Brief Report

RELATIONSHIP OF ATTENTIONAL BIAS TO ANXIETY SENSITIVITY AND PANIC

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Panic disorder and panic attacks have been associated with selective attention to threatening information, a factor that may contribute to the maintenance of panic. Anxiety sensitivity (AS), or fear of anxiety-related symptoms, has been described as a cognitive risk factor for panic. It is of interest to understand the relationship between these cognitive correlates of panic, but the literature on the topic has been equivocal. In this study, 65 individuals completed measures of AS, anxiety symptoms and panic as well as the emotional Stroop task, a commonly used measure of attentional bias. We found that panic history and anxiety symptoms were associated with attentional bias for information related to physical and social threat. AS was not significantly associated with performance on the Stroop, suggesting that previous positive findings may have been a reflection of the confounding effect of panic. Depression and Anxiety 20: 190–194, 2004. © 2004 Wiley-Liss, Inc.

Key words: *anxiety sensitivity; panic; Stroop effect; response bias; threat*

INTRODUCTION

Cognitive theorists relate anxiety disorders to the way in which emotional information is processed [Beck and Clark, 1997]. Selective attention to threat-related information among anxious individuals is consistent with this model. Such attentional bias has been demonstrated using a variety of experimental techniques, most frequently the emotional Stroop task [Williams et al., 1996]. This task requires that an individual name the color in which a word is printed while ignoring the meaning of the word. Performance (i.e., latency to name the color of the print) is impaired to the extent that an individual's attention is drawn to processing the meaning of the word [Williams et al., 1996]. A number of studies have administered the emotional Stroop to patients with panic attacks or panic disorder [Carter et al., 1992; Hope et al., 1990; Lundh et al., 1999; Maidenberg et al., 1996; McNally et al., 1990, 1992, 1994]. In general, patients with panic show interference when presented with threat-related material. It is unknown whether this interference is an outgrowth of the experience of panic or whether it is a dispositional characteristic that may increase risk of developing an anxiety disorder.

Anxiety sensitivity (AS) is defined as the fear of anxiety-related symptoms and involves increased vigilance for anxiety-related symptoms as well as catastrophic interpretations of the meaning of the symptoms [Peterson and Reiss, 1993]. Anxiety sensitivity has been identified as an important factor in the etiology and maintenance of anxiety disorders [Reiss, 1991]. Patients with panic generally have elevated scores on the Anxiety Sensitivity Index (ASI) [Taylor et al., 1992], a commonly used measure of AS. ASI scores also predict the development of spontaneous panic attacks in longitudinal studies [Schmidt, 1999]. The combination of AS and attentional bias could be a more potent risk factor for the development of panic than either factor alone. Thus, it is of interest to establish the relationship between these cognitive correlates of panic.

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A few existing studies have assessed the relationship between AS and attentional bias toward threatening information. Stewart et al. [1998] found a large effect size (.72) for greater Stroop interference for threat-related words in high AS than in low AS students. Similarly, Koven et al. [2003] found a small but significant correlation ($r = .21$) between ASI scores and Stroop interference for threat-related words in undergraduates. Anxiety sensitivity significantly added to the variance explained after controlling for other measures of anxiety (R^2 change = .034). Two other studies, however, did not demonstrate this relationship. McNally et al. [1999] did not find greater Stroop interference in high AS as compared to low AS students. Similarly, Lundh et al. [1999] showed low correlations (Pearson's r ranged from $-.02$ to .09) between ASI scores and Stroop interference among panic patients. Given these mixed findings, the nature of the relationship between AS and attentional bias is unclear.

There are three possibilities regarding the relationship between AS and attentional bias: (1) AS may be independently associated with attentional bias; (2) the constructs may be unrelated; and (3) the association between AS and attentional bias may be secondary to the association of each with panic (i.e., panic may be a confounder). It has been hypothesized that attentional bias is a dispositional characteristic that is only manifested if it is activated by current emotion or circumstances [Williams et al., 1996]; panic may be such an activating event. The existing literature does not adequately address this third possibility because AS and panic have not been evaluated simultaneously. Stewart et al. [1998] measured whether subjects had experienced panic but did not control for panic in the analysis. There was limited variability in the other three studies: Koven et al. [2003] and McNally et al. [1999] excluded anyone who had experienced a spontaneous panic attack, and everyone in the Lundh et al. [1999] sample was diagnosed with panic disorder. In addition, differences in definitions of groups limit the comparability of these studies. The low AS group in the Stewart et al. [1998] study had a lower mean than the low AS group of McNally et al. [1999]. The Lundh et al. [1999] sample was laden with high scorers because all were patients with panic disorder [see McNally, 1999 for discussion of this issue]. Thus, the goal of this study was explore the relationship among AS, panic and attentional bias.

SUBJECTS AND METHODS

Sixty-five subjects participated in this study. They averaged 49.6 ($sd = 12.7$) years of age and included 48 men and 17 women. Subjects were recruited from VA San Diego Healthcare System mental health and primary care clinics. Recruitment took place in two ways; individuals either responded to flyers posted in the waiting areas or were contacted because they previously had agreed to be contacted about potential research participation. Subjects were told that the study was about the effect of how they were feeling on their performance on verbal tasks. Subjects were excluded if they reported current use of a benzodiazepine, current psychotic symptoms, if they could not read and write in English, or if they were colorblind. Those who agreed to participate came to our offices, completed the informed consent form and were paid $25 for their involvement. This study was approved and overseen by the UCSD Human Research Protections Program.

Subjects completed the ASI [Reiss et al., 1986], a 16-item measure of AS, the Beck Anxiety Inventory (BAI) [Beck et al., 1988], a 20-item measure that focuses on physical symptoms of anxiety, and the Beck Depression Inventory-II (BDI-II) [Beck et al., 1996], a 21-item measure of depression. In addition, trained, undergraduate-level students administered the panic disorder section of the lifetime version of the Anxiety Disorders Interview Schedule for the DSM-IV (ADIS-IV) [Di Nardo et al., 1994]. The interview was audio taped. All interviews were co-rated for the presence of a lifetime panic attack by the P.I., a licensed clinical psychologist with experience using the ADIS-IV. In addition, a randomly selected set of 20% of the tapes was co-rated a second time by a post-doctoral level psychologist. There was agreement on all except one case for which we established a consensus diagnosis. All measures have established reliability and validity.

All study subjects also completed a computer-administered Stroop task. For this task, we used an IBM compatible computer with a Pentium processor and Micro Experimental Laboratory (MEL), Version 2 software [Schneider, 1990]. Subject instructions were as follows: "This is an experiment about how fast you can name the color of words while ignoring their content. A word will be presented and you are to name the color of that word out loud at the same time as you press the appropriate key. Try to respond as quickly and accurately as possible. First you will begin with a few practice trials. If you make a mistake, please continue with the next trial."

The experimenter read these instructions aloud to the subject, completed three demonstration trials and answered any questions before beginning. Keystroke measured response latency and accuracy. Ninety-four words of three types, neutral, social threat and physical threat, were drawn from similar studies [Asmundson and Stein, 1994; McNally et al., 1999] and matched for length and frequency of usage. After 24 practice trials (using neutral words), words were presented in blocks of five words of each type. For each subject, the blocks were presented in random order, and word order was randomized within each block. Blocked presentation was used because blocking has been associated with more robust interference effects [McNally et al., 1999]. Stroop reaction time data were dropped if the responses were very fast (<300 ms) or very slow ($>10{,}000$ ms). Reaction time data were analyzed using the difference between threatening and neutral words.

Degree of inaccuracy on the Stroop task (i.e., % of trials with the wrong color indicated) was measured and used as a control variable in analyses to control for differing levels of engagement with the task.

RESULTS AND DISCUSSION

Mean scores on the self-report measures are presented in Table 1. Thirty subjects reported having had at least one panic attack, the majority of these (90%) reporting that at least one panic attack came from "out of the blue." There were no differences in age or gender distribution between panickers and non-panickers. Those who reported at least one panic attack scored higher on the ASI [$t(61) = -2.0$, $P < .05$] and BAI [$t(61) = -2.6$, $P < .05$], but there were no group differences on the BDI-II [$t(59) = -1.9$, *ns*] (Table 1). Each of these variables was approximately normally distributed (by inspection and with no significant skew or kurtosis). Zero-order correlations among these measures and between each measure and the Stroop task are presented in Table 2. Neither the ASI nor the BDI-II were correlated significantly with the Stroop, but both panic history and BAI total score showed some relationship to Stroop reaction time.

Multiple linear regression was used to assess the relationship between the independent variables and Stroop performance. Panic attack history, BAI score, degree of inaccuracy on the Stroop task, and ASI total score were entered simultaneously as independent variables with Stroop performance as the dependent variable. Both models reached significance (Table 3). As can be seen in Table 3, after controlling for all other variables, BAI scores were significantly related to Stroop reaction time to physical words. There was a trend toward panic history also being related to reaction times to both types of words (Table 3).

To describe the magnitude of the Stroop effect, we went on to assess mean differences in reaction time between the groups that did and did not report panic. For words conveying physical threat, those who had experienced panic were on average 169.4 ms ($sd = 298.3$) slower to name the color of the threatening word, whereas this difference was 2.2 ms ($sd = 278.4$) in the group without a history of panic [$t(60) = -2.3$, $P < .05$]. For words conveying social threat, the difference in reaction time among those with panic history was 116.1 ms ($sd = 264.8$) and among those without such history was −15.1 ms ($sd = 185.9$) [$t(60) = -2.3$, $P < .05$].

TABLE 1. Self-report measures among those who did and did not report panic attacks

Group	Reported panic	No panic	Total
ASI	30.8 (13.5) 1–54	24.2 (12.8) 0–52	27.2 (13.3) 0–54
BAI	21.7 (14.5) 4–53	13.4 (11.5) 0–53	17.1 (13.5) 0–53
BDI-II	20.5 (12.1) 2–57	15.2 (9.9) 0–35	17.8 (11.1) 0–57

Values are mean (*sd*) range, based on normative data for each of the measures as follows: ASI, nonclinical 19.01 (9.11), panic patients 30.5–46.7 [Peterson and Reiss, 1993]; BAI, nonanxious 15.88 (11.81), primary anxiety disorder 25.39 (11.48) [Beck et al., 1988]; BDI-II, nondepressed 7.65 (5.9), mildly depressed 19.14 (5.7), moderately depressed 27.44 (10.0), severely depressed 32.96 (12.0) [Beck et al., 1996].

TABLE 2. Correlations among affective measures and between affective measures and Stroop performance

Group	Stroop physical-neutral	Stroop social-neutral	ASI	BAI	BDI-II
Stroop social-neutral	.746**				
ASI	.126	.247			
BAI	.298*	.250*	.690**		
BDI-II	.130	.137	.401**	.528**	
Panic history	.262*	.222	.191	.254*	.183

The correlation coefficient is Pearson's r for pairs of continuous variables and *eta* for the dichotomous and continuous pairs.
**$P < .01$; *$P < .05$.

TABLE 3. Multiple linear regression relating Stroop difference scores to panic symptoms

Variable	B	*se* B	β	Part *r*	R^2	*F (df)*
Physical-neutral Model 1: Panic						
Inaccuracy	−311.96	165.84	−.22*	−.22	.19	3.38 (4,57)**
ASI total	−3.98	3.64	−.18	−.13		
Panic history	128.22	74.10	.22*	.26		
BAI total	8.16	3.68	.37**	.21		
Social-neutral Model 1: Panic						
Inaccuracy	−249.94	132.15	−.23*	−.23	.17	2.89 (4,57)**
ASI total	1.94	2.90	.11	.08		
Panic history	100.76	59.05	.22*	.09		
BAI total	2.14	2.94	.12	.21		

*$P < .10$, **$P < .05$.

CONCLUSION

This is the third study that fails to show a significant relationship between AS and attentional bias [Lundh et al., 1999; McNally et al., 1999]. Consistent with prior research, we found that attentional bias was significantly associated current physical symptoms of anxiety. The magnitude of the Stroop effect in this study was in the range reported in previous studies involving anxious patients [McNally et al., 1994]. In contrast to Hope et al. [1990], we found some evidence of bias toward both physical and social threat words; this is consistent with other work that has found bias to threat generally among panickers [e.g., Lundh et al., 1999; McNally et al., 1994; Maidenberg et al., 1996]. Our findings are not consistent with the conclusion drawn by Lundh et al. [1999] that Stroop interference is related to negative affect. In contrast to their results, Stroop performance in this sample did not correlate significantly with depression scores. Rather, the effect seems to be specific to panic-like symptoms. The two studies may differ because all of their subjects carried panic disorder diagnoses, whereas we had a broader range of subjects.

There are a number of limitations of this work. The ideal design for a test of these ideas would be a prospective study, with AS and attentional bias assessed before and after a first panic attack. Given the number of past negative results, using a cross-sectional study such as this is a reasonable way of evaluating the worth of a more expensive and time-consuming design. In addition, it may not be appropriate to generalize these findings to the general population. Our subjects reported significant depression and anxiety (more similar to patient samples than to community samples), and nearly half had experienced panic. In addition, the between-group difference in ASI scores was relatively small in magnitude, which may diminish group differences on the target task. Because of time constraints and our primary interest in the influence of experience with panic, we did not administer the entire ADIS-IV. Thus, this work is also limited in that we cannot relate these findings to any particular anxiety disorder. Finally, undergraduate students administered the ADIS-IV. Although a doctoral-level psychologist reviewed every interview, the accuracy of the interview may be limited by the inexperience of the interviewers.

There are limitations to our measure of attentional bias. There has been some debate as to whether attentional bias is the true mechanism behind delayed responding on the emotional Stroop task [de Ruiter and Brosschot, 1994]. We used the Stroop task because it is the task that has been used by others who have investigated the relationship between AS and attentional bias. This question should be explored further with other tasks, such as the dot probe, which may be a better gauge of attentional bias. We elected to use blocked presentation of Stroop words because this presentation style has been associated with more robust findings. Blocked presentation, however, raises the possibility that other influences are affecting reaction time, including state anxiety or rumination about the content of repeatedly presented words, avoidance of repeatedly presented stimuli or sensitization. We also used standard presentation of the Stroop stimuli. There is some evidence, however, that subliminal presentation may be more sensitive to trait anxiety [MacLeod and Rutherford, 1992]. If future studies of AS are undertaken, they should take into account these methodological issues.

In summary, this study is the first to consider AS and panic simultaneously in evaluating attentional bias. This work provides further support for the association between panic and attentional bias. It also adds to the body of work finding that AS is not associated with attentional bias. This line of work is important because it will ultimately help us to better understand factors that contribute to the development and maintenance of panic disorder.

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