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Examining content specificity of negative interpretation biases with the Body Sensations Interpretation Questionnaire (BSIQ)

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Abstract

Cognitive biases have been suggested to act as latent vulnerability factors for the onset and maintenance of affective and emotional disorders. Additionally, several global and specific personality constructs are known to influence the course of psychopathology (e.g., trait anxiety, optimism, anxiety sensitivity (AS), injury/illness sensitivity (IS), fear of negative evaluation (FNE)). The current study examined the specificity of the relation between these constructs and a negative interpretation bias. One hundred and fifty-four healthy participants completed the Body Sensations Interpretation Questionnaire (BSIQ) [Clark, D. A., Salkovskis, P. M., Breitholtz, E., Westling, B. E., Öst, L.-G., Koehler, K. A., et al. (1997). Misinterpretation of body sensations in panic disorder. *Journal of Consulting and Clinical Psychology*, *65*, 203–213], measuring negative interpretations on four domains. A confirmatory factor analysis offered support for four factors in the BSIQ. Multiple linear regression analyses demonstrated that optimism is predictive of less negative interpretations. AS, IS, and FNE are specifically predictive of negative interpretations on the panic, other bodily symptoms, and social situations subscale, respectively. In addition, specific pain-related constructs were found most predictive of the other bodily sensations subscale. It is concluded that individual variability in global and specific psychological constructs is associated with a content-specific negative interpretation bias.

Keywords: Interpretation bias; Emotional constructs; Anxiety; BSIQ; Domain-specificity

It is now widely accepted that cognitive processing biases can act as latent vulnerability factors for the onset and the maintenance of emotional and affective disorders (Mathews & MacLeod, 1994). Cognitive theories on emotional disorders state that highly anxious and depressed individuals prioritize the encoding of threatening and negative information to prepare themselves to flee from potential harmful or dangerous situations (Beck & Clark, 1997; Eysenck, 1997). Such prioritizing of information has been suggested to be specific for information that is congruent to the emotional state and current concerns of the individual (Mathews & MacLeod, 1994). One cognitive bias that has frequently been studied in this light is a negative interpretation bias, which reflects the tendency to interpret innocuous situations, symptoms or sensations in a negative or threatening fashion. Research has shown that social anxious individuals often interpret social ambiguous situations in a negative fashion (Amir, Beard, & Bower, 2005; Amir, Foa, & Coles, 1998; Vassilopoulos, 2006), and that chronic

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pain patients negatively interpret ambiguous pain-related information (Pincus & Morley, 2001). Furthermore, there is a large amount of evidence that panic patients interpret innocuous ambiguous sensations and situations as negative or threatening (e.g., Clark, 1986; Harvey, Richards, Dziadosz, & Swindell, 1993).

Clark et al. (1997) developed the Body Sensations Interpretation Questionnaire (BSIQ), as well as a brief version of the BSIQ (BBSIQ) to study the specificity of the relation between panic disorder and negative interpretations of autonomous bodily sensations relating to panic (e.g., heart palpitations, dizziness). The BSIQ assesses interpretations on four different domains: (1) panic-related sensations, (2) other bodily symptoms, (3) social events, and (4) general events. Patients with panic disorder have been found to make significantly more negative interpretations on the panic-related sensations subscale than patients with other anxiety disorders and healthy controls (Austin, Richards, & Klein, 2006; Clark et al., 1997). In non-clinical populations, elevated levels of anxiety sensitivity (AS) have been found associated with negative interpretations on the panic-related sensations subscale as well (Richards, Austin, & Alvarenga, 2001; Teachman, 2005). AS, defined as the fear of anxiety symptoms (e.g., heart palpitations) that arises from the belief that these symptoms will lead to harmful somatic, psychological or social consequences (Reiss, Peterson, Gursky, & McNally, 1986) has been proposed as a specific risk factor for the onset and course of panic disorder (Schmidt & Cook, 1999; Taylor, 1995). As such, the negative interpretation bias towards ambiguous bodily sensations is considered to form not only a by-product of panic disorder, but to characterize healthy individuals who are at risk for developing panic disorder as well.

Hitherto, the BSIQ has rarely been used to study interpretation biases beyond the specified domain of panic. Nevertheless, there are reasons to assume that the measure can provide information on biased interpretations in other domains. Clark et al. (1997) have suggested that the tendency to negatively interpret bodily sensations might be characteristic of other conditions than panic disorder, for example hypochondria. Furthermore, several studies found that panic patients, anxiety patients, and healthy individuals high in AS made significantly more negative interpretations on *all* BSIQ subscales compared to healthy individuals low in AS (Clark et al., 1997; Keogh & Cochrane, 2002; Keogh, Hamid, Hamid, & Ellery, 2004; Richards et al., 2001; Teachman, 2005). Even though the negative bias was most specifically related to panic-related ambiguity in these studies, it is remarkable that anxiety pathology and individual levels of anxiety traits were predictive of negative interpretations in other domains as well. Keogh & Cochrane (2002) and Keogh et al. (2004) have extrapolated the applicability of the BSIQ outside the research area of panic to this of chronic pain. Starting from the knowledge that AS is conceived to serve an important role in the onset and maintenance of chronic pain complaints as well (e.g., Asmundson, Wright, & Hadjistavropoulos, 2000), they demonstrated that the negative interpretation bias (as assessed by the BSIQ) acted as a mediating mechanism in the relation between AS and affective pain responses to experimentally induced cold-pressor pain. This mediating effect was initially observed when the panic-related sensations subscale of the BSIQ was taken as the measure of negative interpretative bias (Keogh & Cochrane, 2002), and was later replicated when the overall BSIQ score was adopted as the mediating variable (Keogh et al., 2004).

The BSIQ is a direct self-report measure, and offers respondents the opportunity to reflect on their responses, and to rely on pre-existing beliefs and schemes in providing responses to each situational description. As such, the BSIQ is assumed to affect later rather than early stages of information processing (Beck & Clark, 1997). According to information processing theories, particularly cognitive biases that occur at these later elaborative stages of information processing are domain-specific and relate to individuals' current concerns (Mathews & MacLeod, 1994). In line with this, it may be suggested that the BSIQ can act as an adequate instrument to measure domain-specificity of interpretations in relation to both global and specific emotional constructs involved in psychopathology. The current study was set up as a first step to test this suggestion. For this purpose, several emotional constructs were included in the current study. These constructs were partly adopted from the hierarchical model of negative emotional constructs as proposed by Lilienfeld (1996). This model contains several general and specific negative emotional constructs that are assumed to be involved in psychopathology (i.e. anxiety). The hierarchical model is built up of several levels with the higher levels representing more global and stable personality traits and the lower levels representing more specific constructs that are closely related with specific manifestations of psychopathology (Keogh & Asmundson, 2004; Lilienfeld, 1996; Vancleef, Peters, Roelofs, & Asmundson, 2006). At the higher levels of this model, dispositional fear or trait anxiety can be found, which is conceived as the general tendency to react fearfully to a broad range of situations. Trait anxiety is assumed to constitute an important trait in the onset and exacerbation of various emotional and affective disorders

(e.g., Lilienfeld, 1996; Spielberger, Gorsuch, & Lushene, 1970). In the current study, it is hypothesized that elevated levels of trait anxiety are predictive of the tendency to make more negative interpretations on all subscales of the BSIQ. In contrast to trait anxiety, optimism has been proposed as a resilience factor for the development and maintenance of psychopathology (for an overview see Carver & Scheier, 2005; Scheier & Carver, 1992). Optimism contributes to physical and psychological well being in general and thereby protects against maladaptive behavioral responses and cognitions (Scheier & Carver, 1992). Therefore, it is hypothesized that heightened levels of optimism are predictive of less negative interpretations on all BSIQ subscales.

Both trait anxiety and optimism are global measures that are assumed to influence negative interpretations of ambiguity referring to panic-related sensations, other bodily sensations, social events, and general events. To study the domain specificity of negative interpretations we included measures of AS, injury/illness sensitivity (IS), and fear of negative evaluation (FNE). In the hierarchical model of negative emotional constructs, these three constructs are nested directly under the higher-order factor trait anxiety. Moreover, AS, IS, and FNE are conceived as three fundamental fears that underlie the daily and common fears (e.g., fear of heights, blood phobia) that we encounter in daily society (Lilienfeld, 1996; Reiss, Peterson, Gursky, & McNally, 1986; Taylor, 1993). As was already stated in the previous paragraph, AS is conceived as a specific risk factor for panic disorder, and has been suggested to contribute to chronic pain as well (Asmundson et al., 2000; Taylor, 1995). IS is commonly defined as the exaggerated fearfulness and excessive worrying of getting injured or becoming seriously ill in the future (Carleton, Asmundson, & Taylor, 2005; Taylor, 1993). Given its intrinsic referral to injury and illness, IS is conceived to form a vulnerability factor for the maintenance and exacerbation of chronic health disorders, such as chronic pain (Keogh & Asmundson, 2004; Peters & Vancleef, in press; Vancleef et al., 2006). FNE, then, stands for the fear of being negatively evaluated by others (e.g., speaking in public, eating in public) and is proposed as an important factor in social anxiety and social phobia (Leary, 1983; Taylor, 1993). Corroborating the specific content of each fear, Taylor (1993) has reported about specific predictive power of FNE for social phobia, IS for blood phobia, and AS for agoraphobia. Furthermore, each fundamental fear has been found specifically related to biased processing of content-congruent information. As such, several studies have demonstrated the association between elevated levels of AS on the one hand, and the memory biases, interpretation biases, and attentional biases in which innocuous stimuli are processed as indicators of threat or danger on the other hand (e.g., Keogh & Cochrane, 2002; Lefaivre, Watt, Stewart, & Wright, 2006; Teachman, 2005). Using an automatic association task, IS was found to be specifically related to the automatic threatening evaluation of stimuli that referred to health threats (Vancleef et al., in press). In addition, it has been demonstrated that persons possessing elevated levels of FNE react catastrophically to innocuous social events, have a focused attention for social threat words, associate positive words implicitly to a smaller degree to themselves than to others, and endorse more negative thoughts when they are in the prospect of performing a socially threatening activity (Stopa & Clark, 2001; Tanner, Stopa, & De Houwer, 2006). Regarding the content-specificity of the direct negative interpretations in this study, we hypothesized that AS, IS, and FNE would be specifically related to negative interpreting ambiguous panic-related sensations, other bodily symptoms, and social events, respectively.

Because the aim of this study is to examine content-specificity of the interpretative bias we additionally explored the supplementary predictive value of specific negative constructs that are assumed to influence psychopathology directly. More specifically, we included measures of two pain-specific constructs that have been proposed to form lower-order factors of IS; Fear of Pain (FOP) and Pain Catastrophizing (PC) (Keogh & Asmundson, 2004; Vancleef et al., 2006). These constructs are known to be very closely related to the experience of pain and have been proposed as crucial variables in predicting the transition from acute to chronic pain (e.g., Vlaeyen & Linton, 2000). We expected that these constructs would show a unique association with the negative interpretation of items from the other bodily symptoms subscale of the BSIQ only, based on the fact that this particular subscale contains items that are reflective of pain, injury and disability.

In sum, the main aim of the current study is to address domain-specificity of negative interpretative bias with the BSIQ by examining the relation between levels of both global and more specific emotional constructs and negative interpretations on four domains, i.e. panic-related sensations, other bodily symptoms, social events, and general events. However, in order to be able to draw reliable conclusions about associations with each separate BSIQ subscale, it is advisable to first examine the factor structure of the BSIQ. The BSIQ was developed to comprise ambiguous situations on four domains that are represented by the four subscales of the

measure. Both the total BSIQ as its subscales have proven to possess well internal consistency (Clark et al., 1997; Keogh et al., 2004), and the BSIQ can effectively discriminate between individuals with panic disorder and other anxiety disorders (Clark et al., 1997). However, no studies reporting on the factor structure of the measure are available to our knowledge. Therefore, we started our study with a confirmatory factor analysis (CFA) on the BSIQ in order to verify whether the four-factor structure of the measure does indeed provide the best model fit to the current data.

1. Method

1.1. Participants

A total of 154 participants (51 male, 103 female), with a mean age of 26.76 years (S.D. = 9.26; range: 18–50) was included in the study. Participants were recruited both inside and outside the local community of Maastricht University. Participants from within Maastricht University ($N = 79$; $M_{age} = 24.03$, S.D. = 6.73) registered by entering their name on enlistment folders that were spread throughout the university buildings. Furthermore, the experimenters personally approached persons outside the university community ($N = 76$; $M_{age} = 29.06$, S.D. = 10.65) with the question if they were willing to participate at the study. This latter group of participants was mainly recruited within the near and far acquaintance environment of the experimenters. All participants were naïve as to the study aims of the research. Since all measures were administered on the pc, participants within the age group of 18–50 years were asked to participate, assuming that this group is likely to be acquainted with the use of computers. Before an actual test appointment was planned, the experimenters verbally checked whether all inclusion and exclusion criteria were fulfilled by asking candidate participants directly whether they were (1) in good mental health (not diagnosed with mental disorder—yes or no), (2) free from acute or chronic (over 3 months) pain complaints (yes or no), and (3) natively and fluently Dutch speaking (yes or no).

1.2. Measures

1.2.1. Interpretation Bias: Body Sensations Interpretation Questionnaire (BSIQ)

The BSIQ (Clark et al., 1997) consists of 27 ambiguous descriptions that are placed under four subscales: (1) panic-related bodily sensations (seven items; e.g., 'You notice your heart is beating quickly and pounding'); (2) other bodily symptoms (six items; e.g., 'You have developed a small spot on the back of your hand'); (3) social events (eight items; e.g., 'You go into a shop and the assistant ignores you'); and (4) general events (six items; e.g., 'A member of your family is arriving home late'). Although the first two subscales both refer to bodily sensations, they differ in that the panic-related sensation subscales contains autonomous sensations that are highly specific for and typically associated with panic attacks. The other bodily symptoms subscale relates to non-autonomous sensations and symptoms, not typically associated with panic, and referring to injury, illness and pain in general.

The ambiguous descriptions are presented one-by-one on the computer screen, accompanied with the question '*Why?* Each description remains on screen for 5 s, enabling participants to think about this description and possible explanations for it. Next, three alternative explanations are provided, one of which is negative and two neutral explanations. For the item 'You notice your heart is beating quickly and pounding', the negative explanation states 'Because there is something wrong with your heart', the two neutral explanations state 'Because you have been physically active' and 'Because you are feeling excited'. Participants then indicate which of these three alternatives comes closest to their personal interpretation (ranking score). Next, participants rate the likelihood of each alternative explanation in percentages (0–100; rating score).

Clark et al. (1997) reported about good content and construct validity of the BSIQ, in that the measure was able to differentiate between patients with panic disorder and patients with other anxiety disorders. Furthermore, Keogh et al. (2004) have demonstrated satisfactory internal consistencies for the subscales of the BSIQ with reliability coefficients ranging between .71 and .83. In the current sample Cronbachs alpha values showed satisfactory to good internal consistency as well with $\alpha = .78$ for the panic-related sensations subscale, $\alpha = .75$ for the other bodily symptoms subscale, $\alpha = .86$ for the social events subscale, and $\alpha = .73$ for the general events subscale.

1.2.2. Self-report measures

The *State-Trait Anxiety Inventory-Trait form* (STAI-T; Spielberger et al., 1970) contains 20 items that tap a general anxiety disposition (e.g., 'I worry too much about unimportant things'). Participants have to indicate on a 4-point Likert scale, ranging from 1 (almost never) to 4 (almost always), to what extent these statements apply to them. A high score on this scale reflects a high general anxiety disposition. The original and Dutch version

(Ploeg van der, Defares, & Spielberger, 1980) proved to be reliable and valid measures.

Optimism was assessed with the *Life Orientation Test* (LOT; Scheier & Carver, 1985). This measure consists of 12 items, of which four are filler items. The remaining eight items consist of four positively worded statements ('I always look on the bright side of things'), and four negatively worded statements (e.g., 'Things never work out the way I want them to'). Participants have to respond to each statement on a 4-point Likert scale ranging from 0 (strongly disagree) to 4 (strongly agree). The LOT has good reliability and validity (Scheier & Carver, 1985). Scheier and Carver (1985) originally developed the measure as a unipolar measure of general optimism, with reverse scoring of the negatively stated items. Although some authors state that the measure consists of two subscales, assessing optimism and pessimism (Andersson, 1996) the constructors of the scale argue that the original scoring method can be used to obtain a general measure of optimism (Scheier, Carver, & Bridges, 1994). Moreover, if two subscales are adopted, these subscales correlate highly among each other, raising the question if the proposed two-factor solution might not originate from the wording of the items, rather than the fact that they measure two separate constructs. We choose to follow the original scoring methods of the LOT, with reverse scoring of the negatively stated items and calculating a sum score that reflects a degree of general optimism.

The three fundamental fears (AS, IS, and FNE) were assessed with the Dutch version of the *Sensitivity Index* (SI)[1] (Vancleef et al., 2006). This questionnaire is a composite measure consisting of three subscales (ASI, ISI, FNE), which tap anxiety sensitivity, injury/illness sensitivity and fear of negative evaluation, respectively. The *Anxiety Sensitivity Index* (*ASI*) (Peterson & Heilbronner, 1987) includes 16 items concerning the negative consequences of experiencing anxiety (e.g., 'It scares me when my heart beats rapidly'). *The Injury/Illness Sensitivity Index* (*ISI*) (Taylor, 1993; Vancleef et al., 2006) contains six items pertaining to the fear of illness (e.g., 'I get scared when I think I'm coming down with an illness') and five items referring to the fear of injury (e.g., 'The thought of injury terrifies me'). The *Brief Fear of Negative Evaluation Scale* (*BFNE*) (Leary, 1983) consists of 12 items measuring the fear of negative evaluation (e.g., 'I worry about what kind of impression I make on people'). Participants indicate their degree of agreement with all statements of the SI on a 5-point Likert scale, ranging from 1 (very little) to 5 (very much).[2] Psychometric properties of both the original and the Dutch version of the SI are satisfactory (Taylor, 1993; Vancleef et al., 2006). Furthermore, the psychometric properties of the ASI (Peterson & Heilbronner, 1987; Rodriguez, Bruce, Pagano, Spencer, & Keller, 2004; Sandin, Chorot, & McNally, 2001), the brief FNE (Collins, Westra, Dozois, & Stewart, 2005; Leary, 1983) and recently the ISI (Carleton, Asmundson, & Taylor, 2005) separately have well been documented.

The *Fear of Pain Questionnaire* (FPQ: McNeil & Rainwater, 1998) was administered to measure fear of pain. In this 30-item measure, respondents indicate how fearful they are of three types of pain: severe pain (e.g., 'Breaking your leg'), minor pain (e.g., 'Getting a paper-cut on your finger'), and medical pain (e.g., 'Receiving an injection in your hip/buttocks'). The items are scored on a 5-point Likert scale ranging from 1 (not at all) to 5 (extreme). The psychometric properties of the English as well as the Dutch version of the FPQ are satisfactory (McNeil & Rainwater, 1998; Roelofs, Peters, Deutz, Spijker, & Vlaeyen, 2005; van Wijk & Hoogstraten, 2006).

The *Pain Catastrophizing Scale* (PCS; Sullivan, Bishop, & Pivik, 1995) taps pain catastrophizing, which is defined as 'an exaggerated orientation towards pain'. Participants need to recall painful past memories, and subsequently indicate on a 5-point scale ranging from 0 (not at all) to 4 (all the time) to what extent they experienced each of 13 feelings and thoughts during that pain (e.g., 'I feel as if I can't take this anymore'). The original and Dutch version (Crombez & Vlaeyen, 1996) of the PCS has proven to be reliable and valid (Osman et al., 1997; Severeijns, van den Hout, Vlaeyen, & Picavet, 2002; Van Damme, Crombez, Bijttebier, Goubert, & Van Houdenhove, 2002).

1.3. Procedure

Prior to participation, all participants received verbal instructions by the experimenter and gave written informed consent. Participants first filled out the BSIQ and subsequently completed the other self-report measures. All measures were completed on the

[1] The English version of the Sensitivity Index was translated in Dutch in a state-of-the-art manner, involving back translation, after which the item content was checked against the original content. The Dutch version of the Sensitivity Index is available from the corresponding author.

[2] Note that the scoring format from the original ASI (Peterson & Heilbronner, 1987) ranges from 0 (very little) to 4 (very much).

computer. Testing occurred individually, and at the participant's own pace. In general, it took about 45–60 min to fill out all questionnaires. When all questionnaires were completed, participants received remuneration in the form of a gift voucher.

The ambiguous descriptions of the BSIQ are presented in the centre of the computer screen and remain on the screen for 5000 ms, after which time period the three alternative explanations are offered. Each alternative is preceded by the letter A, B, or C, and participants choose the alternative that is most likely for them by pressing the corresponding letter as labeled on the left (A), right (B), and down (C) arrow key of the keyboard. The chosen alternative then lights up in red font color. Next, a textbox appears behind each alternative explanation, and the participant allocates a likelihood percentage (rating score) between 0 and 100, using the numerical keypad. A rating score needs to be assigned to each alternative, before the program continues with the presentation of the next item. Upon finishing the BSIQ, participants completed the self-report measures (SI, PCS, FPQ, LOT, STAI).

The test procedure differed for participants recruited inside and outside the local community of Maastricht University with respect to the test location. The first group of participants completed all measurements on a PC that was situated in a room in the university building, while participants who were recruited outside the university completed the measures on a portable PC in their home environment. In both settings, the experimenter was present during test performance, without interacting with the participant. In order to keep the test procedure in the home environment comparable to the laboratory study, the experimenter made sure that the questionnaires were completed in a quiet and silent location, and that no distraction by for example other persons, or telephone took place.

1.4. Data reduction and statistical analyses

Because the negative alternative was rarely chosen as first choice interpretation in the BSIQ, the ranking scores showed floor effects and little dispersion ($M = 8.61\%$; S.D. = 10.28). Therefore, we performed all analyses on the rating scores of the BSIQ only.

1.4.1. Confirmatory factor analysis (CFA)

The factor structure of the BSIQ was examined with a confirmatory factor analysis on the negative rating scores of the BSIQ items (Lisrel 8.54, Jöreskog & Sörbom, 2001). The Maximum Likelihood Estimation Method was used to assess goodness-of-fit, and covariance matrices were analyzed. It was assumed that each item loaded onto one single factor in such a way that every item of a specific BSIQ subscale loaded together on the same latent factor. The Chi-square statistic gives an overall test of the model fit, and should result in a non-significant value to indicate good fit of the hypothesized model with the data. Multiple fit indices were used to decide on goodness-of-fit of the hypothesized factor structure: (a) root mean square error for approximation (*RMSEA*); (b) the comparative fit index (*CFI*); (c) the non-normed fit index (*NNFI*); (e) standardized root mean square residual (*sRMR*). For the *RMSEA*, values of about .08 or less indicate a "reasonable error of approximation"(Browne & Cudeck, 1993). For the *CFI* and the *NNFI*, values above .90 indicate reasonable fit, whereas values above .95 indicate good to very good fit. For the *sRMR*, values close to .08 are indicative of good fit (Hu & Bentler, 1999).

1.4.2. Interpretation bias in relation to general and specific psychological constructs

Mean ratings on negative and neutral alternatives for each item were calculated for the four BSIQ subscales separately (note that two neutral alternatives accompanied each item, and that the ratings for the neutral alternatives were averaged for each item). A paired samples *t*-test was then conducted to compare the scores on the neutral and the negative alternatives. Subsequent analyses were performed on the negative rating scores only, since the neutral rating scores do not contribute to the hypotheses of the current study.

The association between the specific negative interpretation scores and the scores on the questionnaire measures was first examined with Pearson correlations. We next performed hierarchical regression analyses in order to determine which psychological constructs contribute to the explanation of the negative rating scores for each subscale separately. In these analyses, age and gender were entered as control variables in the first step of the model, the global trait measures (STAI and LOT) were entered in the second step, the more specific fundamental fears (ASI, ISI, FNE) were entered as predictors in the third step, and the specific pain-related constructs (FPQ and PCS) were entered as predictors in the last step of each analysis.

2. Results

2.1. Confirmatory factor analysis

Testing the four-factor model resulted in a significant Chi-square statistic ($\chi^2(317, N = 154) = 647.18$;

Table 1
BSIQ items with estimated factor loadings and factor intercorrelations, corrected for attenuation

Item	Item content	Panic-related sensations	Other bodily symptoms	Social events	General events
1	You notice that your heart is beating quickly and pounding	.73			
2	You feel lightheaded and weak	.34			
3	Your chest feels uncomfortable and tight	.67			
4	You suddenly feel confused and are having difficulty in thinking straight	.71			
5	You feel short of breath	.44			
6	You notice that your heart is pounding, you feel breathless, dizzy and unreal	.74			
7	Your vision has become slightly blurred	.76			
8	You have developed a small spot on the back of your hand		.76		
9	You have a sudden pain in your stomach		.55		
10	You have a pain in the small of your back		.37		
11	You find a lump under the skin on your neck		.78		
12	You have been eating normally but have recently lost some weight		.60		
13	Your doctor tells you your headaches are caused by tension, but he wants you to see a specialist		.61		
14	You go into a shop and the assistant ignores you			.55	
15	You are talking to an acquaintance who briefly looks out of the window			.73	
16	You notice a frowning stranger approaching you in the street			.53	
17	You are introduced to someone at a party who fails to reply to a question you ask them			.81	
18	You have visitors round for a meal and they leave sooner than you expected			.76	
19	You notice that some people you know are looking in your direction			.75	
20	A friend suggests that you change the way that you are doing a job in your own house			.61	
21	An old acquaintance passes you in the street without acknowledging you			.63	
22	A member of your family is late arriving home				.69
23	You wake with a start in the middle of the night, thinking you heard a noise, but all is quiet				.60
24	A crisis comes up at work and you cannot immediately think of what to do				.38
25	You are under a great deal of pressure and finding it difficult to manage everything you have to do				.65
26	A letter marked 'URGENT' arrives				.43
27	You smell smoke				.55
Factor intercorrelations (S.E.)					
	Panic-related sensations	1			
	Other bodily symptoms	.93 (.03)	1		
	Social events	.60 (.06)	.77 (.04)	1	
	General events	.77 (.05)	.91 (.04)	.84 (.04)	1

$p < .001$). Although this value was significant, the other goodness-of-fit estimates were found sufficient to good, with an *RMSEA* = .08; *NNFI* = .94; *CFI* = .95, *sRMR* = .07 indicating reasonable fit of the data to the suggested model. The factor solution supports a four-factor solution in which each factor corresponds to a subscale of the BSIQ (Table 1). When we adapt the criterion that loadings above .40 show good belongingness to the scale, item 2, item 10, and item 24 show loadings below this criterion. However, inspection of the precise content of these items does not provide reasons for removal of these items.

Although the goodness-of-fit indices indicate relative good fit, high intercorrelations are observed

Table 2
Descriptives for the rating and ranking scores on the BSIQ subscales and the self-report measures ($N = 154$)

	M	S.D.
BSIQ negative other bodily symptoms	15.49	13.04
BSIQ negative panic-related sensations	11.73	10.36
BSIQ negative social events	27.80	16.79
BSIQ negative general events	18.05	12.87
BSIQ neutral other bodily symptoms	54.65	12.16
BSIQ neutral panic-related sensations	55.50	11.08
BSIQ neutral general events	50.51	11.12
BSIQ neutral general	57.17	11.73
STAI-T	36.69	8.19
LOT	29.71	5.19
ASI	25.13	4.78
ISI	22.10	6.64
BFNE	27.91	10.39
PCS	12.31	6.76
FPQ	74.74	14.91

Note—STAI: State-Trait Anxiety Inventory-Trait Version; LOT: Life Orientation Test; ASI: Anxiety Sensitivity Index; ISI: Injury/Illness Sensitivity Index; BFNE: Brief Fear of Negative Evaluation scale; PCS: Pain Catastrophizing Scale; FPQ: Fear of Pain Questionnaire.

between the four factors, in particular between the panic factor and the other bodily symptoms factor (Table 1).[3]

2.2. Interpretation bias in relation to general and specific psychological constructs

Mean scores on the BSIQ and the self-report measures are presented in Table 2. For the BSIQ, significant higher ratings were given to the neutral alternatives than to the negative alternatives on the panic-related sensations subscale ($t(153) = -41.47$, $p < .001$), the other bodily symptoms subscale($t(153) = -29.97$; $p < .001$), the social events subscale($t(153) = -14.70$; $p < .001$), and the general events subscale($t(153) = -31.47$; $p < .001$). So, participants generally assign a higher likelihood to the neutral than to the negative interpretation of the presented ambiguous situations.

[3] Because of these high intercorrelations, the 3-factor model (factor 1: panic-related sensations + other bodily symptoms; factor 2: social events; factor 3 general events), the 2-factor model (factor 1: panic-related sensations + other bodily symptoms; factor 2: social events + -general events) and the 1-factor model solutions of the BSIQ were tested as well and compared with the 4-factor model fit by performing delta Chi-square tests ($\Delta\chi^2$). None of the other models resulted as significantly better than the 4-factor model. Moreover, the fit indices of the 3-factor model, the 2-factor model, and the 1-factor model resulted in poorer values than these of the 4-factor model. Details on these analyses can be obtained with the corresponding author.

Table 3
Pearson correlations ($N = 154$) between self-report measures and negative rating scores on each subscale

	Panic-related sensations	Other bodily symptoms	Social events	General events
STAI-T	.18	.23	.42	.30**
LOT	−.30**	−.36**	−.44**	−.39**
ASI	.37**	.36**	.34**	.38**
ISI	.22	.33**	.29**	.20
BFNE	.23	.30**	.57**	.43**
PCS	.28**	.45**	.37**	.35**
FPQ	.33**	.35**	.35**	.30**

Note—STAI: State-Trait Anxiety Inventory-Trait Version; LOT: Life Orientation Test; ASI: Anxiety Sensitivity Index; ISI: Injury/Illness Sensitivity Index; BFNE: Brief Fear of Negative Evaluation Scale; PCS: Pain Catastrophizing Scale; FPQ: Fear of Pain Questionnaire.
** $p < .0017$ (significant correlations after Bonferroni correction for multiple correlations; $\alpha = .05/28 = .0017$).

Further analyses were performed on the ratings for the negative alternatives only. We calculated Pearson correlation coefficients to study the association between scores on the self-report measures and the negative ratings that were assigned to the four subscales of the BSIQ (Table 3). As expected, trait anxiety, the fundamental fears and the pain-specific constructs all correlate positively with the negative ratings, whereas a negative association was found between the optimism score and the negative ratings. Table 3 shows that no unique correlations exist between a particular construct and a subscale of the BSIQ corresponding with this construct, but that associations are rather generalized in nature. However, careful inspection of the correlation matrix does indicate a pattern that might suggest at least some specificity. It is remarkable that pain catastrophizing shows the highest correlation coefficient with the other bodily symptoms scale, and that the fear of negative evaluation shows the highest correlation with the social events subscale.

We conducted multiple linear regression analyses to further examine specific predictive power of the global trait measures, the fundamental fears, and the pain-specific measures for the four BSIQ subscales separately. Entering age and gender in the first step of the analysis did not reveal significant prediction for any subscale and these variables were therefore removed from all further analyses.[4] When LOT and

[4] Parallel analyses were conducted for all regression models in which age and gender were entered as predictors in the first step of each regression analysis. These analyses revealed the same pattern of findings.

STAI were considered as predictors of the negative interpretation scores, LOT resulted as the only significant predictor for the panic-related sensations subscale ($\beta = -.33$, S.E. $\beta = .11$, $t = -3.12$, $p < .01$), the other bodily symptoms subscale ($\beta = -.37$, S.E. $\beta = .10$, $t = -3.58$, $p < 001$), the social events subscale ($\beta = -.28$, S.E. $\beta = 10$, $t = -2.83$, $p < .01$), and the general events subscale ($\beta = -.34$, S.E. $\beta = .10$, $t = -3.31$, $p < .001$). Thus, higher levels of optimism are predictive of lower negative interpretations for ambiguous situations implying physical, social or general threat.

Entering the three fundamental fears in the second step of the analyses (Table 4) resulted in significant model changes for the prediction of the panic-related sensations subscale ($\Delta R^2 = .09$; $\Delta F(3, 148) = 5.14$; $p < .01$), the other bodily symptoms subscale ($\Delta R^2 = .11$; $\Delta F(3, 148) = 6.78$; $p < .001$), the social events subscale ($\Delta R^2 = .16$; $\Delta F(3, 148) = 13.04$; $p < .001$), and the general events subscale ($\Delta R^2 = .13$; $\Delta F(3, 148) = 8.88$; $p < .001$). Although optimism remains a significant general predictor for all subscales, adding the fundamental fears results in specific additional predictive value of AS for the panic-related sensations subscale, IS for the other bodily symptoms subscale, and FNE for the social situations subscale. This finding supports our hypothesis of specific predictive power of the fundamental fears for negative interpretations. Both AS and FNE are significant predictors of the general events subscale.

In an additional linear regression analysis we entered the specific pain-related constructs (FOP and PCS) as a third step in the regression model (Table 5). Adding these two variables results in significant changes from the previous step for the panic-related sensations subscale ($\Delta R^2 = .06$; $\Delta F(2, 146) = 5.39$; $p < .01$), the other bodily symptoms subscale ($\Delta R^2 = .07$; $\Delta F(2, 146) = 7.49$; $p < .01$), the social events subscale ($\Delta R^2 = .04$; $\Delta F(2, 146) = 5.14$; $p < .01$), and the general events subscale ($\Delta R^2 = .04$; $\Delta F(2, 146) = 4.70$; $p < .05$). A remarkable finding is that FOP results as an additional significant predictor of all four subscales of the BSIQ. Together with FOP, PCS becomes an additional significant predictor of the other bodily symptoms subscale, whereas the prediction of IS for this subscale (Step 2) disappears after the incorporation of the two specific pain constructs in the model.

3. Discussion

The current study examined how global personality traits, fundamental fears, and pain-specific constructs

Table 4
Results of regression analyses (Step 2) with TA, optimism, AS, IS, and FNE entered as predictors for the negative interpretation scores on the four BSIQ subscales ($N = 154$)

Dependent variable	Predictor	β	S.E. β	t	p
Panic-related sensations: $R^2 = .18$; $F(5, 148) = 6.30$; $p < .001$.	STAI-T	−.15	.11	−1.31	.19
	LOT	**−.24**	**.11**	**−2.27**	**.03**
	ASI	**.27**	**.09**	**2.87**	**.005**
	ISI	.03	.09	.36	.72
	BFNE	.12	.09	1.27	.21
Other bodily symptoms: $R^2 = .23$; $F(5, 148) = 9.04$; $p < .001$.	STAI-T	−.15	.11	−1.34	.18
	LOT	**−.29**	**.10**	**−2.84**	**.005**
	ASI	.16	.09	1.73	.09
	ISI	**.17**	**.09**	**2.06**	**.04**
	BFNE	.17	.09	1.89	.06
Social events: $R^2 = .38$; $F(5, 148) = 18.39$; $p < .001$.	STAI-T	−.02	.10	−.24	.81
	LOT	**−.22**	**.09**	**−2.44**	**.02**
	ASI	.07	.08	.84	.40
	ISI	.09	.08	1.16	.25
	BFNE	**.44**	**.08**	**5.43**	**.000**
General events: $R^2 = .28$; $F(5, 148) = 11.66$; $p < .001$.	STAI-T	−.13	.11	−1.24	.22
	LOT	**−.26**	**.10**	**−2.63**	**.01**
	ASI	**.23**	**.09**	**2.70**	**.008**
	ISI	−.04	.08	−.49	.63
	BFNE	**.33**	**.09**	**3.79**	**.000**

Note—STAI: State-Trait Anxiety Inventory-Trait Version; LOT: Life Orientation Test; ASI: Anxiety Sensitivity Index; ISI: Injury/Illness Sensitivity Index; BFNE: Brief Fear of Negative Evaluation Scale.

Table 5
Results of regression analysis (Step 3) with TA, optimism, AS, IS, FNE, FOP, and PC entered as predictors for the negative interpretation scores on the four BSIQ subscales ($N = 154$)

Dependent variable	Predictor	β	S.E. β	t	p
Panic-related sensations: $R^2 = .23$; $F(7, 146) = 6.31$; $p < .001$.	STAI-T	−.18	.13	−1.67	.10
	LOT	**−.24**	**.13**	**−2.29**	**.02**
	ASI	**.27**	**.11**	**2.89**	**.004**
	ISI	−.07	.11	−.75	.46
	BFNE	.11	.11	1.23	.22
	FPQ	**.27**	**.24**	**3.17**	**.002**
	PCS	.00	.05	.003	.99
Other bodily symptoms: $R^2 = .31$; $F(7, 146) = 9.16$; $p < .001$.	STAI-T	−.16	.09	−1.55	.12
	LOT	**−.24**	**.08**	**−2.41**	**.02**
	ASI	.10	.07	1.17	.24
	ISI	.04	.08	.42	.68
	BFNE	.16	.07	1.82	.07
	FPQ	**.18**	**.17**	**2.29**	**.02**
	PCS	**.22**	**.07**	**2.41**	**.02**
Social events: $R^2 = .42$; $F(7, 146) = 15.36$; $p < .001$.	STAI-T	−.05	.10	−.48	.63
	LOT	**−.20**	**.09**	**−2.25**	**.03**
	ASI	.05	.08	.61	.54
	ISI	−.01	.08	−.14	.89
	BFNE	**.43**	**.08**	**5.48**	**.000**
	FPQ	**.19**	**.18**	**2.67**	**.008**
	PCS	.08	.03	1.02	.31
General events: $R^2 = .33$; $F(7, 146) = 10.09$; $p < .001$.	STAI-T	−.15	.10	−1.48	.14
	LOT	**−.23**	**.10**	**−2.39**	**.02**
	ASI	**.21**	**.09**	**2.41**	**.02**
	ISI	−.15	.09	−1.66	.10
	BFNE	**.32**	**.09**	**3.78**	**.000**
	FPQ	**.19**	**.20**	**2.43**	**.02**
	PCS	.10	.04	1.17	.25

Note—STAI: State-Trait Anxiety Inventory-Trait Version; LOT: Life Orientation Test; ASI: Anxiety Sensitivity Index; ISI: Injury/Illness Sensitivity Index; BFNE: Brief Fear of Negative Evaluation Scale; PCS Pain Catastrophizing Scale; FPQ: Fear of Pain Questionnaire.

are related to the tendency to negatively interpret ambiguous information on four specific domains, i.e. panic-related sensations, other bodily symptoms, social events, and general events.

After introduction of the BSIQ by Clark et al. (1997) several authors have used its four subscales, although no studies pertaining the factor structure of the measure have been conducted to our knowledge. We performed a CFA to test whether the data of the current study supported the hypothesized four-factor structure of the BSIQ. The Chi-square value of model fit was significant, while it should have a non-significant value to indicate good fit to data. However, because the Chi-square test is sensitive to degrees of freedom and sample size, it is possible that this test will reject or accept a model inappropriately (Bentler & Bonnet, 1980; Jöreskog, 1990). Moreover, other goodness-of-fit statistics resulted in reasonable to good values indicating that each BSIQ subscale can independently be adopted as a domain-specific measure. Nevertheless, it should be noted that the four factors showed close interrelations. One possible explanation for these high intercorrelations is that the BSIQ might better be considered as a general threat-specific measure, assessing the tendency to interpret ambiguous situations as threatening or negative in general. This suggestion was not supported by additional analyses however, in which the one-factor model, the two-factor model and the three-factor model were tested and compared with the four-factor model. In these additional analyses, the four-factor model resulted as significantly better than all other models. Alternatively, the high intercorrelations might be attributed to the fact that the separate BSIQ items share the same skewness in their distributions, resulting in high correlations that are based on distribution similarities rather than on item content. Respondents in this study were healthy volunteers varying in levels of optimism and the other anxiety constructs. A large proportion of these respondents assigned very low or no probability at all to the negative

alternatives resulting in skewed distributions to the left of the separate item scores. One could argue that this skewness violates the necessary condition of normality for performing CFA. However, Jöreskog (1990) suggests that in the case of moderate non-normality in continuous scores, the goodness-of-fit indices can be interpreted using the ML estimation method in covariance analyses. Nevertheless, in interpreting the results of the CFA, the matter of non-normality should be kept in mind, and further examination of the factor structure with a more heterogeneous population is warranted.

To study domain specificity of the negative interpretation bias, we incorporated several measures of psychological constructs that are known to play a role in psychopathology. We expected that more global and generalized trait constructs like trait anxiety and optimism would be associated with the negative interpretation bias on all BSIQ domains, whereas more specific anxieties and fear constructs would be associated with negative interpretations on that subscale of the BSIQ that is congruent with the content of the individual's fear. Although the correlation matrix did not provide immediate support for the hypothesized domain specificity, regression analyses demonstrated specific predictive value for optimism, AS, IS, FNE, FOP, and PC. A first and robust finding concerns the strong predictive value of optimism for all subscales of the BSIQ. Higher levels of optimism are predictive of making less negative interpretations to the ambiguous descriptions of the BSIQ. This effect is independent of the influence of other anxiety and fear factors and supports the notion that optimism can serve a protective function in the development and maintenance of psychopathology (Scheier & Carver, 1992). We did not find support for the hypothesis that that trait anxiety would show the opposite effect of optimism. Even when trait anxiety and optimism were considered as the only two predictors of the negative interpretation indexes optimism resulted as the only significant predictor.

Second, specific predictive value of AS, IS, and FNE was found for negative interpretations made on the panic-related sensations subscale, the other bodily symptoms subscale, and the social events subscale of the BSIQ, respectively. This finding supports our hypothesis of domain-specificity of the interpretation bias in relation to specific fundamental fears. This specific predictive value is found to exists independently and additionally to the proportion of variance that was already explained by optimism for each subscale. The unique relation between AS and the panic-related sensations subscale once again stresses the close relation between AS and panic (Richards et al., 2001; Teachman, 2005). Furthermore, the fact that IS proves a good predictor for the negative interpretation scores on the other bodily symptoms subscale only, indicates the importance of IS in pain processing. In line with the expectations, the FNE is the only fundamental fear that contributes significantly to the explanation of the negative interpretations in response to ambiguous social situations. A third objective of the current study was to explore the influence of the addition of two specific pain constructs (PC and FOP) to the prediction of the negative interpretations on the four domains. It was hypothesized that these constructs would be particularly associated with the negative interpretation scores on the other bodily symptoms subscale based on their proximal relation with pain experiences and pain processing (e.g., Vlaeyen & Linton, 2000). Results indeed showed that both FOP and PC were significant predictors of the negative interpretation scores on the other bodily symptoms subscale. Moreover, after adding both constructs in the regression model the earlier observed predictive power of IS disappeared. This provides extra evidence for the high specificity of both constructs in relation to the more fundamental IS factor. Findings were not entirely in line with our expectations, however. Whereas PC was found to be uniquely predictive of the other bodily symptoms subscale, FOP possesses additional predictive value over and above the prediction of optimism and the fundamental fears for each other subscale of the BSIQ as well. The predictive value of FOP for the panic-related sensations subscale can be accounted for, given that the situations in this subscale involve internal and external bodily symptoms that might be interpreted as health threatening, and can thus be related to the fear of pain as well. However, FOP also contributes significantly to the other two subscales of the BSIQ, which do not show links with pain, injury or illness. This finding is difficult to account for, and needs further examination.

Some limitations and recommendations should be taken into consideration when interpreting the current results. First, although the CFA supports four factors in the BSIQ, there were some problems regarding high factor intercorrelations. These problems are probably inherent to the healthy status of the study population. A more heterogeneous population, including patients with social anxiety, panic disorder, and chronic pain would probably result in more dispersion on the item scores. Additional support for this suggestion can be found

in the results from the regression analyses, which show specific relations between individual levels of fundamental fears and scores on the BSIQ subscales. This augments the likelihood that the four factors are indeed distinct from each other rather than representing one general construct. In line with the research already conducted within the area of panic disorder, future research should examine whether the other bodily symptoms subscale and the social event subscale can be adopted to discriminate pain patients from non pain patients, and social anxious individuals from non-social anxious individuals, respectively. Relating to the inclusion of a healthy study population, it is noteworthy to mention that the current healthy population was representative for the general community sample with respect to the dispersion and mean scores on the anxiety-related constructs. More precisely, mean scores and standard deviations on the self-report measures in the current sample were similar to the scores as observed in other studies assessing these constructs in college student or community samples. This was especially true for the STAI (e.g., Ploeg van der et al., 1980), LOT (e.g., Scheier & Carver, 1985; Vinck, Wels, Arickx, & Vinck, 1998), ASI (e.g., Peterson & Reiss, 1992; Sandin et al., 2001; Vancleef et al., 2006), ISI (e.g., Carleton et al., 2005; Vancleef et al., 2006), BFNE (e.g., Carleton, McCreary, Norton, & Asmundson, 2006; Vancleef et al., 2006), and FPQ scores (e.g., Roelofs et al., 2005; van Wijk & Hoogstraten, 2006). The only exception here constituted the PCS scores, for which lower scores were observed ($M = 12$) in the current sample from prior findings in other college student and community samples ($M = 16$) (Crombez, Eccleston, Baeyens, & Eelen, 1998; Van Damme et al., 2002). A second limitation in this study concerns the omission of including specific lower-order constructs of AS and FNE. AS in particularly consists of lower-order factors that could have offered a valuable contribution to the goal of the current study regarding the degree of specificity of the negative bias. In the literature, there has been quite some debate regarding the one-dimensional or multidimensional nature of AS (Blais et al., 2001; Keogh, 2004; Schmidt & Joiner, 2002). Although it is established that AS serves an important role in the pathogenesis of anxiety, pain, and panic, recent evidence has suggested that it may be the lower-order factors of AS (i.e. physical concerns, mental incapacitation concerns, and social concerns) that explain these findings the best (Brown, Smits, Powers, & Telch, 2003; Hunt, Keogh, & French, 2006; Keogh & Asmundson, 2004; Zinbarg, Barlow, & Brown, 1997; Zvolensky, Feldner, Eifert, & Stewart, 2001). However, since both AS and the subscales were measured with the ASI in the current study, it was not possible to study the predictive value of its lower-order factors because this would imply serious violations of collinearity assumptions. At the time that this study was conducted, we were not aware of any other adequate measure to assess the lower-order factors of AS or the overlapping AS construct. In recent studies though, the Anxiety Sensitivity Profile (ASP) has been suggested to constitute a good alternative measure for assessing AS and lower-order components. (Keogh, Barlow, Mounce, & Bond, 2006; Olatunji et al., 2005). It is therefore suggested that future studies aiming to detect differential predictivity of AS and its lower-order components incorporate the ASP in addition to the ASI. Third, the BSIQ is a self-report measure, and is therefore subject to response bias and conscious reconsideration. It can be questioned to what extent these conscious processes reflect the spontaneous, automatic interpretations that will occur in daily life (Fazio & Olson, 2003; Greenwald, McGhee, & Schwartz, 1998). Therefore it is suggested that in addition to subjective measures further research will have to make use of automatic and objective tasks (e.g., lexical decision paradigm, moving window paradigm) to study negative interpretation bias in relation to psychopathology more thoroughly (Calvo, Eysenck, & Castillo, 1997; Hirsch & Mathews, 1997). Using automatized paradigms provides insight in the temporal pattern of interpretative responses. Moreover it offers the opportunity to decide whether specific negative interpretations are made routinely and immediately upon the confrontation with ambiguity or if they are the mere result of a more elaborative process of integrating prior knowledge, experiences, and dysfunctional cognitive schemes with new incoming information. Last, due to the lack of behavioral measures, it was not possible to investigate if negative interpretation biases on a specific domain have a mediating role in the exacerbation of emotional and affective disorders.

The current study provided preliminary evidence that levels of a global resilience trait (optimism), or specific vulnerability traits (AS, IS, FNE) are related with a general or specific negative interpretation bias, respectively. Furthermore, there is evidence that proximal and very specific vulnerabilities for chronic pain are specifically predictive of the tendency to interpret pain-related ambiguous material negatively. The current findings constitute only a first step, though, in studying the exact role of a negative interpretation bias in the onset and maintenance of emotional and

affective disorders. Understanding how emotional traits and cognitive biases act as latent risk factors for the development and maintenance of a disorder can contribute to the development of treatment approaches. As such, it offers helpful information to the early detection for those at risk for developing emotional or affective disorders in acute phases and it helps therapists and doctors to tailor treatment to the relevant cognitions.

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