2007

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RUNNING HEAD: RESPONSES TO CONFLICT AND COOPERATION

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IN PRESS: JOURNAL OF ABNORMAL CHILD PSYCHOLOGY

Abstract

This study examined patterns of behavioral and emotional responses to conflict and cooperation in adolescents with anxiety/mood disorders and healthy peers. We compared performance on and emotional responses to the Prisoner's Dilemma (PD) game, an economic exchange task involving conflict and cooperation, between adolescents with anxiety/depressive disorders (A/D) (*N*=21) and healthy comparisons (n=29). Participants were deceived to believe their co-player (a pre-programmed computer algorithm) was another study participant. A/D adolescents differed significantly from comparisons in patterns of play and emotional response to the game. Specifically, A/D participants responded more cooperatively to cooperative overtures from their co-players; A/D girls also reported more anger toward co-players than did comparison girls. Our findings indicate that A/D adolescents, particularly females, respond distinctively to stressful social interchanges. These findings offer a first step toward elucidating the mechanisms underlying social impairment in youth with internalizing disorders.

KEYWORDS: Anxiety, depression, cooperation, conflict, interpersonal interaction, Prisoner's Dilemma

Introduction

The incidence of mood and anxiety disorders increases dramatically during adolescence (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003; Hankin & Abramson, 2001; Nolen-Hoeksema & Girgus, 1994; Pine, Cohen, Johnson, & Brook, 2002). These disorders are associated with impairment on multiple fronts; for adolescents, who commonly report intense concern with interpersonal matters and heavy reliance on peers for support, the social impairment associated with depression or anxiety is especially problematic (Nelson, Leibenluft, McClure, & Pine, 2005; Paquette & Underwood, 1999; Rudolph, 2002; Steinberg & Morris, 2001). Not only do anxious and depressed youth have greater difficulties forming and maintaining friendships (Rubin, LeMare, & Lollis, 1990), but they also tend to receive more peer rejection and lower ratings of social competence (Rudolph, Hammen, & Burge, 1994). Further, such social difficulties appear to be lasting; affected youth who experience social dysfunction are at risk for pervasive interpersonal problems later in life (Fombonne, Wostear, Cooper, Harrington, & Rutter, 2001; Harrington, Fudge, Rutter, Pickles, & Hill, 1990).

Cognitive theory provides one framework for examining the association between internalizing psychopathology and social difficulty. According to cognitive models (e.g., (Beck, 1983), two distinct personality styles termed sociotropy, which is marked by a heightened need for positive interaction with others, and autonomy, which is characterized by a heightened need to preserve independence, may increase vulnerability to internalizing disorders. Whereas elevated autonomy appears to relate specifically to depression (Bieling & Alden, 1998; Fresco, Sampson, Craighead, & Koons, 2001), a substantial literature has demonstrated associations between elevated sociotropy and both depression and anxiety (Alford & Gerrity, 2003; Brown,

Juster, Heimberg, & Winning, 1998; Clark, Steer, Haslam, Beck, & Brown, 1997; Fresco, Sampson, Craighead, & Koons, 2001; Robins, Bagby, Rector, Lynch, & Kennedy, 1997).

Paradoxically, although sociotropy is defined as a need for positive social interactions, it has been shown to relate to increased frequency of negative interchanges (Flett, Hewitt, Garshowitz, & Martin, 1997). This association may reflect the consequences of behavioral patterns such as excessive reassurance seeking (Davila, 2001; Joiner & Metalsky, 2001) and limited self-assertion in potentially conflictual situations (Bruch, Rivet, Heimberg, Hunt, & McIntosh, 1999; Oakman, Gifford, & Chlebowsky, 2003) that are intended to prevent negative responses from others. This type of self-protective interpersonal approach has been reported consistently in anxious and depressed individuals; however, only a relatively small body of research has measured these behaviors using observational (Bieling & Alden, 1998, , 2001) rather than self-report methods. Therefore, specific patterns of interpersonal engagement that may characterize anxious and depressed individuals in real social situations remain inadequately understood.

Experimental tasks from the economic exchange literature (de Quervain et al., 2004; Fehr & Rockenbach, 2004; King-Casas et al., 2005; McCabe, Houser, Ryan, Smith, & Trouard, 2001; Rilling et al., 2002; Sally, 2003) offer a novel approach to examining distinct patterns of behavior that may contribute to interpersonal difficulties associated with internalizing disorders. These tasks simulate real-life, emotionally charged interactions in controlled settings; the Prisoner's Dilemma (PD) Game, for example, permits turn-by-turn evaluation of interactions that involve pro-social, submissive, and hostile or competitive behaviors. Additionally, when the task is administered in conjunction with other types of measure (e.g., self-report), cognitive and emotional correlates of these behavior patterns can also be examined.

Little research has focused on associations between PD game performance and psychopathology; we could find no published studies that have administered this task to individuals with clinically significant anxiety or depression. Findings from two studies in healthy adults suggest that depressive symptoms relate to an uncooperative pattern of response during the task (Haley & Strickland, 1986; Hokanson, Sacco, Blumberg, & Landrum, 1980). Hokanson and colleagues (1980) found adults with high levels of depressive symptoms to play more uncooperatively and exploitatively than non-depressed peers when they knew their co-player's responses in advance. Additionally, in messages to the other player during the game, depressive participants tended to communicate sadness and self-devaluation. Similarly, Haley and Strickland (1986) found women who self-reported high levels of depressive symptoms to play more aggressively when their co-player explicitly betrayed them than did non-depressed women. Both studies indicate that PD tapped into differences between healthy and symptomatic adults at levels of both phenomenological experience and behavioral performance. However, because neither study examined potential contributions of anxiety to behavior and cognition during the task, it remains unclear whether this pattern of behavior is likely to be consistent across individuals with different internalizing disorders and/or symptoms. Indeed, given that anxious and anxiously depressed individuals appear to display more sociotropic than autonomous personality styles (Robins et al., 1997), this group may show a markedly different pattern of response to the task from that seen in subclinically depressed samples.

Further, economic exchange paradigms have rarely been used with youth, particularly those with psychopathology that relates to impaired social functioning, and no published studies have examined associations between anxiety/depression and task performance in children or adolescents. Findings from one recent study, which demonstrated associations between

loneliness in healthy school-aged girls (but not boys) and a pattern of PD game play marked by low trust suggest that use of this task to study childhood psychopathology may be fruitful (Rotenberg, MacDonald, & King, 2004). This sex difference is particularly noteworthy because several theories suggest that the female bias in mood and anxiety disorders that emerges during adolescence may relate to sex differences in emotional responsiveness and social relationships that become particularly marked during the same period (Cyranowski, Frank, Young, & Shear, 2000; Hankin & Abramson, 2001; Rudolph & Conley, 2005).

In the present study, we administered a version of the Prisoner's Dilemma (PD) game to adolescents with anxiety and depressive disorders (A/D) and healthy comparison participants. The game was rigged to increase the likelihood that participants would experience interpersonal conflict with their co-players. Because social impairment in youth with internalizing disorders may relate to difficulty with self-assertion in potentially conflict-laden situations, we hypothesized first that relative to comparison participants, A/D adolescents would show a conflict-avoidant pattern of play, manifest as consistently cooperative behavior, even when their co-players behaved uncooperatively and that they would perceive themselves as more cooperative. Second, we predicted that A/D adolescents would demonstrate heightened sensitivity to interpersonal conflict during the PD game, as manifested by elevated negative affect following conflict-laden interactions. Additionally, because the one recent study to use the PD game in a pediatric population found evidence of sex differences in patterns of play and their psychological correlates (Rotenberg, MacDonald, & King, 2004), we included sex, along with patient status, as an independent variable. We predicted that interpersonal factors rather than game outcome would drive group differences in patterns of play and emotional response;

consequently, we anticipated that such differences would be evident even in the absence of group differences in propensity to win or satisfaction with game outcome.

Method

Participants

We administered the PD game to 25 A/D adolescents and 33 psychiatrically healthy youth who were recruited from the community via advertisement and referral from physicians and other health care practitioners. The twenty-one A/D participants and 29 comparison participants who reported at post-task debriefing that they had believed they were playing a real co-player were included in the final sample. All participants were enrolled in a larger ongoing treatment study of anxious/depressed youth that was approved by the NIMH Institutional Review Board (IRB). The PD task was administered to all participants in the larger study who had enrolled after the IRB approved the addition of the PD task to the standard battery of pre-treatment behavioral measures. Thus, the only participants in the treatment study who did not complete the PD task were those who had completed the study before the task was added to the assessment battery. Prior to participation, parents provided written informed consent and youth granted written assent.

To determine diagnostic status, all participants and a parent were administered the Schedule for Affective Disorders and Schizophrenia for School-Age Children (K-SADS-PL) (Kaufman et al., 1997) by clinicians who demonstrated excellent inter-rater reliability with senior investigators (all kappa values > .90). In addition to the presence of a DSM-IV anxiety disorder or major depressive disorder (MDD), inclusion criteria for patients included a high level of symptoms, as indicated by a score > nine on the Pediatric Anxiety Rating Scale (PARS) (RUPP, 2001) or a score > 39 on the Children's Depression Rating Scale (CDRS) (Poznanski, Freeman,

& Mokros, 1985), impairment in global function as indicated by a score < 60 on the Children's Global Assessment Scale (CGAS) (Shaffer et al., 1983), willingness to participate in an eight-week treatment study requiring weekly visits, and persistent anxious or depressive symptoms during a three-week trial of supportive therapy. Exclusion criteria for both A/D and comparison groups comprised use of any psychotropic medication; DSM-IV psychiatric diagnoses other than anxiety disorders, major depressive disorder (MDD), attention deficit hyperactivity disorder (ADHD) or oppositional defiant disorder; medical illness; pregnancy; substance abuse; or IQ of less than 70.

All 21 A/D participants met DSM-IV criteria for at least one current anxiety or depressive disorder: generalized anxiety disorder (GAD; n=9), social phobia (n=8), separation anxiety disorder (SAD; n=6), and/or MDD (n=9). Of these participants, eight were diagnosed with two or more disorders. Six participants met criteria for MDD, but not for an anxiety disorder; however, all six of these participants also reported anxious symptoms that were elevated, but below diagnostic thresholds for anxiety disorders. Twelve participants met criteria for at least one anxiety disorder, but not for MDD; and three met criteria for both MDD and at least one anxiety disorder. All comparison participants were free of current or past psychiatric disorders.

Because of high rates of comorbidity, high levels of anxious symptomatology among depressed participants, and small numbers of participants within each diagnostic category in the A/D group, we considered major depression and three anxiety disorders, generalized anxiety disorder (GAD), social phobia, and separation anxiety disorder, as a loosely unified group of internalizing conditions. Several factors drove this decision. First, no prior research has used the PD task to study youth with internalizing disorders of any type, rendering a priori hypotheses

about disorder specificity difficult to formulate. Further, there is ongoing debate about the value of considering individual mood and anxiety disorders in isolation, given the high rates of comorbidity among such disorders, the frequency with which anxiety disorders precede the onset of depression (Costello et al., 2002), and evidence of shared genetic substrates among internalizing disorders (Costello et al., 2002; Khan, Jacobson, Gardner, Prescott, & Kendler, 2005). Second, anxiety and depression relate similarly to social difficulty among adolescents (La Greca, 2005). Finally, the convention of grouping youth with anxiety disorders together has been employed by the Research Units for Pediatric Psychopharmacology (RUPP) Anxiety Study and other randomized controlled treatment trials for pediatric anxiety disorders (Birmaher et al., 2003; Kendall et al., 1997), as well as neurobiological studies of pediatric anxiety disorders (Pine et al., 2000).

Demographic characteristics of both groups are described in Table 1; IQ data were missing for two comparison participants. A/D and comparison groups did not differ according to sex, $\chi^2(1)=.002$, $p> .05$, ethnicity, $\chi^2(7)=7.59$, $p> .05$, or IQ, $t(46)= -.01$, $p> .05$. Groups did, however, differ in age, $t(48)=2.14$, $p< .05$ (A/D: M = 13.37, SD = 2.57; Comparison: M = 14.73, SD = 1.94).

Procedures

Participants played the PD game (Rilling et al., 2002) four times with a computerized confederate, whom they were deceived to believe was a human co-player. At the start of the task the examiner informed participants that they would play a game four times with another study participant via a wireless computer network. The examiner provided no further information about the co-player and deferred responses to all questions about the co-player until the end of

the task. Participants then underwent training on the game and completed 10 practice rounds before starting the games, each of which consisted of 20 rounds.

During each round (see Figure 1), two players (the participant and a computerized co-player) independently and simultaneously chose to cooperate with or "defect from" (not cooperate with) the other player. The participant indicated his or her choice via key press (1="cooperate", 2="not cooperate"). The computerized co-player, which operates according to an algorithm based on human patterns of play (Rilling *et al*., 2002), always cooperates during the first round of a game and always defects during the final two rounds. This ensures some consistency among players in the experience of the game. During all other rounds, the computer generates a "choice" based on the human subject's choices in the prior two rounds. A higher frequency of participant defection in the prior two rounds elicits an increased likelihood of computer defection, while a higher frequency of participant cooperation in the prior two rounds elicits an increased likelihood of computer cooperation. To ensure that the participant experiences periodic defection or "betrayal" by the co-player, the algorithm specifies a 50% likelihood that the computer will defect after four consecutive rounds of mutual cooperation. We used this algorithm because prior research has shown that in an unconstrained game, players engage in mutual cooperation during much of the course of play, defecting only in the final few rounds (Rilling *et al.*, 2002). Such a pattern of play would prevent participants from experiencing perceived betrayal in adequate numbers of trials for statistical analysis. Additionally, use of an algorithm diminishes the likelihood that group differences in outcome frequencies could stem from systematic differences in co-players' patterns of play between groups.

After both players submitted their choices, the outcome of the round appeared on the screen, along with a running total of each player's cumulative earnings for a game. Participants

were informed during training that after completing the task they would be paid the amount that they earned during one of the four games (selected randomly at the end of the task).

After the task, participants completed a brief questionnaire about their perceptions of and emotional responses to the game. Specifically, all participants rated (on 10-point scales, with 1 being lowest and 10 being highest) their satisfaction with their earnings, anger towards the other player, and feelings of cooperativeness toward the other player. Two participants (one A/D, one comparison) did not complete the questionnaire due to time constraints.

Subsequently, in accordance with guidelines for ethically appropriate authorized deception (Wendler & Miller, 2004), participants were debriefed about the deception involved in the task and the motivation for its use. They and their parents had been informed at consent that during the study protocol they would be given misleading or inaccurate information about a task, but they were not told when this would occur. They were also told that if they preferred, this task could be omitted. No participants asked for the task to be omitted. During post-game debriefing, participants were read a standardized statement that described how they had been deceived and explained that deception was necessary to ensure that they experienced the game as a "real" interaction with another person. Participants were also told that no further deception would occur in the study. After the researcher had explained the deception process and rationale, participants were asked if they had been deceived and were encouraged to express any concerns or thoughts that they had about the deception. No participants reported any distress; nor did their parents. Only the patients (n=21, 84%) and comparison subjects (n=29, 88%) who reported having been successfully deceived were included in statistical analyses.

Results

Because mean ages differed significantly between patients and comparison participants, age was included as a covariate in all repeated measures and univariate analyses (two-tailed alpha =.05). For repeated measures ANCOVAs with a significant omnibus effect based on Wilks' Lambda, emotion-specific between-group effects were interpreted and followed-up with Bonferroni-corrected post-hoc tests.

All means for all dependent variables are presented in Table 2.

Game Outcomes

To examine whether game outcome and satisfaction with game outcome varied systematically by group (A/D, comparison) or sex (male, female), two way analyses of covariance (ANCOVAs) were conducted with number of games won (games in which the player earned more money than the co-player), average amount of money earned per game, and satisfaction with amount of money won as dependent variables.

No significant main effects of group or sex were apparent for the number of games won, [Group: $F(1, 46) = 0.03$, $p = .87$, Sex: $F(1, 47) = 0.002$, $p = .97$]; average amount of money earned [Group: $F(1, 46) = 0.07$, $p = .78$, Sex: $F(1, 46) = 0.13$, $p = .72$], or satisfaction with earnings [Group: $F(1, 44) = 0.17$, $p = .68$; Sex: $F(1, 44) = 0.45$, $p = .51$], nor were there significant group x sex interactions for games won, $F(1, 44) < 0.001$, $p = .99$; earnings, $F(1, 46) = 0.04$, $p = .84$; or satisfaction ratings, $F(1, 44) = 0.04$, $p=.85$.

Patterns of Play

We then conducted a repeated-measures ANCOVA to examine the effects of group and sex on patterns of play during the game. This analysis focused on how frequently participants chose to cooperate on trials immediately following a co-player cooperation or defection. Number of responses of each type (cooperate after computer cooperation, cooperate after computer

defection) were dependent variables. The Greenhouse-Geisser correction was applied to results of all repeated measures tests to correct for sphericity.

The repeated measures ANCOVA examining patterns of play during the game yielded a significant main effect of group status, $F(1, 45) = 13.24$, $p < .001$ (see Figure 2). There was no significant main effect of sex, $F(1, 45) = 0.28$, $p = .60$. Post hoc univariate ANCOVAs indicated that following co-player cooperation, A/D participants were significantly more likely than comparison participants to cooperate, $F(1, 47) = 12.07$, $p < .001$. Groups did not differ in their likelihood to cooperate following co-player defection, $F(1, 47) = 1.62$, $p = .21$.

Response Time

We also conducted a repeated-measures ANCOVA to examine the effects of group and sex on response latency for each response type. Mean response times to cooperate or defect following computer cooperation and defection served as dependent variables. This analysis of response times after different types of co-player response provided an alternate means of evaluating participants' reactions to their co-players' behavior.

The repeated measures ANCOVA examining response latencies for cooperation or defection following co-player cooperation or defection yielded no significant main effects for group status, $F(2.59, 108.86) = 1.26$, $p = .29$, or sex, $F(2.59, 108.86) = 0.92$, $p = .42$. The interaction of group status and sex was also non-significant, $F(2.59, 108.86) = 0.04$, $p = .99$.

Emotional Ratings

To compare emotional responses to the co-player across groups and sexes, we conducted two final ANCOVAs with ratings of anger at the other player and feelings of cooperativeness with the other player as the dependent variables.

Comparisons of patients' and comparisons' post-task interview responses revealed a significant group by sex interaction, $F(1, 43) = 4.29$, $p = .04$ (see Figure 3). Decomposition of this interaction indicated that female A/D participants reported significantly more anger towards their co-players than comparison females, $F (1, 19) = 9.09$, $p = .007$. Male and female A/D participants did not differ significantly in their anger ratings, $F (1, 17) = 0.64$, $p = .43$; nor did male comparison participants differ from male A/D participants, $F (1, 23) = 0.24$, $p = .63$, or from female comparison participants, $F (1, 25) = 4.07$, $p=.06$. For feelings of cooperativeness toward the other player, a significant main effect of sex was evident, $F(1,43) = 4.23$, $p < .05$, with girls rating themselves as more cooperative than boys. No other significant main effects or interactions were apparent for ratings reported on the debriefing questionnaire (all p's > .05).

Discussion

Results of the present study showed significant differences between A/D and healthy adolescents in patterns of play during a simulated social interaction involving conflict and cooperation. Differences between A/D and comparison participants in both behavioral and affective responses were evident despite the absence of group differences in earnings, satisfaction with earnings, or frequency of victory. A/D adolescents thus appear to respond in distinctive and specific ways to the interpersonal aspects of the PD game.

Specifically, we found adolescents in the A/D group to be significantly more likely than comparison participants to cooperate following co-player cooperation. This pattern of play, which appears to reflect a priority placed on maintaining positive interpersonal interactions, is consistent with predictions derived from cognitive theory, in which a sociotropic personality style, or one that emphasizes affiliation and positive interactions with peers, has been linked anxious and "anxiously depressed" presentations (Robins et al., 1997). Interestingly, regardless

of group status, female participants perceived themselves as more cooperative with their co-players than did males; however, actual patterns of cooperation differed only by group.

Contrary to our expectations, we did not see a pattern of conflict avoidance, as indexed by increased cooperative behavior in the A/D group following co-player non-cooperation. Prior research using self-report measures has documented associations between conflict avoidance or submission and socially-focused anxiety in youth (Johnson, LaVoie, Spenceri, & Mahoney-Wernli, 2001; Walters & Inderbitzen, 1998). The present findings, however, suggest that a pro-social rather than a submissive behavioral style may characterize more broadly defined anxious and depressed/anxious youth. On the surface, such an interpersonal style might appear unlikely to relate to social difficulties; however, it could signify a reluctance to take the interpersonal risks necessary for all but the most superficial relationships. Such a self-protective pattern of behavior has been associated in prior studies with limited self-disclosure and a tendency to distance oneself from others, which in turn have been shown to elicit negative reactions from peers (Meleshko & Alden, 1993; Pilkington & Richardson, 1988).

As predicted, self-reported emotional response to the game differed between groups, with A/D girls reporting more anger toward the other player at post-task debriefing than did A/D boys or comparison girls. We did not, however, find that A/D participants evaluated themselves as more cooperative than comparison peers, although a sex difference to this effect was apparent across groups. Our finding that sex moderated some group differences are consistent with previous research using the PD task with youth (Rotenberg, MacDonald, & King, 2004).

Our findings underscore the importance of gathering multiple types of data regarding social interactions. Unlike prior studies of social functioning in adolescents with internalizing disorders, this study used a paradigm that models social interchanges in discrete units (rounds)

and assesses global emotional responses to a sustained series of such interactions. The behavioral response data suggest that A/D youth are less willing than healthy peers to disrupt positive interpersonal exchanges, even when doing so would lead to short-term financial rewards. Further, although A/D participants played in a more cooperative manner than peers, this pattern of play did not appear, at least for A/D girls, to result in a more satisfying "relationship" with co-players. Instead, emotional rating data indicate that A/D girls reported experiencing more anger toward the other player after the games had ended.

Taken together, these self-report and behavioral data suggest that youth with internalizing disorders engage in a pattern of social engagement that is designed to facilitate cohesion. This pattern of interchange, however, while ostensibly aimed at keeping interactions positive, appears to engender heightened negative emotion in girls. The sex-specific nature of this finding is intriguing in light of several recent conceptualizations of developmental psychopathology that implicate sex differences in socially focused cognitions and behaviors in the emergence of internalizing disorders (Cyranowski, Frank, Young, & Shear, 2000; Hankin & Abramson, 2001; Rudolph & Conley, 2005).

Why A/D girls, but not boys, reported more anger than same-sex peers with their co-players is unclear and the present data permit only speculation, particularly since specific anxiety diagnoses were unevenly distributed between males and females. Of particular note is that among A/D girls, who showed a distinctive pattern of emotional response to the game, social phobia was the most common diagnosis, followed by separation anxiety disorder. Diagnoses among A/D boys, in contrast, were more heavily weighted toward GAD. It is thus difficult to disentangle the correlates of sex from those of diagnosis. The present data, however, provide

suggestive evidence that both sex and disorder may influence patterns of maladaptive social interaction.

An alternate possibility, however, is that A/D girls, regardless of specific diagnosis, may be particularly prone to heightened rejection sensitivity (RS) or the tendency to readily interpret, anxiously expect, and overreact to rejection (Downey & Feldman, 1996). Such a tendency may have colored their perceptions of their interactions during the game, such that they were more likely than other participants to interpret co-player defection as "rejecting" and thus anger-provoking. Consistent with this possibility, earlier studies have found RS, which correlates highly with anxiety, to be associated in adult women with elevated anger following conflicts with significant others, as well as an increased tendency toward hostility and withdrawal of emotional support from intimate partners (Downey & Feldman, 1996).

The elevated anger that A/D girls reported toward their co-players could also relate to a greater tendency among A/D girls to ruminate about interpersonal interactions perceived as conflict-laden. Such rumination may engender and amplify feelings of anger or distress in response to perceived negative interactions and may then lead to maladaptive behavioral reactions (Lyubomirsky, 1995). This possibility is consistent with a large body of research on adolescence, gender, internalizing disorders, and coping styles (e.g., (Nolen-Hoeksema & Girgus, 1994) and merits further study.

The present study is limited by a relatively small sample that included a heterogeneous group of A/D participants, with diagnoses unevenly distributed according to participant sex, age, and ethnicity. Further, we selected participants who were seeking treatment for a mood or anxiety disorder and who showed consistent signs of impairment. This approach permitted us to focus on individuals with both relatively high levels of symptoms and clear impairment, who are

thus particularly worthy of study. However, use of such stringent selection criteria also limited our participants to a highly impaired subset of the population of individuals with mood and anxiety disorders. As a result, it will be important for future studies to examine adolescents with mood and anxiety both in the clinic and in the community. In both contexts, the present findings need to be replicated in larger samples that permit exploration of patterns of association with specific diagnoses within each sex. In particular, it will be important to include an adequate number of depressed, non-anxious participants to ascertain whether distinct patterns of behavior and emotional response relate independently to depressive versus anxiety disorders. This appears particularly important, in light of findings that depressive symptoms in healthy adults relate to a more conflict-laden pattern of play (Haley & Strickland, 1986; Hokanson, Sacco, Blumberg, & Landrum, 1980). Examining distinctly depressed versus distinctly anxious adolescents, to the extent possible, given high rates of comorbidity, might provide an explanation for divergences between our findings and those in these two earlier studies. In keeping with the cognitive framework of the present research, it would be informative, in the context of such a larger study, to examine explicitly patterns of association among anxious and depressive diagnoses, sociotropic and autonomous personality styles, and behavioral and emotional responses to the PD game.

Age differences between the A/D and comparison groups further complicate interpretation of our findings; although our positive findings remained significant when age was covaried between groups, our small sample size precluded a closer, potentially illuminating, examination of age effects. In particular, although our sample was too small to conduct statistical comparisons within the A/D group, the eight participants with MDD (regardless of whether they also met criteria for an anxiety disorder) were slightly older (M=14.3; SD=2.6) than the 12

participants with anxiety diagnoses alone (M=12.7; SD=2.4). It is consequently difficult to disentangle effects of age and presence or absence of a depressive disorder on the present findings.

Another methodologic limitation is that we assessed emotional responses after the game rather than during the course of play. We chose this approach to be consistent with prior research using the PD task. However, the accuracy with which such retrospective evaluations reflect participants' feelings as they unfold during the course of an interaction is unclear. Participants' reports, for example, may have been excessively weighted toward their emotions at the end of the game (when the computer defects on two consecutive rounds); alternatively, they may have minimized or forgotten distress that they experienced during the game by the time of debriefing.

Further research is needed to understand the temporal/causal nature of the association between psychopathology and group differences in patterns of response in the PD game. Studies of youth at high risk for mood and anxiety disorders would provide an optimal means to study whether differences from youth at low risk for psychopathology exist before the onset of clinically meaningful symptoms. Additionally, administration of the task to youth who have been successfully treated for anxiety or mood disorders or whose symptoms have remitted spontaneously would provide data regarding the persistence of group differences in the absence of clinically significant symptoms.

A second potentially interesting direction for future research is to combine data from behavioral measures such as the PD task and data from physiological measures. Prior studies show that youth with internalizing disorders differ from healthy peers on measures of neural activation in response to threat cues (McClure et al., 2007; C. S. Monk et al., 2006), cardiac functioning (C. Monk et al., 2001), and respiratory functioning (Pine *et al*., 2000); consequently,

such data gathered in the context of the PD game could prove informative. Examination of interactions between sex and diagnostic status for physiological responses also appears warranted in future research, given that heightened sensitivity to social stress is evident in females at physiological, as well as at behavioral and emotional, levels. Some recent findings, for example, suggest that sex may moderate patterns of healthy adults' cardiovascular and cortisol responses to social stressors (Kudielka, Buske-Kirschbaum, Hellhammer, & Kirschbaum, 2004; Stroud, Salovey, & Epel, 2002; Stroud, Tanofsky-Kraff, Wilfley, & Salovey, 2000) and neural responses to social threat cues (McClure *et al.*, 2004).

The PD task provides a novel means for identifying differences between adolescents with internalizing disorders and healthy comparisons in both emotional and behavioral responses to interpersonal conflicts. Teaching anxious and depressed youth effective means of social risk-taking and of coping with conflict may improve their psychosocial functioning and overall quality of life. In addition, the task provides a potential basis for examining differences in psychophysiological and neural patterns of activation associated with interpersonal conflict in both psychopathology and healthy samples. A better understanding of the neural activation, in particular, involved in the impairments of youth with mood/anxiety disorders could lead to the development of more precisely targeted diagnostic and treatment approaches.

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Figure Captions

Figure 1. Trial structure in the Prisoner's Dilemma game. At the beginning of the trial (Figure 1a), the subject is asked to cooperate or not cooperate with a co-player (who simultaneously makes the same decision) by pressing a computer key (1 for "cooperate", 2 for "not cooperate"). A matrix on the screen shows the player's options (columns), as well as the co-player's options (rows) and the payoffs for each conjunction of choices. Depending on the choices made during the trial, subjects accrue varying amounts of money. If both players cooperate during a trial, both win $2. If both defect, both win $1. If one player cooperates and the other defects, the cooperating player wins nothing and the defecting player wins $3. Winnings accumulate continuously across all 20 trials. Thus, the long-term payoff is highest if both players cooperate over numerous trials; however, the short-term (single trial) payoff for an individual subject is highest if he/she defects while the other player cooperates. After the participant chooses, the option that he/she has selected is displayed on the screen (In Figure 1b, the player chose to cooperate).Each player is blind to the other player's selection until the end of the trial, when the conjunction of both players' choices is displayed on the screen, along with a running total of winnings for each player (Figure 1c).

Figure 2. Mean percent of cooperative trials of each type (cooperate after co-player cooperates, cooperate after co-player defects) by group (A/D = anxious/depressed).

Figure 3. Mean anger ratings (on a 0-10 scale) by group (A/D = anxious/depressed) and sex.

Table 1. Demographic and Clinical Characteristics of Patients With Anxiety/Mood Disorders and Healthy Comparison Subjects.

	Patients			Comparisons		
	All (n = 21)	Female (n=10)	Male (n=11)	All (n=29)	Female (n=14)	Male (n=15)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Age	13.4 (2.6)	14.2 (2.8)	12.9 (2.4)	14.7 (1.9)	15.2 (2.0)	14.7 (2.0)
IQ	109.5 (15.6)	108.7 (12.9)	110.3 (18.3)	109.5 (10.7)	107.2 (9.1)	111.6 (12.0)
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Ethnicity						
Caucasian (non-Latino)	16(76)	6 (60)	10 (91)	19 (66)	8 (57)	11 (73)
African American	3 (14)	3 (30)	0 (0)	2 (7)	0 (0)	2 (13)
Latino	0 (0)	0 (0)	0 (0)	2 (7)	2 (13)	0
Mixed/Other	2 (10)	1 (10)	1 (9)	6 (21)	4 (29)	2 (13)
DSM-IV Diagnosis						

Generalized Anxiety Disorder	10 (48)	2 (20)	8 (73)	--	--
Separation Anxiety Disorder	6 (29)	4 (40)	2 (18)	--	--
Social Phobia	8 (38)	6 (60)	2 (18)	--	--
Major Depressive Disorder	9 (43)	4 (40)	5 (45)	--	--

Table 2

Mean scores: Behavioral and Emotional Responses During the Prisoner's Dilemma Game

	Anxious/Depressed			Comparison		
	Female	Male	Total	Female	Male	Total
	N = 10	N = 11	N = 21	N = 14	N = 15	N = 29
Games Won	3.2 (1.1)	3.2 (1.3)	3.2 (1.2)	3.1 (1.3)	3.1 (0.8)	3.1 (1.1)
Total Earnings (in dollars)	31.7 (3.5)	32.2 (2.1)	32.1 (2.8)	32.1 (3.5)	32.2 (2.1)	32.1 (2.8)
Satisfaction with Earnings (1-10 scale)	8.9 (1.8)	8.5 (1.6)	8.7 (1.6)	8.7 (1.7)	8.4 (1.3)	8.6 (1.5)
Behavioral Response Types						
Percent cooperation after co-player defects	8.2 (3.3)	8.1 (8.5)	8.1 (6.4)	8.7 (4.7)	5.7 (3.4)	7.1 (4.3)
Percent cooperation after co-player cooperates	26.4 (8.6)	14.5 (6.1)	20.2 (9.4)	14.4 (7.0)	16.2 (11.4)	15.3 (9.4)

Reaction time (in milliseconds)						
Cooperate after co-player defects	1175.0	1169.7	1172.3	932.1	994.5	964.5
	(585.4)	(375.0)	(478.5)	(257.3)	(361.6)	(311.3)
Cooperate after co-player cooperates	1373.4	1205.3	1285.37	914.86	926.52	920.91
	(568.7)	(490.6)	(522.75)	(211.3)	(318.64)	(267.22)
Defect after co-player defects	1313.5	1213.2	1263.3	967.4	985.1	976.6
	(512.2)	(413.0)	(455.8)	(317.0)	(240.6)	(274.6)
Defect after co-player cooperates	1253.4	1281.3	1267.3	992.5	1129.8	1063.7
	(370.2)	(438.5)	(395.2)	(190.4)	(315.7)	(267.3)
Emotional Ratings (1-10 scales)	N = 9	N = 11	N = 20	N = 13	N = 15	N = 28
Anger at co-player	4.3 (3.1)	3.1 (2.1)	3.7 (2.6)	1.8 (1.7)	3.3 (2.2)	2.6 (2.1)
Cooperativeness with co-player	6.3 (2.7)	3.8 (2.9)	5.0 (3.1)	6.1 (3.0)	5.0 (2.5)	5.5 (2.8)

Figure 1

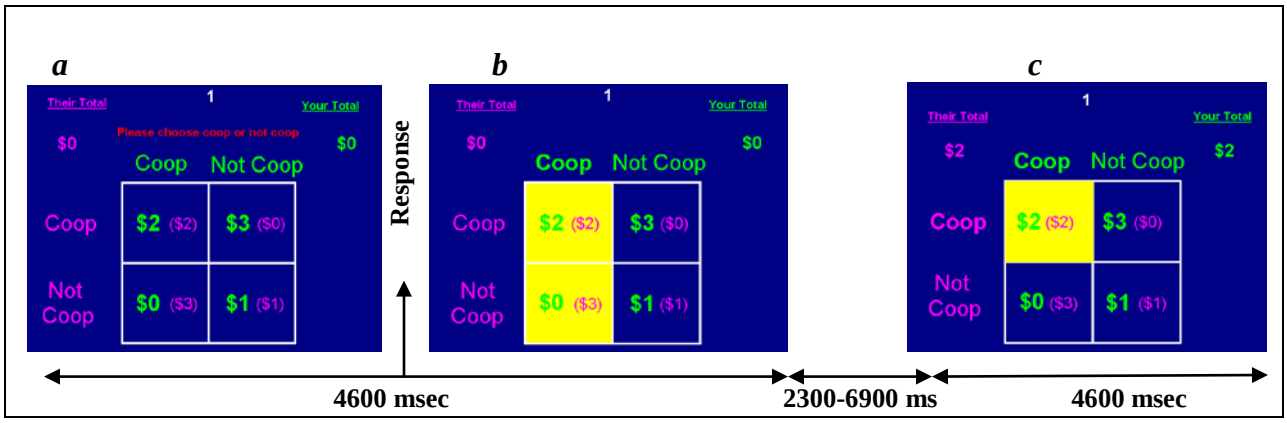
a
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Figure 2.

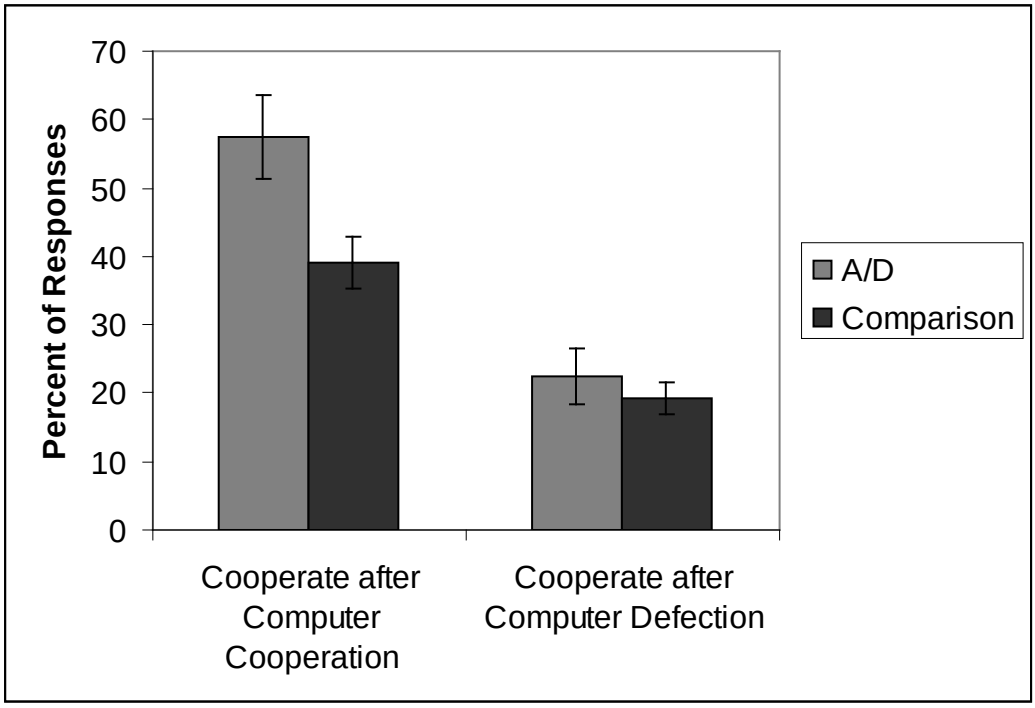
70
60
50
40
30
20
10
0
Percent of Responses
A/D
Comparison
Cooperate after Computer Cooperation
Cooperate after Computer Defection

Figure 3