



Recognition bias for critical faces in social phobia: a replication and extension

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Abstract

Studies using linguistic stimuli have provided little support for explicit memory biases among individuals with social phobia (SP). However, using facial stimuli rated on their criticalness, Lundh and Öst (1996) found that individuals with SP recognized more critical than accepting faces, whereas non-anxious controls tended to show the opposite pattern. Since the publication of Lundh and Öst's findings, additional studies using a variety of facial stimuli have produced inconsistent findings (*J. Anxiety Disord.* 14 (2000) 501; *Behav. Res. Ther.* 39 (2001) 967). Unfortunately, these inconsistencies are difficult to reconcile given great variation in methods and stimuli. Therefore, we designed a study to replicate and extend the work of Lundh and Öst (*Behav. Res. Ther.* 34 (1996) 787). Similar to Lundh and Öst, individuals with SP identified a significantly higher proportion of old critical faces as old than did non-anxious controls. Further, extending the work of Lundh and Öst, signal detection analyses revealed group differences on response bias according to face type. Specifically, controls showed a response bias towards indicating that accepting faces were previously seen, whereas individuals with SP did not. Finally, signal detection analyses failed to reveal group differences in the accuracy of memory.

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1. Introduction

Clinical experience and information-processing models (e.g., Williams, Watts, MacLeod, & Mathews, 1997) suggest that individuals with social phobia (SP) are characterized by biased memory for threatening information. However, a large body of research using linguistic stimuli failed to provide much support for explicit memory biases among individuals with SP. For example, in a series of four studies using a wide variety of dependent measures (recall and recognition, cued recall, recall of feedback from a hypothetical performance task, and autobiographical memory), Rapee, McCallum, Melville, Ravenscroft, and Rodney (1994) failed to find any support for explicit memory biases in SP. Similarly, Cloitre, Cancienne, Heimberg, Holt, and Liebowitz (1995) failed to find evidence for recall and recognition for social threat words among individuals with SP. In addition, two studies using self-referential encoding also failed to find differences in memory for threat and non-threat words between individuals with SP and non-anxious controls (Becker, Roth, Andrich, & Margraf, 1999; Lundh & Öst, 1997). Finally, Amir, Foa, and Coles (2000) failed to find an explicit memory bias towards socially threatening sentences in patients with SP.

In contrast, Lundh and Öst (1996) found support for a recognition bias towards threat in individuals with SP. The Lundh and Öst study was unique in two important ways. First, the stimuli were pictures of faces, very externally valid stimuli for studying social anxiety. And, second, this study utilized an encoding task targeted at the core of SP, fear of negative evaluation; that is, they asked participants to rate how critical each person appeared. Individuals with SP later recognized significantly more critical faces than accepting faces, and the non-anxious controls showed a trend in the opposite direction. These findings were ground-breaking given their consistency with models of SP and that they were at odds with previous work using linguistic stimuli. However, the design of the Lundh and Öst study prohibited them from disentangling the relative contributions of memory and response bias (see Lundh & Öst, 1996: p. 792).

Two additional papers examining memory for faces in SP have been published since the Lundh and Öst (1996) paper. Foa, Gilboa-Schechtman, Amir and Freshman (2000) conducted two studies examining memory for negative emotional expressions in generalized SP. In their second study, patients with generalized SP demonstrated enhanced recognition for angry and disgusted faces compared to neutral and happy faces. While these findings do show support for a bias towards negative facial expressions, their applicability to expressions reflecting negative evaluation, the core of SP, is debatable. Indeed, it is possible to imagine a situation where an observer is angry or disgusted with someone for being socially skilled or performing well. In other words, anger and disgust are not equivalent to negative evaluation. An important strength of this study is the conduct of signal detection analysis. Weaknesses of this study include lack of instructions for encoding and a small sample ($n = 15$ patients with generalized SP). More recently, Pérez-López and Woody (2001) examined memory for facial expressions under conditions of elevated state anxiety. In a comparison recognition task, individuals with SP were not found to demonstrate an explicit memory bias towards threatening expressions. In fact, both individuals with SP and non-anxious controls demonstrated a bias towards remembering more reassuring faces. Strengths of this study include the use of a comparison recognition task to eliminate ceiling effects frequently encountered on item recognition tasks and the use of stimuli that were classified as threatening or reassuring based on an independent sample. Limitations of

this study include the inability to disentangle contributions of memory and response bias and differences in the emotional intensity of the reassuring and threatening faces. Finally, given that individuals with generalized SP have been shown to divert their attention away from negative facial expressions (Chen, Ehlers, Clark, & Mansell, 2002), the simultaneous presentation of threatening and reassuring faces in the forced recognition task may have increased the likelihood that individuals with SP would choose the reassuring faces. Finally, it is surprising that no one has sought to replicate the findings of Lundh and Öst (1996). Kazdin (1998) discusses the need for replications, stating “The importance of replication in scientific research cannot be overemphasized” (p. 409). He goes further to specify that replications are most valuable when new phenomena are being established, when they are conducted by persons other than the original investigators, and when they are done with variations in some of the methods and procedures (a partial replication of previous work, p. 412).

The current study sought to replicate and extend the findings of Lundh and Öst (1996). First, using the same encoding task as Lundh and Öst, we examined whether individuals with SP would recognize more critical faces than accepting faces and whether non-anxious controls would recognize more accepting than critical faces. Next, we designed our study to allow us to conduct signal detection analyses, separating the relative contributions of memory and response bias. There are no published studies of memory for critical faces in SP that have conducted signal detection analyses. Third, we used critical and accepting faces that had been independently classified by individuals with both low and high social anxiety, thereby eliminating any possible confounding of interpretation bias, response bias, and memory bias (see Pérez-López & Woody, 2001: p. 968). We also equated the two types of faces on intensity, eliminating this as a potential confounding variable (see Pérez-López & Woody, 2001: p. 974). Finally, we obtained a larger sample than previous studies of memory for facial expressions in individuals with SP in order to increase power to detect differences.

2. Method

2.1. Participants

The clinical sample consisted of 25 treatment-seeking individuals who met DSM-IV (American Psychiatric Association, 1994) criteria for a principal diagnosis of SP. The comparison sample was comprised of 25 non-anxious control participants who were recruited through advertisements in local newspapers and flyers soliciting the paid participation of individuals who did not experience problems with anxiety or depression. Controls could not meet criteria for any current or past year Axis I diagnosis other than specific phobia. All participants were screened using the Anxiety Disorders Interview Schedule for DSM-IV: Lifetime Version (ADIS-IV-L; DiNardo, Brown, & Barlow, 1994). The ADIS-IV-L has been shown to have good to excellent reliability for the majority of DSM-IV categories and strong reliability ($\kappa = 0.77$) for the diagnosis of SP (Brown, DiNardo, Lehman, & Campbell, 2001). Diagnosticians in the current study were either clinical psychologists or advanced doctoral students, and all were trained to strict reliability standards as delineated by Brown et al. (2001). Further, a recent assessment of diagnostic reliability in our clinic using 87 patients with SP (including those in the current

study) revealed 100% agreement on the principal diagnosis of SP between the initial ADIS interviewer and a subsequent independent assessor ($\kappa = 1.0$).

All participants were between the ages of 18 and 65 and fluent in English. Additional exclusion criteria were schizophrenia or other psychotic symptoms, prominent risk of self-harm, organic brain disorders, or a history of significant head trauma/memory difficulties. Twenty-three of the patients with SP (92%) were assigned to the generalized subtype.

2.2. Development of experimental stimuli

Pilot faces came from two sources: (1) faces developed by [Matsumoto and Ekman \(1988\)](#) (JACFEE and JACNeuf) and (2) faces prepared for this study. Only the Caucasian faces from the Matsumoto and Ekman sets were used (the Japanese faces were not used) as it was anticipated that the majority of participants would be Caucasian and previous studies have shown that Caucasian individuals have poorer memory for Japanese faces than Caucasian faces ([Chance, Goldstein, & McBride, 1975](#)). The Matsumoto and Ekman images were scanned using a slide scanner and converted into JPEG files to allow presentation on a computer monitor. The additional images prepared for this study were taken using a digital camera and software and were matched to the original images (e.g., background color, placement of the face within the frame, resolution, etc.).

Pilot faces were shown to five individuals with SP and five non-anxious controls who did not participate in the larger study. Each participant rated 134 faces as to how critical or accepting the person appeared (1 = ‘a very accepting person’ to 5 = ‘a very critical person’; cf. [Lundh & Öst, 1996](#)). Based on these ratings, the 27 faces with the lowest mean criticalness ratings (across both groups) served as the accepting faces ($M = 2.3$, $SD = 0.4$), and the 27 faces with the highest mean criticalness ratings served as the critical faces ($M = 4.2$, $SD = 0.3$). Each individual was only represented by one type of face, and male and female faces were equally represented. The accepting and critical faces were also matched on size, resolution, brightness, color, and contrast (as done by [Mansell, Clark, Ehlers, & Chen, 1999](#)).

For counterbalancing purposes, the experimental faces were divided into three equivalent sets of faces (9 critical and 9 accepting faces in each set). Each participant received one of the three sets for the encoding phase (e.g., Set A; 18 faces), and the original set plus a new set for the recognition phase (e.g., Sets A and C; 36 faces total). Faces within a given set were presented in a fixed random order so that no more than two faces of the same type appeared consecutively. Efforts were also made to equally distribute the two genders and the two sources of faces (purchased or made).

2.3. Procedure

Participants were given a brief overview of the study and signed an informed consent form indicating their willingness to participate. Participants were then given 10 min to complete the Shipley Institute of Living Verbal Scale (SILS-V; [Shipley, 1940](#)), which provides an estimate of verbal ability and thereby general intelligence. Participants then completed a 20-item self-report measure of state anxiety [State-Trait Anxiety Inventory-State Form (STAI-S); [Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983](#)]. Both the SILS-V and the STAI-S demonstrated

adequate reliability in the current sample ($\alpha = 0.73$ and 0.94 , respectively). Finally, participants provided a single rating of state anxiety rating using a Visual Analogue Scale from 0 ‘Not really experiencing anxiety, or only barely noticeable anxiety’ to 100 ‘the highest anxiety you have experienced or can imagine experiencing’.

For the encoding task, participants saw 18 faces (9 critical, 9 accepting) presented on a computer monitor and rated each face as to how critical or accepting the person appeared. This rating was made on a 5-point scale where 1 meant ‘a very accepting person’ and 5 meant ‘a very critical person’ (Lundh & Öst, 1996). Participants were told that we were interested in their immediate impression of the person in the photograph and that they should not dwell too long on any one face. Each face was presented for 5 s and was then replaced with a screen instructing participants to provide their criticalness rating if they had not already done so and to then press the left mouse key to see the next face. All ratings were circled on data sheets provided by the experimenter. The experimenter left the room during this phase.

After a 5-min delay¹, participants completed the surprise item recognition task. For the recognition task, participants saw 36 faces (18 critical and 18 accepting), half of which had been presented in the encoding task (‘old’ faces) and half of which the participants had not seen before (‘new’ faces). Participants were instructed to indicate whether or not they recognized the face (‘yes’ indicating it was previously seen and ‘no’ indicating it was not previously seen). Each face was presented for 2 s and was then replaced with a screen instructing participants to provide their recognition rating if they had not already done so and to press the left mouse key to see the next face. The experimenter left the room during this phase. Following the recognition task, participants were given a verbal debriefing and questions were answered.

2.4. *Additional measures*

Participants also completed a number of self-report measures. Two measures assessed social anxiety: the Social Interaction Anxiety Scale (SIAS), which assesses fears of general social interaction in dyads and groups, and Social Phobia Scale (SPS), which assesses fears of being scrutinized by others during routine activities (e.g., eating, drinking, writing; Mattick & Clarke, 1998). The Beck Depression Inventory (BDI) was used as a measure of depressive symptoms and attitudes (Beck, Rush, Shaw, & Emery, 1979). Each of these measures exhibited strong internal consistency in the current sample ($\alpha = 0.90$ – 0.97).

2.5. *Signal detection analyses*

Findings that individuals with SP identify a greater proportion of old critical faces as old than controls (i.e., have a higher hit rate) could indicate more accurate recognition or a response bias to label critical faces as old. A practical example is illustrative. Imagine that a participant is given a recognition task with 10 old faces and 10 new faces and correctly identifies

¹The experimental design also included an implicit memory task in which faces were presented mixed with various levels of visual static. However, as this task did not yield a reliable implicit memory index, the results are not presented here. Additional information is available from the first author upon request.

all old faces as old. This would yield a hit rate of 100%, and one may be tempted to conclude that this participant had exceptional recognition memory. However, imagine that this participant also indicated that all of the new faces were old, a false hit rate of 100%. This participant did not have exceptional memory, just a response style of indicating that all faces were old. Therefore, if individuals with SP were found to recognize a greater proportion of old critical faces than controls, signal detection analyses would be performed on the recognition data to disentangle the effects of sensitivity and bias. Signal detection analyses can be applied whenever two possible stimuli must be discriminated (Stanislaw & Todorov, 1999) and allow measurement of a participant's ability to detect, or discriminate between, sensory stimuli (Sorkin, 1999). Sensory factors include the intensity and duration of the stimulus (typically represented as d') whereas non-sensory factors (typically represented as β or c include variables such as motivation and expectancies. d' represents sensitivity and measures the distance between the signal and noise means in standard deviation units (Stanislaw & Todorov, 1999). d' values of 0 indicate an inability to distinguish the signal from the noise and higher values indicate an increasing ability to distinguish the signal and noise. Response bias is typically represented as β or c . However, Pastore, Crawley, Berens, and Skelly (2003) explain that β is a ratio scale and therefore inappropriate for use with inferential statistics (e.g., means, ANOVAs; see also Macmillan & Creelman, 1990). Therefore, we used c as the index of bias. c is defined as the distance between the criterion and the neutral point, where neither response (yes or no) is favored (Stanislaw & Todorov, 1999). Negative values of c signify a bias toward responding 'yes', whereas positive values signify a bias towards responding 'no' (Stanislaw & Todorov, 1999).²

3. Results

3.1. Group demographic comparisons

All participants in the study were Caucasian. No significant group differences were found on gender, age, or years of education. Demographic characteristics and results of statistical comparisons between the two groups (including effect size estimates) are presented in Table 1.³

As shown in Table 1, patients with SP had significantly higher scores (greater symptom severity) than the non-anxious controls on measures of social interaction anxiety (SIAS), scrutiny fears (SPS), depressive symptoms (BDI), and state anxiety at the time of the study (STAI–

² When calculating signal detection indices, problems arise when either the hit or false alarm rates equal either 0 or 1. Numerous methods exist for remedying this problem; however, the loglinear approach seems to work well (Stanislaw & Todorov, 1999) and may not yield biased estimates of sensitivity that occur with the use of other approaches (Hautus, 1995). Therefore, the loglinear approach was used in this study. This approach involves adding 0.5 to both the number of hits and number of false alarms and adding 1 to both the number of signal trials and the number of noise trials before calculating the hit and false alarm rates.

³ Effect sizes reported throughout were calculated using the formula for $r_{\text{effect size}}$ (see Rosenthal, Rosnow, & Rubin, 2000). Specifically, the formulas used are as follows: $r_{\text{effect size}}$ for a $\chi^2 = \sqrt{X^2(1)/N}$; $r_{\text{effect size}}$ for t -tests = $\sqrt{t^2/(t^2 + df_{\text{within}})}$. General guidelines for interpreting the size of $r_{\text{effect size}}$ are as follows: 0.10 = small, 0.30 = medium and 0.50 = large (see Rosenthal & Rosnow, 1991) although these authors emphasize the need to interpret the magnitude of the effect within the larger context.

Table 1
Characteristics of the study sample

	Individuals with SP		Non-anxious controls		χ^2	df	<i>p</i>	<i>r</i> _{effect size}
	<i>N</i>	%	<i>N</i>	%				
Gender								
Female	14	56	15	60	0.08	1	0.77	0.04
Male	11	44	10	40				
	<i>M</i>	SD	<i>M</i>	SD	<i>t</i>	df	<i>p</i>	<i>r</i> _{effect size}
Age	29.48	10.80	32.20	10.90	0.89	48	0.38	0.13
Years of education	15.88	3.30	16.32	2.60	0.52	48	0.60	0.07
SIAS	49.09	16.40	11.52	7.20	10.40	46	<0.001	0.83
SPS	35.74	15.16	4.00	4.65	9.98	46	<0.001	0.82
BDI	12.87	7.18	2.96	3.38	6.19	46	<0.001	0.67
STAI-State	39.68	9.50	25.72	4.80	6.55	48	<0.001	0.69
State Anxiety Rating	28.80	19.40	5.12	9.17	5.51	48	<0.001	0.62
SILS-V	33.22	3.52	32.75	3.99	0.43	45	0.67	0.06

Note: SIAS, Social Interaction Anxiety Scale; SPS, Social Phobia Scale; BDI, Beck Depression Inventory; STAI-State, State-Trait Anxiety Inventory-State Form; SILS-V, Shipley Institute of Living Scale-Verbal Score. Degrees of freedom vary due to missing data.

State and State Anxiety Rating). An independent-sample *t*-test comparing the two groups on their Shipley Institute of Living Verbal Scale scores failed to reveal differences in verbal ability, suggesting that differences in general intelligence is an unlikely explanation for group differences in memory.

3.2. Face type manipulation

Faces intended to be ‘critical’ were rated as more critical [M (SD) = 3.90 (0.59)] than those intended to be ‘accepting’ [M (SD) = 2.22 (0.53); $t(49) = 14.00$, $p(1\text{-tailed}) < 0.001$, $r_{\text{effect size}} = 0.90$]. Further, significant group differences were not found on the mean ratings of critical faces or accepting faces (see Table 2). These analyses suggest that the faces were interpreted similarly by both groups and participants discriminated as intended between critical and accepting faces.

Table 2
Mean ‘criticalness’ ratings by group and face type

	Individuals with SP		Non-anxious controls		df	<i>t</i> _{2-tailed}	<i>p</i>	<i>r</i> _{effect size}
	<i>M</i>	SD	<i>M</i>	SD				
Critical faces	3.81	0.57	3.99	0.62	48	1.09	0.28	0.16
Accepting faces	2.25	0.46	2.19	0.61	48	0.41	0.69	0.06

3.3. Hit rates as a function of group and face type

First, we examined the proportion of old faces correctly classified as old (hits) as a function of group and face type. As hypothesized, individuals with SP correctly classified a higher proportion of old critical faces than did controls (see Table 3). In contrast, the two groups were not found to differ on the proportion of old accepting faces recognized. Within-group dependent *t*-tests were conducted comparing the proportion of old critical faces recognized to the proportion of old accepting faces recognized. Individuals with SP were not shown to differ in their recognition of old critical and old accepting faces [97% vs. 96%, respectively; $t(24) = 0.77$, $p = 0.23$, $r_{\text{effect size}} = 0.11$]. However, the controls recognized more old accepting faces (96%) than old critical faces [90%; $t(24) = 2.14$, $p = 0.02$, $r_{\text{effect size}} = 0.29$].

3.4. Signal detection analyses

Hit rates indicated that the individuals with SP recognized a greater proportion of old critical faces than did the non-anxious controls. Therefore, signal detection analyses were conducted to disentangle the effects of sensitivity and response bias (see Table 3). As we did not make a priori predictions regarding d' and c , a 2(Group) \times 2(Face Type) ANOVA was conducted for each index. Analyses for d' scores failed to reveal significant main effects of Group [$F(1, 48) = 0.63$, $p = 0.43$] or Face Type [$F(1, 48) = 0.58$, $p = 0.45$], or a significant interaction of Group \times Face Type [$F(1, 48) = 0.01$, $p = 0.95$]. Analyses for c scores did not reveal significant main effects of Group [$F(1, 48) = 0.30$, $p = 0.59$] or Face Type [$F(1, 48) = 0.50$, $p = 0.49$], but did reveal a significant interaction of Group \times Face Type [$F(1, 48) = 7.50$, $p = 0.009$]. Controls had significantly lower values of c for accepting faces than critical faces [$t(24) = 2.17$, $p(2\text{-tailed}) = 0.04$, $r_{\text{effect size}} = 0.41$], reflecting a bias towards endorsing accepting faces as old. In contrast, the individuals with SP did not have significantly different values of c as a function of

Table 3

Mean proportion of hits and signal detection indices by group and face type, between-group comparisons of hits and c

	Individuals with SP		Non-anxious controls		df	$t_{2\text{-tailed}}$	p	$r_{\text{effect size}}$
	M	SD	M	SD				
<i>Proportion of hits</i>								
Accepting faces	95.56	0.08	95.56	0.09	48	0.00	1.00	0.00
Critical faces	96.89	0.07	90.22	0.17	48	1.79	0.04	0.25
d'								
Accepting faces	2.42	0.66	2.30	0.59				
Critical faces	2.36	0.64	2.23	0.73				
c								
Accepting faces	-0.22	0.36	-0.29	0.32	48	0.75	0.46	0.11
Critical faces	-0.31	0.36	-0.14	0.48	48	1.49	0.14	0.21

Note: SP, social phobia.

face type [$t(24) = 1.67$, $p(2\text{-tailed}) = 0.11$, $r_{\text{effect size}} = 0.32$]. Independent-sample t -tests failed to reveal group differences within face type between the two groups (see Table 3).

4. Discussion

Results of this study are consistent with those of Lundh and Öst (1996) and also extend their original findings in a meaningful way. First, the pattern of means for recognition of critical and accepting faces by individuals with SP and non-anxious controls was very similar in the two studies. In both studies, individuals with SP recognized more critical than accepting faces, and controls demonstrated the opposite pattern. In the Lundh and Öst study, individuals with SP differed in their recognition of critical and accepting faces, and there was a trend in the opposite direction for the controls. However, in the current study, the significant difference was found for controls, but not individuals with SP. One viable explanation for the failure to find significant within-group differences among individuals with SP is ceiling effects. Indeed, with both groups having hit rates of 96% for accepting faces, there was little room for individuals with SP to demonstrate greater accuracy for critical faces. In the current study, we also conducted between-group comparisons within face type. Individuals with SP recognized a greater proportion of critical faces than did the NACs, whereas the two groups showed identical performance for accepting faces.

Extending the work of Lundh and Öst (1996), we also conducted signal detection analyses to disentangle the relative contributions of memory accuracy and response bias. Results of these analyses suggest that the group differences on recognition (hit rates) were not a result of differences in the accuracy of memory for critical faces, but due to differences in response style. Specifically, non-anxious controls showed a significant response bias towards indicating that accepting faces were previously seen, compared to critical faces. In contrast, individuals with SP did not differ significantly on their bias scores for critical and accepting faces. However, examination of the mean bias scores shows that individuals with SP had a small bias towards indicating that critical faces were previously seen, in comparison to the accepting faces. Replications of these findings are needed before firm conclusions should be made. Only one other study of memory for faces in individuals with SP (Foa et al., 2000) has conducted signal detection analyses, and the substantial methodological differences between that study and the current one (e.g., different types of emotional expressions used, different encoding tasks, different signal detection methods) make comparisons difficult. Regardless, the current findings highlight the utility of disentangling the source of apparent recognition biases and the need for additional research examining a possible role of response bias.

While our findings need to be replicated, it is interesting to consider their potential source and implications. The current results suggest that individuals with SP are not better (or worse) than non-anxious controls at correctly recognizing critical and accepting faces. However, controls, and not individuals with SP, possess a bias towards saying that they have previously seen accepting faces. What may account for this response bias, or tendency to say 'yes' that a face was previously seen? One explanation may be group differences in feelings of familiarity for critical vs. accepting faces. While feelings of familiarity are not direct products of memory, such

feelings are usually sufficient to make one feel one is remembering. However, while feelings of familiarity can be influenced by prior exposure to a stimulus, they can also be produced by many other factors (Whittlesea, 1993). Factors relating to the perceived perceptual and conceptual fluency of the stimulus (including feelings about the meaning, pleasantness, duration, and recency of events) can lead to feelings of familiarity in the absence of recall. Indeed, numerous studies have demonstrated a correlation between fluency of perception and the use of familiarity in performing recognition judgments (e.g., Kelley, Jacoby, & Hollingshead, 1989).

What are the implications of group differences in indicating that accepting vs. critical faces were previously seen? One ready implication is that the world is a much friendlier place when one has a sense that accepting faces are familiar. If one lacks this positive bias, or has a bias towards feeling that critical faces are familiar, the world is likely to be perceived as less friendly, and social interactions may be perceived as more anxiety-provoking. Future studies should examine how social anxiety relates to response biases and familiarity for critical and accepting faces and whether such biases change during treatment.

Finally, it is important to recognize limitations of the current study. First, ceiling effects may have hindered the ability to detect hit rate differences in face type in the individuals with SP. Ceiling effects may also have obscured group differences in recognition accuracy. To reduce ceiling effects future studies could utilize a larger number of stimuli, increase the length of the retention interval, or consider the use of response times instead of accuracy as the principal measure (see Lockhart, 2000). Another limitation is that a relatively small number of trials were used for calculating signal detection indices. As with many statistics, a greater number of trials produce more reliable indices. Future studies would benefit from utilization of a larger number of trials, as stimuli are available. Future studies would also benefit from the inclusion of anxious control groups. Comparisons with various anxious groups would provide information as to the specificity of observed biases to SP or whether they are a more general characteristic of the anxiety disorders. Finally, the current study does not reconcile apparent inconsistencies in the existing literature, particularly from recent studies of memory for facial expressions among individuals with SP (Foa et al., 2000 vs. Pérez-López & Woody, 2001). Studies designed to test possible explanations for existing inconsistencies would be of great use. For example, are differences in signal detection findings between the current study and that of Foa et al. (2000) a product of differences in stimuli, trials, sample size, or analytic methods? One method for reducing the existing confusion is to design studies that manipulate variables that are hypothesized to explain apparent inconsistencies. Another method is to systematically replicate and extend previous studies.

In conclusion, our findings replicate and extend those of Lundh and Öst (1996). Most importantly there is now an additional, independent, demonstration of memory bias (differences in hit rates) for critical faces in individuals with SP. This is extremely important given that information-processing models of anxiety propose a memory bias for threat, but historically little support for this assertion has been found. In combination, the findings from the current study and those of Lundh and Öst (1996) strongly suggest that explicit memory biases for threat *do* exist for externally valid stimuli that are encoded in a manner consistent with the core of the disorder, fear of negative evaluation. Further, these findings suggest modifications of stimuli and methods for future experimental studies, in contrast to modifications of existing theories. Finally, additional information is provided about the potential source of this recognition bias.

Specifically, the current findings suggest that additional work should examine the relative contributions of memory accuracy and response bias in individuals with SP. Elucidation of potential mechanisms underlying apparent memory biases will lead to better conceptualizations of the phenomenology of SP.

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