Facilitating a Benign Interpretation Bias
in a High Socially Anxious Population

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Abstract

Previous research has shown that high socially anxious individuals lack the benign interpretation bias present in people without social anxiety. The tendency of high socially anxious people to generate more negative interpretations may lead to anticipated anxiety about future social situations. If so, developing a more benign interpretation bias could lead to a reduction in this anxiety. The current study showed that a benign interpretation bias could be facilitated (or ‘trained’) in a high socially anxious population. Participants in the benign training groups had repeated practice in accessing benign (positive or non-negative) interpretations of potentially threatening social scenarios. Participants in the control condition were presented with the same social scenarios but without their outcomes being specified. In a later recognition task, participants who received benign interpretation training generated more benign, and less negative, interpretations of new ambiguous social situations compared to the control group. Participants who received benign training also predicted that they would be significantly less anxious in a future social situation than those in the control group. Possible implications of the findings for therapeutic interventions in social phobia are discussed.

Keywords: Social phobia; Social anxiety; Anxiety; Interpretation; Ambiguity; Training
1. Introduction

Social phobia (or social anxiety disorder) is characterised by an overwhelming and persistent fear of being negatively evaluated in social situations (Diagnostic and Statistical Manual of Mental Disorders; APA, 1994). Social phobia is the second most prevalent psychiatric disorder (Kessler, Berglund, Demler, Jin & Walters, 2005) and has a very poor rate of spontaneous remission (Bruce, Yonkers, Otto, Eisen, Weisberg, Pagano & Keller, 2005). Indeed, social phobia persists despite the fact that most individuals with social phobia often have to enter social situations and rarely receive negative feedback. An explanation of the failure of such individuals to learn from these non-threatening situations is that biases in the processing of social information maintain their anxiety (e.g. Beck, Emery, & Greenberg, 1985; Clark & Wells, 1995; Rapee & Heimberg, 1997).

One cognitive process which may maintain social phobia is an interpretation bias. In daily life many social situations are ambiguous and therefore open to a range of interpretations. For example, if a person laughs at a comment you make, it could be taken to indicate that they find what you say amusing or that they at laughing at you with disdain. Both questionnaire studies (Amir, Foa, & Coles, 1998; Stopa and Clark, 2000) and computerised studies of ‘on-line’ processing (Hirsch & Mathews, 1997; 2000) have shown that socially anxious individuals make relatively more negative, and less positive, interpretations of ambiguous social situations than those who are socially confident. The benign interpretation bias present in individuals without social anxiety (Hirsch & Mathews, 1997; 2000) may help these individuals to expect to feel less anxious in future social situations and more positive about their performance. Therefore, facilitating a more benign interpretation bias in high socially anxious individuals could sustain a positive feedback cycle that preserves self-esteem and low anxiety (Hirsch & Mathews, 2000).

Research has shown that it is possible to experimentally facilitate (or ‘train’) interpretation biases. Grey and Mathews (2000) carried out a series of studies showing that volunteers with trait anxiety scores in the normal range could be trained to generate negative interpretations. Mathews and Mackintosh (2000) were also able to train both positive and threatening interpretation biases in a
community population. Participants read descriptions of social scenarios with an ambiguous emotional meaning whilst imagining that they were the central character. At the end of the scenarios the ambiguity of the scenarios was resolved in a threatening or positive way, in line with the direction of training. A recognition test revealed group differences in interpretations of fully ambiguous scenarios which were in line with the direction of training. These effects of training have been replicated and extended by Yiend, Mackintosh and Mathews (2005) who found that training can produce interpretative biases which can be maintained over 24 hours.

The findings of Mathews and Mackintosh (2000) also seemed to provide evidence that interpretation biases may be causal in the development of anxiety since active generation of interpretation biases led to congruent changes in state anxiety. A more recent study provided more direct support for the causal role of interpretation biases in anxiety. Wilson, Macleod and Mathews (2006) found that participants who were exposed to training in a benign interpretation bias showed less anxiety in response to a video stressor, relative to those who had received training designed to induce threat congruent interpretations. These studies seem to support the role of interpretation biases in the development or maintenance of anxiety.

The studies discussed above have found that it is possible to manipulate interpretative biases in non-anxious individuals. These studies have also found that such training can impact on immediate anxiety and future anxiety when the bias is deployed in the presence of stress. Given that high socially anxious individuals appear to lack the benign interpretation bias present in the socially confident, it is important to establish whether a benign interpretation bias can be facilitated in this population. There is currently no other published research which has attempted to do this and it remains unclear whether it would be possible. With regards to the effect of training, it has been found that manipulating interpretative biases in a group of non-socially anxious individuals generalised to predictions of anxiety and performance in an imagined future social situation (Hirsch, Mathews & Clark, in press). It is unclear if this generalisation would also occur in a high socially anxious population. Research exploring the effects of training a benign
bias in a high socially anxious population would help to determine the possible therapeutic application of facilitating such a bias.

In terms of the methodology of training interpretative biases, Holmes and Mathews (2005) established the efficacy of using auditory presentation of training descriptions. Their more recent study using positive interpretation training (Holmes, Mathews, Dalgleish & Mackintosh, 2006) found that participants asked to imagine themselves as described in the training scenarios developed a more positive interpretative bias compared to those who were asked to focus on the verbal meaning of the descriptions. Another consideration is the type of benign information used in training materials. Clearly, facilitating a benign interpretation bias could involve presenting specifically positive information, although Alden et al (2004) posited that it may be useful to utilise non-negative feedback i.e. feedback that refers to the absence of negative behaviour (e.g. not looking anxious) with socially anxious individuals. As yet studies using social scenarios to train a benign interpretative bias (e.g. Mathews & Mackintosh, 2000; Yiend et al, 2005; Holmes et al., 2006) have not explored any potential differential effects of positive and non-negative training materials.

The main purpose of the present study was to facilitate a benign interpretation bias in high socially anxious individuals. It was predicted that training a benign interpretation bias would result in more benign and less negative interpretations of ambiguous social events compared to a control condition. In addition, this study aimed to explore the use of both positive and non-negative training materials, although no predictions were made with regard to the differential efficacy of these two types of benign materials. This study used a similar design to that of Mathews and Mackintosh (2000) for training and assessing an interpretation bias, although the scenarios were presentedaurally. In this method, a benign bias was induced by practice in accessing either positive or non-negative outcomes of descriptions of social situations, compared to a neutral control condition. This study also tested if inducing a benign interpretative bias would generalise to less anticipated anxiety and improved predictions of performance in an upcoming social situation. Participants did not actually have to take part in a social situation; however in order to
increase the ecological validity of the findings participants were told that this would be happening. State anxiety was measured at several time points during the experimental session in order to assess any group differences in mood.

2. Method

2.1. Design
High socially anxious participants were allocated to one of three interpretation training conditions: positive, non-negative or control. Benign (positive and non-negative) training groups listened to descriptions of social situations that could be interpreted in a socially threatening way but which were finally resolved as having positive and non-negative outcomes. Participants in the control condition listened to the same initial descriptions of social situations but without the outcome of the situation being specified. After training, participants read a series of new ambiguous social descriptions where the ambiguity was not resolved. Interpretations of these descriptions were tested using subsequent recognition ratings of possible interpretations. Finally, in order to investigate the generalisability of the effects of training, participants rated their anticipated anxiety and performance for an upcoming social situation.

2.2. Participants
Participants were recruited through Kings College, University of London. The Fear of Negative Evaluation (FNE) Scale (Watson & Friend, 1969) was employed as a screening measure for high social anxiety at the University’s freshers’ fayre. To ensure that participants in the present experiment were high socially anxious, they were invited to participate only if they scored 17 or higher at screening (a score shown to be associated with high social anxiety, Stopa & Clark, 2000). In addition, it was necessary for all participants recruited to be fluent in English to allow for adequate comprehension of training and recognition test items.

The participants took part in testing over a six month period after they were initially screened at the freshers’ fayre. However, participants’ data were only included in the study if, on the day of
testing, they met the following criteria: a score of 17 or above on the FNE and an accuracy score on the training task (number of correctly answered comprehension questions) no more than three standard deviations below the group mean accuracy score, to ensure participants had adequately understood the training task. Only one participant’s data were excluded on the basis of inadequate comprehension. Participants were randomly allocated to the three groups. Participant characteristics for the 66 participants (22 in each group) are shown in Table 1. The positive training group included five men, and the non-negative and control groups each included six men. Groups did not differ significantly on scores on the FNE and the Trait form of the State-Trait Anxiety Inventory (STAI: Spielberger, Gorsuch, Lushene, Vagg & Jacobs, 1983), or age.

[INSERT TABLE 1 ABOUT HERE]

2.3. Training Materials and Apparatus

This study had two sets of training materials (positive and non-negative) designed to induce a benign interpretation bias and one control set of training materials which was not intended to manipulate interpretation bias. The three sets of training materials each comprised 95 short auditory descriptions of social situations. The second person ‘you’ was used throughout the descriptions to help participants to imagine themselves as the central character, to encourage self-referential processing. The first part of each of these descriptions was identical across the three conditions and contained context relevant information setting the social scene; however the items ended differently in each condition. The positive and non-negative training items concluded with information that resolved their outcome in a positive or non-negative manner, respectively, whereas in the control training items this resolution was replaced by neutral filler information that did not refer to outcome. All descriptions were presented aurally, via speakers, using the software programme HighImage (Howard, 2004), executed by a Viglen Genie Pentium 450 MHz computer.

Each description was followed by a comprehension question presented on the computer screen. There were 85 training questions and 10 neutral questions. In the sets of materials for benign training groups, training questions reinforced the desired interpretation as these could only be
answered correctly by reference to the benign outcome. Both the positive and the non-negative training questions were the same so that only the social outcome information provided in the text differed between the benign training groups. In the control condition, the comprehension questions were always neutral and did not contain information about emotional valence. A ‘Yes/No’ prompt appeared underneath each question. Participants were required to respond to the questions using the keys Y for Yes and N for No. Answers were followed by feedback (a ‘Correct’ or ‘Incorrect’ response).

Each set of training items included 10 that were followed by standard neutral questions, regardless of group. Again, the first parts of these descriptions were also the same across groups but ended with positive or non-negative feedback or neutral information according to the assigned condition. However, the ten comprehension questions in these 10 items were the same across all conditions and did not pertain to the emotional valence of the description but to other, more factual, information. These neutral question items were included to increase the likelihood of participants in benign training conditions actively processing the entire descriptions and not only attending to the social feedback at the end of the description in order to correctly answer the questions. Items with neutral questions were placed in a random order amongst the other training items. Comprehension questions and feedback on answers were presented visually on a computer screen.

Three versions of an example training item appear below (one for each condition). In each item the description is followed by the comprehension question in italics and the correct answer to this question in parentheses.

**Positive training item**
You’ve been working for the same company for a number of years. Your boss asks you to give a speech at an upcoming conference and you agree to do it. On the day, you walk up to the podium and you are very steady.

*Were you trembling as you walked to the podium? (No)*

**Non-negative training item**
You’ve been working for the same company for a number of years. Your boss asks you to give a speech at an upcoming conference and you agree to do it. On the day, you walk up to the podium and you aren’t shaking.
Were you trembling as you walked to the podium? (No)

Control training item

You’ve been working for the same company for a number of years. Your boss asks you to give a speech at an upcoming conference and you agree to do it. He tells you that a couple of other colleagues will also be speaking.

Were you the only one from your company giving a speech? (No)

The training items were presented as four blocks, with an opportunity for participants to have breaks in between. Items were self-paced by participants pressing P on the keyboard to proceed to the next item.

2.4. Filler Tasks

A ten minute filler interval was used to give the opportunity for any potential group differences in mood to disappear. This was based on Mathews and Mackintosh’s (2000) study which found that group differences in state anxiety following training were no longer evident after ten minutes. Participants were given an unrelated set of filler tasks to complete for the duration of 10 minutes after the training task: the Wechsler Symbol Search subtest (Wechsler, 1997) and Wechsler Digit Symbol - Symbol Copy subtest (Wechsler, 1997), both subsets of the Wechsler Adult Intelligence Scale, and a letter cancellation task where participants were given six lines of letters and were asked to draw a line through all the vowels present. In order to prevent participants from becoming anxious during these tasks they were told that there was no time limit and that they should work at their own pace.

2.5. Recognition Test Materials and Apparatus

The recognition test materials were developed to assess interpretation biases for new ambiguous social situations (see example below). All items were presented visually on a Toshiba laptop computer using MEL (Micro Experimental Laboratory; Schneider, 1988) software. The test comprised of two phases: the initial encoding phase followed by a recognition phase.

During the encoding phase, ten ambiguous descriptions of new social situations, each headed with a brief identifying title (to be used for later cueing purposes), were presented. In this encoding
phase participants read all ten descriptions whilst imagining themselves as the central character. Participants were also asked to answer a comprehension question after each description, but this did not require participants to make an emotional interpretation (i.e. the ambiguity was preserved). An example description (with the comprehension question in italics) follows:

**Raising a Toast to Your Friend**

You're having a meal with friends to mark your best friend going travelling. You ask people to raise their glasses and wish your friend well on her travels. Later, in the pub, you overhear your friends discussing how you appeared to be feeling during the toast.

*Were you celebrating your friend going travelling?*

A practice description preceded the ten descriptions to ensure that participants understood the task. Reading of the descriptions was self-paced by pressing an advance (arrow down) key on the computer for each line but with a 10 second time limit when the next line would appear on the screen.

The recognition phase that followed was designed to assess the interpretations that had been made of the ambiguous descriptions during the encoding phase. This recognition phase provided the critical test of the effect of benign training on interpretations for new ambiguous social scenarios. To cue recognition of a specific text from the encoding phase, participants first saw the identifying title of each encoding description (e.g. ‘Raising a Toast to Your Friend). These titles were followed one at a time by five sentences which were to be rated for recognition (recognition items). For each description there were three “target” interpretations of the final ambiguous sentence of each encoding description. These target recognition items corresponded in meaning to possible positive, non-negative and negative interpretations of the social scenario. There were also two foil recognition items for each description, one positive and one negative, which were not possible interpretations of the ambiguous social feedback provided in the ten descriptions. Foils were included in order to assess a potential response bias for endorsing any information of a certain emotional valence. All five recognition items were structurally similar to the final sentence of the original encoding description and began with the same first set of context-setting words.
Examples of each type of recognition item, which correspond to the above scenario ‘Raising a Toast to Your Friend’, are given below:

- When you overheard your friends, they said you looked relaxed (Positive Target)
- When you overheard your friends, they said you didn't look uneasy (Non-negative Target)
- When you overheard your friends, they said you looked self-conscious (Negative Target)
- When you overheard your friends, they were planning a surprise party for you (Positive Foil)
- When you overheard your friends, they said they won't invite you next time (Negative Foil)

The recognition phase began with a practice set of recognition items which referred to the initial practice description given in the encoding phase. There then followed the sets of recognition items from the ten ambiguous encoding descriptions, each cued with their original encoding title (e.g. Raising a Toast to a Friend). The scenarios were presented in the same order as used in encoding phase of the recognition task, but the order of the five different types of recognition items for each description was randomised across scenarios. Participants were told that none of the sentences they saw (the recognition items) were worded identically to any in the original (encoding) description, but that any number of them could be similar in meaning. Participants were instructed to rate each recognition item independently, for its similarity in meaning to the original encoding description. A 4-point rating scale was used ranging from 1 (very different in meaning) to 4 (very similar in meaning). The rating scale was presented on-screen after each sentence and participants were asked to press the keys with the corresponding number to indicate their response.

2.6. Anticipated Social Situation Test

This test assessed whether training a benign interpretation bias influenced anticipated anxiety and predicted performance for an upcoming social situation. Participants were told that they would be meeting two people that they did not know for a five minute conversation. Participants were asked to rate their predicted anxiety in the upcoming social interaction on a seven point Likert scale ranging from extremely anxious (1) to extremely relaxed (7). They were then asked to rate their
predicted performance in the situation on a similar scale ranging from extremely poorly (1) to extremely well (7).

2.7. Post-Experimental Interview

At the end of the experiment, participants were asked ‘What did you think the study was about?’ Participants were fully debriefed as to the design and the aims of the study and then asked ‘Did you think that at all while you were doing the experiment?’

2.8. Procedure

At the start of the experiment participants completed the FNE and both the Trait and State Anxiety forms of the STAI. They then sat in front of the computer and received instructions describing the training task, which explained the importance of imagining themselves in each situation while listening to the descriptions. Three practice items preceded the main task. After this the experimenter left the room while participants listened to the series of social scenarios used for training and responded to questions presented on the screen.

After the training task was completed, the experimenter returned to the room and participants filled in a STAI-State. Participants then completed the filler tasks and subsequently repeated the STAI-State. Following this, participants completed the recognition test and then filled in a final STAI-State. Next, participants were given the instructions for the anticipated social situation test, followed by the rating forms. Once this test was completed, participants were thanked for their participation and the post-experimental interview was conducted. All participants were paid for taking part in the study.

3. Results

3.1. Analysis of Positive and Negative Targets and Foils

The recognition ratings were used as the main test of the effects of training on interpretations of new ambiguous social scenarios. The prediction was that participants in the benign training groups
(i.e. positive and non-negative) would make benignly valenced interpretations of new ambiguous
descriptions resulting in higher similarity ratings for benignly disambiguated versions. In
particular, the main hypothesis was that participants in the benign training groups would provide
higher recognition ratings for benign targets than the control group and lower recognition ratings
for negative targets. Non-negative targets were not fully balanced within the design (i.e. there
were no non-negative foils) and so were included in separate analyses of targets only (see below).
Table 2 provides mean scores for recognition items.

A mixed-model ANOVA was performed on the recognition ratings with group as the between-
subjects factor and two within subject factors: valence (positive vs. negative item) and type (target
i.e. possible interpretation vs. foil sentence). There was a significant main effect of type, $F(1, 63) = 413.03, p < .001$, with possible interpretations being more highly endorsed than foils (2.30
vs.1.47), and a significant effect of valence, $F(1, 63) = 295.21, p< .001$, with greater endorsement
of positive than negative sentences (2.41 vs. 1.36). The main effect of group was not significant, $F(2, 63) = 1.279$. There were significant interactions of Group by Valence, $F(2, 63) = 11.24,
p<.001$, Valence by Type, $F(1, 63) = 104.68, p< .001$, and Group by Valence by Type, $F(2, 63) = 18.02, p<0.01$. The three way interaction of Group by Valence by Type was investigated further
by analysing the data from foils and targets separately.

Ratings of foils were entered into a mixed model ANOVA of Group by Valence which
demonstrated a main effect of valence, $F(1,63) = 98.32, p<0.001$, with positive foils being more
highly endorsed than negative foils (1.74 vs. 1.19), but no significant effect of group, $F(2, 63) = 1.91$, ns. The interaction between group and valence was not significant, $F < 1$, suggesting that
benign training did not result in an increased general benign response bias.

Ratings of targets were also entered into a mixed model ANOVA of Group by Valence. There was
a main effect of valence, $F(1, 63) = 259.22, p<0.001$, with positive targets being more highly
endorsed than negative targets (3.08 vs. 1.52), but the main effect of group did not reach significance, $F(2, 63) = 1.28$. This analysis also revealed a Group by Valence interaction, $F(2, 63) = 18.30, p < .001$. To further explore this interaction, separate univariate analyses of positive and negative targets were conducted, with planned contrasts used to compare both benign training groups combined versus the control group. Planned contrasts were used to address the main hypothesis that participants in the benign training groups would provide higher recognition ratings for positive targets than the control group and lower recognition ratings for negative targets. Participants in the benign training groups endorsed positive targets significantly more than those in the control group (3.33 vs. 2.59), $t(63) = 4.71, p < .001$ and furthermore endorsed negative targets significantly less than those in the control group (1.36 vs. 1.85), $t(63) = 4.44, p < .001$.

These planned comparisons were followed up by post-hoc t-tests exploring whether there were any differences between the two benign training groups. These tests revealed no differences between the positive and non-negative groups’ endorsements of the positive targets (3.44 vs. 3.22), $t(42) = 1.15, ns$, or the negative targets (1.34 vs. 1.38), $t(42) = 0.36, ns$.

To summarise, the above analyses have shown that benign training resulted in higher recognition ratings for positive interpretations and lower recognition ratings for negative interpretations. Such group differences were not present in the analysis of foil items, indicating that these findings cannot easily be explained by the benign training groups having developed a general response bias.

### 3.2. Analyses Investigating Non-negative Targets

Subsidiary analyses were also conducted investigating non-negative targets. These analyses firstly explored group differences across targets, testing the hypothesis that benign training groups would endorse non-negative interpretations significantly more than the control group. Secondly this analysis explored any possible differences between the benign training groups with regard to the endorsement of non-negative targets. For example, it may have been the case that participants specifically trained to make non-negative interpretations would be more likely to make non-negative interpretations than the positive training group.
Ratings of target items only were entered into a mixed model ANOVA with group as the between subjects factor and target valence (positive, non-negative, negative) as the within subject factor. There was a main effect of valence $F(1, 63), p<0.001$ and of group, $F(2, 63), p<0.01$. However, this was qualified by a significant interaction effect of Group by Valence, $F(2, 63) = 18.30, p<0.001$. To further explore this interaction, given that previous analyses had already addressed group differences on positive and negative targets, a univariate analysis of the non-negative target was conducted, with a planned contrast used to compare both benign training groups combined versus the control group. This revealed a significant difference, $t(63) = 4.71, p<0.001$, with greater endorsement of the non-negative target by the benign training groups than the control group (3.15 vs. 2.40). This planned comparison was followed up by a post-hoc t-test exploring whether there was a difference between the two benign training groups on this target. This revealed no differences between the positive and non-negative groups’ endorsements of the non-negative targets (3.20 vs. 3.09), $t(42) < 1$.

To summarise the findings so far, training with either positive or non-negative materials facilitated both types of benign interpretations (positive and non-negative) equally well, compared to control training. So the effects on interpretation bias were not specific to the type of benign training received. In other words, after both positive and non-negative training, positive and non-negative interpretations were enhanced to an equivalent extent.

### 3.3. Analyses of the Anticipated Social Situation Test

This test was used to assess whether benign interpretation training influenced expectations of how anxious participants would feel in an upcoming social situation and how well they believed they would perform in this situation. Mean scores are shown in Table 3. It was predicted that participants who had received benign training, i.e. positive and non-negative groups, would report less anticipated anxiety and better predicted performance with regard to an upcoming social event than control participants. Univariate analyses of anticipated anxiety and predicted performance score were conducted, with planned contrasts used to compare both benign training groups.
combined versus the control group. Consistent with the hypothesis, this analysis revealed that participants in the benign training groups anticipated that they would be significantly less anxious in the upcoming social situation than those in the control training group (3.25 vs. 2.55), \( t(61.58) \) \(^†\) = 2.54, p <.05. This planned comparison was followed up by a post-hoc t-test exploring whether there was a difference between the two benign training groups in this respect. This revealed no difference between the positive and non-negative groups’ anticipated anxiety (3.31 vs. 3.18), \( t(42) < 1 \). The difference between the benign training groups and the control group with regards to predictions of performance in this situation did not reach significance, although there was a non-significant trend in the direction of the hypothesis, (4.45 vs. 4), \( t(63) = 1.47, p = 0.07 \).

In summary, training a benign interpretation bias generalised to reduced levels of predicted anxiety with regard to an upcoming social event, although it did not generalise to predictions of better performance in this situation.

[INSERT TABLE 3 ABOUT HERE]

3.4. Analyses of State Anxiety over Time

State anxiety was measured using the STAI-State which was administered on four occasions during testing (see Table 4). This was included to assess whether there were group differences in state anxiety which could explain potential group differences in interpretations and anticipated anxiety and performance in an upcoming social situation. Means and standard deviations of these scores are given in Table 4. A mixed model ANOVA of Group by Time of STAI-state (baseline vs. after training vs. before recognition task vs. before social task) was performed to assess any effects of interpretation training on state anxiety over the course of the experiment. There was no main effect of group, \( F(1, 63) = 2.07, \) ns., or time, \( F(3,63) = 1.5, \) ns, and no interaction effect of Group by Time, \( F(2,63) = 1.02, \) ns. In addition, there were no group differences in state anxiety before the recognition task, \( F(2, 63) = 1.364, \) ns., or before the

\(^†\) Note that Levene’s test found that variances were not homogeneous. Therefore the t-statistic was adjusted so as not assume equal variances.
social situation task, \( F(2,63) = 2.509, \) ns. These results suggest that training in a benign interpretation bias did not influence state anxiety before the anticipated social situation was described and furthermore, that any group differences found on the recognition task and the anticipated social situation task were not due to differences in levels of state anxiety.

3.5. Post-Experimental Interview

To the question ‘What do you think the study was about?’ 65.5% of participants replied that they did not know, and 33% gave responses that did not reflect the study hypotheses. These participants thought that the study was related to: anxiety, anxiety in social situations, or to do with memory or thinking, but they were not able to elucidate these ideas. For example, individual participants reported that the experiment was about: “how kind of nervous you get”, “your memory of the task” and “how people relate to social situations”. Only one participant (1.5%) guessed that the training scenarios were designed to influence responses in future social situations. The patterns of statistical findings remained the same when the data from this participant were excluded.

Once participants were informed about the design and aims of the study they were then asked ‘Did you think that at all while you were doing the experiment?’: 74.5% responded that they had not thought that at all; 24% commented that, on reflection, they realised that some of the recognition items were ambiguous or that the training items provided social feedback of the same emotional valence. For example, “I noticed that the social situations were always pretty positive” and “I realised that you weren’t always told exactly what happened in some of the situations”. However, apart from the single individual mentioned above, none came close to guessing that the aim of the study was to influence their responses to social situations.

4. Discussion

In keeping with the hypotheses, high socially anxious volunteers who were trained to access benign interpretations produced higher recognition ratings for benign interpretations of ambiguous
social scenarios and lower recognition ratings for negative interpretations, compared to a control group. Therefore it was possible to facilitate a benign interpretative bias in a high trait socially anxious population. Furthermore, participants trained to access benign interpretations rated their anticipated anxiety in an upcoming social situation as significantly lower, and there was a non-significant trend for expectations of better social performance, compared to participants in the control group. Notably, there were no other group differences in state anxiety across the experiment. Hence, observed group differences in interpretation and anticipated anxiety cannot easily be attributed to prior group differences in state anxiety induced by training. With regard to effects due to type of training, there were no differences between the positive and non-negative groups on recognition ratings for benign and negative targets, or predictions about the anticipated social situation.

Given that mood effects do not seem to be responsible for group differences in interpretation, what other explanations are there for the effects of training? There were no group differences in the ratings of positive foil items and so it seems implausible that a response bias (i.e. a bias to endorse any interpretation of benign valence irrespective of its match with the original description) could account for the data. Although possible, experimenter demand effects also seem a doubtful explanation of the findings given that during the post-experimental interviews only one participant reported being aware of the purpose of the study (and when this participant’s data were excluded from the analyses the pattern of results remained the same). One possible account of the mechanism underlying the effects of training is given by Mathews and Macleod (2002), who proposed that repeated practice in accessing benign interpretations primes the cognitive process of selecting a benignly valenced meaning over a threatening one when encountering novel ambiguous stimuli. Alternatively, the development of a benign interpretative bias may have been due to a process similar to conditioning via informational acquisition (Rachman, 1977). This could have occurred if participants learnt to associate social scenarios with a benign interpretation.

Training also influenced participants’ reports of anticipated anxiety with regard to an upcoming social situation. Again, since this does not appear to be due to mood effects, what are the possible
explanations? One possibility is that it was due to a direct effect of a benign interpretation bias, where participants interpreted the upcoming (and at this stage ambiguous) social situation in a more benign way and thus expected to be less anxious. Alternatively, less directly, participants may have imagined themselves in the upcoming situation and the content of these self-images may have been similar to those in the training scenarios. This possibility arises because Hirsch, et al. (in press) had previously found that non-anxious volunteers trained using similar methods, who were subsequently presented with ambiguous scenarios and asked to produce an image, generated images that were congruent with the type of training they had received. Hence, an acquired interpretation bias can influence subsequent self imagery. Given this, the current data may be accounted for by the benign interpretation training resulting in more benign self imagery which in turn may have elicited less anticipated anxiety. However, clearly, further research would be needed to test this purely speculative hypothesis.

It is notable that this study found no differences between positive and non-negative training materials in terms of the apparent interpretation bias. Furthermore, there was no advantage for one set of benign training materials over the other with regard to reported anticipated social anxiety or performance predictions. The findings of Alden et al. (2004) suggested that socially phobic individuals may particularly benefit from non-negative feedback. Non-negative feedback may be more important in severe clinical phobias than for the highly socially anxious participants in the present study. However, another difference that may be critical is that the aim of present study was to facilitate a cognitive bias via repeated access to benign interpretations, in contrast to Alden et al. (2004), where participants were provided with feedback from another person on their performance in a single social situation. It may be that the particular valence of the benign material (positive or non-negative) was less important in this study because any initial differences in response disappeared as the repeated exposure involved in both types of training provided participants with a more benign way of viewing social situations.

To our knowledge, this study is the first to show that the training effect demonstrated by Mathews and Mackintosh (2000) can be extended to a socially anxious population. This finding is important
because it shows that the interpretative style of high trait socially anxious individuals is not invariable but rather that it can be beneficially modified. While Stopa and Clark (2000) noted that cognitive biases evident in high socially anxious populations (at the time of publishing) are also evident in patients with social phobia, future research is needed to establish whether individuals with social phobia can be trained to develop more benign interpretive biases and whether this also impacts on anticipated anxiety. It also remains unclear whether increased access to positive interpretations, increased access to non-negative interpretations, or decreased access to negative interpretations, or some combination of these, were important in reducing anxiety levels. Further research could attempt to tease these possible mechanisms apart.

A further limitation of this study is that it addressed expected rather than actual anxiety and performance. In other words, participants reported the anxiety they anticipated they would feel in an upcoming social situation and how well they thought that they would perform. It is unclear whether this would generalise to either anxiety levels or performance beliefs if participants actually had to enter a stressful social situation. However, the anxiety that individuals report when anticipating - or even just thinking about - entering such social situations is enough of a clinical problem that treatment programmes have developed specifically to deal with it (Clark, Ehlers, Hackman, McManus, Fennell, Grey, Waddington & Wild, 2006). Therefore, it seems important to explore the effect of an interpretative bias on predictions about future social situations, although further research needs to also assess the anxiety experienced in real social situations.

Furthermore, given the current findings, it is important for further research to replicate this study in a clinical population with social phobia. This research could also usefully explore the effects of training on different aspects of social anxiety and the durability of such effects. In addition, future research could usefully explore whether similar effects may be found using a test phase of a very different form to that of the training phase, such as using the same training phase used here with a homophone test of interpretation. Of note, we have only found a trend for the effect of benign training on predictions of performance and so further research, for example using a multi-session
training procedure (Yiend & Mackintosh, 2004; Mathews, Ridgeway, Cook & Yiend, 2006), is needed to establish whether training can generalise to predicted performance.

Previous research has shown that social phobia is characterised by the absence of the positive cognitive biases exhibited by low anxious individuals (Hirsch & Mathews, 1997, 2000; Garner, Mogg & Bradley, 2006). Given this, it makes sense to develop clinical techniques to help facilitate positive biases in clinically anxious individuals in order to help them to see the world through non-anxious eyes. Despite the requisite caution needed in generalising the results of this study to a clinical population, it appears that the findings have some interesting clinical implications for how to facilitate a positive interpretation bias in socially anxious individuals. In the past, traditional cognitive-behavioural interventions often focused on challenging negative interpretations, for example by generating contrary evidence. However, across disorders, there appears to be an increasing clinical focus on building up positive cognitive content and processes (e.g. Clark, Ehlers, Hackman, McManus, Fennell, Grey, Waddington & Wild, 2006; MacLeod & Moore, 2000). The findings from this study support this change in clinical focus, suggesting in particular that helping individuals to practice accessing benign interpretations of social situations may be sufficient to facilitate a benign interpretative style.

It is also interesting to consider the differences between the nature of this study’s laboratory task and a therapeutic intervention. In cognitive-behavioural therapy clients’ unhelpful beliefs tend to be activated, even if only indirectly via the process of encouraging the development of more helpful beliefs. However, in this study most participants did not report being aware of the purpose of the study. This may have had the advantage of avoiding the activation of any negative beliefs that participants may have held about themselves in social situations and resistance to change. Indeed, using this method, participants may have built up relatively ‘automatic’ benign interpretations of ambiguous social events. On the other hand, further research would be needed to establish the long-term effectiveness of such an approach, given that more core cognitions may remain unchanged. In addition, this study suggests that facilitating a benign interpretation bias in socially anxious individuals may be achieved by practice in accessing several either positive or
non-negative interpretations. Thus, in clinical interventions it might be helpful to facilitate clients to generate either form of benign interpretation. In summary, this study has demonstrated an effective way of facilitating a benign interpretation bias in a high socially anxious population and shown that this has a beneficial effect on important aspects of social anxiety.

**Acknowledgements**

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References


Table 1

Participant characteristics means (standard deviations in parentheses)\textsuperscript{a}

<table>
<thead>
<tr>
<th></th>
<th>Positive condition</th>
<th>Non-negative condition</th>
<th>Control condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>S.D.</td>
<td>M</td>
</tr>
<tr>
<td>FNE</td>
<td>24.59 (3.57)</td>
<td>23.05 (3.47)</td>
<td>23.45 (4.06)</td>
</tr>
<tr>
<td>STAI-Trait</td>
<td>44.86 (9.99)</td>
<td>47.45 (8.03)</td>
<td>48.95 (9.28)</td>
</tr>
<tr>
<td>Age</td>
<td>20.95 (3.30)</td>
<td>20.18 (2.34)</td>
<td>20.68 (4.75)</td>
</tr>
</tbody>
</table>

\textsuperscript{a}No significant differences in participant characteristics were found between groups.

Table 2

Mean Recognition Ratings (with standard deviations in parentheses)\textsuperscript{b}

<table>
<thead>
<tr>
<th></th>
<th>Target</th>
<th>Foil</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive</td>
<td>Non-negative</td>
</tr>
<tr>
<td>Group</td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td>Positive</td>
<td>3.44 (0.62)</td>
<td>3.20 (0.59)</td>
</tr>
<tr>
<td>Non-negative</td>
<td>3.22 (0.64)</td>
<td>3.09 (0.68)</td>
</tr>
<tr>
<td>Control</td>
<td>2.59 (0.58)</td>
<td>2.40 (0.54)</td>
</tr>
</tbody>
</table>

\textsuperscript{b}Scores range from 0-4. Higher scores represent higher recognition ratings and therefore greater endorsement of the recognition item.
**Table 3**

*Mean Anticipated Anxiety and Predicted Performance Ratings (with standard deviations in parentheses)*

<table>
<thead>
<tr>
<th>Group</th>
<th>Anticipated Anxiety $^c$</th>
<th>Predicted Performance $^d$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>3.32 (1.55)</td>
<td>4.46 (1.10)</td>
</tr>
<tr>
<td>Non-negative</td>
<td>3.19 (1.33)</td>
<td>4.46 (1.18)</td>
</tr>
<tr>
<td>Control</td>
<td>2.55 (0.80)</td>
<td>4.00 (1.27)</td>
</tr>
</tbody>
</table>

$^c$ Predicted anxiety in the upcoming social interaction was rated on a seven point Likert scale ranging from extremely anxious (1) to extremely relaxed (7).

$^d$ Performance was rated on a similar scale ranging from extremely poorly (1) to extremely well (7).

**Table 4**

*Ratings of state anxiety over time (with standard deviations in parentheses)*

<table>
<thead>
<tr>
<th>STAI-State 1: Baseline</th>
<th>STAI-State 2: After training</th>
<th>STAI-State 3: Before recognition</th>
<th>STAI-State 4: Before anticipated social situation task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>$M$ (SD)</td>
<td>$M$ (SD)</td>
<td>$M$ (SD)</td>
</tr>
<tr>
<td>Positive</td>
<td>34.78 (9.00)</td>
<td>32.10 (11.04)</td>
<td>32.50 (9.06)</td>
</tr>
<tr>
<td>Non-negative</td>
<td>36.86 (9.38)</td>
<td>35.18 (10.40)</td>
<td>34.55 (11.15)</td>
</tr>
<tr>
<td>Control</td>
<td>38.18 (8.46)</td>
<td>38.18 (7.06)</td>
<td>37.04 (6.66)</td>
</tr>
</tbody>
</table>

$^e$ Scores range from 20-80, where higher scores represent higher levels of anxiety.