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Identity and Expression Memory for Happy and Angry Faces in Social Anxiety

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Abstract

We examined the influence of social anxiety on memory for both identity and emotional expressions of unfamiliar faces. Participants high and low in social anxiety were presented with happy and angry faces and were later asked to recognise the same faces displaying a neutral expression. They also had to remember what the initial expressions of the faces had been. Remember/know/guess judgements were asked both for identity and expression memory. For participants low in social anxiety, both identity and expression memory was more often associated with "remember" responses when the faces were previously seen with a happy rather than an angry expression. In contrast, the initial expression of the faces did not affect either identity or expression memory for participants high in social anxiety. We interpreted these findings by arguing that most people tend to preferentially elaborate positive rather than negative social stimuli that are important to the self and that this tendency may be reduced in high socially anxious individuals because of the of the negative meaning they tend to ascribe to positive social information.

Key words: Social anxiety; Memory; Face perception; Facial expressions.

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1. Introduction

Cognitive theories of social phobia are based on the idea that differences in how individuals process social/evaluative information may be causal in the development or maintenance of the disorder (Clark & Wells, 1995; Rapee & Heimberg, 1997). Accordingly, researchers have investigated whether social phobics and non-clinical individuals high in social anxiety show biases towards processing socially threatening information at several levels within the information-processing system. The literature clearly indicates that social phobia is associated with an attentional bias towards socially threatening words and an interpretational bias towards self-relevant social information (see Eysenck, 1999; Heinrichs & Hofmann, 2001; Musa & Lépine, 2000 for reviews). On the other hand, the existence of a memory bias has received mixed support in research. Several studies have failed to find an explicit memory bias both in social phobics (Cloitre, Cancienne, Heimberg, Holt, &Liebowitz, 1995; Lundh & Öst, 1997; Rapee, McCallum, Melville, Ravenscroft, & Rodney, 1994) and in non-clinical individuals high in social anxiety (Foa, McNally, & Murdock, 1989; Sanz, 1996). In contrast, other studies have found that non-clinical individuals high in social anxiety tend to recall more negative words than individuals low in social anxiety (Breck & Smith, 1983; O'Banion & Arkowitz, 1977). Finally, Mansell and Clark (1999) found that non-clinical individuals high in social anxiety tended to recall less positive adjectives than individuals low in social anxiety but only when information was encoded in reference to their public self and when they were anticipating a social evaluation. However, high and low socially anxious participants were not significantly different with regard to recall of negative adjectives. When considering these divergent results, a recent review of information processing in social phobia concludes that '… the literature reports little evidence to suggest that social phobia is associated with a memory bias.' (Heinrichs & Hofmann, 2001, p. 763).

The majority of studies have used verbal stimuli in order to investigate memory bias in social anxiety and this may be problematic for several reasons. First, it has been argued that words are only indirect representations of threat and that studies should try to use more ecologically valid stimuli like facial expressions connoting approval or disapproval because these stimuli are directly related to social evaluations (Mogg & Bradley, 1999). Second, Clark and Wells (1995) argued that word-processing studies are modelling attention to mental preoccupations rather than attention to actual social cues, whereas the reverse is true for studies that used more ecological stimuli like faces. Taking these reflections into account, it might be more appropriate to use faces as stimuli if one wants to investigate potential memory biases in social anxiety. The human face is a highly significant social stimulus which provides various information that can be used to recognise familiar people and also to infer people's age, gender, or emotional state (Bruce & Young, 1986). Among all these information, information about face identity and emotional expressions are probably the most salient and important aspects of non-verbal communication in social situations. Accordingly, memory for these two kinds of information might be especially interesting to study in social anxiety.

As far as we know, only one published study examined memory for the identity of new faces in social anxiety. Lundh and Öst (1996) presented photos of faces to social phobics and control participants, asking them to state whether the persons on the photos looked critical or accepting. Participants were then faced with an unexpected recognition task in which they were presented with photos of individuals encountered in the encoding task along with distracter photos depicting other individuals and they were asked to identify the faces they had seen previously. There was no difference between social phobics and controls in terms of overall memory for the faces. However, social phobics recognised more faces they had rated as critical than faces they had rated as accepting, whereas controls tended to display the opposite pattern. One could conclude from these findings that identity memory for critical

faces is enhanced in social phobia. However, as the authors acknowledged, the design of the study does not permit to determine whether the results are due to a true memory bias or to a response bias. It is indeed possible that social phobics tended to designate critical faces as familiar regardless of whether they had seen them before. To explore this alternative explanation, a comparison of the hits and false alarms for each face category (critical vs. accepting) should have been conducted. However, this was not possible because participants did not rate the degree of critical attitude of the distracter faces shown during the recognition task. It is therefore impossible to draw clear conclusions about identity memory from Lundh and Öst's results.

Memory for facial expressions themselves may also be worthy of interest in social anxiety. Indeed, memory for expressions connoting approval or disapproval probably plays an important role in the retrospective evaluation of social situations and consequently it could influence the way one interprets and apprehends current and future interactions. Expression memory was recently examined by Foa, Gilboa-Schechtman, Amir, and Freshman (2000) and by Pérez-Lopez and Woody (2001). In the first experiment reported by Foa et al. (2000), patients with social phobia and control participants learned the names of several faces. They were then presented with photos of the same individuals displaying happy, angry, or neutral expressions and they were asked to name the person on the photo again and also to label his or her emotional expression as happy, angry, or neutral. Finally, they completed a free recall test in which they were asked to write down the names and the expressions of the individuals they had seen previously and a cued recall test in which they were provided with the names of the individuals and were asked to write down the corresponding expressions. Patients with social phobia had an overall better memory for facial expressions than control participants in both tests. Moreover, a memory bias towards threatening (angry) faces in social phobia was found, but only in the cued recall test.

In the second experiment reported by Foa et al. (2000), participants were presented with photos of individuals displaying neutral, happy, angry, and disgusted expressions. They were then presented with the same photos interspersed with photos of the same individuals displaying different emotional expressions and they were asked to recognise the photos they had seen previously. Recognition of facial expressions was overall better in patients with social phobia than in control participants. Moreover, patients with social phobia recognised negative facial expressions (anger, disgust) better than other expressions whereas this was not the case for control participants.

Finally, in the study reported by Pérez-Lopez and Woody (2001), patients with social phobia and control participants were presented with faces displaying either a threatening or a reassuring expression while they were waiting to give a speech in front of an audience. They subsequently completed a forced-choice recognition test in which they viewed pairs of photos consisting of one of the photos seen during the encoding phase and another picture of the same individual displaying a facial expression opposite in valence to the first one. Results showed that patients with social phobia had an overall poorer recognition for facial expressions. However, the difference between the two groups was no longer significant when state anxiety was controlled. In addition, patients with social phobia showed a small bias toward remembering reassuring facial expressions over threatening facial expressions.

The findings concerning memory for emotional expressions reported by Foa et al., on the one hand, and by Pérez-Lopez and Woody, on the other, are inconsistent. However, these studies suffer from several limitations. Firstly, one cannot conclude from Foa et al.' s first experiment that social phobics had a better memory for emotional expressions themselves. Indeed, participants were asked to name each face depicted on the photos and to label the corresponding expression. In these conditions, it is possible that participants recalled the associations between the names and the verbal labels for the expressions rather than the visual

aspect of the expressions themselves. Secondly, in the second experiment reported by Foa et al., the individuals depicted on the photos were not presented with all expressions (each model was represented with a neutral and one emotional expression, either happy, angry, or disgust). This made it impossible to look for the effect of particular emotional expressions unconfounded with differences in the memorability of particular people's faces. Finally, and more importantly, in Foa et al.'s second experiment as well as in Pérez-Lopez and Woody's study, the same photos were used during the encoding and recognition phases. This poses a problem of interpretation because, as Bruce (1982) has pointed out, the recognition of identical photos and the recognition of faces (or, as this is the case here, the recognition of facial expressions) are distinctly different tasks. Indeed, recognition of photos may depend as much on remembering pictorial details (e. g., details of the lighting, grain and flaws in the photos) as it does on remembering the faces and the facial expressions depicted. Thus, it is not possible to know if individuals actually remembered the expressions of the faces in those studies. Furthermore, the use of a recognition task may not be the best way to assess expression memory. Indeed, in everyday life, we rarely try to remember what the expression of an individual was in a previous situation by seeing the same expression again and choosing it among distracters. Instead, we more probably try to retrieve and reconstruct a visual representation of what that expression was. Accordingly, recall or cued recall tasks might be more appropriate and more ecological to assess expression memory.

When considering the reflections we developed above, it is difficult to draw clear-cut conclusions from the existing studies either about identity or expression memory in social anxiety. Accordingly, the present study was designed to address the methodological problems of previous studies in order to further investigate the potential influence of social anxiety on both identity and expression memory. Participants high and low in social anxiety were presented with happy and angry faces and were later asked to recognize neutral faces of the

same individuals. This change of the expression of the faces between presentation and test enabled us, on the one hand, to be sure that memory performances would reflect face recognition rather than mere stimulus recognition, and, on the other hand, to investigate memory bias without confounding with response bias. When a face was claimed to be recognised, expression memory was also assessed by asking participants to decide whether this face had been presented earlier with a happy or an angry expression.

A second purpose of the present study was to examine qualitative aspects of identity and expression memory (see Gardiner & Richardson-Klavhen, 2000; Wheeler, Stuss, & Tulving, 1997). Indeed, face recognition can be associated with different states of awareness. In many cases, recognition of a face is accompanied by a recollection of something that occurred or something that one experienced (what one thought or felt) when this face was seen previously. In other cases, a face can be recognised because it evokes strong feelings of familiarity but nothing about its prior occurrence can be remembered. An investigation of these qualitative aspects of memory with the remember/know/guess procedure (see Gardiner & Richardson-Klavhen, 2000) enabled us to investigate both identity and expression memory in a more precise way. Indeed, recent findings suggest that the effect of emotion on memory, and especially the comparison of memory for positive and negative stimuli, is not always reflected in overall recognition scores but may nevertheless be located in qualitative aspects of recognition memory (Dewhurst & Parry, 2000; Ochsner, 2000). Similarly, it might be that the influence of social anxiety on memory for positive and negative social stimuli is more easily detected when one takes qualitative aspects of memory into account. In particular, if, as argued by Clark and Wells (1995), social anxiety is associated with a tendency to allocate fewer attentional resources to process social stimuli, one should observe a decrease in the frequency of rich recollections of the faces and their expressions (as assessed by “remember” responses) for people high compared to low in social anxiety. Indeed, extensive research has

shown that “remember”, but not “know”, responses are affected by the amount of attention allocated to the stimuli and by the elaboration of their encoding (Gardiner, 1988; Gardiner & Parkin, 1990; see Gardiner & Richardson-Klavhen, 2000 for a review). In addition, if, as assumed by Rapee and Heimberg (1997), socially anxious people tend to preferentially process socially threatening rather than reassuring stimuli, participants high in social anxiety should specifically report more “remember” responses for angry than for happy faces. These predictions were examined in the present study.

2. Method

2.1. Participants

A sample of 324 undergraduate students was screened using the French version of the Social Interaction Self-Statement Test (SISST; Glass, Merluzzi, Biever, & Larsen, 1982). The SISST is a 30-item self-report instrument that assesses cognitions associated with social anxiety. It contains 15 positive and 15 negative thoughts drawn from thought listings following heterosocial interactions. The original study showed that this instrument has good reliability and validity for assessing cognitions associated with social anxiety in non-clinical participants (Glass et al., 1982). The SISST has been used in various ways: some studies have given the test immediately after a real social interaction (Glass et al., 1982), whereas other studies have given the test following an imagined interaction (Zweig & Brown, 1985). Subsequently, Dodge, Hope, Heimberg, and Seckert (1988) modified the original instructions to use the SISST as a general measure of how frequently subjects may have experienced each thought before, during, or after any social interactions. Several studies showed that this general version of the SISST significantly discriminated social phobics from non-clinical control subjects, and that it correlates significantly with other measures of social anxiety (Becker, Namour, Zayfert, & Hegel, 2001; Dodge et al., 1988; Yao et al., 1998). In the

present study, we used the French version of the general version of the SISST which has been showed to have good empirical and concurrent validity (Yao et al., 1998).

Those scoring in the upper and lower quartiles on the negative subscale of the SISST were contacted by telephone and invited to participate in the study. A total of 24 high socially anxious participants and 24 low socially anxious participants agreed to participate. Two low socially anxious participants were excluded because they did not follow the procedure of the experiment correctly. Thus, 22 participants low in social anxiety (4 males and 18 females) and 24 participants high in social anxiety (3 males and 21 females) constituted the final sample.

All participants completed the State-Trait Anxiety Inventory-Trait version (STAIT; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) and the Beck Depression Inventory (BDI; Beck, Rush, Shaw, & Emery, 1979). They also rated their level of state anxiety on a 0-10 scale, where 10 represented maximum anxiety. Table 1 shows the means. Independent-samples t-tests indicated that the high social-anxiety group scored higher than the low social-anxiety group on the negative subscale of the SISST, on the STAIT, and on the BDI. The low social-anxiety group scored higher than the high social-anxiety group on the positive subscale of the SISST. The level of state anxiety was low for both groups but was significantly higher for participants high in social anxiety. The two groups did not differ in age.

-INSERT TABLE 1 ABOUT HERE-

2.2. Materials

In the present experiment, black and white pictures of 24 different faces (12 males and 12 females), each displaying a neutral, a happy, and an angry expression were used. These pictures were selected from four different databases (Beaupré, Cheung, & Hess, 2000; Bégin, Kirouac, & Doré, 1984; Ekman & Friesen, 1976; Martinez & Benavente, 1998). Stimuli with unusual features (e.g., beards, glasses) were not used. All the photos were retouched with

Adobe Photoshop software to standardise their frame, size, background colour, and, whenever possible, luminosity and contrast.

Two sets (A and B) of 12 faces (6 male and 6 female) were made. Whenever possible, faces in sets A and B were matched for physical similarity (e. g., hair size and colour, complexion). Six happy faces (three male, three female) and six angry faces were presented during the inspection phase. The use of sets A and B as studied or nonstudied items was counterbalanced across participants. Also, within each set, each face was seen with a happy expression by half the participants and with an angry expression by the other half. This made it possible to look for the effect of face expression unconfounded with differences in the memorability of particular people's faces. Stimuli were placed in a pseudorandom but fixed order in such a manner that no more than two faces with the same expression occurred in succession. To counterbalance for order effects, the photos were presented in one order for half the participants and in the reverse order for the other half. Two test lists were constructed using the 24 neutral faces. Stimuli were placed in a pseudorandom but fixed order so that no more than three ‘old’ or ‘new’ faces, and no more than two ‘old’ faces that had the same expression at study should occur in succession. The second list presented the photos in reverse order.

2.3. Procedure

Participants were tested individually several weeks after completing the screening SISST. Each face was shown to the participants for 5 s on a computer screen approximately 60 cm in front of them. They were asked to look carefully at the faces in order to be able to recognise them later. No mention was made of the emotional expressions of the faces. After a 5-min retention interval, participants were presented with the recognition test. They were told that they would be shown a series of faces some of which represented people they had been shown initially, though the expression of the faces had changed (all the faces were neutral).

When each face appeared they had to decide whether they had seen it before. Furthermore, they had to report whether their recognition was of the remember (R), the know (K) or the guess (G) variety. The instructions we used to explain the R, K, and G responses were adapted from those used by Gardiner and colleagues (see Gardiner & Richardson-Klavehn, 2000). Briefly, participants were told that an R response should be given to any face which, at the time it was recognised, brought back to mind something they had consciously experienced (e.g., an association, a thought, a feeling, etc.) at the time it was presented. In contrast, they were asked to make a K response if the face felt familiar but they were unable to recollect details of its prior exposure. Finally, they were asked to make a G response if they were unsure whether or not the face had been presented in the study phase.

Participants were also asked to remember the initial expression of the faces they claimed to recognise. They were told that some of the faces they had seen in the study phase had a happy expression and other faces an angry expression. When they classified a face as old, they were asked to decide whether this face had had a happy or angry expression when they saw it in the study phase, and they also had to classify their responses according to the R/K/G paradigm. They were asked to make an R response if they could consciously recall seeing the expression of the face, if they could remember what the expression looked like. They were asked to make a K response if they believed that the face had a particular expression but they could not consciously recollect what the expression looked like. They were asked to make a G response if they had no idea of the expression and they had guessed. Participants were asked to repeat the instructions concerning the R/K/G classification for identity and for emotional expression of the faces and also to explain the rationale for some of their responses to ensure that they had understood the classification correctly. All the responses were made orally and each face remained on the screen until participants indicated their responses. Participants completed the STAIT and the BDI at the end of the session.

3. Results

3.1. Identity recognition

We examined differences in overall identity recognition performance by analysing the hit scores as a function of social anxiety (high vs. low) and expression type (happy vs. angry). We also examined the relation between these two factors and states of awareness by decomposing overall recognition data into R, K, and G responses. Table 2 shows the mean proportions of R, K, and G responses for identity recognition as a function of social anxiety and expression type.

-INSERT TABLE 2 ABOUT HERE-

Separate 2 (social anxiety: high vs. low) X 2 (expression type: happy vs. angry) analyses of variance (ANOVAs) were performed on the hit scores, and on R, K, and G responses. For the hit scores, there was a significant main effect of expression type, $\underline{F}(1, 44) = 5.08$, $\underline{p} < 0.05$, indicating that happy faces were overall better recognised than angry faces. However, there was no significant effect of social anxiety and the crucial social anxiety by expression type interaction was not significant, $\underline{F}s < 1$.

When considering qualitative aspects of recognition, there was a main effect of expression type for R responses, $\underline{F}(1, 44) = 6.59$, $\underline{p} < 0.05$, but not for K or G responses, $\underline{F}s < 1$, indicating that happy faces received more R responses than angry faces. Social anxiety had a significant effect on the proportions of R and K, but not G, responses, $\underline{F}(1, 44) = 12.54$, $\underline{p} < 0.001$, $\underline{F}(1, 44) = 8.42$, $\underline{p} < 0.01$, and $\underline{F}(1, 44) = 1.25$, n.s., respectively. Participants high in social anxiety reported less R and more K responses than participants low in social anxiety. The main effect of social anxiety on R responses was qualified by a social anxiety by expression type interaction, $\underline{F}(1, 44) = 4.85$, $\underline{p} < 0.05$. Planned comparisons indicated that participants low in social anxiety reported more R responses than participants high in social anxiety for happy faces, $\underline{F}(1, 44) = 17.16$, $\underline{p} < 0.001$, but not for angry faces, $\underline{F}(1, 44) = 1.29$,

n.s. (effect sizes were d = 1.045 and d = 0.334, respectively). Furthermore, participants low in social anxiety produced significantly more R responses for happy than for angry faces, F(1, 44) = 10.90, p < 0.01, while this was not the case for participants high in social anxiety, F < 1 (effect sizes were d = 0.727 and d = 0.049, respectively). There were no significant interaction effects for K and G responses, F(1, 44) = 1.73, n.s. and F(1, 44) = 1.00, n.s., respectively.

In order to compare the present results with those reported by Lundh and Öst (1996), identity memory data were also analysed with signal detection analysis. From the hits and false alarms, discrimination scores (d') and response bias (C) were calculated (MacMillan & Creelman, 1991); d' and C could not be computed separately for happy and angry faces because all faces were presented with a neutral expression during recognition. Therefore, only general recognition accuracy could be evaluated, as was the case in Lundh and Öst' s study. High and low socially anxious participants were not significantly different on either d' (M = 1.64 and M = 1.55 respectively), F < 1, or C (M = .23 and M = .10 respectively), F(1, 44) = 2.05, n.s. (effect sizes were d = 0.146 and d = 0.40, respectively).

3.2. Memory for emotional expressions

Memory for emotional expressions was assessed by determining the probability that a participant correctly recalled expression conditionalised upon correct identity recognition. For each participant, proportions of correct and incorrect responses for expression memory were calculated separately for each type of expression (happy vs. angry). This was made by dividing the number of correct or incorrect R, K, and G responses for each type of expression by the number of correct identity recognition (hits) for that type of expression. Table 3 shows mean proportions of R, K, and G responses for expression memory as a function of social anxiety and expression type[1].

-INSERT TABLE 3 ABOUT HERE-

Separate 2 (social anxiety: high vs. low) X 2 (expression type: happy vs. angry) ANOVAs were performed on total correct responses, and on correct R, K, and G responses. For total correct responses, there was a significant main effect of expression type, $F(1, 44) = 4.24$, $p < 0.05$, indicating that expression memory was overall better for happy than angry expressions. However, there was no significant effect of social anxiety, $F < 1$, and the social anxiety by expression type interaction was not significant, $F(1, 44) = 1.13$, n.s.

When considering qualitative aspects of expression memory, there was a significant main effect of expression type for G responses, $F(1, 44) = 4.33$, $p < 0.05$, but not for R and K responses, $Fs < 1$. There were no significant effects of social anxiety either on R, K, or G responses, all $Fs < 1$. The crucial social anxiety by expression type interaction was significant for R responses, $F(1, 44) = 4.23$, $p < 0.05$. Planned comparisons indicated that, although participants low and high in social anxiety were not different with regard to their proportions of correct R responses either for happy, $F(1, 44) = 1.58$, n.s., or for angry, $F(1, 44) = .71$, n.s., expressions (effect sizes were $d = 0.350$ and $d = 0.019$, respectively), there was a tendency to produce more correct R responses for happy than for angry expressions for participants low in social anxiety, $F(1, 44) = 3.57$, $p = 0.06$, but not for participants high in social anxiety, $F(1, 44) = 1.01$, $p = .32$ (effect sizes were $d = 0.451$ and $d = 0.191$, respectively). There were no significant interaction effects for K and G responses, $F(1, 44) = 1.24$, n.s. and $F(1, 44) = .13$, n.s., respectively. We chose not to perform statistical analyses on the proportions of incorrect responses because of the small cell sizes.

3.3. Depression and state anxiety as mediators of memory bias

Heinrichs and Hofmann (2001) noted that studies which have found a memory bias for threatening words in social anxiety did not control for depressive symptoms although depression has been found to cause a memory bias. Furthermore, Pérez-Lopez and Woody (2001) found that the memory impairment they observed in social phobics was no longer

present after controlling for state anxiety. In the present experiment, the high and low social anxiety groups differed in depression and state anxiety. This raises the possibility that the between-group differences in identity and expression memory could be due to individual differences in depression or state anxiety. To investigate this possibility, the identity and expression memory analyses were repeated using depression and state anxiety as covariates. All the effects reported above remained significant and no additional significant effects were found.

4. Discussion

The present experiment was designed to further examine identity and expression memory in social anxiety while aiming to address methodological criticisms of previous studies. Furthermore, qualitative aspects of memory were assessed in order to investigate both identity and expression memory in a more precise way. With regard to identity memory, we found that high and low socially anxious participants were not different either on hit scores or on discrimination scores (d'). This absence of differences between high and low socially anxious individuals concerning overall identity memory is consistent with the results reported by Lundh and Öst (1996). In addition, we found that identity recognition was better for faces that were presented with a happy rather than an angry expression and that high and low socially anxious participants did not differ in this respect. However, when examining qualitative aspects of recognition memory, we found that high socially anxious participants reported less R and more K responses than low socially anxious participants. The overall difference between the two groups concerning R responses was mainly due to differences in recognition of happy faces. Indeed, high socially anxious participants reported less R responses than low socially anxious participants for faces that were presented with a happy expression but not for faces that were presented with an angry expression. Moreover, participants low in social anxiety reported more R responses for happy than for angry faces,

whereas this was not the case for participants high in social anxiety. Therefore, it was the qualitative aspects of identity memory that was affected by social anxiety in the present study, and not overall identity recognition per se (whether assessed by hit scores or by signal detection analysis).

With regard to memory for facial expressions of emotions, we found that high and low socially anxious participants were not different on total correct responses and that expression memory was better for happy than angry expressions in both groups. However, participants low in social anxiety tended to report more R responses for happy than for angry expressions, whereas this was not the case for participants high in social anxiety. These results are inconsistent with those already reported in the literature (Foa et al., 2000; Pérez-Lopez & Woody, 2001) and are not in accordance with the view that socially anxious people should show a bias towards the processing of social threat (Rapee & Heimberg, 1997). Foa et al. (2000, Experiment 2) found that social phobics recognised negative expressions better than non-negative ones, whereas this was not the case for controls. On the other hand, Pérez-Lopez and Woody (2001) found that social phobics had a small recognition bias for positive expressions. However, as we have already argued, there are several methodological problems in these studies. Most importantly, previous studies used the same photos during encoding and recognition, whereas we used different photos of the same individuals. In the former case, but not in the latter, performance could reflect recognition of pictorial details rather than recognition of facial expressions themselves.

The main finding of the present study was that social anxiety was associated with a decrease in the R component of recognition memory for happy faces, but not for angry faces. We think that these findings could be explained in terms of a differential encoding of positive social stimuli in social anxiety. In a previous study with undergraduate students, we found that recognition was more often associated with R responses for happy faces than for angry

faces, but only when encoding of these faces was intentional (rather than incidental). We interpreted these findings by arguing that, when strategic efforts are engaged to process the stimuli, people tend to elaborate faces with happy expressions more than faces with angry expressions (D'Argembeau, Van der Linden, Comblain, & Etienne, in press). Indeed, it has been found that the degree of elaboration and attention during encoding affected the proportion of R responses (see Gardiner & Richardson-Klavehn, 2000 for a review). For instance, Gardiner (1988) observed that semantic elaboration of words (as opposed to phonological processing) increased R responses while leaving the proportion of K responses unaffected. Furthermore, Gardiner and Parkin (1990) found that, when attentional resources are engaged in a concurrent task during word encoding, the R component of recognition memory decreased while K responses remained unaffected. Similar findings were also reported by Parkin, Gardiner, and Rosser (1995) with face stimuli. This supposedly better elaboration of happy compared to angry faces is also consistent with the fact that most people possess a very positive view of themselves and tend to pay more attention to and to better elaborate positive rather than negative social information that is important to the self (Baumeister, 1998; Taylor & Brown, 1988). Indeed, a happy expression denotes approval with our current behaviour or attitude and is therefore consistent with a positive self-concept, whereas an angry expression denotes disapproval and may constitute a threat to the self. Therefore, the meaning of facial expressions for the self could make faces more richly recollected when they were previously seen with a happy rather than an angry expression. This claim may seem inconsistent with other recent studies that showed that recognition of negative words or pictures was more often associated with R responses than recognition of positive ones (Dewhurst & Parry, 2000; Ochsner, 2000). However, emotional pictures and words that were used in those studies may have a different meaning than emotional expressions because they do not provide information that are directly relevant to the self-

concept (i.e., they do not provide social feedback to the self as is the case for faces with emotional expressions). Consistent with this proposed role of the self-relevance of stimuli, a recent study has found that memory for verbal positive stimuli was better than memory for negative stimuli, but only when the encoded information was of relevance to the self (Sedikides & Green, 2000).

In the present study, individuals low in social anxiety reported more R responses for happy than for angry faces, as was the case for participants in D'Argembeau et al.'s (in press) study. In contrast, this higher proportion of R responses for happy faces was not found for participants high in social anxiety. These findings suggest that the preferential elaboration of happy faces, which seems to be characteristic of most people, might have been reduced in high socially anxious individuals. This might be the case because positive social feedbacks seem to be interpreted differently in high and low socially anxious people. Indeed, Wallace and Alden (1995) found that, unlike low socially anxious individuals, high socially anxious individuals who experienced a successful social interaction believed others would expect more of them in upcoming interactions. High socially anxious people thus appeared to process positive social outcomes as information about others' expectations for them rather than as information about their own competence. Rapee and Heimberg (1997) further argued that this process might increase perceived anxiety in response to positive feedback. We propose that this biased interpretation of positive social stimuli might cause high socially anxious individuals to allocate fewer resources than low socially anxious individuals for the elaboration of positive stimuli. This reduced elaboration would in turn make positive stimuli less richly recollected in high socially anxious people. A reduced encoding of positive social information in memory could contribute to make high socially anxious people hold less positive beliefs about social interactions and consequently could play a role in the maintenance of social anxiety.

In conclusion, the present study provides evidence that high and low socially anxious individuals differ in identity and expression memory for happy faces. Low socially anxious participants had better identity and expression memory for happy than angry faces, when memory was measured by R responses, while this was not the case for high socially anxious participants. We interpreted these findings by arguing that elaboration of happy faces during encoding may be reduced in high socially anxious individuals because of the negative meaning they tend to ascribe to positive social information.

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Footnotes

1. One may question the utility to evaluate qualitative indices for expression memory in addition to qualitative indices for identity memory. Indeed, it could be argued that, when a participant gave an R response for identity recognition, he or she might have done this because he or she remembered what the expression of the face had been when it was previously seen. In other words, one could expect that "remember" rates for identity and expression memory would be closely linked. In fact, this does not seem to be the case. Indeed, the probability that a participant made a correct R response for expression memory, given that he or she had reported an R response for identity recognition, was 42% (SD = 29%). This means that a substantial proportion of R responses given for identity recognition were based on a recollection of attributes other than facial expression. These attributes could be, for instance, associations (a thought, a feeling) that participants had while encoding the faces. Unfortunately, the present study did not permit to identify the attributes underlying R responses because participants were not asked to systematically report what they actually remembered when they gave an R response. This could be an interesting issue to investigate further in future studies.

Table 1

Characteristics of Participants in each Social-Anxiety Group

	Low social anxiety		High social anxiety		
	M	SD	M	SD	t
Age	19.64	1.26	19.83	1.01	-.59
SISST (negative subscale)	27.59	3.87	53.71	4.93	-19.85**
SISST (positive subscale)	48.95	5.18	38.96	6.17	5.92**
STAIT	40.59	7.18	57.13	8.69	-6.99**
BDI	4.86	3.71	13.25	8.30	-4.49**
State anxiety	0.80	2.14	2.34	2.55	-2.19*

Note: * $p < .05$; ** $p < .001$

Table 2

Mean Proportions (and Standard Deviations) of R, K, and G Responses for Identity Recognition as a Function of Social Anxiety and Expression Type

	Low social anxiety			High social anxiety		
Response	Happy	Angry	False alarms	Happy	Angry	False alarms
R	.63 (.17)	.45 (.18)	.05 (.09)	.40 (.21)	.38 (.21)	.03 (.05)
K	.15 (.12)	.20 (.16)	.11 (.10)	.29 (.18)	.26 (.21)	.08 (.07)
G	.02 (.06)	.05 (.09)	.05 (.07)	.06 (.11)	.05 (.09)	.05(.07)
Total	.80 (.16)	.70 (.18)	.21 (.12)	.75 (.14)	.69 (.21)	.16 (.11)

Table 3

Mean Proportions (and Standard Deviations) of R, K, and G Responses for Expression Memory as a Function of Social Anxiety and Expression Type

	Low social anxiety				High social anxiety			
	Hits		Errors		Hits		Errors	
Response	Happy	Angry	Happy	Angry	Happy	Angry	Happy	Angry
R	.33 (.27)	.23 (.21)	.04 (.12)	.06 (.11)	.24 (.24)	.29 (.28)	.05 (.14)	.04 (.09)
K	.15 (.15)	.21 (.23)	.04 (.10)	.15 (.18)	.16 (.19)	.13 (.15)	.15 (.19)	.07 (.11)
G	.27 (.19)	.18 (.20)	.17 (.20)	.17 (.25)	.28 (.20)	.22 (.21)	.12 (.18)	.25 (.22)
Total	.75 (.20)	.62 (.21)	.25 (.20)	.38 (.21)	.68 (.26)	.64 (.22)	.32 (.26)	.36 (.22)