Available online at www.sciencedirect.com
SCIENCE DIRECT®
Personality and Individual Differences 40 (2006) 1007–1016
PERSONALITY AND INDIVIDUAL DIFFERENCES
www.elsevier.com/locate/paid

Repeating the stimulus exposure to investigate what happens after initial selective attention to threatening pictures

Xinghua Liu [a,b,*], Mingyi Qian [a,*], Xiaolin Zhou [a,b,*], Aimin Wang [c]

[a] *Department of Psychology, Peking University, Beijing 100871, China*
[b] *Learning and Cognition Laboratory, Capital Normal University, Beijing 100037, China*
[c] *Miami University, USA*

Received 30 November 2004; received in revised form 18 August 2005; accepted 10 October 2005
Available online 7 December 2005

Abstract

This study investigated whether individuals with a high trait anxiety (HTA) rating retain attentional bias towards threatening pictures when such pictures are repeatedly presented. Subjects rated high ($n = 20$) and low ($n = 20$) on an anxiety scale participated in a forced-choice reaction time version of a modified dot-probe task. Picture pairs were presented in four exposure blocks. On each exposure, the attentional bias to the threatening pictures was measured. HTA individuals showed more selective attention to the high threatening pictures than individuals with low trait anxiety (LTA). However, HTA individuals did not maintain attentional bias. On the fourth block, the attentional bias to threatening pictures disappeared. Theoretical and methodological implications of these findings are discussed.

Keywords: Attentional bias; Anxiety; Exposure occasion; Dot-probe task; Threatening pictures

1. Introduction

Several cognitive models (e.g. Eysenck, 1997; MacLeod, Mathews, & Tata, 1986; Mathews & MacLeod, 1994; Williams, Watts, MacLeod, & Mathews, 1997) propose that vulnerability to

* Corresponding authors. Address: Department of Psychology, Peking University, Beijing 100871, China.
E-mail addresses: xinghua_liu999@163.com (X. Liu), qmy@pku.edu.cn (M. Qian), xz104@pku.edu.cn (X. Zhou).

0191-8869/$ - see front matter
doi:10.1016/j.paid.2005.10.006

anxiety is associated with an initial selective attention to emotionally negative information, a hypothesis supported by evidences from different paradigms (see Williams et al., 1997). Such initial attentional bias to negative stimuli in the environment has been demonstrated not only in anxiety disorder patients (Mogg, Mathews, & Eysenck, 1992; Tata, Leibowitz, Prunty, Cameron, & Pickering, 1996) but also in non-clinical HTA individuals (Keogh, Dillon, Georgiou, & Hunt, 2001; Williams, Mathews, & MacLeod, 1996; and Williams et al., 1997).

What happens subsequently after the initial selective attention towards threatening cues? Beck's (1976) schema model and Bower's (1981) network model suggest that anxiety-related biases to negative stimuli operate not only in the initial orientation, but also in the maintenance of attention. High trait anxious (HTA) individuals have difficulty in disengaging their attention from negative stimuli. However, other researchers suggest a "vigilance–avoidance" pattern, in which HTA individuals rapidly divert their attention away from negative stimuli after the initial orienting to the negative stimuli (Mathews, 1990; Mogg & Bradley, 2002; Mogg, Mathews, & Weinman, 1987). This strategy is reported to have the function of reducing their state anxiety level (see Mogg, Bradley, Miles, & Dixon, 2004).

Using a modified visual probe task, several studies examined whether the pattern of attentional bias to negative stimuli (e.g. emotional words and pictures) changed over the stimulus exposure–duration (Bradley, Mogg, Falla, & Hamilton, 1998; Koster, Verschuere, Crombez, & Damme, 2005; Mogg, Bradley, de Bono, & Painter, 1997; Mogg et al., 2004; Rohner, 2002). In the eye-registration study, Rohner (2002) found that HTA group showed avoidance of angry facial expression at the time course of 1500 ms. Mogg et al. (2004) found that individuals with high levels of blood-injury fear showed an initial vigilance for high threatening scenes at the exposure–duration of 500 ms, and a subsequent avoidance of those scenes at the duration of 1500 ms. In a recent study, HTA individuals showed an attentional bias to threatening picture at the duration of 100 ms and a clear sign of avoidance to these pictures at 1250 ms (Koster et al., 2005). But other studies did not observe such a change of attentional bias as a function of exposure–duration (Bradley et al., 1998; Mogg et al., 1997).

Another approach is to investigate the dynamic variation of attentional bias towards salient (negative) stimuli through repeating the stimulus exposure occasions. This approach has not yet been explored extensively. Recently, using a similar methodology, findings were reported by Harris and Pashler (2004) who showed normal participants two digits surrounding a word and asked them to make a speeded judgment about whether the two digits matched (i.e. identical parity or not). When the participant's own name was presented as the word on two scattered trials among a total of 50 stimuli, responses from the participant were markedly slowed, indicating that attention was captured by participant's own name. However, in a subsequent block of trials in which half the words were the participant's name, this delayed response did not occur.

So far, no published study has investigated the relationship between attentional bias to threatening stimuli and stimuli exposures. The present study was to explore whether individuals would maintain their attention bias towards threatening pictures over multiple exposure occasions or not. A pictorial version of the dot-probe task (Mogg et al., 2000, 2004) was used to assess the change in attentional bias. Emotional pictures were used as stimuli because compared with emotional words, pictures have a higher threat value and may be potentially more informative (Bradley et al., 1998). Both high and mild threatening pictures were selected as stimuli to investigate what happens after initial selective attention to the threatening pictures because previous research

found that the threatening levels of the pictures made a difference in terms of capturing participants' attention (Mogg et al., 2000). Pictures were presented in four consecutive blocks, and the change of attentional bias to threatening pictures in these blocks was thus examined as a function of number of exposures.

2. Method

2.1. Participants

A total of 41 first year undergraduate students from a major university in Beijing, China, participated in the experiment. One participant was excluded due to a high percentage of error responses (9% of the total trials while the average error was less than 1%). The remaining participants were divided into high trait anxious (HTA) and low trait anxious (LTA) groups by the median score (36) of the Chinese version of the state trait anxiety inventory (STAI, with $\alpha = 0.87$ for STAI-trait and $\alpha = 0.87$ for STAI-state; Li & Qian, 1995; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). The groups are similar in age and gender ratio (about 50% each), but differed significantly in trait anxiety (45.1 versus 29.8, $t(38) = 10.31$, $p < 0.001$), and in state anxiety (45.5 versus 30.3, $t(38) = 6.57$, $p < 0.001$) measured by the STAI, and Beck depression (8.6 versus 3.2, $t(38) = 4.11$, $p < 0.001$) measured by the Chinese version of Beck Depression Inventory (BDI, $\alpha = .91$; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961; Zhang, Wang, & Qian, 1990).

2.2. Materials

The stimulus sets were selected from the International Affective Picture System (IAPS) (Lang, Bradley, & Cuthbert, 1995). Of the 144 pictures selected, 24 were classified as high threatening and 24 as mild threatening, and the other 96 as non-threatening, based on scores produced by six independent judges who rated the level of threat of each picture on an anchored 9-point scale (1 = not at all threatening, 9 = very threatening). These judges were graduate students in the field of Psychology. Three of them were males and the other three were females. The mean ratings were 6.5 (SD = 0.6) for high threatening pictures, 4.4 (SD = 0.9) for mild threatening pictures, and 1.6 (SD = 0.6) for non-threatening pictures. Each threatening picture was matched with a non-threatening picture of similar color, shape and nature of the focal object. The total 72 picture pairs include 24 high threatening and non-threatening picture pairs, 24 mild threatening and non-threatening picture pairs, and 24 filler pairs of non-threatening pictures so that threatening pictures were not presented on all the trials.

The digitized pictures were adjusted in size so that each was 11.0 by 7.6 cm, with a distance of 3.0 cm between the inner edges of the pictures in each pair. The distance between the probe and the central fixation was 5.0 cm. Participants sat at about 100 cm from the screen.

2.3. Dot-probe task

A fixation cross was presented at the center of a computer screen for 1000 ms. A pair of pictures were then presented for 500 ms separately on the left and the right of the fixation, followed

immediately by a probe target (a single illuminated dot) presented at the same location of one of the pictures. Participants were told to press one of two mouse keys as quickly and as accurately as possible to indicate whether the probe occurred at the location of the left or right picture. The probe remained on the screen until the participant made the localization response. After the response, another trial began. The inter-trial interval varied randomly between 500 and 1500 ms.

There were 12 practice trials (with non-threatening picture pairs that would be not used in formal trials), followed by four test blocks. Each block had all 72 picture pairs. The positions of the pictures as well as the probe target were counterbalanced, so that the probe appeared with equal probability to the left and the right of fixation, and to the threatening or non-threatening picture locations, and the picture pairs were presented in a random order for each participant.

2.4. Procedure

Participants were informed that the experiment contained some unpleasant pictures from the IAPS, and if they found that disturbing, they could withdraw from the study at any time. Participants then engaged in the practice trials (additional non-threatening picture pairs that were not used in formal trials), followed by the formal trials. They were tested individually in a quiet room, and were given a short break between test blocks. After the formal experiment, participants completed the Chinese version of STAI and BDI. It took ≈25 min to complete the entire experiment.

3. Results

After examining the reaction time (RT) data with box and whisker plots, latencies greater than 900 ms or less than 200 ms were excluded as outliers. Trials of errors and outliers were about 1% of all trials, and there was no evidence that anxiety groups differed in either the error or outlier rates. The average reaction times (RTs), after excluding errors and outliers, were calculated separately according to whether the probe targets in each block appeared at the threatening picture location or the non-threatening picture location. Table 1 presents the average RTs to probes in each condition. Attentional bias scores were calculated by subtracting the average RTs at the

Table 1
Mean reaction times (SD) between LTA and HTA groups on different types of pictures

Threat type	Anxiety group	Location	Exposure occasion			
			1st	2nd	3rd	4th
High threat	LTA	Threat	462 (80)	455 (86)	440 (55)	421 (62)
		Non-threat	468 (81)	448 (80)	437 (72)	411 (52)
	HTA	Threat	478 (77)	465 (58)	454 (61)	462 (50)
		Non-threat	488 (77)	487 (60)	474 (68)	449 (59)
Mild threat	LTA	Threat	448 (84)	449 (86)	424 (55)	422 (64)
		Non-threat	445 (75)	446 (72)	430 (65)	415 (55)
	HTA	Threat	458 (71)	461 (59)	449 (60)	431 (64)
		Non-threat	467 (73)	461 (62)	455 (57)	440 (62)

location of threatening pictures from the average RTs at the location of the paired non-threatening pictures. Positive values indicated that participants responded to the probes faster at the location of the threatening pictures than they did at the location of the paired non-threatening pictures, and showed an attentional bias toward the threatening pictures.

Attentional bias scores were analyzed as the dependent variable using a $2 \times 4 \times 2$ mixed-design ANOVA, with two within-subjects variables of threat type (high versus mild threat), exposure occasion (first, second, third and fourth test exposure block), and one between-subjects variable of level of anxiety group (HTA versus LTA). There was a significant main effect of anxiety group, $F(1,38) = 6.41$, $p < 0.05$, with a higher average attentional bias score for threatening pictures in the HTA group (8 ms) compared to the LTA group (−3 ms). There was also a main effect of exposure occasion, $F(3,114) = 3.04$, $p < 0.05$. There was a significant interaction among threatening picture type × exposure occasion × anxiety group, $F(3,114) = 3.19$, $p < 0.05$. No other significant differences were found (interaction between threat type and exposure occasion, $F(3,114) = 2.07$, $p > 0.1$; all other F-value < 1). Subsequently, separate ANOVAs on attentional bias scores were conducted due to the significant three-way interaction.

For mild threatening pictures, no significant effect was found between anxiety group, exposure occasion and their interaction (all F-value < 1). For high threatening pictures, there were significant effects of anxiety group, $F(1,38) = 5.12$, $p < 0.05$, with greater vigilance for high threatening pictures in the HTA group (10 ms) compared to the LTA group (−3 ms); exposure occasion, $F(3,114) = 4.40$, $p < 0.01$, and significant interaction between anxiety group and exposure occasion, $F(3,114) = 2.96$, $p < 0.05$, (see Fig. 1).

Separate one-way ANOVAs were employed for both HTA and LTA groups for high threatening picture due to the significant interaction. For LTA group, there was no significant effect in exposure occasion ($F = 1$). For HTA group, there was a significant main effect of exposure occasion, $F(3,57) = 5.56$, $p < 0.01$. Trend analysis revealed a significant Linear trend $F(1,19) = 6.49$, $p < 0.05$, and a significant Quadratic trend, $F(1,19) = 11.36$, $p < 0.01$. These significant trends indicated an overall tendency of reducing attentional bias over time, and a non-linear pattern of this reduction as seen on Fig. 1. None of the higher order trends were significant. One-sample

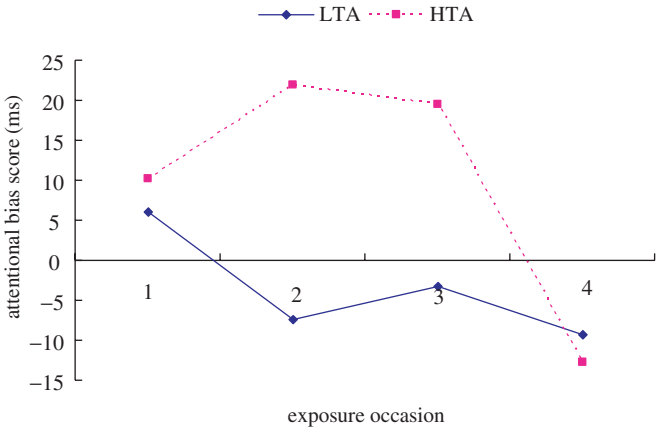

Fig. 1. Average attentional bias scores to high threatening scenes of exposure occasion and trait anxiety group.

Table 2
Pearson correlations between attentional bias scores and scores of STAI-trait, STAI-state and BDI on each exposure occasion of high threatening pictures

	Exposure occasion			
	1st	2nd	3rd	4th
Beck depress	0.07	0.26	0.10	−0.12
State anxiety	0.30	0.32*	0.39*	0.12
Trait anxiety	0.20	0.33*	0.36*	−0.10

* $p < 0.05$.

t-test was used to compare the attentional bias in each block with zero, which representing no attentional bias. The results showed a marginally significant attentional bias to high threatening pictures in the first exposure occasion, $t(19) = 1.78$, $p = 0.09$, significant bias to high threatening pictures in the second exposure occasion, $t(19) = 2.48$, $p < 0.05$, and the third exposure occasion, $t(19) = 2.87$, $p < 0.01$. No significant difference was found at the fourth exposure occasion, $t(19) = -1.33$, $p > 0.1$. As seen on Fig. 1, there was high attentional bias on the first three exposures. However, this bias diminished at fourth exposure.

Since the HAT and the LAT groups were divided at the mid-point of their STAI-trait scores, and the mid-point dividing might reduce the possibility to find significant difference in comparison to using extreme groups, Pearson correlation as a more sensitive statistical analysis method was employed to examine the relationship between participants' STAI-trait scores and their attentional bias scores. As seen in Table 2, significant correlations were found between the STAI-trait scores and attentional bias scores on the second and the third exposures with about 10% of the shared variance. This result is similar to the findings when the effects were examined by comparing group differences through ANOVAs or *t*-tests. The same patterns of correlations were also found between STAI-state scores and the attentional bias scores as reported in Table 2. However, no significant difference was found between the depression scores and attentional bias scores. These finding suggested that the attentional bias to threatening pictures were associated more with anxiety in comparison to depression.

4. Discussion

The present study found that attentional bias to high threatening pictures changed when the pictures were presented on multiple occasions. This variation was found in the HTA individuals only. These participants responded significantly faster when the probe was presented at the location of high threatening pictures than when the probe was presented at the location of non-threatening pictures in the first three exposure occasions. This indicated that these participants paid more attention to the threatening pictures and therefore indicated an attentional bias toward threatening pictures. This attentional bias, however, disappeared at the fourth exposure occasion. Responses to probes at the location of mild threatening pictures did not show this pattern. No significant attentional bias was found in either HTA or LTA participants when exposed to such pictures.

4.1. Initial capture of attention by threatening pictures

Previous studies using threatening pictures (Koster et al., 2005), emotional words (e.g. MacLeod et al., 1986), or participants' own names (Harris & Pashler, 2004) found strong effects of salient (negative) stimuli in capturing attention in only one exposure. However, in the present study, attentional bias for high threatening pictures was only marginal significance for the HTA group in the first exposure. This was not completely consistent with the results of the above studies. Several reasons may have contributed to this difference. One possibility is that the statistical power was not high enough to reveal the difference when the effect size was small due to the small number of participants. Another possible reason is that the pictures presented in the present research might have provided more information than words and therefore might require more exposures or longer exposure duration to reveal the difference. The third possible reason is that there was only one exposure of each threatening picture in the first exposure block in the present study, while Koster et al. (2005) averaged four exposures of the same picture. When comparing with other studies in which threatening stimuli were presented only one time, such as Mogg et al. (2000) and Yiend and Mathews (2001), the findings were consistent with results of the present study. Yet another possible reason is that the participants may not show a full attentional bias to threatening pictures when they are first presented. The threatening nature of these pictures may become more obvious when they are presented more than one time so that the participants do not perceive that the threatening pictures were presented accidentally and without enough significance. This possibility also explains why the attentional biases were stronger in the second and the third exposure blocks.

Most importantly, in the present study, significant attentional bias to high threatening pictures was observed in the second and third exposure in HTA individuals, which was not separately examined by previous studies. This overall result may be considered as consistent with the finding of Koster et al. (2005) when the same threatening picture pair was presented for four times.

The pattern that attentional bias was observed at both the second and the third testing exposures was not exactly consistent with the slightly quicker disappearance of the attentional capture effect in Harris and Pashler (2004). A possible reason is that emotional pictures, in comparison with emotional words, may have stronger ability in capturing attention (Bradley et al., 1998) or may need a longer time to comprehend, which may account for the maintained attentional bias on the second and the third exposure occasions in this study.

No significant attentional bias was found for mild threatening pictures in either high or low anxiety group in the overall analyses across exposures. This finding is consistent with Mogg et al. (2000, 2004) although Mogg et al. (2000) did find a significant tendency of avoidance to such pictures in the LTA group in one experiment (but not in another experiment). However, in study of Koster et al. (2005), HTA individuals showed clear attentional bias to mild threatening pictures. One possible reason may be the number of stimuli exposures. As discussed earlier, the same threatening picture pair had been presented for four times in study of Koster et al. (2005), while in the present study stimuli were only presented once in each test block. Another possibility may relate to how the pictures were presented. In study of Koster et al. (2005), picture pairs were presented at up–low location, while in the present study, picture pairs were presented at left–right location.

4.2. Variation of attentional bias over exposures

Most previous studies investigating the time course of attentional bias in the dot-probe paradigm manipulated the exposure duration of threatening stimuli (Bradley et al., 1998; Koster et al., 2005; Mogg et al., 1997; Mogg et al., 2004). Mogg et al. (2004) showed that after initial selective attention to high threatening pictures at 500 ms, no subsequent attentional bias was found at 1500 ms in HTA individuals. In addition, previous studies found attention avoidance to threatening stimulus at longer duration, which is consistent with the "vigilance–avoidance" hypothesis (Mathews, 1990). In a recent study, HTA individuals showed a clear trend of avoidance of threatening pictures at duration of 1250 ms after initial attention to these pictures at duration of 100 ms (Koster et al., 2005). The reason that this avoidance was not found in the present study may relate to the way in which the threatening pictures were presented. Prolong presentation of the same picture may lead to a deeper processing of the information and hence avoidance. In contrast, because the threatening pictures were presented very briefly in the present study, the avoidance therefore had no time to develop.

The findings of the present study did not support the view of Beck (1976) and Bower (1981) that an initial shift of attention to negative stimuli is followed by maintaining attention to those stimuli in high anxious individuals. However, these findings are consisted with the findings of Harris and Pashler (2004) in which participants are asked to make a speeded judgment about whether the parity of the two digits surrounding a word were identical to each other or not. When the participant's own name was presented on two scattered trials among a total of 50 stimuli, the responses were markedly slow. In a subsequent block of trials in which half the words were the participant's name, the slowing did not occur. This indicated that the participants might have adapted to the presentation of their names, and their names, therefore, lost the ability to capture their attention.

Why the attentional bias to high threatening pictures was not maintained over exposure occasions? It is possible that after repeated exposures, the threatening pictures lose the threat value and novelty, and thus no longer capture attention. At the neurophysiological level, neurons responsible for processing the threat-related information are no longer responsive to the repeated or prolonged presentation of the same stimuli. Veltman et al. (2004), for example, presented pictures of spiders or butterflies to 12 participants with spider phobia while these participants underwent positron emission tomography (PET). Prolonged exposure to phobic stimuli is associated with a significant decrease in regional cerebral blood flow in bilateral anterior MTL (medial temporal lobe). After repeated exposure to threatening pictures in the present study, HTA individuals might have been habituated to those stimuli and show no attentional bias.

A few limitations exist in this research. The first limitation is that the sample size is relatively small. A small sample might not have enough statistical power to reveal all the significant differences between the HTA and LTA groups. Another limitation is the HTA and LTA groups were divided at median of their STAI-trait scores. Although the overall group difference still existed, the participants who scored close to the median may not be different from each other although they may be categorized into different groups and therefore reduce the sensitivity of identifying the differences between the two groups. On the other hand, this method of dividing participants were used in numerous previous studies and therefore allow a better comparison with these research (i.e. Avila & Parcet, 2002; Mogg et al., 1997; Mogg et al., 2000; Rohner, 2002). In addition, this approach might have contributed to a potentially meaningful distinction between the

responses of the first and subsequent exposures. The pattern of responses that are associated with number of exposures might have been overlooked if the difference between the HTA and LTA groups on the first exposure block was not marginally significant.

A basic technique in contemporary cognitive and behavior therapy is exposure therapy, which is widely used to treat anxiety-related disorders (Barlow, 2001). This idea was brought to prominence in the clinical literature by Marks (1978). Findings in the present study provide initial empirical support for the use of this technique, although clinical anxiety disorder patients should be examined using this paradigm with more stimuli exposures before a firm conclusion could be made.

In addition to the findings reported so far, another contribution of the present study over previous ones was that attentional bias was measured over the exposure occasions. This paradigm was not found in previous published studies. Using more stimulus exposure occasions provided researchers a different angle to examine attentional bias to threatening pictures. In variations of this approach using different stimuli, such as words or faces, the change of attentional bias to threatening stimuli can be further examined in future studies. Investigating the pattern of attentional bias in patients with general anxiety disorders may also be studied through repeating stimulus exposure in the future in order to provide more direct measures of this clinical population.

Acknowledgements

This research was supported by National Science Foundation of China (Project Nos. 30370483, 30470569, 60435010) and by the Beijing Key Laboratory of Learning and Cognition, Capital Normal University.

References

Avila, C., & Parcet, M. A. (2002). The role of attentional anterior network on threat-related attentional biases in anxiety. *Personality and Individual Differences, 32*, 715–728.

Barlow, D. H. (Ed.). (2001). *Clinical handbook of psychological disorders: A step-by-step treatment manual*. New York: Guilford Press.

Beck, A. T. (1976). *Cognitive therapy and the emotional disorders*. New York: International Universities Press.

Beck, A. T., Ward, C. H., Mendelson, M., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry, 4*, 561–571.

Bower, G. H. (1981). Mood and memory. *American Psychologist, 36*, 129–148.

Bradley, B. P., Mogg, K., Falla, S. J., & Hamilton, L. R. (1998). Attentional bias for threatening facial expressions in anxiety: Manipulation of stimulus duration. *Cognition and Emotion, 12*, 737–753.

Eysenck, M. (1997). *Anxiety and cognition: A unified theory*. Hove, UK: Psychology Press.

Harris, C. R., & Pashler, H. E. (2004). Attention and the processing of emotional words and names: Not so special after all. *Psychological Science, 15*, 171–178.

Keogh, E., Dillon, C., Georgiou, G., & Hunt, C. (2001). Selective attentional biases for physical threat in physical anxiety sensitivity. *Journal of Anxiety Disorders, 15*, 299–315.

Koster, E. H. W., Verschuere, B., Crombez, G., & Damme, S. V. (2005). Time-course of attention for threatening pictures in high and low trait anxiety. *Behaviour Research and Therapy, 43*, 1087–1098.

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1995). *International affective picture system: Technical manual and affective ratings*. Gainesville, FL: University of Florida.

Li, W., & Qian, M. (1995). Revision of the state-trait anxiety inventory with sample of chinese college students. *Acta Scientiarum Naturalium Universitatis Pekinensis, 31*, 108–114.

MacLeod, C., Mathews, A., & Tata, P. (1986). Attentional bias in emotional disorders. *Journal of Abnormal Psychology, 95*, 15–20.

Marks, I. M. (1978). Behavioral psychotherapy of adult neurosis. In S. L. Garfield & A. E. Bergin (Eds.), *Handbook of psychotherapy and behavior change* (pp. 493–547). New York: Wiley.

Mathews, A. (1990). Why worry? The cognitive function of anxiety. *Behaviour Research and Therapy, 28*, 455–468.

Mathews, A., & MacLeod, C. (1994). Cognitive approaches to emotion and emotional disorders. *Annual Review of Psychology, 45*, 25–50.

Mogg, K., & Bradley, B. P. (2002). Selective orienting of attention to masked threat faces in social anxiety. *Behaviour Research and Therapy, 40*, 1403–1414.

Mogg, K., Bradley, B. P., de Bono, J., & Painter, M. (1997). Time course of attentional bias for threat information in non-clinical anxiety. *Behaviour Research and Therapy, 35*, 297–303.

Mogg, K., Bradley, B. P., Miles, F., & Dixon, R. (2004). Time course of attentional bias for threat scenes: Testing the vigilance–avoidance hypothesis. *Cognition and Emotion, 18*, 689–700.

Mogg, K., Mathews, A., & Eysenck, M. (1992). Attentional bias to threat in clinical anxiety states. *Cognition and Emotion, 6*, 149–159.

Mogg, K., Mathews, A., & Weinman, J. (1987). Memory bias in clinical anxiety. *Journal of Abnormal Psychology, 96*, 94–98.

Mogg, K., McNamara, J., Powys, M., Rawlinson, H., Seiffer, A., & Bradley, B. P. (2000). Selective attention to threat: A test of two cognitive models of anxiety. *Cognition and Emotion, 14*, 339–375.

Rohner, J. (2002). The time-course of visual threat processing: High trait anxious individuals eventually avert their gaze from angry faces. *Cognition and Emotion, 16*, 837–844.

Spielberger, C. D., Gorsuch, R. L., Lushene, R., Vagg, P. R., & Jacobs, G. A. (1983). *Manual for the state–trait anxiety inventory, STAI (form Y): Self-evaluation questionnaire*. Palo Alto, CA: Consulting Psychologists Press.

Tata, P., Leibowitz, J., Prunty, M. J., Cameron, M., & Pickering, A. D. (1996). Attentional bias in obsessional compulsive disorder. *Behaviour Research and Therapy, 34*, 53–60.

Veltman, D. J., Tuinebreijer, W. E., Winkelman, D., Lammertsma, A. A., Witter, M. P., Dolan, R. J., et al. (2004). Neurophysiological correlates of habituation during exposure in spider phobia. *Psychiatry Research: Neuroimaging, 132*, 149–158.

Williams, J. M. G., Mathews, A., & MacLeod, C. (1996). The emotional Stroop task and psychopathology. *Psychological Bulletin, 129*, 3–24.

Williams, J. M. G., Watts, F. N., MacLeod, C., & Mathews, A. (1997). *Cognitive psychology and the emotional disorders* (second ed.). Chichester, UK: Wiley.

Yiend, J., & Mathews, A. (2001). Anxiety and attention to threatening pictures. *Quarterly Journal of Experimental Psychology, 54A*, 665–681.

Zhang, Y., Wang, Y., & Qian, M. (1990). Beck depression inventory: Reliability and validity. *Chinese Mental Health Journal, 4*, 164–168.