EXAMINING THE EXISTENCE AND MODERATORS OF THE POSITIVE ILLUSORY BIAS IN BOYS WITH ATTENTION-DEFICIT/HYPERACTIVITY DISORDER

by

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Abstract

Previous studies suggest that on average, children with Attention-Deficit/Hyperactivity Disorder (ADHD) possess a Positive Illusory Bias (PIB) wherein they overestimate their competence in various domains. Most of these studies have used difference scores to operationalize the PIB, where more objective measures of competence, such as parent- or teacher-reports, were subtracted from child self-reports of competence. However, the PIB associated with child ADHD may be driven by the fact that children with ADHD have significantly lower actual competence levels than typically-developing children. Therefore, it is unclear whether children with ADHD actually possess a PIB. This study investigated whether the PIB exists among boys with ADHD in the social domain by utilizing a new methodology that avoids the use of difference scores and instead equates differences in the actual performance of boys with and without ADHD, so as to allow for a clearer testing of differences in estimations between the two groups. This study also investigated the role of clarity of feedback as a moderator of the PIB. Eight- to 12-year-old boys with and without ADHD participated in controlled social interaction tasks with computerized peers. Three conditions of social feedback were employed (unclear, clear positive, and clear negative). After each social interaction task, boys rated how well they performed. Standardized difference scores using self- and other-reports were also constructed, consistent with how the PIB has been commonly measured in the past. Results showed that ADHD and non-ADHD groups did not differ in self-perceptions when actual performance was made comparable across groups, despite the fact that a significant between-group difference was found when difference scores were used. Exploratory analyses to further understand the PIB were carried out. Overall, results call into question prior PIB findings.

Preface

The ideas presented in this dissertation are by the author. They were developed through collaboration with her advisor, Dr. Charlotte Johnston. The author was primarily responsible for all aspects of the research presented. This research was approved by the University of British Columbia's Behavioural Research Ethics Board (Project Title: Understanding Self-Perceptions in Boys; Ethics Certificate Number: H13-00051).

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Dedication

To my family

Introduction

Although moderately unrealistic positive self-illusions have been shown to be typical and even psychologically adaptive (Taylor & Brown, 1988), past studies indicate that children with Attention-Deficit/Hyperactivity Disorder (ADHD) exhibit more extreme positive self-illusions that are maladaptive (Owens, Goldfine, Evangelista, Hoza, & Kaiser, 2007). This self-illusion among children with ADHD has been labelled the Positive Illusory Bias (PIB), wherein children overestimate their competence in areas in which they are actually deficient (Owens et al., 2007). Much of the research demonstrating this PIB has used difference scores, which are typically constructed by subtracting more objective evaluations of children's competence from the children's self-ratings of competence. The interpretations of these studies using difference scores have recently been called into question. Thus, it is unclear whether children with ADHD actually have a PIB compared to children without ADHD. The first aim of this study was therefore to investigate whether children with ADHD have a PIB using a methodology that does not rely on difference scores. Using this new methodology, the current study also examined moderators of the PIB, as a small body of studies examining the PIB suggests that its presence may depend on the clarity of feedback provided to the children about their performance. Thus, the second aim of this study was to determine whether the presence of the PIB in children with ADHD is moderated by the clarity of feedback they receive. In addition, child self-reports and parent-reports of social competence were gathered so as to construct difference scores to operationalize the PIB. Therefore, the third aim of the study was to compare the results regarding the presence of the PIB found using the new methodology with the findings of the difference score methodology

used in past literature. Finally, a series of exploratory analyses were carried out to further explore the PIB.

I begin by briefly describing child ADHD, and then present findings of past research exploring the PIB in children with ADHD. It will be apparent that the majority of past studies have utilized difference scores to operationalize the PIB. Due to the statistical limitations of difference scores, it is therefore difficult to determine the validity of these previous results. The few studies of the PIB that have not relied on difference scores also are described. The limitations of these studies are addressed, and possible moderators of the presence of the PIB are outlined. Finally, the current study and predictions are presented, along with the methodology, results of the data analysis, discussion, and conclusion.

Child ADHD

According to the Diagnostic and Statistical Manual of Mental Disorders-IV Text Revision (DSM-IV TR; American Psychiatric Association, 2000), ADHD is a psychopathology characterized by developmentally inappropriate inattentiveness and/or hyperactivity/impulsivity. ADHD is diagnosed in children with at least six symptoms of inattention and/or six symptoms of hyperactivity/impulsivity, which must be present prior to age 7. As well, these symptoms must cause impairment in at least two domains of life (e.g., school, home). The DSM-5, a newer version of the DSM, is now available (American Psychiatric Association, 2013). The diagnostic symptom criteria for ADHD in DSM-5 do not differ markedly from the criteria in DSM-IV TR. However, the age requirement has been relaxed such that inattention and/or hyperactivity/impulsivity symptoms must have been present prior to age 12. Similar to the DSM-IV TR criteria, several ADHD symptoms must be present in two or more settings, and symptoms must clearly be causing impairment with

academic, occupational, or social functioning. The prevalence rate of ADHD is approximately 5% in children, and ADHD affects more boys than girls with a ratio of about 2:1 (American Psychiatric Association, 2013). Given this gender imbalance, the current study involved only boys with ADHD so as to be able to better understand the existence of the PIB in this group of children as a first step. Children with ADHD appear to have a number of emotional, linguistic, motoric, cognitive, health, peer, and family difficulties, and show serious impairments in various areas of life (American Psychiatric Association, 2013; Barkley, 2006; Gerdes et al., 2007; Wiener & Mak, 2009).

Studies of the Positive Illusory Bias

In contrast to the many impairments children with ADHD experience, previous studies suggest that these children, on average, demonstrate positively biased self-perceptions (Owens et al., 2007). This self-optimism among children with ADHD is called the PIB, and was most often captured by a discrepancy between positive self-reports of competence in comparison to more objective and lower measures of actual competence (Hoza, Pelham, Dobbs, Pillow, & Owens, 2002). It has been argued that the competencies of children are better captured by the reports of others (such as parents or teachers) who know the child well or by lab tasks than by child self-reports (e.g., Hoza et al., 2004; Owens et al., 2007). The overestimation of competence found, on average, in children with ADHD is claimed to be different from the positive self-optimism of typically-developing children because it is greater in magnitude, counterintuitive as children with ADHD experience profound deficits in a number of domains, and maladaptive in that the PIB is not associated with improved performance, motivation, or persistence (Hoza, Pelham, Waschbusch, Kipp, & Owens, 2001; Milich & Okazaki, 1991), and is related to later risky driving behaviour (Hoza et al., 2013),

lower success in treatment (Mikami, Calhoun, & Abikoff, 2010), as well as behavioural and social difficulties (Kaiser, Hoza, Pelham, Gnagy, & Greiner, 2008; Linnea, Hoza, Tomb, & Kaiser, 2012; Ohan & Johnston, 2011).

Research suggests that children with a PIB have social deficits compared to children without a PIB. Linnea et al. (2012) found that in peer interactions, children with ADHD and a PIB exhibited less prosocial behaviour than children with ADHD without a PIB. As well, children with ADHD and a PIB exhibited less effortful behaviour and more disruptive behaviour than children without ADHD in social interactions, whereas there were no differences in these behaviours between the ADHD group without a PIB and the non-ADHD group. In addition to its adverse association with peer relations, the existence of a PIB in children with ADHD may interfere with response to treatment. Although parents or teachers typically implement the empirically-supported medication and behavioural interventions for ADHD (Biederman, Spencer, & Wilens, 2004; Pelham & Fabiano, 2008), a child's motivation and willingness to comply with treatment is crucial to treatment success. The PIB may prevent children from acknowledging their widespread and serious ADHD-related deficits, thereby limiting their engagement with treatment and ultimately hindering treatment progress. Indeed, research suggests that overly high self-confidence may reduce positive treatment outcomes in children with ADHD (e.g., Mikami et al., 2010). Given that the PIB has such substantial implications for social relations and treatment, better understanding its existence and nature is useful in informing the management of ADHD.

The question of whether a PIB exists in children with ADHD has been investigated by many studies (see Owens et al., 2007 for a review). In these studies, children's self-perceptions of competence were typically measured using Harter's (1985) Self-Perception

Profile for Children (SPPC), a questionnaire that asks children to rate their level of competence compared with other children their age in various life domains (i.e., social, academic, behavioural, athletic, and physical appearance). To attain more objective indices of the children's performance, adults such as parents or teachers are asked to rate the child's competence. Therefore, the SPPC has been adapted to gather the ratings of others with respect to how a child's competence differs from other children his/her age. Discrepancy scores involving other-ratings subtracted from child self-ratings of competence have been constructed, and compared between ADHD and non-ADHD groups. It is important to note that the difference scores used to operationalize the PIB have most commonly been standardized difference scores (Owen et al., 2007), based on first standardizing the component parts of the difference score (i.e., child self-perceptions and more objective ratings of child performance) before creating a difference score. The use of standardized difference scores was recommended by De Los Reyes and Kazdin (2004), as the standardization allows for the difference score to be uniformly correlated with both of its components. Higher discrepancies in children with ADHD in contrast to children without ADHD are deemed indicative of a PIB among children with ADHD. Studies have utilized this approach comparing child self-ratings and ratings from the adapted SPPC completed by a variety of significant others, such as teachers, mothers, and fathers, and findings consistently support, on average, the presence of a PIB among children with ADHD (e.g., Emeh & Mikami, 2012; Evangelista, Owens, Golden, & Pelham, 2008; Hoza et al., 2002; Hoza et al., 2004). Furthermore, studies that do not use the SPPC to construct standardized difference scores also show a PIB among children with ADHD (e.g., Wiener et al., 2012).

In addition to utilizing ratings by significant others to measure children's objective competence levels, studies also have used scores on achievement tests or lab-based social interactions as objective estimates of children's academic and social competence. Consistent with the use of self- and other-ratings, difference scores are computed by subtracting children's test scores from their self-ratings of competence. Supportive of a PIB in the academic domain among children with ADHD, a study that created a discrepancy score between self-perceptions of math competence and achievement test scores showed that children with ADHD had higher discrepancy scores than children without ADHD (Owens & Hoza, 2003). Similarly, Ohan and Johnston (2011) demonstrated that girls with ADHD had higher discrepancy scores than girls without ADHD when the discrepancy score was created between children's self-perceptions of social competence and their lab-based performances on a social task. As an alternative to having children rate their general competence with respect to a particular domain (e.g., academic or social), children have also been asked to predict their performance on specific lab tasks (e.g., an academic or social task), then engage in the lab task, and to retrospectively evaluate their performance on the task. For instance, a study using difference scores comparing post-task evaluations to actual task performance found that children with ADHD overestimated their actual performance compared to children without ADHD in the social domain (Diener & Milich, 1997). Although research using others' ratings of actual competence has shown that children with ADHD possess a PIB in a number of life domains, studies using lab tasks as the measures of actual competence have investigated the PIB in a more limited number of areas.

Along with investigating the presence of a PIB in children with ADHD compared to children without ADHD, studies also have shed light on the mechanisms that may underlie

this phenomenon. Four hypotheses regarding PIB mechanisms have been put forth. Firstly, the cognitive immaturity hypothesis proposes that, because all typically-developing young children exhibit positive illusions regarding their performance, the PIB in children with ADHD may be due to their cognitive immaturity (Owens et al., 2007). However, the PIB in children with ADHD is maladaptive (e.g., Hoza et al., 2001; Mikami et al., 2010; Milich & Okazaki, 1991), which differs from the adaptive positive illusions of typical children. In addition to the cognitive immaturity hypothesis, an ignorance of incompetence hypothesis has been posited, which suggests that the PIB results from an inability to evaluate competence due to poor knowledge of the skills required for competence. Supporting this hypothesis is the finding that children with ADHD tend to have higher PIBs in their area of greatest impairment (Hoza et al., 2002; Hoza et al., 2004). However, this hypothesis is refuted by research showing higher PIBs in children with the hyperactive-impulsive compared to the inattentive subtype of ADHD despite the fact that the children in the two subtype groups had comparable levels of actual performance (Owens & Hoza, 2003), studies showing that the PIB decreases in children with ADHD after they receive positive feedback regarding their performance (e.g., Diener & Milich, 1997; Ohan & Johnston, 2002), and a study demonstrating that children with ADHD can accurately rate the performance of other children despite holding PIBs with respect to themselves (Evangelista et al., 2008).

A third hypothesis to explain the PIB is the neuropsychological deficit hypothesis (Owens et al., 2007), which posits that the executive function deficits of children with ADHD account for the PIB. In the wider adult literature, a condition called anosognosia involves poor self-awareness of impairments that is associated with frontal lobe damage (Owensworth, McFarland, & Young, 2002; Starkstein, Jorge, Mizrahi, & Robinson, 2006).

Providing support for similarly poor self-awareness in children with ADHD is the finding that these children are not able to accurately match their self-ratings of competence to ratings of their competence made by teachers, even when given a monetary incentive to do so (Hoza, Vaughn, Waschbusch, Murray-Close, & McCabe, 2012). Further support is provided by McQuade, Tomb, Hoza, Waschbusch, Hurt, and Vaughn (2011), who found that compared to children with ADHD and no PIB, children with ADHD and a PIB had greater executive function deficits. They also found that executive function deficits mediated the relationship between ADHD status and the PIB.

A fourth hypothesis to explain the PIB is the self-protective hypothesis, which suggests that children with ADHD hold PIBs so as to protect their self-esteem (Diener & Milich, 1997). Support for this hypothesis comes from studies showing that children with ADHD hold higher PIBs in domains in which they are most impaired (Hoza et al., 2002; Hoza et al., 2004), studies demonstrating that the PIB decreases in children with ADHD after they receive positive feedback regarding their performance (e.g., Diener & Milich, 1997; Ohan & Johnston, 2002), and studies showing that the PIB increases in children with ADHD after a failure experience (e.g., Hoza, Waschbusch, Pelham, Molina & Milich, 2000). Other studies showing that children with ADHD are able to partially decrease their self-ratings of competence to match the ratings of their teachers when explicitly instructed to do so (Hoza et al., 2012), and that parental criticism is associated with higher PIBs in children with ADHD (Emeh & Mikami, 2012) also are supportive of the self-protective hypothesis.

In summary, the PIB literature based on the difference score methodology appears to demonstrate the existence of a PIB in groups of children with ADHD, in comparison to children without ADHD. More specifically, although there are children with ADHD who do

not possess a PIB, a meaningful subgroup of children with ADHD do show a PIB, and the scores of these children allow for the conclusion that on average, child ADHD is associated with a PIB. In addition, a number of explanations for the PIB have been posited, and the research literature has provided important insights with respect to the existence of these possible mechanisms. However, the validity of the conclusions offered by the difference score methodology may be in question.

Limitations of PIB studies using difference scores.

Although difference scores allow for the measurement of self-perceptions in relation to a criterion (i.e., other-report, actual task performance), they have major methodological limitations. One serious criticism is that significant correlations between other variables (e.g., ADHD versus non-ADHD group status) and difference scores may be a function of a relation between the other variable and only one of the difference score components (e.g., Edwards, 1994; Griffin, Murray, & Gonzalez, 1999). Another concern with using difference scores to index the PIB reflects the suggestion that children with ADHD may be more likely to overestimate their competence simply because they have lower levels of actual competence compared to children without ADHD (Owens et al., 2007), and therefore may have more "mathematical room" to show a PIB in their ratings compared to children without ADHD. Similarly, there may be a ceiling effect in that children without ADHD may not have as much room to overestimate their competence, because their actual competence is already high. However, this criticism with the use of difference scores is diminished by studies in which a PIB is demonstrated and yet actual performance levels of both children with and without ADHD appear to have sufficient range and show little evidence of floor or ceiling

effects (e.g., Hoza et al., 2012; Hoza et al., 2000; Ohan & Johnston, 2011; Owens & Hoza, 2003).

Despite the aforementioned concerns with using difference scores, some researchers have argued for conceptual validity over statistical validity. For instance, Tisak and Smith (1994) have argued that difference scores are conceptually distinct from constructs that are represented by individual difference score components. Similarly, Colvin, Block, and Funder (1995) noted that difference scores are parsimonious in capturing concepts that would be otherwise difficult to investigate. Thus, despite the statistical warnings, research on the PIB in children with ADHD has continued to use difference scores.

Recently, methodological problems with difference scores were again brought to the forefront in a paper by Laird and Weems (2011), who demonstrated that regressions with a difference score as the predictor are statistically equivalent to regressions using the separate components of the difference score as well as the means of the separate component scores as predictors. They argued that finding that a difference score is a significant predictor in a regression model should, therefore, be interpreted as indicating that there is a difference in the predictive ability of the two difference score components. That is, unequal relations between components of the difference score and the third variable may account for the difference score's relation to the third variable. In the context of PIB research, unequal associations between ADHD/non-ADHD status and child self-perceptions versus other-perceptions or actual task performance may explain the presence of PIBs in children with ADHD as compared to children without ADHD. Thus, it is possible that ADHD is not associated with the PIB per se but that there is simply a stronger correlation between other-ratings or actual performance and ADHD status compared with the correlations between

child self-perceptions and ADHD status. As a possible solution, Laird and Weems suggested the use of polynomial regressions, in which the predictive power of the interaction between the components of the difference scores is investigated in lieu of using difference scores. Given the arguments against difference scores put forth by Laird and Weems, which are akin to the earlier discussions around the problematic use of difference scores (e.g., Edwards, 1994; Griffin et al., 1999), it is necessary to interpret the existing PIB and ADHD literature with this caution in mind.

Studies attempting to address difference score weaknesses.

Not all studies of the PIB have ignored arguments against the use of difference scores. A few studies have attempted to reduce the likelihood of misinterpreting their PIB findings. For instance, a recent study published after the Laird and Weems (2011) article attempted to clarify the relations between the components of a PIB difference score and various variables. In this study, Swanson, Owens, and Hinshaw (2012) investigated the PIB across 5 years in 6- to 12-year-old girls with ADHD. They tested whether girls' PIBs were more strongly predictive of later impairment and adjustment than more objective measures (i.e., informant ratings and test scores) of behaviour in the children. Consistent with the possibility suggested by Laird and Weems, results indicated that later impairment and adjustment were more strongly related to measures of the children's levels of actual competence than the PIB. This finding suggests that actual levels of impairment may account for the relations found between the PIB and other measures of functioning in children with ADHD, and underscores concerns with the use of difference scores in operationalizing the PIB.

Also investigating the value of the PIB in predicting later adjustment, Mikami et al. (2010) measured whether baseline levels of the PIB in behavioural and social domains was related to response to treatment among 6- to 11-year-old boys with ADHD attending a 2-month treatment program. They controlled for proxy measures of competence or impairment such as comorbid ODD and baseline peer social preference in their analyses. In contrast to the results of Swanson et al. (2012), they found that the PIB in the behavioural and social domains was related to poorer response to treatment even after controlling for these proxy measures of actual performance. Similarly, Ohan and Johnston (2011) examined the relationship between the PIB in the social domain and psychosocial functioning among 9- to 12-year-old girls with and without ADHD. They found that the PIB was negatively associated with functioning among girls with ADHD, despite being positively associated with functioning among girls without ADHD. They found a comparable pattern of associations even after controlling for actual social impairment.

Examining directly whether the PIB is associated with ADHD status, Helseth, Bruce, and Waschbusch (2013) assessed self-perceptions of competence in 10- to 12-year-old boys with and without ADHD across four physical ability tasks involving vertical reach, horizontal reach, stepping, and clearance. For each type of task, a baseline level of competence for each child was determined. Each task involved three trials with different levels of difficulty (i.e., baseline, 8% above baseline, and 13% above baseline). In predicting their performance, children were given the binary options of “yes” or “no” in response to whether they could perform each task successfully. These predictions were then compared with their success in completing the task (again scored as “yes” or “no”), and scores were given for overestimations (i.e., score of 1 for children who said they could complete a task

but did not) or lack of overestimations (i.e., score of 0 for children who said they could complete a task and did). Results were consistent with a PIB in children with ADHD, especially for the more difficult levels of physical tasks. One can argue that Helseth et al.'s procedure limits the methodological weaknesses of difference scores by establishing a baseline level of performance for each boy, and then having boys complete tasks a certain level above their individualized baseline levels. Such a method allows for the performance of ADHD and non-ADHD groups to be somewhat comparable. However, establishing a baseline level of performance does not absolutely guarantee that boys with and without ADHD would perform at the same level in the above-baseline tasks, and no comparisons of performance between ADHD and non-ADHD groups were reported in the study.

Shedding further light into the validity of difference scores in characterizing the PIB, McQuade et al. (2011) examined the absolute child self- and teacher perceptions for 7- to 12-year-old children categorized into an ADHD/high PIB group, an ADHD/low PIB group, and a non-ADHD group for each of the academic, social, and behavioural domains. They found that in each domain, the teacher-perceptions of the non-ADHD group were significantly higher than the ADHD/low PIB group, which was in turn significantly higher than the ADHD/high PIB group. McQuade et al. also found that the ADHD/high PIB group had greater self-perceptions than the ADHD/low PIB group. Interestingly, those in the non-ADHD group had significantly higher self-perceptions compared to the ADHD/low PIB group. As well, the self-perceptions of the non-ADHD group did not differ significantly from those of the ADHD/high PIB group. Such results suggest that the association between the PIB difference score and ADHD status may likely be due to teacher-perceptions, which capture actual impairment.

Results somewhat contrary to the interpretation that the relation between the PIB difference score and ADHD status is driven by actual impairment come from Evangelista et al. (2008), who examined impairment as a predictor of the PIB in the academic, social, and athletic domains for children in grades 3 to 5. They found that higher impairment was associated with significantly higher PIBs in various domains, which substantiates the claim that impairment is strongly associated with the presence of the PIB. However, this positive relation between impairment and the PIB was the case only when children had less severe ADHD symptoms as measured by parents and teachers. That is, more severe ADHD symptoms were associated with the PIB regardless of level of impairment. Given that Evangelista et al. used a combination of clinic and community ADHD samples, they likely demonstrated a significant link between impairment and the PIB only for the less severe community sample.

Other studies that have only clinic samples of children with ADHD appear to find a significant positive association between the PIB and impairment, however. For instance, Ohan and Johnston (2011) examined the association between the PIB and impairment, and found that for the ADHD group, higher overall impairment was positively associated with PIB difference scores as assessed by three different methodologies (i.e., child- minus parent–ratings, child- minus teacher-ratings, child-ratings minus lab task performance). Providing further evidence that the PIB may be driven by impairment, Hoza et al. (2002; 2004) found that children with ADHD appeared to overestimate the most in their domain of highest impairment (e.g., behavioural PIB for those with high aggression, academic PIB for those with low achievement).

Overall, prior studies have attempted to account for the confounding influence of impairment in the relation between the PIB and ADHD status by controlling for actual competence or impairment, examining the relations of the individual components of the PIB difference score to ADHD status, and investigating the association between level of impairment and the PIB among boys with and without ADHD. Some findings support the predictive validity of the PIB or the idea that the PIB is not driven by actual impairment while others demonstrate more inconclusive results. Given the mixed findings of these prior studies that attempt to shed light on difference score issues, interpretations of the PIB continue to be unclear.

In summary, a number of studies have examined, and provide support for, the existence of the PIB in children with ADHD. Studies have even looked into mechanisms to explain the PIB. However, the majority of these studies have used difference scores, which have methodological limitations that cannot be ignored, or have attempted to address these limitations with mixed methodologies and findings. These limitations cast the results regarding the PIB in children with ADHD into question. Consequently, despite the many studies, very little is known about the PIB in various life domains in children with ADHD. The current study avoids the problems associated with difference scores by instead equating the actual performance of children with and without ADHD. Although it is difficult to ensure that children with ADHD exhibit the same level of performance as children without ADHD in naturalistic settings, the current study constrains a task such that only limited, similar performance options are available to all children.

PIB Studies Using Only Child Self-Reports

Given that the findings of studies of the PIB using difference scores have been cast in doubt, I also examine the results of studies that have used only child self-report scores to measure the PIB. Firstly, some studies compare self-reports of competence between groups of children with and without ADHD, without measuring actual performance. Although it is assumed that the ADHD samples in these studies have lower competence levels than children without ADHD, this is not actually demonstrated. These studies comparing self-perceptions between ADHD and non-ADHD groups without a criterion for actual performance provide somewhat mixed findings regarding the presence of the PIB. For instance, Treuting and Hinshaw (2001) found that boys with ADHD had lower self-perceptions than boys without ADHD in such areas as behavioural, academic, and social functioning as well as physical appearance and popularity. Interestingly, they found that boys with lower levels of aggression were less likely to estimate their competence as lower than boys without ADHD. However, boys with ADHD, irrespective of aggression, significantly perceived themselves as worse off than those without ADHD in the social domain. This finding suggests that boys with ADHD may not exhibit a PIB. However, the presence of a PIB among the boys with ADHD in this study is difficult to determine given that their actual levels of impairment were not measured.

The majority of other studies of the PIB in children with ADHD using absolute self-perceptions have found no significant differences between ADHD and non-ADHD groups (e.g., Hoza, Pelham, Milich, Pillow, & McBride, 1993; Owens & Hoza, 2003; Treuting & Hinshaw, 2001). Although it is argued that these findings of non-significant differences indicate a PIB in children with ADHD given their well-established functional impairment

relative to typically-developing children, the children with ADHD are not overestimating in an absolute sense compared to children without ADHD. When children with ADHD are found to be overestimating in an absolute sense, the effect appears unreliable. For instance, Whalen, Henker, Hinshaw, Heller, and Huber-Dressler (1991) found that children with ADHD had higher self-perceptions compared to children without ADHD, but this difference was evident only half of the time.

Studies also exist that compare self-perceptions between ADHD and non-ADHD groups, and use an objective criterion of performance. The design of these studies is stronger in ascertaining the existence of a PIB as they do actually measure competence levels in children with and without ADHD. These studies generally show lower self-perceptions, as well as lower actual performance in the ADHD group compared to the non-ADHD group, a pattern that does not support the existence of a PIB among children with ADHD. For instance, Horn, Wagner, and Ialongo (1989) found that children with ADHD rated themselves as lower in popularity and scored lower on teacher-rated peer popularity than children without ADHD. Similarly, Ialongo, Lopez, Horn, Pascoe, and Greenberg (1994) found that children with ADHD, compared to children without ADHD, had lower self-ratings of competence in the social, academic, and behavioural domains, and had greater impairment in teacher-rated peer relationships and social skills, achievement test scores, and as objectively observed during play and independent seatwork. In these studies, the self-perception ratings of children with ADHD were made with respect to a general domain (e.g., social, academic) rather than with respect to the particular measure of actual competence (e.g., achievement test) used. Such a design makes it difficult to conclude that these children are estimating their performance specifically with respect to the actual measure of

competence used, rather than estimating their performance on a more general construct. Other studies have addressed this weakness by having children complete lab tasks and evaluate their performance with respect to the particular task.

Studies in which children complete a lab task and make pre-task predictions and/or post-task self-evaluations of performance show mixed results with regard to the existence of the PIB in the academic and social domains. Within the academic domain, most studies provide findings supportive of a PIB, although there also are inconclusive results. For instance, Milich and Okazaki (1991) assessed pre-task ratings, post-task ratings, and actual performance to evaluate the PIB in 9- to 11-year-old boys in the academic domain. They asked boys to report how well they would do, and how well they did, before and after solving word-search puzzles. Boys with ADHD solved fewer puzzles but predicted better performance for themselves compared to boys without ADHD, which suggests a PIB in boys with ADHD. As well, despite their lower actual performance, boys with ADHD did not differ in their post-task self-evaluations of performance compared with boys without ADHD, which is again suggestive of a PIB in children with ADHD. Milich and Okazaki's findings are similar to those of O'Neill and Douglas (1991), who asked 11-year-old boys to predict their story recall performance. Although boys with ADHD did not differ in their actual story recall performance from children without ADHD, they did overestimate their performance compared with these children. Across these two studies, findings suggest a PIB in the academic domain in boys with ADHD.

Contrary findings come from Hoza et al. (2001) who also evaluated pre- and post-task evaluations as well as actual performance in the academic domain by having 7- to 13-year-old boys complete word-search puzzles. They were interested in the effect of prior success or

failure at a puzzle task on self-evaluations for a second puzzle task. The outcomes of the first puzzle tasks were manipulated using puzzles that were either impossible to solve or very easily solved. In contrast, the outcome of the second puzzle task was not manipulated. Hoza et al. found that boys with ADHD did not differ from boys without ADHD in terms of self-rated performance either before or after they had completed the second, non-manipulated puzzle task, despite the fact that they actually solved fewer second puzzles. Such a finding suggests the presence of a PIB among children with ADHD, given that their estimates were higher than their actual performance. However, in the first manipulated success and failure puzzle tasks, boys with ADHD did not differ from boys without ADHD in terms of their self-evaluations of success or failure. That is, all boys had more positive self-evaluations after the success manipulation and more negative self-evaluations after the failure manipulation. Therefore, Hoza et al.'s pattern of findings is inconclusive in that boys with ADHD appeared to hold a PIB with respect to the non-manipulated puzzle tasks, but their self-evaluations of performance were consistent with those of boys without ADHD when manipulated puzzle tasks were used. Such a finding suggests that characteristics of the task or task situation may influence the expression of a PIB among children with ADHD.

Turning to the social domain, Diener and Milich (1997) had 8- to 11-year-old boys with and without ADHD socially interact with a partner. Prior to the interaction, boys with ADHD did not differ in their predictions of their upcoming performance compared to boys without ADHD. After the interaction, boys with ADHD had higher self-perceptions of how much their partner had liked them compared to boys without ADHD. Both sets of results are indicative of a PIB among boys with ADHD, as partner-ratings suggest that these boys with ADHD had lower actual levels of performance than boys without ADHD.

Demonstrating mixed results, Hoza et al.'s (2000) study had 7- to 13-year-old boys with and without ADHD complete a social task in which their goals were to get another child to like them and convince this child to attend a camp. Again, Hoza et al. were interested in manipulating success and failure in order to examine the influence of prior success or failure on a subsequent social task. For the first social interaction, a computerized peer's behaviour was predetermined so that the boy either succeeded or failed in convincing the peer to attend the camp. Each boy then interacted with a new computerized peer in a second social task in which the peer remained neutral in his interaction with the boy. Boys with ADHD rated their performance on this second social task as higher than boys without ADHD, despite being rated by external coders as lower in actual social competence during the task. In contrast to these PIB-consistent findings, there appeared to be no main effect of ADHD diagnosis on pre-task self-predictions. That is, boys with and without ADHD did not differ in how well they thought they would do in getting the peer to like them and to want to go to camp, before completing social interaction tasks. As well, in rating their performance immediately after the earlier manipulated social situations, boys with ADHD did not differ in their self-evaluations of performance compared to boys without ADHD. That is, all boys made more positive self-evaluations in the success condition and more negative self-ratings in the failure condition. Such a pattern of results again suggests that possible moderators of the PIB may exist, such as the clarity of the feedback received by children about their performance.

In summary, within the literature on the PIB using pre-task predictions and/or post-task self-evaluations of performance, the majority of studies support the existence of a PIB in children with ADHD in the academic and social domains, although findings remain somewhat mixed. The mixed findings are suggestive of possible moderators of the PIB, such

as the clarity of feedback children receive regarding their performance. On the whole, these studies do not reliably answer the question of whether children with ADHD exhibit a PIB in the academic and social domains.

Limitations of PIB studies using only child self-reports.

Although the aforementioned studies of the PIB using only children's self-ratings avoid the interpretive issues associated with difference scores, they have methodological issues of their own. For instance, the ratings in these studies are still susceptible to floor and ceiling effects, caused by performance differences between the groups. Although examining the variances of self-perceptions and actual performance scores in prior studies (e.g., Hoza et al., 2000; Hoza et al., 2012; Owens & Hoza, 2003) provides some assurance that floor and ceiling effects are not a serious issue, children with and without ADHD may still have differential probabilities of overestimating their competence when the actual competence levels of the two groups differ. In addition, studies of the PIB using absolute scores of children's self-ratings only allow for the nomothetic interpretation that children with ADHD as a group have higher self-perceptions than the group of children without ADHD. These studies also allow for the conclusion that children with ADHD, on average as a group, show lower levels of performance than children without ADHD. However, it is unknown, on an individual level, whether individual children with ADHD are overestimating their actual performance.

In summary, the use of stand-alone child self-ratings continues to face statistical issues. Equating performance, such that children with and without ADHD show comparable levels of performance, provides a solution to floor and ceiling limitations by equalizing the degree to which performance may be overestimated or underestimated across ADHD and

non-ADHD groups. Equating performance also addresses the issue of having only nomothetic knowledge such that it is difficult to ascertain whether each child with ADHD has self-perceptions above their performance levels. Although a study in which performance is equated between groups would still involve analyses examining group level differences, interpretation of the group level scores is more meaningful because the self-rating in comparison to the actual performance of each child is known. The current study constrains the performance of boys with and without ADHD, which not only eliminates the difficulties involved in using discrepancy scores but also provides both groups with an equal chance of overestimating their performances, and allows for more meaningful interpretations of self-perceptions at both individual and group levels.

Potential Moderators of the PIB

As noted above, even beyond issues with discrepancy scores, a possible explanation for the inconclusive results of previous studies of the PIB may be the role of moderators. Indeed, the results of Hoza et al. (2000) and Hoza et al. (2001) suggest that the question of whether or not the PIB exists may not be completely unconditional. That is, the PIB may be present among children with ADHD in certain situations and not in others. Hoza et al.'s (2001) study shows that children with ADHD exhibit a PIB for academic performance when the outcome of the task is relatively unclear, and yet do not exhibit a PIB when success or failure outcomes are predetermined. Similarly, Hoza et al.'s (2000) study demonstrated that children with ADHD show a PIB in a social situation in which the outcome is ambiguous (i.e., when boys engage in a social interaction with a confederate who was instructed to remain neutral), but do not possess a PIB in social situations where social success or failure outcomes are manipulated. One interpretation of these results may be that children with

ADHD do not exhibit a PIB in situations involving clear feedback regarding their performance. One can argue that the manipulated outcomes on the puzzle tasks in Hoza et al.'s (2001) study provided clear feedback of success or failure to the children, because the children were either finding no words in the puzzles or successfully completing the majority of word puzzles. Similarly, the manipulated social situation in Hoza et al.' s (2000) study involved clear feedback of success or failure at the task in that confederates clearly expressed whether the boys with ADHD had achieved their goals of convincing the confederate to attend the camp (i.e., "that sounds like fun", "I like to do that too", and "I really hope I come to camp next year" for the success condition, and "that's not very much fun", "I don't like doing that", and "I don't want to come to this stupid camp" for the failure condition). Confederates in the social interactions also behaved in a clearly positive or negative manner both verbally (e.g., greeting or not greeting the child) and nonverbally (e.g., smiling and maintaining eye contact, or frowning and avoiding eye contact). Given these findings, it may be that boys with ADHD do not exhibit a PIB compared with boys without ADHD when they receive clear feedback on their performance.

In contrast to the situations involving very clear feedback, other studies support the argument that children with ADHD exhibit a PIB in situations where they receive unclear feedback about their performance. For instance, studies using only children's self-perceptions to demonstrate a PIB in children with ADHD have generally used tasks with either an absence of feedback or unclear feedback. In the academic domain, Milich and Okazaki (1991)'s results supporting a PIB were obtained in conditions where there was variability in terms of the number of puzzles the boys with ADHD successfully solved, therefore the boys did not experience absolute success or failure on these puzzles. As well, the boys were given

no explicit feedback regarding their performance. Similarly, O'Neill and Douglas (1991) found that boys with ADHD had higher estimates of their performance than boys without ADHD, despite not differing on average from boys without ADHD in terms of actual recall performance. Whether there was unclear feedback regarding performance in this study can only be inferred from the fact that success and failure in outcomes were not directly manipulated. As noted above, in Hoza et al.'s (2001) study, boys with ADHD exhibited a PIB when they did not encounter clear success or failure on the puzzle tasks they had to complete. Similarly, Hoza et al.'s (2000) study showed that boys with ADHD were more likely to show a PIB in a more ambiguous social situation in contrast to social situations with manipulated and clear success or failure outcomes. As well, Diener and Milich (1997) found that boys with ADHD exhibited a PIB with respect to social performance in an interaction task where success and failure outcomes were not directly manipulated.

The aforementioned studies suggest that clarity of feedback may be a moderator of the PIB among children with ADHD. Such a moderator makes sense in light of both the neuropsychological deficit and self-protective explanations for the PIB. With respect to the neuropsychological deficit hypothesis, poor self-awareness may be typical in these children's assessments of their performance except when an extremely clear external evaluation of their performance is presented. That is, even with executive function and self-awareness deficits, children with ADHD may be able to incorporate performance feedback into their self-perceptions when this feedback is explicit and clear. In other, more ambiguous feedback situations, children with ADHD may be less able to use the feedback to inform their self-perceptions. With respect to the self-protective hypothesis, unclear feedback may more likely allow for the operation of implicit and/or explicit self-protective tendencies compared to

clear feedback. In contrast, clear feedback may be more challenging to deny for self-protective purposes because in this case, the need to be accurate opposes the need to self-protect. That being said, the purpose of the current study was not to disentangle the mechanisms behind the PIB, but rather to assess whether clarity of feedback indeed plays a role in the expression of the PIB.

The potential moderating effects of clarity of feedback on the PIB have not been directly investigated in either the academic or social domains. Given that social tasks (e.g., peer interactions) are likely to involve more ambiguous feedback than academic tasks (e.g., homework and tests), understanding how clarity of feedback is associated with the expression of the PIB may be more relevant for the social than academic domains. Indeed, McQuade et al. (2011) suggest that greater cognitive skills may be necessary to process the many nuances of social information compared to other types of information. Therefore, the current study examined the moderating influence of feedback clarity on the PIB in the social domain as a first step to more fully understanding the PIB among children with ADHD. This study used a new methodology involving a social interaction in which social feedback to boys was constrained across ADHD and non-ADHD groups to be clearly positive, clearly negative, or unclear. Boys' self-perceptions of competence in these social interactions were then assessed to determine whether they differed depending on the clarity of social feedback.

In contrast to the unexplored moderator of feedback clarity, moderators of the PIB that have been directly studied in previous research are the co-occurring conditions of children with ADHD. In a number of existing PIB studies, researchers have controlled for co-occurring depressive or aggressive symptoms when examining the PIB among children with ADHD in comparison to children without ADHD (e.g., Hoza et al., 2002; Hoza et al., 2004;

Ohan & Johnston, 2011). Such covarying is wise, as studies have found that aggressive difficulties in addition to ADHD are associated with higher PIBs while comorbid internalizing symptoms are correlated with lower PIBs (e.g., Jiang & Johnston, 2013). Based on these results, the current study assesses whether boys' levels of aggressive and depressive symptoms are associated with variables measuring the PIB, and if so, treats these symptoms as covariates in analyses.

In summary, clarity of feedback is a potential moderator of the PIB that has remained unexplored, and co-occurring aggressive and depressive symptoms in children with ADHD have been shown to moderate the effect of the PIB. Therefore, to address the potential moderator of clarity of feedback, the current study examined the influence of feedback that varies in terms of clarity (i.e., clear versus unclear) on the expression of the PIB in boys with ADHD. In addition, the current study controlled for depressive and aggressive symptoms among boys, if necessary.

Current Study

This study examined the presence of the PIB while equating actual social performance across groups of boys with and without ADHD. A social interaction task was employed in which boys with and without ADHD interacted with a computerized peer in a computer program with the goal of convincing the peer to be friends with them. During the interaction, the computerized peer asked the boy questions, and the boy answered by choosing from a limited set of response options that were equivalent in their social impact. Similarly, the boy chose a limited set of questions to ask the computerized peer. Performance on this social task was uniform across the ADHD and non-ADHD groups as all possible responses were comparable in terms of social appropriateness. As well, the responses of the

computerized peer were constrained across all children. Such steps taken to equate performance allowed for the PIB to be elucidated without the possible confound of greater impairment on the task in the ADHD group compared to the non-ADHD group. After the social interactions, boys were asked to complete post-task self-evaluations of their performance. These post-task self-ratings were compared across ADHD and non-ADHD groups as a measure of the PIB.

Each boy in the current study completed three such social interactions. These three interactions varied in terms of the clarity of feedback on performance provided to the boy. In one condition, boys received clear positive feedback from the computerized peer in the form of positive responses throughout the interaction. In another condition, boys received clear negative feedback from the computerized peer in the form of negative responses throughout the interaction. Finally, in the third condition, boys received unclear feedback regarding their social performance, such that the computerized peer provided responses that were ambiguous in terms of whether they like the boys. These three different conditions (Unclear, Positive, Negative) allowed for a better understanding of whether self-perceptions of performance (or the PIB) differed depending on the clarity and valence of feedback.

For the main analyses, a 2 (ADHD versus non-ADHD group) x 3 (Unclear versus Positive versus Negative feedback) repeated measures ANOVA was conducted, with ADHD status as the between-subjects variable, clarity of feedback as the within-subjects variable, and the boys' ratings of their social performance as the dependent variable. The co-occurring aggressive and depressive symptoms of boys were controlled if they were related to child self-ratings. It was predicted that boys with ADHD would exhibit a PIB in the social domain only under certain conditions. That is, boys with ADHD would show significantly higher

self-evaluations of performance compared to boys without ADHD when they receive unclear feedback regarding their performance on the social task. In contrast, after receiving clear positive or clear negative feedback in the social task, boys with ADHD would show no differences in self-evaluations compared with boys without ADHD.

In order to compare previous PIB findings to the results found using this paradigm that equates social performance across groups, standardized difference scores between child- and parent-reports also were constructed and compared between boys with and without ADHD, again with aggressive and depressive symptoms controlled if necessary. It was predicted that boys with ADHD would show a PIB using the previous methodology of constructing standardized difference scores between child- and parent-reports.

In an exploratory manner, the relations between ADHD status and the individual difference score components of the PIB were investigated. In addition, the validity of the PIB as captured by difference scores was assessed using logistic regressions where the ability of PIB difference scores to predict ADHD group status after controlling for impairment was examined, akin to the methodology used by Swanson et al. (2012). Furthermore, the existence of the PIB was investigated using the recommended methodology of polynomial regressions by Laird and Weems (2011), in which the significance of the interaction between child- and parent-reports of the PIB difference scores in predicting ADHD status was examined. These exploratory analyses were conducted to gain further insight into the presence of the PIB, and its assessment across different methodologies. No predictions were made for these supplemental analyses given their exploratory nature.

Method

All boys were recruited from Vancouver and surrounding areas using advertisements in the community, referrals from health professionals at local ADHD clinics (e.g., the ADHD Clinic at British Columbia's Children's Hospital), notices distributed in ADHD support groups, advertisements in a newsletter created by the Parenting Lab, the volunteer registry at the Parenting Lab, emails on campus mailing lists, and general word of mouth. Non-biological parents were eligible to participate if they had lived with their son for more than 1 year. Parents or children who had not spoken English for more than 3 years were excluded. As well, boys whose parents reported them as having significant developmental delays (e.g., pervasive developmental disorder, intellectual disability) were excluded. Parents of boys who were currently stimulant-medicated for ADHD were asked to withdraw their child's medication at least 24 hours before participating in the study, so as to allow for a better understanding of the association between self-perceptions and ADHD symptoms when not influenced by medication.

Diagnostic Measure and Inclusion Criteria

ADHD-IV rating scale.

The ADHD symptoms of boys were rated by their parents and teachers using the ADHD-IV Rating Scale (ADHD-IV RS; DuPaul, Power, Anastopoulos, & Reid, 1998). The ADHD-IV RS is a measure that inquires about the frequency of a child's ADHD symptoms over the past 6 months using a 4-point Likert scale (0 = *never or rarely*, 1 = *sometimes*, 2 = *often*, 3 = *very often*). This questionnaire contains 18 items that map onto DSM-IV diagnostic criteria for ADHD, assessing symptoms in the inattentive and hyperactive-impulsive domains. These symptoms have not changed in the newest edition of the DSM (DSM-5;

American Psychiatric Association, 2013). An impairment item assessing how much the child's ADHD difficulties interfere with home or school functioning (0 = *never or rarely*, 1 = *sometimes*, 2 = *often*, 3 = *very often*), as well as an age of onset item assessing whether the ADHD symptoms occurred prior to age 7, were added to the parent version of this questionnaire. The ADHD-IV RS has been standardized, and has adequate levels of reliability and validity (DuPaul et al., 1998). Raters were asked to rate the boy's behaviour as it appeared off of medication. In cases when it was impossible to answer questions according to an un-medicated boy (i.e., the boy was taking a long-acting medication), raters were asked to answer questions according to the boy's usual behaviour. In this study, the overall internal consistencies for parent-reports on this measure were .94 for the inattention domain and .90 for the hyperactive/impulsive domain. Parent-reports consisted of 78 (96%) mother- and three (4%) father-reports. For the teacher-reports on this measure, the internal consistencies were .92 for the inattention domain and .89 for the hyperactive/impulsive domain.

In order to be categorized in the ADHD group, the boy was required to meet DSM-IV TR ADHD criteria (i.e., he had to have six or more ratings of 2 or 3 (*often* or *very often*) for inattention symptoms, and/or six or more such ratings for hyperactivity/impulsivity symptoms) based on either parent- or teacher-ratings on the ADHD-IV RS (American Psychiatric Association, 2000). Furthermore, on the parent version of the ADHD-IV RS, the boy had to receive a reported onset of ADHD symptoms prior to age 7. As well, parents and teachers were required to both give a rating of 1 (*sometimes*), 2 (*often*), or 3 (*very often*) for the boy's level of impairment from ADHD symptoms.

In order to meet research criteria for the non-ADHD group, by parent-report, boys had to never have been diagnosed with ADHD or have experienced any other psychological

disorder, and have three or fewer ratings of 2 or 3 (*often* or *very often*) for symptoms of inattention as well as three or fewer ratings of 2 or 3 (*often* or *very often*) for symptoms of hyperactivity/impulsivity on the ADHD-IV RS. In addition, parents had to give boys a rating of less than 2 (*often*) for impairment from these symptoms. Teacher-ratings of ADHD symptoms were not gathered for boys in the non-ADHD group.

Participants

Fifty-one 8- to 12-year-old boys in the ADHD group and 56 8- to 12-year-old boys in the non-ADHD group, as well as their mothers or fathers, participated in this study. For the ADHD group, a total of nine boys were excluded from analyses due to not meeting the research criteria outlined above. Two of these nine boys were missing ratings of ADHD symptoms from their teachers, and were therefore excluded. Seven of these nine boys did not meet research criteria (four had ratings of 0 [*never or rarely*] for teacher-rated impairment, and three had fewer than six symptoms of inattention and/or hyperactivity/impulsivity endorsed as 2 [*often*] or 3 [*very often*] on both parent- and teacher-ratings). An additional three boys were missing teacher-ratings of ADHD-related impairment, but were included in analyses as they met all other research criteria for ADHD and had been diagnosed with ADHD by a mental health professional in the community. For the non-ADHD group, one boy was excluded from analyses due to not meeting research criteria. He was reported by his parents as having a psychological disorder, specifically problems with learning.

To be included in data analyses, in addition to meeting research criteria, boys needed to respond to a series of believability questions in a way that suggested that they believed that the computerized peers in the social interaction task were real. Of the 42 boys in the ADHD group who met research criteria, 35 (83.33%) believed that the computerized peers were real.

Of the 55 boys in the non-ADHD group who met research criteria, 46 (83.64%) believed that the computerized peers were real. Therefore, 35 boys in the ADHD group and 46 boys in the non-ADHD group formed the final dataset used for analyses.

To check whether the exclusion due to lack of believability may have influenced the generalizability of results, analyses were performed to determine whether believers and nonbelievers differed in terms of their ADHD status, self-reports of competence in each of the three social interaction tasks, socioeconomic status (SES), and age. A repeated measures 3 (Unclear versus Positive versus Negative feedback) x 2 (ADHD versus non-ADHD group) x 2 (believers versus non-believers) ANOVA was conducted with the self-reported competence ratings as the dependent variable. No significant main effect of believability nor interactions of believability with other variables were found, indicating that believers and non-believers did not differ in their self-reports of competence on the three interaction tasks, regardless of whether they were from the ADHD or non-ADHD group, *p*s > .20. In addition, to test whether believers and non-believers differed in SPPC standardized difference scores (child- minus parent-ratings on the child- and other-report versions of the SPPC, respectively), and whether ADHD status interacted with believability in predicting these SPPC difference scores, a univariate 2 (ADHD versus non-ADHD group) x 2 (believers versus non-believers) ANOVA was conducted with SPPC standardized difference scores as the dependent variable. Again, no significant main effect of believability or interaction of believability with ADHD status were found, *p*s > .27.To investigate whether believers differed from non-believers in SES, a 2 (ADHD versus non-ADHD group) x 2 (believers versus non-believers) ANOVA was conducted with SES as the dependent variable. Results demonstrated no significant main effect of believability on SES, $p = .51$, and no significant

interaction of believability by ADHD status, $p = .68$. To examine whether believers differed from non-believers in age, a similar 2 (ADHD versus non-ADHD group) x 2 (believers versus non-believers) ANOVA was conducted. Findings indicated a significant main effect of believability on age, $F(1, 102) = 6.22$, $p < .05$, such that non-believers were older than believers. That believers are younger than non-believers makes intuitive sense as the cognitive sophistication of older children may have allowed them to be more skeptical of the computerized peers. Overall, aside from age, there does not appear to be other differences between the believers who were included in analyses and the non-believers who were excluded.

Of the 35 boys in the ADHD group who met the research diagnostic criteria and believed in the computerized peers in the social interaction task, 29 (82.86%) were reported by parents to have been formally diagnosed with ADHD in the community, while six (17.14%) had not. Eighteen (51.43%) boys included in the ADHD group were currently taking medication for ADHD. Fourteen (77.78%) of these boys were taking a stimulant and parents were asked to withdraw these children from the medication for 24 hours before the study. According to parent-report on the day of the testing session, 13 of the 14 boys had not taken their medication within 24 hours prior to the study. The remaining boy took a stimulant 10.5 hours before participating in the study. According to parent-report, seven (20.00%) boys in the ADHD group also had problems with learning, four (11.43%) had problems with behaviour, one (2.86%) boy had problems with learning, motor coordination, and anxiety, and another boy (2.86%) had problems with learning and anxiety. Finally, one boy (2.86%) had a speech delay, and another (2.86%) had problems with anxiety.

Family socioeconomic status (SES), based on the Hollingshead (1975) Four-Factor Index of Social Status, was predominantly lower middle-class for the ADHD group, and predominantly middle-class for the non-ADHD group (see Table 1). Independent *t*-test comparisons between ADHD and non-ADHD groups yielded a significant difference in family SES, a marginally significant difference in child age, and a non-significant difference in number of siblings. Fisher's exact test showed a significant relationship between child ADHD status and marital status of parents such that the ADHD group had fewer married or common law families than the non-ADHD group, $p < .01$. In addition, a chi-square test examining the relationship between ADHD status and Caucasian versus non-Caucasian child race/ethnicity found a significant difference, such that the ADHD group had more Caucasian boys than the non-ADHD group, $\chi^2(1) = 3.78$, $p = .05$. Of these variables, ones (i.e., child age, family SES, number of siblings) that were significantly associated with the dependent variables were controlled in later analyses. For detailed demographic information on age, SES, number of siblings, marital status, and ethnicity of the boys, see Tables 1 and 2.

Table 1
Descriptive Statistics for Participating Families

	ADHD Group		Non-ADHD Group			
Variable	*M* (*SD*)	Range	*M* (*SD*)	Range	*t*	*df*
Child age in years	10.50 (1.34)	8.16-12.83	10.00 (1.23)	8.08-12.58	-1.76†	79
Family SES	41.16 (14.04)	20.00-66.00	50.28 (12.18)	14.00-66.00	3.13**	79
Number of siblings	1.24 (.78)	.00-4.00	1.15 (.84)	.00-3.00	-.45	78
ADHD-IV RS parent-ratings	1.97 (.42)	1.11-2.72	.65 (.30)	.17-1.28	-15.82***	58.48
ADHD-IV RS teacher-ratings	1.52 (.60)	.17-2.61	NA	NA	NA	NA

Note. ADHD = Attention-Deficit/Hyperactivity Disorder; SES = socioeconomic status score: 8 = low SES, 66 = high SES; ADHD-IV RS = Attention-Deficit/Hyperactivity Disorder-IV Rating Scale; NA = not applicable. † $p < .10$. ** $p < .01$. *** $p < .001$

Table 2
Marital Status of Parents and Ethnicity of Child

	ADHD Group		Non-ADHD Group	
Variable	Number	%	Number	%
Marital Status				
Married or Common Law Families	23	65.71	43	93.48
Divorced, Separated, or Single-Parent Families	11	31.43	3	6.52
Ethnicity				
Caucasian/European/Canadian	25	71.43	24	52.17
East Asian	4	11.43	18	39.13
South Asian	2	5.71	1	2.17
Hispanic	1	2.86	1	2.17
First Nations	0	0	1	2.17
Mixed	3	8.57	1	2.17

Note. ADHD = Attention-Deficit/Hyperactivity Disorder.

Primary Research Measures

Social interaction task.

A computerized social interaction task was used to assess boys' social interactions in a task that equated social performance between boys with and without ADHD, and provided three types of social feedback (see Appendices A, B, and C for scripts). Boys interacted with three computerized peers (Ben, Sam, and Kevin), and were led to believe that these peers were real boys. In reality, no actual peers existed and instead, all responses of the peers were pre-programmed. Each interaction took approximately 3 to 5 minutes. Pilot testing of the questions and responses of the computerized peers was undertaken to enhance their believability, so as to increase the likelihood that boys would believe that the peer was a real boy between the ages of 8 and 12.[1] Each boy was told that he and the peer would interact,

[1] Participants in the pilot testing rated the believability of each of the questions and responses of the computerized peers from the three social interaction tasks on a scale of 1 (not at all believable) to 7 (extremely believable). Believability ratings for each interaction task were above 6.25. The average rating across interaction tasks was 6.32. Pilot participants also rated the believability of the entire script of the computerized peer from the social interaction tasks on the same scale. These global believability ratings for each interaction task were at 5.80 and above, and the average global rating across interaction tasks was 5.97.

and that his goal for the task was to get the peer to like him. To ensure comparable social performance across ADHD and non-ADHD groups, boys selected from a limited number of questions to ask the computerized peer and responded to each of the computerized peer's questions by clicking on one of two question or response options. Although the choices of questions and responses differed from each other, they either did not vary in any meaningful way (e.g., questions such as "hi, how are you?" and "hello, how are you?") or were straightforward factual responses (e.g., "yes" or "no"). Pilot testing was conducted to determine that the questions and response options were equivalent in level of social skill (e.g., how socially skilled or socially appropriate they were).[2]

The computerized peer provided pre-programmed responses to the boys based on the feedback condition of the task. In the clear positive condition (Positive), the computerized peer responded by providing a direct and clearly positive judgment (e.g., "You are so cool", "You're so right") and a statement in agreement (e.g., "I do too") with every response the boy made. In contrast, in the clear negative condition (Negative), the computerized peer responded by providing a direct and clearly negative judgment (e.g., "You are so weird", "You are not cool") and a contradicting statement (e.g., "They're so boring") to every response the boy offered. In the unclear condition (Unclear), the computerized peer responded ambiguously to the boys' responses (e.g., "You like swimming. I swim sometimes"). Pilot testing was conducted to ensure that the conditions were appropriately different in terms of the valence (e.g., how positive or negative the computerized peer's

[2] Pilot participants rated the equivalence of the level of social skill of each of the question and response options provided to participating boys for the three social interaction tasks on a scale of 1 (not at all equal in social skill/appropriateness) to 7 (extremely equal in social skill/appropriateness). Ratings for each interaction task were at or above 6.75. The average rating across interaction tasks was 6.78. Pilot participants also rated the equivalence of level of social skill of the response options overall on the same scale. Global ratings for each interaction task were at or above 6.00, and the average global rating across interaction tasks was 6.41.

questions or responses were in terms of indicating whether the computerized peer liked or disliked the boy) and clarity (e.g., were the questions/responses of the computerized peer very clear or unclear in terms of providing positive or negative feedback about liking or disliking the boy) of the computerized peer's feedback to the boy.[3] All pilot testing was undertaken with graduate and undergraduate students working in the Parenting Lab, all of whom had experience with children.

The order of the three feedback conditions (Unclear, Positive, Negative) was counterbalanced across boys in the study, given possible carryover effects of the Negative feedback conditions on self-perceptions in subsequent tasks as demonstrated by Hoza et al. (2000), who found that failure on a task was associated with higher self-perceptions on a subsequent task for children with ADHD. Counterbalancing allowed for better disentangling the effects on the PIB of clarity of feedback from the effects of the valence of the feedback.

Post-task self-evaluations of performance.

To avoid the possibility that boys would rate their self-perceptions according to a more generalized view of their overall social performance rather than make ratings specific to the social interaction task, the questions used to probe their post-task self-evaluations were chosen to be specific to the experimental task. These questions thus referred to a level of social performance that was held constant across boys by the constraints of the task. Boys

[3] Pilot participants rated the valence and clarity of the feedback responses of the computerized peers for the three social interaction tasks on a scale of 1 (extremely negative to participant) to 7 (extremely positive to participant) for valence and a scale of 1 (extremely unclear in conveying like/dislike) to 7 (extremely clear in conveying like/dislike) for clarity. The average valence ratings for the Unclear, Positive, and Negative conditions were 3.89, 7.00, and 1.34, respectively. With respect to clarity of feedback, average ratings for the Positive and Negative conditions were at or above 6.56 while the average rating for the Unclear condition was 2.82. Pilot participants also rated the valence and clarity of the feedback for the entirety of the three social interaction tasks on the same scale. Average global valence ratings for the Unclear, Positive, and Negative conditions were 4.00, 6.50, and 1.70, respectively. Average global ratings of clarity of feedback for the Positive and Negative conditions were at or above 6.30, while the average global rating for the Unclear condition was 2.64.

were therefore asked, after their interaction with the computerized peer in each feedback condition, to rate their performance during the interaction on the Post-task Self-evaluations of Performance (PSP) questionnaire, comprised of four items using 9-point Likert scales. The scale was labeled with five anchors (1 = *very poorly*, 3 = *not so good*, 5 = *okay*, 7 = *pretty good*, 9 = *very well*) for the first question and another five anchors (1 = *not at all*, 3 = *a little*, 5 = *some*, 7 = *a lot*, 9 = *a whole lot*) for the remaining three questions. Specifically, the boys were asked the following questions to assess their views of how well they achieved their goal of getting the peers to like them: (1) *how well did you do in getting the boy to like you?*, (2) *how much do you think the boy liked you?*, (3) *how much do you think the boy liked talking to you?*, and (4) *how much do you think the boy wanted to be friends with you?*. The mean of ratings for these four questions formed the post-feedback self-evaluation score.

These types of questions have been used successfully in past PIB and ADHD research (e.g., Diener & Milich, 1997; Hoza et al., 2000; Ohan & Johnston, 2002). Across all boys, the internal consistencies of the self-ratings were .86 for the Unclear feedback condition, .83 for the Positive feedback condition, and .88 for the Negative feedback condition. Within ADHD and non-ADHD groups separately, the internal consistencies for self-ratings were respectively .85 and .87 for the Unclear condition, .79 and .85 for the Positive condition, and .86 and .90 for the Negative condition.

Self-perception profile for children.

In order to replicate the findings of previous studies of the PIB that have used discrepancy scores, boys and their parents completed the SPPC (Harter, 1985). The self-rated SPPC is a 36-item measure inquiring about children's agreement with statements regarding their competence (e.g., *some kids would like to have a lot more friends* but *other kids have as*

many friends as they want). Children are first asked to pick one of the two statements that they agree with more, and then to endorse whether this statement is *sort of true* or *really true* for them. Parents completed the Parent's Rating Scale of Child's Actual Behavior (PRSCAB), an other-rater version of the SPPC to rate the boys' competence. This version of the SPPC is comparable to the child version, but has only three questions per subscale. The SPPC has been found to have adequate levels of reliability and validity (Harter, 1985). The social domain of the SPPC was specifically used for analyses. In this study, the internal consistencies were .74 and .87 for the social domain for child- and parent-ratings, respectively. Standardized difference scores were constructed by first standardizing boys' self-perceptions and their parents' perceptions of them in the social domain, and then subtracting boys' self-perceptions from their parents' perceptions.

Descriptive and Covariate Measures

Child and family information questionnaire.

The Child and Family Information (CFIQ) questionnaire, developed in the Parenting Lab, was used to collect information regarding the demographics of the family members, such as the age, grade, number of siblings, psychological difficulties of the child, as well as the age, ethnicity, education, employment, and marital status of the parents.

Child behavior checklist.

The Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001) is a 114-item measure, which measures internalizing, externalizing, and other child difficulties. Parents are asked to rate their child's behaviour on a 3-point Likert scale (0 = *not true*, 1 = *somewhat or sometimes true*, 2 = *very true or often true*). This measure has been standardized and has adequate levels of reliability and validity (Achenbach & Rescorla, 2001). The aggressive

behaviour and social problems subscales of the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001) were used to assess aggressive behaviours and social problems in the boys in this study, so as to be able to treat these difficulties as covariates in analyses. In this study, the internal consistencies were .91 for the aggressive behaviour scale, and .73 for the social problems scale.

Children's depression inventory 2.

The Children's Depression Inventory 2 (CDI-2; Kovacs, 2010) was used to measure the boys' ratings of their depressive symptoms over the past 2 weeks, so as to be able to treat these symptoms as a covariate in the analyses. The CDI-2 is a 27-item self-report questionnaire, which inquires about a number of depressive symptoms, such as disturbed mood, low self-evaluations, hopelessness, interpersonal difficulties, and loss of pleasure. Boys responded to statements regarding depressive symptoms on a 3-point Likert scale, where a response of 0 indicates the absence of the symptom, 1 signifies that the symptom is mild or probable, and 2 indicates that the symptom is definitely present. This measure has been standardized, and has adequate levels of reliability and validity (Kovacs, 2010). The internal consistency of this scale was .84 in this sample.

Procedure

Upon calling the lab, parents were informed of the details of the study, including the deception involved in leading their child to think that the computerized peers that they would interact with were real. Parents were informed that if they wanted to participate in the study, they would be asked to not inform their child of the deception involved. If parents decided to participate, a research assistant assessed whether they met study criteria. The research assistant asked the age and gender of the child, whether the parent and child were fluent in

English, and if the child had significant developmental difficulties. The family's city of residence also was noted, so that computerized peers could be described as from the same city as the boy. If parents agreed to participate after being fully informed of the nature of the study, and if parents and children met inclusion criteria for the study, an appointment was made for the family to come into the lab.

Upon arriving at the lab, study procedures were again reviewed and written consent was received from the parent. Before starting the interaction task, the boy was asked what he thought would happen in this study (i.e., *what do you think we'll be doing today?*, *do you know that you'll be talking to three boys?*, *who do you think you're going to talk to?)* to check if his parent informed him of the deception. None of the children reported knowing of the deception beforehand. A research assistant then explained to the boy that the study was about what children think when they meet other children. The research assistant told the boy that there were three boys online that he would interact with one at a time, and that his goal was to try to get these boys to like him. Before each interaction, the research assistant let the boy know that the peer was a boy of the same age and from the same city as him, and that his goal was to try to get the peer to like them. Before the first interaction, the research assistant informed the boy that the peers on the computer would ask him questions and that he was to click on the response that was the best match for what he wanted to say in reply to the peer. The boy also was informed that he would be able to choose between sets of two questions to ask the boys on the computer. Finally, the research assistant informed the boy that using the Internet to talk to a stranger in this study was different from doing so at home or alone, where it may be inappropriate to engage in these types of interactions without their parents'

permission. Assent for the study was gathered from the boy before proceeding with the interaction tasks.

The boy used a laptop computer to complete the social interaction tasks while his parent filled out questionnaires in counterbalanced order in a separate room. One research assistant remained with the boy to supervise while he completed the interactions, while a second research assistant went to the other room with the parent. After each social interaction task, the boy was asked the PSP questions by another research assistant who had not been in the room during the interaction. This second research assistant asked the PSP questions so that the boy could report how well he did in getting the computerized peer to like him to someone who had not been in the same room as him when he interacted on the computer. Such a set-up was designed to minimize experimenter demand for more accurate ratings from the boy. After the first and second interactions, the in-room research assistant informed the boy that now another boy was online and reminded the boy that the peer was the same age and from the same city as him. The research assistant again reminded the boy that his goal was to get the other peer to like him. After each interaction task, the research assistant who had not seen the boy complete the interaction asked the boy the PSP questions with respect to that interaction. After all three interactions, boys completed the remaining child questionnaires in counterbalanced order.

After the boy filled out his questionnaires, a research assistant asked the boy the believability questions to check for the success of the deception in convincing him that the computerized peers were real (i.e., *what did you think about the three boys you talked to?, do they seem like boys you see at school?, was there anything strange about these boys?, if so, how were they strange?, were they all strange or were only one or two of them strange?).*

Then, the research assistant debriefed the boy, and told him that the peers were computer programmed. The research assistant explained that the deception was necessary in order to understand how children think about their interactions with an actual peer because if they knew the other child was not real, they might have had different thoughts about how well they did in the interactions. Such debriefing is consistent with prior studies using simulated peers (e.g., Ohan & Johnston, 2011). After the debriefing, the boy engaged in positive social play with a research assistant to counteract any negative effects of the negative peer feedback. Parents and children were then thanked, and the family was given a $15 honourarium. The study lasted approximately 60 minutes in total.

For the non-ADHD group, 43 (93%) families participated in the lab and three (7%) families participated at their homes. For the ADHD group, 31 (89%) families participated in the lab and four (11%) participated at home. As well, 16 (35%) families from the non-ADHD group participated in the context of a longer visit associated with the family participating in a larger study on family interactions of children with ADHD while 30 (65%) families participated in this study alone. For the ADHD group, 18 (51%) families participated in the context of a longer visit while 17 (49%) participated in this study alone. During these longer visits, parents filled out two of the parent questionnaires (CFIQ and CBCL) as part of the larger study and provided consent to allow for their use for this study.

Results

Data Screening and Assumptions

Data screening.

Univariate statistics for all variables were inspected to ensure that means and standard deviations were plausible, and that all values were within range.

Missing data.

The dependent variable of PSP ratings across the three levels of the independent variable of feedback condition (Unclear, Positive, and Negative) was inspected for missing values and none were found. The SPPC standardized difference scores (child minus parent standardized scores) for the social domain were inspected for missing values. One boy (1.23%) was missing data for the SPPC standardized difference scores. Given that less than 5% of data was missing for these variables, the missing data was deemed negligible and scale-specific mean substitution was used. Thus, for the boy with missing data, the mean of the other items in the scales that comprise the difference score (SPPC and PRSCAB ratings for the social domain) was substituted and used to calculate the missing difference score.

For the three covariates (CDI-2 depressive symptoms, CBCL aggressive behaviour, CBCL social problems), two boys (2.47%) were missing data for the CBCL social problems variable, six boys (7.41%) were missing data for the CDI-2 depressive symptoms variable, and six boys (7.41%) were missing data for the CBCL aggressive behaviour variable. Given that less than 5% of data was missing for the CBCL social problems variable, the missing data is likely negligible and was treated with scale-specific mean substitution, where the mean of the other items was substituted for the missing value. For the two variables missing more than 5% of data, *t*-tests were performed to investigate whether boys with data missing

differed from boys without missing data in their scores on the primary dependent variable of PSP ratings across the three conditions (Unclear, Positive, and Negative) and on the dependent variable of SPPC standardized difference scores for the social domain. There were no significant differences in these dependent variables depending on whether or not boys were missing data for the CDI-2 depressive symptoms or CBCL aggressive behaviour covariates, aside from one exception: boys with missing values on the CBCL aggressive behaviour scale had significantly lower PSP ratings in the Negative condition, $t(79) = -2.60$, $p < .05$. These findings suggest that the data on the CDI-2 depressive symptoms covariate is likely missing at random while the data on the CBCL aggressive behaviour covariate may not be missing at random.

Despite not being missing at random, the missing data on the CBCL aggressive behaviour covariate is unlikely to have significant consequences for the main results of the analyses. Given that this was the only significant finding from the *t*-tests involving missing data and the data was missing on a covariate rather than a primary dependent variable, the missing data was deemed not likely to affect the associations between the independent (ADHD status and feedback condition) and dependent variables (PSP ratings for the three conditions, SPPC standardized difference scores for the social domain). In addition, the impact of the CBCL aggressive behaviour missing data is minimized because the scale is comprised of 18 items, and data was deemed missing when just one item from these 18 was missing (which was the case for four of the six boys missing data; the remaining two boys had two and four items missing). Therefore, scale-specific mean substitution of the missing data was utilized, wherein the mean of the other items in the scale for the boy was substituted for the missing item. One boy from the non-ADHD group did not answer any items on the

CDI-2, and therefore was missing data on the CDI-2 depressive symptoms covariate. For this case, variable-specific mean substitution was used in which the missing data on the CDI-2 depressive symptoms covariate was replaced with the group mean.

Univariate and multivariate outliers.

Univariate outliers were examined by inspecting data for the ADHD and non-ADHD groups for boys with scores more than 3.29 standard deviations above or below the mean of their respective group (as recommended by Tabachnick & Fidell, 2006). There were two outliers for the CDI-2 depressive symptoms variable, both from the non-ADHD group. For the ADHD group, no outliers were found. The two CDI-2 outliers were assigned a raw score one unit larger than the next highest score in the group (as recommended by Tabachnick & Fidell, 2006). No multivariate outliers were found based on calculations of Mahalanobis distances on all variables for each of the non-ADHD and ADHD groups, at a threshold of $p < .001$ (as recommended by Tabachnick & Fidell, 2006).

Normality and transformations.

Skewness, kurtosis, and standard errors were calculated for the dependent variables and covariates. The Shapiro-Wilk test of normality suggested that all dependent variables and covariates, except for the PSP ratings for the Unclear condition, were non-normal for the non-ADHD group, $p < .05$. More specifically, the PSP ratings for the Positive condition and the SPSS standardized difference score were negatively skewed while the PSP ratings for the Negative condition, and the covariates (CBCL aggressive behaviour, CBCL social problems, CDI-2 depressive symptoms) were positively skewed. For the ADHD group, PSP ratings for the Positive condition as well as all three covariates (CBCL aggressive behaviour, CBCL social problems, CDI-2 depressive symptoms) were non-normal, $p < .05$. The three

covariates (CBCL aggressive behaviour, CBCL social problems, CDI-2 depressive symptoms) were positively skewed while the PSP ratings for the Positive condition were negatively skewed.

Unfortunately, due to the severity of the positive skew for the variables of CBCL aggressive behaviour and CBCL social problems, no transformations were sufficient to normalize the distributions. Thus, a decision was made that because these variables would be used in analyses with SPPC standardized difference scores as well as CDI-2 depressive symptoms, all variables should remain untransformed to allow for easier interpretability of results. Similarly, although the PSP ratings for the Positive condition were moderately negatively skewed for both ADHD and non-ADHD groups, and the PSP ratings for the Negative condition were moderately positively skewed for the non-ADHD group, because these scores would need to be compared with the PSP ratings for the Unclear condition as well as with each other in primary analyses, no transformations were conducted so as to preserve the interpretability of the data. Fortunately, tests of the main analyses are relatively robust against non-normal data (Tabachnick & Fidell, 2007).

Linearity, homogeneity of variance, multicollinarity and singularity.

Visual inspection of bivariate scatterplots suggested that relationships between relevant variables were relatively linear. Levene's test of homogeneity of variances was used for relevant analyses that require such an assumption. Inspection of bivariate correlations between the dependent variables and covariates suggested no multicollinearity, *r*s < .70.

Descriptive Statistics

Means, standard deviations, and ranges.

Table 3 displays the means, standard deviations, and ranges of the dependent variables and covariates. These descriptive statistics, and all further analyses, are based on data that have been mean-substituted and treated for outliers, but not transformed. For the PSPs, higher scores indicate more positive self-reports of competence. Descriptively, it can be seen that for both groups, the PSP for the Positive condition was more positive (i.e., average ratings of *Pretty Good* for the question of *how well did you do in getting the boy to like you*, and *A Lot* for questions of *how much do you think the boy liked/liked talking to/wanted to be friends with you*) than the PSP for the Negative condition (i.e., average ratings of *Not So Good* for the question of *how well did you do in getting the boy to like you*, and *A Little* for questions of *how much do you think the boy liked/liked talking to/wanted to be friends with you*), while the average ratings for the PSP for the Unclear condition fell in between (i.e., average ratings of between *Okay* and *Pretty Good* for the question of *how well did you do in getting the boy to like you*, and between *Some* and *A Lot* for questions of *how much do you think the boy liked/liked talking to/wanted to be friends with you*). For the SPPC and PRSCAB ratings for the social domain, both children and parents gave ratings that were more positive than negative (i.e., rating *Sort of True* on average for phrases that indicated social competence).

For the CDI-2 depressive symptoms scale, boys in both the ADHD and non-ADHD groups, on average, rated themselves as identifying with the response choice indicating the lowest level of depressive symptoms (i.e., *I am sad once in a while*). For total CDI-2 depressive symptoms scores, boys in both ADHD and non-ADHD groups had, on average, *t*-

scores at or within a quarter of a standard deviation of the normative mean. Boys in both groups did not exhibit clinically-elevated depressive symptoms on average. For the CBCL aggressive behaviour and social problems scales, parents of boys in the ADHD group on average rated items of problematic aggressive or social characteristics, respectively, as *Somewhat or Sometimes True* of their sons, while parents of boys in the non-ADHD group on average rated these characteristics as *Not True* of their sons. In terms of *t*-scores, on average, parents of boys in the non-ADHD group made ratings within half of one standard deviation above the normative mean for both the CBCL social problems and aggressive behaviour scales. For the ADHD group, parents rated their boys on average as being more than one standard deviation above the normative mean in terms of *t*-score. Boys in the non-ADHD group did not appear to exhibit clinically-elevated social problems or aggressive symptoms on average, while boys in the ADHD group had scores in these domains that were approaching clinical elevation.

Table 3
Descriptive Statistics for Dependent Variables and Covariates

	ADHD Group		Non-ADHD Group	
Variable	*M* (*SD*)	Range	*M* (*SD*)	Range
PSP Unclear	5.72 (1.20)	3.50-8.75	5.73 (1.12)	3.50-9.00
PSP Positive	7.73 (.92)	6.00-9.00	7.45 (1.00)	4.50-9.00
PSP Negative	2.74 (1.19)	1.00-5.50	2.99 (1.20)	1.00-5.25
SPPC Social Domain	2.81 (.76)	1.33-4.00	2.92 (.53)	1.00-3.83
PRSCAB Social Domain	2.56 (.88)	1.00-4.00	3.18 (.59)	1.67-4.00
SPPC Standardized Difference	.35 (1.58)	-3.11-3.08	-.26 (.86)	-3.06-1.03
CDI-2 Depressive Symptoms	1.30 (.20)	1.04-1.89	1.25 (.17)	1.00-1.64
CBCL Aggressive Behaviour	.62 (.38)	.11-1.56	.20 (.17)	.00-.67
CBCL Social Problems	.50 (.29)	.18-1.36	.18 (.18)	.00-.64

Note. ADHD = Attention-Deficit/Hyperactivity Disorder; PSP = Post-task Self-evaluations of Performance; SPPC = Self-Perception Profile for Children; PRSCAB = Parent's Rating Scale of Child's Actual Behavior; CDI-2 = Children's Depression Inventory 2; CBCL = Child Behavior Checklist.

Mean differences for covariates.

Independent samples *t*-tests were used to examine mean differences between groups on the three covariates. Boys in the ADHD group had significantly higher scores than boys in the non-ADHD group on CBCL aggressive behaviour, $t(44.35) = -6.08$, $p < .001$, and on CBCL social problems, $t(54.28) = -5.80$, $p < .001$. The ADHD and non-ADHD groups did not differ on CDI-2 depressive symptoms.

Bivariate correlations.

Table 4 displays the bivariate correlations among the dependent variables and covariates. CDI-2 depressive symptoms were negatively associated with the PSPs for the Negative condition, and marginally associated with the SPPC standardized difference scores. As well, CBCL aggressive behaviour and child age were marginally related to the SPPC standardized difference scores. To be conservative in testing the hypothesized models, covariates that were at least marginally significantly ($p < .10$) correlated with the dependent variables were included in main analyses. Thus, CDI-2 depressive symptoms were included as a covariate in the model examining differences in PSPs for the feedback conditions. In addition, CDI-2 depressive symptoms, CBCL aggressive behaviour, and age were included in the model examining group differences in SPPC standardized difference scores.

Table 4

Bivariate Correlations between Dependent Variables and Covariates across Groups

	Correlations										
Variables	1	2	3	4	5	6	7	8	9	10	11
1. PSP Unclear	-	.36**	.29**	.06	-.11	.14	-.18	-.02	.10	.05	-.13
2. PSP Positive		-	-.09	.07	.07	.01	-.05	.12	.08	.13	-.01
3. PSP Negative			-	.23*	-.03	.21†	-.26*	-.03	-.09	-.02	.08
4. SPPC Social Domain				-	.22†	.63***	-.48***	-.06	-.17	-.02	-.02
5. PRSCAB Social Domain					-	-.63***	-.23*	-.31**	-.59***	-.28*	-.01
6. SPPC Standardized Difference						-	-.21†	.20†	.33**	.20†	-.01
7. CDI-2 Depressive Symptoms							-	.19†	.26*	.00	.24*
8. CBCL Aggressive Behaviour								-	.68***	.27*	-.25*
9. CBCL Social Problems									-	.32**	-.09
10. Age										-	-.10
11. SES											-

Note. PSP = Post-task Self-evaluations of Performance; SPPC = Self-Perception Profile for Children; PRSCAB = Parent's Rating Scale of Child's Actual Behavior; CDI-2 = Children's Depression Inventory 2; CBCL = Child Behavior Checklist; SES = socioeconomic status. † $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

Preliminary Analysis

Order effects.

Order effects of the three feedback conditions and their interactions with the PSP and ADHD status were investigated using a 3 (Unclear versus Positive versus Negative feedback) x 6 (number of orders) x 2 (ADHD versus non-ADHD groups) repeated measures ANOVA. Across groups, there was a significant interaction between condition and order, $F(8.92, 123.04) = 2.91$, $p < .01$. Post-hoc tests revealed no significant order effects for the PSP ratings in the Unclear condition, four significant order effects for the PSP ratings in the Positive condition (i.e., the Unclear-Negative-Positive order had significantly higher PSP scores than the Positive-Negative-Unclear order; the Negative-Unclear-Positive order had significantly lower PSP ratings than the Negative-Positive-Unclear order; the Negative-Positive-Unclear order had significantly higher PSP ratings than the Positive-Negative-Unclear order; and the Positive-Negative-Unclear order had significantly lower PSP ratings than the Positive-Unclear-Negative order), and three significant order effects for the PSP ratings in the Negative condition (i.e., the Unclear-Negative-Positive order had significantly lower ratings than the Unclear-Positive-Negative condition; the Unclear-Negative-Positive order had significantly lower ratings than the Negative-Unclear-Positive order; the Negative-Unclear-Positive order had significantly higher ratings than the Positive-Unclear-Negative condition).

Given that the orders were counterbalanced across children, the total number of post-hoc comparisons conducted, and the lack of consistent findings regarding the nature of the effect of order on the ratings made in the feedback conditions, these significant differences were judged to be spurious and unlikely to affect results. In addition, order effects were

tested primarily to determine whether there would be an effect of the Negative feedback condition on ratings made in later Unclear or Positive conditions for the ADHD group (as was found by Hoza et al., 2000). This did not appear to be the case. Furthermore, the fact that condition had a significant main effect across groups despite the significant order effects suggests that any overall effects of presentation order are likely negligible.

Main Analyses

ADHD status and feedback conditions as related to PSP ratings.

The independent variables are the between-subjects variable of whether or not the children have ADHD and the within-subjects variable of the three different feedback conditions (Unclear, Positive, and Negative), and the dependent variables are PSP scores for the three feedback conditions. It was hypothesized that ADHD group status would interact with the three feedback conditions such that boys with ADHD would have higher PSP scores than boys in the non-ADHD group for the Unclear condition but not for the Positive or Negative conditions. This hypothesis was not supported by the findings. A repeated-measures ANCOVA was conducted to test for an interaction between ADHD status and feedback condition, controlling for depressive symptoms. Only a main effect of condition was found, $F(1.83, 142.37) = 13.72$, $p < .001$, partial $\eta^2 = .15$, in the expected direction. That is, pairwise comparisons demonstrated that when boys received clear positive feedback, they rated their social performance more highly than when they received unclear feedback, which in turn resulted in higher PSP ratings than when they received clear negative feedback, *p*s < .001. This result is important as it confirms that the manipulation of the feedback was effective in changing boys' self-perceptions of their social performance. No significant interaction between feedback condition and ADHD status was found, $F(1.83, 142.37) = 1.04$,

p = .35, partial η^2 = .01 and no main effect of ADHD status was found, $F(1, 78) = .16$, p = .69, partial η^2 = .00. These null findings suggest that ADHD status was not associated with a tendency to over-report social performance in response to unclear feedback, nor other ADHD versus non-ADHD differences in ratings of social performance. Thus, in a social interaction task that constrained the feedback and performance of boys with and without ADHD, no evidence of a PIB among the children with ADHD was found (see Figure 1 below).

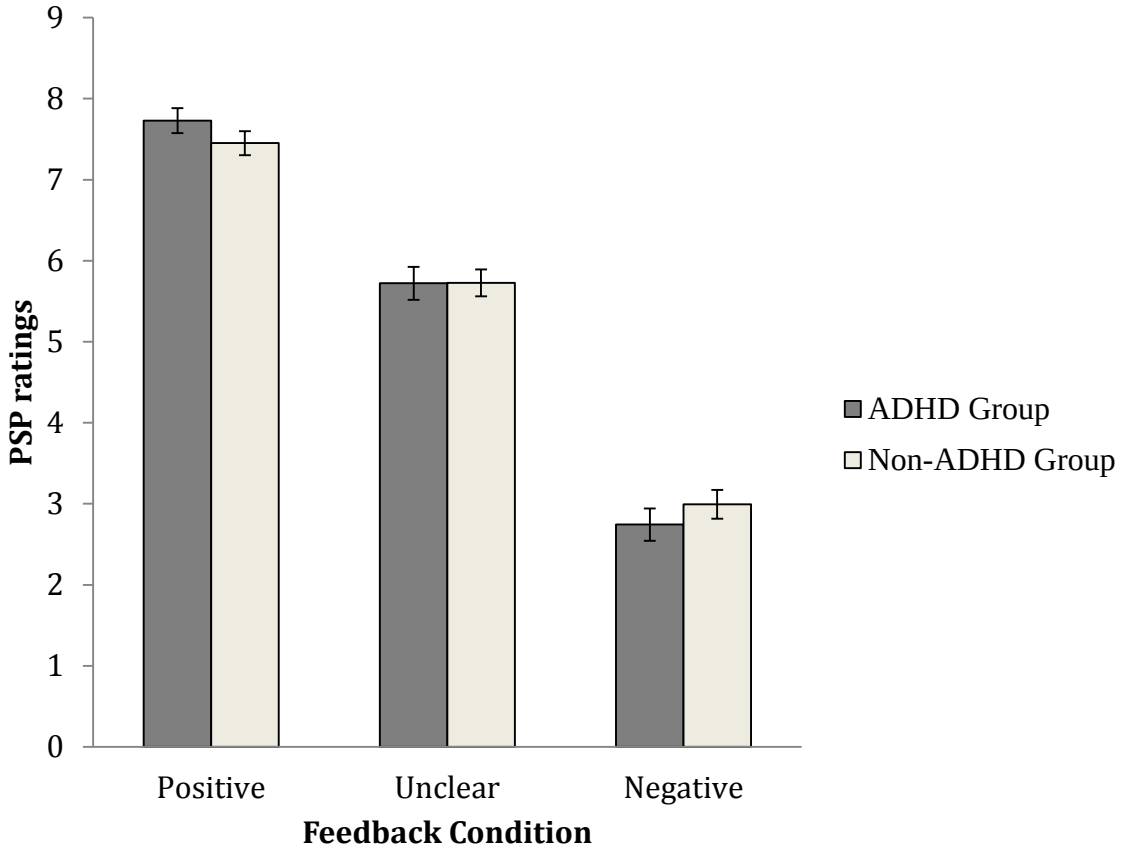

Figure 1*: Group differences in self-ratings for each feedback condition. ADHD = Attention-Deficit/Hyperactivity Disorder. PSP = Post-task Self-evaluations of Performance. Error bars represent standard errors.*

ADHD status as related to difference scores.

It was hypothesized that, consistent with previous research, when standardized parent-child difference scores were used, boys with ADHD would show a PIB. A one-way ANOVA was used to determine whether boys in the ADHD and non-ADHD groups differed on the SPPC standardized difference scores. Boys in the ADHD group had higher standardized difference scores than those in the non-ADHD group, $F(1, 79) = 4.95$, $p < .05$, $\eta^2 = .06$. These findings confirm that boys with ADHD over-report their social competence compared to their parents' reports, and thus show a PIB compared to boys without ADHD using this difference score methodology that has been the most consistently used method for measuring the PIB in the past.

However, after taking into account covariates, this difference became non-significant. As noted above, a conservative approach to covariates was implemented such that those variables that were at least marginally related to SPPC standardized difference scores were controlled. The model testing SPPC standardized difference scores therefore included child aggressive behaviour, depressive symptoms, and age as covariates. Results from this analysis showed no significant difference between ADHD and non-ADHD groups on the SPPC standardized difference scores, $F(1, 76) = 2.40$, $p = .13$, partial $\eta^2 = .03$. These results suggest that the PIB found in boys with ADHD by way of the difference score methodology may be accounted for by the presence of aggressive behaviour, depressive symptoms and/or age.

Interestingly, controlling for only depressive symptoms and age in the model did not change the effect of ADHD status on SPPC standardized difference scores, $F(1, 77) = 5.37$, $p = .02$, partial $\eta^2 = .07$. That is, boys with ADHD continued to have higher SPPC standardized difference scores after covarying depressive symptoms and age. However, when the covariate

of aggressive symptoms alone was controlled in analyses, the group difference became non-significant, $F(1, 78) = 2.01$, $p = .16$, partial $\eta^2 = .03$. These findings suggest that it is the aggressive behaviour that is comorbid with ADHD that may account for the standardized difference score PIB in boys with ADHD.[4] Overall, results appeared robust against heterogeneity of variances.

Exploratory Analyses

ADHD status as related to difference score components.

It is helpful to examine ADHD versus non-ADHD group differences on the components of the SPPC standardized difference scores to determine which component scores may be driving the relationship between the standardized difference scores and ADHD status. A one-way ANOVA compared ADHD and non-ADHD groups on the individual components of the SPPC difference scores (i.e., standardized child-reported SPPC and parent-reported PRSCAB social domain scores). Results showed that ADHD and non-ADHD groups did not differ on child-reported SPPC social domain scores, $F(1, 79) = .60$, $p = .44$, partial $\eta^2 = .01$. However, boys in the ADHD group had significantly lower ratings on the parent-reported PRSCAB social domain compared to boys in the non-ADHD group, $F(1, 79) = 14.23$, $p < .001$, partial $\eta^2 = .15$. These findings suggest that difference scores computed between parent- and child-reports may show group effects primarily due to lower parent-ratings on the PRSCAB social domain and not to the boys' self-ratings on the SPPC social

[4] A similar pattern of results was found when SPPC standardized difference scores were composed of the variable, parent-reported CBCL social problems, instead of scores from the variable, PRSCAB social domain. Boys in the ADHD group continued to have higher difference scores than those in the non-ADHD group, $F(1, 79) = 12.92$, $p < .01$, partial $\eta^2 = .14$. Similarly, controlling for the relevant covariates of aggressive behaviour, depressive symptoms, and age, results showed no significant group differences on the difference scores, $F(1, 70) = 2.38$, $p = .13$, partial $\eta^2 = .03$. Moreover, only controlling for depression and age as covariates in the model yielded group differences on the difference scores, $F(1, 77) = 13.61$, $p < .001$, partial $\eta^2 = .15$. As well, controlling only for aggressive behaviour as a covariate led to no significant group differences on the difference scores, $F(1, 72) = 1.99$, $p = .16$, partial $\eta^2 = .03$.

domain, which suggests that any effect consistent with a PIB in boys with ADHD may actually be driven by their lower level of impairment compared to boys without ADHD.[5]

The above analyses were repeated, controlling for relevant covariates. Similar results were found in that ADHD and non-ADHD groups did not differ on child-reported SPPC social domain scores after controlling for CDI-2 depressive symptoms, $F(1, 78) = .01$, $p = .93$, partial $\eta^2 = .00$. Only CDI-2 depressive symptoms were controlled given that this was the only potential covariate that correlated with SPPC social domain scores. However, boys in the ADHD group continued to have significantly lower ratings on the parent-reported PRSCAB social domain score compared to boys in the non-ADHD group after covarying CDI-2 depressive symptoms, CBCL aggressive behaviour, and age, $F(1, 76) = 5.55$, $p < .05$, partial $\eta^2 = .07$. These findings corroborate the above results that indicate that group effects in difference scores are driven by parent-reports of greater impairment in boys with ADHD compared to boys in the non-ADHD group. Overall, results appeared robust against heterogeneity of variances.

I also examined the bivariate correlations between standardized SPPC and PRSCAB social domain scores to determine whether there was an association between these two scores amongst ADHD and non-ADHD groups. Results showed a significant correlation between the two scores for the non-ADHD group, $r(44) = .42$, $p < .01$, but not for the ADHD group, $r(33) = .06$, $p = .73$. These findings suggest that the self-perceptions of boys in the non-ADHD group were associated with their parents' reports of them whereas the self-perceptions of boys in the ADHD group were not associated with parent perceptions.

[5] A similar pattern of results was found for group differences in CBCL social problems scores. Boys with ADHD had significantly lower scores on parent-rated CBCL social problems than the non-ADHD group, $F(1, 79) = 37.78$, $p < .001$, partial $\eta^2 = .32$.

Difference scores as related to ADHD status controlling for impairment.

Given the argument that differences scores may reflect actual impairment, it was important to determine whether ADHD status could be predicted by SPPC standardized difference scores above and beyond impairment. To avoid multicollinearity, components of the SPPC difference scores could not be used as the measures of impairment, and so the CBCL social problems score was used given that it represents another measure of social impairment similar but not identical to PRSCAB social domain scores. Tolerance and variance inflation factors indicated acceptable levels of independence of predictors. Logistic regressions were used to examine whether SPPC standardized difference scores predicted ADHD status above and beyond the covariate of CBCL social problems. For the model, CBCL social problems were entered into Step 1 as a predictor and SPPC standardized difference scores were entered into Step 2 as a predictor. CBCL social problems alone were significantly predictive of ADHD status, $\beta = 1.86$, $p < .001$. When SPPC standardized difference scores were added to the model, CBCL social problems continued to be significantly predictive of ADHD status, $\beta = 1.82$, $p < .001$, while SPPC standardized difference scores were not significant predictors, $\beta = .20$, $p = .39$. It is interesting to note that SPPC standardized difference scores alone were significantly predictive of ADHD status, $\beta = .42$, $p < .05$. These results suggest that when level of social impairment in boys with ADHD is controlled, the PIB per se is not associated with having ADHD.

Another set of logistic regressions were run, this time with a standardized difference score representing the PIB composed of the standardized child-reported SPPC social domain score minus the standardized parent-reported CBCL social problems score, controlling for the standardized parent-reported PRSCAB social domain score. This analysis was conducted

to reduce the likelihood that in the above model, the SPPC difference score was no longer a significant predictor of ADHD status because the CBCL social problems score was more strongly associated with ADHD status than PRSCAB social domain scores. For this model, PRSCAB social domain scores were entered into Step 1 as a predictor and standardized difference scores using CBCL social problems scores as a component were entered at Step 2. PRSCAB social domain scores alone were significantly predictive of ADHD status, $\beta = -.90$, $p < .01$. Interestingly, when the difference score composed of the CBCL social problems scores was entered into Step 2, it was significantly predictive of ADHD status, $\beta = .63$, $p < .05$, and the PRSCAB social domain score alone continued to be significantly predictive of ADHD status, $\beta = -.81$, $p < .01$. At first glance, such a result might suggest that the PIB as measured by the child-parent difference using the CBCL social problems scale is associated with ADHD. However, further investigation of the measures of actual impairment was necessary to better understand the inconsistent results.

In separate one-predictor logistic regressions, both parent-reported PRSCAB social scores and CBCL social problems scores were significant predictors of ADHD status, $\beta = -.90$, $p < .01$, and, $\beta = 1.86$, $p < .001$. Interestingly, in a two-predictor logistic regression with both of these scores predicting ADHD status, the PRSCAB social mean score was not a significant predictor, $\beta = -.29$, $p = .41$, while the CBCL social problems score was, $\beta = 1.72$, $p < .001$. These analyses show that parent-reported CBCL social problems are more predictive of child ADHD status than PRSCAB social mean scores. Given that the child-reported SPPC social domain score was not significantly predictive of ADHD status, $\beta = -.18$, $p = .44$, this confirms that the association between ADHD and the PIB difference score based on child self-reports of competence and parent-reported CBCL social problems may be

driven by parent-reports of impairment, and that the PRSCAB social domain score may not be as good a measure of this impairment.

Therefore, these results do not indicate that a PIB has predictive validity beyond impairment, but rather that regressions controlling for impairment are sensitive to the relative strength of impairment measures. That is, if the PIB is created using a measure of impairment that is more strongly linked to ADHD than the separate impairment measure used as the control, then in a regression, the PIB may be spuriously viewed as predictive of the outcome variable above and beyond actual impairment.

Difference score components predicting ADHD status in polynomial regressions.

In recent literature, polynominal regressions have been suggested as a method for examining informant discrepancies without relying on difference scores (Laird & Weems, 2011). The main effects and interactions of the standardized components of the SPPC standardized difference scores were examined as predictors of ADHD status using a polynominal regression. As per the recommendations of Laird and De Los Reyes (2013), the PIB was tested by examining the interaction term of the SPPC social domain score (child-report) by the PRSCAB social domain score (parent-report). In these analyses, it has been recommended that regression models include not only the linear interaction, but also quadratic coefficients so as to consider the possibility of associations that are higher in complexity, and also to avoid computing misleading interaction terms (Edwards, 1994; Ganzach, 1997).

A logistic regression model was constructed whereby child-reported SPPC and parent-reported PRSCAB social domain scores and their interaction were entered in Step 1, and the quadratic terms of the squared variables of SPPC and PRSCAB social domain scores

were entered in Step 2. Based on Step 1 of the model, parent-reported PRSCAB social domain scores were the only significant predictor of ADHD status, $\beta = -.93$, $p < .01$. Child-reported SPPC social domain scores and the interaction of SPPC x PRSCAB social domain scores were non-significant, βs = -.07, -.34, ps > .25 respectively. When quadratic terms were entered into Step 2 of the model, SPPC social domain scores remained a non-significant predictor, $\beta = .63$, $p = .12$, and PRSCAB social domain scores remained a significant predictor, $\beta = -1.15$, $p < .01$. In addition, the linear interaction between SPPC x PRSCAB scores became significant, $\beta = -.91$, $p < .05$. As well, the quadratic terms for SPPC and PRSCAB social domain scores were significant, βs = .57, 1.04, ps < .05, respectively.

To learn more about the possible presence of a PIB, the significant linear interaction between SPPC and PRSCAB social domain scores in the overall model was probed using simple slopes. When parent-ratings of the child's social functioning were at the mean or one standard deviation above the mean, the relationship between child-reported SPPC social domain scores and ADHD status was non-significant, βs = .63, -.28, ps = .12, .56, respectively. However, when parent-ratings were one standard deviation below the mean, a significant positive relationship between SPPC social domain scores and ADHD status was found, $\beta = 1.53$, $p < .05$. These findings suggest that only at low levels of parent-rated child social competence, did the relationship exist between higher child-rated social competence and the probability of the child having ADHD. These results are consistent with the finding that ADHD and non-ADHD groups differed on SPPC standardized difference scores, and with the possibility of a PIB in children with ADHD.

The results of the polynomial analyses indicate that only at low levels of parent-rated social competence is higher child-reported social competence positively associated with a

higher probability of ADHD. However, only two boys in the non-ADHD group had parent-reported social competence at one standard deviation below the mean, whereas 12 boys in the ADHD group had such scores. The fact that there were so few boys without ADHD with low parent-reported social competence suggests that the results of the significant interaction in the polynomial analyses may be relatively unstable.

In addition, a second logistic polynomial regression using a different measure of competence, parent-reported CBCL social problems, instead of parent-reported PRSCAB social domain scores in the model demonstrated no significant interaction between child-reported SPPC social domain scores and parent-reported CBCL social problems scores. Child-reported SPPC social domain scores and parent-reported CBCL social problems scores and their interaction were entered in Step 1, and the quadratic terms of the squared variables of SPPC and CBCL scores were entered in Step 2. Based on Step 1 of the model, parent-reported CBCL social problems were the only significant predictor of ADHD status, $\beta = 1.89$, $p < .001$. SPPC social domain scores and the interaction of SPPC and CBCL scores were non-significant, βs = .13, -.05, ps = .67, .91, respectively. When quadratic terms were entered into Step 2 of the model, CBCL social problems scores remained a significant predictor, $\beta = 2.04$, $p < .001$, and SPPC scores remained non-significant, $\beta = .38$, $p = .29$. The linear interaction between SPPC by CBCL scores was also non-significant, $\beta = -.11$, $p = .80$. Similarly, the quadratic terms for SPPC and CBCL scores were non-significant, βs = .29, -.34, ps = .18, respectively. These findings indicate that parent-reported impairment is associated with ADHD status rather than self-reports of competence.

Discussion

Summary

This study investigated whether a PIB in the social domain can be detected using a new methodology amongst boys with ADHD who exhibit a PIB as assessed using a prior statistical technique, as well as whether clarity of peer social feedback is a moderator of self-perceptions in these boys. A novel procedure was used that avoided the statistical weaknesses of prior methods used to assess the PIB. Boys with and without ADHD completed three peer social interaction tasks, with differing types of social feedback. The types of social feedback that boys received were clearly positive, clearly negative, and unclear. After each interaction, boys rated how well they achieved their goal of getting the boy with whom they interacted to like them. The social performance of the participating boys in the social interactions was made comparable between the ADHD and non-ADHD groups. It was predicted that compared to boys without ADHD, boys with ADHD would overestimate their social performance (i.e., exhibit a PIB) when the social feedback they received was unclear, and no PIB when the social feedback received was clearly positive or clearly negative. Although self-perceptions varied as expected with type of social feedback for all boys, contrary to hypotheses, boys with and without ADHD did not differ in self-perceptions in any of the social interactions. That is, on this structured social task, boys with ADHD did not exhibit a PIB after having received clearly positive or negative social feedback, and also did not show a PIB after having received unclear feedback.

This study also collected both self-ratings and parent-ratings in the social domain for the boys, so as to be able to compare the findings of boys' estimated performance on the social interaction tasks (where actual social performance was held constant) with the findings

of the difference score approach. Using standardized difference scores between child- and parent-ratings, considered the "gold standard" of PIB research, to operationalize the PIB, boys with ADHD did indeed exhibit a PIB in the social domain compared to boys without ADHD. Interestingly, when level of aggression was treated as a covariate, the PIB measured by standardized difference scores was no longer present among boys with ADHD. Overall, the findings of this study show that when social performance is made comparable, boys with ADHD do not exhibit a PIB in the social domain compared to boys without ADHD.

Main Findings

PIB and actual performance.

Results of this study showed that when actual social performance is equated between ADHD and non-ADHD groups, boys with ADHD do not demonstrate a PIB with respect to their performance. Given that this same sample of boys with ADHD do show a PIB in the social domain based on the difference score approach to PIB measurement, the lack of PIB can likely be attributed to the constraining of performance on the social interaction tasks. This pattern of results suggest that the difference scores used in the past to operationalize the PIB are likely driven by the component of the difference score that represents actual competence or impairment, as opposed to the self-perception component of the difference score. That is, boys with ADHD may not be overestimating per se. Indeed, their much lower levels of competence compared to children without ADHD are significantly associated with ADHD rather than their self-perceptions.

A related finding was that higher levels of aggression in boys with ADHD, compared to boys without ADHD, significantly accounted for the PIB as measured by difference scores. This result was likely due to aggression being a proxy for impairment. Indeed, child

aggressive behaviour was significantly correlated with actual impairment as captured by parent-rated child social competence scores on both the PRSCAB and CBCL, at -.31 and .68 respectively. Thus, controlling for a variable that represents actual impairment in this study allowed for an absence of the PIB. Such findings make the concept of a PIB possibly redundant and without incremental validity, because it is likely that actual impairment itself is associated with ADHD and other variables such as adjustment, rather than the difference score of child self-report minus actual impairment.

Past studies have discussed the importance of studying the PIB among children with ADHD due to the association of the PIB with maladaptive present and future characteristics among these children. The PIB was seen to be of high clinical importance due to its implications for such aspects of adjustment as treatment progress, social skills, driving problems, and behavioural difficulties (e.g., Hoza et al., 2013; Kaiser et al., 2008; Linnea et al., 2012; Mikami et al., 2010; Ohan & Johnston, 2011). However, the results of the current study suggest that the lower impairment levels of children with ADHD are predictive of such adjustment difficulties rather than the magnitude of the difference between self-reported impairment and actual impairment. The PIB may not provide additional information beyond what is already known about the competence of children with ADHD.

Some may argue that even if the PIB in children with ADHD is driven by impairment and not self-perceptions per se, it remains a valid concept because children with ADHD are still overestimating their actual performance compared to children without ADHD. However, the results of this study show that boys with ADHD are not more likely to overestimate their performance at any level (that is, when their performance is constrained to be equivalent to that of children without ADHD, they do not exhibit the PIB), but rather that their

overestimations are only found as a result of their lower actual performance. Therefore, it is not that boys with ADHD hold positive "illusions" but rather that they view themselves, in general, as on par with boys without ADHD.

In addition, the findings of the current study may extend to other studies of overestimations in children, given that the PIB is not a uniquely ADHD-related phenomenon (Owens et al., 2007). That is, the overly positive self-perceptions found in other populations may simply be due to the greater levels of impairment in these populations. Indeed, many studies have found a positive correlation between aggression and overestimations of social acceptance (e.g., Brendgen, Vitaro, Turgeon, Poulin, & Wanner, 2004; Pardini, Barry, Barth, Lochman, & Wells, 2006; Sandstrom & Herlan, 2007) and overestimations of academic competence (Hughes, Cavell, & Grossman, 1997; Hymel, Bowker, & Woody, 1993). As well, research suggests that overestimations of competence are found in children with learning disabilities (Heath & Glen, 2005). Therefore, the validity of the PIB in providing unique information in both ADHD and other populations is cast in doubt by this study's findings.

Self-esteem of children with ADHD.

Research studying the PIB stems from the basic question of the nature of the self-esteem of children with ADHD. That is, do children with ADHD have high, average, or low self-esteem? Because low self-esteem is associated with a variety of maladaptive characteristics such as depressive symptoms (e.g., Orth, Robins, & Roberts, 2008), and very high self-esteem is similarly related to a host of problems such as aggressive behaviour (e.g., Baumeister, Smart, & Boden, 1996), it is important to understand just where the self-esteem levels of children with ADHD lie. The answer to this question is complicated, as it appears to

depend on a number of factors, such as how self-esteem is defined (i.e., global or domain-specific), what measures are used to operationalize self-esteem, and the child's co-occurring problems.

To the extent that domain-specific self-perceptions contribute to a global sense of self-worth, the results of this study show that boys with ADHD do not necessarily have lower or higher levels of self-esteem than typically-developing boys. In other words, the self-worth of boys with ADHD (at least with respect to their social functioning) appears to be on par with that of boys without ADHD. Although the PIB difference score literature indicates that boys with ADHD have atypically high self-esteem given their deficits (e.g., Owens et al., 2007), this study suggests that the best way to describe the self-esteem of children with ADHD may be to state that these children have self-esteem levels that do not significantly differ from children without ADHD, although they are generally more impaired. No evidence of inflated self-perceptions was found in the social domain by the current study, suggesting that children with ADHD do not appear to have inflated self-perceptions.

Mechanisms of PIB.

The results of the current study have implications for the mechanisms postulated to underlie the PIB in children with ADHD. Two leading explanations for the PIB in children with ADHD are the neuropsychological deficit and self-protective hypotheses. The current study shows that when the performance of boys with ADHD is equated to that of typically-developing children, their understanding regarding the valence and degree of social feedback is comparable. The neuropsychological deficit hypothesis would suggest that boys with ADHD have difficulty integrating self-relevant information into their self-concepts due to problems with executive functions (Owens et al., 2007). However, the current study suggests

that these boys with ADHD did not exhibit neuropsychological deficits in making cognitive accommodations of the social information present in this study. They appear able to accurately perceive social feedback that is positive or negative, as well as feedback that is unclear, insofar as accurate perception is defined as having perceptions akin to those without ADHD. However, the in-person social communications that occur in everyday life are far more multidimensional than the tasks of this study, and could be perceived less accurately by children with ADHD due to the greater detail and different types of social information that require processing. It may be that with the addition of other elements in a social interaction such as auditory verbal information, facial expressions, and/or non-verbal body language, children with ADHD may have more difficulty processing all of the information and therefore, be less accurate in their self-perceptions. Indeed, research on general social cognitions suggests that higher attentional load is associated with more positive self-presentations than lower attentional load (Paulhus, Graf, & Van Selst, 1989), and that more limited cognitive resources are related to greater self-enhancement than less limited resources (e.g., Beer, Chester, & Hughes, 2013), pointing to the possibility that higher cognitive resources are linked to a preference for information, negative or positive, that verifies one's self-concept (e.g., Swann, Hixon, Stein-Seroussi, & Gilbert, 1990). Therefore, outside of a computer/texting environment, the possibility remains that the neuropsychological deficits of boys with ADHD may prevent them from integrating cognitively-taxing social information regarding their level of performance.

The self-protective explanation proposes that boys with ADHD are defensive about negative feedback due to a history of failures. The current study shows that boys with ADHD do not exhibit high self-perceptions that would be suggestive of being more self-protective

than boys without ADHD. However, it may be the case that when actual performance is held constant, such as is the case in the current study, boys with ADHD feel less of an urge to self-protect. The study by Hoza et al. (2000), where boys with ADHD engaged in in-person interactions with a confederate peer and received differing types of feedback, is similar in methodology to the current study. However, instead of finding an absence of the PIB in their sample, they found that boys with ADHD had higher self-perceptions than the non-ADHD group after receiving neutral feedback. A difference from the current study is that Hoza et al. did not make the actual performance between boys with and without ADHD comparable, and so, the performance of boys with ADHD was significantly lower than the performance of the non-ADHD group. It is possible that impaired actual performance may contribute to overestimations of ability in children with ADHD. It may be that in everyday life where their impairment is prevalent, boys with ADHD do indeed self-protect, and report self-views that are average or no different in competence from those without ADHD. Overall, it is important to note that teasing apart whether neuropsychological deficits or self-protective motivations can cause higher self-perceptions may be quite difficult due to the possibility that these mechanisms may be intricately intertwined and not mutually-exclusive.

Beyond difference scores.

Although inflated self-perceptions among children have been shown to be maladaptive, it remains unclear whether average levels of self-perceptions that may be driven by self-protection are maladaptive. Research shows that most individuals have an above-average bias in terms of their views of themselves (Taylor & Brown, 1988). This positive bias has been found to be adaptive and associated with higher motivation, persistence, and engagement (e.g., Taylor & Brown, 1988). Given that the findings of this study substantiate

claims about the statistical weaknesses of the difference scores previously used to characterize the PIB, it is critical that studies that examine the adaptiveness or maladaptiveness of the PIB utilize methods that go beyond difference scores. Overall, this study indicates that boys with ADHD can have accurate self-views of controlled social interactions that involve written communication, despite showing mathematically overestimated self-perceptions regarding their social acceptance in real life.

PIB and clarity of feedback.

Results of the current study suggest that clarity of feedback does not moderate the self-perceptions of boys with ADHD. This finding is unsurprising given that no PIB was found among boys with ADHD when performance was controlled. However, the lack of moderation appears inconsistent with Hoza et al.'s (2000) study, which demonstrated that children with ADHD showed a PIB when encountering neutral feedback but did not display a PIB when they encountered positive or negative feedback from a peer in a social interaction. A difference between the current study and that of Hoza et al. is that although Hoza et al. ensured that both boys with and without ADHD received the same types of feedback from confederate peers, they did not equalize the social performance of their two groups. Indeed, coded observations indicated that boys with ADHD demonstrated lower social effectiveness than boys without ADHD. Therefore, the social performance of boys in Hoza et al.'s study was free to vary. It is possible that the lower social performance of boys with ADHD may have contributed explicitly and/or implicitly to their need to inflate their self-perceptions in order to protect their self-esteem, whereas boys with ADHD in the current study may have felt less compelled to inflate their performance after sensing that they had not made any obvious social mistakes in their interactions. However, if this explanation is the case, it is

uncertain why the boys in Hoza et al.'s study did not exhibit a PIB in the other feedback conditions.

Exploratory Findings

Absolute component scores of the PIB.

Exploratory analyses were conducted to better understand the presence of the PIB in the current sample when using difference scores, despite an absence of the PIB when using new methodology that makes between-group social performance comparable. These exploratory analyses examined the difference score components separately, covaried actual impairment, controlled for aggression, and used polynomial regressions. Firstly, in probing the relations between difference score components and ADHD status, boys with ADHD were found to have significantly lower parent-ratings of social competence compared to boys without ADHD. However, their self-perceptions of social competence did not differ from boys without ADHD. This finding suggests that the significant ADHD versus non-ADHD group difference in the PIB difference score is accounted for by parent-ratings.

Predictive validity of the PIB when controlling for impairment.

The association of PIB difference scores with ADHD status was further investigated, controlling for the boys' social impairment. Two measures of actual social competence were utilized to avoid multicollinearity. The PIB difference score was found to no longer be associated with ADHD status when a parent-reported measure of actual impairment (the CBCL) was controlled. Although the PIB did remain predictive of ADHD status when another parent-reported measure of actual impairment (the PRSCAB) was controlled, a deeper examination of the predictive ability of the two measures of actual impairment found that the CBCL parent-report was the measure more strongly related to ADHD status. This

pattern of findings demonstrated how conclusions that the PIB is a significant predictor above and beyond impairment are dependent on the particular measures of impairment. The findings of these regressions suggest that using such a methodology to better understand whether the PIB is driven by impairment must include a closer examination of the relative strength of the measures of impairment used in the models. Controlling for a measure of impairment that is weakly related to a third variable (such as ADHD status) or an outcome variable (such as adjustment) may give the false illusion of having controlled for the intended construct of impairment. It is important to be aware of this caution when interpreting the findings of studies that have attempted to control for measures of impairment (e.g., Mikami et al., 2010; Swanson et al., 2012). Conducting a regression pitting one measure of impairment against another as predictors can be useful in better understanding their unique contributions to the PIB.

Polynomial regressions.

Using the statistical methodology recommended by Laird and Weems (2011) to further explore the difference score issue, the individual difference score components were used to predict ADHD status in a series of logistic polynomial regressions. Results indicated that higher child-reported social competence was associated with higher ADHD probability only when parent-reported social competence was low. At first glance, this finding is consistent with a PIB among children with ADHD. However, it is important to consider that in the current study, 12 boys with ADHD had low parent-reported social competence scores while only two participants in the non-ADHD group did. Unfortunately, given the small number of boys without ADHD but with low parent-reported social competence scores, it is

difficult to determine from these polynomial results alone that the PIB is present among boys with ADHD.

Further results supporting a lack of PIB come from the second polynomial model in which a different measure of impairment was used as a predictor. In this model, there was a main effect of this measure of impairment. However, self-perceptions and the interaction between self-perceptions and impairment were non-significant. The lack of significant interaction between self-perceptions and impairment levels corroborates the argument that the PIB is not present among children with ADHD.

Similar polynomial analyses were conducted by Fefer, Ogg, and Dedrick (2015) for a sample of young adolescents with varying ADHD symptoms. Fefer et al. found that ADHD symptoms were associated with *both* high and low child self-reports of social competence in instances where the teacher-report of social competence was low. Thus, low teacher-reported competence seemed to be consistently positively associated with ADHD symptoms irrespective of whether the youths' self-reports were high or low. Their findings and the findings of the current study speak to the importance of considering impairment as the driving force behind the PIB.

Conclusion

Overall, the results of the main and exploratory analyses suggest that the relation between ADHD and the PIB in the social domain is likely driven by lower competence associated with ADHD, and less likely associated with child over-reports of social competence. When the actual social performance of boys was made comparable, boys with ADHD did not demonstrate self-perceptions of social performance that differed significantly from boys without ADHD. Boys with ADHD showed no PIB when actual performance was

standardized despite showing a PIB when measured by the widely-used difference score approach. The between-group differences in this PIB difference score were no longer significant when impairment was controlled as a covariate, and logistic polynomial regressions appeared generally supportive of an absence of a PIB. Given an absence of the PIB on the social interaction tasks, it is unsurprising that clarity of social feedback did not appear to moderate levels of the PIB. All in all, the results of the study suggest that the PIB found by so many past studies in boys with ADHD may be accounted for by impairment, and that clarity of social feedback is not associated with varying levels of the PIB.

Strengths, Limitations, and Future Directions

Although this study makes a significant contribution to better understanding the PIB in children with ADHD, it has limitations along with its strengths. The study's social interaction tasks are similar to the many online and texting interactions that children may have, and are thus relevant given the increasing prevalence of textual communication among children. However, these interaction tasks do not exactly mirror in-person interactions. In-person interactions involve considerably more social information, such as non-verbal (e.g., body language, eye contact) and auditory cues (e.g., speech prosody, volume of speech). In addition, in-person interactions are embedded in a detail-rich context. Such interactions provide a substantial amount of information to process. Because the essential details of in-person interactions cannot be captured by a text conversation with a peer over the computer, it is difficult to determine the degree to which the results of the current study would generalize to in-person interactions. Future research would do well to include in-person interactions using a comparable methodology.

The fact that all main and exploratory analyses were conducted only for boys who were assessed as believing that their interaction peers were real is a further strength of this study, as it provides supporting evidence for the idea that the negative interactions would be threatening to their self-esteem. If defensive self-protection is a mechanism of the PIB, the task would need to be threatening to self-esteem in order for the PIB to appear. Additional support for the meaningful nature of the social interaction task comes from prior studies using virtual social interactions. This research indicates that social rejection in computer interactions is related meaningfully with characteristics consistent with rejection, such as the activation of neural areas associated with physical pain, greater pupil dilation related to feeling less socially connected, as well as self-reports of distress, decreased happiness, lower inclusion, greater exclusion, sadness, and experiencing more anger (e.g., Eisenberger, Lieberman, & Williams, 2003; Masten et al., 2009; Silk et al., 2012). Although the current study did not measure the physiological and emotional reactions of participants, it is likely that boys' reactions to the social interaction tasks approximated that felt in real life given that all of the data analyzed involved boys who believed that the computerized peer was real. However, it would be helpful for future studies to measure physiological activity and self-reported emotions in boys with and without ADHD after social rejection from a computerized social interaction task, and also to explore new ways of making the performance of children with and without ADHD comparable in in-person interactions.

An additional strength of this study is that along with using a novel design that equated level of performance across groups, it used techniques that are relatively similar to established methods in the field (e.g., Owens et al., 2007). That is, the study examined post-task self-evaluations of performance, and also used Harter's (1985) SPPC, both of which are

methods that have generally been used in past PIB studies. However, a limitation is that because boys provided self-perception ratings with respect to their social performance in the specific social interaction task instead of giving global estimates of their general social competence (the construct measured by Harter's SPPC), it is possible that results comparing the PIB difference score with self-perception ratings for the social interaction task were inconsistent because of the difference in global versus specific constructs being measured. However, the PIB in past literature has been demonstrated across studies that have used the SPPC as well as studies utilizing post-task self-perceptions of performance on lab tasks (Owens et al., 2007). Although no studies have directly tested the association between the PIB found using lab tasks and the SPPC, the fact that both methodologies yield a PIB among comparable samples of children suggest that there is a relation between the two techniques. Therefore, it is unlikely that the lack of findings for the PIB in the current study is due to the self-perceptions being specific to a particular task as opposed to overall self-views. However, further insight could be gained through future studies that investigate the correlation between the PIB found using lab tasks and the PIB found using the SPPC.

This study investigated the PIB exclusively in boys, which is important in maximizing similarity to past research, given that the majority of previous PIB research involved all-boy samples. In addition, because ADHD in childhood affects more boys than girls, these results allow for greater relevance to ADHD in the general child population. However, a related limitation is that this sample restriction reduces the extent of generalizations to girls. ADHD is a valid disorder in girls (American Psychiatric Association, 2013), and although past PIB studies using all-girl samples have found similar PIB findings as studies of all-boy samples (e.g., Ohan & Johnston, 2011), it is important for future studies

to examine directly whether the results of this study's methodology also apply to girls, or whether gender is a moderator of the findings. Similarly, future studies would do well to explore the extent to which these results may generalize to samples with different ethnic compositions.

This study investigated the PIB in the social domain, which is important as the PIB has been shown by past literature to be robust in this particular domain (e.g., Owens et al., 2007). However, a limitation is that the PIB was not examined in other life domains by this study. Although the possibility remains that the PIB as measured by difference scores is a valid concept for areas outside of the social domain, this may not be the case. It would be important for future studies to address whether children with ADHD show a PIB in other life areas, by employing academic, athletic, or behavioural tasks in which ADHD and non-ADHD performances are held constant.

Lastly, this study provides evidence that boys with ADHD are able to be accurate perceivers of their performance in the social area if this performance is equated to that of typically-developing children. This conclusion was reached by using a research design with high internal validity at the cost of somewhat decreased external validity. Although social performance was equated in the lab, boys with ADHD are not as socially competent as boys without ADHD in reality. However, the findings of this study provide valuable insights that boys with ADHD do not appear to overestimate themselves at any level of performance, and that the PIB as measured by difference scores may not be a useful concept in terms of its predictive validity above and beyond actual impairment. Future studies would do well to investigate whether boys with ADHD are able to be accurate perceivers when this performance is impaired in a manner that is similar across ADHD and non-ADHD groups.

The continued absence of a PIB in this situation would provide further evidence for the idea that if performance is held constant in situations, boys with ADHD do not show a PIB. However, if these boys do indeed show a PIB, then taken together with the results of the current study, it is possible that boys with ADHD, despite receiving a certain type of social feedback, may continue to have an overall sense that their social performance is poor and may overestimate due to self-protection. It would also add to the literature for such future studies that make ADHD and non-ADHD performance comparable to examine whether the self-ratings of the ADHD group are predictive of later difficulties.

Clinical Implications

This study is one of the first to constrain the actual social performance of boys with and without ADHD so as to tease apart whether the association between the PIB and ADHD is due to self-perceptions or to actual impairment. The finding that boys with ADHD do not appear to show a PIB in the social domain when their performance is held comparable to that of typically-developing boys suggests that boys with ADHD are able to perceive their own competence at a social task as accurate insofar as being on par with boys without ADHD, even if the social feedback about their competence is unclear. Thus, boys with ADHD do not appear to possess a PIB that leads them to inflate their self-perceptions when their performance is typical.

The results of this study have implications for clinical practice. The finding that, in this particular study, boys with ADHD do not appear to hold illusory biases that prevent them from perceiving themselves accurately is helpful in better understanding the social cognition of these children. Supporting the accuracy in perceptions of performance for boys with ADHD, Evangelista et al.'s (2008) study showed that children with ADHD do not show

illusory biases when it comes to assessing the performance of others. Although children with ADHD have been shown to have lapses in social cognition, the bulk of the research has identified such difficulties in terms of facial affect and verbal prosody perception (e.g., Uekermann et al., 2010). This study implies that boys with ADHD have a sense of how well they are doing compared to typically-developing boys, at least in written social communications.

It has been suggested that clinical interventions may be needed to focus on decreasing the self-perceptions of children with ADHD, if the PIB is interfering with treatment progress (e.g., Hoza et al., 2012). However, the current results would question the benefit of such approaches. Indeed, interventions that instead help to improve social behaviour and acceptance may be most valuable to children with ADHD. Such interventions that already exist take the form of skills training groups, friendship interventions, parent training, classroom management, medication, or some combination of these treatments (e.g., American Academy of Pediatrics, 2011; De Boo & Prins, 2007; Mikami, 2010; Pelham & Fabiano, 2008). In sum, the results of the current study suggest that it may not be so important to focus on lowering the self-perceptions of children with ADHD, but rather, it may be more crucial to devote our resources and energy into genuinely strengthening the actual competencies of these children.

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Appendices

Appendix A: Social Interaction Script for Unclear Condition

Interaction Partner	Category of Phrase(s)	Phrase(s)
Computerized peer	Statement	Hi, Ben here
Participant	Response Options	Hi, how are you?; Hello, how are you?
Computerized peer	Responses	I'm ok; I'm alright
Computerized peer	Question	Do you like school?
Participant	Response Options	Yes; No
Computerized peer	Responses	So you like school. I do sometimes; You don't like school. I don't sometimes
Participant	Response Options	What's your favourite class?; Do you have a class you like?
Computerized peer	Responses	Depends on the teacher; Depends on who's in the class
Computerized peer	Question	Do you like winter or summer more?
Participant	Response Options	Winter; Summer
Computerized peer	Responses	You like winter more. Sometimes I don't; You like summer more. Sometimes I don't
Participant	Response Options	Do you like gym class?; Do you like going to gym class?
Computerized peer	Responses	It's ok; It's alright
Computerized peer	Question	Do you have a favourite sport?
Participant	Response Options	Yes; No
Computerized peer	Responses	You have one. Ok I see; You have none. Ok I see
Participant	Response Options	Do you like basketball?; Do you like hockey?
Computerized peer	Responses	Sort of; Kind of
Computerized peer	Question	Do you like baseball or soccer more?
Participant	Response Options	Baseball; Soccer

Computerized peer	Responses	You like baseball more. It is ok; You like soccer more. It is ok.
Participant	Response Options	Do you like volleyball?; Do you like tennis?
Computerized peer	Responses	I haven't tried it; Didn't try it before
Computerized peer	Question	Do you like swimming?
Participant	Response Options	Yes; No
Computerized peer	Responses	You like swimming. I swim sometimes; You don't like swimming. I swim sometimes
Computerized peer	Statement	Ok, gotta go

Appendix B: Social Interaction Script for Clear Positive Condition

Interaction Partner	Category of Phrase(s)	Phrase(s)
Computerized peer	Statement	Hi, Sam here
Participant	Response Options	Hi, how are you?; Hello, how are you?
Computerized peer	Responses	I'm ok; I'm alright
Computerized peer	Question	Do you like animals?
Participant	Response Options	Yes; No
Computerized peer	Responses	You are pretty cool. Animals are fun!; You are pretty cool. Animals are boring!
Participant	Response Options	What's your favourite animal?; What's an animal you really like?
Computerized peer	Responses	I don't really have a favourite; I don't really have a favourite
Computerized peer	Question	Do you have a favourite food?
Participant	Response Options	Yes; No
Computerized peer	Responses	You are so cool. I do too!; You are so cool. I don't either!
Participant	Response Options	Do you like breakfast or dinner more?; What's your favourite meal: breakfast or dinner?
Computerized peer	Responses	It depends on the day
Computerized peer	Question	Which do you like more: chocolate or vanilla?
Participant	Response Options	Chocolate; Vanilla
Computerized peer	Responses	You're so right. I love chocolate; You're so right. I love vanilla
Participant	Response Options	Do you like pancakes?; Do you like cereal?
Computerized peer	Responses	Sort of; Kind of
Computerized peer	Question	Do you have a favourite dessert?
Participant	Response Options	Yes; No
Computerized peer	Responses	You are so cool. I do too; You are so cool. I don't either

Participant	Response Options	Do you like chips?; Do you like cookies?[6]
Computerized peer	Responses	Yeah, sometimes; Yeah, sometimes
Computerized peer	Question	Do you like cats or dogs more?
Participant	Response Options	Cats; Dogs
Computerized peer	Responses	You're so cool. Cats are fun!; You're so cool. Dogs are fun!
Computerized peer	Statement	Ok, gotta go

[6] Due to technical difficulties, this question and its corresponding response were omitted for participants. Omitting this question from the social interaction task was deemed to have negligible effects on the manipulation as analyses show that as expected, participants viewed the Positive condition as significantly more positive than the Negative and Unclear conditions.

Appendix C: Social Interaction Script for Clear Negative Condition

Interaction Partner	Category of Phrase(s)	Phrase(s)
Computerized peer	Statement	Hi, Kevin here
Participant	Response Options	Hi, how are you?; Hello, how are you?
Computerized peer	Responses	I'm ok; I'm alright
Computerized peer	Question	Do you like board games?
Participant	Response Options	Yes; No
Computerized peer	Responses	You are so strange. They're not fun!; You are so strange. They are fun!
Participant	Response Options	What's your favourite board game?; Do you have a board game you like?
Computerized peer	Responses	I don't have a favourite; They're all the same
Computerized peer	Question	Do you have a favourite video game?
Participant	Response Options	Yes; No
Computerized peer	Responses	You are not cool. They're so boring; You are not cool. They're so fun
Participant	Response Options	Do you like playing video games after school?; Do you like playing video games on weekends?
Computerized peer	Responses	It depends on the day; It depends on the weekend
Computerized peer	Question	What do you like more: video games where you get to race cars or ones that don't have racing cars?
Participant	Response Options	Games with racing cars; Games without racing cars
Computerized peer	Responses	You're so wrong. I hate them!; You're so wrong. I hate them!
Participant	Response Options	Do you like card games?; Do you like games where you play with cards?
Computerized peer	Responses	Sort of; Kind of
Computerized peer	Question	Do you have a favourite card game?
Participant	Response Options	Yes; No
Computerized peer	Responses	You are so weird. I really don't; You are so weird. I really do

Participant	Response Options	Do you like watching cartoons with friends?; Do you like watching cartoons with family?
Computerized peer	Responses	Yeah, sometimes
Computerized peer	Question	Do you like shows with cartoons or real people more?
Participant	Response Options	Cartoon shows; Real people shows
Computerized peer	Responses	You're not cool. They're not fun!; You're not cool. They're not fun!
Computerized peer	Statement	Ok, gotta go