Impaired positive inferential bias in social phobia.

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Abstract

Social phobics report anticipatory and retrospective judgements about social situations that appear consistent with negatively-biased interpretations. However, it not at all clear that biased interpretations are made at the time that ambiguous information is first encountered (i.e. “on-line”), rather than at other times, perhaps based on other sources of information. In a previous text comprehension study, volunteers who were anxious about interviews were found to lack the positive on-line inferential bias that was characteristic of non-anxious controls, but also failed to show a bias favoring threatening inferences (Hirsch & Mathews, 1997). This finding was confirmed in the present study, in which social phobics showed no evidence of making on-line emotional inferences, in contrast with non-socially anxious controls who were again clearly biased in favor of positive inferences. We conclude that non-anxious individuals are characterised by a benign inferential bias, which may protect self-esteem, but that this is impaired in social phobics.
The complexity of social encounters often forces us to draw inferences about the intentions, thoughts and feelings of others. A mild joke at our expense, a failure to respond fully to a greeting, or a temporary disagreement, can all be interpreted in a benign way, or as a serious threat to our self-esteem. The thoughts typically reported by social phobics (such as “I am a very boring person”, or “I’ll go red and everyone will notice”; see Stopa & Clark, 1993), could thus be seen as the outcome of a biased inferential process, leading to negative interpretations of ambiguous social information that serve to maintain or increase social anxiety. Support for this view, however, depends mainly on research studies obtaining anticipatory or retrospective estimates of subjective probability or cost of negative social events from questionnaires (see Lucock & Salkovskis, 1988; Foa, Franklin, Perry & Herbert, 1996; Amir, Foa, & Coles, 1998).

According to the Clark & Wells cognitive model (1995, see also Wells & Clark, 1997), in social situations the attention of social phobics shifts from processing external information - such as feedback from other people - to an internal self-focus. Consequently, reported judgements are less likely to arise from interpretations of external information made at the time of the event, but rather from internal self-images based on pre-existing negative beliefs. In support of this position, Hackmann, Surawy & Clark (1998) and Wells, Clark & Ahmad (1998) found that social phobics often report stereotyped negative self-images occurring in social settings; for example, images of themselves blushing, as seen from an “observer perspective”. These distorted images are thought to be used by phobics when judging their own social performance, rather than basing their judgements on
processing external social cues. Wells & Clark (1997) further describe social phobics as typically engaging in negatively-biased anticipatory processing prior to a social event, and “post-mortem” processing afterwards. This processing typically draws on pre-existing negative beliefs and the content of negative self-images, and so may be relatively independent of interpretations of external feedback made at the time of an actual social event. Thus a social phobic may base their post-mortem judgement of poor performance on an image of themselves blushing, or behaving clumsily, without reference to external social cues.

Following the convention used in text comprehension research, we will distinguish between “on-line” inferences, in which interpretations are made at the time that ambiguous information is first encountered; and “off-line” processing, in which interpretations are made retrospectively. The negative judgements of social phobics can thus be understood in at least two ways. The first hypothesis assumes that they arise because social phobics routinely interpret ambiguous social information on-line in a negatively-biased fashion. These biased interpretations are then accessed later when making post-mortem judgements, or when anticipating similar situations in the future.

The second hypothesis is that social phobics do not routinely make on-line inferences about ambiguous social information, perhaps because they tend to rely on other sources of information when judging their own performance (e.g. self-imagery). This contrasts with non-phobic individuals, who do use external cues to generate on-line inferences, as will be documented later. Such non-phobic inferences appear to be biased in a positive direction, perhaps thereby serving to protect self-
esteem and mental health, as suggested by Taylor & Brown (1988). If so, then social phobics’ failure to use external cues and make positive inferences might prevent them from modifying their negatively-biased self-images.

Experimental evidence of interpretation bias related to anxiety.

In order to resolve the issue of whether emotional inferences are made on-line or not, several researchers have exposed participants varying in anxiety level to emotionally ambiguous text, and then assessed how it was understood at the time. For example, Eysenck, Mogg, May, Richards & Mathews (1991) had patients with Generalised Anxiety Disorder (GAD), recovered GAD patients and non-anxious controls listen to a set of sentences that could be understood in a threatening or more positive manner, such as "The doctor examined little Emma's growth". Alternative versions of these sentences, that had been changed so as to make them unambiguously threatening or relatively positive (e.g. by referring to cancer versus height), were then rated for similarity of meaning to the recalled originals. In two experiments, the non-anxious groups rated positive versions as being more similar in meaning to the original than threatening versions. Currently anxious patients, however, rated both as being equivalently similar in meaning to the original. On the face of it, this suggests that non-anxious individuals are biased in favor of non-threatening or positive interpretations, while anxious patients are more even-handed. However, this data does not conclusively demonstrate that inferences were made on-line. This is because participants could...
have recalled either the original sentence and/or both possible interpretations, and then have retrospectively selected one or other meaning to endorse.

To overcome this methodological problem, Calvo, Eysenck & Estevez (1994) presented test-anxious students with incomplete sentences that implied a threatening continuation, and then immediately required a speeded lexical (word/non-word) decision for probe words that were either consistent with the threatening continuation, or disconfirmed it. The logic of this method is that if readers have already made an inference about the likely outcome, then they will be faster to recognise a word that matches this inference. The main finding was that non-anxious controls were faster than test-anxious students to endorse word probes that disconfirmed a threatening continuation, although there were no group differences for probes that confirmed the threatening inference. This finding implies that the non-anxious controls were more likely than were test-anxious students to have made on-line inferences about a positive outcome. These results, albeit obtained with non-clinical populations, are consistent with those of Eysenck et al (1991) in suggesting that non-anxious controls are biased in favor of non-threatening interpretations, but that this positive bias is absent in anxious groups. Other studies using similar methods and materials, and student participant groups varying in anxiety level, have revealed comparable results (MacLeod & Cohen, 1993; Calvo, Eysenck & Castillo, 1997; and Calvo & Castillo, 1997).

In three experiments using longer and more realistic texts, Hirsch and Mathews (1997) investigated whether emotional inferences were made while volunteers read and imagined personally-involving descriptions of job interviews.
Participants were community volunteers who responded to advertisements for people experiencing excessive levels of anxiety in social situations such as job interviews, and who had high scores on a questionnaire developed to assess interview anxiety; or were matched non-anxious controls. Narrative texts describing interviews were developed that incorporated critical ambiguous sentences, compatible with either a negative or a positive interpretation, depending on their last word. These sentences were selected from those found to differentiate high from low socially-anxious participants in pilot work, and then re-worded to leave them ambiguous until the final word (see Hirsch & Mathews, 1997, for development details).

In the first experiment, participants read about and imagined themselves being interviewed, and at the critical ambiguous points made a speeded decision about whether these final words could grammatically complete the sentence. For example, after reading the incomplete sentence: “You tell the interviewer your idea and she seems to be .....”; participants could be offered the probe word “interested”, and required to decide as quickly as possible whether this would legitimately complete the sentence. Participants reporting severe anxiety in interviews endorsed either threatening or benign (as in the above example) probe words at about the same speed. Responses to threatening probes by non-anxious controls were similar to those seen in the anxious group, but their latencies to endorse non-threatening or positive probes were significantly speeded. By implication, the non-anxious participants had made positive inferences on-line, thus speeding their endorsement of words matching such interpretations, but not of words matching threatening
inferences. The same logic implies that the anxious group either made both negative and positive on-line inferences, or made neither.

In a second experiment the grammatical verification task was replaced by the lexical decision task; as the latter does not force readers to refer back to the text and may therefore be a more appropriate measure of spontaneous inferences. Comparison groups scoring at either low or intermediate levels on the questionnaire measure of interview anxiety were faster to endorse probe words matching positive rather than negative inferences. The group reporting unusually high levels of interview anxiety again showed no differences between probe types, with both latencies being similar to those of responses to threatening probes by the non-anxious groups. That is, regardless of probe valence, the anxious participants’ responses were similar to those of controls made under conditions when they apparently did not make inferences.

Finally, in a third experiment comparing high versus low interview anxious participants, group differences were abolished when the same probe words were repositioned at irrelevant points in the text, where any inferences were unlikely. Comparison of these data with those from the earlier experiments thus indicated that the group differences found previously were most likely due to the generation of on-line positive inferences by the low anxious control groups.

Rather than demonstrating an on-line bias favoring negative inferences in socially anxious individuals, these data are actually more consistent with the view that anxious populations do not routinely make on-line inferences at all. On the other hand, non-anxious controls seem to be much more likely to generate non-
threatening or positively-biased inferences on-line. Excessive social-anxiety may be 
associated more with the absence of a protective positive bias that is characteristic of 
healthy populations, rather than with an on-line bias in favor of threatening 
interpretations. So far the data are more consistent with the second hypothesis put 
forward earlier to the effect that reported negatively-biased judgements in social 
phobics are based on some other source of information, such as pre-existing beliefs, 
rather than on-line inferences. None of the above studies, however, included a 
clinical group of social phobics, so that it remains possible that, contrary to previous 
evidence, such a population would show evidence of on-line negative inferences. It 
seems important to investigate this issue, to clarify any possible differences between 
social phobics and other anxious groups, and because it may have implications for 
the appropriate target of cognitive therapy.

**Form and purpose of the present study.**

The main purpose of the present study was to extend the method used by 
Hirsch & Mathews (1997) to social phobics, and test if the previous findings could be 
replicated in a clinical population. Perhaps, in this more severe form of social 
anxiety, there might be a shift towards more active generation of negative inferences. 
However, based on the foregoing evidence and discussion, our hypothesis remained 
that social phobics will not make any emotional inferences on-line, perhaps because 
their processing resources are directed elsewhere.

One problem in resolving this question is the lack of a fully satisfactory 
baseline condition, so that latencies assumed to reflect variations in whether
inferences were generated or not, as yet cannot be compared with a standard condition without such variation, in the same individuals. The pattern of the data reported by Hirsch & Mathews (1997) showed that latencies were similar across groups (including those in a separate “non-inference” baseline experiment), with the exception of faster endorsement of probes matching positive inferences in mid and low anxious groups. As indicated earlier, this suggests that mid and low anxious individuals actively generated positive (but not threatening) inferences, and that highly anxious groups generated neither positive nor negative inferences on-line.

To further test our hypothesis that social phobics do not make unforced emotional inferences, the design used by Hirsch & Mathews (1997, experiment 2) was modified by adding a within-participant baseline condition. In this new baseline condition, probes followed sentences designed to ensure that that all readers would be forced to the same inference, and thus speed responses to the subsequent probes (see materials for an example). If social phobics do routinely make unforced inferences when encountering emotionally ambiguous information, then responses to probes under these latter conditions should be as fast as those in the baseline condition, when such inferences are forced. Alternatively, if they make no inferences at all, then response latencies following ambiguous information should always be slower than in the baseline condition.

In other respects the present experiment resembled that described by Hirsch & Mathews (1997, experiment 2). Social phobics and matched non-anxious controls read realistic narrative descriptions of interviews, written so that despite easy comprehension of literal meaning, the emotional implications of the situation
remained ambiguous. Possible interpretative inferences were assessed at several critical points in each text from speeded lexical decision times to probe items. The critical sentences were adapted from those found in development work (reported in Hirsch & Mathews, 1997) to distinguish between the responses of socially-anxious versus confident individuals in their descriptions of interviews. In a counterbalanced design the probe words presented in ambiguous contexts were presented at other points where a given inference was very likely to have been generated by all readers, irrespective of anxiety. THE DEVELOPMENT WORK WAS ON NON-ANBIGUOUS SENTENCES- MENTIONED EARLIER. THERE ARE NOW BOTH THREAT AND NON-THREAT VERSIONS OF THE AMBIGUOUS ENDINGS TO THE SENTENCES- BEFORE IT WAS NOT COUNTERBALANCED. I AM NOT SURE HOW MUCH OF THIS NEEDS TO BE SAID HERE.

Because we expected that non-anxious controls would generate positive inferences only, our predictions for this group were that endorsement latencies for positive probes would be as fast as in the forced-inference baseline condition; but that endorsement of negative probes would be significantly slower. We also predicted that social phobics would make neither positive nor negative inferences on-line, so that in this group responses to both type of probe should be slower than in the baseline condition.

METHOD

Design
Twelve social phobics and twelve matched controls read six realistic descriptions of being interviewed for a job, and responded as quickly as they could to word or non-word lexical decision probes that appeared unpredictably at critical points in the text. A given set of real-word probes included both threatening and relatively positive resolutions to the ambiguous incomplete sentence that they followed. Decision latencies for these probes were taken to reflect the availability of the matching emotional inference. Within a counter-balanced design, the other set of word probes were presented at different points, where they represented a forced inference from the preceding text, and thus provided a baseline measure of the latency to be expected when a matching inference was highly available to all participants. A comparison of latencies for probes following emotional ambiguity with this baseline could then be used to assess whether emotional inferences had been made on-line. That is, if inferences had been made from the preceding ambiguous text, then decision latencies should be similar to baseline values. If such inferences had not been made, however, then decision latencies following ambiguity should be significantly slower than baseline.

Participants

The social phobia and control participants were matched for gender, age, and years of education. The mean age of the social phobia group was 32 (s.d. 6.9; range 22-45) and for the controls it was 32.5 (s.d. 7.4; range 24-49). Both groups included five women and seven men. The twelve clinical participants were all volunteers currently receiving treatment for social phobia, but all remained severely phobic at
the time of testing and none gave any indication that treatment had as yet reduced their phobic symptoms, so that there was no reason to believe that their performance was affected by treatment already received. Four had remained phobic despite medication for 6 weeks or longer, three had begun a behavioral exposure procedure (none more than 5 sessions), and five had begun cognitive-behavior therapy (CBT, none more than 3 sessions). They were referred from within the Maudsley Hospital by psychologists, psychiatrists, or behavior nurse-therapists. All patients had been diagnosed as having social phobia using DSM IV criteria by the mental health professional working with the client. This diagnosis was verified with the SCID (Spitzer, Williams, Gibbon & First, 1992), administered by the first author (a Clinical Psychologist) immediately after testing. Ten patients had generalised Social Phobia, while two were phobic of specific social situations. In both of the latter these fears included interviews, and one of them also feared public speaking.

Of the twelve volunteers in the control group, eight were recruited from the local community, and four others were porters or kitchen staff at the Institute of Psychiatry or Maudsley Hospital. None were in treatment for psychiatric problems, nor did any reach criteria for social phobia as assessed by the SCID. No control participant was therefore excluded on psychiatric grounds, and all were paid £12 for taking part in the study.

Participants completed a 20-item set of statements found in earlier work (Hirsch & Mathews, 1997) to distinguish between people high and low in anxiety about interviews (Interview Anxiety Questionnaire, IAQ; for development details see Hirsch & Mathews, 1997). Each item (e.g. “When I have an interview, I get so
nervous I forget facts I really know") was rated on a 5-point scale from "strongly agree" to "strongly disagree", with maximum anxiety thus corresponding to a score of 100. To ensure that those in the social phobia group reported feeling anxious about job interviews, they were required to score 65 or higher on the IAQ. As expected, the social phobia group had higher scores than controls on the IAQ; 79 (s.d. 8.4, range 66-95) versus 48 (s.d. 17.3, range 30-86), t (22) =5.6, p< 0.001 1.

Participants also completed the Trait form of the State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg & Jacobs, 1983); and the Hospital Anxiety & Depression Inventory (HAD; Zigmond & Snaith, 1983). Social phobics had higher scores on all questionnaire measures: for STAI-T, 58 versus 38, t(22)= 5.6, p< 0.001; for the HAD anxiety scale, 13.7 versus 6.5; and for HAD depression, 7.7 versus 2.5, both p’s<.01. Only one social phobic had scores falling clearly within the severe range for Depression (17 on the HAD depression scale, see Snaith & Zigmond, 1994). Removal of this participant from subsequent analyses made no difference to the results, so these are reported for the whole group.

To ensure that the groups were also matched for their ability to understand the experimental material and perform the lexical decision task, participants were included in the final groups only if they correctly answered 75% or more of the comprehension questions that followed the interview descriptions (see later under materials); and 66% of the lexical decisions were correct in each type of probe trial. Participants (particularly in the clinical group) were drawn from a socially-deprived area in South London, characterised by low average years of education and socio-economic levels: consequently, an unusually high proportion had poor reading
skills. Data from ten people with social phobia and four people recruited for the control group were excluded from the analysis because they failed to reach performance criteria on the comprehension and/or lexical decision tasks. Other than poor reading skills, there were no obvious differences between patients included or excluded from the study, or any other reason to believe the final group to be unrepresentative of social phobics in general.

**Materials and Apparatus**

Eight descriptions were presented, adapted from those used by Hirsch and Mathews (1997): two were short practice descriptions of common social situations, and six were about interviews for different types of job (varying from a position in a bank, to supermarket checkout). These six critical descriptions ranged in length from 528 to 690 words, and from 93 to 137 lines of text.

The descriptions were designed to be emotionally neutral in relation to the person being interviewed, except for the resolution of ambiguity from probe words (see below). No emotional descriptors relating to the protagonist were included, and no information about the success or failure of the interview was given, in the text itself. To maximize readability the descriptions had grammatically simple constructions, using high-frequency, regular words whenever possible. The incomplete sentences followed by threat versus non-threat probes were matched for grammatical complexity (as assessed by the Flesch readability formula; Flesch, 1948).

[Insert table 1 about here]
There were a total of 48 probe words, 24 designed in their ambiguous contexts to produce a threatening resolution, and 24 a non-threatening resolution (see Table 1). Each set of 24 was then further subdivided into two matched subsets, so that a subset could be assigned to each of the two context conditions, with the subset assigned to each condition being counter-balanced across participants within groups.

In the first condition, at critical ambiguous points in the text, probe words were presented that would produce either a threatening or non-threatening resolution. These probes and the associated text had been developed in extensive pilot work with interview-anxious volunteers at the MRC Cognition & Brain Sciences Unit, Cambridge (see Hirsch & Mathews, 1997). For example, one critical incomplete sentence and following probe were:

(1) You wonder if, when you are in the interview, all your preparation will be
(2) forgotten. [probe for ambiguous threatening inference]

In the second (baseline) condition, probe words appeared at points in the text, where they matched inferences that would be accessible for all readers. To develop these baseline text contexts, pilot versions in the form of incomplete sentences were presented to other volunteers, who were asked to complete each with the first word that came to mind. These versions were included only if 85% of completions offered matched the intended probe word or was a very close synonym. Pilot versions that did not elicit this extent of agreement were reworded and retested until they did so.
An example of a baseline sentence, designed to elicit the inferred probe word “forgotten” is shown below.

(3) If it is important to remember a particular detail, then it is annoying if it is

(4) forgotten [probe for forced inference]

In addition to the 48 critical word probes, there were also 48 non-word probes constructed by replacing letters from 24 threat and 24 non-threat words, which were equivalently placed in either ambiguous and baseline contexts. After a non-word probe was presented, a neutral completion of the sentence was provided. For example:

(5) The interviewer asks you to tell them more about your last job and you think this means that they are

(6) ageering [to-be-rejected non-word probe]

(7) listening. They then . . . [continuation]

At the end of each description, three verification questions, unrelated to the probe trials, were presented as a check on comprehension. Descriptions were presented on an IBM computer, with the screen approximately 35 centimetres from the participant, controlled by Micro Experimental Laboratory software, version 2.0 (Schneider, 1995). Each line of text, or probe word, was revealed by volunteers pressing the “arrow down” key (labelled “A” for advance) on a standard keyboard, positioned in front of the participant. Yes/no lexical decision and comprehension responses were made by pressing the right and left arrow keys.
(labelled Y and N respectively). When an incorrect response was made, or if there was no response within two seconds, a computer-generated tone signalled the error.

Procedure

Participants were seated in front of the computer, with their fingers on the advance, Y and N keys, and asked to read the instructions on the screen. They were instructed that their main task was to answer correctly the comprehension questions at the end of each description and that the secondary task was to indicate, as quickly as possible, whether probes that appeared during the text were English words or not.

After two practice descriptions had been completed, the experimenter left the room, and the six interview descriptions were presented in a random order determined by the program. Each situation was first briefly introduced, and participants reminded to imagine themselves in that situation while reading. Each time the advance key was pressed a new line of text appeared, masking the previous line, until a probe trial occurred. This began with a row of flashing question marks for 750 ms, warning that a lexical decision trial was beginning, followed by the presentation of a probe word or non-word until the participant responded, or two seconds had elapsed. After another one-second pause the next line of text appeared. The type of probe trials varied unpredictably throughout each text, and were separated by varying numbers of lines, so that appearance of the next probe could not be anticipated.
When each description had been completed, the three comprehension questions were presented. After the final description had been read, the experimenter returned and participants completed the 20-item interview anxiety questionnaire (IAQ), the State-Trait Anxiety Inventory (Trait version; Speilberger, 1983), and the Hospital Anxiety and Depression scale (Zigmond & Snaith, 1983). The SCID (Spitzer, Williams, Gibbon & First, 1992) was then administered, and finally the participants were thanked and paid for their time.

RESULTS

Accuracy data.

An independent t-test of accuracy scores for the 18 comprehension questions showed that there was no significant difference in mean percentage of correct responses between the social phobia and control groups; 84.7 % (s.d. 5.7) vs. 85.7 % (s.d. 8.0); t(22) = -0.3, n.s. This confirmed that groups did not differ in their understanding of the non-ambiguous aspects of the text.

Mean percentage errors for probe word decisions in all participants was 4%. An analysis of the accuracy data was conducted using a mixed model ANOVA, with one between-participant factor of group (social phobia versus control) and repeated within-participant factors of probe valence (threatening versus non-threatening) and inference context (ambiguous versus forced). The only significant effect was due to context, with responses following forced inferences being more accurate; 97.2 % vs.
94.8%, $F(1,22)= 5.04, p< .05$. There was again no evidence of any accuracy differences between groups.

**Latency data.**

Only latencies for word probes were analyzed, as our hypotheses did not concern rejection times for non-word probes. Analyses were performed on the median latencies for correct responses to probes matching threatening and non-threatening inferences, and within each context condition. Medians are commonly used in the analysis of reaction time data when estimates are required of the central location of distributions that are less sensitive to long outlying values than are means (Ratcliffe, 1993). Means of these median latencies are shown in Table 2. Mixed model ANOVAs were as above, with group as the between-participant factor, and probe type and context as within-participant factors.

There was a significant main effect of context, $F(1,22)= 18.72, p< 0.001$, with faster reaction times for probes in the baseline condition than in an ambiguous context (845 versus 892 ms.). There was also a marginal trend towards a two-way interaction between group and context, $F(1,22)= 4.27, p<0.06$, but both of these effects were qualified by a significant three-way interaction between group, probe valence and context, $F(1,22)= 6.3, p< 0.05$. This three-way interaction was investigated further by analyzing the data from social phobia and control groups separately.

ANOVA of data from the social phobia group revealed only a significant main effect of context, $F(1,22)= 20.43, p< 0.001$, with faster median latencies for
probes in the baseline condition, (884 vs. 953 ms.). There was no effect of probe valence; mean for threat 926 ms., non-threat 911 ms., F(1,22) = 0.43; nor was there a significant interaction of probe valence with context, F(1,22) = 0.91. Thus the social phobia group responded more slowly to either threat or non-threat probes presented in the ambiguous context, compared with the forced-inference baseline condition. Both comparisons were individually significant when contrasted across contexts: for threatening probes, 955 versus 896 ms., t (11) = 3.9, p< .01; for non-threatening probes, 951 versus 872 ms., t(11) = 4.5, p<.01.

An identical analyses for the control group revealed only a significant interaction between probe type and context, F(1,22) = 6.79, p< 0.05. From Table 2, it can be seen that the controls had slower latencies for threat probes when they were in an ambiguous context than when they were in the baseline condition; 856 versus 804 ms, t(11) = 2.3, p<.05. However, when responding to non-threatening probes there was no slowing at all attributable to an ambiguous context, and latencies were essentially identical; 804 versus 807ms., t(11) = 0.15, n.s.

[insert Table 2 about here]

DISCUSSION

The present experiment provides further confirmatory evidence that non-anxious controls make positively-valenced on-line inferences in an ambiguous social context. At points of emotional ambiguity, these participants endorsed probe words
matching unforced non-threatening interpretations as rapidly as in the forced-inference baseline condition. In contrast, these same participants were significantly slower to endorse probe words matching a socially-threatening inference than in the baseline condition. Since this baseline was designed to provide an estimate of latencies when matching inferences had almost certainly been made, this implies that non-anxious participants did not make threatening inferences. The finding of a positive on-line bias in non-anxious individuals thus seems to be robust, and also confirms that the method used is sensitive to emotional inferences.

Furthermore, consistent with our hypothesis and with earlier findings, social phobics did not show any such evidence of unforced on-line inferences. In an ambiguous context, phobic participants were significantly slower to endorse words matching either valenced interpretation than they were in the forced-inference baseline. The alternative possibility - that socially anxious individuals might make both threatening and benign inferences on-line - is clearly not supported. Rather, the data is again consistent with the hypothesis that high levels of social anxiety are associated with a failure to generate such unforced emotional inferences. Under the present experimental conditions at least, social phobics seem to differ from non-anxious individuals mainly in lacking a positive interpretative bias.

Before considering the implications of this conclusion, a number of possible objections need to be considered. First, it might be thought that the absence of evidence for on-line inferences in social phobics was due to some special features of the current sample, such as concurrent depression, medication, other treatment or poor reading ability. While it is impossible to rule them out completely, we do not
consider these features to be likely explanations for the findings. First, only one social phobic had a depression score clearly in the clinical range, and removal of this individual left results unchanged. Removal of all those on medication would have left too few for analytic purposes, but the means for medicated and unmedicated participants were similar. Although five had just begun CBT, none had received more than three sessions, and all remained severely phobic at the time of testing. Finally, we had removed all poor readers from the sample, and there were no remaining differences in comprehension or lexical decision accuracy between the groups. Despite this similarity in reading ability across groups, only the non-anxious participants made unforced inferences. Another possible concern might be that the interview descriptions did not tap the specific fears of social phobic patients; or conversely, that the material may have aroused too much anxiety and thus interfered with all responding. We chose job interviews for our descriptions because our previous experience indicated that anxiety about being evaluated in interviews was frequently reported by social phobics, and was typically rated as one of the more difficult social situations. This was confirmed here by the universally high scores obtained by social phobics on the Interview Anxiety Questionnaire. It is possible that even more severe concerns may have been tapped by using idiosyncratically chosen material, but this would of course have prevented any precise comparisons of latencies across participants. Furthermore, results were essentially the same as those with participants specifically chosen for their interview anxiety (Hirsch & Mathews, 1997).
From participant comments, it did seem that mild anxiety was sometimes
aroused by reading about interviews, but this was apparently not sufficient to
prevent good comprehension, or accurate lexical responses. Furthermore, the
consistent difference in latencies between baseline and ambiguous conditions in
social phobics shows that any interference must have been greater in the ambiguous
context than when just reading about interviews and making lexical decisions. Thus
anxiety may have interfered with on-line emotional inferences, but it seems unlikely
that it interfered with the capacity to follow instructions in general.

As in all strictly controlled experiments, the conditions used cannot fully
match those occurring naturally, in the “real world”. In the present case, this might
raise the question of whether the current task - reading and imagining oneself in an
interview - fully simulates what happens in real interviews. It seems extremely
unlikely that this task could be as anxiety-provoking as a real interview, so that if the
lack of inferences made by social phobics is attributed to anxious mood, then this
failure should be just as severe in reality.

Previous experiments (e.g. Eysenck et al., 1991; Calvo et al., 1994) have used
much less involving and realistic texts, typically of only one or two sentences,
without any encouragement to identify with the character being described. We
deliberately set out to make our descriptions as realistic and involving as possible,
by using material drawn from interviews with socially-anxious as well as confident
individuals; by using “you” as a personal pronoun; and by instructing participants
to imagine themselves as the central character. Participants reported no difficulty in
identifying with this central character, and together with the evidence of inferences
made by non-anxious participants, we take this to indicate that the involvement with
the descriptions was sufficient to elicit responses similar in kind, even if reduced in
intensity, to those elicited by real interviews.

Finally, there is the possibility that the mental effort of reading and imagining
oneself in the situation described may have depleted cognitive resources,
particularly in social phobics, thus preventing inferences that would occur in real
social situations. Although we have no direct evidence on this issue, it seems likely
to us that real social situations - such as interviews - are at least as cognitively
demanding. Even in normal conversation, it is necessary to pay attention and
comprehend what others are saying, and to formulate and deliver appropriate
responses. Also, according to the clinical data cited earlier, social phobics typically
experience mental images of themselves during real social events, so that the
requirement here for all participants to do something similar should mean that in
this respect the experimental conditions resembled those normally experienced by
social phobics in reality.

The above arguments concerning validity can only be fully evaluated by
further research, but the close consistency between the present and previous
findings suggest that the results can at least be considered reliable. If it is accepted
for the purposes of the present discussion that these data show social phobics to lack
the positive on-line inferential bias shown by non-anxious controls, we can now turn
to examine the implications of this finding.

First, it seems consistent with some aspects of the Clark & Wells (1995) model:
namely, the supposition that social phobics fail to use on-line processing when
making judgements of themselves and their own social performance. In this model, it is supposed that early social experiences, typically involving embarrassing social failures, set up stereotyped beliefs (embodied in negative self-images), that are relatively impervious to disconfirming feedback. On-line inferences in social situations may thus be blocked by an habitual tendency to ignore external cues and to rely instead on internal sources of information. Judgements about social performance or outcome are then based on these negative beliefs and images, rather than on-line inferences.

If so, then social phobics are unlikely to modify their negative beliefs on the basis of positive inferences arising from external cues, such as comments or non-verbal cues consistent with approval. By contrast, a non-phobic individual, even one with moderate levels of social anxiety, is more likely to make positive than threatening inferences on the basis of ambiguous external feedback (see Hirsch & Mathews, 1997, experiment 2). We suppose that this positive inferential bias sustains a benign feedback cycle that serves to maintain self-esteem, and helps to prevent clinical levels of social anxiety from developing. Early experiences of severe social failure, however, may lead to stereotyped negative beliefs and a distorted self-image, causing failure of the benign inferential bias, and consequent development of persistent social phobia.

Existing cognitive and behavioral treatments include methods aimed at altering negative beliefs and reducing anxiety via exposure to social situations varying in difficulty. One implication of the findings from the present study is that such treatments may profitably include additional procedures directed at re-establishing
the on-line positive inferential process that has apparently failed in social phobics. One possible method would be to increase the attention paid to external cues that could be used to generate inferences, and to practice generating such inferences under conditions designed to support positive rather than negative interpretations. Experiments aimed at testing the consequences of training based on these methods are currently in progress.
REFERENCES


Footnotes

1. Two volunteers from the control group had Interview Anxiety Questionnaire scores which were higher than some of the participants in the social phobia group. Since the controls were unselected for presence or absence of anxiety in job interviews, inclusion of their data in the main analyses was deemed appropriate. However, to check that the inclusion of data from the two interview-anxious controls did not significantly alter the findings, the analyses reported here were repeated, excluding data from these two control volunteers. These analyses replicated those of the full data set.

2. The error estimate was based on that of the three-way analysis.
Table 1
Words used as lexical decision probes

<table>
<thead>
<tr>
<th>Threat probe words</th>
<th>Non-threat probe words</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rejected; bored; poorly; dull; slim; worried; badly; hate; control; difficult; pathetic; weak; ordeal; alarming; emotions; terrifying; scary; blank; harsh; nervous; undermined; intimidated; unlikely; forgotten.</td>
<td>discussion; stimulating; points; challenging; fine; working; positive; excited; improved; relaxed; possible; useful; successful; interested; clearly; intelligent; high; unaffected; appropriately; handle; problems; easy; confident; good.</td>
</tr>
</tbody>
</table>
Table 2
Means of median decision latencies in milliseconds (standard deviations in parentheses).

<table>
<thead>
<tr>
<th></th>
<th>Social phobia</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Threat probes:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambiguous context</td>
<td>955 (152)</td>
<td>856 (186)</td>
</tr>
<tr>
<td>Baseline condition</td>
<td>896 (114)</td>
<td>804 (172)</td>
</tr>
<tr>
<td>Difference</td>
<td>59</td>
<td>52</td>
</tr>
<tr>
<td><strong>Non-threat probes:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambiguous context</td>
<td>951 (179)</td>
<td>804 (144)</td>
</tr>
<tr>
<td>Baseline condition</td>
<td>872 (135)</td>
<td>807 (171)</td>
</tr>
<tr>
<td>Difference</td>
<td>79</td>
<td>-03</td>
</tr>
</tbody>
</table>