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Short report

Barking up the wrong tree in attentional bias modification? Comparing the sensitivity of four tasks to attentional biases

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ABSTRACT

Background and objectives: Attentional bias modification (ABM) is a potentially exciting new development in the treatment of anxiety disorders. However, reported therapeutic benefits have not always been replicated. To gauge the sensitivity of tasks used in ABM treatment and assessment, we used a counterbalanced within-subject design to measure their discriminant sensitivity to neutral and threatening facial expressions, comparing them with other well-known tasks that measure visual attention.
Methods: We compared two tasks often used in the assessment and treatment of attention bias (the dot-probe and the spatial cueing paradigms) with two well-known visual attention tasks (the irrelevant singleton and attentional blink paradigms), measuring their sensitivity to processing differences between threatening and neutral expressions for non-clinical observers.
Results: The dot-probe, spatial cueing and irrelevant singleton paradigms showed little or no sensitivity to processing differences between facial expressions while the attentional blink task proved very sensitive to such differences. Furthermore, the attentional blink task provided an intriguing picture of the temporal dynamics of attentional biases that the other paradigms cannot do.
Limitations: These results need to be replicated with larger samples, including a comparison of a group of individuals diagnosed with social anxiety disorder and normal controls.
Conclusions: Our results indicate that the sensitivity of putative attentional bias measures should be assessed experimentally for more powerful assessment and treatment of such biases. If the attentional blink task is indeed particularly sensitive to attentional biases, as our findings indicate, it is not unreasonable to expect that interventions based on this task may be more effective than those based on the tasks that are currently used.

1. Introduction

Attentional processes are widely believed to play an important role in the development and maintenance of anxiety disorders. Anxious individuals are, for example, likely to attend to threatening stimuli (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van Ijzendoorn, 2007; Clark, 1986; Clark & Wells, 1995; Heimberg, Brozovich, & Rapee, 2010; Warwick & Salkovskis, 1994; Wells & Matthews, 1994). Such biases are also observed for non-clinical samples, and faces with threatening or negative expressions (anger or disgust) tend to grab people's attention (Eastwood, Smilek, & Merikle, 2001; Fox, Lester, Russo, Bowles, & Dutton, 2000; Hodsoll, Viding, & Lavie, 2011). Researchers have used various tasks to measure attentional processing in anxiety, such as the emotional Stroop task, finding that anxious individuals showed longer response latencies to emotional words than non-anxious participants (Mathews & MacLeod, 1985; Ray, 1979). Subsequently, increased accuracy for threat-related words for anxious compared to non-anxious participants has been found in dichotic listening studies (Burgess et al. 1981).

MacLeod, Mathews, and Tata (1986) developed a probe detection task (Navon & Margalit, 1983) that involved emotional versus neutral stimuli. Many studies using this probe task suggest that anxious individuals have an attentional bias toward threatening stimuli (e.g., Bradley, Mogg, Falla, & Hamilton, 1998; Fox, 1993; Fox, Russo, Bowles, & Dutton, 2001; Macleod & Mathews, 1988; Mogg, Bradley, & Hallowel, 1994). One question that has arisen is whether attentional biases reflect quicker orientation to negative

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stimuli or delayed disengagement from them. Fox et al. (2001) tested a modified version of Posner's (1980) cueing paradigm, where a cue (neutral or threatening) was presented briefly in one of two locations shortly before a target appeared in one location, directly measuring differences in disengagement time from threatening or neutral stimuli. Their anxious participants did indeed dwell longer on threatening stimuli than non-anxious participants (see also Fox et al., 2001).

Anxious individuals have been shown to be faster at searching for threatening faces than non-anxious individuals (Byrne & Eysenck, 1995; Eastwood & Smilek, 2005; Gilboa-Schechtman, Foa and Amir, 1999; Juth, Lundqvist, Karlsson, & Öhman, 2005). And visual search studies have shown how attentional processing in anxiety may differ as a function of the type of anxiety the individual experiences. Öhman and Mineka (2001) found that participants are faster when searching for fear-related stimuli (e.g., spiders for participants afraid of spiders) than other types of stimuli and Byrne and Eysenck (1995) found that participants high in trait anxiety were slower in searching for a happy target in an angry crowd than a neutral crowd. Eastwood and Smilek (2005) found that individuals with social anxiety disorder or panic disorder are faster when searching for negative target faces than positive but individuals with obsessive-compulsive disorder are not.

However, visual attention does not only operate spatially, but has notable temporal characteristics as well (Kristjánsson, Eyjólfsdóttir, Jónsdóttir, & Arnkelsson, 2010; Niemi & Näätänen, 1981). The rapid serial visual presentation task (RSVP) is a useful paradigm for measuring temporal aspects of selective attention. A stream of briefly presented stimuli (<100 ms) is presented in a single spatial location. Two targets (T1 and T2) are embedded in the stream and the lag (number of intervening stimuli) between the two targets varies. Accuracy for the second target (T2) is usually low with shorter lags but increases with longer lags. The accuracy pattern for the two targets is a measure of the participant's attentional deployment in time giving an estimate of how fast the first target can be processed. The period where performance accuracy for T2 significantly drops following the appearance of T1 is called an attentional blink (see e.g., Lawrence, 1971; Raymond, Shapiro, & Arnell, 1992; Smith & Kosslyn, 2007). Arend and Botella (2002) found that the attentional blink was larger for anxious individuals when T1 words were threatening, compared to participants low in anxiety (see also Fox, Russo, & Georgiou, 2005).

1.1. The current goals

A recent therapeutic intervention for anxiety involves training participants to attend preferentially to non-threatening stimuli. While some randomized controlled trials (RCTs) indicate that such *Attentional Bias Modification* (ABM, Amir et al., 2009; Heeren, Reese, McNally, & Philippot, 2012; Schmidt, Richey, Buckner, & Timpano, 2009) can reduce anxiety symptoms, other RCTs do not, and benefits are often unreliable (Bunnell, Beidel, & Mesa, 2013; Neubauer et al., 2013; Rapee et al., 2013; Sigurjónsdóttir, Björnsson, Ludvigsdóttir & Kristjánsson, ahead-of-print). One reason for why findings in this literature are mixed may be the lack of sensitivity of the paradigms used for measuring and treating attentional biases. Tasks used to measure and treat dysfunctional attention biases need to be sensitive to such biases in both clinical and non-clinical populations. However, their sensitivity and reliability have rarely been studied. In the present study we used a counterbalanced within-subject design to assess the sensitivity of 4 different tasks to processing differences between neutral and threatening stimuli. We compared the sensitivity of the most commonly used tasks to measure and treat attentional biases, the *dot-probe* (MacLeod et al., 1986) and *spatial cueing* paradigms (Kristjánsson, Mackeben, & Nakayama, 2001; Posner, 1980), to two popular visual attention tasks, *the attentional blink* task (Kristjánsson & Nakayama, 2002; Raymond et al., 1992) and a visual search paradigm with irrelevant distractors (Theeuwes, 1992; Yantis & Jonides, 1990).

2. Method

2.1. Participants

24 students from the University of Iceland (15 women, 9 men, M_{age} = 23.1 years, age range: 22–32 years) were recruited with online and on-campus advertising. Sample size goal was 20–30 participants and final sample size was determined by a time limit of 2 months to complete data collection. All participants completed self-report measures of anxiety (SIAS and SPS; see below). The SIAS mean score was 22.1 (s.d. = 11.6) and SPS mean score 11.2 (s.d. = 9.5). This indicates that the sample is close to a representative sample of the normal population where SIAS mean score is reported to be 18.8 (s.d. = 11.8) and SPS mean score 14.4 (s.d. = 11.2) (Mattick & Clarke, 1998). All participants completed the four tasks in counterbalanced order to neutralize any sequence effects. Their visual acuity was normal or corrected-to-normal.

2.2. Equipment

The experimental displays were programmed in C using the Vision Shell software library and presented on a 75-Hz CRT controlled by a 400-MHz G4 Apple computer.

2.3. Stimuli and procedure

The same grey scale facial images of 39 Caucasian Dutch people (20 males) showing neutral expressions or expressions of disgust (threatening stimuli) were used in all 4 tasks (see Fig. 1a). The images were drawn from the *Radboud Faces Database* (Langner et al., 2010). We used facial images, firstly because prior studies have mainly used faces and secondly because faces are easy to use for all the tasks that we wanted to examine. Also using face stimuli for measuring attentional processing arguably poses fewer confounds than word stimuli. Word perception is complex, relies on learning, speed and interpretation. People react more strongly to faces than other types of stimuli, using a special region of the brain specially dedicated to face perception, the fusiform face area, making faces an optimal stimuli for measuring attentional processing (see e.g., Kanwisher, McDermott, & Chun, 1997).

All participants underwent four computerized attentional tasks: *Probe task* (2 × 100 trials), *spatial cueing* (2 × 100 trials), *irrelevant distractor* (2 × 100 trials) and *attentional blink* (3 × 50 trials) in counterbalanced order. Before commencing each task, participants received verbal instructions from the experimenter and completed 5 practice trials. Participation took 50–60 min.

All four tasks started with the presentation of a central white fixation cross on a black background (see Fig. 1). Following a variable interval (1100–1500 ms, randomly determined for each trial) the experimental stimuli appeared. Auditory feedback on whether the answer was correct or incorrect was provided after each trial. The main measure of interest in all four tasks was whether there were any performance differences that could be traced to facial expression.

2.3.1. Probe task

Each trial on the *probe task* started with the presentation of two facial images of the same individual, one neutral and the other threatening ($5.24° \times 5.71°$) for 146 ms, above and below the fixation cross, with its center 3.5° from it (see Fig. 1b). A white arrow

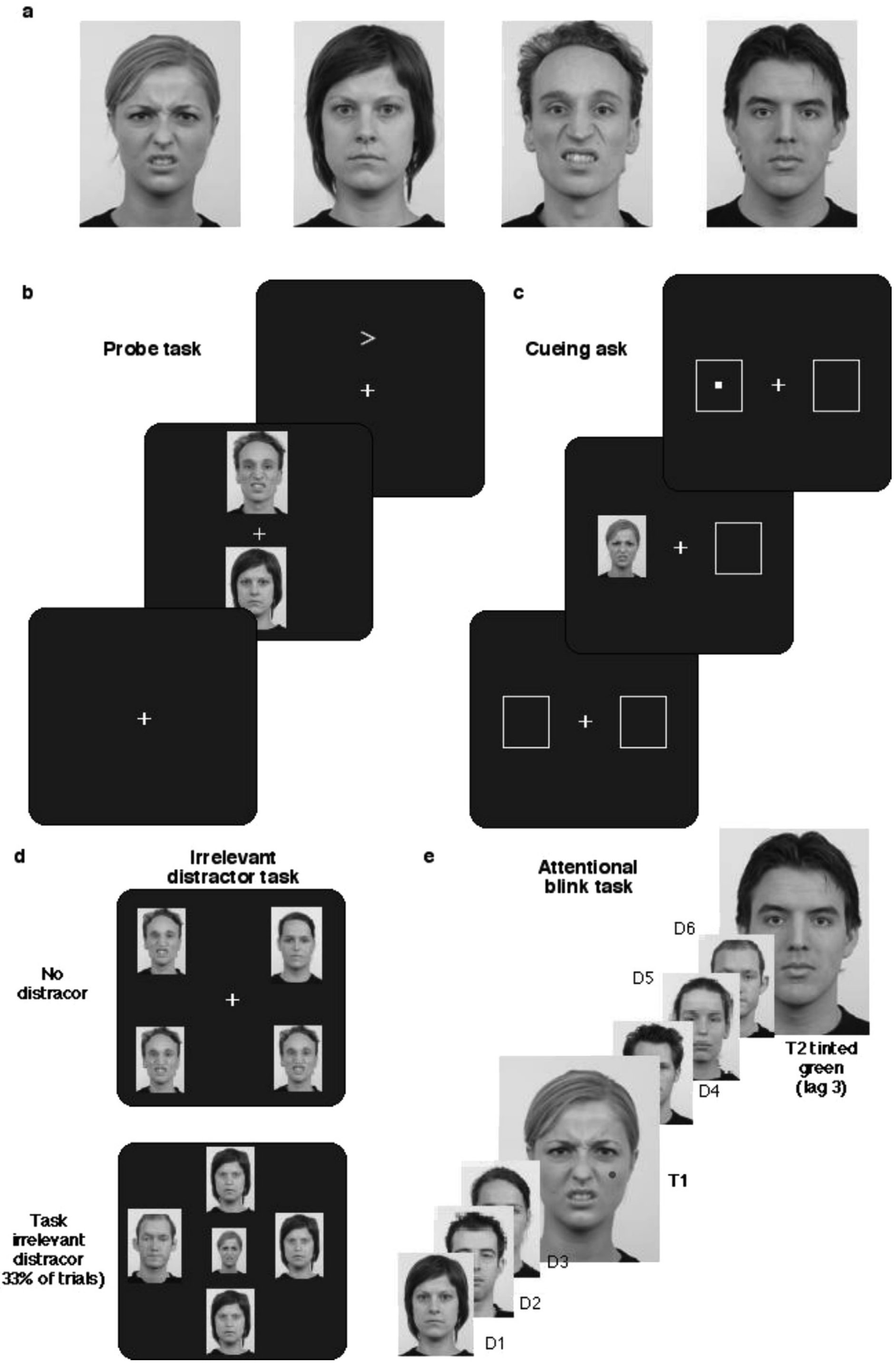

Fig. 1. Examples of the faces used, and the four experimental paradigms. A) Four examples of faces, two of each gender and two with each expression (neutral or disgust). B) The *Probe task*: Two faces were presented for 146 ms following initial fixation, followed by an arrow at one of the locations. C) The *Cueing task*: A face cue was presented for 146 ms, immediately followed by the target at either the cued or uncued location. D) The *Irrelevant distractor task*: Participants searched for the odd face out and judged its gender. On 33% of trials a larger task irrelevant face appeared at screen center E) The *Attentional blink task*: Participants had to detect the target that had a dot on either cheek (target 1, T1), and indicate where the dot was located and then judge the gender of the green tinted face (target 2, T2) that appeared 1–8 presentations later (T1 and T2 are inflated in size for demonstrative purposes, but were actually the same size as the other facial images).

(each line 30 arc min) followed, presented either where the neutral or threatening face had appeared. Participants judged (by keypress) whether the arrow pointed to the left or right. The main variable of interest was whether there would be differences in response time depending on whether the arrow appeared behind a threatening or neutral face.

2.3.2. *Cueing task*

Each trial started with the presentation of two white frames (4.95° × 4.95°) at the left and right of fixation (center of the square 4.5° from fixation). A cue, a neutral or threatening facial image, appeared in one of the frames 1100–1500 ms later (randomly determined) for 146 ms followed immediately by a small white square (30° × 30° arc min) either in the cue frame (if the cue was valid) or in the opposite frame (when the cue was invalid). Participants judged (by keypress) whether the square appeared to the left or right of fixation. The main variable of interest was whether performance would differ depending on whether the cue was threatening or neutral.

2.3.3. Irrelevant distractor task

Following fixation, four search items (5.71° × 4.57°) appeared. Three were of the same individual with one image of a member of the opposite gender, and participants had to find the odd-face-out and judge its gender (by keypress). The expression of each face (threatening or neutral) was random. On 1/3 of trials, an irrelevant face (4.38° × 3.91°), which participants were instructed to ignore (expression was random), appeared in the center of the display. The main variable of interest was whether any effect of the irrelevant distractor would differ by expression.

2.3.4. Attentional blink task

On each trial, a stream of 30 facial images (5.24° × 5.90°) was presented at screen center on a dark background. Each face was presented for 67 ms with a 40 ms blank screen in between. Two target images were embedded in the stream, target 1 (T1) marked by a dot (0.19°) on the left or right cheek of the face, which could be face number 5 to 15 in the stream, and target 2 (T2) distinguished by green tint. T2 was the first to eighth face following T1, determined randomly on each trial. The remaining images (distractors) were all faces of different individuals presented in greyscale and were either all neutral or all threatening. Participants were prompted after each trial to judge (by keypress) whether the dot was on the left or right cheek on T1 and whether T2 was male or female. The two main variables of interest were, whether detection of T2 would depend on T1 facial expression, and also on whether T2 was threatening or neutral.

2.3.5. Social anxiety measures

Social anxiety disorder (SAD) symptoms were measured using the *Social Interaction Anxiety Scale* and the *Social Phobia Scale* (SIAS & SPS; Mattick & Clarke, 1998). Each scale comprises 20 items. Together they assess the main fears and avoidance behaviours of SAD; interaction fears (SIAS) and performance fears (SPS). The Icelandic translations have been shown to have good psychometric properties ($\alpha > .80$; Ólafsdóttir, 2012).

3. Results

For the probe, cueing and irrelevant distractor tasks, trials with response times ±3 SDs for each participant (<0.27% of their responses) were excluded from analyses along with error trials for the probe and cueing task (1% of trials for each task). Effect sizes (Cohen's d) were calculated for each task to provide a standardized measure of the differential sensitivity of attentional processing of facial expression on performance.

3.1. Probe task

The results for the probe task are presented in Fig. 2a. Mean RT on the probe task was 452.7 ms (s.d. = 97.2, range = 161–744 ms) and accuracy was 99%. RTs on trials where targets appeared in the location of threatening face did not differ significantly from RTs on trials where the arrow appeared in the location of a neutral face; threat trials M = 448.0 ms, s.d. = 41.0: neutral trials M = 446.4, s.d. = 41.0, $t(23) = 0.98$; $p = .338$; $d = 0.05$, indicating no effect (Cohen, 1977). There was, in other words, no influence of facial expression on performance on the probe task.

3.2. Cueing task

The results for the cueing task are shown in Fig. 2b. Mean RT was 367.9 ms (s.d. = 94.5, range = 84–652 ms) and accuracy was 99%. A 2 × 2 (Cue Validity × Cue Type [threat, neutral]) repeated-measures ANOVA revealed neither main effects of cue validity, $F(1, 22) = 0.22$, $p = .646$ nor cue type, $F(1, 22) = 0.97$, $p = .336$, nor was there a Cue Validity × Cue Type interaction ($F(1, 22) = 3.42$, $p = .078$). Cohen's d for the effect size for the differences of the means on invalid threatening trials and invalid neutral trials was 0.03, an effect close to 0. Again, there was no influence of facial expression on performance on the cueing task.

3.3. Irrelevant distractor task

The results for the irrelevant distractor task are shown in Fig. 2c. Overall mean RT was 1429.7 ms and total accuracy 94.3%. RTs on trials with an irrelevant distractor were significantly longer (M = 1489 ms) than RTs on trials without a distractor (1362 ms), $t(23) = 7.0$, $p < .001$; $d = -0.56$. A 2 × 2 (Distractor Type [threat, neutral] × Target Type [threat, neutral]) repeated-measures ANOVA showed no effect of distractor type, $F(1, 22) = 0.69$, $p = .413$, nor target type, $F(1, 22) = 0.001$, $p = .97$, nor was there a distractor type

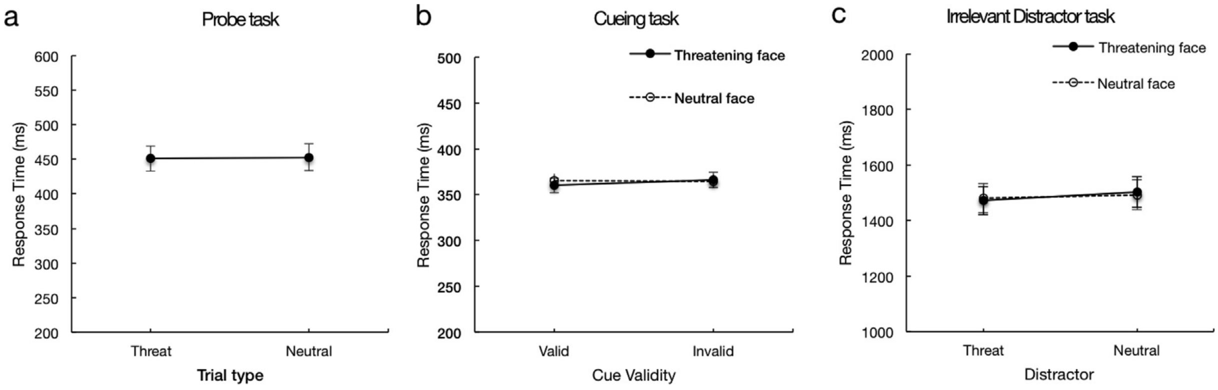

Fig. 2. The results for the probe, spatial cueing and the irrelevant distractor tasks. a) Response times on the probe task, as a function of expression of the face where the target appeared. b) Response times on the spatial cueing task as a function of whether the cue was a threatening or neutral face and whether it was valid or invalid. c) Response times as a function of expression of the irrelevant distractor and whether it appeared among search stimuli with threatening or neutral expressions. Error bars represent the standard error of the mean (SEM).

by target type interaction; $F(1, 22) = 0.05$, $p = .825$; $d = -0.05$. There was no influence of distractor type on response time on the irrelevant distractor task although there was a moderate effect of presenting a distractor on 1/3 of trials, in line with previous results (Theeuwes, 1992; Yantis & Jonides, 1990).

There were no significant differences in accuracy between trials with or without a distractor, $t(23) = 1.0$, $p = .310$. A 2 × 2 (Distractor Type [threat, neutral] × Target Type [threat, neutral]) repeated-measures ANOVA showed no effect of distractor type on accuracy, $F(1, 22) = 1.767$, $p = .197$, nor target type, $F(1, 22) = 1.558$, $p = .224$, but the distractor type by target type interaction was significant, $F(1, 22) = 5.197$, $p = .032$, reflecting slightly higher accuracy (~2%) when both target and distractor were threatening (see Fig. 3). This difference is, however, very small.

3.4. *Attentional blink task*

Overall accuracy for T1 was 98.6% and 76.9% for T2. We initially ran a 2 × 2 × 2 × 4 (T1-type [threat, neutral] × T2-type [threat, neutral] × Distractor Type [threat, neutral] × Lag Between Targets [1–2, 3–4, 5–6, 7–8]) repeated measures ANOVA. A few cells had missing data so the eight lags were merged into four groups. This analysis showed a main effect of lag between targets, $F(3, 51) = 5.13$, $p = .004$, reflecting an attentional blink where accuracy for T2 increased with lag from T1 (see Fig. 4). The main effect of T2-type was also significant, reflecting higher accuracy on trials where T2 was threatening, showing that faces with threatening expressions were less affected by the attentional blink than faces with neutral expressions, $F(1, 17) = 16.73$, $p = .001$. The T2-type × Distractor Type interaction was significant, $F(1, 17) = 4.48$; $p = .049$ as was the T1-type × Lag interaction $F(3, 51) = 4.47$, $p = .005$.

We also ran a 2 × 2 × 2 × 8 (T1-type [threat, neutral] × T2-type [threat, neutral] × Distractor Type [threat, neutral] × Lag [1, 2, 3, 4, 5, 6, 7, 8]) repeated measures ANOVA where missing values were estimated with linear regression. Average percent correct for T2 is shown in Fig. 4 as a function of whether T1 was threatening or neutral and as a function of lag between T1 and T2. This ANOVA revealed similar effects as the previous one with a main effect of T2 ($F(1,23) = 32.01$, $p < .001$) and of lag ($F(7,17) = 4.62$, $p < .001$) and an interaction of T1 and T2 ($F(1,23) = 4.92$, $p = .037$). In this second ANOVA the interaction of T2 and distractor type was not quite significant by conventional standards, but it is doubtful that this differs in principle from the previous results ($F(1,23) = 4.17$, $p = .053$). There was both an interaction between T1 and lag ($F(7,17) = 3.28$, $p = .003$) and T2 and lag ($F(7, 17) = 2.34$; $p = .026$). To follow up on these interactions, we conducted t-tests on each of the lags (significant ones indicated in Fig. 4).

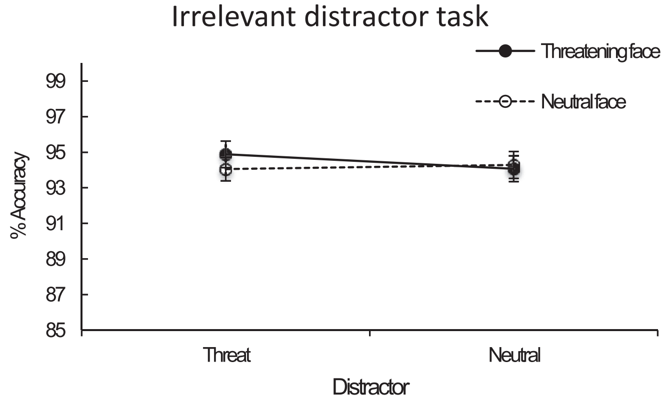

Fig. 3. Accuracy on the irrelevant distractor task as a function of whether the irrelevant distractor was a face with a threatening or neutral expression. Error bars represent the standard error of the mean.

For further clarification of the results, Fig. 5a shows the main effect of T1 type, showing how the attentional blink is stronger (accuracy 15% lower) when T1 is threatening. The blink then evens out at lags 2–4. It is possible that increased performance following threatening T1s at lags 5–8 reflects increased vigilance following threatening stimuli. Fig. 5b shows the main effect of T2 type, showing how threatening T2s recover better and more quickly from the attentional blink, with performance becoming equal at lags 7–8.

The effect size of facial expression on performance on the attentional blink task was calculated to give a standardized measure of its differential sensitivity. When T1 was threatening, the mean accuracy across all distances when T2 was threatening was 79.99% and 74.28% when T2 was neutral. The effect size for T2 type was $d = 0.73$, a medium effect (Cohen, 1977). When T1 was neutral, the mean accuracy across all distances when T2 was threatening was 81.93% and 72.54% when T2 was neutral. Cohen's d for T2 type was 2.17, indicating a large effect (Cohen, 1977).

The attentional blink results indicate that threatening T1s induce an attentional blink more quickly than neutral T1s. Secondly, threatening T2s are more likely to be identified than neutral T2s; and threatening T2s “recover” more quickly from the attentional blink than neutral T2s. The attentional blink proves to be very sensitive to processing differences between threatening and neutral faces and furthermore, the time courses of attentional blink effects show interesting temporal dynamics as a function of facial expression, which may prove useful in the assessment and treatment of attentional biases.

4. Discussion

Measures of attentional biases towards threatening stimuli should readily distinguish between how faces with different emotional expressions are processed. These attentional biases likely reflect evolutionary biases toward threat (Ekman, 1973; Öhman & Mineka, 2001) and should be found in non-clinical as well as in clinical populations. Our results show that the tasks most often used for measuring and modifying attention biases; the probe and spatial cueing tasks (Bar-Haim, 2010; Beard, Sawyer, & Hofmann, 2012), do not reliably detect such differences in a non-clinical sample. They may therefore not be sensitive to the attentional biases they are designed to assess and treat. Our results suggest, however, that the attentional blink task is highly sensitive to changes in performance depending on whether the faces contain threatening or neutral expressions. The irrelevant distractor task showed minor modulations dependent on facial expression for accuracy, but the implications are unclear.

Two important considerations follow: First, assessment of attentional biases with the spatial cueing and dot probe tasks may not be as precise as it could be and, second, current ABM interventions, typically based on the dot probe paradigm, could be made more effective with a more sensitive task. In fact, the latter point may explain why the effects of ABM interventions are as elusive as they appear to be.

Our results also reveal interesting temporal dynamics of the effects of facial expression during the attentional blink: i) the attentional blink occurs faster if T1 is threatening, reminiscent of lapses in attention to a probe appearing shortly following emotionally arousing stimuli (the emotional blink; Kristjánsson, Óladóttir, & Most, 2013; Most, Chun, Widders, & Zald, 2005) and ii) observers recover faster from the attentional blink if T2 is threatening. Whether attentional biases cause capture by

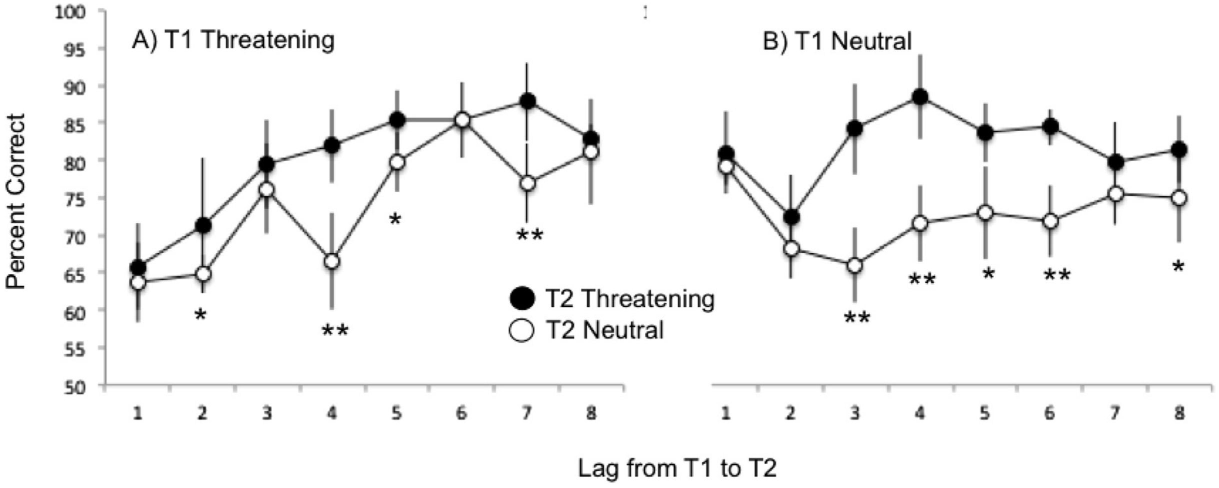

Fig. 4. Average accuracy for the threatening and neutral T2s for the eight different lags between T1 and T2 when T1 was threatening (a) and neutral (b). Error bars represent the standard error of the mean (SEM). Single stars denote that a t-value for that difference was significant at $\alpha = .05$ and double stars indicate a difference significant at $\alpha = .01$.

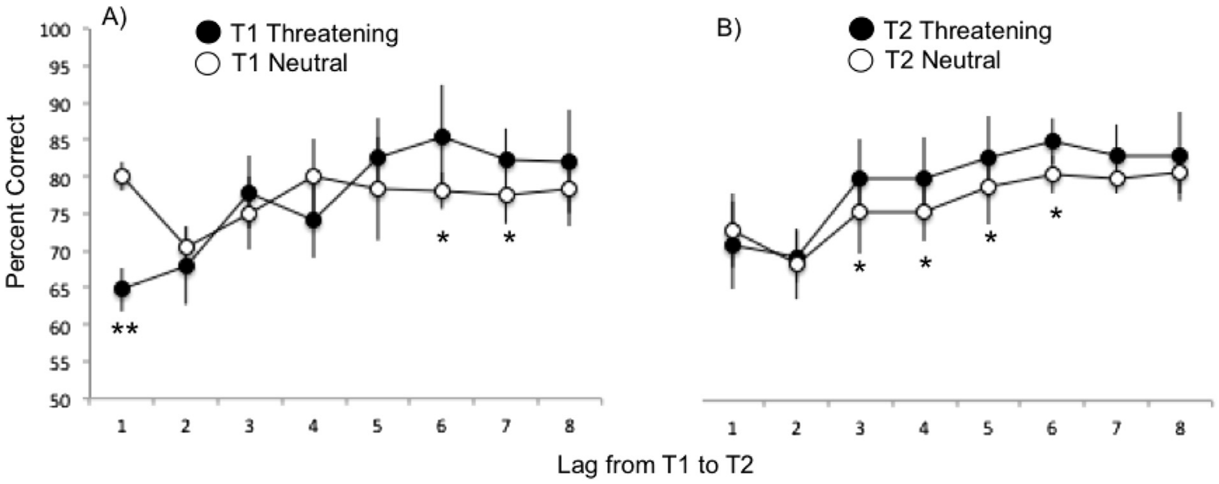

Fig. 5. Panel (A) shows the main effect of T1 type on T2 accuracy, for threatening versus neutral T1s. Panel (B) shows the main effect of T2 type on T2 accuracy, showing average accuracy for the threatening and neutral T2s. Error bars represent the standard error of the mean (SEM). Single stars denote that a t-value for that difference was significant at $\alpha = .05$ and double stars indicate a difference significant at $\alpha = .01$.

threatening stimuli, or the inability to disengage from them is debated (Amir, Elias, Klumpp, & Przeworski, 2003; Fox et al., 2000; Moriya & Tanno, 2011; Staugaard, 2010) and the intriguing temporal dynamics that the attentional blink task reveals, may allow for more nuanced assessment of how attentional biases unfold over time than the snapshot measurements other paradigms provide. By developing more diverse assessment methods of dysfunctional attention, theories of the role of attention in the development and maintenance of anxiety disorders can be fine-tuned, potentially yielding more effective treatment. Unlike the dot probe task that taps into spatial dynamics of attention, the attentional blink task taps into the temporal dynamics of attention, bringing the task a step closer to the actual dynamics of a social situation. This makes the attentional blink task a promising contender for development of a new attention modification task.

Dysfunctional attentional processing in anxiety is likely related to decreased capacity to regulate attentional processes when confronted with threatening stimuli (Derryberry & Reed, 1996, 2002; Eldar & Bar-Haim, 2010; Moriya & Tanno, 2008). Our failure to detect processing differences of threatening and neutral stimuli in a non-clinical sample for three out of four tasks, might therefore bear witness to the capacity of healthy participants to regulate biases toward threat rather than reflecting a lack of sensitivity to attentional biases. But this begs the question of why we observed these large differences between the facial expressions in the attentional blink task. Further studies comparing clinical and non-clinical groups are needed to give a clearer answer to this question.

We should acknowledge that our measures of clinical symptoms were somewhat limited. The self-report measures (SPS & SIAS) of social anxiety suggest however, that our sample is representative of a non-clinical sample. A study is currently underway in our laboratory which involves comparing these tasks in a sample of patients diagnosed with social anxiety disorder to a control non-clinical sample, and in which more comprehensive measures of clinical symptoms will be applied. Our study was based on 24 participants, which may raise the issue of limited statistical power. However we do have 150–200 trials for each participant on each task. The statistical analyses we did were based on within-subject comparisons. If they were based on between-group comparisons a larger sample would have been appropriate.

More generally, our results show how research into dysfunctional attention can benefit from progress in the study of visual cognition where new tasks are constantly being developed to measure and give insights into attentional processes.

In conclusion, our findings indicate that the sensitivity of putative attentional bias measures should be assessed in order to develop more powerful assessment and treatment of such biases in anxious individuals. Attentional bias modification is rightly considered an exciting development in the treatment of anxiety disorders, but our results highlight the need for further study of the paradigms used.

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