significant. One possibility is that the relatively small sample size reduced the power of the statistical test to detect group differences. However, sample sizes in the present study *exceeded* those used in other studies of reward dominance which have detected group differences (Daugherty & Quay, 1991; Shapiro *et al.*, 1988). Therefore, it is likely that some other factor contributed to these results.

One potential factor that may have reduced our ability to detect group differences was a failure to measure intelligence in all subjects. All BD subjects were screened for intelligence quotients above 85 through chart review or through an individually administered intelligence test. Therefore, the only statement that could be made was that this group did not include children with below average intelligence. Also, there was no assessment of intelligence in the normal control group and so the comparability of groups on intellectual level is open to question. This methodology was felt to be justifiable given the very basic level of cognitive skill required by the computer task. This contention is supported by the results of Daugherty and Quay (1991), who found that the number of trials on the reward dominance task was uncorrelated with measures of reading and math achievement.

This study did, however, uncover a more plausible explanation for the lack of group differences, one with important theoretical implications. When an elevated level of anxiety was included as a factor, significant differences between the BD and the NC groups emerged. This suggests that group differences were obscured in the overall analysis by a significant proportion of BD children who also exhibited high levels of anxiety. Anxious subjects tended to have *fewer* trials, and therefore, including anxiety as a factor reduced the error variance in the ANOVA sufficiently to result in a significant effect for BD.

The importance of anxiety in explaining task performance is consistent with Gray's (1982, 1987) biobehavioral theory. Gray's theory states that anxiety is related to activation in the neurologically based BIS, which increases responsivity to cues for punishment and frustrative nonreward. Hence, highly anxious children were more responsive to the increase in nonrewarded trials on the computer task and, therefore, played fewer trials. In contrast, the findings for the BD group can be explained by a combination of an underactive BIS and an overactive BAS, which controls appetitive behavior responding to cues for reward. As stated in Gray's theory, behavioral patterns are determined by the relative balance of the BAS and BIS. Hence, the BD group played longer in spite of increasing cues to punishment. However, this patten of "reward dominance" was found only when anxiety (a behavioral marker for the BIS) was controlled.[3]

Although the size of our anxious group was small, past studies on the reward dominance paradigm in adults and adolescents are consistent with the present study. Specifically, reward dominance has typically been found in groups screened for the presence of anxiety. For example, Newman *et al.* (1987) found that the reward dominance paradigm differentiated "psychopathic" prisoners from nonpsychopathic prisoners. Although many behaviors were included in the definition of psychopathy (e.g., lack of empathy, callousness, shallow emotions), a major defining characteristic was a lack of guilt and anxiety. In the studies by Shapiro *et al.* (1988) and Daugherty and Quay (1991), CD subjects were selected based on elevated scores on a scale measuring antisocial behavior, with an additional restriction that no other scale was elevated. Therefore, these authors likely eliminated many highly anxious subjects with CD.

In addition to supporting Gray's model, these findings support the presence of anxiety as delineating a distinct subgroup of children with behavior disorders (see Lahey *et al.*, 1992). Past research has shown that juvenile delinquents who exhibited elevated levels of anxiety were found to have lower rates of recidivism than nonanxious delinquents (Quay & Love, 1977). Also, children with CD who did not show elevated levels of anxiety were found to show a much more severe and impairing patten of antisocial behavior than anxious children with CD (Walker *et al.*, 1991). Nonanxious children with CD also had neurochemical differences from anxious children with CD (McBurnett *et al.*, 1991). This line of research, illustrating important interactions between anxiety and conduct problems, could be quite important in delineating a subgroup of children with conduct problems at high risk for showing psychopathic features as adults.

A puzzling finding in our study was that eliminating children with ADHD but without significant conduct problems resulted in minimal changes in results. This suggests that the performance on the reward dominance task of the ADHD children was similar to that of the other children

[3]Another possible explanation for our findings is that the group differences were due to impulsive responding by the BD group or simply to insensitivity to punishment, rather than to reward dominance per se. Truly to rule out these possibilities, one could employ a "punishment-only" condition to see if the BD group showed a greater number of responses in this condition as well, and one could correlate measures of impulsivity with performance on the reward dominance task. Although we did not employ either methodology, there are several data that are not consistent with attributing this style purely to insensitivity to punishment or impulsive responding. First, at least in adults, psychopaths have not differed from controls on tasks simply employing punishment contingencies (Newman & Kosson, 1986). Second, in our study there was no significant main effect for pause, nor was there a pause × group interaction, which suggests that a condition designed to break impulsive response sets did not appreciably affect the results for either group.

in the BD group. This is contrary to many other areas of research which have documented important differences between children with ADHD and children with conduct problems (see Hinshaw, 1987). It may be that the similarities among the disruptive behavior disorders in the reward dominance paradigm reflects a common process (e.g., underactive BIS) that could account for the high degree of overlap within these disorders. However, this interpretation must be made cautiously, given that the BD sample was recruited primarily for children who "displayed conduct problems or aggression." This may have led to the selection of an unrepresentative ADHD sample. Also, classification of groups was based purely on parent and teacher rating scales, without consideration of age at symptom onset, symptom duration, or functional impairment, which should be a part of more stringent clinical diagnoses (Frick & Lahey, 1991).

Another purpose of this study was to determine whether the use of a visual cue and/or a forced 5-sec pause between opportunities to respond would moderate the children's performance on the reward dominance task. The evidence in this area was mixed. There were no significant main effects in any analysis for either the Cue or the Pause conditions, nor were there any significant interactions involving the within-subjects conditions. However, the significant effect for the order of conditions was due to a higher number of trials played when the No Pause/No Cue condition was the first one presented. This result seems to suggest that the presence of a cue and/or a pause in early games led to an increased responsiveness to punishment on future games. However, clearly the utility of a cue and/or forced pause as potential moderators to the reward dominance style requires further study before conclusive statements can be made.

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