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Can Children With ADHD Be Motivated to Reduce Bias in Self-Reports of Competence?

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Objective: Our purpose in the current study was to examine whether children with attention-deficit/hyperactivity disorder (ADHD) and comparison children, if adequately motivated, are able to purposefully match their teachers' ratings of competence in multiple domains and whether any reductions in self-perceptual bias normalize self-views in relation to comparison children's self-perceptions. ***Method:*** Participants included children with ADHD ($n = 178$) and comparison children ($n = 86$), between 7 and 12 years of age. The majority of participants were Caucasian (81.4%) and male (77.3%). Primary measures included the Self-Perception Profile for Children (SPPC; Harter, 1985), which was administered during a baseline assessment. In a subsequent session, children completed the SPPC twice more following instructions to first attempt to match their teachers' ratings of competence and then following the offer of an incentive for matching their teachers' ratings. Repeated measures analyses of covariance were conducted with between- and within-subjects factors. ***Results:*** Significant reductions in 2 of 3 domains (scholastic, behavioral conduct) were found for children with ADHD. No reductions were found across domains for comparison children or in the social domain for children with ADHD. Across conditions, the amount of bias exhibited by children with ADHD was never normalized in relation to comparison children's ratings. ***Conclusions:*** Explicit instructions to match teacher ratings of competence and implementation of incentives were only partially effective in reducing the biased self-perceptions of children with ADHD. Results suggest that children with ADHD, on average, cannot view themselves in a completely unbiased fashion, rather than that they will not do so, although self-protection clearly plays a partial role.

Keywords: attention-deficit/hyperactivity disorder, ADHD, self-concept, self-perceptions, positive illusory bias

A relatively well-established finding in the recent child psychopathology literature is that many children with attention-deficit/hyperactivity disorder (ADHD) report "positive illusory" self-perceptions—self-perceptions that are positively biased relative to external criteria for evaluating competence. Indeed, this finding holds regardless of whether criteria for evaluating level of bias involve teacher report (Hoza et al., 2004; Hoza, Pelham, Dobbs, Owens, & Pillow, 2002), parent report (Hoza et al., 2004), or objective performance measures (Owens & Hoza, 2003), as well as across multiple domains of competence (for a review, see Owens, Goldfine, Evangelista, Hoza, & Kaiser, 2007).

Attempts to better understand the mechanisms underlying positively biased self-perceptions in children with ADHD have most often focused on the self-protective role they may play, although recent work has considered several other explanations as well (see Owens et al., 2007). The self-protective explanation suggests that children with ADHD bolster their self-views in areas of uncertain or deficient competence, in order to make chronic failure or uncertainty about their abilities less threatening (Diener & Milich, 1997). Viewed in this manner, positively biased self-views may be considered a coping strategy that allows children to face daily challenges without suffering high levels of distress or depression regarding their difficulties.

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Past research also has documented the presence of a moderate positive bias in the general population: the "better-than-average effect" (Alicke & Govorun, 2005). For example, Taylor and Brown (1988) reported three illusions about oneself that maintain well-being including "unrealistically positive self-evaluations, exaggerated perceptions of control or mastery, and unrealistic optimism" (p. 193). They concluded that these illusions both foster mental health and prevent dysphoric tendencies. However, the bias exhibited by children with ADHD tends to differ from that of the general population, as children with ADHD demonstrate differences of significantly greater magnitude between actual and perceived competence, display significantly worse performance and less task persistence despite illusory bias, and maintain a high perception of competence despite objective failure (for a review, see Owens et al., 2007). Further, children with ADHD inflate self-views the most in domains of greatest deficit (Hoza, Gerdes, et al., 2004; Hoza, Pelham, et al., 2002), making domain-specific examination of self-views particularly important. Indeed, one prominent self-concept theory (Harter, 1985) indicates that children's self-concept can and does, in fact, vary by domain of competence.

Prior research examining self-protection as a potential mechanism underlying positively biased self-views supports its viability in the social (but not academic) domain. In particular, two prior studies employing laboratory manipulations documented that children with ADHD will relax their self-protective stance in the social domain following receipt of external positive feedback—that is, once self-bolstering is no longer needed (Diener & Milich, 1997; Ohan & Johnston, 2002). These studies, therefore, provide support for the self-protective function of positively biased social self-views for children with ADHD. Yet, the finding that this bias lessens when positive feedback is given does not shed light on the extent to which children with ADHD are aware that they are inflating and/or whether or not they can purposefully reduce bias in their self-perceptions. Furthermore, yet unknown is the extent to which these biases can be reduced to levels that fall within normative ranges (i.e., are comparable to those for children without ADHD). The present study was designed to address these questions.

Consistent with the self-protection perspective, there is an inverse relation between depressive symptoms and positively biased self-perceptions, such that children with ADHD and co-occurring depressive symptoms either do not exhibit positively biased self-perceptions or do not exhibit them to the same degree (Hoza, Gerdes, et al., 2004; Hoza, Pelham, et al., 2002). Although direction of influence was not examined in these studies, it is possible that positively biased self-perceptions may buffer children from symptoms of depression. Further, recent longitudinal work examining the dynamic covariation between positively biased self-perceptions and depressive symptoms found that decreases in positive biases over a 6-year period were associated with corresponding increases in depressive symptoms (Hoza et al., 2010). Similarly, reductions in positively biased self-perceptions over a 2- to 3-year period in children with ADHD were related both to increased symptoms of depression and to greater levels of depressive attributions (McQuade, Hoza, et al., 2011). Taken together, these results suggest that positively biased self-perceptions may serve a self-protective role, buffering children with ADHD from depressive symptoms and other depressive cognitions. They also suggest that depressive symptoms should be taken into account when examining levels of biased self-perceptions in children with ADHD, a strategy we adopt in the present study.

To date, self-views have not generally been considered in tailoring treatment plans for optimal treatment response. Empirically supported treatments for ADHD include stimulant medication, behavior therapy, and their combination (Hoza, Owens, & Pelham, 1999). All of these treatments are notably focused on modifying the behavior of children with ADHD using methods external to the child—a chemical intervention in the case of pharmacotherapy and environmental modifications or contingencies in the case of behavior modification. Interestingly, treatment strategies requiring self-application and self-monitoring (e.g., self-control training) have been unsuccessful as primary treatments for ADHD (for reviews, see Abikoff, 1991; Hinshaw, 2000). However, if potent external contingencies rewarding use of these strategies are concurrently applied, improvements can be ascertained using these methods (Hinshaw, 2000), suggesting that ADHD children are quite poor at self-monitoring and self-regulating and do so only when external structure requires it.

One possible consequence, therefore, is that for children with positively biased self-views, poor self-awareness as manifested in the failure to recognize or acknowledge need for improvement may result in impaired social information processing and reduced motivation for therapeutic change (Hughes, Cavell, & Grossman, 1997). Children with ADHD may continue to exhibit unrealistic or overly optimistic expectations for performance despite receiving negative feedback. As a result, negative or inappropriate behavior may continue to be displayed, with negative feedback ignored, in order to protect against perception of failure. This maintains a positive self-view and fails to result in changes in behavior or response to treatment. Indeed, a recent study now links inflated self-perceptions in youths with ADHD with poorer treatment response (Mikami, Calhoun, & Abikoff, 2010). Similarly, for a subset of boys with ADHD, high confidence was associated with less counselor-rated improvement in a summer treatment program (Hoza & Pelham, 1995). Finally, in yet another study, positively biased self-views were associated with a higher average daily rate of negative maladaptive behaviors in a summer treatment program (e.g., rule violations, lying, verbally abusing staff, noncompliance, and interrupting others; Kaiser, Hoza, Pelham, Gnagy, & Greiner, 2008). Although preliminary, these studies suggest that lack of awareness of and/or failure to acknowledge one's difficulties may predispose externalizing children to poorer treatment response. Indeed, in nonclinical samples of school children, positively biased self-perceptions have been linked with higher levels of aggression and/or more delinquent behavior (David & Kistner, 2000; Edens, Cavell, & Hughes, 1999; Hughes et al., 1997; Hymel, Bowker, & Woody, 1993) and worse social skills (Gresham, Lane, MacMillan, Bocian, & Ward, 2000). This work indicates clearly that although positively biased self-perceptions may play a protective role in regard to depression, they may be a risk factor for other forms of maladjustment.

In light of this complex set of issues, it becomes even more important to understand whether children with ADHD who report positively biased self-views cannot report accurately about their competence or whether they fail to do so as part of a self-protective stance. If the latter explanation is correct, a reasonable therapeutic strategy might be to simultaneously work to improve competence

and the ability to cope adaptively with failure experiences while also decreasing bias in self-perception. Improving competence would lessen the need for self-protection and risk for depression, whereas reducing bias would lessen risk for aggressive and delinquent behaviors. However, if some children with ADHD cannot report accurately about their competence, such an approach is unlikely to have an impact. Therefore, demonstrating the modifiability of positive illusions in response to a deliberate effort by the child to reduce bias across several different competence domains is an important first step needed to justify further research aimed at developing intervention components targeting biased self-perceptions.

Hence, there were two primary goals in the present study. First, we examined in a domain-specific manner whether levels of bias in the self-perceptions of children with ADHD could be decreased via manipulations introduced to reduce bias. We expected that maximal change in self-perception would be achieved only after introducing a potent incentive for congruence with teacher ratings. Second, in secondary analyses, we considered the extent to which any improvements obtained through the use of these manipulations "normalized" levels of bias in the self-perceptions of children with ADHD, relative to comparison children.

Method

Participants

Recruitment occurred following institutional review board evaluation and approval at each site. Participants were 178 children with combined or hyperactive/impulsive type ADHD and 86 comparison children between the ages of 7.68 and 11.42 years (mean age = 9.24). Approximately half of the children were recruited from each of two sites; identical procedures were used for eligibility determination and diagnosis.[1] Participants were recruited from multiple sources at each site including (a) media advertisements; (b) referrals from local pediatricians, child psychologists, and psychiatrists; (c) local schools; and (d) ADHD specialty clinics and summer programs. Although data were not collected regarding recruitment source for each participant, each of the sources noted was utilized at each site.

All ADHD participants were required to have a *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (*DSM–IV–TR*; American Psychiatric Association, 2000) diagnosis of ADHD, combined or predominantly hyperactive/impulsive type, as positively biased self-perceptions appear not to be associated with predominantly inattentive type ADHD (Owens & Hoza, 2003). Diagnoses were made at each site by two independent doctoral-level (PhD) diagnosticians, via chart review, considering all information gathered. Primary diagnostic measures included the National Institute of Mental Health Diagnostic Interview Schedule for Children, Version IV (DISC–IV; Shaffer, Fisher, Lucas, Dulcan, & Schwab-Stone, 2000), administered to a primary caretaker, parent and teacher ratings on the updated *DSM–IV* version (Pelham, 2002) of the Disruptive Behavior Disorders (DBD) Rating Scale (Pelham, Gnagy, Greenslade, & Milich, 1992), and the parent Child Behavior Checklist and Teacher Report Form (Achenbach & Rescorla, 2001).

Participants with ADHD were accepted for the protocol only if the two diagnosticians agreed on combined or hyperactive/impulsive type of ADHD and secondary diagnoses of oppositional defiant disorder (ODD; $n = 89$, 50.0% of ADHD group) or conduct disorder (CD; $n = 26$, 14.6% of ADHD group). Exclusionary criteria included the following: (a) children with inattentive type ADHD; (b) children who did not score 80 or above on full or estimated IQ; (c) children with a history of neurological problems that could call into question an ADHD diagnosis; (d) children being treated for ADHD with medications that could not be withdrawn for testing (e.g., antidepressants); (e) children with a concurrent diagnosis of any of the following disorders: pervasive developmental disorder, schizophrenia or other psychotic disorders, sexual disorder, or organic mental disorder.

Comparison participants were evaluated with the same measures as the children with ADHD. Comparison children could not currently nor in the past have met criteria for ADHD. The same diagnosticians who established final diagnoses of the children with ADHD also reviewed the comparison files, and agreement was required among the two diagnosticians at each site. To the extent possible, comparison children were selected to have the same gender and ethnic composition as the children with ADHD. Comparison children were not excluded on the basis of ODD, CD, or internalizing problems such as anxiety or depression. This approach was taken to maximize the generalizability of the comparison sample to the general population and to avoid recruiting a "supernormal" sample that would bias results in the direction of finding differences between groups. Despite this approach, none of the comparison children met full criteria for ODD and only one met criteria for CD. Additional exclusionary criteria for comparison children were the same as those listed above for children with ADHD. Demographic characteristics of the ADHD and comparison samples were comparable (i.e., not significantly different) on age, sex distribution, ethnicity, family composition, parental education, and parental income. Baseline measures of behavior problems, academic achievement, and estimates of intellectual ability yielded differences in the expected directions, supporting validity of our groups (see Table 1).

Medication status of ADHD participants. Because of the well-known potentiating effects of ADHD medications on a variety of tasks and consistent with standard practice in research studies in which the primary goal is not the examination of medication effects, all ADHD children were unmedicated at the time of testing. Also, parents and teachers were asked to rate the children's unmedicated behavior. For a subset of children with ADHD ($n = 44$), teachers nonetheless provided competence ratings about medicated behavior or did not report whether their ratings were on or off medication; hence, analyses (described in footnote 3) were run comparing results with and without these children.

Measures

Self- and teacher-reported competence. Children and teachers completed the respective child and teacher versions of the Self-Perception Profile for Children (SPPC; Harter, 1985). The child report version is a 36-item, domain-specific measure of

[1] The primary investigator at one site relocated midway through the study; hence, the two sites involved three geographic locations. Recruitment methods were consistent across all sites.

Table 1
Demographic Variables for Children With ADHD and Comparison Children

Variable	Children with ADHD	Comparison children	*p*
Total *N*	178	86	
Age, *M* (*SD*)	9.23 (0.94)	9.26 (0.86)	ns
Male, *n* (%)	142 (80)	62 (72)	ns
Ethnicity, *n* (%)			ns
Caucasian	147 (84)	68 (79)	
African American	16 (9)	9 (11)	
Other	13 (7)	9 (11)	
CBCL T score, *M* (*SD*)			
Internalizing	61 (10)	50 (10)	.000
Externalizing	64 (9)	46 (9)	.000
TRF T score, *M* (*SD*)			
Internalizing	59 (10)	47 (8)	.000
Externalizing	63 (8)	48 (7)	.000
WJ BIA, *M* (*SD*)	99 (13)	108 (15)	.000
WJ ACH, *M* (*SD*)			
Broad Reading	98 (14)	108 (11)	.000
Broad Math	102 (12)	112 (12)	.000
Broad Written Language	98 (15)	110 (11)	.000
Family composition			ns
2 parents, *n* (%)	129 (73)	71 (83)	
1 parent, *n* (%)	49 (28)	15 (17)	
Mother's education, *n* (%)			ns
High school or less	39 (23)	16 (19)	
Some college (<4 yrs)	52 (30)	39 (45)	
4-year college degree	42 (24)	16 (19)	
Postgraduate degree	40 (23)	15 (17)	
Father's education, *n* (%)			ns
High school or less	47 (36)	15 (22)	
Some college (<4 yrs)	35 (27)	17 (25)	
4-year college degree	30 (23)	24 (35)	
Postgraduate degree	20 (15)	12 (18)	
Mother's income, *n* (%)			ns
Not working	31 (19)	16 (20)	
≤20,000	34 (21)	21 (26)	
20,001–50,000	79 (48)	39 (48)	
≥50,001	22 (13)	5 (6)	
Father's income, *n* (%)			ns
Not working	6 (5)	3 (5)	
≤20,000	11 (9)	1 (2)	
20,001–50,000	60 (47)	31 (46)	
≥50,001	50 (39)	32 (48)	

Note. Subgroup *n*s may not sum to the total *N* due to missing data. Percentages represent percentages of valid (not missing) data and may not sum to 100% due to rounding error. Father income results should be interpreted with caution due to cell counts <5. ADHD = attention-deficit/hyperactivity disorder; CBCL = Child Behavior Checklist; TRF = Teacher's Report Form; WJ BIA = Woodcock–Johnson III Brief Intellectual Ability; WJ ACH = Woodcock–Johnson III Tests of Achievement; ns = nonsignificant.

self-perceived competence in the scholastic, social acceptance, athletic, physical appearance, and behavioral conduct domains (six items per domain); it also includes a subscale indexing global self-worth. Ratings are made on a 4-point scale, with higher scores indicating greater self-perceived competence or self-worth. The teacher report version of the SPPC is comparable, except that generally only 15 items are administered (three per competence domain; Harter, 1985). Only the scholastic competence, social acceptance, and behavioral conduct domains were of interest in the present study. In order to keep items across the adult and child versions as comparable as possible, we expanded the adult version of these three subscales to include five or six items parallel to those rated by the children. In the present sample, alphas ranged from .76 to .92 for child report (assessed across three administrations, as described below) and from .90 to .97 for teacher report. All teachers were asked to report how many hours per week the child spent in their classroom and to complete a Likert rating indicating how well they felt they knew the child. For children with multiple teachers, this information was used to select the teacher most familiar with the child to provide ratings.

Children's Depression Inventory (CDI; Kovacs, 1992). The CDI is a widely used 27-item child self-report measure of depressive symptomatology. For each item, children select one of three responses (coded 0–2) on which higher scores indicate greater depressive symptomatology. The CDI is supported by a large body of reliability and validity data (see Kovacs, 1992). Because seven of the items on the CDI (Items 5, 15, 21, 22, 23, 26, 27) reflect school, behavioral, or social problems that are common for children with ADHD even in the absence of depressive symptoms, prior work (Hoza, Pelham, Milich, Pillow, & McBride, 1993) recommends eliminating these items to get a purer measure of depressive symptoms when this measure is used with children with ADHD. Hence, for the present study mean scores were computed based on the remaining 20 items. The internal consistency of these 20 items as assessed with coefficient alpha was .84.

Experimental Procedure and Manipulation

This study involved a three-step procedure: First, we assessed children's perceptions of their competence by having them complete the SPPC during a baseline testing session. In a subsequent session, conducted on a different day, children were told: "This time, starting right now, we're going to do something a little different. As you know, I also asked your teacher from school to fill out this paper about you. Now we are going to play a game called the 'match game.' The point of the game is to match what your teacher said about you when I asked them to answer these questions about you. For example, I want to know what you think *your teacher* said about how good you are on your schoolwork, how well you get along with other kids, and how well you behave at school. A match is when you come really close to saying what your teacher said." The children were then asked to rate the 18 items according to how they thought their teacher rated them. Then a 5-min distractor task (a Go Fish game with the research assistant) was administered.[2] Upon completion of the distractor task, the child was told: "Oh, I'm sorry. I made a mistake. I forgot to tell you last time that you get paid when you match your teacher. Since I gave you the wrong instructions, in order to be fair to you, we are going to do that same matching task again, but this time, if you correctly pick which of the two sentences your teacher said describes you, you will get 50 cents for the match. If you pick the correct sentence *and* match on whether your teacher says the

[2] Deviations occurred during the distractor task for four children as follows: (a) Go Fish game lasted 5 min 45 s; (b) child went to the bathroom instead of playing Go Fish; (c) table collapsed and had to be put back together; and (d) Band-Aid was retrieved for child's finger that was bleeding. No deviations took longer than 6 min 20 s. In all cases, the research assistant judged that the trial was still valid.

sentence is "sort of true" or "really true" about you, you'll get a dollar. If you match exactly on all questions you can earn $18! Do you understand the rules? Because it's my mistake, you can give either the same answer you gave before, or a different answer, it's up to you. But the more you match, the more money you'll earn. When we are finished, I'll go look at your teacher's paper and see how much money you earned. Let me put a big X over this one we did wrong so I don't get them mixed up."

Administering this task both with and without the monetary incentive allowed us to separate the effects of the matching manipulation from those of the monetary incentive. In order to make the money more salient as a motivator, the research assistant also engaged in a brief discussion with the child about what he or she would like to buy with the $18. Following these instructions within the task manipulation, the children were asked to rate the 18 items a third time with incentive in place according to how they thought the teacher had rated them. The children were not allowed to see the teacher's ratings for ethical reasons. All children were given a minimum of $5 for matching (even if they did not earn it) and up to $18 if they matched the teacher perfectly on all items.

Computation of bias scores. Three sets of domain-specific discrepancy scores were computed to reflect the three conditions under which bias was assessed: (a) at baseline, (b) when children were asked to match their teacher, and (c) when money was awarded for matching their teacher. The teacher's rating of the child's competence was subtracted from the child self-perception scores in each condition (baseline, matching, money) and separately for each of the three domains (scholastic, social, behavioral), yielding nine discrepancy scores. These scores were used as dependent variables in the main analyses.

Despite known criticisms of difference scores in the literature (see Colvin, Block, & Funder, 1996; Owens et al., 2007), we chose to employ them in this study for several reasons. First, possible alternatives such as residual scores also are not without serious statistical limitations and, in addition, are hard to interpret in a clinically meaningful way (Colvin et al., 1996). Second, despite the somewhat lower reliability of difference scores (as compared to their components), their reliability is comparable to alternatives such as residual scores (Rogosa, 1988, as cited in Colvin et al., 1996). In addition, even if some degree of unreliability is present, "unreliability will only attentuate and never spuriously inflate correlations" (Colvin et al., 1996, p. 1253); hence, whenever significant effects are found, they are likely to be robust. Finally, analyzing difference scores addresses different research questions than separately analyzing their components (Tisak & Smith, 1994a, 1994b); hence, use of the components in lieu of the difference score is not an acceptable substitution. Therefore, we used the discrepancy scores as our primary measure of bias.

Results

Manipulation Check

As a manipulation check to verify that the monetary incentive was indeed motivating for all children, children with ADHD and comparison children were compared on self-reports of how much they cared about earning the $18. Mean scores for both groups were uniformly high. The mean score on a 10-point scale was 8.77 for comparison children ($SD = 1.91$) and 8.99 ($SD = 2.00$) for children with ADHD. Groups did not differ significantly on this variable, $F(1, 261) = 0.73$, $p > .35$, which indicated that both groups were highly motivated to earn the $18.

Overview of Data Analytic Strategy

Separate analyses were run for each domain to examine the effects of the matching and money manipulations on bias in self-reported competence. In particular, three general linear model (GLM) repeated measures analyses of covariance were conducted with one between-subjects factor (group: ADHD, comparison) and one within-subjects factor (condition: baseline vs. matching vs. money) for each of the three domains (scholastic, social, behavioral). Given the established relation between depressive symptoms and levels of bias in self-perceptions, the 20-item depressive symptoms score served as a covariate in these analyses. Because sphericity assumptions were violated, only multivariate results, which do not have a sphericity assumption, were interpreted.

Main Analyses

In two of three domains, the multivariate Group × Condition interactions were significant according to the Pillai's Trace criterion, $F(2, 260) = 4.95$ for scholastic; $F(2, 260) = 5.29$ for behavioral, ps $< .01$; this interaction was not significant for the social domain, $F(2, 259) = 1.75$, $p > .15$. In addition, in all three domains, the Condition × Depressive Symptoms interaction (i.e., collapsed across group) was significant, $F(2, 260) = 12.39$, $p < .001$ for scholastic; $F(2, 259) = 4.71$, $p < .05$ for social; $F(2, 260) = 7.67$, $p < .01$ for behavioral.

The two significant Group × Condition interactions were followed up by GLM repeated measures analyses of covariance (again, employing depressive symptoms as the covariate and interpreting only multivariate tests of significance) and run separately for each group (ADHD, comparison) to determine which group differed significantly across the three conditions (baseline, matching, money). Analyses for the comparison children indicated no significant condition effects for either domain; Fs(2, 83) ranged from 1.11 to 1.84, ps $> .15$ and, hence, were not considered further. Analyses for children with ADHD indicated significant condition effects for both the scholastic domain, $F(2, 175) = 15.37$, $p < .001$, and the behavioral domain, $F(2, 175) = 23.93$, $p < .001$. Therefore, analyses of covariance were rerun in a pairwise fashion (baseline compared to matching condition; matching compared to money condition) to pinpoint exactly where differences occurred. Results indicated that the matching manipulation significantly reduced the amount of positive bias for children with ADHD (as compared to baseline) in both the academic domain, $F(1, 176) = 14.77$, $p < .001$, and the behavioral domain, $F(1, 176) = 30.32$, $p < .001$. Comparison of the matching and money conditions indicated that the money manipulation further significantly reduced the amount of bias in both domains for children with ADHD: $F(1, 176) = 9.31$, $p < .01$ for the scholastic domain; $F(1,$

176) = 12.62, $p < .001$ for the behavioral domain. See Table 2 for means and standard deviations.[3]

The Condition × Depressive Symptoms interactions were not of primary interest, as our focus was on differences between the ADHD and comparison groups. Nonetheless, to further understand these interactions, we ran correlations between the depressive symptoms index and the nine discrepancy scores (three per domain, collapsed across ADHD and comparison groups) and examined them on a domain-by-domain basis. Examination of correlations revealed that whereas discrepancy scores at baseline in all three domains were significantly ($p < .01$) inversely correlated with depressive symptoms (rs = −.23, −.16, −.18, for the scholastic, social, and behavioral domains, respectively), they were not significantly correlated with depressive symptoms either for the matching condition (rs = −.11, −.06, −.07 for scholastic, social, and behavioral domains, respectively) or for the money condition (rs = −.00, −.04, −.04, for scholastic, social, and behavioral domains). Hence, depressive symptoms were primarily related to self-perceptual bias in the baseline condition.

Normalization Analyses

As noted earlier, one goal in the present study was to consider whether the final manipulation (i.e., monetary incentive condition) normalized the self-perceptions of the children with ADHD, relative to the baseline scores of the comparison children. Hence, we compared child minus teacher discrepancy scores from the money manipulation condition for the children with ADHD to comparison children's baseline scores on a domain-by-domain basis using univariate analyses of covariance, again covarying depressive symptoms. As shown in Table 3, even when the money manipulation was employed, across all domains, children with ADHD continued to display significantly more positively biased self-perceptions relative to comparison children's baseline scores. Hence, our manipulations, although reducing bias in the self-perceptions of children with ADHD, did not succeed in normalizing them.

Supplemental Analyses

Supplemental analyses were conducted to rule out possible alternative explanations of the results. To rule out the possibility that the obtained pattern of results in the main analyses were due solely to differences in how the two groups of children (ADHD, comparison) were viewed (and hence rated) by teachers, rather than to differences in the children's self-ratings, we reran the main analyses, substituting the children's self-perception scores for the three conditions (baseline, matching, money) for the discrepancy scores. The overall pattern of significant findings was similar, hence ruling out the possibility that the obtained results were solely a function of teacher ratings of competence. Means and standard deviations for these analyses may be found in Table 4.

Discussion

The present study was designed to examine whether children with ADHD, if adequately motivated to purposefully reduce the level of positive bias in their self-perceptions, are able to do so. A second goal was to consider whether any obtained reductions in the self-perceptual biases of children with ADHD "normalized" their levels of bias relative to comparison children. Consistent with our expectation, maximal reductions in bias were obtained in the potent monetary incentive condition. Although significant reductions in positive bias were seen in two of three domains from the baseline to the matching condition, further additional reductions in bias were obtained in these two domains by introducing the potent monetary incentive. The amount of bias for children with ADHD, however, was never normalized as compared to that for comparison children.

The present results are consistent with prior work (Diener & Milich, 1997; Ohan & Johnston, 2002) in demonstrating the modifiability of positively biased self-perceptions in children with ADHD. Our findings, however, extend prior work in important ways. We asked children in our study to purposefully and effortfully try to match what their teachers said about them, and we offered a potent monetary incentive for doing so. This manipulation was designed to override self-protection by providing a highly motivating incentive for matching teacher ratings of competence, and our manipulation check indicated that children were indeed motivated to do so. In contrast, prior studies examined changes in what children reported following performance feedback but did not explicitly instruct children to try to match a criterion.

Despite our explicit matching instruction, the manipulations we employed were only partially effective in reducing the biased self-perceptions of children with ADHD. Even when comparing scores of children with ADHD in the highly motivating monetary incentive condition to comparison children's baseline scores, moderate-sized group effects were found (ds ranged from 0.45 to 0.77). This indicates that the resultant self-views of children with ADHD, although improving in agreement with teacher ratings, never showed normative levels of agreement even when motivation for matching one's teacher was maximized. Hence, it seems unlikely that the self-protective hypothesis fully accounts for the positively biased self-perceptions of children with ADHD.

We were not able to reduce bias to a significant degree in the social domain, despite being able to do so in the scholastic and behavioral domains. Although we cannot be certain of the reason for this pattern, one explanation might be that low self-perceptions in the social domain are especially threatening. This would make self-protective effects more resistant to modification, with a bolstering experience required to reduce the need for self-protection (e.g., Diener & Milich, 1997; Ohan & Johnston, 2002) before modification can occur. Alternatively, perhaps children receive less feedback regarding their social competence from teachers and other adults and, hence, are given less information relevant to adjusting their self-views. This remains a question for future research.

A strength of the present study was its ability to more definitively demonstrate that the normative pattern for children without

[3] Rerunning the main analyses excluding children whose teacher ratings were made regarding their medicated behavior, or whose medication status was unknown, did not alter the overall pattern of significant results. In follow-up analyses run to clarify the interactions, however, some significant results became marginally significant or nonsignificant. Because the loss of significance was likely due to reduced sample size, the results including all children are reported.

Table 2
Discrepancy Means and Standard Deviations of ADHD and Comparison Groups Across Conditions

Condition and domain	Baseline		Matching		Money	
	M	*SD*	*M*	*SD*	*M*	*SD*
ADHD						
Scholastic	0.29	0.90	0.16	0.85	0.09	0.85
Social	0.50	1.02	0.49	0.99	0.46	0.90
Behavioral	0.91	1.03	0.69	0.93	0.51	1.00
Comparison						
Scholastic	−0.26	0.71	−0.26	0.69	−0.27	0.59
Social	−0.11	0.86	−0.07	0.74	−0.03	0.78
Behavioral	−0.19	0.82	−0.25	0.69	−0.34	0.66

Note. Means and standard deviations are unadjusted for the effects of the covariate. Group *n*s were as follows: scholastic domain: control $n = 86$, ADHD $n = 178$; social domain: comparison $n = 86$, ADHD $n = 177$; behavioral domain: comparison $n = 86$, ADHD $n = 178$. Higher mean scores indicate greater overestimation of competence by the child relative to teacher report. ADHD = attention-deficit/hyperactivity disorder.

ADHD was one of congruence with teachers' perceptions of competence (or even a slight modesty bias). Notably, the comparison children's self-views were quite congruent with teacher ratings in all domains and across all manipulation conditions and, on average, always yielded discrepancy scores that fell within the range from 0 to −.35. This indicates that the positive self-perceptual bias seen for many children with ADHD is indeed a deviation from normative development and a potential target for future intervention.

Our tentative conclusion based on these results is that, on average, children with ADHD cannot view themselves in a completely unbiased fashion, rather than that they will not, although self-protection clearly plays a partial role. This raises the question of which additional factors may prevent children with ADHD from being able to view themselves in an unbiased manner. Prominent candidate factors could be cognitive or executive-functioning deficits that impair their capacity for accurate self-perception. Indeed, impaired self-awareness or insight has been noted in other populations with known cognitive or executive functioning deficits (Ownsworth, McFarland, & Young, 2002; Shad, Tamminga, Cullum, Haas, & Keshavan, 2006; Starkstein, Jorge, Mizrahi, & Robinson, 2006).

It should be noted that IQ was not included as a covariate in the statistical analyses despite significant group differences. This decision was based on past reviews suggesting that the analysis of covariance is inappropriate when applied to situations involving nonrandom group assignments, as preexisting group differences cannot then be assumed to be independent of the predictor variables (Miller & Chapman, 2001). Given information discussed above, it is likely that some form of executive functioning or cognitive deficits play a role in the development and expression of a positive illusory bias. Furthermore, in analyses reported elsewhere using this sample, not only were cognitive deficits associated with presence of a positive bias but evidence was found that specific cognitive deficits partially mediate the relation between ADHD status and positively biased self-perceptions (McQuade, Tomb, et al., 2011).

Even in the absence of a definitive answer to the question of why those in the ADHD group cannot view themselves in an unbiased fashion, an extremely important question arising from our results has to do with implications for treatment of children with ADHD. Although we are not confident in our ability to answer this question at the present time, it seems inadvisable nonetheless to promote further enhancements to their already inflated self-views. Hence, we do not recommend that clinicians and parents pursue higher self-concept as a treatment goal unqualifiedly for children with ADHD. For those with already inflated self-views, further bolstering could potentially have an adverse

Table 3
Normalization Analyses of Covariance Comparing Comparison Children's Baseline Discrepancy Scores to the Money Manipulation Discrepancy Scores for Children With ADHD

Domain	Comparison		ADHD		Cohen's *d* (effect size)	*F*	*p*
	M	*SD*	*M*	*SD*			
Academic	−0.26	0.71	0.09	0.85	0.45	12.46	.000
Social	−0.11	0.86	0.46	0.90	0.65	27.39	.000
Behavioral	−0.19	0.82	0.51	1.00	0.77	37.50	.000

Note. Means are unadjusted for the effects of the covariate. Comparison $n = 86$; ADHD *n* ranged from 177 to 178. The effect of the covariate was significant ($p < .05$) for the behavioral domain only. Higher mean scores indicate greater overestimation of competence by the child relative to teacher report. ADHD = attention-deficit/hyperactivity disorder.

Table 4
Child-Rated Means and Standard Deviations of ADHD and Comparison Groups Across Conditions

Condition and domain	Baseline		Matching		Money	
	M	*SD*	*M*	*SD*	*M*	*SD*
ADHD						
Scholastic	2.87	0.77	2.75	0.77	2.67	0.79
Social	2.79	0.82	2.79	0.79	2.76	0.80
Behavioral	2.91	0.78	2.69	0.76	2.51	0.88
Comparison						
Scholastic	3.23	0.59	3.24	0.57	3.23	0.56
Social	3.18	0.63	3.23	0.62	3.27	0.61
Behavioral	3.31	0.64	3.25	0.60	3.16	0.75

Note. Means and standard deviations are unadjusted for the effects of the covariate. Group *n*s for child ratings were as follows: control $n = 86$, ADHD $n = 178$. Higher mean scores indicate better ratings of competence by the child. For comparison purposes, teacher-rated means (and standard deviations), assessed only at baseline, were 2.58 (0.75), 2.29 (0.83), 2.00 (0.86) for the scholastic, social, and behavioral domains for children with ADHD (teacher-rated *n*s = 177–178); and 3.50 (0.58), 3.29 (0.67), 3.50 (0.66) for the scholastic, social, and behavioral domains for comparison children (teacher-rated *n*s = 86). ADHD = attention-deficit/hyperactivity disorder.

effect on treatment response, given the documented link between positive bias and worse treatment outcome (Hoza & Pelham, 1995; Kaiser et al., 2008; Mikami et al., 2010); however, findings to date on this topic are correlational and admittedly quite preliminary. Bolstering this tentative conclusion, however, are findings from the adult social psychological literature indicating that grossly inflated self-views are linked to severe forms of maladjustment, such as aggression and violence (Baumeister, Smart, & Boden, 1996). Recent longitudinal analyses with a large sample that included both children with ADHD and a local normative comparison group indicated a prospective association between biased self-views and later aggression/conduct problems and/or worse social skills (Hoza et al., 2010; Murray-Close et al., 2010), suggesting that inflated self-views, although protective against depression, may predispose children to other forms of maladjustment over time.

Given this pattern of findings, there have been surprisingly few attempts in the intervention literature to "train" more accurate self-evaluation (for an exception, see Hinshaw, 2000), and to our knowledge, there are few empirical data to address the usefulness of this intervention approach. Although on the one hand one might argue that if executive functioning deficits render certain individuals with ADHD unable to see themselves accurately, it may be challenging to overcome these limitations. On the other hand, we know from the improvements seen in our sample that self-protection plays at least a partial role, and hence, such training may be successful at lessening, even if not eliminating, these biased self-views.

In the current study, children did not receive feedback regarding their ratings of competence until the conclusion of the task (and this feedback was limited to amount of money earned). Consequently, the impact of corrective feedback on revising self-perceptions of competence is unclear. However, exciting new work from the adult social psychology literature has shown that social tasks that involve interpersonal engagement and taking another's perspective can actually improve executive functioning (Ybarra, Winkielman, Yeh, Burnstein, & Kavanagh, 2011), suggesting that interpersonally based training in self-evaluation that involves seeing oneself as another (e.g., teacher) sees you may indeed hold promise. This work seems particularly relevant, given arguments that "those with ADHD cannot hold in mind as well information that would govern their responses to ongoing events" (Barkley, 1999, p. 305). This suggests that feedback from others, such as teachers, may therefore not "get through" to children with ADHD. This deficit, Barkley (1999) argued, impairs the ability of children with ADHD to carry forward information on past behavior in order to govern future behavior. This speculation awaits empirical study.

Limitations

Despite the strengths of our experimental design, several limitations deserve mention. First, all participants received the same order of conditions (baseline, matching only, matching plus incentive). As conditions were not counterbalanced within the task, it is possible that practice effects contributed to change in ratings across conditions. However, no differences were found across conditions for the comparison group, suggesting practice effects were minimal. As instructions were included within the manipulation (between matching and matching plus incentive conditions) requiring participants to "re-do" the SPPC due to experimenter error, they were part of the manipulation itself, rather than conceptually distinct, and may have impacted ratings of self-perception. Second, we examined the measure of bias utilizing only child and teacher ratings of competence. Teachers' ratings of competence are susceptible to bias themselves, leading to increased difficulty for children in matching the ratings of their teacher. Thus, in ambiguous domains such as social acceptance, children with ADHD would have to recognize teacher bias and overcome any threat of negative evaluation in order to match their teachers' ratings. However, as noted, comparison children provided relatively "on target" estimations of their teachers' ratings of their competence without incentive to do so, suggesting that this is indeed feasible for children of this age.

Third, given the small number of girls in our sample, the examination of subgroups by gender was not possible. Hence, we do not know whether the current conclusions apply equally well to boys and girls. Similarly, the level of ethnic and racial diversity in our sample did not permit the examination of effects separately by racial/ethnic group. We also included only the hyperactive/impulsive and combined subtypes of ADHD in our sample; hence, our results are not generalizable to children with inattentive-type ADHD. In addition, this was a cross-sectional study examining elementary school-age children. Considering how stability or change in bias may differentially predict a variety of later outcomes in studies examining level of bias in self-perceptions across a wider age range that includes adolescents with ADHD is an important unanswered question that has rarely been examined (e.g., Hoza et al., 2010).

Conclusion

This study demonstrates that levels of bias in self-perceptions of children with ADHD can be reduced to a limited degree if children are motivated to reduce such bias. Nonetheless, even when motivated to do so, children with ADHD were not able to completely eliminate the bias in their self-perceptions. Further work is needed to better understand the mechanisms maintaining these biases and the implications of these domain-specific patterns of self-perceptions both for adjustment and for the development of treatments addressing these deficits.

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