A multi-session attribution modification program for children: Effects on hostile attributions and reactive/proactive aggression

Vassilopoulos, S. P., & Brouzos, A.

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A MULTI-SESSION ATTRIBUTION MODIFICATION PROGRAM FOR CHILDREN: EFFECTS ON HOSTILE ATTRIBUTIONS AND REACTIVE/PROACTIVE AGGRESSION

Stephanos P. Vassilopoulos¹ & Andreas Brouzos²
¹University of Patras, Greece ²University of Ioannina, Greece

Abstract. Past research suggests that aggressive individuals are more likely to interpret others’ motives and intentions in ambiguous situations as hostile. In addition, there is preliminary evidence that attribution training programs, in which children are trained to endorse benign rather than hostile attributions in response to ambiguous social scenarios, are effective for reducing aggression-related cognitive biases. The present study was designed to replicate and extend the findings reported by Vassilopoulos, Brouzos, and Andreou (2015) by investigating whether a novel attribution training program can reduce hostile attributions and reactive aggression in a sample of primary school children. A sample of children aged 10 to 12 years was trained over three sessions to endorse benign rather than hostile attributions in response to ambiguous social scenarios. This group (n = 84) was subsequently less likely to endorse hostile attributions in response to a new set of ambiguous social situations in a pretest - posttest with control group (n = 45) design. Crucially, self-reported proactive and reactive aggressive behavior was reduced more in the trained group than in the untrained controls, and this effect was greater for reactive aggression. Children who received attribution training also reported less perceived anger than those in the control group. Implications of these findings are discussed.

Keywords: Aggression, Attribution training, Cognitive bias modification, Proactive aggression, Reactive aggression

INTRODUCTION

Contemporary conceptualizations of social development in youth suggest that information processing plays an important role in the development and maintenance of children’s social maladjustment (Crick & Dodge, 1994; Dodge, 1986). In addition, there is preliminary and indirect evidence that when presented with ambiguous social information, aggressive children will interpret it as containing more threat and consequently respond with aggression (Barrett et al., 1996; Martinelli et al., 2018). For example, an aggressive person who approaches a group of peers and notice that they are laughing is likely to interpret their behavior in a threatening light, “They think I am dumb and laugh at me” compared to a less aggressive person who might interpret it as showing that someone is telling funny jokes...
(Barrett et al., 1996). Given accumulated evidence suggesting that negatively biased social-cognitive factors mediate the association between social-environmental risk and aggression in adolescents (e.g., Bradshaw & Garbarino, 2004; Bradshaw et al., 2013), there is an urgent need to alter the developmental trajectory towards more serious externalizing problems through the implementation of effective, developmentally appropriate, and easy-to-administer interventions.

The information-processing model of aggression as described by Dodge (1986) posits a central role of cognitive distortions in the development and maintenance of children’s social maladjustment. According to this model (and its updated version presented by Crick & Dodge, 1994), children’s social behavior is a function of six sequential steps of processing: (1) encoding of social cues; (2) interpretation of social cues; (3) goal selection; (4) response generation; (5) response evaluation, and (6) behavior enactment. From these six processing steps, the second one concerning interpretation of social cues (which is equivalent to attribution processes) is considered fundamental, because such attributions are conjectured to affect children’s response to ambiguous peer provocations, and such actions may impact their (mal)adjustment and well-being (Dodge, 2006; Perren et al., 2013).

Early intervention studies targeting maladaptive attribution style in aggression have indeed found evidence suggesting that reducing hostile attribution bias also reduces aggression (e.g., Hudley et al., 1998; Hudley & Graham, 1993). However, these intervention programs were typically time- and cost-intensive and resulted in only modest effects. More recently, aggression researchers have started using cognitive bias modification (CBM) paradigms (Mathews & Mackintosh, 2000), which, so far, have been shown to be successful in altering maladaptive cognitive style and mood in anxious individuals (Liu et al., 2017; MacLeod & Mathews, 2012). These procedures modify interpretation biases by introducing a contingency in which participants are reinforced for consistently resolving the meaning of an ambiguous vignette in either a negative or a benign way.

Using a CBM paradigm, Hawkins and Cougle (2013) trained undergraduate students in a single lab session to make either benign or hostile interpretations of others’ ambiguous intentions. It was found that the positive training resulted in greater increase in positive interpretation bias relative to the negative group, though these increases were only marginally greater than the control group. Crucially, during an interpersonal insult, participants in the positive group reported less anger than those in the control condition and were rated by observers as appearing less irritated than those in the negative group. Recently, van Bockstaele et al. (2020) reported a study in which a similar CBM procedure to that reported by Hawkins and Cougle (2013) was employed. They found that attribution bias training was effective in reducing reactive – but not proactive – aggressive behavior in a sample of adolescents selected for high levels of aggression, although the effect on hostile attributions was only marginal. Taken together, these results suggest that CBM procedures may be a promising intervention for reducing anger and aggressive behavior in both adolescents and adults.

Vassilopoulos and colleagues also developed a text-based modification bias methodology for use with primary school children (e.g., Vassilopoulos et al., 2009; Vassilopoulos et al., 2012) and found further support for the notion that the hostile attribution style reported in the literature on aggressive youths is malleable. Specifically, they trained a
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sample of aggressive children aged 10-12 years to endorse benign rather than hostile attributions of ambiguous realistic vignettes (Vassilopoulos et al., 2015). During each training session, children were presented with a series of ambiguous stories printed on flashcards. Each event description was followed by two possible interpretations, one hostile and one benign. Children were asked to circle one of the two alternative interpretations and then to turn each card and read the required response (benign interpretation) printed on the back of each flashcard and followed by “correct” feedback message. After completing three sessions over one week, the training group was subsequently less likely to endorse hostile attributions, as well as more likely to endorse benign attributions in response to new ambiguous social situations than children who did not receive any training. Children who received interpretation training also showed reduced self-reported aggression and anticipated feeling less angry in response to the (potentially provocative) social situations, compared with children in the control group (Vassilopoulos et al., 2015).

The study reported by Vassilopoulos et al. (2015) suggests that it is possible to modify attribution biases in aggressive preadolescents via a training paradigm, and that trained attributions affect important aspects of aggression. While these data are taken as further support for a causal link between attribution bias and aggression, there are still a few issues that need to be resolved. First, the findings of the Vassilopoulos et al. (2015) study need to be replicated to prove their validity, especially the effect of the benign attribution training on hostile attributions. Second, Hudley et al. (1998) observed that children showing hostile or reactive aggression (i.e., which can be seen as an angry, impulsive reaction to a presumed threat or provocation) are especially likely to respond to attributional bias modification compared to proactive aggressive children (i.e., planned “coldblooded” aggression to dominate or intimidate). This observation seems promising and certainly warrants further investigation (see also Martinelli et al., 2018, for the association between hostile attribution bias and reactive aggression).

In this study, we sought to replicate and extend the results reported by Vassilopoulos et al. (2015) using a similar attribution bias modification procedure. As prior studies in preadolescents (e.g., van Bockstaele et al., 2020; Vassilopoulos et al., 2015) seem to indicate that multiple sessions are important for symptom reduction, the first aim of the present study was to manipulate attributional bias in children in three sessions. Pre- and post-training measures of attributional style were administered and compared to a second group of children who did not receive any form of attribution training. Drawing mainly from the Vassilopoulos et al. (2015) study reported above, it was predicted that training children with positive feedback about benign rather than hostile attributions would result in less hostile and more benign attributions in response to ambiguous social situations compared to a control group. It was also predicted that, following training, aggressive children trained to make more benign attributions would report less negative emotional reactions to the hypothetical scenarios, relative to children in the control condition. The second aim was to assess self-reported reactive and proactive aggressive behavior, both before the training sessions and after them, to assess any group differences in these behaviors. Drawing from the van Bockstaele et al. (2020) study, we predicted that attribution training would lead to a reduction in reactive - but not proactive - aggressive behavior.
METHOD

Design

One hundred twenty-nine children were recruited and randomly allocated to three sessions of attribution training ($n = 84$; 44 girls, 40 boys), or to a control situation ($n = 45$; 19 girls, 26 boys). Using a pretest-posttest design, we assessed children’s reactive/proactive aggressive behaviours, initial attributional bias, and emotional reaction estimates, and repeated all these assessments two weeks later.

Participants

Participants were primary school children enrolled in 5th and 6th grade classes from four mainstream primary schools in the southwest of Greece, who were predominantly from a middle-class SES background. Some of the schools were chosen on a convenience basis and some on a random basis. Most students (97%) had a Caucasian ethnic background. All participants were fluent in Greek and ranged in age from 10 - 12 years ($M = 11.20, SD = 0.64$). This particular age group was selected because several studies indicate that aggressive behavior interventions in early adolescence are associated with a decreased risk of future difficulties or mental health problems (e.g., Fandrem et al., 2020; Moffitt, 1993). Before starting, teachers were asked whether the children had a severe reading problem, a current or past mood disorder (no child was excluded due to these exclusionary criteria). All children had normal or corrected-to-normal vision and were informed that they are free to withdraw or not participate in the study at any time without giving reason. No invited child declined participation or withdrew from the study. Children were trained in small groups consisting of four-six students in a quiet, well lighted room at their school.

Attribution training program

We used a similar procedure to that described by Vassilopoulos et al. (2015). Participants in the training condition read 60 descriptions of hypothetical social events across three sessions (20 descriptions in each session). Each of 60 descriptions was presented on a different laminated flashcard in a form requiring participants to endorse a benign attribution rather than a hostile attribution. At the beginning of each training session, participants were informed that they would read some hypothetical event descriptions and should imagine themselves as the central character in each description, irrespective of whether they thought such a situation could ever actually happen to them. Then each child received a pack of 20 flashcards with the event descriptions printed on them and was asked to read one description at a time and answer the question that followed, which was designed to elicit the required response. Participants circled one of the two alternative attributions following each description. For example, one item read as follows:

During art class, you find that some of your crayons are broken.
What would you think if this happened to you?
(a) My schoolmate broke them because s/he doesn’t like me (hostile attribution)
(b) They broke yesterday when we all drew a picture together (benign attribution)

After circling their chosen response, participants turned the flashcard over and saw the required response (always benign attribution) printed on the back with a “correct” feedback message above it. No explanation for the correct response was provided. Before turning to the next card, children were asked to spend a few seconds comparing their response with the required response and reflecting on how the latter (always benign) attribution could explain what had happened in the vignette. They then repeated this procedure for the rest of the flashcards.

**Measures**

**Reactive-Proactive Aggression Questionnaire**

The Reactive-Proactive Aggression Questionnaire (RPQ; Raine et al., 2006) is a 23-item self-report measure, which is used to assess the degree to which children (aged 11- to 13-year-old) engage in physical or verbal aggression and the motivation and situational context for the aggression. Eleven items focus on reactive aggression (e.g., Reacted angrily when provoked by others; Gotten angry when frustrated), and 12 items focus on proactive aggression (e.g., Had fights with others to show who was on top; Had taken things from other students). A response scale ranging from 0 (never) to 3 (often) determines the frequency of the occurrence of each item. The RPQ has displayed good psychometric characteristics (Raine et al., 2006). For this measure for our sample, Cronbach’s alphas were .73 and .77 (for proactive and reactive aggression, respectively) at pre-assessment, as well as .61 and .87 (for proactive and reactive aggression, respectively) at post-assessment. The RPQ was translated by a bilingual translator to guarantee linguistic and cultural equivalence. The translated version was then submitted to a panel of two experts in developmental psychology, who confirmed its face validity. A subsequent factor analysis also confirmed the two-factor structure.

**The Ambiguous Vignette Paradigm**

The Ambiguous Vignette Paradigm (Vassilopoulos et al., 2015) was used to measure children’s attributional bias and emotional reaction estimates. In total there were 18 vignettes, nine of which were administered at pre-assessment and nine at post-assessment. To control for unintentional order effects, vignettes were administered in a counterbalanced fashion. That is, half of the children (within each group) received vignettes 1-9 at pre-assessment and vignettes 10-18 at post-assessment, whereas this order was reversed for the other half of the children. All vignettes described a negative outcome for the student and most of them involved an unnamed peer (or group of peers) in either accidental or ambiguous (i.e., the intent of the interacting person is not clear) social situations. Situations include missing or damaged personal property (e.g., not finding the history book in the bag), physical harm (e.g., you trip on the leg of your schoolmate, and you fall over), social ridicule (e.g., you answer a teacher’s question, and everyone start giggling at you), and social rejection (e.g., inviting classmates to your birthday party some of whom do not reply). Each
description was followed by two thoughts which sometimes occur to people in these situations. One attribution always involved a hostile disambiguation of the situation, and the other attribution involved a benign disambiguation or the situation. For example, the attributions in response to the above-mentioned situation were: “You’ve invited a group of classmates to your birthday party. However, a few have not yet said if they’re coming”. Could it be that a) They don’t want to come because they don’t like me (hostile attribution); and b) They don’t know yet if they can come or not (benign attribution). Participants rated the attributions in terms of how likely was to come to their mind if this event had happened to them, using a five-point Likert scale ranging from 1 (I would not think of it at all) to 5 (I would think of it immediately). Hostile and benign attributions per situation were shown in a fixed order.

Participants also answered the following question: How angry would you feel if such an event had really happened? Children rated their emotional reaction to it using a 5-point Likert scale ranging from 1 (not at all angry) to 5 (very angry). Cronbach’s alphas were .80, .62, .81 (for hostile or benign attributions, and emotional reaction, respectively) at pre-assessment, as well as .89, .86, .88 (for hostile or benign attributions, and emotional reaction, respectively) at post-assessment. Note that this vignette method has been successfully and reliably employed to demonstrate biased interpretations in children high in social anxiety (Vassilopoulos & Banerjee, 2008; Vassilopoulos et al., 2009) or aggression (Vassilopoulos et al., 2015).

**Procedure**

First, an approval from the Ethics Committee of the Department of Education, University of Patras was obtained. Parental consent was also obtained as an opt-out option. Children were first informed that they were taking part in a study measuring social event perception and next they were randomly assigned on a 2:1 basis (individual-level randomization) to either the attribution training condition or to the no-training control condition. Before being assigned to each of the conditions, all participants were administered during lesson time in their classroom the RPQ and the measures of attributional bias and emotional reaction estimates. During this initial assessment, a research assistant and a teacher were always present to ensure children’s independent and confidential responding. Those allocated to the attribution training group were visited by the research assistant after one week and received the first training session. Two subsequent visits were then arranged with the teacher of the class and the participants, spread as evenly as possible over the next seven days but at a specific time slot (10:00 a.m. to 11:30 a.m.). All training material was presented on flashcards in a self-paced fashion. In the session, the experimenter briefly greeted the children and then read the instructions. During the training the experimenter kept herself apart but was available to answer any questions regarding the events or the alternative attributions when asked. No other interaction took place between the experimenter and each child. Two subsequent visits were then arranged with the teacher of the class and the participants, spread as evenly as possible over the next 7 days. Each training session lasted approximately 15 minutes. The re-administration of the RPQ and the measures of
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Attributional bias and emotional reaction estimates took place immediately after the third session.

Participants allocated to the control condition were also visited after two weeks and completed the same tests of attributional bias and emotional reaction estimates together with the RPQ. Finally, all participants were fully debriefed and thanked for their participation in the study.

RESULTS

All participants completed the pre-assessment and post-assessment. There were very few missing data (< 1%) and these were replaced with the variable mean. Three outliers were identified and removed from the data. Groups did not significantly differ in levels of self-reported reactive and proactive aggression, hostile attribution ratings, benign attribution ratings, and emotional reaction estimates at pre-assessment. Gender ratio did not differ significantly between conditions (attrition training: 40 boys, 44 girls; control: 26 boys, 19 girls), \( \chi^2 = 1.2, p > .05 \). Although boys reported significantly greater reactive and proactive aggression than girls at baseline, \( t(127) = 3.04, p = .003 \), and \( t(127) = 3.27, p = .001 \), respectively, no significant effects of gender emerged in any of the following analyses and we did not consider this variable further. Means and standard deviations are presented in Table 1.

Table 1. Means (and standard deviations) of the main variables for each group per testing occasion

<table>
<thead>
<tr>
<th></th>
<th>Attribution trained group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pretest</td>
<td>Posttest</td>
</tr>
<tr>
<td>Hypothetical social events</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hostile attributions</td>
<td>2.73 (0.91)</td>
<td>2.11 (1.02)(^a)</td>
</tr>
<tr>
<td>Benign attributions</td>
<td>2.94 (.76)</td>
<td>3.10 (1.17)</td>
</tr>
<tr>
<td>Emotional reaction</td>
<td>2.80 (.94)</td>
<td>2.15 (.92)(^a)</td>
</tr>
<tr>
<td>Reactive aggression</td>
<td>6.59 (4.21)</td>
<td>3.97 (3.68)(^a)</td>
</tr>
<tr>
<td>Proactive aggression</td>
<td>1.82 (2.67)</td>
<td>.71 (1.23)(^a)</td>
</tr>
</tbody>
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Note: \(^a\)Pre- vs. Post-training means differ significantly \( p < .001 \)

Attribution bias

We had predicted that children in the attribution training group would be less likely to endorse hostile attributions and/or more likely to endorse benign attributions than would those in the control group. This hypothesis was tested using mixed ANCOVAs with Group (attrition training versus control) as the between-subjects factor and Time (pre- versus post-training) as the within-subjects factor with Order (vignettes 1-9 before vignettes 10-18 vs. vice versa) as the covariate. In the ANCOVA on hostile attributions, a main effect of
time, \( F(1, 126) = 21.62, p < .001 \), was qualified by a significant interaction of time with group, \( F(1, 126) = 8.80, p = .004 \), partial \( \eta^2 = .07 \), which was consistent with our hypothesis of a greater reduction in ratings of perceived hostile intent following training as compared to the control condition. Post hoc comparisons showed a significant reduction in hostile attribution ratings after training, \( t(83) = 5.19, p < .001 \), but no significant reduction in ratings for the control group, \( p > .10 \).

The analysis of benign attribution scores revealed a main effect of time, \( F(1, 126) = 7.51, p < .001 \), but no significant interaction of time with group (\( F < 1 \)). Thus, training condition did not appear to differentially influence participant’s benign attributions. Mean scores for each group are provided in Table 1.

### Perceived anger

Recall that each hypothetical scenario was accompanied by a question that directly assessed students’ judgments of emotional reaction: “How angry would you feel if such an event had really happened?” Changes in emotional reaction estimates to the hypothetical social events from pre-training to post-training were examined using a similar ANCOVA to that described above. As with the hostile attribution ratings, there was a significant interaction of time with group, \( F(1, 126) = 15.82, p < .001 \), partial \( \eta^2 = .11 \). Consistent with findings above, post hoc comparisons revealed a significant decrease in ratings of perceived anger after training, \( t(83) = 6.90, p < .001 \), but no significant reduction in ratings for the control group, \( p > .10 \). Mean scores for each group are provided in Table 1.

### Reactive and proactive aggressive behavior

The hypothesis that participants in the attribution training condition would show greater reduction in self-reported reactive and proactive aggressive behavior than those in the control condition was tested using a 2 (Group) x 2 (Time) mixed ANCOVA with order of vignettes as the covariate. In the ANCOVA on reactive aggression, the crucial interaction of time with group was found to be significant, \( F(1, 126) = 3.64, p = .05 \), partial \( \eta^2 = .03 \), which was consistent with our hypothesis of a greater reduction in self-reported reactive aggressive behaviors following attribution training as compared to the control condition. According to our post-hoc comparisons, the attribution training group showed a significant reduction in reactive aggressive behavior, \( t(83) = 6.72, p < .001 \), but reactive aggression scores did not significantly change for the control group, \( p > .10 \). Mean scores for each group are provided in Table 1.

The analysis of proactive aggression scores also showed a significant interaction effect of time with group, \( F(1, 126) = 6.80, p = .01 \), partial \( \eta^2 = .05 \). Post hoc comparisons showed significant reductions in proactive aggressive behavior after training, \( t(83) = 4.28, p < .001 \), whereas the control group did not significantly change in their proactive aggression scores, \( p > .10 \). Nevertheless, analyses of change scores revealed that the pre-/post-training change of the reactive aggression scores (mean change = 2.61, \( SD = 3.57 \)) was greater than the pre-/post-training change of the proactive aggression scores (mean change = 1.10, \( SD = 2.36 \)) in the training group, \( t(83) = 4.42, p < .001 \), Cohen’s \( d = 0.49 \).
DISCUSSION

In the present study we have shown that it is possible to modify hostile attributional biases in children using a text-based attribution training paradigm. That is, participants who received three sessions of training designed to influence attributional biases in a less hostile and more positive direction, showed more change than did non-trained controls on a measure of attributional bias and perceived anger in response to new hypothetical scenarios. Second – and perhaps more crucially – our data showed that the intervention could significantly reduce self-reported reactive and proactive aggressive behavior, a change that did not characterize children in the comparison control group. Note that the reduction in aggression scores was greater in the case of reactive aggression, as the analysis of change scores has indicated.

Findings from the current study replicate past research with adults (Hawkins & Cougle, 2013) and youth (van Bockstaele et al., 2020; Vassilopoulos et al., 2015) demonstrating that CBM training can be effective in modifying attribution bias regarding ambiguous social information. Importantly, the present findings extend these previous results by demonstrating that the training paradigm used in the current study is effective in modifying participants’ both self-reported proactive and reactive aggressive behavior. These results might have useful clinical repercussions. In their pioneering social information-processing model, Crick and Dodge (1994) described the thinking error of “hostile attribution bias” (interpreting others’ motives in ambiguous social events as provocative rather than harmless or accidental – Nasby et al., 1980), as one of several information processing distortions associated with maladaptive social development in youth. Since then, interventions have sought ways to address this information-processing bias effectively. The current findings highlight the therapeutic promise of CBM techniques as an adjunct to more conventional forms of psychoeducational intervention (MacLeod et al., 2009). They also suggest that children characterized by high levels of reactive aggression are more likely to benefit from the current intervention than children displaying high levels of proactive aggression.

Interestingly, the attribution training procedure used in the current study was found to be effective in reducing, not only self-reported reactive aggression, but also proactive behavior. First, it should be noted that the high intercorrelation observed between the functions of aggression makes it difficult to clearly distinguish the cognitive correlates of proactive and reactive aggression (Card & Little, 2006). Nevertheless, we speculate that the reduction of the proactive aggression scores observed in the CBM training group may be an artifact of the vignette-based training paradigm employed in the current study. Had we used a real-time hostile attribution training (see Yaros, 2014), we might have found more clear-cut effects on the functions of aggression. More research is needed on this point.

The present study’s findings replicated the results of a previous training study (Vassilopoulos, et al., 2015), which also found a reduction in hostile attributions in ambiguous social situations. This indicates that the benign attribution training used in the current study has potent effects in terms of reducing threat bias. Thus, an intriguing aspect of the current training program is that, without having to directly challenge children’s
maladaptive thoughts, we found a marked reduction in hostile attributions. This is important given that the intervention involved giving feedback about benign attributions only, suggesting that this kind of benign training can depress the salience of the hostile attributions.

Although our findings are encouraging, they should be considered preliminary due to the following limitations. First, the study exclusively used self-report measures and hypothetical scenarios and so generalizability to real life events is not guaranteed. Second, this study included a no-training control group which did not involve repeated exposure to the training material. Salemink et al. (2010) found that changes in emotional state can be mediated by exposure to the training material only. Thus, future studies should also expose the control group to the same training material, without exposing them to possible interpretations. Second, the text-based attribution training used in the current study relied heavily on vignettes describing various ambiguous social situations. However, vignettes may lack the contextual information that is often available in real life (e.g., the posture, gestures and the facial expressions of the persons involved in an interaction). Therefore, future studies could use more ecologically valid training material (e.g., pictures or animated videos) to optimize the effect of the CBM training. Finally, future studies should also investigate whether the attributional bias change reported in the current study is due to demand characteristics or due to a change in the children’s information processing patterns through repeated practice.

Taken together, these findings provide further evidence suggesting that attribution biases can be modified in children via a relatively easy, brief, positive and cost-effective procedure. However, more research is needed to ascertain whether individuals maintain improvement at follow-up. Nevertheless, the text based CBM training used in the current study could be easily disseminated via school workbooks, on-line programs or self-help books. It could also be used in conjunction with adjunctive, infrequent therapist visits to reinforce the material (see also Abramowitz et al., 2009). Thus, providing a rigorously tested (and cost-effective) minimal therapist contact treatment program (Lau, 2015) may be effective for those with milder forms of aggressive and violent behavior who are opposed to or cannot afford a face-to-face talking therapy.

An important and interesting avenue for future research would be to examine whether manipulating attention bias affects interpretation of intent and aggressive behavior in children. Findings from attention modification studies showed that training attentional bias toward threat not only modified interpretations of emotional ambiguity in adults (Bowler et al., 2017), but also reduced children’s symptom severity or emotional vulnerability to a subsequent stressful event (Chang et al., 2019; Eldar et al., 2008). In addition, previous research has demonstrated interrelations between various cognitive biases and has indicated that these biases influence one another in maintaining symptoms (the combined cognitive bias hypothesis - see Vassilopoulos, 2012; Vassilopoulos et al., 2012). Thus, future work with children should also examine the possibility of combining interpretation and attention bias modification procedures for maximizing the potential therapeutic gains (see also Brosan et al., 2011).

Moreover, multiple practices outside the laboratory setting may prove to result in more enduring effects on both attribution biases and reactive or proactive aggression. This
may be of particular interest when applying CBM training to children displaying high levels of aggression. As Mobini et al. (2014) suggest, “…future researchers should investigate how to optimise the transfer of CBM induced cognitive changes from the laboratory into the naturalistic setting and to effectively maintain these modified selective processing over time” (Mobini et al., 2014, p. 277). In that case, we would be able to “… determine whether CBM induced changes fundamentally alter cognitive processes that cause and/or maintain aggression, or if they simply produce transient, context-dependent effects” (Mobini et al., 2014, p. 277).

Conclusions

The current study replicated and extended previous findings (e.g., Vassilopoulos, et al., 2015) suggesting that attribution biases can be beneficially modified in a sample of primary school children. It also found that the effects of the attribution training program employed in the current study were more pronounced for reactive rather than proactive aggression. It is easy to envisage such a paradigm being easily and cheaply distributed and administered via a workbook in schools or other settings. The study was limited by its reliance on responses to hypothetical situations and its exclusive reliance on self-report, and the results should be considered in the light of the low effect sizes observed in some of the analyses, as well as the absence of any manipulation checks that could confirm comprehension of the scenarios by the children. Nonetheless, the study does highlight the need to continue to systematically investigate the impact of attribution training programs on children’s aggressive behavior, if psychologists are to design more effective interventions for children at risk for developing behavior problems.

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