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pg 1796

DV = panic disorder based on DSM, BAT = pre, peak, time

NEW

~~pg 1794~~

IAT = ① panic - calm self-concept, pg 1796

② body changes - body parts, meaningless - alarm pg 1796

~~BSIQ, pg 1797 OR NONE~~

EMs = BDI (depress)
ASI (anx)
Fear Q'naire
PDSS (panic dis) } pg 1795

~~(both overall)~~ ~~pg 1796~~

~~BAT & subjective distress~~

(10) k-claimed, pg 1791

(11) pg 1799 avg (2) FOR DSM ~~except for~~ BAT (1) (single, but 3 separate ones before anx, peak anx, time)

(12) self (panic ones), belief (body ones), pg 1796 p1796

(13) ~~NONE~~ self (3), pg 1795

(14) ~~Not (2), except for BAT~~ obs (1), pg ~~1795~~ - 1796 & 1794

(15) emotion (3) except for BAT (5), pg 1795 - 1796

(16) algor (2), pg 1799

request if not have already - reported partially in tables
Subject 1799/1803

(17) words (0) pg 1796

(18) 2 IATs (19) IAT 2nd (2) (20) EMs 3rd

(21) 1 (DSM) 4 (BAT)

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(22) alter (2) for DSM, before (1) for BAT

(23) alter (2) for DSM, before (1) for BAT

pg
(26) I-SD 3
(27) E-SD 3
(28) B- 5
(29) IAT-Spec 5
(30) EM-Spec 5

(24) same (0)

(25) Same (0)

(31) oppositions 4

(32) Not (0), (33) dual (2)

DONE

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Information processing biases and panic disorder: Relationships among cognitive and symptom measures

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Abstract 10

To test cognitive models of panic disorder, a range of information processing biases were examined among persons with panic disorder ($N = 43$) and healthy control participants ($N = 38$). Evidence for automatic associations in memory was assessed using the Implicit Association Test, interference effects related to attention biases were assessed using a modified supraliminal Stroop task, and interpretation biases were assessed using the Brief Body Sensations Interpretation Questionnaire. In addition, the relationship between information processing biases and clinical markers of panic (including affective, behavioral, and cognitive symptom measures) was investigated, along with the relationships among biases. Results indicated more threat biases among the panic (relative to control) group on each of the information processing measures, providing some of the first evidence for an implicit measure of panic associations. Further, structural equation modeling indicated that the information processing bias measures were each unique predictors of panic symptoms, but that the bias indicators did not relate to one another. These findings suggest that cognitive factors may independently predict panic symptoms, but not covary. Results are discussed in terms of their support for cognitive models of panic and the potential for automatic versus strategic processing differences across the tasks to explain the low relationships across the biases. 32

Keywords: Information processing; Panic disorder; Interpretation; Attention; Implicit associations; Automatic

Introduction

The choice to observe one's pounding heart without jumping to the conclusion that it is a sign of a heart attack or other impending disaster is thought by cognitive theorists to be the key to unraveling panic attacks. The cognitive model of panic disorder was developed in part from observations of pharmacological and neurochemical studies of agents that promoted panic attacks, but only in select individuals—those who tended to interpret the bodily sensations induced by the agents in a disastrous way (Clark, 1986). This led Clark (1986) to suggest that panic attacks occur because certain bodily sensations are misinterpreted as indicating a catastrophe, such as a heart attack or loss of control (see also Goldstein & Chambless, 1978).

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study to investigate panic associations in a diagnosed sample. An additional implicit measure of panic associations tied specifically to beliefs about the dangerousness of bodily sensations (reflecting Clark's, 1986, model) will also be included.

As noted, each of the information processing bias measures is expected to distinguish individuals diagnosed with panic disorder from healthy control participants, and each bias measure is anticipated to predict a range of panic symptoms. However, the relationships among the information processing measures are considerably harder to predict. On the one hand, many theoretical models of anxiety and panic (e.g., Beck et al., 1985; Clark, 1986) suggest that the different cognitive processes should be inter-related. On the other hand, some models are more cautious in this regard, and the limited available data have not supported this hypothesis, finding no significant correlations among bias measures in samples diagnosed with panic disorder. Further, mixed results were observed in Teachman's (2005) study with a high anxiety sensitive sample, which used similar bias measures to those used in the current study.

Thus, McNally, Hornig, Hoffman, and Han's (1999) suggestion that cognitive factors may independently present risk for panic but not covary is quite compelling. While this idea was based on their evaluation of anxiety sensitivity and its low relation to interpretive, attentional, and memory tasks (they did not report correlations among the information processing measures), their suggestion may be informative for panic disorder as well. Perhaps, as McNally and colleagues suggest, "it is entirely possible that within the cognitive domain, risk factors may function independently of one another and not figure as different aspects of the same construct" (p. 52). If independence among the measures were evident in the current study, it would imply unrelated correlates or maintaining factors for panic. We tentatively hypothesized little relationship among the information processing measures in the present study, following from the lack of significant relationships observed in prior research.

Method

Participants

Participants with panic disorder were recruited as part of a larger treatment study through newspaper, television, e-mail, radio, print ads and flyers posted around the Charlottesville-Albemarle community and University of Virginia campus that invited individuals who had experienced panic attacks to contact our confidential phone line. Interested individuals were then screened over the phone to evaluate whether they would likely meet criteria for panic disorder, and to confirm they had experienced a panic attack over the past month. Other inclusion criteria, also assessed by phone, included: (1) minimum 18 years of age; (2) mastery of written and spoken English (to complete the assessment battery); and (3) no history of completing a prior course of cognitive-behavioral therapy (CBT) for panic (due to previous discussion of cognitive biases associated with panic). In addition, the phone screen inquired about substance abuse or dependence within the past year, current psychosis, and unmanaged manic symptoms, as these were all exclusion criteria given their potential influence on information processing biases. Other comorbidity, including current depression and other anxiety disorders, as well as other prior or current medication or psychosocial treatments were not grounds for exclusion (though we asked that participants be stable in their treatment course for at least six weeks).

PV #1 11 14

Individuals who met the inclusion criteria were then invited to come to our clinic to complete the Structured Clinical Interview for DSM-IV (SCID; First, Spitzer, Gibbon, & Williams, 1995) in order to establish a diagnosis of panic disorder with or without agoraphobia, check for suicidal ideation (an additional exclusion criterion), and assess current or lifetime history of other Axis I disorders. All phone screens and SCID interviews were conducted by trained doctoral students in clinical psychology with at least one year assessment experience, and all cases were presented to the first author and other interviewers during a weekly meeting to establish diagnostic consensus. Tape review and follow-up questions were used if there was any doubt about diagnoses. Of the approximately 155 individuals who completed the phone screen, 64 (41%) were appropriate and interested in coming in for the SCID evaluation. Of the remaining 155, 37 (24%) individuals were appropriate for participation but were not interested in completing the SCID and 54 (35%) individuals were not appropriate for participation based on the study exclusion criteria. From the group of 64, 59 were eligible following the intake evaluation (the other five were excluded based on further diagnostic information that emerged during the SCID) and were invited to complete the assessment battery at a separate session. Forty-three people completed the assessment battery, which was administered as the pre-treatment evaluation for a larger treatment study (thus, all individuals in the sample had agreed to, but not yet started, treatment).

The final sample for the panic disorder group ($N = 43$; 70% with agoraphobic avoidance) was 70% female, mean age was 37.95 years old ($SD = 15.19$; range = 18–70), and 88% were Caucasian (7% African-American, 2% described themselves as biracial, and 2% indicated "other" for ethnicity). The mean duration between participants' first panic attack and intake was 158.21 months ($SD = 165.09$; range = 2–612 months). Although panic disorder was the primary diagnosis in all cases (based on participant's report of current interference and/or symptom severity), current comorbid Axis I diagnoses at intake included: 35% had other anxiety or related disorders (Specific Phobia, Generalized Anxiety Disorder, Obsessive Compulsive Disorder, Social Phobia, Post Traumatic Stress Disorder, and Trichotillomania), 26% had mood disorders (21% Major Depressive Disorder, 2% Bipolar I Disorder, and 2% Bipolar II Disorder), and 7% had eating disorders (Binge Eating Disorder and Eating Disorder NOS). In addition, 58% of the sample reported current psychotropic medication use at intake: 42% on antidepressants, 2% on antipsychotics, 30% on benzodiazepines, 2% on beta-blockers, and 9% on mood-stabilizers. Further, 17% reported ongoing psychosocial treatment at intake (for issues other than CBT for panic).

The healthy control group ($N = 38$) was recruited through the psychology participant pool (using a prescreening measure) and through flyers posted around the community inviting individuals with no serious anxiety problems to call our confidential phone line. The prescreening written measure and phone screen inquired about current and past anxiety disorders, as well as current mood disorders, substance abuse, or dependence. All phone screens were completed by trained doctoral students in clinical psychology. During the testing session, participants were interviewed using a modified Mini International Neuropsychiatric Interview (MINI Plus, version 5.0, 2003; original by Sheehan et al., 1998), a brief structured diagnostic interview to confirm that the participant did not have a current or past anxiety disorder, or current mood, eating or psychotic disorder, nor a substance abuse or dependence diagnosis over the past year. (The MINI was used for the control sample because it is a relatively brief instrument that has been widely used to screen healthy participants, and can be administered more rapidly than the SCID, while obtaining comparable diagnostic information to assess inclusion/exclusion criteria.) This interview resulted in exclusion of nine participants, leaving a final sample of 38. The final control sample was 53% female, mean age was 33.13 years old ($SD = 17.11$; range = 18–78), and 90% were Caucasian (3% Asian, and 8% did not report ethnicity). A chi-square test indicated that the panic and healthy control groups did not differ by gender ($\chi^2 = 2.51$, $p > 0.10$), and an independent samples t-test indicated no significant age difference between groups ($t_{79} = 1.34$, $p > 0.10$, Cohen's $d = 0.30$).

Materials

EMS

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Measures of mood and anxiety symptoms

Anxiety Sensitivity Index (ASI; Reiss, Peterson, Gursky, & McNally, 1986). This 16-item questionnaire measures concern over the symptoms associated with anxiety (e.g., "It scares me when my heart beats rapidly"), and has adequate psychometric properties (Telch, Shermis, & Lucas, 1989).

Beck Depression Inventory (BDI-II; Beck, Steer, & Brown, 1996). The BDI-II is a 21-item self-report inventory that measures severity of symptoms associated with depression.

General measures of panic symptoms and avoidance

Fear Questionnaire-Agoraphobia subscale (FQ-Agoraphobia; Marks & Mathews, 1979). This 5-item subscale measures participants' level of phobic avoidance toward common situations, such as crowded shops.

Panic Disorder Severity Scale (PDSS; Shear et al., 1997). This 7-item scale has good inter-rater reliability, and provides a composite severity score of frequency, distress and impairment associated with panic attacks. Although this measure was designed as a clinician-administered instrument, several prior studies have had participants complete it as a self-report measure (e.g., Otto, Pollack, Penava, & Zucker, 1999; Penava, Otto, Maki, & Pollack, 1998; Teachman, 2005). The instrument was modified slightly for this study by adding a description of panic attacks to the instructions so that it could be completed in a self-report format.

DV #2

Behavioral Avoidance Test (BAT) and Subjective Distress. A BAT was conducted to activate mild suffocation sensations in order to evaluate avoidance of physical sensations and subjective distress during a panic-relevant provocation. Participants were asked to breathe through a thin straw for up to 2 min. This is a harmless activity, based on the interoceptive exposure used in Taylor and Rachman (1994), which typically produces some very temporary dizziness and lightheaded feelings. Participants were explicitly told they could stop the task at any point and that we did not expect everyone to complete the task. The task ended when participants had either reached the 2-min point or reported that they did not wish to proceed further. Immediately after the task ended, participants were asked to report their peak level of anxiety during the task using a Subjective Units of Distress Scale (SUDS) ranging from 0 (very low) to 100 (very high) to measure subjective distress (participants also reported their anticipatory anxiety before the task began, but after the instructions had been explained). 11 14

Measures of information processing

Automatic Panic Associations: Implicit Association Test (IAT; Greenwald et al., 1998). The IAT measures automatic associations. Associations are automatic in the sense that evaluations occur outside conscious control, and at times, outside conscious awareness. Further, the evaluations reflect interconnected associations in memory, thus appearing to share some of the qualities ascribed to schemata (Segal, 1988). The IAT has adequate psychometric properties (Greenwald & Nosek, 2001), and like many tasks used by social cognition researchers (Fazio, 2001), it is a reaction time task that purportedly reflects strength of association between concepts in memory. The computerized version of the IAT requires items to be classified while two category labels are paired on either side of the screen. (See http://implicit.harvard.edu/implicit/ for more information and a sample test.) Specifically, the task involves comparing the time taken to classify stimuli when paired categories match a person's automatic associations (e.g., the concept 'panicked' is paired with the self for a person with panic disorder) versus the time taken when paired categories contradict automatic associations (e.g., the concept 'calm' is paired with the self for a person with panic disorder). It is expected that when categories are paired to match a person's automatic associations, he or she will be able to classify the stimuli more quickly.

The task has a number of features that make it particularly suitable for panic research. First, the methodology minimizes the influence of self-presentational concerns (Greenwald et al., 1998). Second, the IAT uses a within-subject design, so the influence of state affect is held constant because the anxiety-evoking stimuli are present in both conditions being compared, permitting a relatively clean evaluation of cognitive processing.

IAT 1 12

The IAT is a relative task, so comparison categories are required for both the target and descriptor categories. In the first IAT task, which evaluated a panic self-concept (referred to as 'IAT panicked > me'), the category 'calm' was used as a comparison to the category 'panicked' because it reflects the opposing emotional response. These categories were compared while being paired with descriptor categories to reflect the self versus others. Specifically, the categories 'panicked' and 'me' were paired at the top left of the computer screen while 'calm' and 'not me' were simultaneously paired at the top right. Participants were told to classify any stimuli that belonged to *either* the 'panicked' or 'me' categories on the left, and any stimuli that belonged to *either* the 'calm' or 'not me' categories on the right. They were not reporting on their evaluation of the stimuli and they had previously seen a list indicating which stimuli belonged in which category (so knew the correct answer); they were simply asked to complete the categorization task. Because participants did not directly report their evaluation, it was an indirect measure of associations. The dependent variable was speed of classification across a series of trials. Following this category pairing condition, the labels were switched and the same categorization task was completed while pairing 'panicked' with 'not me' and 'calm' with 'me'. Thus, for each IAT task, two sets of category pairs were presented simultaneously. 18 17

IAT 2 12

A second IAT task was included to focus more specifically on Clark's (1986) prediction of catastrophic misinterpretation of bodily sensations among persons with panic disorder (referred to as 'IAT bodily changes > alarming'). Here, the target categories 'bodily changes' versus 'body parts' were paired with the descriptors 'meaningless' versus 'alarming'. 'Body parts' was selected as the comparison category because of the semantic parallel to the 'bodily changes' category. (Unfortunately, this design assumed that body parts, like shoulder and ear, would not have negative, alarming associations for either group, an assumption that

The word stimuli for the present study (see Appendix) included one panic-relevant category (panic/physical threat words) and three control categories (social threat, positive and neutral words). Stimuli were selected from the word lists published in Beck et al.'s (1992) examination of attention for threat in panic disorder. Twelve words from their initial list of 20 were selected that were thought to best reflect the category of interest for the present study. The panic, social, and positive words had previously been matched by independent raters for level of emotionality. The social threat category was included to permit evaluation of the specificity of threat biases associated with panic, given findings of common processing biases in panic disorder and social phobia (e.g., Heinrichs, Hofmann, & Barlow, 2004; Hicks, Leitenberg, & Barlow, 2005). The Stroop blocks were administered in random order to control for possible order effects, and semantically related neutral words (all household items) were used to control for potential priming effects. Procedures were modeled after those described in Holle, Neely, and Heimberg (1997) using a blocked presentation (this choice was made because of evidence from Holle et al. that the blocked, but not random presentation, resulted in stronger effects). Participants first completed a brief practice task (naming the ink color of 12 musical instrument words). The four critical blocks of word categories were then presented with each block consisting of 48 trials (so each word was presented four times, and each ink color was used with equal frequency). The ink colors (red, green, blue, yellow) were used in random order. Error feedback was given in the form of a red exclamation mark on the screen and the incorrect color name needed to be corrected before the program would proceed to the next trial. The percentage of correct responses and the average response time in milliseconds was presented at the end of each block. Participants were instructed to respond as quickly and as accurately as possible by pressing one of four keys that were clearly marked with either an R for red, G for green, B for blue or Y for yellow. They were told to ignore the meaning of the word and to simply press the correct color key. One participant's Stroop data were deleted due to an unusually high error rate (approximately 13%), and one participant's data were deleted because he reported being color blind. Remaining participants had little difficulty with this response format as indicated by a 98% correct response rate across the critical blocks.

Given concerns about precisely what Stroop effects demonstrate, we refer to this task as a measure of interference/attentional bias. Resolving the debate about this measure is beyond the scope of the current study. Rather, the Stroop was selected not as a pure measure of attention but as the most-widely used measure of biases in panic disorder that captures involuntary processing of emotional information (see McNally, 1995). Use of this task thus provides a useful comparison to past research in panic disorder with a measure whose mechanisms have been well researched.

1) SCID 2) ~~IAT~~ 3) EMs 4) BAT

19-25

Procedure

Informed consent was obtained before the SCID interview. At the testing session, participants completed the three information processing bias measures ~~and a series of questionnaires~~. Order of the information processing tasks (IATs, Stroop, BBSIQ) and the questionnaire set (BDI, FQ-Agoraphobia, ASI, PDSS) was counterbalanced, order within the questionnaire set was randomized, and order of the IAT blocks (i.e., panicked + me/not me, and bodily changes + alarming/meaningless) was counterbalanced. Based on availability of testing space, some participants completed the computer tasks and questionnaires in an individual testing room, while others completed the tasks in a group testing room that included multiple testing carrels, separated by dividers. Headphones could be worn for the group administration if a participant desired, but all other procedures were identical and participants could not observe one another's responses. Finally, all participants completed the straw breathing BAT in a private room. This task was always completed last because of concerns that residual anxiety from the task could contaminate responding on the other measures.

Results

Sample characteristics

As anticipated, independent samples *t*-tests indicated that the panic and ~~healthy control~~ groups differed on each of the mood and panic symptom measures in the expected direction (see Table 1). This was true for both

Table 1
Sample characteristics

Measure	Full sample		Panic disorder		Healthy control	
	M	*SD*	*M*	*SD*	*M*	*SD*
Beck Depression Inventory	8.99	9.53	14.21	10.06	3.08	3.72
Anxiety Sensitivity Index	22.24	14.68	33.24	10.87	9.79	5.67
Fear Questionnaire—Agoraphobia subscale	6.59	8.09	10.37	9.11	2.32	3.46
Panic Disorder Severity Scale	7.04	7.29	13.22	4.24	.05	.32
BAT straw breathing anticipatory anxiety	23.90	21.57	35.05	23.86	12.74	10.89
BAT straw breathing peak anxiety	48.32	27.02	62.62	26.42	34.03	19.03
BAT straw breathing time (ms)	62.32	36.59	57.92	35.88	66.73	37.24

the questionnaires (BDI: $t_{79} = 6.44$, $p<0.001$, $d = 1.45$; FQ-Agoraphobia: $t_{79} = 5.13$, $p<0.001$, $d = 1.15$; ASI: $t_{79} = 11.93$, $p<0.001$, $d = 2.68$; PDSS: $t_{79} = 19.08$, $p<0.001$, $d = 4.29$), where the panic group reported more depressive symptoms, agoraphobic avoidance, anxiety sensitivity and panic severity, and for the straw-breathing BAT,[1] where the panic group indicated greater subjective distress (anticipatory anxiety: $t_{72} = 5.17$, $p<0.001$, $d = 1.16$; peak anxiety: $t_{72} = 5.34$, $p<0.001$, $d = 1.20$). To assess avoidance during the straw-breathing BAT, a median split was conducted on the time spent in the task because the variable was not normally distributed. As expected, the panic group spent less time in the task, indicating greater avoidance of physical sensations, than did the healthy control group ($t_{72} = 2.13$, $p = 0.04$, $d = 0.50$).

Group differences in information processing biases[2]

Automatic panic associations

16

The IAT data were scored according to the new scoring algorithm developed by Greenwald, Nosek, and Banaji (2003), because this approach maximizes convergent validity as assessed by the relationship between implicit and explicit measures, and improves the psychometric properties of the tool by taking into account each respondent's latency variability. Using this approach, no participants' IAT data needed to be eliminated (based on either high error rates and/or unusually fast or slow response times). Positive IAT effects, known as D scores,[3] reflect relatively faster response times for panic-relevant automatic associations. An omnibus test was first conducted to determine whether follow-up, focused tests examining the individual IAT tasks were justified. A repeated measures analysis of variance (ANOVA) with panic group (2-level) as the between-subjects factor and IAT (2-level) as the within-subjects factor was conducted. There was a significant group by IAT interaction, $F_{(1,79)} = 7.35$, $p = 0.008$, $\eta^2 = 0.09$ (and not a significant main effect of group, $p>0.10$), thus follow-up tests examining the source of the interaction were conducted. As expected, the panic group responded more quickly to self-evaluations with panic (IAT panicked > me: $t_{79} = 2.12$, $p = 0.04$, $d = 0.48$) than did the healthy control group,[4] providing support for automatic panic associations (see Fig. 1).

[1] Due to an administrative error, straw-breathing data were not collected for seven participants (one from the control group, six from the panic group).

[2] Given the heterogeneity of the panic group sample with regard to diagnoses and medication use, a series of additional analyses examining group differences in information processing biases were run that isolated the different panic disorder subsamples (e.g., with and without a current mood disorder; with and without a current anxiety disorder (beyond panic and agoraphobia); current use of psychotropic medications). These analyses suggested that the primary findings could not be explained by any particular comorbid condition or the presence of psychotropic medications.

[3] IAT D scores reflect the difference in mean reaction time across critical blocks divided by the standard deviations across blocks, which is conceptually similar to Cohen's d (see Greenwald et al., 2003).

[4] Note that the absolute value of the IAT D measures (less than zero) reflect more automatic associations with calm, relative to panicked, for both groups. The finding of a positive absolute value for self-evaluations, even in clinical samples, is not unusual on the IAT (e.g., Buhlmann, Teachman, Gerbershagen, Kikul, & Rief, in press). It is the group comparison that is critical because the absolute value of the IAT score cannot be interpreted outside the context of the relative nature of the task.

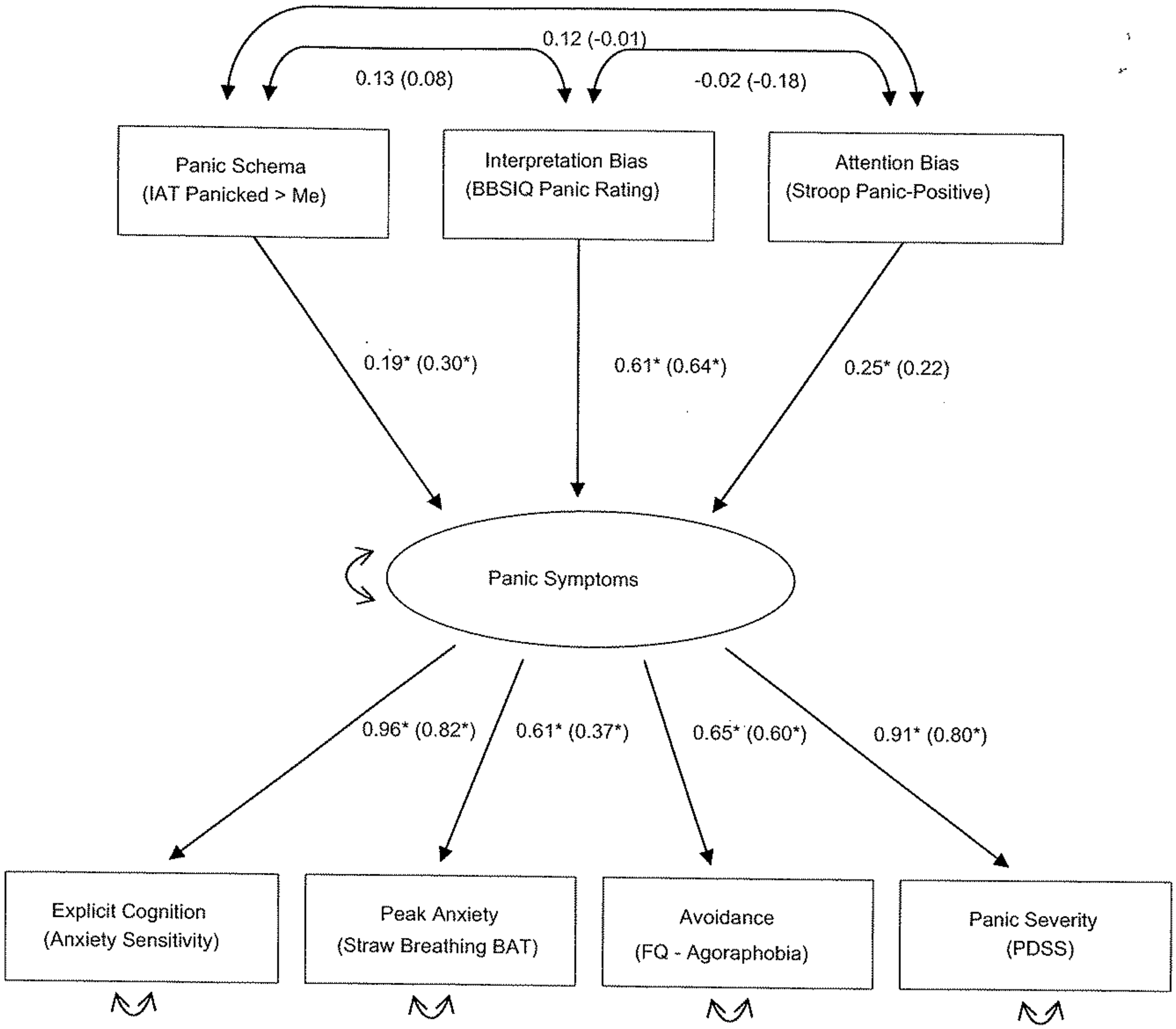

Fig. 4. Information processing biases predicting panic symptoms: Structural equation model with standardized coefficients noted (for both the full sample and panic group alone). *Note*: indicate error terms. $^{*}p<0.05$. The numbers in brackets reflect the standardized coefficients for the model run with only the panic group, and the numbers not in brackets reflect the coefficients for the full sample.

Table 2
Correlations among model indicators (full sample)

DV

Variable	1	2	3	4	5	6
1. Peak anxiety (Straw Breathing BAT)						
2. Explicit cognition (Anxiety Sensitivity Index)	.61**					
3. Avoidance (FQ-Agoraphobia Subscale)	.31**	.59**				
4. Panic severity (Panic Disorder Severity Scale)	.53**	.88**	.66**			
5. Panic self-schema (IAT Panicked > Me)	.25*	.26	.30**	.30**		
6. Interpretation bias (BBSIQ Panic Rating)	.46**	.65**	.38**	.49**	.13	
7. Attention bias (Stroop Panic-Positive)	−.03	.20+	.36**	.33**	.12	−.03

Note: $^{+}p<.10$, $^{*}p<.05$, $^{**}p<.001$. These correlations should be interpreted with caution because the original sample was pre-selected to have a bimodal distribution on panic symptoms.