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Effects of a Multi-session Cognitive Bias Modification Program on Interpretative Biases and Social Anxiety Symptoms in a Sample of Iranian Socially-Anxious Students

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Abstract

This study examines the effects of a multi-session Cognitive Bias Modification (CBM) program on interpretative biases and social anxiety in an Iranian sample. Thirty-six volunteers with a high score on social anxiety measures were recruited from a student population and randomly allocated into the experimental and control groups. In the experimental group, participants received 4 sessions of positive CBM for interpretative biases (CBM-I) over 2 weeks in the laboratory. Participants in the control condition completed a neutral task matched the active CBM-I intervention in format and duration but did not encourage positive disambiguation of socially ambiguous scenarios. The results indicated that after training the positive CBM-I group exhibited more positive (and less negative) interpretations of ambiguous scenarios and less social anxiety symptoms relative to the control condition at both 1 week post-test and 7 weeks follow-up. It is suggested that clinical trials are required to establish the clinical efficacy of this intervention for social anxiety.

Keywords: negative interpretation, cognitive bias modification, social anxiety

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Table of Contents

Introduction

Social anxiety disorder (SAD) is one of the most prevalent anxiety disorders with life-time prevalence of 12.1% (Kessler, Berglund, Demler, Jin, & Walters, 2005) and has a very poor rate of recovery (Bruch, Fallon, & Heimberg, 2003). Individuals with social anxiety have a markedly poor quality of life, similar to that of depressed out-patients (Wittchen & Beloch, 1996). For example, students with social anxiety leave school earlier than their peers (Stein & Kean, 2000) and have lower educational attainment and a higher risk of being unemployed (e.g., Katzelnick & Greist, 2001). Moreover, people with social anxiety are more often engaged in jobs below their level of qualification (see Fehm, Pelissolo, Furmarkc, & Wittchen, 2005 for a review).

People with social anxiety might define their social fears abstractly as an apprehensive response to individuals or to social situations involving a number of people (Stravynski, 2007). They normally live with this debilitating problem for most of their lifetime, despite the fact that they often have to confront social situations and rarely receive negative feedback. It is assumed that negative biases in processing social information impair these individuals' ability to learn from non-threatening social situations resulting in maintaining their social anxiety (Heinrichs & Hofmann, 2001; Hirsch & Clark, 2004). Consistent with this view, a number of studies using Western populations have shown that socially-anxious individuals tend to interpret ambiguous social information in a more negative (or less positive) manner (Amir, Beard, & Bower, 2005; Hertel, Brozovich, Joormann, & Gotlib, 2008; Huppert, Pasupuleti, Foa, & Mathews, 2007; Stopa & Clark, 2000). This biased information processing is consistent with the cognitive models of social anxiety suggesting that biases towards negative information play a key role in vulnerability to social anxiety (e.g., Clark & McManus, 2002; Ledley & Heimberg, 2006).

Given the existence of negative cognitive biases in social anxiety, it is important to examine whether they are amenable to any interventions (Mobini & Grant, 2007). It is generally assumed that negative cognitive biases in anxiety operate outside of awareness and are relatively automatic and habitual (Beck & Clark, 1997; Mathews & Mackintosh, 1998). In recent years, there have been some attempts to develop interventions which can directly target these habitual cognitive biases. Mathews and Mackintosh (2000) developed a Cognitive Bias Modification for Interpretative bias (CBM-I) paradigm in which participants were trained during a number of trials to consistently

resolve emotionally ambiguous scenarios in a positive or negative direction. Subsequently, laboratory studies have developed a number of CBM interventions to directly modify interpretative biases associated with anxiety via repeated practice on computerized cognitive tasks (see Beard 2011 for a recent review). This line of research demonstrates that it is possible to experimentally train interpretative biases in healthy volunteers (e.g., Mackintosh, Mathews, Yiend, Ridgeway, & Cook, 2006; Mathews & Mackintosh, 2000; Yiend, Mackintosh, & Mathews, 2005) and in a clinical sample of anxious participants (Brosan, Hoppitt, Sillence, Shelfer, & Mackintosh, 2011).

Thus far, a few published studies using different methods of cognitive bias modification have examined the effects or this computerised task on modifying interpretative biases and reducing anxiety in non-clinical or clinical social anxiety (e.g., Amir & Taylor, 2012; Beard & Amir, 2008; Beard, Weisberg, & Amir, 2011; Bowler, Mackintosh, Dunn, Mathews, Dalgleish, & Hoppitt, 2012; Mobini, Mackintosh, Illingworth, Gega, Langdon, & Hoppitt, 2014; Murphy, Hirsch, Mathews, Smith, & Clark, 2007; Turner, Hoppitt, Hodgekin, Mackintosh, & Fowler, 2011). In a randomised controlled trial (RCT), Amir & Taylor (2012) used a word–sentence association task in which patients with social anxiety decided whether a word implying a threatening or benign meaning was related to an ambiguous social scenario. The results revealed that this Interpretation Modification Program (IMP) significantly decreased threat interpretations and clinician-rated social anxiety symptoms from pre- to post-assessment relative to the control group, although no effects on self-rated social anxiety symptoms were reported. Moreover, 3 months follow-up assessments revealed that IMP participants' clinician-rated symptoms were maintained after completing the training, suggesting that the beneficial effects of training were enduring. However, Amir and Taylor (2012) did not conduct follow-up assessments in the control condition.

In recent RCT study, Salemink and colleagues (Salemink, Kindt, Rienties, & van den Hout, 2014) examined the effects of internet-based CBM-I in patients with anxiety disorders (panic disorder, social anxiety and generalised anxiety disorder) with 3 months follow-up for both for the CBM-I training group as well as the placebo-control condition. The results showed that anxious patients who received online positive CBM-I training developed more positive (and less negative) interpretations than control patients. However, as there was not baseline (pre-test) assessment of interpretive bias, it was not possible to determine the actual change in interpretive bias in this study. Furthermore, Salemink et al. (2014) reported that CBM-I training had no specific effects on emotions and both training and control conditions showed a decrease in trait anxiety, depressive mood, and psychological distress at post-test and this decrease was maintained at 3 month follow-up. As the authors acknowledged, in this study patients suffered from different anxiety disorders and the scenarios were not matched to the specific concerns of each anxiety condition. This later limitation might explain some of the inconclusive findings in this study.

In a recent study, Mobini et al. (2014) investigates the effects of a single session of a text-based cognitive bias modification program on modifying interpretative biases in socially-anxious participants. In this positive CBM-I training participants were trained during a number of trials to consistently resolve ambiguous social situations in favour of either positive or neutral outcomes via completion of word stems (Mathews & Mackintosh, 2000). The results revealed that this method of positive interpretation training increased positive interpretations of ambiguous social scenarios and reduced anxiety symptoms relative to a control condition. Taken together, there seems to be growing literature suggesting that it is possible to induce benign interpretations in socially-anxious individuals and reduce social anxiety symptoms (see Mobini, Reynolds, & Mackintosh, 2013 for a review).

One of the limitations of previous studies is that the CBM-I paradigms used in these studies have been developed and used mainly in Western countries. Research suggests that culture can influence various aspects of cognition including attribution style (e.g., Morris & Peng, 1994) and memory and reasoning (D'Andrade, 1995). However, it is also clear that there are substantial similarities in clinical presentations of anxiety disorders among people from different cultural background. For example, cognitive models of anxiety disorders have directed attention to the role of cognitive processing mechanisms (e.g., Beck, Emery, & Greenberg, 1985; Mathews & MacLeod, 1994; Williams, Watts, MacLeod, & Mathews, 1997). It seems that these underlying cognitive mechanisms, mainly manifested as negative information processing, are universal experiences across various cultures (Thakker & Durrant, 2001). While research indicates that the existence of negative attentional biases in anxiety disorders follows a universal pattern (see Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007; Mobini & Grant, 2007), only one published study has investigated interpretation biases in anxiety disorder using a non-Western sample (Fu, Du, Au, & Lau, 2013). In a recent study with a Chinese sample, Fu and colleagues found that adolescent

patients with generalized anxiety and social anxiety disorders who received positive CBM-I interpreted new ambiguous scenarios less negatively than the neutral training group although training effects on mood were absent (Fu et al., 2013). The present study is another study which uses a non-Western sample of socially-anxious adult individuals and examines the effects of CBM-I on interpretation biases. While the cognitive models of anxiety disorders suggest a universal pattern of biased information processing, it is of particular interest to examine further whether such biases in a non-Western sample are amenable to changes via CBM-I. We adopted a CBM-I paradigm used in Mobini et al. (2014) and translated the scenarios to Farsi language with some cultural adaptions (see below).

Taken together, the present study has two main advantages as compared to previous CBM-I studies. First, it is the first CBM-I study which examines the generalisability of CBM-I effects on interpretation biases and social anxiety in a non-Western adult population with social anxiety. Second, there seems to be a few long-term follow-up studies in the current CBM-I research and the present study aims to examine whether CBM-I changes in interpretative biases and social anxiety will be observed over a long-term period (7 weeks follow-up) in a sample of non-Western socially-anxious participants. It was hypothesised that the positive CBM-I training would increase positive interpretations of ambiguous social scenarios at 1 week post-test and 7 weeks follow-up as compared to the control condition. We also hypothesised that the positive CBM-I training would decrease social anxiety symptoms at 1 week post-test and 7 weeks follow-up relative to a control condition.

Method

Participants

Thirty-six socially-anxious participants were selected for the study from a student population at the Ferdowsi University of Mashhad in Iran. In total, 137 volunteers were screened for the study and those students who scored 17 or higher on the Fear of Negative Evaluation (FNE) (Stopa & Clark, 2001) and 12 or higher on the Social Avoidance and Distress Scale (SADs) (Watson & Friend, 1969) were invited to take part in the main study. All participants were native Farsi speakers. They were randomly assigned into either an experimental (positive CBM-I) group or a control (neutral CBM-I) group. One of the participants in the control group dropped out of the study. The demographic information for participants in each group is depicted in Table 1.

Measures

Fear of Negative Evaluation Scale (FNE, Watson & Friend, 1969):

The FNE comprises 30 true–false items that refer to expectation and distress related to negative evaluation from others in social situations. A cut-off score of 17 on the FNE has been shown to be associated with high social anxiety (Stopa & Clark, 2001). Psychometric properties of this scale in a sample of Iranian socially-anxious students have been reported as follows; test-retest reliability r = .88, Cronbach's Alpha = .86, construct validity, r = .75, and concurrent validity, r = .56 (Sarafraz, 2007, Unpublished dissertation data). In the present study, Cronbach's alpha was .92, indicating a high internal consistency for this measure.

Social Avoidance and Distress Scale (SADs, Watson & Friend, 1969):

The SADs comprises of 28 true/false items measuring features associated with social anxiety such as distress, discomfort, fear, and anxiety, and the avoidance of social situations. Psychometric properties of the SADs in a sample of Iranian socially-anxious students have been reported as follows; test-retest reliability r = .83, Cronbach's Alpha = .90, construct validity, r = .75, concurrent validity, r = .62 (Mahmodi, Godarzi, Taghavi, & Rahimi, 2010). In the present study, Cronbach's alpha was .91, indicating a high internal consistency for this measure.

Beck's Depression Inventory-II (BDI-II, Beck, Steer, & Brown, 1996):

The BDI-II is a commonly used 21-item measure of physical, emotional, cognitive, and behavioral symptoms of depression. We used this measure to exclude participants with scores of 29 or above indicating 'severe' levels of

depression (Beck et al., 1996). This measure was included to minimize the impact of low mood on participants' interpretations of social scenarios (Holmes, Lang, & Shah, 2009). A study with Iranian students has reported internal consistency (Cronbach's Alpha = .87) and acceptable test-retest reliability (r = .74) for the BDI-II-Farsi version (Ghassemzadeh, Mojtabai, Karamghadiri, & Ebrahimkhani, 2005). In the present study, Cronbach's alpha was .82, indicating a high internal consistency.

Recognition test

Interpretative bias was tested individually using a text-based encoding task which has been widely used in a number of studies investigating interpretative biases in anxiety (e.g., Hertel et al., 2008; Mackintosh et al., 2006; Mathews & Mackintosh, 2000; Mobini et al., 2014). A recent study demonstrated that this recognition test was capable of differentiating between high and low levels of neuroticism (Salemink & van den Hout, 2010).

The materials for interpretative bias test were adopted from Mobini et al., (2014) and translated from English to Farsi language with some content modifications according to the Iranian culture and social norms. For examples, words such as pub, wedding reception, Sunday lunch, and partner were translated to Farsi versions and the names of locations were replaced with some local names. This content modification was carried out very carefully to make the social scenarios more suitable for the Iranian culture. The modified task was piloted with two groups of socially-anxious (n = 30) and non-anxious students (n = 30). The results showed that the modified task could differentiate the two groups for the positive interpretations, $F(1, 58) = 37.43$, $p = .001$); and negative interpretations, $F(1, 58) = 49.74$, $p = .001$). The modified interpretative bias test was used in the present study.

In total, 45 passages were randomly allocated into three sets and matched with regard to some themes related to social interaction and social performance. Each set of the interpretative bias task consisted of 10 social scenarios and 5 neutral (fillers) scenarios. To ensure that interpretative bias was not assessed with identical stimulus materials across all three phases of the study and in order to prevent the habituation effect due to using repetitive passages, three sets (A, B, C) of the interpretative bias task were individually used across three phases, i.e. pre-test, post-test, and 7 weeks follow-up, in a counter-balanced order.

In this computerized task, participants were presented with ambiguous social scenarios and instructed to imagine themselves in the situation while reading each description as if they were actually there. Each scenario ended ambiguously to allow participants to apply their own spontaneous interpretation to the meaning of the passage. After all the scenarios were presented, participants were presented with four different interpretations of each scenario, one at a time. Two of these four items were target sentences matching the positive and negative meanings of the text. The remaining two were foils, which did not match the text but were positively and negatively valenced. Foils were included in order to assess any wider valence priming effects of training indicating a potential response bias for endorsing any information of a certain emotional valence. Participants were asked to rate each sentence according to how closely it corresponded in meaning to what was described in the preceding scenario. The recognition ratings were collected using a 4-point Likert scale ranging from 1 *(very different in meaning)* to 4 *(very similar in meaning).*

Interventions

Cognitive Bias Modification to Induce Positive Interpretation (Mathews & Mackintosh, 2000)

CBM-I was a text-based computerized task aimed at systematically training individuals to interpret emotionally ambiguous information in a particular direction. The present study adopted the procedure used by Mathews and Mackintosh (2000) in which participants were trained during a number of trials to consistently resolve (via completion of word stems) ambiguous situations in favor of either positive or neutral outcomes, depending on the training condition. The training materials were translated from English to Farsi and modified according to the Iranian culture and social norms. For example, words such as Christmas, partner, pub, and bowling were replaced with Farsi words such as Nowrouz (Persian New Year), wife/husband or fiancée, café, and volleyball, respectively, and the content of each scenario was modified accordingly. We also replaced the Western countries and cities with

Middle Eastern countries and Iranian cities. The modified Farsi CBM-I version was piloted with a small number of socially-anxious volunteers before being used in the present study. A postgraduate clinical psychology student, the experimenter, translated all the scenarios from English to Farsi, and two qualified clinical psychologists familiar with both languages in the United Kingdom and Iran checked the compatibility of scenarios in both versions. This was to ensure that the passages in the Farsi version are matched to the English version in meaning.

In total, 160 ambiguous social scenarios were used in the positive CBM-I training. These passages were randomly allocated into 4 sets with 40 in each set (A, B, C, D) and presented in a counterbalanced order for all participants. There were 4 block of 10 scenarios for each session, presented in a randomised order. Each scenario was presented in 4 lines and participants were instructed to imagine themselves in the situation while reading each passage as if they were actually there. The imagery technique used here was consistent with Holmes and colleagues' findings that mental imagery is more effective than verbal training in inducing positive mood (Holmes, Mathews, Dalgleish, & Mackintosh, 2006). Each passage was designed to stay emotionally ambiguous until the last word (presented as a fragment, e.g., fri--d-y) which resolved the passage in a positive way (*friendly*). The participants' task was to complete the fragmented word by keying the first missing letter. When participants provided their answers the final word appeared on the computer screen. An example of the CBM-I positive training is "You take your mother in-law into town to do some shopping and on the way, put on your favourite radio station. You are sure that she found the music ag--e-b-e (*agreeable*).

CBM-I Control Condition

In this control condition, the passages were similar to those used in the CBM-I training condition, with the critical exception that these passages did not communicate ambiguous scenarios, amenable to positive or negative interpretation, but unambiguous scenarios that are all emotionally neutral in tone. The final word fragment yields words that provide a meaningful emotionally neutral completion to these unambiguous emotionally neutral scenarios. An example of a control passage is *"Having finished painting the lounge, you invite friends around to dinner. When they arrive you greet them and then go to fetch some drinks from the fridge in the k--ch-- (kitchen)"*.

Design

The design of the study was a mixed experimental design with type of treatment (Positive CBM-I vs. Control neutral CBM-I) as a between-subjects factor and measures of interpretative biases and social anxiety symptoms at three time intervals (pre-test, 1 week post-test, and 7 weeks follow-up) as within-subject factors.

Procedure

Following the receipt of the completed FNE and SADs and demographic information such as age and gender, 36 participants who met eligibility criteria were invited to the Psychology laboratory at the Department of Psychology, Ferdowsi University of Mashhad in Iran. There was a one-week gap between the screening and pre-test phases. Participants were given an information sheet and signed a consent form prior to taking part in the study. The aim of the study described as 'research on comprehension of social situations and learning to cope with social events'. The study followed a single blind procedure and participants were not aware of the training conditions they were assigned to. Using a computer-generated randomization method, participants were randomly assigned into one of two conditions, i.e. the experimental CBM-I condition and the Control (neutral CBM-I) condition. At pre-test, participants completed the interpretative bias assessment for 20 minutes. At the treatment (training) phase, the experimental group received the positive CBM-I training for 4 non-consecutive days over 2 weeks and the control group received neutral CBM-I training with a testing and training schedule identical to that of the positive CBM-I training. Thus, all participants completed 4 training sessions, each positive or neutral CBM-I session lasting approximately 40 minutes. The first CBM-I (and control) training session was carried out 10 minutes after the interpretative bias test but the remaining 3 more training sessions were carried out separately in non-consecutive days in the same laboratory. At post-test, after 1 week of the last training session all participants returned to the laboratory and completed the interpretative bias assessment and social anxiety measures (FNE and SADs). At 7 weeks follow-up, participants returned to the laboratory and completed the interpretative bias assessment and both

social anxiety scales. In the end, the participants were debriefed about the main purpose of the study and were thanked for their participation. In accordance with ethical guidelines the control group volunteers were given either an opportunity to take part in the positive CBM-I program or psychological treatment for social anxiety offered at the University's Psychology Clinic.

Apparatus

The interpretative bias measure and CBM-I training tasks were programmed using Super Lab Pro Software with Farsi alphabets. The final programs were presented on a PC laptop with 15" display. The computer recorded the participants' answers after each key press.

Data Analysis

The data from 18 participants in the positive CBM-I and 17 in the control group were analysed. The data from the interpretative bias assessment (recognition test) and social anxiety scales at three times (pre-test, 1 week post-test, and 7 weeks follow-up) were the focus of our statistical analysis and subjected to the Analysis of Variance (ANOVA) and *t*-tests using SPSS software.

Results

Baselines measures

Table 1 summarises the baseline data for each group. An independent *t*-test revealed no difference between the positive CBM-I training and control group on the depression (BDI-II) scores, CBM-I M (SE) = 17.06 (2.34) vs. Control M (SE) = 15.47(1.58), $t(33) = .58$, $p = .57$. Further independent *t*-tests revealed no significant differences between these groups on the FNE with CBM-I M (SE) = 24.56 (.88) vs. Control M (SE) = 24.06 (.86), $t(33) = .21$, $p = .90$, and on the SADs with CBM-I M (SE) = 18.00 (1.18) vs. Control M (SE) = 17.76 (1.16), $t(33) = .14$, $p = .89$.

Table 1. Demographic information and baseline measures for each group.

	CBM-I (n = 18)	**Control (n = 17)**
	Mean (SE)	**Mean (SE)**
Age	23.28 (.58)	22.44 (.77)
Gender (%female)	70.50	64.70
Ethnicity	Iranian (Farsi speakers)	Iranian (Farsi speakers)
FNE:	24.56 (.88)	24.06 (.86)
SADs:	18.00 (1.18)	17.76 (1.16)
BDI-II	17.06 (2.34)	15.47 (1.58)

Note: FNE: Fear of Negative Evaluation; SADs: Social Avoidance and Distress Scale; BDI-II: Beck Depression Inventory (II)

Interpretative bias

One of the main aims of the present study was to test whether the positive CBM-I training could lead to more positive interpretations of the ambiguous situations. Therefore, participants' recognition ratings of disambiguated versions of the final sentences of the test scenarios were the main measure of interest to show the persistence of any training effects. The program was designed such that participants were forced to enter a 1 - 4 rating before proceeding to the next sentence. Consequently, there were no errors or omissions within this section of the data. Mean ratings for each participant were calculated across the four different sentence types as interpretative bias scores: negative target, positive target, negative foil, and positive foil. Three bias scores for each participant (Pre-test, 1 week Post-test, 7 weeks Follow-up) were calculated by subtracting the mean recognition rating for the negative targets from the mean recognition ratings for the positive targets. This gave each participant three bias scores that could range from -3 to + 3, with a negative score indicating a less positive (or negative) bias and a

positive score representing a positive bias. Similar bias scores were calculated by subtracting the mean recognition rating for the negative foils from the mean recognition ratings for the positive foils.

Table 2 summarises the bias scores for target and foil sentences for each group at pre-test, 1 week post-test, and 7 weeks follow-up. It was hypothesised that socially-anxious individuals in the positive CBM-I condition would demonstrate an increase in positive interpretations (and reduction in negative interpretations) of ambiguous scenarios as compared to the control condition. To test this hypothesis, the mean values of bias scores were entered into a repeated measure three-way mixed (2 × 3 × 2) ANOVA with Group (CBM-I, Control) as a between-subjects factor and Time (1 = pre-test, 2 = post-test, and 3 = follow-up), Sentence Type (targets vs. foils), as within-subjects factors. The results indicated a significant main effect of Group, $F(1, 33) = 28.52$, $p < .001$, $\eta^2 = .46$ and a significant three-way interaction effect, Time × Sentence Type × Group, $F(2, 66) = 21.98$, $p < .001$, $\eta^2 = .40$. To follow up this significant interaction, planned post hoc comparisons using Fisher's Least Significance Difference (LSD) were conducted to locate the sources of the significance. This planned post hoc *t*-test revealed a significant reduction in the negative bias scores for targets from pre-test (M = -.48) to 1 week post-test (M = 1.16), $t(66) = 5.37$, $p < .01$, and from pre-test (M = -.48) to 7 weeks follow-up (M = 1.50) $t(66) = 8.04$, $p < .01$ in the CBM-I group. No such differences were observed for targets from pre-test (M = -.42) to 1 week post-test (M = -.28), $t(66) = .65$, $p = .25$, and from pre-test (M = -.42) to 7 weeks follow-up (M = -.22), $t(66) = 1.12$, $p = .15$ in the control group. Similar comparisons revealed no significant differences for foils across the 3 times in the CBM-I or control groups $t(66) \leq 1$.

Table 2. Means (M) and standard errors (SE) of bias scores for the target and foil sentences for each group at pre-test, 1 week post-test, and 7 weeks follow-up (N = 35). Negative scores represent less positive interpretations of ambiguous social scenarios and positive scores represent more positive interpretations of these scenarios.

	CBM-I	Control	$F_{(1, 33)}$	$p <$	*d*
	M (SE)	M (SE)			
Pre-test					
Targets	48 (.14)	42 (.15)	.31	.58	-
Foils	.29 (.08)	.11 (.14)	1.03	.22	-
1 week Post-test					
Targets	1.16 (.17)	-.28 (.13)	43.16	.001	2.23
Foils	.39 (.12)	.21 (.10)	1.12	.25	-
7 weeks Follow-up					
Targets	1.50 (.22)	- .22 (.12)	44.51	.001	2.26
Foils	.42 (.17)	.27 (.11)	1.31	.20	-

Note: d: Between-group Cohen's effect size estimates.

To further analyse between-group differences, the bias change scores were subjected to one-way ANOVA. The results revealed no significant between-groups differences on bias scores for targets $F(1, 33) = .31$, $p = .58$ and foils $F(1, 33) = 1.53$, $p = .22$ at pre-test indicating that the baseline scores did not differ significantly between the experimental and control groups. However, there were significant differences on targets between two CBM-I and control groups at 1 week post-test and 7 weeks follow-up, $F(1, 33) = 43.16$, $p < .001$, $d = 2.23$ and $F(1, 33) = 44.51$, $p < .001$, $d = 2.26$ respectively. No such between-group differences were observed for the foil sentences at both post-test and 7 weeks follow-up, $F(1, 33) = 1.12$, $p = .25$ and $F(1, 33) = 1.31$, $p = .20$, respectively (see Table 2). These results indicate that changes in bias scores were limited to the target sentences.

In addition to biases scores, recognition ratings (positive and negative interpretations) of targets and foils were subjected to further analysis to identify the direction of the changes. Table 3 shows recognition ratings separately for positive and negative interpretations of target and foil sentences across three times. To examine changes in the interpretations of ambiguous scenarios we conducted a 4-way ANOVA with groups as between-subjects factor and time (pre-test, post-test and follow-up), valence (positive vs. negative) and type of sentences (targets vs. foils) as between-subjects factor. The results showed a 4-way Group × Time × Valence × Type of Sentence interaction, $F(2,$

66) = 25.26, $p < .001$, $\eta 2 = .43$. To further investigate this interaction effect, between-groups comparisons were carried out using LSD post-hoc. The results showed that after training participants in the CBM-I group endorsed positive targets significantly more than those of the Control group at both post-test, $t(1, 33) = 4.42$, $p < .001$, $d = 1.44$ and 7 weeks follow-up, $t(1, 33) = 5.57$, $p < .001$, $d = 1.66$ (see Table 3 for Means). Similarly, after training participants in the CBM-I group endorsed negative targets significantly less than those of the Control group at both post-test, $t(1, 33) = 5.92$, $p < .001$, $d = 2.18$ and 7 weeks follow-up, $t(1, 33) = 6.71$, $p < .001$, $d = 2.19$ (see Table 3 for Means). No significant changes in valence rating between two groups were observed for the foil sentences, t values ≤ 1.42.

Table 3. Means (M) and standard deviations (SD) of recognition ratings for the target and foil sentences for each group at pre-test, 1 week post-test, and 7 weeks follow-up (N = 35).

	CBM-I	Control	$t_{(33)}$	$p <$	d
	M (SD)	M (SD)			
Pre-test					
Positive Targets	2.20 (.49)	2.32 (.54)	.85	NS	-
Negative Targets	2.68 (.40)	2.74 (.41)	.86	NS	-
Positive Foils	2.15 (.53)	2.14 (.52)	.07	NS	-
Negative Foils	1.86 (.37)	2.03 (.43)	1.21	NS	-
1 week Post-test					
Positive Targets	3.01 (.49)	2.39 (.38)	4.42	.001	1.44
Negative Targets	1.84 (.36)	2.67 (.40)	5.92	.001	2.18
Positive Foils	2.13 (.51)	2.01 (.52)	.86	NS	-
Negative Foils	1.73 (.43)	1.82 (.47)	.64	NS	-
7 weeks Follow-up					
Positive Targets	3.17 (.61)	2.39 (.32)	5.57	.001	1.66
Negative Foils	1.67 (.42)	2.61 (.44)	6.71	.001	2.19
Positive Foils	2.32 (.48)	2.12 (.48)	1.42	NS	-
Negative Targets	1.90 (.48)	1.85 (.45)	.36	NS	-

Note: d: Between-group Cohen's effect size estimates; NS: Non-significant.

Furthermore, paired t-tests were used to compare the changes in recognition ratings for both targets and foils from pre-test to post-test and to follow-up. The results showed significant increases in positive interpretations of targets from pre-test (M = 2.20) to post-test (M = 3.01), $t(17) = 7.94$, $p < .001$ and to follow-up (3.17), $t(17) = 5.79$, $p < .001$ in the CBM-I group. In contrast, negative interpretations of targets reduced significantly from pre-test (M = 2.68) to post-test (M = 1.84), $t(17) = 7.46$, $p < .001$ and to follow-up (M = 1.67), $t(17) = 8.18$, $p < .001$ in the CBM-I group. Similar paired *t*-tests comparisons did not reveal any significant changes in the recognition ratings of both positive and negative targets from pre-test to post-test and to follow-up in the Control group, *t* values = .21 – 1.20. No significant changes were observed in the recognitions ratings of positive or negative sentences from pre-test to post-test and to follow-up in both CBM-I and Control groups, *t* values = .12 - .96.

Taken together, these results suggest that after training participants in the positive CBM-I condition endorsed positive interpretations of ambiguous scenarios more and negative interpretations less than pre-test ratings as compared to the control group. This indicates that positive CBM-I training produced changes in both directions including an increase in endorsement of positive interpretations and a reduction in negative interpretations of ambiguous scenarios.

Social Anxiety

Table 4 summarises the means of the Fear of Negative Evaluation (FNE) and the Social Avoidance and Distress Scale (SADs) for each group at pre-test, 1 week post-test, and 7 follow-up. The means of FNE were subjected to a two-way ANOVA (2 × 3), with the Group (CBM-I vs. Control) as a between-subjects factor and 3 times (pre-test, post-test, and follow-up) as within-subject factors. There was a significant group effect $F(1, 35) = 9.70$, $p < .01$, $\eta^2 = .23$ and group by time interaction effect $F(2, 68) = 12.92$, $p < .001$, $\eta^2 = .28$. To follow up this significant interaction, planned post hoc comparisons using Fisher's Least Significance Difference (LSD) were conducted to locate the sources of the significance. The LSD *t*-test revealed significant differences in the mean values of FNE between the CBM-I and Control groups at 1 week post-test, $t(68) = 5.62$, $p < .01$, $d = 1.15$ and 7 weeks follow-up, $t(68) = 6.44$, $p < .01$, $d = 1.30$.

Similarly, a two-way ANOVA was used to analyse the mean values of the Social Avoidance and Distress Scale across three times for each group. The results showed a significant group effect $F(1, 35) = 5.27$, $p < .01$, $\eta^2 = .12$ and group by time interaction effect $F(2, 68) = 9.53$, $p < .001$, $\eta^2 = .23$, both indicating a medium effect size. The planned post hoc (LSD) *t*-test revealed significant differences in the means values of SADs between the CBM-I and Control groups at 1 week post-test, $t(68) = 3.45$, $p < .05$, $d = .67$ and 7 weeks follow-up, $t(68) = 5.92$, $p < .01$, $d = 1.13$.

Table 4. Means and Standard Deviations of the Fear of Negative Evaluation (FNE) and Social Avoidance & Distress Scale (SADS) for each group at 1 week post-test and 7 weeks follow-up.

	CBM-I (n = 18)	Control (n = 17)	*p* <	*d*
	M (SD)	M (SD)		
Pre-test				
FNE	24.56 (4.73)	24.06 (3.55)	.90	-
SADS	18.00 (4.86)	17.76 (4.80)	.85	-
1 week post-test				
FNE	17.56 (6.02)	24.53 (5.09)	.01	1.15
SADS	13.00 (5.11)	16.41 (5.94)	.05	.67
7 weeks Follow-up				
FNE	16.72 (6.12)	24.71 (4.84)	.01	1.30
SADS	11.24 (5.51)	17.47 (5.87)	.01	1.13

Note: d: Between-group Cohen's effect size estimates.

In addition to between-groups comparisons, the paired *t*-tests revealed significant reductions on the FNE scores for the experimental group from pre-test to 1 week post-test, $t(18) = 4.62$, $p < .001$, $d = 1.56$ and from pre-test to 7 weeks follow-up $t(18) = 5.0$, $p < .001$, $d = 1.45$. No such differences were observed for the control group, $t(17) \leq 1$. Similarly, paired t-tests revealed significant reductions on the SADs scores for the CBM-I group from pre-test to 1 week post-test, $t(18) = 3.53$ $p < .01$, $d = 1.00$, and from pre-test to 7 weeks follow-up $t(18) = 6.25$, $p < .001$, $d = 1.31$. No such differences were observed for the control group $t(17) \leq 1$.

Taken together, these results suggest that the positive CBM-I training reduced social anxiety symptoms with medium to larger effects sizes observed in both social anxiety measures at 1 week post-test and 7 weeks follow-up.

Discussion

The main aim of the present study was to examine the effects of a positive multi-session CBM-I program on interpretative biases and social anxiety in a non-Western socially-anxious population. The first prediction was that

the positive CBM-I training would increase positive interpretations (or reduce negative interpretations) of ambiguous scenarios in socially-anxious individuals as compared to a control condition. Consistent with this hypothesis, the results revealed that participants in the positive CBM-I made more positive interpretations and less negative interpretations than the control group. These results are consistent with the previous findings suggesting that the positive CBM-I training can facilitate a benign interpretation of ambiguous social scenarios in social anxiety (e.g., Beard & Amir, 2008; Beard, et al., 2011; Mobini et al., 2014; Murphy et al., 2007). The large between-group effect size on interpretative biases in the present study (d = 2.23) are similar to those of reported in similar multi-session CBM-I studies: Beard and Amir (2008) with effect sizes of 1.85 and 2.25 and Amir & Taylor (2012) with effect sizes of .92 and 1.30.

The second prediction was that the positive CBM-I training would decrease social anxiety symptoms. In line with similar studies using Western populations (e.g., Amir & Taylor, 2012; Beard & Amir, 2008; Mobini et al., 2014), the results showed reductions in social anxiety symptoms in the CBM-I group as compared to the control condition. The fact that these positive changes in social anxiety are shown in two widely used social anxiety scales with larger effect sizes observed at 7 weeks follow-up suggests a robust effect of a multi-session CBM-I program on social anxiety. The multi-session CBM-I program demonstrates promising efficacy (d = .67 – 1.30), with the between-group effect size for change in social anxiety symptoms comparable to previous multi-session CBM-I studies. For example, Amir and Taylor (2012) reported a large effect size on social anxiety with 8 sessions of CBM training and Beard & Amir (2008) reported a medium effect size (d = .65) following interpretation training for 8 sessions.

These findings imply that the therapeutic value of the CBM-I training can go beyond the practice sessions and produce more long-lasting positive effects. Taken together, results from this study suggest that positive CBM-I induced changes are not limited to socially-anxious individuals from the Western countries, and that similar changes can be observed in non-Western socially-anxious individuals. This is an interesting finding as it suggests that the CBM paradigm developed in a specific cultural context can be adopted and used with anxious people from a different cultural background with similar effects.

CBM-I is a novel intervention that is strongly grounded in the cognitive models of anxiety (Beck, et al., 1985; Clark & Wells, 1995; Rapee & Heimberg, 1997). It has been developed from the basic science laboratory research and generated very encouraging results in clinical and non-clinical populations (see Beard, 2011). CBM-I delivery requires minimal clinical supervision and it can provide a therapeutic alternative for socially-anxious patients who prefer a non-pharmacological intervention or patients who are reluctant to engage in ‘talking therapies’ requiring face-to-face contact with a therapist. CBM-I is a very flexible treatment. If the positive findings of CBM-I are repeated in controlled clinical trials, this computerised intervention could be used as a stand-alone treatment for patients who are not able to benefit from usual treatments for social anxiety. Given anxiety disorders impose a societal economic burden comparable with the cost of depression, with 54% of the cost expended for non-psychiatric medical care of physical complaints (Shearer, 2007), the economic value of this treatment method can be of substantial benefits.

It is worth noting the primary limitations in this study as well as some suggestions for further investigations. First, as this study used a relatively small non-clinical sample of socially-anxious students, and mainly females, future studies using larger clinical samples with a more balanced gender and education distribution are needed. In this regard, the use of clinical trials would be particularly beneficial for further clarifying the clinical efficacy of CBM-I as a treatment method for social anxiety. Similarly, the effect sizes observed in this study should be interpreted with caution, given that effect sizes from small samples are known to be unreliable. Second, although the present study suggests some enduring positive changes in interpretative biases and social anxiety symptoms, future research should determine whether these changes improve social functioning in real-life social situations. For example, it is not clear whether developing benign interpretations of ambiguous situations can result in reductions in avoidance behaviors in socially-anxious individuals. Another interesting question is whether changes in negative interpretative biases can result in modifications of underlying thinking processes such as dysfunctional assumptions or negative core beliefs associated with social anxiety.

Conclusions

Taken together, the results of present study provide further evidence for effectiveness of a multi-session positive CBM-I training in inducing positive interpretations of ambiguous scenarios and reducing social anxiety symptoms in a sample of non-Western socially-anxious individuals. It remains to be seen whether this experimental intervention can improve social functioning in real-life situations and result in long-lasting changes in underlying negative thinking patterns involved in the maintenance of social anxiety disorder. The results from different studies in Western and non-Western countries suggest that CBM-I has potential for further development and use across different cultures.

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