Belief bias in panic disorder: Domain and disorder specificity

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Abstract

Previous work in spider phobic patients showed that high fearful individuals display a fear-confirming belief biased reasoning pattern that logically acts in a way to confirm (rather than falsify) prior beliefs. To corroborate and extend these earlier findings, this study investigated whether (i) enhanced belief bias can also be found in a group of individuals suffering from panic disorder, (ii) this bias is in content specific to panic disorder patients, and (iii) this bias is restricted to the domain of concern or reflects a more generally enhanced belief bias. Panic disorder patients (PD patients $n = 34$), a clinical control group of obsessive-compulsive patients (OCD patients $n = 25$), and non-clinical controls (NCCs $n = 21$) completed a belief bias task consisting of neutral and panic disorder relevant materials prior to treatment. No evidence emerged for a generally enhanced belief bias in PD patients or OCD patients. Consistent with previous research, PD patients showed a belief bias for panic disorder related materials. However, the OCD patients displayed an even stronger belief bias, casting doubt on the specificity of the belief bias effect in PD.
Introduction

Cognitive theories of psychopathology propose that dysfunctional beliefs provide the causal basis for the catastrophic misappraisals that are typical for anxiety disorders (Beck, 1976). According to these theories, anxiety patients overestimate the dangerousness of the situation due to an underlying belief and misinterpret harmless stimuli as forerunners of oncoming catastrophe (e.g., McNally, 2001). These theories propose that each anxiety disorder is associated with one or more specific dysfunctional beliefs that cause people to draw erroneous conclusions that are characteristic for the various disorders (e.g., Clark, 1986; Clark & Wells, 1995; Ehlers & Clark, 2000; Salkovskis, 1999). For example, panic patients who believe that palpitations signify impending cardiac arrest might get a panic attack, merely by misinterpreting some harmless interoceptive cues (e.g., Clark, 1986).

Given the fact that anxiogenic beliefs are mostly unrealistic, the question arises why these beliefs are so persistent. For therapeutic purposes, particular attention has been paid to the factors that prevent anxiety patients from changing their negative beliefs about the dangers they fear (e.g., Clark, 1999). Oftentimes, anxiety patients engage in avoidance and safety-seeking behaviours that hamper disconfirmation of their irrational beliefs (APA, 1994; Salkovskis, Clark, Hackmann, Wells, & Gelder, 1999). However, although avoidance and safety-seeking behaviours may play an important role in the persistence of symptoms, it provides no satisfying explanation for the observation that dysfunctional beliefs also persist when disconfirming evidence is available (and when it is not being [or cannot be] ignored, in contrast to confirmation bias). For example, why does a panic disorder patient hold on to his conviction that every next attack of dizziness and palpitations will be fatal, even after having experienced dozens of panic attacks that turned out to be harmless? In other words, a crucial question that remains is why panic disorder patients persist in concluding that particular physical symptoms are dangerous even in the presence of disconfirming evidence (e.g., palpitations are typically not followed by a heart attack). Satisfying answers to questions like these may provide a valuable contribution to the understanding of the maintenance of anxiety disorders and the improvement of treatments.

One mechanism that may play a fairly direct role in patients’ failure to correct their dysfunctional beliefs is their deductive reasoning style. Correcting erroneous beliefs requires the ability to accurately deduce the logical implications of empirical evidence for certain beliefs. In general, people are characterized by a bias in deductive reasoning that acts in a way to confirm rather than to falsify prior beliefs (“belief bias”; e.g., Evans, Over, & Manktelow, 1993). That is, belief bias is demonstrated in a general tendency to endorse
conclusions which are a priori believable as valid and those which are unbelievable as invalid, regardless of their actual logical status. This interference of prior beliefs is at least partly automatic in the sense that it is unintentional and involuntary (e.g., Evans & Curtis-Holmes, 2005). There is considerable evidence that some degree of belief bias is characteristic of human reasoning (e.g., see Evans, Newstead, & Byrne, 1993). In everyday life, some degree of belief bias can be considered functional. In potentially dangerous situations for example, it seems adaptive to rely on prior beliefs and act on quick and dirty conclusions, rather than to pause and consider the logical validity of those conclusions. However, if the perceived threat is based on pathogenic convictions, the same strategy becomes counterproductive. In that case, jumping to a conclusion would hinder the falsification of the underlying argument and logically immunize against the refutation of phobogenic views.

Earlier research in the context of spider phobia (de Jong, Weertman, Horseelenberg, & van den Hout, 1997) provided preliminary evidence to suggest that an enhanced belief bias in psychopathology may take two forms. First, enhanced belief bias may be evident in the domain of disorder-related concerns that are relevant for the patient. If enhanced belief bias is restricted to the domain of concerns this would be consistent with the idea that the incorrigibility of anxiogenic beliefs may not itself result from a reasoning abnormality, but represents a normal manifestation of tenacity for important and strongly held beliefs (cf. Garety & Hemsley, 1997). Second, a strong belief bias might (also) be a general cognitive characteristic of individuals suffering from psychopathological symptoms, exerting its influence in complaint-irrelevant domains as well. As such, this reasoning bias may reflect a trait-like information processing bias that acts as a diathesis in the development of psychopathology in general (cf. Arntz, Rauner, & van den Hout, 1995). Note that a relatively strong belief bias will impede the correction of somehow acquired erroneous and potentially pathogenic convictions, which in turn may render people liable to psychopathology because the presence of an enhanced belief bias might prevent participants from giving up such beliefs (e.g., “I am worthless”) in the face of logically incompatible data (cf. de Jong, Weertman et al., 1997; Smeets & de Jong, 2005). In other words, generally enhanced belief bias would immunize against refutation and thus enable the consolidation of all kinds of pathogenic views.

The aim of the present study was therefore to replicate and extend the finding of a domain-specific reasoning bias in anxiety disorders other than spider phobia and to test whether anxiety disorder patients can indeed also be characterized by a generally enhanced belief bias irrespective of the domain of concerns (which would be in line with the findings of de Jong, Weertman et al., 1997). Therefore, we measured domain-specific and general belief bias prior to
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treatment in panic disordered patients as well as in a group of normal controls. If indeed belief bias plays a critical role in the development and/or maintenance of anxiety disorders, individuals suffering from panic disorder should display generally enhanced levels of belief bias compared to individuals without symptoms as well as domain-specific belief bias. Moreover, if belief bias is a general premorbid characteristic that contributes to the development of dysfunctional beliefs, enhanced belief bias in anxiety patients should not only be present in the domain of their concerns, but in the neutral domain as well. To test the specificity of the domain specific belief bias, we also measured belief bias in a clinical control group (obsessive-compulsive disorder patients).

Method

Participants
Thirty-four patients with primary diagnosis panic disorder (27 women) and twenty-five patients with primary diagnosis obsessive-compulsive disorder (16 women) were recruited among individuals seeking treatment at the community mental health care centre in Maastricht, the Netherlands. The mean age was 34.8 years ($SD = 10.3$) in the panic disorder (PD) group and 30.5 years ($SD = 9.3$) in the obsessive-compulsive (OCD) group. Modal educational level (range ‘no education’ to ‘university degree’) was pre-vocational secondary education in the PD group (but mean close to secondary education) and secondary vocational education in the OCD group.

All patients met DSM-IV criteria for panic disorder with or without agoraphobia or obsessive-compulsive disorder, as assessed with the Structural Clinical Interview for DSM-IV (SCID; First, Spitzer, Gibbon, & Williams, 1995). Of the 34 PD patients, 27 (79%) suffered from PD with agoraphobia. Fifty-nine percent of the PD patients had additional comorbidity: 11 patients of the PD group had one additional diagnosis, 3 had two additional diagnoses, 3 had three additional diagnoses and 3 had four additional diagnoses. Among the additional diagnoses were 16 mood disorders (depressive episodes), 11 other anxiety disorders (4 generalized anxiety disorder, 1 OCD, 3 social anxiety, 2 specific phobia, 1 post-traumatic stress disorder), six somatic disorders (2 hypochondriasis, 4 pain disorder), three substance-related disorders (2 alcohol dependence, 1 substance abuse), one eating disorder NOS and one intermittent explosive disorder.

In the OCD group, 84% suffered from comorbid disorders: 9 patients had one additional diagnosis, 7 had two additional diagnoses, 2 had three additional diagnoses, 1 had four additional diagnoses and 2 had five additional diagnoses. Among the additional diagnoses were 19 mood disorders (15 depressive
### Table 4.1

*Example of a neutral syllogism with conclusions varying in logical validity and believability.*

<table>
<thead>
<tr>
<th>Believable conclusion</th>
<th>Unbelievable conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>valid</strong></td>
<td></td>
</tr>
<tr>
<td>An adult is older than an adolescent</td>
<td>A toddler is older than an adolescent</td>
</tr>
<tr>
<td>An adolescent is older than a toddler</td>
<td>An adolescent is older than an adult</td>
</tr>
<tr>
<td>An adult is older than a toddler (Type 1)</td>
<td>A toddler is older than an adult (Type 3)</td>
</tr>
<tr>
<td><strong>invalid</strong></td>
<td></td>
</tr>
<tr>
<td>A toddler is older than an adolescent</td>
<td>An adult is older than an adolescent</td>
</tr>
<tr>
<td>An adolescent is older than an adult</td>
<td>An adolescent is older than a toddler</td>
</tr>
<tr>
<td>An adult is older than a toddler (Type 2)</td>
<td>A toddler is older than an adult (Type 4)</td>
</tr>
</tbody>
</table>

### Table 4.2

*Example of a PD congruency syllogism with conclusions varying in logical validity and PD congruency.*

<table>
<thead>
<tr>
<th>PD congruent conclusion</th>
<th>PD non-congruent conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>valid</strong></td>
<td></td>
</tr>
<tr>
<td>Palpitations are more dangerous than a wasp's sting</td>
<td>A mosquito bite is more dangerous than a wasp's sting</td>
</tr>
<tr>
<td>A wasp's sting is more dangerous than a mosquito bite</td>
<td>A wasp’s sting is more dangerous than palpitations</td>
</tr>
<tr>
<td>Palpitations are more dangerous than a mosquito bite (Type 1)</td>
<td>A mosquito bite is more dangerous than palpitations (Type 3)</td>
</tr>
<tr>
<td><strong>invalid</strong></td>
<td></td>
</tr>
<tr>
<td>A mosquito bite is more dangerous than a wasp's sting</td>
<td>Palpitations are more dangerous than a wasp's sting</td>
</tr>
<tr>
<td>A wasp's sting is more dangerous than palpitations</td>
<td>A wasp’s sting is more dangerous than a mosquito bite</td>
</tr>
<tr>
<td>Palpitations are more dangerous than a mosquito bite (Type 2)</td>
<td>A mosquito bite is more dangerous than palpitations (Type 4)</td>
</tr>
</tbody>
</table>
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episodes, 4 dysthymia), nine anxiety disorders (1 PD, 1 generalized anxiety disorder, 7 social anxiety, 1 post-traumatic stress disorder), three somatic disorders (1 hypochondriasis, 2 pain disorder), six substance-related disorders (3 alcohol dependence, 3 substance abuse), one eating disorder NOS, one pathological gambling, one Tourette’s disorder and one delusional disorder.

Twenty-one healthy control participants (14 women) were recruited through advertisements in local newspapers. They received a small financial remuneration for their participation in the study (€10,-). Controls were included after screening on the presence of any DSM-IV axis-I disorder. Their mean age was 35.3 years ($SD = 14.4$) and the modal educational level was higher professional education.

There were no significant differences between the three groups of participants with respect to gender ($\chi^2[2] = 1.77, p = .43$), age ($F[2,79] = 2.79, p = .20$) or educational level ($\chi^2[16] = 19.82, p = .21$), although there was a tendency for the educational level of the PD group to be lower than that of both other groups.

Materials

Reasoning task

The reasoning task that was used in the present study was an adapted version of the computerized task used by de Jong, Weertman et al. (1997; see also Smeets & de Jong, 2005). The task consisted of three sets of four different linear syllogisms. The three sets concerned neutral themes (e.g., a mouse is larger than an elephant), PD-relevant themes (e.g., palpitations are more dangerous than a mosquito bite), and a third set that was included for pilot purposes (these themes will not be discussed in this paper). The PD-relevant themes were developed in consultation with experienced therapists. These were based on the most frequently reported concerns relevant for panic disorder and included palpitations, dizziness, gasping, and pain on the chest. A list of the themes that were used for the two experimental sets is included in the Appendix.

For each of the neutral syllogisms, four different types were constructed by systematically varying the logical validity and believability of the conclusions. An example of these four types can be seen in Table 4.1. For each of the syllogisms, two types had a conclusion in line with participants’ prior view of the world, one of which was logically valid (believable and valid; Type 1), and one of which was invalid (believable but invalid; Type 2). Furthermore, there were two types with a conclusion opposing the participants’ prior view of the world, again one of which was logically valid (unbelievable but valid; Type 3), and one which was logically invalid (unbelievable and invalid; Type 4). Belief bias would be reflected by a relatively poor performance (i.e., many errors; long latencies) if
the conclusions were in line with participants’ prior beliefs but logically invalid or when the conclusion was opposite to participants’ prior beliefs but logically valid. More specifically, belief bias would be reflected in an interaction effect between the believability and the logical validity of the syllogisms’ conclusions.

For the panic-related syllogisms, a lack of consensus regarding ‘believability’ of the conclusions is expected across the groups. We therefore refer to the ‘believability’ of the conclusions of the panic related themes as ‘PD congruent’ and ‘PD non-congruent’. With this distinction, the four different types of syllogisms were created in a similar vein as the neutral syllogisms: two PD congruent types, one logically valid and one logically invalid (type 1 and 2 respectively), and two PD non-congruent types, again one logically valid and one logically invalid (type 3 and 4 respectively). An example of the four types of a PD-relevant syllogism are presented in Table 4.2.

To counter possible reading strategies each syllogism was presented in two orders (a > b, b > c, therefore a > c and b > c, a > b, therefore a > c). In total, there was a pool of 3 (domains) * 4 (themes) * 4 (types) * 2 (orders) = 96 syllogisms.

All participants were exposed to the same pool of 96 syllogisms. Syllogisms were presented in fixed random order. To prevent that fatigue would influence the responses as the reasoning task progressed, participants had to take a rest period for at least two minutes after the first and the second set of 32 syllogisms. Outcome measures are the number of errors and the time required for solving each syllogism.

Believability ratings
As an explicit measure of the believability of the syllogisms that were used, participants were asked to rate all conclusions on believability using a Visual Analogue Scale (VAS). This 100 mm scale ranged from very unbelievable (0 mm) to very believable (100 mm).

Self-reported measures of psychopathology
To index level of symptoms, the Fear Questionnaire (FQ; Marks & Mathews, 1979) and the Symptom Checklist (SCL-90; Arrindell & Ettema, 1986; Derogatis, Lipman, & Covi, 1973) were administered. The FQ is a frequently used measure in anxiety disorder research, measuring avoidance symptoms. One of the subscales concerns the intensity of the patients’ main phobia (i.e., the

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11 We have chosen not to use disorder specific measures such as the PDSS (Shear et al., 1997) or the BAI (Beck, Epstein, Brown, & Steer, 1988) for the PD group and the Y-BOCS (Goodman, Price, Rasmussen, Mazure, Delgado et al., 1989; Goodman, Price, Rasmussen, Mazure, Fleischmann et al., 1989) or the PADUA (Sanavio, 1988) for the OCD-group, because this would exclude the option of comparing both groups on these measures or collapsing the groups for further analysis. Instead we have chosen to use a general psychopathology measure commonly used in clinical practice (SCL-90) and an anxiety measure widely used in research (FQ).
disorder for which treatment is requested). The main phobia subscale provides a global indication of the severity of the disorder. This subscale could not be assessed for the normal controls due to the nature of the question. Another subscale relevant to this population is the agoraphobia subscale, which measures agoraphobic symptoms. This scale was assessed for all participants. The SCL-90 is a widely used multidimensional index of psychopathological symptoms. The SCL-90 sum score gives an indication of the overall level of psychopathology. Both questionnaires have acceptable psychometric properties (Arrindell & Ettema, 1986; Marks & Mathews, 1979).

Procedure
Patients were tested one week prior to the start of their treatment. All measures were administered in the following order: reasoning task; believability ratings; SCL-90; FQ. In a sound attenuated room, the participant was seated in front of a 14-inch monitor on which the syllogisms and the standard instructions were presented. Participants were instructed to decide as quickly as possible whether or not the conclusion was correct (i.e., logically valid) given the two premises. It was emphasized that the reality basis (i.e., the believability or the PD congruency) neither of the premises nor of the conclusions should be taken into account. To get familiarized with the reasoning task, participants received four examples. After the first two examples, the participants received feedback about the correctness of their decision, along with a standard explanation about the validity of the conclusion to be sure that the participants would understand their task. After the third and fourth example, the participants received feedback about the correctness of their decision without further explanation. While the feedback and explanation were presented, the particular syllogism remained on the screen. After the example syllogisms, the instructions for the reasoning task were summarized. The participant could start the actual reasoning task by pushing the space bar whenever he or she was ready.

Preceding every single stimulus presentation the sentence “pay attention!” appeared on the screen to alert the participant for the next syllogism. The participant indicated whether he or she considered the syllogism valid or not by pushing either the ‘valid’ or the ‘not valid’ button. The syllogism disappeared from the screen immediately after the participant had pushed one of the two buttons. Every next stimulus presentation appeared after a 2000 ms interval. The program recorded the participants’ decisions (valid or invalid) as well as their response latencies (in milliseconds) on a trial by trial basis. During the experiment, the participants received no feedback about their performance.
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After the first and the second set of 32 syllogisms, the computer paused and displayed the text “This was the first (second) set of syllogisms. Please take a break for at least two minutes. Whenever you are ready, you may push the space bar to continue”. During the rest period, the computer did not respond for two minutes.

Data-reduction and analysis
For each type of syllogism within each domain, all errors are summed, resulting in 8 (2 domains * 4 types) error scores per participant. It can be expected that many participants will make zero errors on the belief bias task (linear syllogisms are relatively easy to solve, cf. de Jong, Weertman et al., 1997), and as such, it can be expected that the distribution of the error data on the belief bias task will be extremely skewed. If transformation can not sufficiently repair the skewness, we will perform no analysis of variance on the error data. Reaction times scores will be calculated by averaging the reaction times of the correct responses, again per type of syllogisms within each domain. For both types of syllogisms the responses will be subjected to repeated measures ANOVAs.

Results
Groups and psychopathology
The mean scores and standard deviations for the levels of psychopathology for the three groups are shown in Table 4.3. A multivariate ANOVA with group as between subject factor and FQ agoraphobia, FQ total and SCL total as outcome measures showed that the groups differed from each other on all measures, multivariate $F(6,146) = 18.05, p < .01$, $\eta^2 = .44$. For both FQ agoraphobia and FQ total, the PD group scored higher than the OCD group (contrast estimate = 13.56, $p < .01$ and contrast estimate = 17.50, $p < .01$ respectively) and the NCC group (contrast estimate = 19.60, $p < .01$ and contrast estimate = 35.87, $p < .01$ respectively). Also, the OCD group scored higher than the NCC group (contrast estimate = 6.04, $p = .024$ and contrast estimate = 18.27, $p < .01$ respectively). For SCL total, the PD group scored higher than the NCC group (contrast estimate = 100.56, $p < .01$) and the OCD group scored equal to the PD group (contrast estimate = 12.00, $p < .42$; also, the OCD group scored higher than the NCC group, contrast estimate = 112.56, $p < .01$). An additional one-way ANOVA, comparing the PD group and the OCD group on FQ main phobia, showed that the two groups did not differ in the strength of their main phobia ($F[1,59] = 0.16, p = .70$).
Table 4.3
Mean levels (and SD) of psychopathology for the three groups as measured with the FQ (main phobia and agoraphobia subscale, and sum score [total]) as well as the SCL-90.

<table>
<thead>
<tr>
<th></th>
<th>Panic Disorder group</th>
<th>Obsessive-Compulsive Disorder group</th>
<th>Non Clinical Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>FQ main phobia</td>
<td>6.36 (1.78)</td>
<td>6.16 (2.21)</td>
<td>- a</td>
</tr>
<tr>
<td>FQ agoraphobia</td>
<td>22.00 (11.07)</td>
<td>8.79 (7.87)</td>
<td>2.40 (3.86)</td>
</tr>
<tr>
<td>FQ total</td>
<td>49.81 (21.74)</td>
<td>32.63 (17.56)</td>
<td>13.95 (8.96)</td>
</tr>
<tr>
<td>SCL total</td>
<td>210.76 (56.58)</td>
<td>221.54 (73.22)</td>
<td>110.20 (18.80)</td>
</tr>
</tbody>
</table>

aThe main phobia subscale cannot be answered by non-clinical controls, since they do not have a main phobia.

Self-reported believability ratings
Due to miscommunication 8 participants were not presented with the self-report believability ratings, resulting in N = 72 for the believability analysis. The groups did not differ in their believability ratings for the believable neutral themes (F[2,69] = .37, p = .69): The themes were rated as very believable (M = 92.77). The unbelievable neutral themes were rated as unbelievable. Unexpectedly, the NCC group rated them as less unbelievable (M = 22.63) than the PD and the OCD group (M = 7.44 and M = 4.54 respectively), F(2,69) = 14.62, p < .01, \( \eta^2 = .30 \).

The PD congruent themes were rated as overall believable (M = 81.59), and the PD non-congruent themes as overall unbelievable (M = 15.98). Unexpectedly, there were no differences between the groups: F_{PDcongruent}(2,69) = 0.55, p = .58 and F_{PDnon-congruent}(2,69) = 0.29, p = .76, respectively. All groups perceived the PD congruency themes as believable, whereas we had expected that only (or especially) the PD group would consider them believable.

Differences in belief bias effects over groups
The error data were too skewed to be able to successfully transform them to meet assumptions for testing in repeated measures analyses of variance. Therefore, only the RT data are analyzed.

Generally enhanced belief bias?
For 11 participants it was impossible to compute belief bias RT scores for the neutral syllogisms because they made too many errors on at least one of the types of syllogisms, resulting in N = 69 for this part of the analysis. A repeated measures ANOVA with group as between subject factor and believability and validity as within subject factors showed a very large belief bias effect (viz. believability*validity effect, \( F[1,64] = 49.17, p < .01, \eta^2 = .44 \)). The belief bias effect is shown in Figure 4.1. Participants needed more time to solve believable-invalid and unbelievable-valid syllogisms than to solve believable-valid and
unbelievable-invalid syllogisms. This effect did, however, not differ significantly over the groups \( F[2,64] = 2.21, p = .12 \). Furthermore, there was a significant main effect of believability \( F[1,64] = 4.45, p = .04, \eta^2 = .07 \). Participants were faster solving believable syllogisms than solving unbelievable syllogisms.

**Figure 4.1.** Neutral belief bias effect (measured in s) averaged over the various groups.

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**Domain specific belief bias?**

For 10 participants it was impossible to compute the belief bias RT scores for the PD-relevant syllogisms because they made too many errors on at least one of the types of syllogisms, resulting in \( N = 70 \) for this part of the analysis. A repeated measures ANOVA with group as between subject factor and PD congruency and validity as within subject factors showed a strong belief bias effect (viz. PD congruency*validity effect, \( F[1,65] = 18.59, p < .01, \eta^2 = .22 \)). The belief bias effects of the three groups are displayed in Figure 4.2. Participants needed more time to solve PD congruent-invalid and PD non-congruent-valid syllogisms than to solve PD congruent-valid and PD non-congruent-invalid syllogisms. Furthermore, there was a moderately strong group*validity interaction \( F[2,65] = 4.26, p = .02, \eta^2 = .12 \); \( M_{PD-valid} = 10.56, M_{PD-invalid} = 10.98, M_{OCD-valid} = 10.73, M_{OCD-invalid} = 10.32, M_{NCC-valid} = 8.94, M_{NCC-invalid} = 9.49 \).

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\( ^{12} \) Because of the unexpected group differences in believability ratings of the neutral themes, we checked whether including the believability ratings as covariate would change the non-significant outcome of the group*believability*validity interaction. It did not: \( F(2,60) = 1.92, p = .16 \).
Most pertinent to the present study, the group*PD congruency*validity interaction effect approached the conventional level of significance ($F[2,65] = 2.89, p = .07, \eta^2 = .08$), indicating that the groups tended to differ in PD-relevant belief bias effect. Since this interaction is most relevant to our a priori hypothesis, we further explored the belief bias effect as expressed by each of the groups: As expected, the PD group indeed showed a belief bias effect ($F_{PD congruency*validity}[1,33] = 4.23, p = .048, \eta^2 = .11$), whereas the NCC group did not display belief bias for the PD congruency syllogisms ($F_{PD congruency*validity}[1,20] = 0.82, p = .38, \eta^2 = .06$). Unexpectedly, also the OCD group displayed a belief bias effect for the PD congruency syllogisms ($F_{PD congruency*validity}[1,20] = 16.21, p < .01, \eta^2 = .45$). A post hoc ANOVA restricted to the OCD and PD groups showed a significant group*PD congruency*validity interaction ($F[1,49] = 4.96, p = .03, \eta^2 = .09$), indicating that the OCD group displayed an even stronger belief bias than the PD group.

Figure 4.2. Panic disorder-related belief bias effects (measured in s.) for the various groups.

Discussion

This study investigated the relationship between belief bias and panic disorder. The main results can be summarized as follows: All groups showed a clear belief bias effect for the neutral themes. This belief bias effect was however not especially pronounced in the clinical (PD/OCD) groups. Only the clinical groups also showed a belief bias effect for the PD-themes, supporting the notion that belief bias may be involved in the maintenance of anxiety disorders. Unexpectedly, this effect appeared most pronounced for the OCD group.

The present study provides provisional evidence for a disorder-related belief-confirming reasoning bias. The finding that the OCD group displayed a similar (and even stronger) PD belief-confirming bias may indicate that the domain-
specific belief bias (which was found in the present study for PD patients, but also in spider phobia patients; de Jong, Weertman et al., 1997) is in fact not domain-specific (viz. in content related to the convictions specific to the disorder) but a general tendency for anxiety patients to engage in fear-confirming reasoning when presented with anxiety related materials. However, in apparent conflict with this line of reasoning, previous research in a non-clinical sample has found no evidence for the existence of a relationship between general fear-confirming reasoning and anxiety disorder symptoms (Vroling & de Jong, 2010b). More likely, therefore, the present pattern of findings indicate that the syllogisms we used were not sufficiently specific for PD and/or did not sufficiently reflect the critical PD convictions. Panic is not uniquely related to panic disorder: panic attacks frequently occur in many anxiety disorders (e.g., APA, 1994; Barlow et al., 1985; MacAndrew, Heimberg, & Mennin, 1999). The OCD patients in the present sample have probably experienced panic attacks themselves, and are thus not unfamiliar with the PD congruent themes, which could have decreased the specificity of the themes for PD patients. Also, the use of linear syllogisms may have further decreased the specificity: Linear syllogisms require the use of a comparison category, which limits the possibility to closely match the syllogisms with dysfunctional beliefs. It seems plausible that statements such as ‘dizziness is scarier than sniffing a flower’ are more generally acceptable than convictions such as ‘if I feel palpitations, then I am going to have a heart attack’, which are typically reported by PD patients. This is also echoed in the self-reported believability ratings: all groups rated the PD congruency statements equally believable. It may therefore be helpful to look for alternative ways to measure belief bias which allow for a more close resemblance of the reasoning materials to dysfunctional beliefs (such as in conditional reasoning tasks, in which ‘if P then Q’ statements are used).

Previous research provided preliminary evidence that women suffering from spider phobia are characterized by a more extreme belief bias for general materials. The present study found no evidence to sustain these earlier findings. The anxiety patients in the present study showed a similarly enhanced belief bias as the non-clinical controls. In other words, we found no evidence for the notion that panic disordered and obsessive-compulsive patients differ from normal controls with respect to their reasoning strategies concerning neutral materials. These findings are consistent with two recent studies testing non-clinical samples that neither found evidence for a relationship between the strength of a generally enhanced belief bias and the intensity of people’s anxiety symptoms (Smeets & de Jong, 2005; Vroling & de Jong, 2010b). This casts further doubt on the role of a generally enhanced belief bias in the origin of anxiety disorders.
The present results do nevertheless fit to earlier findings reported by Pélissier and O'Connor (2002). Using a series of reasoning tasks concerning neutral themes, these authors tested whether obsessive-compulsive and generalized anxiety disordered patients differed from non-anxious controls with respect to inductive and deductive reasoning patterns. Although the experimental paradigms used by Pélissier and O'Connor did not focus directly on the influence of subjective believability of the premises and conclusions in their deductive reasoning tasks (i.e., belief bias), they too failed to find evidence to sustain the idea that the clinical groups differ from normal controls with respect to their ability to make correct deductions.

Even though we found no evidence for the notion that anxiety patients’ reasoning is deviant, there is reason to assume that their reasoning will be heavily belief-biased when patients are confronted with fearful situations: As anxiety increases, working memory capacity becomes limited, which limits the reasoning to heuristic belief-based processing (viz. System 1 processing, as opposed to System 2 processing, which involves more deliberate complex reasoning; see Evans, 2003). This will further consolidate the dysfunctional beliefs (Evans & Curtis-Holmes, 2005; Tohill & Holyoak, 2000). Future studies should look into the effects of (induced) anxiety on deductive reasoning performance to validate this assumption.

**Limitations**

The most important limitation concerns the discrepancy between PD beliefs and the conclusions of the syllogisms. The believability ratings indicate that there is room for improvement in the resemblance of the PD congruency themes and dysfunctional PD convictions. This may well have diminished the sensitivity of the domain-specific part of the reasoning task. Also, the equally high believability ratings for the PD congruency themes by the OCD group hinders firm conclusions concerning the domain-specificity (or content-specificity) of the belief bias effect.

**Conclusion**

As expected, we found a domain-specific belief bias for PD patients. Unexpectedly, a similar (and even somewhat stronger) effect was found for the OCD patients. Future research needs to determine whether the present results represent a lack of sensitivity of the (PD congruency part of the) reasoning task. The present study provided no evidence for the existence of a generally enhanced belief bias within PD or OCD patient groups. As we found no differences between patients and normal controls, it seems unlikely that a generally enhanced belief bias plays an important role in the development of
anxiety disorders. In sum, we found no evidence for belief bias being involved in the development of anxiety disorders, but did find evidence for a domain-relevant belief bias which logically serves to maintain the disorder.
Appendix: Syllogism content used in the experiment*

Neutral themes
- castle > house > caravan (bigger)
- airplane > car > bicycle (faster)
- tree > bush > plant (bigger)
- elephant > dog > mouse (bigger)

PD congruency themes
- palpitations > wasp’s sting > mosquito bite (more dangerous)
- dizziness > hearing an ambulance > sniffing a flower (scarier)
- gasping > dark cellar > romantic movie (scarier)
- pain on the chest > broken leg > cold (more dangerous)

* Note: The neutral syllogisms varied systematically in believability and validity; the PD congruency syllogisms varied systematically in PD congruency and validity. See Tables 4.1 and 4.2 for an example of this systematic variation.