Measuring online interpretations and attributions of social situations: Links with adolescent social anxiety

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Abstract

Objective: We evaluated the utility of a novel, picture-based tool to measure how adolescents interpret and attribute cause to social exchanges and whether biases in these processes relate to social anxiety. Briefly presented ambiguous visual social scenes, each containing a photograph of the adolescent as the protagonist, were followed by three possible interpretations (positive, negative, neutral/unrelated) and two possible causal attributions (internal, external) to which participants responded.

Method: Ninety-five adolescents aged 14 to 17 recruited from mainstream schools, with varying levels of social anxiety rated the likelihood of positive, negative and unrelated interpretations before selecting the single interpretation they deemed as most likely. This was followed by a question prompting them to decide between an internal or external causal attribution for the interpreted event.

Results: Across scenarios, adolescents with higher levels of social anxiety rated negative interpretations as more likely and positive interpretations as less likely compared to lower socially anxious adolescents. Higher socially anxious adolescents were also more likely to select internal attributions to negative and less likely to select internal attributions for positive events than adolescents with lower levels of social anxiety.

Conclusions: Adolescents with higher social anxiety display cognitive biases in interpretation and attribution. This tool is suitable for measuring cognitive biases of complex visual-social cues in youth populations with social anxiety and simulates the demands of daily social experiences more closely.

Limitations: As we did not measure depressive symptoms, we cannot be sure that biases linked to social anxiety are not due to concurrent low mood.

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1. Introduction

Anxiety disorders are common in adolescence (Kessler, Stang, Wittchen, Stein, & Walters, 1999). Since adolescence is generally associated with increased salience of social cues, heightened self-consciousness and increasing importance of peer relationships, it is not surprising that social anxiety disorder (SAD) is one of the most common and disabling anxiety conditions in youth – persisting to explain a significant proportion of adult SAD (Kessler et al., 1999; Wittchen, Stein, & Kessler, 1999). SAD is marked by a persistent and disabling fear of social interactions, specifically a fear of negative evaluations by others (Clark & Wells, 1995; Foa, Franklin, Perry, & Herbert, 1996). Consequentially, individuals with SAD often avoid social situations or approach them with maladaptive social behavior, thereby maintaining and reinforcing their fears (Clark & Wells, 1995; Rapee & Heimberg, 1997). Understanding how adolescents with social anxiety process information in anticipation of and during social exchanges is therefore crucial for understanding how symptoms arise and for interventional purposes, how they abate.

Cognitive biases represent a key factor in the maintenance of social anxiety by introducing systematic distortions in the processing of social cues, thereby increasing the salience of socially threatening information in the environment (Clark & Wells, 1995; Muris & Field, 2008; Ollendick & Hirshfeld-Becker, 2002; Rapee & Heimberg, 1997). As social interactions often involve dynamic and subtle, indirect or limited cues to mental states, the decoding of
ambiguity is central to the computational challenges of social inference making. Hence, biases that operate at the stage of disambiguating social signals may be particularly pertinent to social anxiety.

The misinterpretation of social cues has been shown to differentiate adult clinical/subclinical socially anxious populations from low socially anxious populations. Both increased negative interpretation and a lack of positive interpretations have been suggested to characterize adults with social anxiety (Amir, Foa, & Coles, 1998; Amir, Prouvost, & Kuckertz, 2012; Constans, Penn, Ihen, & Hope, 1999; Stopa & Clark, 2000). Socially anxious individuals are also thought to exhibit an attributional bias, that is, an increased tendency to adopt personal responsibility (i.e., an internal cause) for negative compared to positive events such as failures and successes at a task (Arkin, Appelman, & Burger, 1980; Heimberg et al., 1989).

Consistent with adult research that suggests that several different biases influence social anxiety and interact to maintain anxiety dysfunction (Hirsch, Clark, & Mathews, 2006), the present study will provide data on a novel measure that assesses both interpretational and attributional biases in relation to adolescent social anxiety levels.

1.1. Studies of interpretation bias and social anxiety

Most adult studies of interpretation bias have relied on vignette-based stimuli and participants' ability to evoke a mental image of the described situation. While these data find results in support of the link between distorted interpretations and social anxiety, little is known about the ecological validity of this type of assessment. Further, many of the central but also more subtle social cues that play an important role in social interactions are visual in nature. These include facial and bodily gestures, which are a central source of another's thoughts and feelings, convey signals of threat or affiliation, and communication of intent. Interpersonal attitudes and action prediction are often conveyed by expression, gaze direction and body posture. While there are a number of studies on visual cue interpretation using face stimuli of different intensity or morphed facial expressions, findings are mixed and less clear than those emerging from questionnaire vignettes. Some studies report that high socially anxious or individuals with SAD are more likely to evaluate or mistake facial expressions as threatening (Dimberg, 1997; Dimberg, Frederikson, & Lundquist, 1986; Heuer, Lange, Isaac, Rinck, & Becker, 2010; Pozo, Carver, Wellens, & Scheier, 1991; Vassilopoulos, 2011; Winton, Clark, & Edelmann, 1995), whilst others report no differences in ratings or detection rates (Clark, Siddle, & Bond, 1992; Merckelbach, van Hout, van den Hout, & Mersch, 1989; Jusyte & Schoenenberg, 2013; Schofield, Coles, & Gibb, 2007). With so few studies, it is difficult to ascertain why some studies report significant findings and others do not. Inconsistencies in findings could relate to methodological differences such as task demands, nature and length of stimuli presented and/or sample characteristics.

Of those studies that have employed younger, non-adult samples to investigate the link between social anxiety and interpretational biases, only one has specifically focused on adolescents. Using a questionnaire-based measure consisting of five social and five non-social ambiguous scenarios, Miers and colleagues (Miers, Bönke, Bögel, & Westenberg, 2008) reported that socially anxious adolescents rated negative interpretations of social scenarios as significantly more likely than low socially anxious adolescents, with no social anxiety related difference in the ratings of positive interpretations and interpretations to non-social scenarios (after controlling for negative affect). Using visual cues to assess interpretation of ambiguous social cues in relation to social anxiety, a few studies have used samples that span childhood and adolescence. A study by Simonian, Beidel, Turner, Berkes, and Long (2001) reported poorer facial affect recognition skills in children and adolescents with social phobia, while Melfsen and Florin (2002) did not find differences in the ability to decode facial expressions nor response biases towards negative facial expressions in their socially anxious group; however, they found that participants with social phobia were more likely to interpret neutral faces as emotional (both positive and negative). Both studies used close-up, detailed face stimuli rather than contextually embedded complex cues. Interpretation biases may become more apparent with more ecologically valid visual social stimuli, which contain a range of ambiguous overt and more subtle peer-related cues embedded in a social scene to mirror those captured in vignette-based measures.

1.2. Studies of attributional bias and social anxiety

Drawing on early models of learned helplessness (Abramson, Metalsky, & Alloy, 1989), there is a wealth of literature on maladaptive causal attributions as part of the cognitive style of depressed youths (e.g., Gladstone & Kaslow, 1995). Far less empirical data links negative attributional styles to social anxiety in developmental populations, despite there being strong theoretical reasons (mainly from longstanding adult work) for expecting such an association (Bell-Dolan & Wessler, 1994). According to this body of work, high levels of self-focused attention of socially-anxious individuals in social situations predisposes them to make more internal causal attributions of the outcomes of these social events. As socially-anxious individuals may be more likely to elicit negative responses from others and to expect and remember negative interactions, the tendency to attribute social event outcomes to the self occurs more frequently for actual or perceived social failures (see Hope, Gansler, & Heimberg, 1989). While ample data supports these predictions, studies have also found that adults with high levels of social concern present the opposite pattern of attributions for positive social outcomes. For example, they might be less likely to take responsibility (Hope et al., 1989) — although the theoretical rationale for this is less clear.

There have been some studies of attributional style in anxiety in youth (see Bell-Dolan & Wessler, 1994), but none that focus on social anxiety in particular. However, as causal attributions sometimes appear in experimenter-provided responses within measures of interpretation biases (e.g., “They don’t want me on their team because I’m boring.” — where the first part of this response reflects an interpretation and the second part a causal attribution) these have been measured indirectly in developmental studies of interpretation biases in social anxiety. These data would therefore suggest that there is an association between social anxiety symptoms in adolescents and a negative attributional bias. However, confounding interpretation-attribution dimensions may have artificially inflated/deflated the association between social anxiety and interpretation of social ambiguity. Measuring biases separately will allow a more nuanced understanding in how strongly each is associated with social anxiety and for clinical purposes, which one to primarily target. In order to map out the cognitive profile of socially anxious adolescents, it is important to understand whether a negative attributional style also characterizes adolescents with social worries.

1.3. The current study

To our knowledge there is just one study of interpretation bias and social anxiety in adolescents — and none that measure attributional biases specifically. It may be that cognitive biases in social situations are more readily probed by presenting participants with
visual social cues in the context of everyday settings. For a teenager high in social anxiety, real world social encounters are fraught with ambiguities. Youths are confronted with complex settings where facial displays and gestures of multiple peers are encountered simultaneously against the backdrop of a natural scene (e.g., school cafeteria). Using methods that simulate most closely the demands of everyday life and simpler, more naturalistic interactions. Given evidence that adolescents have greater difficulties in the interpretation and causal attribution of ambiguous visual cues.

The present study therefore aimed to determine the extent to which interpretational and attributional biases of ambiguous visual social information characterize adolescents with social anxiety. We developed a novel measure that involved adolescent-appropriate ambiguous visual social scenarios to assess interpretational and attributional biases. To increase self-relevance, a photograph of the participant was superimposed onto each depicted scenario in order to aid mental imagery and simulation of the participant within the social scene. This tool adds to the existing set of measures of interpretational and attributions by providing a way in which to probe the interpretation of complex visual social cues. The use of pictures including a photograph of the participant may serve to enhance the ecological validity and social salience of this measure, representing an intermediate step between linguistically demanding vignettes and simpler, more naturalistic interactions. Given evidence that adolescents have greater difficulty than adults in imagining situations in the absence of visual cues (Burnett Heyes, Lau, & Holmes, 2013), the use of verbal vignettes may underestimate the interpretational and attributional biases that differentiate socially anxious from healthy adolescents.

Using this new measure, we sought to investigate the extent to which interpretational and attributional biases of social situations differentiated adolescents with high and low levels of social anxiety recruited from the community. On the basis of the extant literature, we hypothesized that adolescents reporting higher levels of social anxiety would endorse more negative interpretations of ambiguous social situations compared to their lower socially anxious counterparts. Guided by research in socially-anxious adults and depressed youths, we also expected those adolescents with higher levels of social anxiety to exhibit a higher proportion of internal attributions to negatively interpreted events than low socially anxious adolescents.

2. Materials and Methods

2.1. Participants

A total of 98 adolescents participated in the study. Two participants were excluded due to missing data and technical issues during the testing procedure; one participant was identified as an outlier. The final sample comprised 95 adolescent participants aged 14.13 to 17.97 (M = 16.67; SD = 1.05, 60 females). Participants were recruited through local schools and an advertisement in the university newspaper. Informed consent was obtained from parents and/or legal guardians and the adolescent participants prior to testing. The research project received ethical approval from the Research Ethics Committee of the University of Oxford.

2.2. Materials

Development of the new measure. Twenty-three photographs depicting ambiguous social scenes were created, which connoted themes of peer evaluation. For the stimulus set, please contact the author. A picture of the participant was inserted into each scenario photograph. This was done so as to create the illusion of the participant as an active partaker within each social scene, thereby increasing the personal salience of the scenarios. Each scenario was presented for 2.5 s followed by three interpretative statements. This exposure length was selected on the basis of our previous experience of presenting different types of complex visual stimuli to youths e.g. in a MRI scanner. Two of the three statements were interpretations related to the participant; one was valenced positively (e.g., “They want me to join them.”) whereas the other was valenced negatively (e.g., “They do not want me with them.”). The third statement was unrelated to the participant’s presence in the photograph (e.g., “They are talking about their afternoon plans.”).

Participants were first required to rate each statement on a Likert scale from 1 to 5 indicating how likely they were to interpret the situation in this manner (rating data). Next, participants selected the single interpretation they perceived to be most likely (forced choice data). If participants selected the positive or negative interpretation in the forced choice question, they were given a follow-up question to discern the internal versus external cause of the interpreted event, i.e. an attribution (e.g., internal negative: “I am not very popular.” versus external negative: “Their lunch table is already full.”). The participant was required to select the attribution that he/she perceived as more likely (see Fig. 1 for trial sequence and example pictures). Our outcome measures were the likelihood ratings for each type of interpretation (positive, negative, unrelated) and the proportion of internal to external attributions of positively and negatively interpreted events. In this way, we separated out interpretation biases from attribution biases. The computerized test was presented using E-prime (Version 2.0) on a Toshiba laptop and the order of stimuli and interpretations was randomized in blocks across participants.

Rating data for each of the positive and negative scales across all 23 items showed adequate levels of internal consistency with a Cronbach’s α of .79 and .80, respectively. The rating scale associated with ‘unrelated interpretations’ also exhibited satisfactory internal consistency (Cronbach’s α = .75). To assess the face validity of the pictures, we divided pictures up into those that we considered marginally more positive (n = 7, those showing potential peer acceptance e.g. smiling peers), those that were marginally more negative (n = 6, those that could signal rejection e.g., frowning peers), and those that were most ambiguous (n = 10, those that were neither straightforwardly positive nor negative). Next, we investigated these categories in relation to participants’ forced choice data. We found that for the pictures we classified as positive, participants were more likely to choose the positive statement (70.5%) than for both negative (11.4%; t(94) = 23.57, p < .001) and ambiguous scenes (20.8%, t(94) = 23.69, p < .001). Similarly, for our negative picture category, we found that participants tended to select the negative statements more often (70.9%) in comparison to both positive (11.9%; t(94) = 25.51, p < .001) and ambiguous scenes (46.6%; t(94) = 10.73, p < .001).

Social anxiety measure. Social anxiety was assessed using the Social Anxiety Scale for Adolescents (SAS-A; La Greca & Lopez, 1998). The SAS-A consists of 18 statements (e.g., “I get nervous when I meet new people.”) and four filler items and has good internal consistency (Inderbitzen-Nolan & Walters, 2000; La Greca & Lopez, 1998; Myers, Stein, & Aarons, 2002). The suggested clinical cut-off score of this measure is 50 (Storch, Masi-Warner, Dent, Roberti, & Fisher, 2004). In the current study, Cronbach’s α was .94. Participants reflected a range of social anxiety scores (M = 49.23, SD = 12.77, range: 26–73) and scores followed a normal distribution. Girls reported significantly higher social anxiety than boys (t(93) = 2.91, p < .005), which has been consistently found in previous samples using this measure (e.g., Ingles, La Greca, Marzo, Garcia-Lopez, & Garcia-Fernandez, 2010; La Greca & Lopez, 1998).
2.3. Procedure

Participants were tested individually. The study took place in a quiet room, either at the Department of Experimental Psychology or at participants’ schools. At the start of the session, a single photograph was taken of each participant from the back and superimposed onto the set of experimental stimuli using a graphics software (Gimp, Version 2.6). A ‘cartoon’ filter was used, which shades all borders of the picture with a thin black rim and integrates the superimposed picture. As a means of enhancing participants’ immersion into the scenarios, the experimenter carried out a mental imagery practice prior to the task with each participant, adapted from previous studies (Holmes, Geddes, Colom, & Goodwin, 2008). This mental imagery exercise entailed presenting participants with several example social scenarios featuring their own photograph and asking them to describe their perception and sensory experience of each scenario with prompts (e.g., “What can you see, hear, and smell in this scenario?”). This exercise was also designed to increase familiarity of the participant with her picture and therefore reduce any possible aversive effects participants might have when viewing their own picture. This exercise was followed by instructions and a practice trial, which was a social scenario with response choices. The experimenter watched the participant whilst he/she performed the practice trial to ensure that he/she understood the instructions. The task was approximately 20 min long and split into two parts with a short break between blocks. After completion of the task and a short break, participants were asked to fill out the SAS-A. At the end of the experimental session, participants were debriefed about the nature of the research and received a £5 Amazon gift voucher.

2.4. Statistical analysis

The mean likelihood rating of each interpretation (positive, negative and unrelated) as the within-subjects factor and Social anxiety as the covariate was performed on mean likelihood ratings. Social anxiety was entered as a covariate in order to retain the full range of scores on this continuous measure. Pearson correlations were calculated to further examine interactions with the covariate. To examine effects of adolescent sex differences, we entered sex as a variable to a second repeated-measures ANCOVA. Results of the statistical analyses are provided with standard p-values (the cutoff for statistical significance was set at \( p < .05 \)) and effect sizes: partial eta squared (\( \eta^2_p \)) for F-tests, which is the proportion of the effect plus error variance that is attributable to the effect (Cohen, 1973). Where assumptions of sphericity were violated (Mauchly’s test of sphericity at \( p < .05 \)), Greenhouse-Geisser corrected degrees of freedom are reported.

The attribution data was analyzed as proportions of internal to external attributions for positively and negatively interpreted events. Proportions of internal attributions were first calculated for each participant. In order to be more conservative, we only included participants in this analysis who had sufficient trials, i.e. who selected at least 4 positive and 4 negative interpretations. This criterion for minimum number of trials let to seven participants being omitted from the analyses (\( n = 88 \)). To ensure that the exclusions of seven data points did not lead to a misrepresentation of the data, we repeated the following analysis with the full sample (\( n = 95 \)). We also repeated the analysis with arcsine-transformed data as the analysis of binary data summarized as proportions can be associated with violations of the homogeneity of variance. The data was subjected to a repeated-measures design with Event type (positive or negative) as a within-subjects factor and Social anxiety score as the covariate. To further investigate significant interactions, post-hoc Pearson correlations were conducted. In a final analysis, we entered sex as a variable to this repeated-measures ANCOVA, to examine adolescent sex differences.

For the purpose of visualizing the results, participants were grouped into a lower and higher social anxiety group based on a median split (SAS-A median score: 48). Error bars represent
standard error of the mean.

3. Results

3.1. Interpretations

Interpretation ratings were analyzed using a repeated-measures ANCOVA with Interpretation type (positive, negative and unrelated) as the within-subjects factor, and Social anxiety as the covariate.

A significant main effect of Interpretation type ($F(1.57, 145.59) = 17.37, p < .001, \eta^2 = .16$) was further modified in a significant two-way interaction with Social anxiety ($F(1.57, 145.59) = 23.28, p < .001, \eta^2 = .20$; see Fig. 2). To interpret the interaction between social anxiety and interpretation type, we calculated separate Pearson correlation coefficients between social anxiety score and positive, negative and unrelated interpretations respectively. Results indicated that social anxiety was significantly negatively correlated with positive interpretation ratings ($r(93) = -.483, p < .001$) and significantly positively correlated with negative interpretation ratings ($r(93) = .450, p < .001$). No significant relationship was found between social anxiety and ratings of unrelated interpretations ($r(93) = -.075, p = .47$).

Re-running the analysis whilst also controlling for adolescent sex revealed no additional significant terms.

3.2. Attritions

A repeated-measures ANCOVA was performed on the proportions of internal attributions for positively and negatively interpreted events and social anxiety score as a covariate. Results showed a significant main effect of Type of event ($F(1.86) = 57.49, p < .001, \eta^2 = .40$), which was further qualified by a significant two-way interaction with Social anxiety ($F(1.86) = 33.03, p < .001, \eta^2 = .28$; see Fig. 3). To further investigate significant interactions, post-hoc Pearson correlations were conducted. Proportion of internal attributions selected to negative events correlated significantly negatively with social anxiety ($r(86) = .451, p < .001$) while the proportions of internal attributions made to positive events exhibited a significant negative relationship with social anxiety ($r(86) = -.399, p < .001$). Repeating this analysis including all participant regardless of the number of trials encountered or using transformed data were consistent with these findings, hence, analysis are reported based on untransformed data and the restricted sample as the most conservative and parsimonious approach.

Re-running the ANCOVA with sex as an additional factor revealed no additional significant terms.

Table 1 provides a summary of all main effects and interactions.

4. Discussion

The present study provides data on a new, age-appropriate, picture-based tool to measure interpretational and attributional biases of complex visual social cues in youths. This novel task uses a photograph of the adolescent participant in realistic social scenes to augment personal relevance and mental imagery.

The results support the utility of this new tool in measuring cognitive biases of complex, self-relevant visual scenes associated with social anxiety in adolescents. We found that higher socially anxious adolescents rated negative interpretations as significantly more likely and positive interpretations as significantly less likely compared to lower socially anxious adolescents. These findings corroborate in part a previous study employing verbal stimuli (Miers et al., 2008), which evidenced interpretational biases in mid-adolescent youth. In contrast to this previous study, our data further suggests that not only an increase of negative interpretations but also a lack of positive interpretations characterizes social anxiety in adolescents. Reasonably moderate correlations were found between both positive and negative mean interpretation ratings and social anxiety.

Beyond an interpretational bias, higher socially anxious adolescents also exhibited an attributional bias that further distinguished them from lower socially anxious participants. The grouped data suggests that differences in attribution ratings may be driven by a positive bias in the lower socially anxious group. These findings extend the limited previous work on attributional biases in children and early adolescents (Vassilopoulos & Banerjee, 2012) by providing further evidence that a different attributional style characterizes adolescents with social anxiety.

A central component of current models of adult and pediatric social anxiety is the role of systematic biases in contributing to the maintenance of the disorder (Clark & Wells, 1995; Ollendick & Hirshfeld-Becker, 2002). Cognitive biases that underscore the salience of perceived threatening features of social interactions and decrease the likelihood of experiencing positive affect during these
encounters are likely to undermine perceived social competence, which, in turn, will increase the likelihood of avoiding future social interactions. The current study provides evidence that adult models, which center on cognitive biases as maintaining factors, may be extended to the interpretation of complex visual social cues and adolescent models of social fears. Future studies should assess younger age groups to evaluate possible developmental effects in the link between distorted cognitions and social anxiety during the transition to adolescence, particularly as studies of younger children have yielded mixed results. Furthermore, whether or not these biases precede the onset of social anxiety, i.e. what role these factors play in the onset of SAD symptoms, remains to be established conclusively using longitudinal designs.

Our data support our measure as a new tool for assessing visual social cue interpretation. Participants’ selection of negative, positive and unrelated explanations to each picture indicated that our pictures did include scenes that suggested potential peer acceptance and potential peer rejection. However, even with pictures that appeared more positive, that is, most participants regarded these as positive, a minority of individuals would consider these negative. This suggests that our pictures varied on a continuum of ambiguity. Future work requiring a brief assessment tool for measuring differences in interpretational style associated with adolescent social anxiety could use our ratings to identify items that are most ambiguous. Our measure has an additional strength: as well as tapping emotion recognition/judgments about facial emotional intensity consistent with previous tasks, the complex picture stimuli presented here provide many other cues that could signal potential social threat (e.g. gestures, body posture, situational cues). Arguably, these features make it more ecologically-valid for young people. Further, the insertion of the participant into each picture could increase the salience of the scenario compared to previous tasks.

Second, the novel measure can successfully assess multiple cognitive biases of visual social cues related to social anxiety in adolescents. Interrelations amongst biases operating in different stages of processing have been hypothesized to exist from the earliest theoretical frameworks onwards. Biases are thought to influence each other and interact to maintain psychological dysfunction. The combined effects of biases in several processing stages have been suggested to have increased impact beyond additive effects of each individual bias. This has been referred to as the ‘combined cognitive biases hypothesis’ (Hirsch et al., 2006). Biases in different processing stages are likely often closely intertwined, if not independent. It is therefore important to develop ways to probe several biases together but independently.

Several limitations of the study have to be noted, too. First, although we tried to encourage a first-person perspective when viewing the complex social scenes and supplemented these efforts with a mental imagery practice, the picture of each participant’s back in the social scene potentially encouraged a ‘third person’ perspective instead. This contrasts with most imagery work that involves asking people to relive/imagine the events/triggers etc. from the first person’s perspective. Future studies could systematically investigate how perspective affects cognitive biases. Related to this, it would be interesting to also see whether biases only emerge when the picture is of oneself or of another person to investigate the role of self-referential material.

Although our task provided information about two sources of bias—one of which (attributional style) has been relatively understudied in relation to adolescent social anxiety, participants only received an attribution question if they selected a preceding positive or negative interpretation. If participants selected the unrelated interpretation, they were not inquired about causal attributions. This meant that the measure of attributional bias was not entirely independent of the interpretation bias measure: each participant encountered a different number of positive and negative attribution questions depending on their response to the interpretation question. This precluded the treatment of both scores as independent in the analysis.

A third limitation is that we did not assess depression levels, which often co-occur with social anxiety symptoms. Thus, the extent to which social anxiety differences arose from low mood effects on interpretation and attributional processes is not known.

Finally, we relied on participants from the community and it would be important to assess whether this tool is suitable for clinical populations and whether, with some small changes to the stimuli, the findings extend to other anxious conditions e.g. panic disorder, generalized anxiety. If appropriate for use in clinical samples, this measure could be helpful as an outcome measure in treatment studies and could also be used in conjunction with various outcome measures such as eye-tracking and functional magnetic resonance imaging to probe the biological correlates of these biases.

5. Conclusion

Adolescence is a key period for the development of persistent and impairing social anxiety. However, there are very few tools available to measure cognitive biases linked to social anxiety in this population. The newly developed picture-based tool is suitable for examining cognitive biases in both community and clinical populations with social anxiety. Moreover, its visual nature extends its applicability to a range of different samples for which verbal stimuli may be challenging. Social anxiety has a slew of adverse effects for adolescents, such as detachment from peers, school refusal, and apathy toward academics (Rheingold, Herbert, & Franklin, 2002). As adolescence is an important period for the development of sophisticated social-cognitive skills and independence in navigating the social world, early interventions are crucial in promoting a trajectory that allows for normal socio-cognitive learning and experiences. These interventions are, however, contingent on the identification of cognitive risk factors in adolescents.

Table 1

Analysis of Covariance (ANCOVA).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Effect</th>
</tr>
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<tbody>
<tr>
<td>Interpretation</td>
<td></td>
</tr>
<tr>
<td>Type of interpretation</td>
<td>$F(1.57, 145.59) = 17.37, p &lt; .001, n^2_g = .16$</td>
</tr>
<tr>
<td>Social anxiety</td>
<td>$F(1.93) = .01, p = .91, n^2_g &lt; .01$</td>
</tr>
<tr>
<td>Social anxiety x Type of interpretation</td>
<td>$F(1.57, 145.59) = 23.28, p &lt; .001, n^2_g = .20$</td>
</tr>
<tr>
<td>Attribution</td>
<td></td>
</tr>
<tr>
<td>Type of Event</td>
<td>$F(1.86) = 57.49, p &lt; .001, n^2_g = .40$</td>
</tr>
<tr>
<td>Social anxiety</td>
<td>$F(1.86) = .03, p = .86, n^2_g &lt; .01$</td>
</tr>
<tr>
<td>Social anxiety x Type of event</td>
<td>$F(1.56) = 33.03, p &lt; .001, n^2_g = .28$</td>
</tr>
</tbody>
</table>

Significant effects in bold.
Acknowledgments

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