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Worry and rumination : underlying processes and transdiagnostic characteristics

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WORRY AND RUMINATION

Underlying processes and transdiagnostic characteristics



Jolijn Drost

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Worry and Rumination: Underlying processes and transdiagnostic characteristics

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Worry and Rumination

Underlying processes and transdiagnostic characteristics

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Chapter 1

General introduction

General Introduction

With evolution of our species and the subsequent development of the human brain came our ability to think, to reflect and reason. It is an ability from which mankind has hugely profited and which has placed us at the top of the food chain, however, in its extreme forms it has proven to be counterproductive, hold us back and make us ill. Although from a psychiatric perspective cognitions were long viewed as a side product of psychopathology this all changed with the introduction of cognitive theory in the 1960's (Beck, 1967). Cognitions suddenly became the focal point in explaining psychological dysfunction. This paradigm shift put cognitive content and its associated processes at the forefront. Two cognitive processes that have received a lot of attention are worry and rumination. Worry is typically defined as a chain of thoughts and images, negatively affect-laden and relatively uncontrollable. It is considered to be an attempt to engage in mental problem-solving on issues of which the outcome is uncertain but contains the possibility of one or more negative outcomes (Borkovec, Robinson, Pruzinsky, & DePree, 1983, p. 10). Worry is the cardinal feature of generalized anxiety disorder (GAD) and has mainly been studied in this context. One of the main differences with rumination is that worry is considered to be future oriented and rumination past oriented. Rumination can be defined as an attempt to analyse the causes and consequences of negative events, problems and moods (Watkins & Baracaia, 2001) and is typically linked to depression. In contrast to depression, GAD was long a relatively understudied disorder (Dugas, 2000; Dugas, Anderson, Deschenes, & Donegan, 2010) and consequently, not much attention was initially paid to the process of worry. In the last couple of decades worry has been placed in a different perspective and together with rumination it is now at the centre of an ongoing debate on whether these processes are possibly the driving force across many psychological disorders, emotional disorders in particular. Besides the question surrounding the transdiagnostic nature of worry and rumination it is also debated whether worry and rumination are in fact conceptualizations of the same underlying cognitive process (e.g. Ehrling & Watkins, 2008). At first glance there seem to be many similarities between the two concepts and they are often referred to by the overarching term repetitive negative thinking (RNT) which has been defined as "repetitive thinking about one or more negative topics that is experienced as difficult to control" (Ehrling & Watkins, 2008, p.193). Whether there is more to this than meets the eye is currently debated. The main aim of this thesis is to clarify some of the pending issues surrounding the transdiagnostic nature of worry and rumination as well as whether they share the same underlying processes and functions.

Worry and rumination compared

If worry and rumination are indeed conceptualizations of the same underlying transdiagnostic process then they are expected to meet two sets of criteria: those for a transdiagnostic process and those for establishing a shared underlying process.

A truly **transdiagnostic process** should meet several criteria: 1) to be present *across* multiple disorders but not due to comorbidity with one specific disorder; 2) exhibit similar process characteristics *across* these disorders; and 3) contribute to the onset, maintenance and/or recurrence of psychopathology across disorders.

Even if worry and rumination are indeed established to be transdiagnostic processes this does not necessarily mean that they share *the same* underlying process. In case of a **shared underlying process** between worry and rumination, it is to be expected that they 1) are present in the *same* disorders, 2) have the *same* causal status regarding these (emotional) disorders, 3) share the *same* process characteristics and 4) are highly interrelated.

Over the past few decades important steps have been made in unravelling these issues and many have at least in part been successfully addressed. A few of the main developments as well as the pending issues are briefly discussed here.

Worry and rumination as transdiagnostic processes

Worry levels have been found to be higher among patients diagnosed with GAD compared to all other anxiety disorders (Brown, Antony, & Barlow, 1992) and levels of rumination have been reported to be higher among patients suffering from depression than those suffering from anxiety disorders (for an overview of the literature see Olatunji, Naragon-Gainey, & Wolitzky-Taylor, 2013). These findings seem to advocate a disorder specific approach. However, the well documented differences in temporal orientation between worry and rumination (worry-future; rumination-past) are probably at least in part responsible for the observed differences in levels of worry and rumination between anxiety and depressive disorders. Moreover, when comparing worry and rumination levels found in clinical populations to those in healthy controls, heightened levels are found across nearly all axis-I disorders (see Ehling & Watkins, 2008 for an overview). This observation has led to the proposition that worry and rumination are transdiagnostic processes (Harvey et al., 2004). Still, it has to be noted that a vast majority of the studies on worry and rumination have been conducted in MDD and GAD leaving other axis-I disorders relatively understudied. Also, most studies focussed on individual disorders while disregarding comorbidity which is well known to be the rule rather than the exception and which may pose an important confound. That being said, if worry and rumination are indeed transdiagnostic processes then it is to be expected that they are also in part responsible for the occurrence of comorbidity.

Similarities at process level

The assumption that worry and rumination share the same process is largely based on studies showing substantial correlations between the two constructs (e.g. Segerstrom et al., 2000, $r=.32$ to $r=.46$; Muris et al., 2004, $r=.55$; Watkins, 2004, $r=.51$; Hong, 2007, $r=.42$). The mere fact that these processes seem to co-occur is however not sufficient to conclude that they are the same. If they truly are reflections of one shared underlying process then it is to be expected that they also show the same process characteristics and operate via the

same mechanisms. A few aspects have received specific attention in this regard among which the format in which worry and rumination present themselves and the processing style they represent. To date evidence suggests that both worry and rumination contain more verbal thoughts than imagery (e.g. Borkovec & Inz, 1990; Fresco et al., 2002) and that they are characterized by a more abstract style of processing (i.e. cross-situational, indistinct and unclear) as opposed to a concrete processing style which is situationally specific, unequivocal and clear (Stöber & Borkovec, 2002; Watkins & Moulds, 2005). These are promising avenues which are being explored, and will be discussed in more detail in the next section of this introduction.

Causal status

Worry and rumination are generally referred to as trait variables, stable over time, and are proposed to constitute vulnerability factors for emotional disorders. Longitudinal prospective studies concerning rumination have shown that rumination predicts the occurrence of both anxiety and depressive symptoms over time, including new onset of depressive disorders (Nolen-Hoeksema, 2000). Likewise, worry has been found to be a vulnerability factor predicting increments of anxiety and depressive symptoms over time (Hong, 2007). The role of worry and rumination is further confirmed by an extensive review of the literature on repetitive (negative) thinking (RNT) revealing that RNT is a vulnerability factor for both anxiety and depressive disorders (Watkins, 2008). In sum, evidence on the causal status of worry and rumination is accumulating. So far both cognitive constructs seem to be involved in very similar ways which is a prerequisite for identical processes.

Unresolved issues

As already mentioned, the worry-rumination debate would benefit from studies examining the transdiagnostic nature of these cognitive processes across axis-I disorders (not solely in GAD and MDD), and also by taking comorbidity into account. At the moment this is often not the case, limiting the interpretation of the findings. Moreover, there are only few studies that examine whether worry and rumination contribute to the occurrence of comorbidity which would be expected from a transdiagnostic process. In line with this they would be expected to mediate the prospective relationship between anxiety and depressive disorders and vice versa. McLaughlin and Nolen-Hoeksema (2011) found some support for these predictions however they focussed on symptoms, not disorders, and only examined rumination.

Regarding the causal status of both cognitive constructs existing studies have certain limitations. Often there is no correction for severity of (sub)clinical symptoms or the presence of previous episodes (see overview Watkins, 2008). Also, it is unknown to what extent rumination and worry have incremental predictive validity over and above more general predictors. Hierarchical vulnerability models (Mineka, Watson, & Clark, 1998; Brown & Naragon-Gainey, 2013) distinguish different dimensions of which the higher order ones are very general and involved in all disorders whereas lower-order dimensions are more disorder specific. In existing studies it is seldom clear whether the

lower-order processes of worry and rumination add anything to well established higher order components such as personality traits (e.g., neuroticism or extraversion).

Besides the (methodological) limitations of existing studies there are also several other aspects which are in need of further exploration/clarification. First of all the assumption that worry and rumination are stable across substantial periods of time has to be addressed. Test-retest periods are usually short whereas true trait components are expected to be stable across long periods of time. Secondly, it has to be examined whether fluctuations in worry and rumination scores co-occur as would be expected if they share the same underlying process. Finally, the direction of effects between worry-rumination and emotional disorders are in need of attention. So far most studies have focused on cross-sectional or uni-directional relationships of worry and rumination with each other and with particular emotional disorders, and did not examine reciprocal effects nor the temporal character of the effects. Considering that experimental studies have repeatedly shown that experimentally induced worry or rumination directly and negatively affects anxious and depressed mood states (e.g. McLaughlin, Mennin, & Farach, 2007; McLaughlin, Borkovec, & Sibrava, 2007; Behar, Zuellig, & Borkovec, 2005) as well as the opposite effect of mood inductions leading to the activation of cognitive processes (Gemar, Segal, Sagrati, & Kennedy, 2001; Miranda, Gross, Persons, & Hahn, 1998; Miranda & Persons, 1988) it would be interesting to investigate whether such relationships are also present when studied using a longitudinal design and if so which direction of effects prevails. Furthermore elucidation on the presence of a mutually reinforcing downward spiral between repetitive negative thinking and emotional disorders would provide important insights into the mechanisms involved in psychopathology and shed light on the role of worry and rumination herein. If worry and rumination indeed constitute one shared process then it is to be expected that the results will show identical patterns for both types of repetitive negative thinking.

Finally, although evidence of similarities between worry and rumination at process level has accumulated over the last few years there are still issues which need to be addressed. In this thesis the focus will be on worry and its avoidance function. In the next section this will be discussed more in depth.

Worry & Avoidance

Both worry and rumination have been proposed to serve as a type of avoidance. In a recent review Nolen-Hoeksema et al. (2008) described that worry and rumination both appear to have an avoidance component, however motivated by different goals/aims. They proposed that the unconscious motive when engaging in rumination is to avoid aversive situations and the responsibility to take action whereas the unconscious motive involved in worry is to avoid core negative affect and painful images. In this thesis the focus is solely on the processes via which *worry* serves its avoidance purpose and the negative effects it may have.

Behavioural avoidance

Avoidance is considered the hallmark of anxiety disorders (Barlow, 2004), a view that has consequently led to the development of therapies targeting this specific aspect. Exposure based therapies in particular are aimed at breaking the reinforcing avoidance mechanism and have since their introduction been applied across anxiety disorders. Most of these disorders are typified by clear overt behavioural avoidance which then becomes the focal point of therapy. GAD however, is characterized by a wide range of mainly internally generated feared outcomes (Borkovec, Hazzlett-Stevens, & Diaz, 1999) between which individuals suffering from GAD appear to switch frequently (Butler, 1994; Borkovec & Roemer, 1994). The absence of clear behavioural markers complicates traditional exposure based therapies which have thus far only been moderately successful in treating GAD (e.g. Gould et al., 2004). This does not necessarily mean that behavioural avoidance does not occur, it may just not be in a circumscribed domain. Roemer and Orsillo posit that attention should also be given to behavioural inaction. Worrying takes up a lot of energy and is time-consuming with GAD patients reporting to spend as much as 50% to 90% of their time engaging in worrying and feeling anxious (Sanderson & Barlow, 1990). All this mental activity does generally however not result in the accomplishment of desired goals. On the contrary; procrastination and quest for absolute certainty slows down decision making (Metzger, Miller, Cohen, Sofka, & Borkovec, 1990) and is believed to undermine successful problem solving. Thus, although worriers are mentally active their behavioural activity range seems restricted (Roemer & Orsillo, 2002).

Cognitive avoidance

The continued search for the avoidance component in GAD combined with the limited success of traditional exposure therapy and the inclusion of worry as the cardinal feature of GAD in the DSM-III-R (APA, 1987) has swung the focus from behavioural avoidance to that of cognitive avoidance. This new perspective is best captured in the Avoidance Theory of worry (Borkovec, Ray, & Stöber, 1998) which postulates that worry is a form of cognitive avoidance that operates via the reduction of aversive imagery with the purpose to avoid somatic anxiety reactions. Studies indeed show that worry is a predominantly verbal thought (rather than imagery-based) activity, and that the percentage of imagery is greatly reduced when engaging in worry instead of a relaxation condition (Borkovec & Inz, 1990; East & Watts, 1994; Freeston, Dugas, & Ladouceur, 1996). Moreover, individuals with GAD report less imagery than non-psychiatric controls both during worry and relaxation (Borkovec & Inz, 1990). In turn, it has been found that verbal thought activity yields significantly less cardiovascular fear responses than imagery (Vrana, Cuthbert, & Lang, 1986) leading to the hypothesis that verbal worry might be an attempt to avoid the physiological sensations that accompany aversive imagery. This process of avoidance however interferes with successful emotional processing of threat related material for which activation is deemed necessary (Foa & Kozak, 1986). The evasion of emotional experiences is in line with self-reported reasons for worrying by GAD patients (Borkovec & Roemer, 1995) and may reinforce engagement in the worry process; however, it has

long term negative consequences as it inhibits closure on worry topics consequently maintaining anxiety/worry.

A caveat in the avoidance theory is that it does not address the question of *how* worrying leads to reduced imagery. A possible explanation comes from the Reduced Concreteness theory of worry (Stöber, 1998; Stöber & Borkovec, 2002). This theory posits that the mediator between worrying and reduced imagery is reduced concrete thinking (increased abstract thinking), which is presumed to be characteristic of worry. *Concrete thinking* is defined as “distinct, situationally specific, unequivocal, clear, singular” whereas *abstract thinking* is described as “indistinct, cross-situational, equivocal, unclear, aggregated” (Stöber & Borkovec, 2002, p. 92). Paivio and Marschark (1991) found that the concreteness of words and sentences is related to the quality of imagery and that abstract thinking not only evokes less imagery but also less vivid imagery. Hence, the Reduced Concreteness theory hypothesizes that it is the relatively abstract style of thinking during worry which is responsible for reduced aversive visual imagery, which in turn contributes to the maintenance of worry. It does so not only by hindering emotional processing but also by thwarting the problem solving function of worry as abstract thinking is less likely to produce a specific conclusion and effective problem solutions.

Unresolved issues

So far evidence supports the notion of reduced concreteness in the *problem analysis phase* in worriers (Stöber, 1996; Stöber, Tepperwien, & Staak, 2000; Stöber & Borkovec, 2002), but this has not yet been established in the next phase within the problem solving process: i.e., the *solution generation phase*. Critically, although the reduced concreteness theory predicts that reduced concreteness of thinking during worry will impair problem-solving, this prediction has not yet been directly tested. Although the theory originated in worry, to date, the only direct evidence that concreteness of thinking influences problem solving is in patients with depression (Watkins & Baracaia, 2002; Watkins & Moulds, 2005). Thus a logical next step is to examine this issue in its original context i.e. worry. If worry and rumination are indeed conceptualizations of the same underlying process as is often proposed, then it is to be expected that they establish their (negative) effects through the same mechanisms.

Besides cognitive avoidance, behavioural avoidance or better the behavioural inaction that typifies worriers is thought to slow down decision making (Metzger et al., 1990). The aspiration of obtaining complete certainty and the tendency to prepare for all possible scenarios often results in worriers postponing or abandoning decision making altogether. This situation in which they do not move forward nor backwards is likely to undermine learning due to lack of ‘learning by experience’. However, there is some evidence that contradicts this idea. Mueller et al. (2010) found that people suffering from GAD show better decision making than healthy controls as evident through their steeper learning curve on a forced decision making task. This proposed positive effect of worrying could pose a reinforcement mechanism underlying pathological worrying. However, the question remains whether worriers still show this superiority when not forced to make a decision and given the option to display their behavioural inaction and avoid making a decision.

Aims and outline

The aim of the present thesis was twofold; (a) to compare worry and rumination in their relationship with each other and with emotional disorders; (b) to examine worry at a more functional/process level. In order to address these issues we used epidemiological data from the Netherlands Study of Depression and Anxiety (NESDA). NESDA is an ongoing longitudinal study including 2981 participants who are followed for many years. The study has several important strengths among which a large sample size, longitudinal design and the inclusion of multiple waves. The NESDA study allowed us to investigate the first main aim of this thesis (i.e., comparing worry and rumination in their relationship with each other and with emotional disorders). The NESDA study however is not designed to investigate worry and rumination at process level. To accommodate for this, additional experimental studies were conducted to examine the second main aim of this thesis (i.e., studying process and functional characteristics of worry).

The first part of the thesis focusses on the comparisons between worry and rumination using epidemiological data from the NESDA.

Chapter 2 includes a study with a cross-sectional design examining the predictive utility of both worry and rumination. Specifically, it is investigated whether worry and rumination have incremental validity in predicting the presence of a history or current occurrence of emotional disorders over and above more general personality traits while taking comorbidity into account.

Chapter 3 includes a study with a three-wave longitudinal design and focusses on the stability of worry, rumination and psychopathology over time as well as the reciprocal relationships among these three aspects. This is done by establishing the trait and state components of worry, rumination and psychopathology and examining the correlations between these different trait and state components across time. Specifically, the presence of a mutually reinforcing downward spiral between repetitive negative thinking and emotional disorders is examined.

Chapter 4 presents a study using a cross-sectional and longitudinal (three wave) design, examining whether worry and rumination account for the comorbidity among emotional disorders. Specifically it is investigated whether both worry and rumination account for the cross-sectional overlap of emotional disorders at baseline and whether they mediate the prospective cross-disorder (fear → distress and distress → fear) relations among emotional disorders.

The second part of the thesis contains experimental studies which focus on worry at process level and highlight the role of avoidance in maintaining pathological worry.

Chapter 5 includes two experimental studies that investigate whether reduced concreteness is a pivotal component in explaining the cognitive avoidance function of worry and indeed leads to poorer problem solving as is often suggested.

Chapter 6 presents an experimental study focussing on the presence of behavioural avoidance in decision making and how this affects the maintenance of worry. The study investigates whether the positive effect that worry has previously shown to have on decision making is also present when worriers are given the opportunity to avoid making decisions.

Finally, **chapter 7** contains a summary and integration of the main findings, clinical implications, limitations and suggestions for future directions in the field.

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Chapter 2

General, specific and unique cognitive factors involved in anxiety and depressive disorders

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Abstract

Comorbidity among anxiety and depressive disorders is the rule rather than the exception. The Integrative Hierarchical Model proposes that each of these disorders contains general (common to all), specific (common to some) and unique components. However, research into this model is limited and hampered by small (clinical) sample sizes. The aim of the present study is to investigate the incremental validity of the cognitive constructs Anxiety Sensitivity, Pathological Worry and Cognitive Reactivity to sad mood over and above the personality traits neuroticism and extraversion. Symptomatic (N = 1111) and remitted (N = 834) patients were selected from the 2981 participants of the Netherlands Study of Depression and Anxiety (NESDA). Results revealed both specific and unique cognitive components of anxiety and depression. Across symptomatic and remitted groups, Anxiety Sensitivity was specific to social anxiety disorder and panic disorder, Aggression Reactivity was a unique component of dysthymia, and Rumination on Sadness was unique to major depressive disorder. We conclude that cognitive constructs have additional value in understanding anxiety and depressive disorders. Moreover, they prove to be more than mere epiphenomena of current disorders.

Introduction

Anxiety and depressive disorders not only have high prevalences, but also high comorbidity rates (Angst, 1996; de Graaf, Bijl, Smit, Vollebergh, & Spijker, 2002; Kessler et al., 1994; Sartorius, Ustun, Lecrubier, & Wittchen, 1996). This has resulted in an ongoing debate about the breakdown of disorders as postulated in DSM-IV-TR (APA, 2000). There is considerable overlap between anxiety and depressive disorders, which is also expressed in a certain degree of similarity in symptomatology, etiology, vulnerability factors and therapeutic interventions.

Etiological models have followed these developments and introduced common higher order factors accounting for comorbidity. The most promising psychological model explaining the findings reported in research and matching the experiences in clinical practice is the Integrative Hierarchical Model (IHM) for anxiety and depression introduced by Mineka, Watson and Clark (1998). This model, a revised version of the tripartite model (L. A. Clark & Watson, 1991), has recently attracted a lot of interest (e.g., Prenoveau et al., 2010). According to this model each disorder contains a general, a specific, and a unique component. The general component refers to a factor that anxiety and depressive disorders have in common, the specific component is shared with certain disorders but not all, and the unique component is an aspect characteristic of a particular disorder differentiating it from all the others. Hence, the model addresses the comorbidity issue while still acknowledging the heterogeneity of the disorders (Kotov, Watson, Robles, & Schmidt, 2007; Mineka, et al., 1998).

In line with its predecessor – the tripartite model – the general component of IHM consists of the personality trait Neuroticism. Elevated scores across anxiety and depressive disorders have been reported numerous times and studies investigating a hierarchical structure within the emotional disorders have confirmed its position as a higher order factor (Norton & Mehta, 2007; Norton, Sexton, Walker, & Norton, 2005; Sexton, Norton, Walker, & Norton, 2003). Extraversion is another influential Big Five personality trait. In both Clark and Watson's tripartite model as well as Barlow's Three Factor Model, extraversion constitutes a component unique to depression. This position was questioned however after several studies demonstrated links with Social Anxiety Disorder (SAD) (e.g., Brown, Chorpita, & Barlow, 1998; Norton & Mehta, 2007) and to a lesser extent Generalized Anxiety Disorder (GAD) (Norton, et al., 2005). While not in line with the original hierarchical models it does fit well within the IHM where it reflects a specific component.

Potential candidates for specific or unique components can be found within the wide array of cognitive constructs which includes factors such as rumination on sadness, self-focused attention, and attentional bias to threat. Some of these constructs, like self-focused attention, were originally linked to one or several disorders but as research progressed have later been established as more general components (Ingram, 1990). Others are still awaiting further clarification. Three of these cognitive constructs which, though related to trait anxiety or neuroticism, cannot be totally accounted for by these general traits are anxiety sensitivity (AS), pathological worry (PW) and cognitive reactivity

to sad mood (CR) (Cox, Borger, Taylor, Fuentes, & Ross, 1999; Meyer, Miller, Metzger, & Borkovec, 1990; Reiss, Peterson, Gursky, & McNally, 1986; Van der Does, 2002). AS has been defined as the fear of anxiety related sensations resulting from beliefs held about their potentially harmful physical, psychological or social consequences (Reiss & McNally, 1985; Reiss, et al., 1986). It is viewed as a dispositional characteristic which is relatively stable over time (for an overview see p.68 of R. A. Peterson & Plehn, 1999) and has mainly been linked to panic disorder (PD). PW on the other hand is the key feature of GAD (DSM-IV-TR; APA, 2000) and can be defined as an unwanted, uncontrollable, aversive cognitive activity associated with negative thoughts and emotional discomfort (Borkovec, 1994). It is considered a trait like construct and is thought to share the same underlying cognitive process as rumination (Watkins, 2008). Contrary to AS and PW where the main focus is on anxiety disorders, the concept of CR has so far only been investigated in relation to depression. CR is defined as the extent to which dysfunctional schemas are activated when mood decreases. It is reported to successfully distinguish euthymic individuals with and without a history of depression with the remitted group showing consistently higher reactivity (Merens et al., 2005; Miranda, Gross, Persons, & Hahn, 1998; Moulds et al., 2008; Van der Does, 2002, 2005; Williams, Van der Does, Barnhofer, Crane, & Segal, 2008). Furthermore, high CR has also shown to increase the risk of depressive relapse (Segal, Gemar, & Williams, 1999; Segal et al., 2006).

Although all three constructs are mainly linked to one specific form of psychopathology which suggests that they are unique factors in the IHM model, there are also studies reporting otherwise. AS for example, has besides its connection to PD also been linked to all the other anxiety disorders as well as depression (Otto, Pollack, Fava, Uccello, & Rosenbaum, 1995; Rector, Szacun-Shimizu, & Leybman, 2007; Rodriguez, Bruce, Pagano, Spencer, & Keller, 2004). Similar findings have been reported for PW (Chelminski & Zimmerman, 2003; Starcevic, 1995; Starcevic et al., 2007) suggesting its relationship with GAD is not an exclusive one. CR has thus far only been studied in relation to depressive disorders, specifically those with a history of depression, where theoretically its influence is expected to be the most pronounced.

Studies investigating the role of cognitive constructs within hierarchical models are limited. PW has been mainly studied as a measure representing a key characteristic of GAD, but GAD is more encompassing than unwanted, uncontrollable, aversive cognitive activity and this cognitive process may have a wider relevance as a predictor of GAD, but also of related disorders (Watkins, 2008). To our knowledge, both PW and CR have thus far not been tested as predictors in a hierarchical model. AS on the other hand has been included in a few such studies, where it differentiated PD from other anxiety and depressive disorders (Norton & Mehta, 2007; Norton, et al., 2005). However, studies did not investigate the direct contributions of lower order factors of AS and were hampered by either the use of analogue or small clinical samples. Moreover, only a couple of cognitive constructs were used and outcome measures consisted of symptoms, not actual psychiatric diagnoses.

The main aim of the present study is to investigate the incremental validity of the

cognitive constructs AS, PW and CR in predicting specific depressive and anxiety disorders over and above the Big Five personality traits of neuroticism and extraversion. We will investigate this question both in symptomatic patients and in participants who are in remission, hence exploring whether elevated scores on cognitive constructs merely reflect an epiphenomenon of current psychopathology or not. We will address several limitations from previous studies by using both clinical and healthy samples. Moreover, the availability of a very large sample permits us to investigate multiple personality traits and cognitive constructs simultaneously in order to investigate their relative predictive power, while also taking comorbidity into account. The sample comes from diverse settings (community, primary care, and specialised mental health care) and includes patients in various stages of illness, enhancing generalizability.

Method

Participants and Setting

Participants were selected from the Netherlands Study of Depression and Anxiety (NESDA), an ongoing 8-year multi-site naturalistic, longitudinal cohort study including 2981 adult subjects aged 18 through 65 years. The sample consists of 687 healthy controls, 2294 persons with a life-time diagnosis of depression or anxiety disorder of which 1342 have a current diagnosis (past month). In order to be representative of those with depressive and anxiety disorders respondents in different stages of the developmental history of the disorders (normal, high familial risk, subthreshold disorders, first and recurrent episodes) and from different health care settings (community, primary care and specialized mental health care) were included. The NESDA community sample had been previously identified in two population based studies: the Netherlands Mental Health Survey and Incidence Study (NEMESIS; Bijl, van Zessen, Ravelli, de Rijk, & Langendoen, 1998) and the Adolescents at Risk of Anxiety and Depression (ARIADNE) study (Landman-Peeters et al., 2005). The recruitment of primary care patients took place through 65 general practitioners –using a three-stage screening method- and the recruitment of psychiatric outpatients through 17 mental health care institutions.

Across recruitment settings uniform in- and exclusion criteria were used. A general inclusion criterion was an age of 18 through 65 years. An exclusion criterion was a primary psychotic, obsessive compulsive, bipolar or severe addiction disorder. In addition patients who were not fluent in Dutch were excluded. A more extensive description of the rationale, method and recruitment strategy can be found elsewhere (Penninx et al., 2008).

In the current study the psychological disorders of interest are anxiety disorders SAD, GAD, PD (with or without agoraphobia), and depressive disorders dysthymia (DD) and Major Depressive Disorder (MDD). Two psychiatric groups will be investigated; patients with a diagnosis at time of assessment (current diagnosis) and patients who fulfilled criteria of the disorder of interest at some point in life but did not meet full DSM-IV criteria in the past month (remission). Using a current sample dovetails nicely with existing literature

allowing results to be easily compared. The remission sample provides an opportunity to replicate the findings of the current sample and to challenge the possibility of results merely reflecting epiphenomena of current disorders. This was further safeguarded by controlling for residual symptoms.

Measures

Within the scope of NESDA many different measures have been administered. Only the ones relevant to the present study will be discussed here.

Assessment of psychiatric diagnoses

Depressive disorders (DD, MDD) and anxiety disorders (SAD, GAD, PD) were diagnosed using the Composite Interview Diagnostic Instrument (CIDI-WHO lifetime version 2.1; Ter Smitten, Smeets, & Van den Brink, 1998). The CIDI is a worldwide used instrument which classifies diagnoses according to DSM-IV criteria (APA, 1994). It has shown high interrater reliability (Wittchen et al., 1991), high test-retest reliability (Wacker, Battegay, Mullejons, & Schlosser, 2006) and high validity for depressive and anxiety disorders (Farmer, Katz, McGuffin, & Bebbington, 1987; Wittchen, 1994; Wittchen et al., 1989). The CIDI was conducted by specially trained clinical research staff.

Assessment of general factors

Neuroticism

The personality trait neuroticism was measured using the NEO Five-Factor Inventory (NEO-FFI) personality questionnaire (Costa & McCrae, 1995). This 60-item questionnaire contains a subscale for Neuroticism consisting of 12-items which are scored on a five-point scale ranging from 'strongly agree' to 'strongly disagree'. Scores ranged from 1 – 5 for each item, and the total score for each domain ranged from a minimum of 12 to a maximum of 60. The psychometric characteristics are satisfactory (Costa & McCrae, 1995). In the present study internal consistency was satisfactory with $\alpha = .75$.

Assessment of specific factors

Extraversion

The personality trait extraversion was measured in the same manner as neuroticism using a subscale of the NEO-FFI personality questionnaire. Internal consistency in the present study reached an adequate level with $\alpha = .78$.

Anxiety sensitivity

Anxiety sensitivity was assessed using the Anxiety Sensitivity Index -16 items (R.A. Peterson & Reiss, 1992; Reiss, et al., 1986). This self-report questionnaire indicates the degree to which respondents are concerned about possible negative consequences of anxiety-related sensations. Items are scored on a 5-point Likert scale ranging from '0 = very little' to '4 = very much'. Total scores range from 0 to 64. The ASI has high levels of internal consistency, good test-retest reliability, and good validity (R. A. Peterson & Plehn, 1999;

Reiss, et al., 1986). Evidence from previous studies concerning the lower-order factorial structure of the ASI was nonconclusive (Cox, Parker, & Swinson, 1996; Schmidt & Joiner, 2002; Vujanovic, Arrindell, Bernstein, Norton, & Zvolensky, 2007; Zinbarg, Barlow, & Brown, 1997). Consequently, the NESDA data were screened beforehand to determine the best fitting factor structure. Considering the large sample size of NESDA this is expected to prove a reliable method. Exploratory factor analyses presented 4 factors with eigenvalues greater than 1, of which 2 showed relatively poor internal consistency. This is in line with previous findings by Vujanovic (2007) who also reported low internal consistency for 2 of the 4 factors. To maintain good internal consistency factors were combined to form 2 factors: a physical concerns factor (ASI-phc) and a social-cognitive concerns factor (ASI-scc). This was based both on theoretical and on statistical grounds. Theoretically it was most logical to combine factors of which the content was related. This theoretical solution matched the statistically emerging solution of a factor analysis with a forced 2 factor solution. The two factors explained 54.6% of the total variance in ASI scores. Items 7 and 13 were left out as both items showed very low loadings on each of the 2 factors and reliability analyses revealed that removal would improve the internal consistency. Removal of these two items did not affect the factor structure. The internal consistency of the 2 factors used in this study are adequate with $\alpha = 0.89$ for the physical concerns factor (items 3, 4, 6, 8, 9, 10, 11, 14) and $\alpha = 0.80$ for the social-cognitive concerns factor (items 1, 2, 5, 12, 15, 16). The subdivision into two factors makes AS a candidate for a unique as well as a specific factor.

Assessment of unique factors

Pathological worry

Pathological worry was operationalized using the Penn State Worry Questionnaire (PSWQ; Meyer, et al., 1990). Items consist of statements related to worry, each rated on a 5-point Likert-scale ranging from '1 = not at all typical of me' to '5 = very typical of me'. The PSWQ consists of two subscales: a 'General worry' subscale (11 items) and a 'Not-worry' subscale (5 items) (van Rijsoort, Emmelkamp, & Vervaeke, 1999). The 'General worry' subscale is the strongest of the two (Brown, Antony, & Barlow, 1992; Meyer, et al., 1990; van Rijsoort, et al., 1999) and only this subscale was administered in the NESDA study. Psychometric properties of this Dutch 11-item version are not available but the original PSWQ has been proven to be a valid measure of trait worrying unaffected by the content of the worry (Davey, 1993; Molina & Borkovec, 1994) with high internal consistency, good test-retest reliability and unaffected by social desirability (Meyer, et al., 1990). The adjustments made to the original PSWQ are not expected to have had a negative effect on these characteristics. Internal consistency in the present study was high, namely $\alpha = 0.96$.

Cognitive reactivity to sad mood

Cognitive reactivity to sad mood was measured using the revised version of the Leiden Index of Depression Sensitivity (LEIDS-R; Van der Does, 2002; Williams, et al., 2008). The LEIDS-R is a self-report instrument which has been found to reliably discriminate between never-depressed and recovered depressed groups (e.g., Firk & Markus, 2009; Merens, et

al., 2005; Moulds, et al., 2008; Van der Does, 2002). LEIDS-R scores also correlate with biological vulnerability markers of depression: response to acute tryptophan depletion (Booij & Van der Does, 2007) and a serotonin transporter gene polymorphism (Antypa, Van der Does, & Penninx, 2010).

The LEIDS-R consists of 34 items divided over six subscales: Hopelessness/Suicidality Reactivity (HOP), Acceptance/Coping (ACC), Aggression Reactivity (AGG), Control/Perfectionism (CTR), Risk Avoidance (RAV) and Rumination on Sadness (RUM). Participants are asked to indicate whether and how their thinking patterns change when they experience mild dysphoria by scoring each item on a 5-point Likert-scale ranging from 0 'not at all' to 4 'very strongly' applicable to me. In the present sample internal consistencies of the subscales ranged from $\alpha = 0.62$ (ACC) to $\alpha = 0.86$ (HOP).

Covariates

Assessment of demographic and personal characteristics

Detailed sociodemographic and socioeconomic data were collected, of which sex, age and number of years of education, were used in the present study.

Assessment of symptom levels

In order to control for residual symptoms in the remission sample, two broad and well established measures of anxiety and depressive symptomatology were used:

Anxiety

The 21-item Beck Anxiety Inventory (BAI) (Beck, Brown, Epstein, & Steer, 1988) provides a reliable and valid assessment of anxiety symptomatology. In previous research it has shown high internal consistency, high test-retest reliability and good concurrent and discriminant validity (Ferguson, 2000). Internal consistency in the present study was high with $\alpha = 0.95$.

Depression

Depressive symptoms were measured using the Inventory of Depressive Symptomatology (IDS) a 30-item self report questionnaire. Psychometric properties are satisfactory (Rush, Gullion, Basco, Jarrett, & Trivedi, 1996). In the present study internal consistency was satisfactory with $\alpha = 0.91$.

Procedure

The study protocol was approved centrally by the Ethical Review Board of the VU University Medical Centre and subsequently by local review boards of each participating centre. NESDA subjects were assessed during a 4-hour clinic visit at one of the seven field centre locations.

Once full verbal and written information about the study was given, written informed consent was obtained from all participants of the baseline assessment. Interviews were administered with computer-assisted personalized interviewing (CAPI) procedures with data entry checks on outliers and routing. When necessary the interview was taken in

more than one session to avoid fatigue. Specially trained research assistants conducted the assessments. All interviews were taped to monitor data-quality and interviewer performance. In addition, the data monitoring centre routinely carried out data quality checks to review missing data and check for inconsistencies. After completion of the assessment respondents were compensated with a small incentive (gift certificate of 15 euros and payment of travel costs) for their time and cooperation.

Statistical Analyses

First scores on all measures were compared between participants meeting criteria for current disorder and participants who did not meet these criteria, as well as comparing participants with a disorder in remission to a control group with no lifetime disorders.

The ability of measures to (independently) predict an anxiety or depressive diagnosis was investigated within the total sample of participants who fulfilled criteria for a current anxiety or depressive disorder as well as in a group with a disorder in remission (cp. Gibb, Chelminski, & Zimmerman, 2007). A benefit of this analysis is that it includes a built-in psychiatric control group. Binominal logistic regression was conducted to assess this relative specificity of cognitive constructs using a hierarchical procedure. Demographics (gender, age and number of years of education) were entered as covariates by using forced entry into the model. In order to test whether the cognitive constructs would uphold their predictive value after correcting for neuroticism and extraversion, personality traits were also entered into the model using forced entry. The independent variables of interest, namely PSWQ, ASI-phc, ASI-scc and the six LEIDS-R-subcales were entered last, using a stepwise backward procedure (likelihood ratio) with a removal probability of 0.01. A stepwise backward procedure was chosen over a stepwise forward procedure because the latter has a higher risk of Type II error due to suppressor effects (Field, 2005).

Analyses were conducted for both the current diagnosis and diagnosis in remission group, with the only difference being that in the remission models BAI and IDS were added as covariates to control for residual symptoms.

A significance level of .01 was applied in order to control the familywise error rate and reduce the chances of a Type I error. To guard against multicollinearity the VIF score for each variable in each model was examined. No VIF statistic for any variable was found with a value above 2.7 (tolerance not below .37), suggesting that multicollinearity was not a problem for these regression models (Menard, 1995; Myers, 1990). All analyses were conducted using PASW Statistics package 17.0 (SPSS, INC, Chicago, Illinois, 2009).

Results

Sample Description

Demographic information on the sample and detailed information on the personality traits and cognitive constructs can be found in Tables 1 and 2. The NESDA sample consists of 2981 adult subjects aged between 18 and 65 years, of which complete data

Table 1: Comparison of participants with a current disorder and those without current psychopathology

Current diagnosis	No current disorder N=1462	SAD N=462*	GAD N=322*	PD N=422*	DD N=228*	MDD N=647*
Gender female	67.4%	66.0%	64.3%	69.9%	64.0%	66.2%
Age	42.5 (13.7)	41.7 (11.9)	42.7 (11.9)	42.2 (12.0)	44.4 (11.5)	42.3 (12.2)
Education (years)	12.7 (3.2)	11.7 (3.3)	11.6 (3.3)	11.4 (3.3)	11.5 (3.5)	11.6 (3.1)
Neuroticism	31.3 (8.4)	43.8 (6.6)	44.1 (6.5)	41.6 (7.3)	44.5 (6.0)	43.1 (6.6)
Extraversion	39.8 (6.7)	31.7 (6.4)	32.3 (6.2)	34.4 (7.0)	30.5 (6.9)	32.1 (6.6)
PSWQ	25.2 (10.4)	39.2 (9.6)	42.0 (8.8)	38.3 (10.0)	41.5 (8.5)	39.5 (9.7)
ASI-phc	4.6 (4.7)	9.5 (6.8)	9.7 (6.6)	12.0 (7.0)	9.4 (6.5)	8.6 (6.5)
ASI-scc	4.8 (3.1)	9.6 (4.5)	9.2 (4.7)	9.3 (4.9)	9.5 (4.8)	8.7 (4.7)
LEIDS-R-rum	7.0 (4.7)	12.3 (4.6)	12.5 (4.8)	11.3 (5.0)	13.3 (4.2)	12.6 (4.5)
LEIDS-R-hop	2.9 (3.2)	7.9 (5.1)	8.1 (5.4)	6.9 (5.2)	9.2 (5.1)	8.2 (5.2)
LEIDS-R-acc	1.2 (1.8)	2.0 (2.3)	2.1 (2.4)	2.0 (2.5)	2.0 (2.4)	2.0 (2.4)
LEIDS-R-agg	3.5 (3.4)	7.0 (5.1)	6.7 (4.8)	6.2 (5.2)	7.8 (5.1)	6.7 (4.9)
LEIDS-R-ctr	4.6 (3.7)	7.2 (3.8)	7.0 (3.9)	6.8 (4.1)	7.2 (3.8)	6.9 (4.0)
LEIDS-R-rav	6.4 (4.4)	11.8 (4.5)	11.5 (4.6)	10.7 (4.9)	12.1 (4.5)	11.4 (4.5)
N current disorders	0.0	2.3 (1.2)	2.7 (1.1)	2.3 (1.2)	3.0 (1.1)	2.2 (1.1)

*Due to comorbidity participants in the disorder columns might overlap

including NEO-FFI, PSWQ, ASI and LEIDS-R scores were available for 2590 participants (86.9%). The study sample mean age is 42.3 years ($SD = 13.1$), and 67.2% is female. Almost half (43.2%) of the participants has one or more current anxiety or depressive disorders and three-quarters (75.6%) has a lifetime anxiety or depressive disorder.

Comparison of Healthy Controls with Acute and Remitted Diagnostic Groups

When comparing participants with a current disorder ($N = 1111$) to the group without current psychopathology ($N = 1462$) the former group scores significantly higher ($p < 0.001$) on the personality traits (except for extraversion where the relationship is reversed) and all cognitive constructs. Cohen's d effect size is 0.33 (small effect) for LEIDS-R-acc and all others vary between 0.56 and 1.37 (large effect).

With regard to demographics, a significant difference ($p < 0.001$) for education was found, with the current disorder group completing fewer years of education ($d = 0.27$). Differences in gender and age were not significant.

Similar results were found when comparing participants with a disorder in remission ($N = 834$) to participants who had never experienced psychopathology in their lives ($N = 628$), with highly significant ($p < 0.001$) differences for all personality traits and cognitive constructs. LEIDS-R-acc had a Cohen's d effect size of 0.29 (small effect) and all others varied between 0.50 and 0.96 (large effect). Results were all in the expected direction.

In demographics, a significant difference was observed in the gender distribution ($\phi = -.10$) indicating that the remission group contained a higher percentage of females. Further, there was a negligible effect ($d = 0.13$, $p = 0.02$) for age reflecting a slightly older remission sample. No difference was found for number of years of education. Demographic variables were included as covariates in all analyses, and between group differences in demographics were thereby controlled for.

Hierarchical Regression Analyses Investigating Incremental Validity

Binomial logistic regression was conducted for each of the disorders. Logistic coefficients, Wald statistic, odds ratio and 95% confidence intervals from each logistic regression analysis are presented in Tables 3 to 6. As shown above, psychopathology groups scored significantly higher than healthy controls (with the exception of extraversion where -as expected- an inverse relation was reported). Because the present analysis is conducted in participants with an acute disorder or a disorder in remission only (excluding healthy controls), associations in an unexpected direction merely reflect that the predictor is not so important for that particular disorder in comparison to the other disorders it is compared to. These associations indicate that the predictor is less dominant in a particular disorder and does not imply that the predictor constitutes a protective factor for that disorder. Therefore below only predictors with a significant contribution to the model in the expected direction will be discussed.

Table 2: Comparison of participants who are in remission^a and those without any psychiatric history

Diagnosis in remission	No psychiatric history N=628	SAD N=192 ^a	GAD N=194 ^a	PD N=188 ^a	DD N=157 ^a	MDD N=694 ^a
Gender female	62.3%	69.8%	72.7%	77.1%	74.5%	71.9%
Age	41.5 (14.6)	43.7 (12.5)	43.4 (12.5)	40.4 (12.4)	46.6 (11.6)	43.2 (12.5)
Education (years)	12.8 (3.2)	12.4 (3.3)	12.5 (3.2)	12.4 (3.2)	12.2 (3.7)	12.6 (3.2)
Neuroticism	27.1 (7.4)	35.7 (8.2)	36.5 (7.7)	35.9 (7.5)	36.0 (7.3)	34.8 (7.8)
Extraversion	42.0 (6.2)	36.7 (6.5)	37.4 (6.3)	38.4 (6.7)	36.4 (6.7)	37.9 (6.7)
PSWQ	20.7 (8.8)	28.7 (10.1)	31.5 (10.4)	29.6 (10.0)	31.2 (10.3)	29.0 (10.2)
ASI-phc	3.3 (3.8)	6.2 (5.5)	6.1 (5.0)	7.6 (5.9)	6.0 (5.1)	5.4 (5.2)
ASI-scc	3.8 (2.4)	6.3 (3.5)	6.0 (3.5)	6.1 (3.7)	6.0 (3.4)	5.5 (3.3)
LEIDS-R-rum	4.8 (4.0)	9.1 (4.8)	9.3 (4.7)	9.0 (4.8)	9.6 (4.4)	8.9 (4.5)
LEIDS-R-hop	1.6 (2.3)	4.5 (3.9)	4.4 (3.7)	4.2 (3.8)	4.8 (4.0)	4.1 (3.6)
LEIDS-R-acc	0.9 (1.6)	1.4 (1.9)	1.6 (2.2)	1.5 (1.9)	1.8 (2.4)	1.5 (2.1)
LEIDS-R-agg	2.6 (2.7)	4.7 (4.0)	4.7 (3.6)	3.8 (3.3)	5.1 (3.9)	4.4 (3.7)
LEIDS-R-ctr	3.4 (3.1)	5.5 (3.8)	6.3 (4.2)	5.3 (3.3)	6.3 (4.0)	5.6 (3.9)
LEIDS-R-rav	4.4 (3.6)	8.5 (4.3)	8.9 (4.4)	8.3 (4.5)	8.7 (4.1)	8.2 (4.3)
N disorders in remission	0.0	2.4 (1.1)	2.6 (1.0)	2.4 (1.0)	2.8 (0.9)	1.8 (0.9)

^aDue to comorbidity participants in the disorder columns might overlap

^a History of psychopathology, but none of the current diagnoses

Prediction of current diagnosis by cognitive constructs after correction for personality traits

In the first series of analyses only participants with a current diagnosis were included ($N = 1111$). Results of the binominal logistic regressions are presented in Tables 3 and 4. These tables also show model fit and explained variance (Nagelkerke R^2) for each model.

After correction for demographics and personality traits results reveal PSWQ as a predictor of GAD, ASI-physical concerns of PD and ASI-social-cognitive concerns of SAD. Hence, indicating that these cognitive constructs possess additional predictive value over and above neuroticism and extraversion. Inspection of the LEIDS-R-subscales reveals that the hopelessness subscale (LEIDS-R-hop) predicts MDD as does the rumination subscale (LEIDS-R-rum). Finally, the LEIDS-R-aggression is a predictor for DD.

The omnibus binomial logistic regression model indicated a significant model overall for each of the disorders (see Tables 3 and 4) as well as a reasonable proportion of explained variance (Nagelkerke R^2 - varied from .12 to .18). Considering the type of analysis -using a built in psychiatric control group and thus exclusion of healthy controls- these figures indicate that a reasonable proportion of the variance can be explained by each of the models.

When comparing these final models to the versions without the cognitive constructs, – only including demographics and the personality traits of neuroticism and extraversion –, all models significantly improved their fit as a result of adding the cognitive constructs. For SAD the improvement was $\chi^2(2, N = 462) = 28.20, p < 0.001$, for GAD $\chi^2(1, N = 319) = 33.93, p < 0.001$, for PD $\chi^2(1, N = 419) = 124.60, p < 0.001$, for DD: $\chi^2(1, N = 226) = 11.85, p = 0.001$ and for MDD: $\chi^2(3, N = 644) = 57.95, p < 0.001$.

Prediction of disorders in remission by cognitive constructs after correction for personality traits

In contrast to the previous models that aimed to predict current diagnosis, the next models aim to investigate whether the established relationships will hold up when disorders are in remission without current diagnoses being able to dominate the relationship. In order to do so all participants with no history of depressive or anxiety disorders and all participants currently suffering from a disorder were excluded from the analyses, resulting in a sample of $N = 834$. Moreover, in order to correct for residual symptoms the covariates BAI and IDS were added to the models. Results are presented in Tables 5 and 6. These tables also show model fit and explained variance (Nagelkerke R^2) for each model.

Results for the anxiety disorders were very similar to what was reported for current diagnosis: ASI-social-cognitive concerns predicted SAD and ASI-physical concerns PD. Surprisingly PSWQ was the only exception as its contribution became non-significant in the prediction model of GAD where its influence seems to be completely overruled by neuroticism which now is a highly significant predictor.

Results for the depressive disorders show LEIDS-R-agg as predictor for DD and LEIDS-R-rum as a predictor of MDD. Most notable is the non-significant contribution of LEIDS-R-hop, which did add significantly to MDD's current disorder model.

Table 3: Prediction of current anxiety disorders by personality factors and cognitive constructs, controlled for demographics

	SAD				GAD				PD			
	B	Wald test	OR	95% CI	B	Wald test	OR	95% CI	B	Wald test	OR	95% CI
<i>Forced entry</i>												
Sex	0.12	0.57	1.11	0.85 – 1.46	0.26	2.99	1.30	0.97 – 1.74	-0.21	1.95	0.82	0.61 – 1.09
Age	-0.01	1.53	0.99	0.98 – 1.00	0.01	2.76	1.01	1.00 – 1.02	-0.001	0.03	1.00	0.99 – 1.01
Education	-0.01	0.17	0.99	0.95 – 1.03	-0.03	1.31	0.98	0.94 – 1.02	-0.06	6.85**	0.95	0.91 – 0.99
Neuroticism	0.06	18.70***	1.06	1.03 – 1.09	0.04	7.87**	1.04	1.01 – 1.07	-0.02	2.90	0.98	0.96 – 1.00
Extraversion	-0.04	12.87***	0.96	0.94 – 0.98	0.00	0.04	1.00	0.98 – 1.03	0.03	6.43*	1.03	1.01 – 1.06
<i>Stepwise Backward</i>												
PSWQ	-0.03	8.54**	0.98	0.96 – 0.99	0.05	32.23***	1.05	1.03 – 1.07				
ASI-phc									0.11	108.44***	1.12	1.10 – 1.14
ASI-scc	0.08	25.16***	1.08	1.05 – 1.12								

* $p < .05$, ** $p < 0.01$, *** $p < 0.001$.

Note 1: SAD: $R^2 = .13$ (Nagelkerke). Model χ^2 (7) = 108.66, $p < 0.001$; GAD: $R^2 = .12$ (Nagelkerke). Model χ^2 (6) = 94.40, $p < 0.001$; PD: $R^2 = .18$ (Nagelkerke). Model χ^2 (6) = 156.03, $p < 0.001$

Note 2: In the stepwise backward section of the model, non-significant cognitive factors are not reported

Table 4: Prediction of current depressive disorders by personality factors and cognitive constructs, controlled for demographics

	DD				MDD			
	B	Wald test	OR	95% CI	B	Wald test	OR	95% CI
<i>Forced entry</i>								
Sex	-0.02	0.02	0.98	0.70 – 1.37	-0.04	0.08	0.96	0.73 – 1.27
Age	0.03	13.88***	1.03	1.01 – 1.04	0.002	0.09	1.00	0.99 – 1.01
Education	-0.01	0.23	0.99	0.94 – 1.04	-0.06	9.53**	0.94	0.90 – 0.98
Neuroticism	0.05	9.76**	1.05	1.02 – 1.08	0.01	0.48	1.01	0.98 – 1.03
Extraversion	-0.05	14.29***	0.95	0.92 – 0.98	-0.04	10.74**	0.96	0.94 – 0.99
<i>Stepwise backward</i>								
ASI-phc					-0.04	19.16***	0.96	0.94 – 0.98
LEIDS-R-rum					0.07	15.02***	1.07	1.03 – 1.11
LEIDS-R-hop					0.06	10.68**	1.06	1.02 – 1.10
LEIDS-R-agg	0.06	11.91**	1.06	1.03 – 1.09				

* $p < .05$, ** $p < 0.01$, *** $p < 0.001$.Note 1: DD: $R^2 = .13$ (Nagelkerke). Model χ^2 (6) = 91.79, $p < 0.001$; MDD: $R^2 = .15$ (Nagelkerke). Model χ^2 (8) = 133.93, $p < 0.001$

Note 2: In the stepwise backward section of the model, non-significant cognitive factors are not reported

Table 5: Prediction of anxiety disorders in remission by personality factors and cognitive constructs, controlled for demographics, BAI and IDS

	SAD				GAD				PD			
	B	Wald test	OR	95% CI	B	Wald test	OR	95% CI	B	Wald test	OR	95% CI
<i>Forced entry</i>												
Sex	0.01	0.004	1.01	0.70 – 1.46	-0.02	0.01	0.98	0.68 – 1.42	-0.13	0.42	0.88	0.58 – 1.31
Age	-0.001	0.01	1.00	0.99 – 1.01	0.01	1.79	1.01	1.00 – 1.02	-0.03	15.56***	0.97	0.96 – 0.99
Education	-0.01	0.19	0.99	0.94 – 1.04	0.002	0.01	1.00	0.95 – 1.06	-0.01	0.11	0.99	0.94 – 1.05
BAI	-0.004	0.07	1.00	0.96 – 1.03	0.01	0.66	1.01	0.98 – 1.05	0.04	3.93*	1.04	1.00 – 1.07
IDS	-0.003	0.05	1.00	0.97 – 1.03	-0.03	3.56	0.97	0.95 – 1.00	-0.01	0.75	0.99	0.96 – 1.02
Neuroticism	0.03	2.98	1.03	1.00 – 1.07	0.06	16.82***	1.07	1.03 – 1.10	0.02	1.23	1.02	0.99 – 1.05
Extraversion	-0.04	6.78**	0.96	0.93 – 0.99	0.001	0.01	1.00	0.97 – 1.03	0.01	0.69	1.01	0.98 – 1.05
<i>Stepwise Backward</i>												
PSWQ	-0.04	9.61**	0.96	0.94 – 0.99					0.10	28.99***	1.10	1.06 – 1.14
ASI-phc												
ASI-scc	0.11	15.91***	1.12	1.06 – 1.18								
LEIDS-R-agg									-0.10	11.95***	0.91	0.86 – 0.96

* $p < .05$, ** $p < 0.01$, *** $p < 0.001$.
Note 1: SAD: $R^2 = .06$ (Nagelkerke). Model $\chi^2 (9) = 35.04, p < 0.001$; GAD: $R^2 = .04$ (Nagelkerke). Model $\chi^2 (7) = 23.53, p = 0.001$; PD: $R^2 = .13$ (Nagelkerke).
Model $\chi^2 (9) = 74.18, p < 0.001$
Note 2: In the stepwise backward section of the model, non-significant cognitive factors are not reported

Table 6: Prediction of depressive disorders in remission by personality factors and cognitive constructs, controlled for demographics, BAI and IDS

	DD				MDD			
	B	Wald test	OR	95% CI	B	Wald test	OR	95% CI
<i>Forced entry</i>								
Sex	-0.38	3.18	0.68	0.45 – 1.04	-0.23	1.13	0.80	0.53 – 1.21
Age	0.03	14.25***	1.03	1.02 – 1.05	0.01	0.61	1.01	0.99 – 1.02
Education	-0.02	0.63	0.98	0.92 – 1.03	0.01	0.07	1.01	0.95 – 1.07
BAI	-0.01	0.38	0.99	0.96 – 1.02	-0.01	0.09	0.99	0.95 – 1.04
IDS	0.02	1.69	1.02	0.99 – 1.05	0.03	2.35	1.03	0.99 – 1.06
Neuroticism	0.01	0.21	1.01	0.98 – 1.04	0.01	0.10	1.01	0.97 – 1.04
Extraversion	-0.03	3.62	0.97	0.94 – 1.00	-0.01	0.33	0.99	0.96 – 1.03
<i>Stepwise backward</i>								
ASI-phc					-0.06	10.47**	0.94	0.90 – 0.98
LEIDS-R-rum					0.09	11.21***	1.09	1.04 – 1.15
LEIDS-R-agg	0.08	9.44**	1.08	1.03 – 1.13				

* $p < .05$, ** $p < 0.01$, *** $p < 0.001$.
 Note 1: DD: $R^2 = .08$ (Nagelkerke). Model χ^2 (8) = 44.70, $p < 0.001$; MDD: $R^2 = .08$ (Nagelkerke). Model χ^2 (9) = 38.04, $p < 0.001$
 Note 2: In the stepwise backward section of the model, non-significant cognitive factors are not reported

All models are significant overall (see Tables 5 and 6) although the explained variance is slightly lower than for the current disorders. Nagelkerke varied from .04 to .13 with PD scoring at the higher and GAD at the lower end.

When comparing these final models to the versions without the cognitive constructs -only including demographics, the BAI and IDS, and the personality traits of neuroticism and extraversion- all models, except for GAD where neuroticism dominated, significantly improved their fit as a result of adding the cognitive constructs. For SAD the improvement is $\chi^2 (2, N = 192) = 21.20, p < 0.001$, for PD $\chi^2 (2, N = 187) = 42.13, p < 0.001$, DD $\chi^2 (1, N = 157) = 9.20, p < 0.01$ and for MDD $\chi^2 (2, N = 693) = 20.30, p < 0.001$.

Repeating Analyses with Comorbidity Correction

As comorbidity among anxiety and depressive disorders is very common this could have influenced the results. In order to check this, analyses for both the current and remission sample were re-run, controlling for comorbidity by adding to each model the different diagnoses (dummy coded variables: absent/present) as covariates (data not shown). Hence, in each sample five binomial logistic regression analyses were run. The models consisted of demographics, personality traits and the different diagnoses with the exception of the index disorder (forced entry), and the cognitive variables (stepwise backward procedure). The same was done for the remission sample with the addition of BAI and IDS (forced entry) to control for residual symptoms.

Compared to the analyses without comorbidity correction, results in the current diagnosis sample showed only a minor difference in the model of DD: neuroticism no longer made a significant contribution. The models on disorders in remission showed no differences. Overall the results are very similar to the analyses without correction for comorbidity, with the same significant cognitive predictors still present in the models, indicating that the reported results are very robust and not critically confounded by comorbidity.

Discussion

The aim of this study was to investigate the incremental validity of the cognitive constructs AS, PW and CR in predicting depressive and anxiety disorders over and above the personality traits of neuroticism and extraversion, while controlling for sociodemographic characteristics. This was investigated in both symptomatic and remitted patients.

Results from the symptomatic group revealed that both specific and unique cognitive components exist: Anxiety Sensitivity is a specific component involved in both SAD and PD, and Pathological Worry a unique component for GAD. Within the depressive disorders, Aggression Reactivity (LEIDS-R-agg) is unique for DD, and Rumination on Sadness (LEIDS-R-rum) and Hopelessness Reactivity (LEIDS-R-hop) are unique factors in MDD. As expected, odds ratios were small, but when considering that we applied a stringent test by using a psychiatric control group, these results are noteworthy and robust.

The subscales of AS have unique aspects; social-cognitive concerns (ASI-scc) is

solely related to SAD and physical concerns (ASI-phc) to PD. At a higher-order level both factors capture the same underlying mechanism -the fear of anxiety related sensations. The involvement of AS in both PD and SAD was no surprise, as misinterpretation of bodily sensations and maladaptive cognitions such as the fear to lose control are well known to play a prominent role in these disorders (e.g., D. M. Clark, 1988; D.M. Clark & Wells, 1995).

PW is also a unique component. Note that 'uniqueness' does not mean that the construct is not involved in other disorders, but that it has a dominant role in one disorder. As pointed out by Mineka, Watson and Clark (1998) "symptom specificity must be viewed in relative rather than absolute terms.". So even though PW is elevated in many disorders, it has a more defining role in GAD, which is in line with both cognitive models and the DSM classification (APA, 2000). Two other unique components are Rumination on Sadness and Hopelessness Reactivity, which are both linked to MDD. This relationship is unique in the sense that their predictive value of MDD is over and above that of personality traits and anxiety constructs, and remains limited to this one disorder. Further, this finding is consistent with previous research highlighting the core role of rumination and hopelessness in maintaining and predicting depression (e.g., Alloy et al., 1999; Nolen-Hoeksema, 2000).

Contrary to the above findings, the relationship between DD and Aggression Reactivity (LEIDS-R-agg) was somewhat unexpected. Irritability is a common symptom of DD but has not been investigated as a (cognitive) vulnerability factor. For example, Fava et al. (1997) reported increased anger attacks among people with dysthymia or atypical depression compared to normal controls. More recently, irritability was examined as a potential subtype of MDD in the general population and it was found that the presence of irritability (versus its absence) in MDD is associated with higher comorbid dysthymia and lifetime persistence of symptoms (Fava et al., 2009). Further, a recent large-scale longitudinal study showed that irritability during adolescence predicts an adult diagnosis of dysthymia, and to a lesser extent GAD and MDD, over a period of 20 years (Stringaris, Cohen, Pine, & Leibenluft, 2009). The present finding expands on this literature by showing a unique association between aggression reactivity and dysthymia, but not major depression. It is noteworthy that dysthymia was also related to lower extraversion in our sample. At first glance this pattern of results is suggestive of an introvert profile characterizing the dysthymic patient consistent with older psychoanalytic theories focusing on the central role of anger in depressive disorders. In this orientation difficulties with the expression of anger are thought to cause intrapsychic conflicts that lead to anger being directed inwards (Busch, 2009). As a result, defence mechanisms, such as passive aggression, are triggered and maintained in dysthymic patients (Bloch, Shear, Markowitz, Leon, & Perry, 1993). It should be noted however, that aggression reactivity is conscious, self-reported aggression.

The findings found in acute patients also appeared in the remission group, and the similarities are striking. With the exception of LEIDS-R-hop and PW all cognitive constructs uphold their position in the prediction models. An explanation for the non-significant

contribution of LEIDS-R-hop to MDD can be found in a recently conducted study. This study showed that only remitted depressed participants with a history of suicidal ideation during their prior depressive episode are likely to experience high hopelessness reactivity scores during remission, whereas participants without such history do not show elevated hopelessness (Antypa, et al., 2010). Consequently, the level of LEIDS-R-hop during remission seems to be dependent upon prior suicidal ideation status. This implies that although hopelessness was not represented in the overall MDD remission model it could still be a unique component for a specific subgroup. Another cognitive predictor conspicuous by its absence is PW. In the remission model of GAD, PW was no longer a significant predictor. This is most likely due to the high shared variance with neuroticism (e.g., Wells, 1994). The cognitive predictors that continued to make a significant contribution to the remission models are AS (specific component: SAD and PD), LEIDS-R-agg (unique component: DD) and LEIDS-R-rum (unique component: MDD). The fact that these constructs uphold their position in the remission models, even when corrected for current symptomatology, supports the idea that these constructs are not merely epiphenomena of current disorders. Whether the results reflect scarring or more stable vulnerability factors cannot be derived from the present data.

The present study has several strengths such as the large (clinical) sample size, the recruitment from diverse settings, the replication in a remission group and the inclusion of several affective disorders and cognitive constructs.

There are also some limitations. The cross-sectional design limits insight into the direction of relationships. This was partly circumvented by also investigating remitted patients, however longitudinal data are needed to investigate cause and effect relationships. Another limitation lies in the selection of cognitive constructs. There are many other cognitive constructs which would have been interesting to include, such as intolerance of uncertainty, and experiential avoidance. Thirdly, the self-report nature of some of the instruments used in the present study has obvious downsides. Most of these measures are well established and accepted in research, however. The only exception is the LEIDS-R, which has a relatively short history. Although the present golden standard for CR measurement involves a mood induction (Scher, Ingram, & Segal, 2005), this has also its drawbacks and the success rates of inducing sadness also varies. Furthermore, as mentioned above, the support for the LEIDS-R as a valid measure of CR is accumulating (e.g., Moulds, et al., 2008). Finally, the categorical diagnosis/no-diagnosis approach is necessarily accompanied by the issue of subsyndromal symptoms. In the remission sample the BAI and IDS were added as control variables in order to correct for residual symptoms. These measures however, do not cover the entire symptomatology spectrum of anxiety in particular and thus the presence of some residual (anxiety) symptoms cannot be excluded. The current diagnosis sample did not allow for a similar approach to correct for subsyndromal (comorbid) symptoms as this would have corrected for the severity of the current index disorder itself and hence analyses would have provided non-informative results. Therefore it cannot be excluded that subsyndromal comorbid symptoms might

account for some of the associations of current disorders with global or specific cognitive factors. Overall the findings support the Integrative Hierarchical Model. Moreover, when considering the additional value of cognitive constructs in understanding anxiety and depressive disorders, one can conclude that reliance on a few general measures does not do justice to the complexity of these psychopathologies. On a more practical level the results imply that although a patient might no longer meet (symptomatic) criteria of a disorder, cognitive mind sets might still be latently present, increasing the risk for relapse.

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Chapter 3

Longitudinal associations between repetitive negative thinking and emotional disorders

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Abstract

Background: It is undecided whether worry and rumination are conceptualizations of the same underlying process of repetitive negative thinking, which is hypothesized to be a transdiagnostic factor underlying various emotional disorders. The aim of this study is to investigate stable and time specific aspects of worry and rumination in fear disorders (social anxiety, panic disorder, agoraphobia) and distress disorders (dysthymia, depressive disorder, generalized anxiety disorder).

Method: Longitudinal cohort study in 2981 participants (healthy controls, persons with a prior disorder history and persons with a current distress and/or fear disorder). Assessment of DSM-IV diagnoses and worry/rumination took place at baseline (T1), 2-year follow-up (T2), and 4-year follow-up (T3). Latent trait-state models were fitted using structural equation analyses.

Results: Results revealed that i) worry and rumination each contain stable trait components, which are strongly correlated; ii) state level fluctuations of worry and rumination are moderately and positively correlated; iii) trait worry and trait rumination are strongly associated with the stable components of both distress and fear disorders; iv) state fluctuations in distress/fear disorder predict state fluctuations in worry/rumination 2 years later and not vice versa.

Conclusion: Our results highlight the similarities between worry and rumination and support their conceptualization as transdiagnostic processes.

Introduction

Worry is a central feature of generalized anxiety disorder (GAD) and rumination of major depressive disorder (MDD), although, levels are elevated across anxiety and depressive disorders. Both cognitive processes are characterized by uncontrolled, excessive and repetitive thinking about current concerns, problems, past experiences or worries about the future; so called Repetitive Negative Thinking (RNT; Ehrling & Watkins, 2008, p. 192). If a distinction is to be made, worry is more about the future, rumination about the past – although this distinction is a simplification. The question is justified whether worry and rumination are conceptualizations of the same underlying process. Another question is whether these process(es) are transdiagnostic or that their presence across emotional disorders is due to comorbidity with one specific disorder. If they are indeed conceptualizations of the same underlying process we would expect the stable trait components of worry and rumination to be highly related, fluctuations at state level to occur in sync and similar relations of worry and rumination with emotional disorders. If worry and rumination are transdiagnostic processes we would also expect them to be present across emotional disorders independent of comorbidity with a specific disorder. Finally, a third question is whether -in line with cognitive theory- reciprocal lagged relations between worry/rumination and emotional disorders are mutually reinforcing each other, setting off a downward spiral towards enduring psychopathology.

The proposition that worry and rumination are transdiagnostic processes (Harvey et al., 2004; Ehrling & Watkins, 2008) is predominantly based on studies revealing elevated levels across disorders. These studies were generally focussed on individual disorders (major depressive disorder (MDD) and generalized anxiety disorder (GAD) in particular) while disregarding comorbidity. Comorbidity is however the rule rather than the exception (e.g. Kessler et al., 1994) especially between MDD/DYS and GAD (e.g. Spinhoven et al., 2009; Kessler et al., 1999) and could be responsible for the similar findings across disorders. A recent cross-sectional study by Lamers and colleagues (2011) reported that among MDD patients the co-occurrence with GAD was 31% and life-time comorbidity was as high as 38%. In GAD patients comorbidity numbers were even higher with up to 78% (lifetime 88%) of the patients reporting to suffer from a depressive disorder. The limitation of studying separate disorders is further highlighted by findings that suggest that MDD and GAD share a genetic based common cause (Gorwood, 2004; Kendler et al., 2007). Given the high comorbidity among emotional disorders, studying the relation of worry and rumination with various emotional disorders simultaneously while accounting for their comorbidity may provide additional insight into their potentially transdiagnostic characteristics. One way to address this issue is to cluster related disorders and study them simultaneously. An example of this would be to examine 'emotional disorders' or to use the traditional DSM-IV division of emotional disorders into 'anxiety' and 'depressive' disorder clusters. Another, increasingly popular categorization of emotional disorders is that into fear and distress disorders. The latter division is supported by recent studies of the structure of psychopathology that show that GAD is better placed with the depressive

disorders than the anxiety disorders (for an overview see Beesdo-Baum et al., 2009). The present study will take comorbidity into account by applying this fear-distress model when investigating worry and rumination.

So far most studies have focused on cross-sectional or uni-directional relationships of worry and rumination with each other and with particular emotional disorders, and did not examine reciprocal effects nor the temporal character of the effects. Longitudinal studies concerning rumination have shown that rumination predicts the occurrence of both anxiety and depressive symptoms over time, including new onset of depressive disorders (Nolen-Hoeksema, 2000). Likewise, worry has been found to be a vulnerability factor predicting increments of anxiety and depressive symptoms over time (Hong, 2007). Unlike the longitudinal studies examining rumination, studies concerning worry usually covered limited time frames of around one week to two months (e.g. Calmes & Roberts, 2007; Hong, 2007; Segerstrom et al., 2000). The role of worry and rumination is further confirmed by an extensive review of the literature on repetitive (negative) thinking (RNT) revealing that RNT is a vulnerability factor for both anxiety and depressive disorders (Watkins, 2008). A reverse effect of psychopathology predicting the occurrence of RNT has, to the best of our knowledge, not been investigated longitudinally.

The assumption that worry and rumination share the same process is largely based on studies showing substantial correlations between the two constructs (e.g. Segerstrom et al., 2000, $r = .32$ to $r = .46$; Muris et al., 2004, $r = .55$; Watkins, 2004, $r = .51$; Hong, 2007, $r = .42$). By using a latent trait-state model (see Naragon-Gainey, Gallagher, & Brown, 2013, and Ormel & Schaufeli, 1991, for the development of similar models) it is possible to separate stable and state components of worry and rumination. This will provide information on whether these supposedly vulnerability factors are indeed stable over time and how they relate to each other and to the stable components of psychopathology. Worry and rumination state levels are also of interest as levels are known to fluctuate and to be heightened during periods of psychopathology (e.g. Bagby et al., 2004; Kasch, Klein, & Lara, 2001). These fluctuations around a person's set point may put into motion a downward spiral in which increases in worry/rumination lead to heightened levels of psychopathology which in turn triggers worry/rumination. If reciprocal influences are present this could potentially be an important mechanism underlying enduring psychopathology.

The NESDA study, with presently three-wave data available on worry/rumination and emotional disorders, offers an unique possibility to analyse the temporal and directional character of a reciprocal relationship between worry and rumination as well as between emotional disorders and worry/rumination, on the basis of longitudinal data in a relatively large and representative sample of participants with depressive and/or anxiety disorder from different recruitment settings. Using a latent trait-state model, we expect the trait components of worry and rumination to be highly related and fluctuations at state level to occur in sync. Further, we expect that worry/rumination and emotional disorders are mutually reinforcing each other over time in a downward spiral. Finally, we expect both worry and rumination to show stronger associations with distress disorders than with fear disorders.

Method

Participants and Setting

The Netherlands Study of Depression and Anxiety (NESDA) is an ongoing multi-site longitudinal cohort study including 2981 adult subjects aged 18 through 65 years. The baseline sample consists of 687 (23.0%) healthy controls and 2294 (77.0%) persons with a life-time diagnosis of depression or anxiety disorder of whom 1701 (57.1%) have a current diagnosis (past 6 months). In order to be representative of those with depressive and anxiety disorders respondents in different stages of the developmental history of the disorders (normal, high familial risk, subthreshold disorders, first and recurrent episodes) and from different health care settings (community, primary care and specialized mental health care) were included. A general inclusion criterion was an age of 18 to 65 years. An exclusion criterion was a primary psychotic, obsessive compulsive, bipolar or severe addiction disorder. In addition patients who were not fluent in Dutch were excluded. An extensive description of the rationale, method and recruitment strategy can be found elsewhere (Penninx, et al., 2008).

Procedure

The study protocol was approved centrally by the Ethical Review Board of the VU University Medical Centre and subsequently by local review boards of each participating centre. Participants provided written informed consent. Baseline assessment (T1) took place at one of the seven field centre locations during a 4-hour clinic visit. Assessment included demographic and personal characteristics, medical assessment and the standardized diagnostic psychiatric interview Composite Interview Diagnostic Instrument (CIDI, version 2.1).

A face-to-face follow-up assessment, including the same diagnostic interview, was conducted after 2 years (T2 response: $n = 2596$, 87.1%) and after 4 years (T3 response: $n = 2402$, 80.6%). During each assessment presence of DSM-IV (APA, 1994) based depressive [Major Depressive Disorder (MDD), Dysthymia (DYS)] or anxiety [Panic Disorder (PAN), Social Anxiety Disorder (SAD), Generalized Anxiety Disorder (GAD), Agoraphobia without panic (AGO)] disorders was established. Presence of the disorders was defined as the occurrence of the disorder at any time during the six months preceding each assessment (T1, T2, and T3).

Measures

Assessment of psychiatric diagnoses

Diagnostic status (6 month recency diagnosis) was established using the Composite Interview Diagnostic Instrument (CIDI-WHO lifetime version 2.1; Ter Smitten, Smeets, & Van den Brink, 1998). The CIDI is a worldwide used instrument which classifies diagnoses according to DSM-IV criteria (APA, 1994). It has shown high interrater reliability (Wittchen et al., 1991), high test-retest reliability (Wacker, Battegay, Mulleijans, & Schlosser, 2006) and high validity for depressive and anxiety disorders (Farmer, Katz, McGuffin, & Bebbington, 1987; Wittchen, 1994; Wittchen et al., 1989). The CIDI was conducted by specially trained clinical research staff.

Questionnaires

Worry was measured with the Penn State Worry Questionnaire (PSWQ; Meyer, et al., 1990). This questionnaire consists of 16 items rated on a 5-point Likert scale ranging from '1 = not at all typical of me' to '5 = very typical of me'. The PSWQ consists of two subscales: a 'General worry' subscale (11 items) and a 'Not-worry' subscale (5 items) (van Rijsoort, Emmelkamp, & Vervaeke, 1999). The 'General worry' subscale accounts for most of the variance in PSWQ scores (Brown, Antony, & Barlow, 1992; Meyer, et al., 1990; van Rijsoort, et al., 1999), and only this subscale was administered in the NESDA study. Psychometric properties of this Dutch 11-item version are not available but the original PSWQ has been proven to be a valid measure of trait worrying unaffected by the content of the worry (Davey, 1993; Molina & Borkovec, 1994) with high internal consistency, good test-retest reliability and unaffected by social desirability (Meyer, et al., 1990). The adjustments made to the original PSWQ are not expected to have had a negative effect on these characteristics. Internal consistency in the present study was high, namely $\alpha = .96$ at T1, T2 and T3.

Rumination was assessed with the subscale Rumination on Sadness of the revised version of the Leiden Index of Depression Sensitivity (LEIDS-R; Van der Does, 2002; Williams, et al., 2008). The LEIDS-R is a self-report instrument which measures cognitive reactivity to sad mood and has been found to reliably discriminate between never-depressed and recovered depressed groups (e.g., Firk & Markus, 2009; Merens, et al., 2005; Moulds, et al., 2008; Van der Does, 2002). LEIDS-R scores also correlate with biological vulnerability markers of depression: response to acute tryptophan depletion (Booij & Van der Does, 2007) and a serotonin transporter gene polymorphism (Antypa, Van der Does, & Penninx, 2010).

The subscale Rumination on Sadness (RUM) consists of 6 items. Participants are asked to indicate whether and how their thinking patterns change when they experience mild dysphoria by scoring each item on a 5-point Likert-scale ranging from 0 'not at all' to 4 'very strongly' applicable to me. In the present sample the internal consistency of the RUM-scale was 0.82 at T1, 0.84 at T2 and 0.85 at T3.

Statistical Analyses

Psychopathology measurement model

We expected the distress-fear model (Distress: MDD, DYS, GAD; Fear: PAN, SAD, AGO) to best represent the latent structure and stability of emotional disorders based on high comorbidity rates between GAD and depressive disorders as well as on previous research supporting the distress-fear measurement model (for an overview see Beesdo-Baum et al., 2009). In order to test this assumption confirmatory factor analyses (CFA) were performed to examine the fit of the distress-fear model, the DSM-IV model and a single-factor model to the longitudinally collected diagnostic CIDI data. In these analyses the T1, T2 and T3 assessments of the 6 diagnostic variables (i.e., MDD, DYS, GAD, SAD, PAN, and AGO) were considered as repeated measures. Factor loadings of the observed disorders on their latent trait factor(s) were constrained to be equal over time. Goodness-of-fit was

assessed using: chi-square test of the model ($p > .05$), Comparative Fit Index (CFI; $\geq .96$), Tucker-Lewis Index (TLI; $\geq .95$), and Weighted Root-Mean-Square Residual (WRMR; ≤ 1.0). However, we considered the Root-Mean-Square Error of Approximation (RMSEA; $\leq .05$), as the main index of model fit as it has been shown to be sensitive to model misspecification and less sensitive than other global fit measures to distribution and sample size in badly fitting covariance structure models (Hu & Bentler, 1998).

Trait and State Models (T&S)

Next, we analysed five structural models ((1) Rumination and Worry; (2) Distress Disorders and Worry; (3) Distress Disorders and Rumination; (4) Fear Disorders and Worry; and (5) Fear Disorders and Rumination). See Figures 1-5 for an overview of these models. In order to clarify these models we will describe the four Emotional Disorder-RNT models together (model 2-5). The Rumination-Worry model (model 1) has a similar structure. The models consist of three parts: two identical trait and state (T&S) models for three time points, one addressing psychopathology (Distress or Fear Disorders, top half of the model) and one repetitive negative thinking (Worry or Rumination, bottom half of the model), four correlations (Paths c, d, e, and f) and four regression effects (Paths a1, a2, b1, b2) linking the T&S models. The T&S Disorders model assumes that psychopathology (Distress or Fear disorders) at each time point is the function of two latent (unobserved) variables: a trait component (common factor) and a state component. The state component represents the variance not accounted for by the common factor and consequently reflects time-variant fluctuations within-subject over the 2-yr study period including measurement error. The same assumptions are made for the T&S models of repetitive negative thinking (worry and rumination).

The across-time structure of the latent state psychopathology variables (State 1, State 2, State 3) in the T&S model was modeled as a first-order auto-regressive model. Hence, State 2 and 3 variances consist of variance transmitted from an earlier time point (paths p and q) and new variance resulting from the effects of unobserved variables active during the interval between the measurement points as well as measurement error. The across-time structure of the latent repetitive negative thinking variables was modeled in a similar way (paths r and s).

By combining the T&S models for psychopathology and repetitive negative thinking an integrated model is obtained in which the latent state variables of psychopathology can act as a change agent of repetitive negative thinking and, vice versa, the cross-variable effects. The model allows correlation between the common trait factors (correlation f) and between the state components of psychopathology and repetitive negative thinking (correlations c, d, e). Finally, the effects of the latent state variables can be lagged (Paths a1, a2, b1, b2).

Model Specification and Identification

To solve the structural equations of the full model, the following assumptions for both the psychopathology and repetitive negative thinking T&S parts of the models were made:

(a) the regressions of the observed RNT scores and psychopathology factors scores (as derived from the CFA modeling) on their respective latent trait factor are equal over time (equality constraints $x_1 = x_2 = x_3$; $y_1 = y_2 = y_3$); (b) the lagged cross-variable effects at Time 2 equal those at Time 3 ($a_1 = a_2$, $b_1 = b_2$) (c.f., Duncan-Jones et al., 1990; Ormel & Schaufeli, 1991); and (c) the residual variances of the observed variables equal 0.

Descriptive statistics as well as model fitting were obtained using the MPlus computer program (version 7; Muthén & Muthén, 1998 - 2012). Participants who did not participate in the T2 and T3 assessment were included in the analyses by using Full Information Maximum Likelihood (FIML) estimation for missing data. The full model, depicted in Figures 1-5, necessitates the estimation of 18 parameters (variance of the six latent state variables was fixed at unity). Consequently the full model has 3 degrees of freedom left. Standardized estimates, or path coefficients, with a theoretical range from zero (no effect) to ± 1 (maximum positive or negative effect) are provided. Path coefficients of $< .10$ were considered to be negligible, of $\geq .10$ and $< .30$ to be small, of $\geq .30$ and $< .50$ to be moderate and $\geq .50$ to be large. As estimation method we used MLR -maximum likelihood parameter estimates with standard errors and a chi-square test statistic that are robust to non-normality and non-independence of observations.

Results

Participant Characteristics

The NESDA sample (T1) consists of 2981 adult participants of whom 66.4% is female and the mean age is 41.9 years ($SD = 13.1$). At T1 1701 participants had a current diagnosis: MDD = 37.4%, DYS = 10.2%, GAD = 15.6%, SAD = 22.3%, PAN = 22.5%, and AGO = 6.3%. As expected comorbidity rates were high with 57.5% of the participants with a current (6-month recency) diagnosis meeting criteria for two or more disorders (see Table 1 for an overview of comorbidity rates). After 2 years (T2) the sample consisted of 2596 (87.1%) participants and after 4 years (T3) of 2402 (80.6%) participants. Potential bias due to selective attrition was checked. Compared to completers, dropouts at T2 and T3 were less educated, younger, had higher latent factor scores for fear and distress disorders, and reported higher worry levels (all $p < .05$). Gender and rumination scores were not associated with attrition.

The relationship of worry with rumination

The rumination-worry model (Figure 1) with cross-variable lagged effects had a good model fit, $RMSEA = 0.031$. The estimated trait variance of worry scores varied from 59% (.77²) at T1 to 67% (.82²) at T3 and for rumination between 55% (.74²) and 66% (.81²) indicating that up to two thirds of the between subject differences in worry and rumination scores are stable over time. The remaining variance, i.e. state variance, consequently varied between 34% and 45%. See Figure 1 for an overview of the results.

Table 1: Comorbidity at T1 for the current (6 month recency) sample

	MDD	DYS	GAD	SAD	PAN	AGO
MDD (n = 1115)	-	23.5%	30.5%	34.7%	35.9	8.2%
DYS (n = 305)	85.9	-	45.6	43.6	39.7	10.5
GAD (n = 464)	73.3	30.0	-	44.0	42.5	10.3
SAD (n = 665)	58.2	20.0	30.7	-	45.9	9.6
PAN (n = 670)	59.7	18.1	29.4	45.5	-	-
AGO (n = 187)	48.7	17.1	25.7	34.2	-	-

Note. MDD = Major Depressive Disorder; DYS = Dysthymia; GAD = Generalized Anxiety Disorder; SAD = Social Anxiety Disorder; PAN = Panic Disorder; AGO = Agoraphobia w/o panic.

Worry and rumination were strongly related at trait level (.76) underlining the interrelatedness of the two forms of RNT. At state level the cross-variable concurrent relationships (c, d, e) were moderate in strength (.44, .39, .45), indicating that participants who increased their engagement in worry also started to ruminate more and vice versa. The cross-variable lagged effects of rumination on worry (a1, a2) were significant but small (.13 and .15). The opposite effects of worry on rumination (b1, b2) were non-significant. Overall it seems that state fluctuations in worry/rumination levels present themselves in sync, while only state fluctuations in rumination have a small effect on state fluctuations in worry 2 years later.

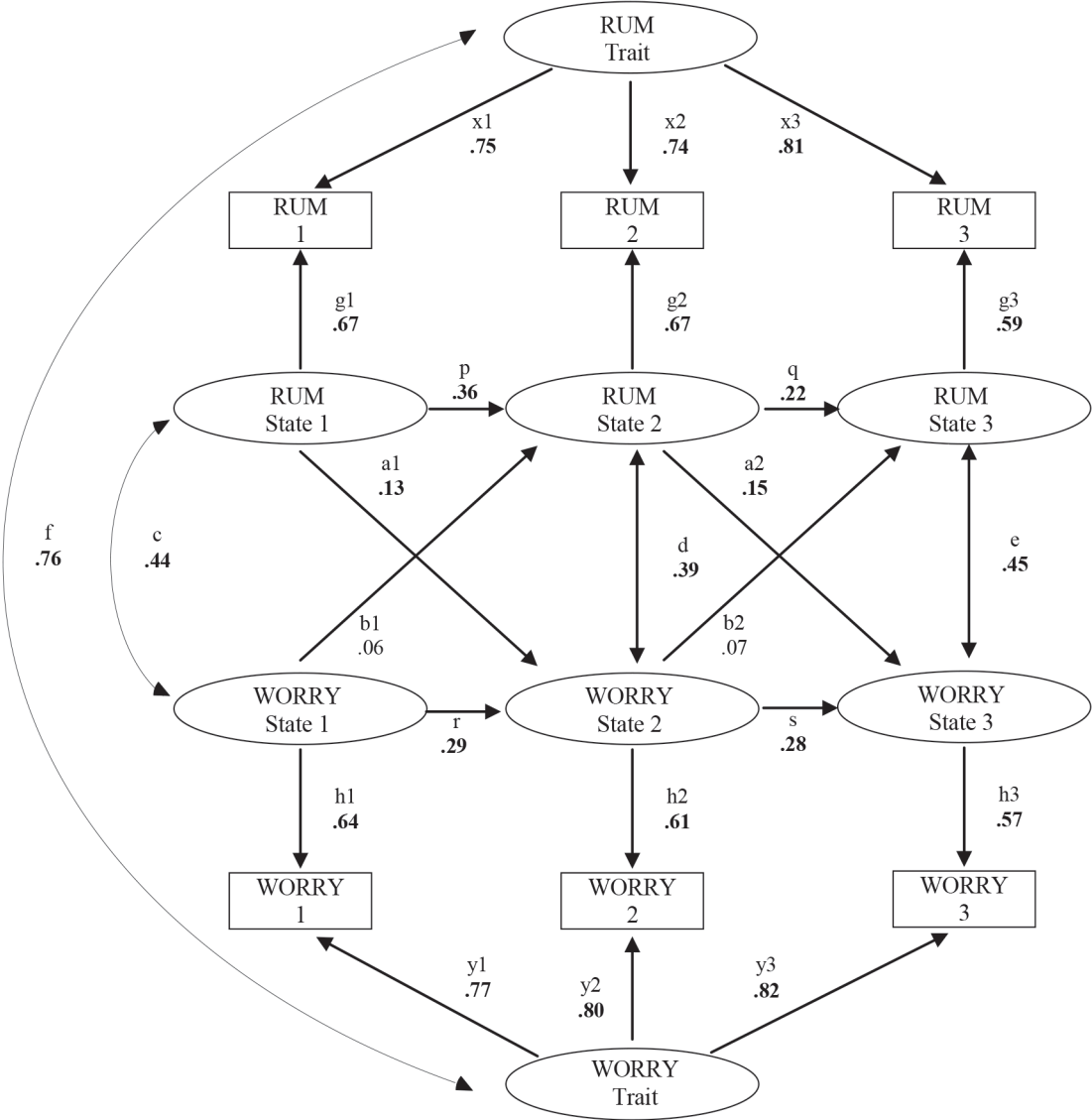
Psychopathology Measurement Model Selection

In line with expectations CFA showed the best goodness-of-fit for the Distress-Fear (MDD, DYS, GAD vs. SAD, PAN, AGO) model — $\chi^2(110) = 201.140$; TLI = .988; CFI = .991; RMSEA = .017; WRMR = 1.056. Followed by the DSM-IV (MDD and DYS versus SAD, PAN, AGO and GAD) model $\chi^2(110) = 275.464$; TLI = .978; CFI = .984; RMSEA = .022; WRMR = 1.258 and finally the single-factor model $\chi^2(124) = 374.281$; TLI = .971; CFI = .976; RMSEA = .026; WRMR = 1.491). Based on these results and on previous literature supporting a Distress-Fear two factor solution (for a review see Beesdo-Baum et al., 2009) this model was chosen for further statistical analyses. Latent factor scores for Distress and Fear disorders were used as input variables in subsequent Trait&State models (see Table 2 for factor loadings on the latent variables).

The relation of rumination with psychopathology

Rumination's estimated trait variance within the Fear-model (Figure 2) varied from 48% (.69²) at T1 and T2 to 58% (.76²) at T3 indicating that about half of the between-subject differences in rumination scores are stable over time. The other half of the variance consists of state variance and subsequently varied between 52% (.72²) at T1 and T2 to 42% (.65²) at

Figure 1: Rumination and Worry T&S models linked at trait level via correlations between trait factors (f) and at state level through contemporaneous correlations (c,d,e,) and cross-variable 2-year lagged effects (a,b).



Note. Equality constraints applied to identify model equations were: $x_1 = x_2 = x_3$; $y_1 = y_2 = y_3$; $a_1 = a_2$; $b_1 = b_2$. Significant ($p < .05$) correlations and regression coefficients are depicted in bold.

Table 2: Factor loadings on the latent variables for the distress-fear CFA solution

Factor	Distress				Fear		
	T1	T2	T3		T1	T2	T3
MDD	.81	.85	.82	SAD	.72	.76	.69
DYS	.81	.86	.83	PAN	.66	.69	.62
GAD	.69	.73	.70	AGO	.39	.41	.37

Note. MDD = Major Depressive Disorder; DYS = Dysthymia; GAD = Generalized Anxiety Disorder; SAD = Social Anxiety Disorder; PAN = Panic Disorder; AGO = Agoraphobia w/o panic.

T3. An almost identical pattern of results was found in the Distress model (Figure 3) where estimated trait variance of rumination ranged from 50% (T1 and T2) to 62% (T3) and state variance ranged from 50% (T1 and T2) to 38% (T3).

The trait fear factor accounted for 67% (.82²) of the variance in fear scores at T1, 61% (.78²) at T2 and 76% (.87²) at T3. These scores are slightly higher than those of the trait factor distress with variances of 52% (T1), 50% (T2) and 59% (T3), suggesting that individual differences in fear scores are slightly more stable over time.

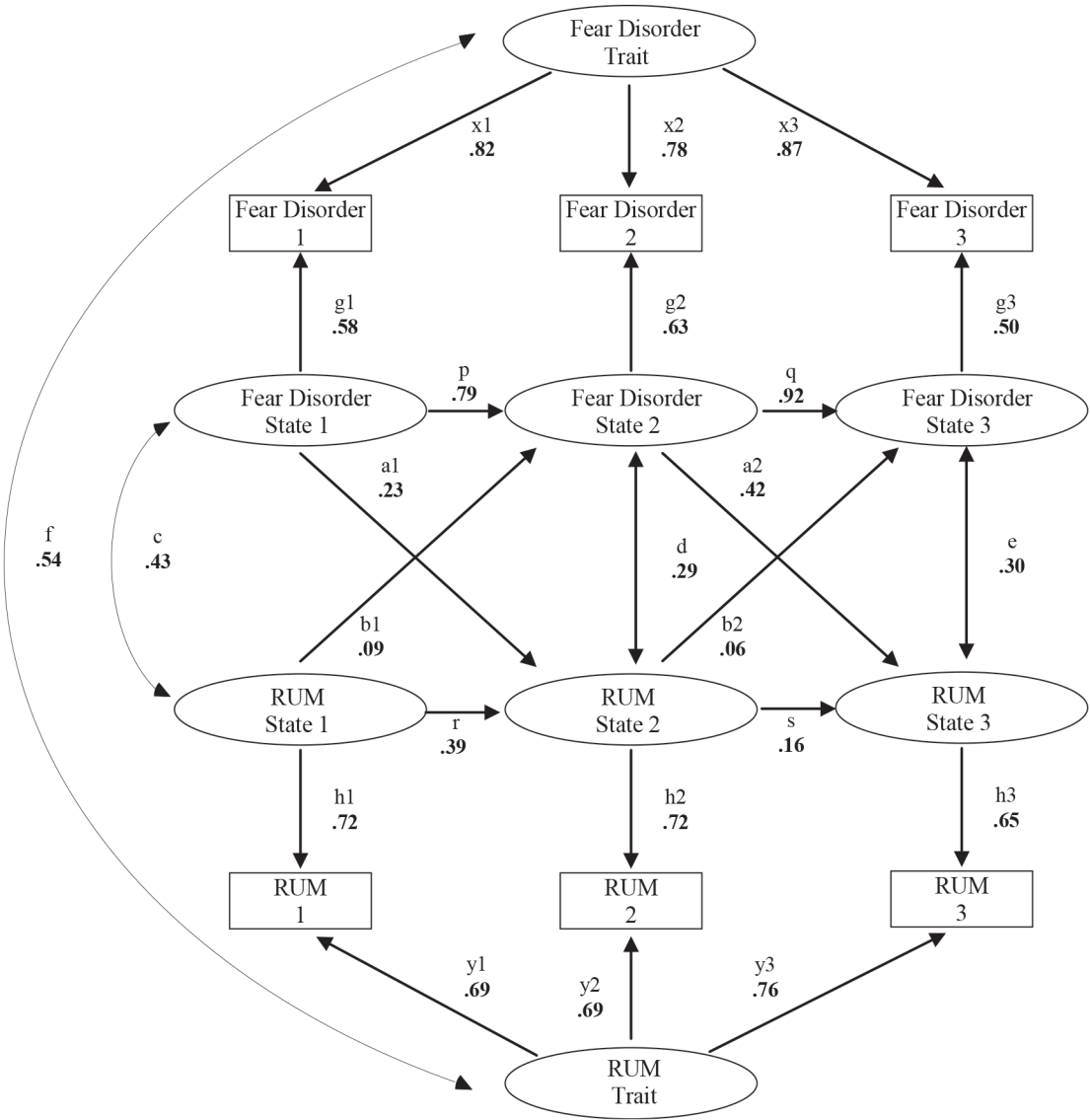
The fear and distress trait factor are both strongly (.54, respectively .66) related to the rumination trait factor. These numbers demonstrate the interconnection between the stable components of the emotional disorders and the stable trait of rumination.

The cross-variable effects revealed a fairly similar pattern for the fear and distress model. Both models show that all concurrent relationships (c, d, e) are significant and small to moderate in strength, indicating that participants who became more fearful or distressed also engaged more in rumination and vice versa. Small to moderate lagged effects (a1, a2) were also found for state level fluctuations of distress or fear disorders on state rumination indicating that more distress or fear resulted in higher levels of rumination 2 years later. Results of lagged effects (b1, b2) of state level rumination on state level psychopathology differed between the distress and fear model. Where the fear model showed a significant positive effect of state fluctuations in rumination on state fluctuations in fear disorder this effect was not observed for distress disorder. Regression coefficients (.09 and .06) were however so small that these effects can be considered negligible. In sum, state fluctuations in rumination seem to be primarily driven by state fluctuations in psychopathology and not vice versa.

The relation of worry with psychopathology

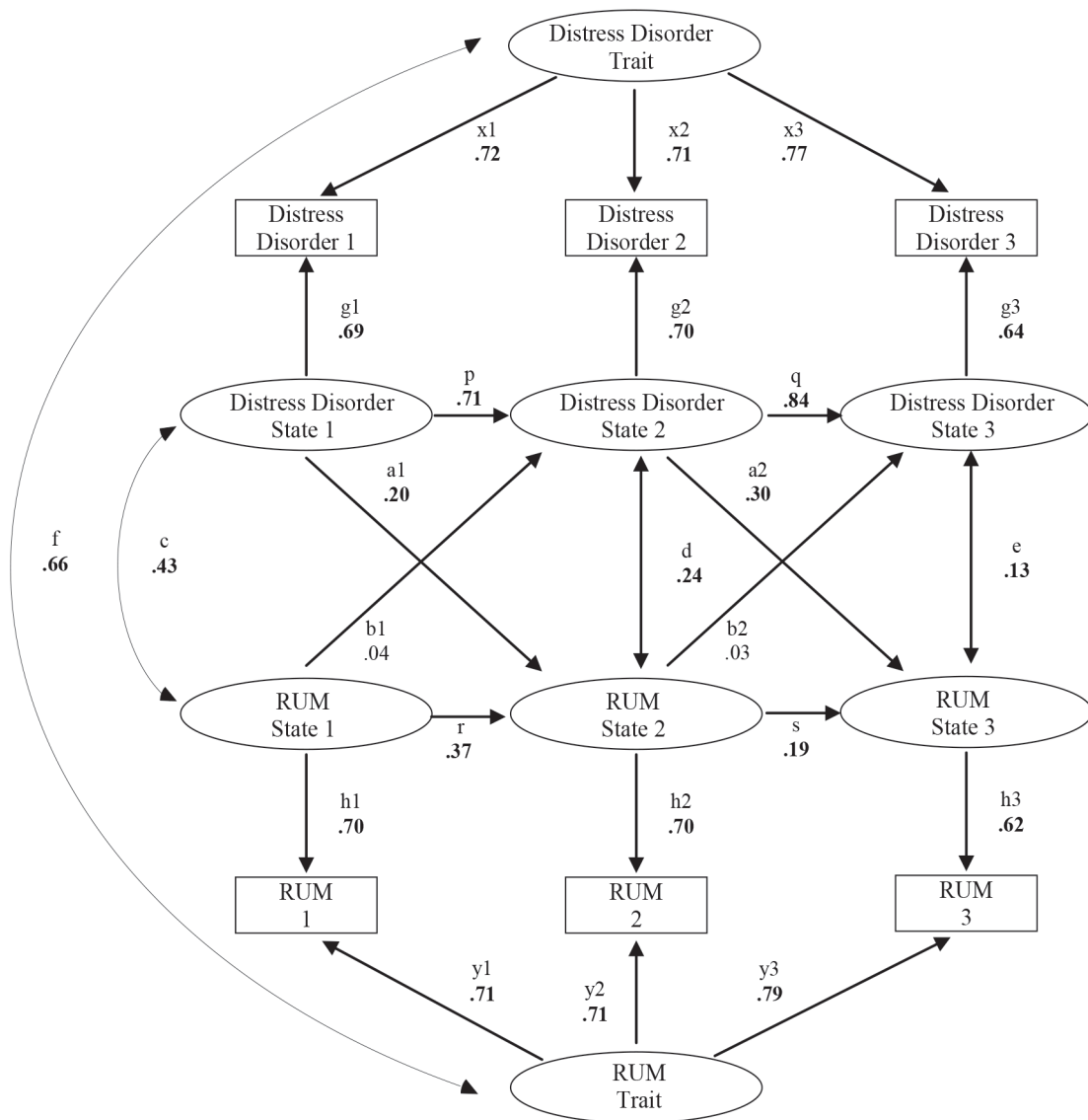
The estimated trait variance of Worry scores within the Fear-model (Figure 4) varied from 55% (.74²) at T1, to 58% (.76²) at T2 and 62% (.79²) at T3 indicating that over half of the between-subject differences in worry scores are stable over time. The remaining variance, i.e. state variance, consequently varied from 45% (.67²) at T1 to 42% (.65²) at T2 and 38%

Figure 2: Rumination and Fear T&S models linked at trait level via correlations between trait factors (f) and at state level through contemporaneous correlations (c,d,e,) and cross-variable 2-year lagged effects (a,b).



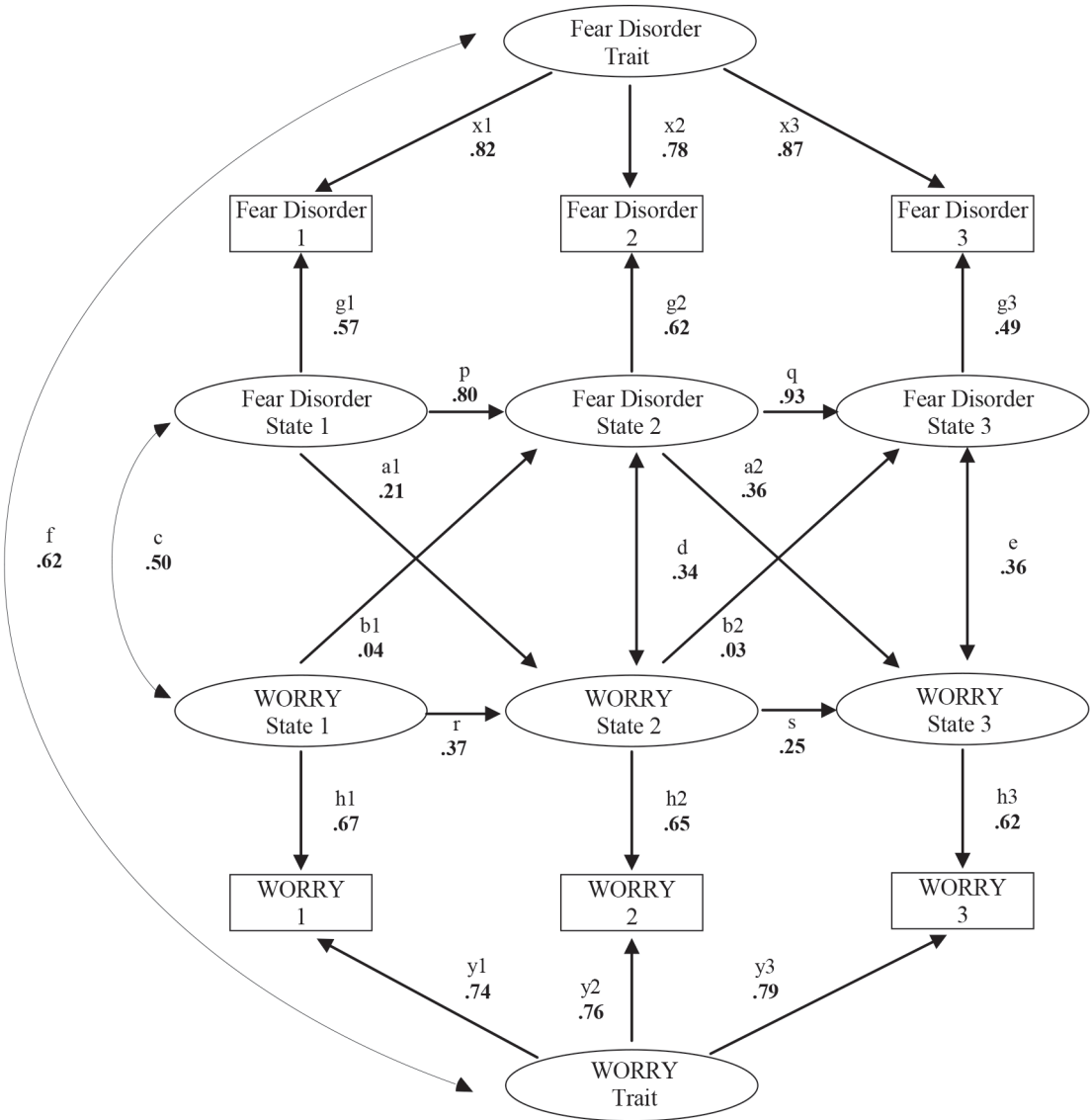
Note. Equality constraints applied to identify model equations were: $x1 = x2 = x3$; $y1 = y2 = y3$; $a1 = a2$; $b1 = b2$. Significant ($p < .05$) correlations and regression coefficients are depicted in bold.

Figure 3: Rumination and Distress T&S models linked at trait level via correlations between trait factors (f) and at state level through contemporaneous correlations (c,d,e) and cross-variable 2-year lagged effects (a,b).



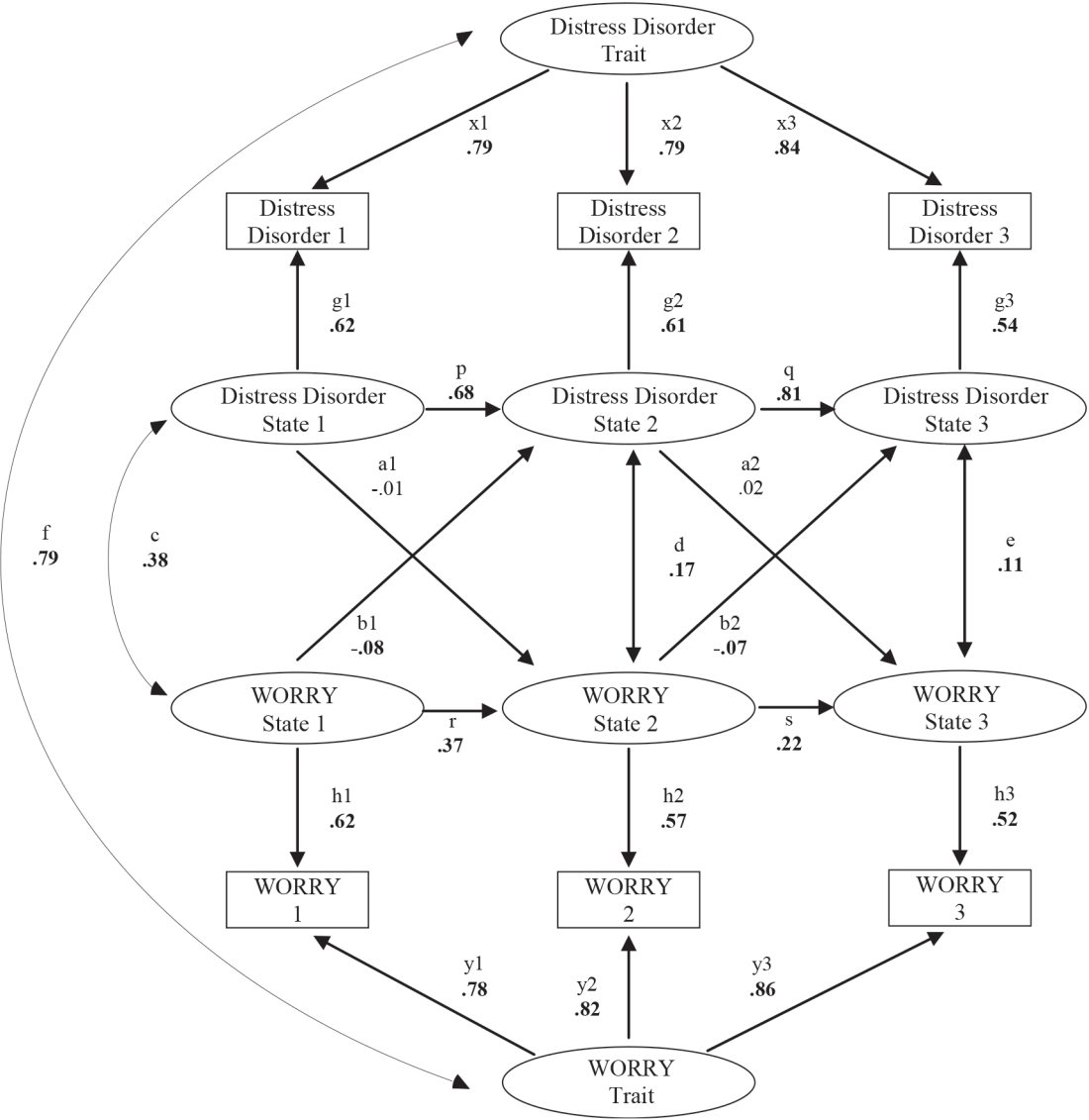
Note. Equality constraints applied to identify model equations were: $x_1 = x_2 = x_3$; $y_1 = y_2 = y_3$; $a_1 = a_2$; $b_1 = b_2$. Significant ($p < .05$) correlations and regression coefficients are depicted in bold.

Figure 4: Worry and Fear T&S models linked at trait level via correlations between trait factors (f) and at state level through contemporaneous correlations (c,d,e,) and cross-variable 2-year lagged effects (a,b).



Note. Equality constraints applied to identify model equations were: $x_1 = x_2 = x_3$; $y_1 = y_2 = y_3$; $a_1 = a_2$; $b_1 = b_2$. Significant ($p < .05$) correlations and regression coefficients are depicted in bold.

Figure 5: Worry and Distress T&S models linked at trait level via correlations between trait factors (f) and at state level through contemporaneous correlations (c,d,e) and cross-variable 2-year lagged effects (a,b).



Note. Equality constraints applied to identify model equations were: $x_1 = x_2 = x_3$; $y_1 = y_2 = y_3$; $a_1 = a_2$; $b_1 = b_2$. Significant ($p < .05$) correlations and regression coefficients are depicted in bold.

(.62²) at T3. In the Distress model (Figure 5) about two-thirds to three quarters of the total estimated variance in Worry scores can be accounted for by the trait rumination factor (scores ranging from 61% to 74%) with state variance scores consequently ranging from 26% to 39%.

The psychopathology parts of the T&S models revealed estimated trait variance for fear and for distress disorders scores comparable to those in the rumination models. Trait components of both psychopathology categories were strongly related to the trait component of worry, .62 for fear and .79 for distress disorders, demonstrating that worry is intertwined with these components.

The results of the cross-variable effects of the concurrent relationships (c, d, e) were all significant. In the fear model they were moderate to large in strength whereas in the distress model relationships were small to moderate. This suggests that state fluctuations in worry go more hand in hand with state fluctuations in fearfulness than with distress. Cross-variable lagged effects (a1, a2, b1, b2) in both the distress and the fear model were either non-significant or of negligible strength. The only exception was the effect of state fear on worry (.21 and .36) with more fear resulting in higher levels of worry 2 years later. In sum, state fluctuations in psychopathology are not driven by state fluctuations in worry and only for fear disorders do state fluctuations in psychopathology affect subsequent worry levels.

Discussion

The aim of the present study was to investigate how trait and state components of worry and rumination relate to each other and to emotional disorders (fear and distress). The 3-wave setup of our study design enabled us to separate trait and state effects and to examine the temporal and directional character of reciprocal effects. Results confirmed our expectation that trait components of worry and rumination are highly related and that fluctuations at state level occur in sync. Regarding repetitive negative thinking (RNT; worry & rumination) and emotional disorders we predicted that they would mutually reinforce each other over time, setting off a downward spiral. This hypothesis was not confirmed by the present study: fluctuations in psychopathology predicted state levels of worry/rumination 2 years later but not vice versa. Finally, we expected both worry and rumination to show stronger associations with distress disorders than with fear disorders. Results showed strong associations with both fear and distress disorders but as expected those with the distress disorders were the strongest. Overall, these results support the idea that worry and rumination contain a shared underlying process as well as that they both have transdiagnostic characteristics.

The relationship between worry and rumination was assessed in one comprehensive design using trait-state models which enabled us to operationalize each cognitive process as the function of a trait component, stable across time, and a state component reflecting fluctuations over the 4 year period. The trait variance was substantial across

waves (explained variance for worry: 59% - 67%; and for rumination 55% - 66%) suggesting the presence of a stable underlying trait. Moreover, the trait components of worry and rumination were highly correlated (.76) and at state level correlations between concurrently measured worry and rumination were of medium strength (.39 - .45). These findings support the idea that worry and rumination have a solid, shared, base.

The similarities between worry and rumination were further explored by examining whether worry and rumination differed in their relationships with psychopathology. The latent structure and stability of emotional disorders was as expected – and in accordance with previous studies (for a review see: Beesdo-Baum et al., 2009) – best represented by the distress (GAD, DYS, MDD) - fear (PAN, SAD, AGO) model allowing for analyses to be performed while taking comorbidity among these disorders into account. The latent factor scores derived for fear and distress disorders permitted us to examine reciprocal and temporal relationships of repetitive negative thinking (worry and rumination) with psychopathology. Traditionally worry is linked to GAD and rumination to MDD. Considering that both disorders are now placed within the distress disorders category it was expected that RNT would show stronger associations with the distress than the fear disorders. This was indeed the case although differences were modest and correlations between the trait components of RNT and psychopathology were strong in all four T&S models investigated. These results suggest that trait worry and trait rumination show similar relationships to both trait distress and trait fear disorders, which has several implications. Firstly, there is no differential effect of worry and rumination regarding fear and distress disorders, thus underlining the similarities of the two constructs. Secondly, repetitive negative thinking is involved in both distress and fear disorders even when GAD is grouped with the depressive disorders, hence supporting the notion of a transdiagnostic process (Harvey et al., 2004; Ehring & Watkins, 2008). It should be noted however, that the direction of the relationships between the trait components cannot be determined within our study design. It could reflect the influence of a third variable in line with the common cause model (e.g. genetic vulnerability) (for an explanation of the model see Klein, Kotov, & Bufferd, 2011) or for instance a directional relationship, c.q. predisposition model. There are studies supporting the predisposition model showing a causal relationship with repetitive negative thinking preceding changes in psychopathology (for an overview see Watkins, 2008; and Ehring & Watkins, 2008). Rumination has received more attention in this regard than worry (Topper, Emmelkamp, & Ehring, 2010). Our results suggest that it would be informative to conduct prospective studies on the nature and direction of the relationship of trait RNT (as also measured with generic measures for RNT, such as the Repetitive Thinking Questionnaire (RTQ; McEvoy, Mahoney, & Moulds, 2010) or the Perseverative Thinking Questionnaire (PTQ; Ehring et al., 2011)), with various emotional disorders while taking comorbidity into account.

By combining T&S models for psychopathology and repetitive negative thinking we were also able to examine whether state level fluctuations on either one led to state level fluctuations on the other. The 3-wave set up of our study provided a unique opportunity to examine both concurrent relations and lagged cross-variable effects. As is to be

expected the concurrent relations showed that state fluctuations in psychopathology were accompanied by state fluctuations in repetitive negative thinking in the same direction (positive correlations d and e). This is in line with experimental studies which have repeatedly shown that experimentally induced worry or rumination directly and negatively affects anxious and depressed mood states (e.g. Lyubomirsky, Caldwell, & Nolen-Hoeksema, 1998; McLaughlin, Mennin, & Farach, 2007). Similarly, in accordance with the 'differential activation' hypothesis of Teasdale (1988) and the 'mood state' hypothesis of Miranda and Persons (1988) latent dysfunctional attitudes have been found to become activated during sad mood.

Contrary to our expectations, analyses concerning cross-variable lagged (2-yr follow-up) effects at state level did not support our mutual reinforcement hypothesis. State fluctuations in worry and rumination were not predictive of state fluctuations in fear or distress levels two years later. However the opposite cross-variable lagged effects – state fluctuations in psychopathology on state fluctuations in repetitive negative thinking – were significant albeit small to moderate in strength.

Cognitive theory posits that change in cognition precedes change in symptoms of psychopathology, a view that has led to the development of therapies aimed at altering cognition (i.e. CBT) and the assessment of cognitive change in establishing treatment progress (e.g. Dozois, Covin & Brinker, 2003). However evidence for this supposition is not unequivocal as some studies have shown that cognitive change is not specific to therapies tackling cognitions and that this even occurs when using pharmacotherapy (e.g. Simons, Garfield, & Murphy, 1984). Moreover, and in line with our state level findings, it has been reported that changes in cognitive content during CBT are not predictive of changes in depressive symptoms (Jarrett et al., 2007). Also, it has been found that changes at cognitive level and changes in symptomatology occur in tandem and a recent review of cognitive mediation in CBT for anxiety disorders concluded that it is too early to conclude that cognitive changes cause improvement and that cognitive change is not a proxy for other third variables (Smits et al., 2012). The state-trait distinction may also be relevant in this context. Changes in state cognitions (such as negative automatic thoughts) may be primarily a reflection of changes at symptom level. However, as has been stressed in the earliest formulations of cognitive theory (Beck, 1967), it may well be that in order to establish long lasting changes in psychopathology it is necessary to alter underlying cognitive vulnerabilities (i.e., cognitive structures and schema's) which, when activated, give rise to momentary cognitive content c.q. negative automatic thoughts. The therapeutic relevance of altering stable underlying cognitive vulnerabilities instead of more time variant cognitions is in line with the present findings which show that RNT and psychopathology are highly interrelated at the trait level in particular.

Several limitations should be taken into account when interpreting the current results. Firstly, distress and fear disorders had to be analyzed in separate models and as a consequence results may have been confounded by the high comorbidity of these disorders. Secondly, attrition was not completely random. The response rate was 87.1%

at wave 2 and 80.6% at wave 3, and non-response was significantly higher among those with younger age, lower education, higher levels of psychopathology and higher levels of worry consequently somewhat restricting generalizability of study results. Thirdly, the present models did not differentiate between groups of first onset, current psychopathology and remitted anxiety/depression. These groups may show slightly different response patterns for instance due to scarring effects. Fourthly, rumination was assessed using the subscale 'rumination on sadness' of the LEIDS-R, an instrument measuring cognitive reactivity. There are several other questionnaires that measure rumination; results may differ depending on the instrument chosen. Finally, the present study did not include a generic RNT instrument. Therefore, our findings may not be representative of all types of repetitive negative thinking such as post-event processing.

The present study also has several strengths: i) a longitudinal design in a representative sample of participants with depressive and/or anxiety disorder from different recruitment settings; ii) use of a structured diagnostic interview to assess presence of depressive and anxiety disorders; iii) examining the structure of anxiety and depressive disorders instead of individual disorders separately; iv) use of trait and state model in analyzing temporal and reciprocal relationships of emotional disorders with RNT.

Conclusions

The present data show that worry and rumination have strong trait-like components, which are also strongly interrelated. Moreover, state fluctuations around set-point in worry level covary with state fluctuations in the level of rumination. These findings combined with the similar relationships of worry and rumination with emotional disorders are in line with the idea that they are conceptualizations of the same underlying process of repetitive negative thinking. Furthermore, the lack of differential relationships of worry and rumination with fear and distress disorders supports the notion that they can be conceptualized as transdiagnostic processes critically involved in emotional disorders.

However, we did not find support for the hypothesis that state fluctuations of RNT offset a downward spiral in which psychopathology and RNT mutually reinforce each other. State fluctuations in worry/rumination are preceded by state fluctuations in psychopathology but not vice versa. This pattern suggests that fluctuations in RNT may merely be epiphenomena of emotional disorders. From a clinical perspective it seems more pertinent to modify the underlying trait component(s) of worry and rumination in order to obtain enduring therapeutic benefits.

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Chapter 4

Repetitive negative thinking as a transdiagnostic factor in depression and anxiety: A conceptual replication

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Under revision *Behaviour Therapy and Research*

Abstract

Background: Comorbidity among affective disorders is high. Rumination has been found to mediate cross-sectional and prospective relations between anxiety and depressive symptoms in adolescents and adults. We examined whether rumination and worry, both forms of repetitive negative thinking, also explain the associations between affective disorders.

Method: Prospective cohort study. In a mixed sample of 2,981 adults (persons with a prior history of or a current affective disorder and healthy individuals) we assessed DSM-IV affective disorders (CIDI), rumination (LEIDS-R) and worry (PSWQ). All measures were repeated 2 years and 4 years later.

Results: Using structural equation models, we found that baseline rumination and worry partly mediated the association of baseline fear disorders (social anxiety disorder, panic disorder, agoraphobia) with distress disorders (dysthymia, major depressive disorder, generalized anxiety disorder). Moreover, baseline fear disorders predicted changes in distress disorders and changes in worry and rumination mediated these associations. The association between baseline distress disorders and changes in fear disorders was mediated by changes in rumination but not by changes in worry.

Conclusions: Repetitive negative thinking is an important transdiagnostic factor. Rumination and worry are partly responsible for the cross-sectional and prospective co-occurrence of affective disorders and may be suitable targets for treatment.

Introduction

Comorbidity of mental disorders is the rule rather than the exception, especially among anxiety and depressive disorders (Brown, Campbell, Lehman, Grisham, & Mancill, 2001). Efforts to unravel why there is such a high comorbidity rate have drastically increased in recent years, as has the call for broad and disorder transcending therapies (e.g. Fairburn, Cooper, & Shafran, 2003; Barlow, Allen, & Choate, 2004). Generally it is assumed that there are certain factors that are shared between multiple disorders, which not only contribute to the occurrence of a specific disorder but are also (in part) responsible for comorbidity among these disorders. Such disorder transcending factors are commonly referred to as transdiagnostic factors (e.g. Harvey, Watkins, Mansell, & Shafran, 2004; Ehring & Watkins, 2008). Better understanding of these shared factors is not only of theoretical importance, but also clinically relevant as it could lead to the development of more effective therapeutic interventions.

One of the main candidate cognitive processes involved in comorbidity among emotional disorders is repetitive negative thinking (RNT; Ehring & Watkins, 2008). In the anxiety literature RNT is referred to as worry, in the depression literature it is referred to as rumination. Both processes are characterized by uncontrolled, excessive and repetitive thinking about current concerns, problems, past experiences or worries about the future (Ehring & Watkins, 2008, p. 192). The main difference between the two is that worry is more future focused and rumination is more past focused (e.g. Smith & Alloy, 2009; Watkins et al., 2005). However, it has to be noted that this is a simplification; both processes contain both future- and past-related aspects (e.g. McLaughlin, Borkovec, & Sibrava, 2007). Furthermore, other differences between worry and rumination have also been reported (see Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008 for an overview). Research has shown that both worry and rumination scores are elevated across the emotional disorders (Chelminsky & Zimmerman; see Ehring & Watkins, 2008 for an overview regarding rumination) and that these scores are higher in individuals with multiple diagnoses than in individuals with a single diagnosis (McEvoy, Watson, Watkins, & Nathan, 2013). Although these findings are in line with a transdiagnostic account, the mere presence of these cognitive processes across disorders does not qualify them as causative factors, let alone causative of comorbidity. Evidence for their causal influence comes from experimental studies showing that RNT exacerbates depressed and anxious mood (e.g. McLaughlin, Borkovec, & Sibrava, 2007; Behar, Zullig, & Borkovec, 2005) as well as from prospective and longitudinal studies supporting RNT's involvement in the onset, maintenance and recurrence of both anxiety and depressive disorders (e.g. Just & Alloy, 1997, Nolen-Hoeksema, 2000; see Watkins, 2008 for an overview). However if RNT truly contributes to the high comorbidity rates among emotional disorders it should also mediate the relationship between anxiety and depressive disorders and vice versa. McLaughlin and Nolen-Hoeksema (2011) indeed found that rumination mediated the concurrent relationship of depression with anxiety symptoms in two large samples of adults and adolescents. Moreover, baseline depressive symptoms predicted subsequent

increases in anxiety and rumination fully mediated this association. This innovative study has a few limitations. It investigated anxiety and depression symptoms, not clinical diagnoses; and it only examined rumination and did not include other types of RNT (such as worry).

The aim of the present study is to test whether RNT also accounts for the comorbidity among emotional *disorders*, both cross-sectionally and longitudinally. In other words, we carried out a conceptual replication of McLaughlin and Nolen-Hoeksema (2011), by focusing on clinical diagnoses instead of symptoms and by examining two types of RNT –worry and rumination. We expected that both rumination and worry would account for the cross-sectional overlap of emotional disorders at baseline and would mediate the prospective cross-disorder relations among emotional disorders.

Methods

Participants and design

The Netherlands Study of Depression and Anxiety (NESDA) is an ongoing cohort study designed to investigate determinants, course and consequences of depressive and anxiety disorders. A sample of 2981 persons aged 18 through 65 years, consisting of healthy controls, persons with a prior history of depressive and anxiety disorders, and persons with a current depressive and/or anxiety disorder were included in the study. Respondents were recruited in the general population, through a screening procedure in general practice, or when newly enrolled in specialized health care in order to represent different health care settings and different developmental stages of psychopathology. General exclusion criteria were a primary diagnosis of other severe psychiatric disorders (e.g. psychotic, obsessive compulsive, bipolar or severe addiction disorder) and not being fluent in Dutch.

A detailed description of the NESDA design and sampling procedures is given elsewhere (Penninx et al., 2008). The baseline assessment included assessment of demographic and personal characteristics, a standardized diagnostic psychiatric interview and a medical assessment. This study reports on the baseline and the 2-yr and 4-yr follow-up assessments. The research protocol was approved by the Ethical Committees of participating universities and all respondents provided written informed consent.

Measures

Assessment of psychiatric diagnoses

The diagnostic status (6-month prevalence) of depressive [Major Depressive Disorder (MDD), Dysthymia (DYS)] or anxiety [Panic Disorder with or without Agoraphobia (PAN), Social Anxiety Disorder (SOC), Generalized Anxiety Disorder (GAD), Agoraphobia without panic (AGO)] disorders was established at T0, T2 and T4 using the Composite Interview Diagnostic Instrument (CIDI-WHO lifetime version 2.1; Ter Smitten, Smeets, & Van den Brink, 1998). The CIDI classifies diagnoses according to DSM-IV criteria (APA, 1994).

Trained interviewers can reach high interrater reliability, high test-retest reliability (Wacker, Battegay, Mulleijans, & Schlosser, 2006) and high validity for depressive and anxiety disorders (Wittchen, 1994). The CIDI was conducted by trained clinical research staff.

Questionnaires

Worry was measured with the Penn State Worry Questionnaire (PSWQ; Meyer, et al., 1990). This questionnaire consists of 16 items rated on a 5-point Likert scale ranging from '1 = not at all typical of me' to '5 = very typical of me'. The PSWQ has been proven to be a valid measure of trait worrying unaffected by the content of the worry (Davey, 1993; Molina & Borkovec, 1994) with high internal consistency, good test-retest reliability and unaffected by social desirability (Meyer, et al., 1990). The PSWQ consists of two subscales: a 'General worry' subscale (11 items) and a 'Not-worry' subscale (5 items) (van Rijsoort, Emmelkamp, & Vervaeke, 1999). The 'General worry' subscale is the strongest of the two (Meyer, et al., 1990; van Rijsoort, et al., 1999) and only this subscale was administered in the NESDA study. Internal consistency in the present study was high, namely $\alpha = .96$ at T0, T2 and T4.

Rumination was assessed with the subscale Rumination on Sadness of the revised version of the Leiden Index of Depression Sensitivity (LEIDS-R; Van der Does, 2002; Williams, et al., 2008). The LEIDS-R measures cognitive reactivity to sad mood and is a self-report instrument, which has been found to reliably discriminate between never-depressed and recovered depressed groups (e.g., Moulds, et al., 2008; Van der Does, 2002). The subscale Rumination on Sadness (RUM) consists of 6 items. Participants are asked to indicate whether and how their thinking patterns change when they experience mild dysphoria by scoring each item on a 5-point Likert-scale ranging from 0 'not at all' to 4 'very strongly' applicable to me. In the present sample the internal consistency of the RUM-scale was 0.82 at T0, 0.84 at T2 and 0.85 at T4.

Statistical analyses

Differences in rumination (LEIDS-R) and worry (PSWQ) baseline scores between psychopathology groups were analyzed with separate ANOVA's using five multiple imputed datasets to account for missing data on LEIDS-R and PSWQ. Significant main effects were followed-up by Bonferroni adjusted multiple comparisons. Next, structural equation models were fit using WLSMV parameter estimates in Mplus (version 7.0). Participants who did not participate in the 2-yr and/or 4-yr follow-up assessment were included in the analyses using all available pairwise present information. Standardized estimates, or path coefficients, with a theoretical range from zero (no effect) to + 1 (maximum positive or negative effect) are provided. Model fit was evaluated using the Tucker-Lewis Index (TLI), the Comparative Fit Index (CFI), and the Root Mean Square Error of Approximation (RMSEA). For the TLI and CFI, values between 0.90 and 0.95 are considered acceptable, and ≥ 0.95 as good. For the RMSEA, acceptable models have values of ≤ 0.10 , and good models of ≤ 0.05 .

In accordance with previous studies (for a review of the literature see Beesdo-Baum et al., 2009) and a previous confirmatory factor analysis (CFA) of the T0, T2 and T4

assessments of the six diagnostic variables (i.e., MDD, DYS, GAD, SAD, PAN, and AGO) as repeated measures in NESDA (Spinhoven et al., 2014), we choose the distress-fear model (Distress: MDD, DYS, GAD; Fear: PAN, SAD, AGO) to best represent the latent structure and stability of emotional disorders. Latent factor scores for distress and for fear disorders were used as dependent variables in further statistical analyses.

Next, we determined the role of rumination and worry as putative mediators of the cross-sectional relations of distress with fear disorders. More specifically, we determined whether the association of distress with fear disorders was attenuated after including both rumination and worry as independent variables into the prediction model.

Finally, we examined two longitudinal mediation models: one examining the role of rumination as a putative mediator of the longitudinal association of distress with fear disorders (and vice versa) and one examining the role of worry in these longitudinal relations. More specifically, we determined: 1) the association of T0 distress with T4 fear disorders (and vice versa); 2) the association of T0 distress/fear with T2 rumination/worry, controlling for T0 rumination/worry; 3) the association of T2 rumination/worry with T4 distress/fear, controlling for T0 distress/fear; and 4) the attenuation of the association of T0 distress with T4 fear after accounting for changes in rumination/worry from T0 to T2 (and vice versa). In this way we could analyze whether baseline distress disorders predicted changes in rumination/worry and whether these changes predicted subsequent changes in fear disorders (and vice versa). The significance of the indirect effect of fear disorders on distress disorders through changes in rumination/worry (and vice versa) was determined using a bootstrap approximation with 1000 iterations to obtain biased-controlled confidence intervals.

Results

Descriptive statistics

At baseline, we included 2,981 participants with a mean age of 41.9 years ($SD = 13.1$), a mean duration of education of 12.1 years ($SD = 3.3$); 66.4% was female. Face-to-face follow-up assessments were conducted with a response of 87.1% ($n = 2,596$) at 2-yr follow-up and 80.6% ($n = 2,402$) at 4-yr follow-up. At baseline, 1,701 participants had a current diagnosis: MDD = 37.4%, DYS = 10.2%, GAD = 15.6%, SAD = 22.3%, PAN = 22.5%, and AGO = 6.3%. As expected, comorbidity rates were high with 57.0% ($n = 725$) of the 1,273 participants with a 6-month recency distress diagnosis (MDD, DYS, GAD) meeting criteria for a fear disorder (SAD, PAN, AGO) and 62.9% of the 1,153 participants with a fear disorder having a comorbid distress disorder. Comorbidity rates at T4 were as follows: 43.6% ($n = 225$) of the 516 participants with a 6-month recency distress diagnosis fulfilled criteria for a fear disorder and 47.4% of the 475 participants with a fear disorder had a comorbid distress disorder.

We examined whether sample attrition had introduced response bias. Compared with completers, dropouts at 2-yr follow-up as well as at 4-yr follow-up were younger, less

educated, more often had an anxiety or depressive disorder at baseline, and also manifested higher levels of worry (PSWQ). There was no significant association of gender with attrition.

Table 1 presents descriptive statistics on rumination and worry in participants with no 6-month recency diagnosis ($n = 1280$), one or more fear disorders ($n = 428$), one or more distress disorders ($n = 548$), and comorbid fear and distress disorders ($n = 725$). Separate ANOVA's yielded a significant main effect for group on rumination ($F(3, 2977) = 335.49, p < .001$) and worry ($F(3, 2977) = 527.33, p < .001$). Subsequent Bonferroni adjusted comparisons showed that all groups differed significantly from each other (all $p < .001$) regards rumination and worry. In accordance with expectations the lowest scores were found in participants with no disorder and the highest scores in participants with comorbid disorders. Moreover, participants with distress disorders obtained higher scores than participants with fear disorders.

Table 2 presents the zero-order correlations of rumination and worry scores with factor scores for distress and fear disorders (see below). As hypothesized both rumination and worry were positively associated with each other and with distress and fear disorders, which were also positively associated with each other (all $p < .001$).

Measurement model

In line with expectations, CFA showed that a Distress-Fear (MDD, DYS, GAD vs. SAD, PAN, AGO) model — $\chi^2(110) = 201.1$; TLI = .99; CFI = .99; RMSEA = .02 — showed a good fit to the data (see Table 3 for factor loadings on the latent variables).

Mediation analysis

Cross-sectional analysis

T0 distress disorders were significantly associated with T0 fear disorders, $\beta = .84, p < .001$. The association of distress with fear disorders was attenuated, $\beta = .70, p < .001$, but remained significant after including T0 rumination and worry as predictors into the model (rumination: $\beta = .12, p < .001$, and worry: $\beta = .14, p < .001$).

Longitudinal analysis

Next, we analyzed the associations between T0 distress disorders and T4 fear disorders while controlling for T0 fear disorders (and vice versa). T0 fear disorders significantly predicted T4 distress disorders, controlling for T0 distress disorders, $\beta = .21, p < .001$. T0 distress disorders were associated significantly with T4 fear disorders, controlling for T0 fear disorders, $\beta = .07, p < .001$.

T0 fear was associated with T2 rumination, controlling for rumination at T0, $\beta = .15, p < .001$. T2 rumination was associated with T4 distress, controlling for T0 distress, $\beta = .14, p < .001$. In the final mediation model, T0 fear was no longer a significant predictor of T4 distress, controlling for T0 distress and T0 rumination, when T2 rumination was added to the model, $\beta = .11, p = .22$ (see Fig. 1). The covariance between T0 distress and fear and T0 rumination and both T0 distress and fear was accounted for in the final model. Fit indices

Table 1: Descriptive statistics on rumination (LEIDS) and worry (PSWQ) baseline scores in participants with no 6-month recency diagnosis, one or more fear disorders (SAD, PAN, AGO), one or more distress disorder (MDD, DYS, GAD) and comorbid fear and distress disorders (n = 2981)

Variables	1. No disorder (n = 1280)		2. Fear disorder (n = 428)		3. Distress disorder (n = 548)		4. Fear + Distress disorder (n = 725)		F-value (3, 2977)	Contrasts
	M	SD	M	SD	M	SD	M	SD		
LEIDS: Rumination	6.3	4.6	9.2	5.0	11.3	4.9	12.5	4.6	335.49	1<2<3<4
PSWQ: Worry	23.5	10.6	32.4	10.5	35.9	10.7	40.3	11.2	527.33	1<2<3<4

Note. MDD = Major Depressive Disorder; DYS = Dysthymia; GAD = Generalized Anxiety Disorder; SAD = Social Anxiety Disorder; PAN = Panic Disorder with or without Agoraphobia; AGO = Agoraphobia w/o panic; LEIDS = Leiden Index of Depression Sensitivity-Revised: Rumination subscale; PSWQ = Penn State Worry Questionnaire: General worry subscale; all Bonferroni adjusted comparisons < .001. Because of missing T0 values on LEIDS (n = 368) and PSWQ (n = 363) and assuming data are missing at random (MAR) five multiple imputed datasets were created and Table 2 presents the pooled estimates for M, SD, F-value and Contrasts. A completers analysis yielded identical results.

Table 3: Factor loadings on the latent variables for the distress-fear CFA solution (n = 2981)

Indicator	Distress			Indicator			Fear		
	T1	T2	T3	T1	T2	T3	T1	T2	T3
MDD	.81	.85	.82	SAD	.72	.76	.69		
DYS	.81	.86	.83	PAN	.66	.69	.62		
GAD	.69	.73	.70	AGO	.39	.41	.37		

Note. MDD = Major Depressive Disorder; DYS = Dysthymia; GAD = Generalized Anxiety Disorder; SAD = Social Anxiety Disorder; PAN = Panic Disorder with or without Agoraphobia; AGO = Agoraphobia w/o panic.

Table 2: Zero-order correlations between rumination, worry and distress and fear disorders (n = 2981)

Variables	1	2	3	4	5	6	7	8	9	10	11
1. LEIDS, Rumination T0	-										
2. PSWQ, Worry T0	.63	-									
3. CIDI, Distress T0	.63	.73	-								
4. CIDI, Fear T0	.52	.68	.70	-							
5. LEIDS, Rumination T2	.73	.54	.53	.46	-						
6. PSWQ, Worry T2	.57	.75	.59	.58	.62	-					
7. CIDI, Distress T2	.53	.57	.69	.48	.60	.67	-				
8. CIDI, Fear T2	.50	.59	.59	.81	.54	.67	.76	-			
9. LEIDS, Rumination T4	.65	.52	.53	.45	.70	.57	.56	.52	-		
10. PSWQ, Worry T4	.51	.67	.54	.52	.54	.75	.56	.53	.66	-	
11. CIDI, Distress T4	.46	.55	.61	.51	.52	.63	.76	.62	.59	.67	-
12. CIDI, Fear T4	.49	.56	.59	.80	.53	.64	.65	.86	.58	.68	.81

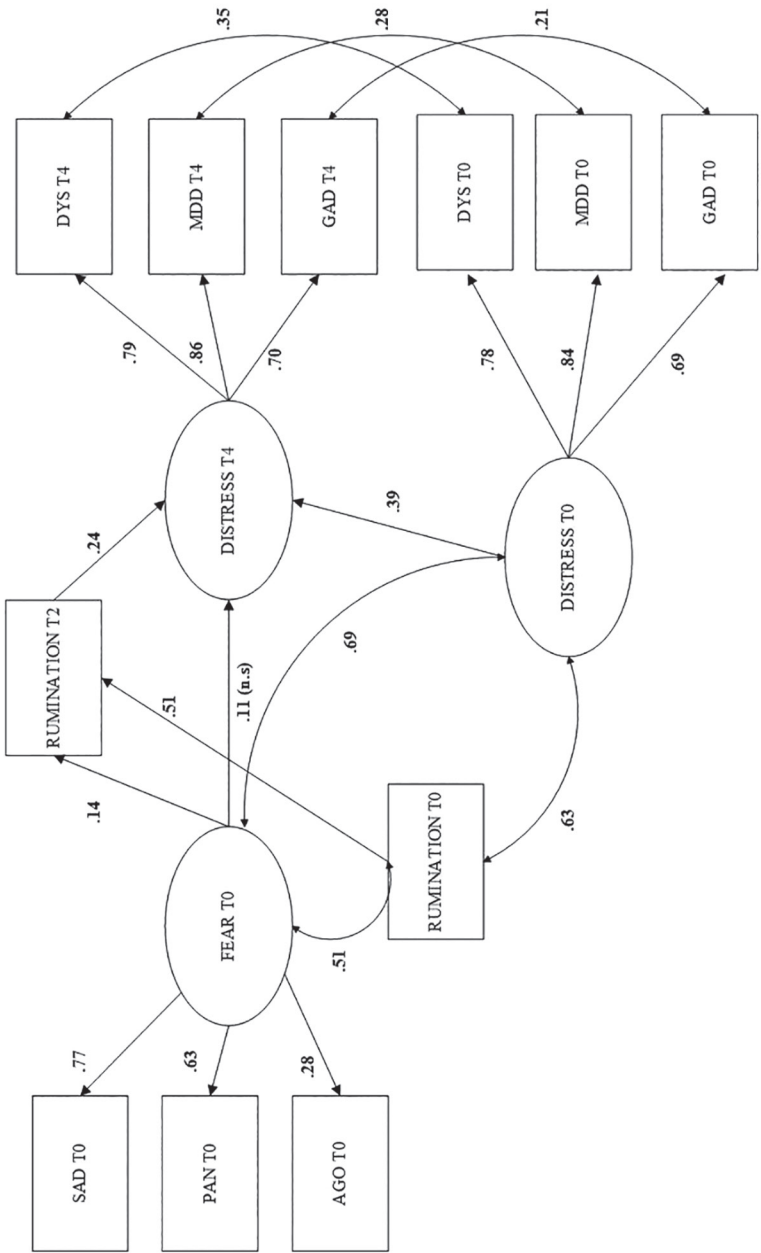
Note: LEIDS = Leiden Index of Depression Sensitivity-Revised: Rumination subscale; PSWQ = Penn State Worry Questionnaire: General worry subscale; CIDI = Composite Interview Diagnostic Instrument, version 2.1; Distress = combined factor scores for Dysthymia, Major Depression, Generalized Anxiety; Fear = combined factor scores for Social Anxiety, Panic, Agoraphobia; T0 = baseline; T2 = 2-yr follow-up; T4 = 4-yr follow-up; all $p < .001$.

indicated that the model showed an excellent fit to the data: $\chi^2(37) = 103.1$; TLI = .99; CFI = .98; RMSEA = .02. Bootstrapping estimates showed that the indirect effect of fear through rumination on distress ($\beta = .03$; 99% BCI = .01 - .06) was significant. Repeating this analysis in participants with complete CIDI and LEIDS data at T0 (n = 2618) gave similar results.

Subsequently, we analyzed worry as a putative mediator of the longitudinal fear – distress association in a similar way. T0 fear was associated with T2 worry, controlling for worry at T0, $\beta = .15$, $p < .001$. T2 worry was associated with T4 distress, controlling for T0 distress, $\beta = .17$, $p < .001$. In the final mediation model, T0 fear was no longer a significant predictor of T4 distress, controlling for T0 distress and T0 worry, when T2 worry was added to the model, $\beta = .04$, $p = .70$ (see Fig. 2). Fit indices indicated that the model showed an excellent fit to the data: $\chi^2(37) = 105.80$; TLI = .99; CFI = .98; RMSEA = .02. Bootstrapping estimates showed that the indirect effect of fear through rumination on distress ($\beta = .06$; 99% BCI = .01 - .11) was significant. Repeating this analysis in participants with complete CIDI and PSWQ data across waves (n = 2613) gave similar results.

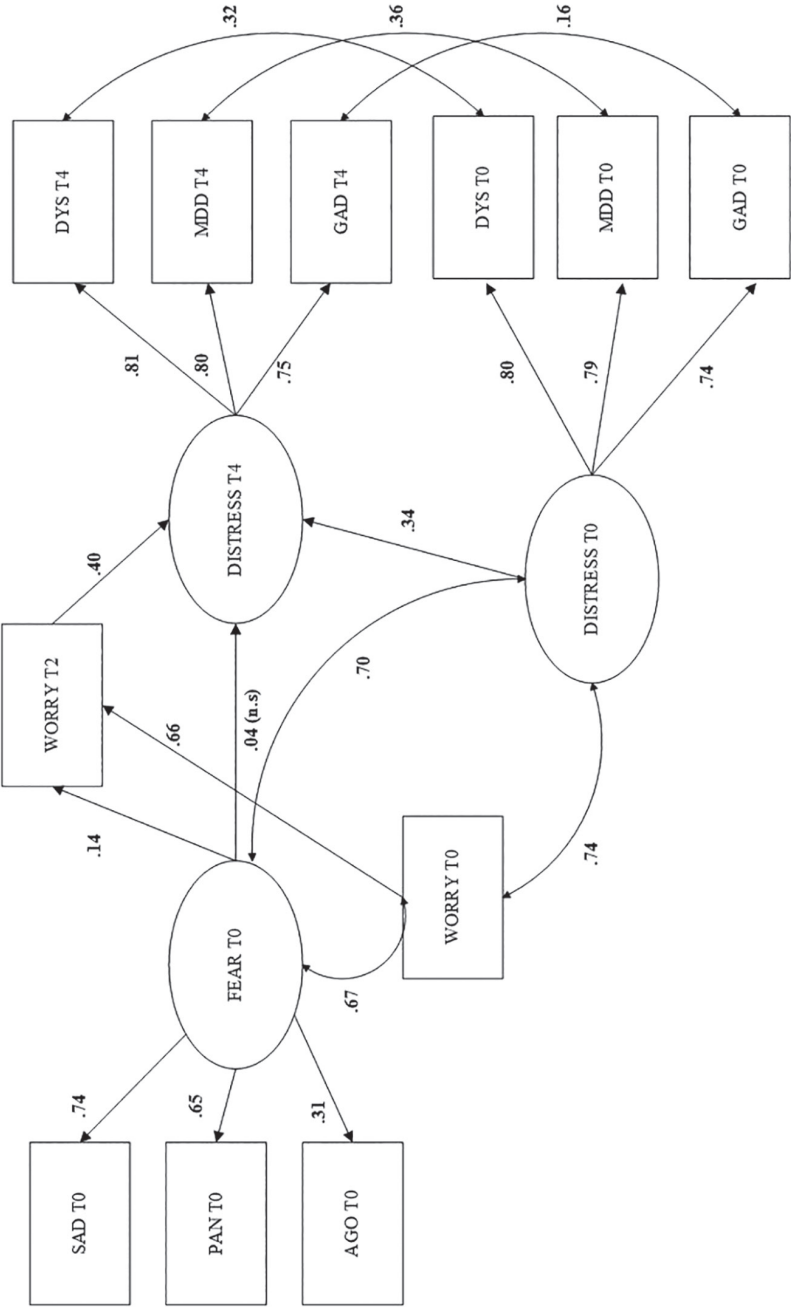
Next, we examined rumination and worry as putative mediators of the longitudinal distress – fear association. These analyses showed that the very small direct standardized path coefficient (β) of .07 became insignificant ($\beta = -.06$, $p = .62$) after including T2

Figure 1: Longitudinal mediation model of rumination mediating fear and distress disorders



Note: Parameter estimates for the longitudinal mediation model of rumination mediating the prospective relations between fear and distress disorders in 2981 participants from the Netherlands Study of Depression and Anxiety (NESDA). Squares represent observed variables and ovals latent variables. Single-headed arrow path coefficients represent standardized partial regression coefficients. Two-headed arrows represent correlation coefficients. Loadings, standardized estimates, or path coefficients, with a theoretical range from zero (no effect) to + 1 (maximum positive or negative effect) are provided. MDD = Major Depressive Disorder; DYS = Dysthymia; GAD = Generalized Anxiety Disorder; SAD = Social Anxiety Disorder; PAN = Panic Disorder with or without Agoraphobia; AGO = Agoraphobia w/o panic. T0 = baseline; T2 = 2-yr follow-up; T4 = 4-yr follow-up. All parameter estimates were significant at $p < .001$, except the association of Fear T0 – Distress T4 ($p = .22$), DYS T0-DYS T4 ($p < .01$), MDD T0 – MDD T4 ($p < .05$) and GAD T0 – GAD T4 ($p < .05$).

Figure 2: Longitudinal mediation model of worry mediating fear and distress disorders



Note: Parameter estimates for the longitudinal mediation model of worry mediating the prospective relations between fear and distress disorders in 2981 participants from the Netherlands Study of Depression and Anxiety (NESDA). Squares represent observed variables and ovals latent variables. Single-headed arrow path coefficients represent standardized partial regression coefficients. Two-headed arrows represent correlation coefficients. Loadings, standardized estimates, or path coefficients, with a theoretical range from zero (no effect) to + 1 (maximum positive or negative effect) are provided. MDD = Major Depressive Disorder; DYS = Dysthymia; GAD = Generalized Anxiety Disorder; PAN = Social Anxiety Disorder; PAN = Panic Disorder with or without Agoraphobia; AGO = Agoraphobia w/o panic. T0 = baseline; T2 = 2-yr follow-up; T4 = 4-yr follow-up. All parameter estimates were significant at $p < .001$, except the association of Fear T0 – Distress T4 ($p = .70$), GAD T0 – GAD T4 ($p = .13$) and DYS T0 – DYS T4 ($p < .05$).

rumination or T2 worry ($\beta = -.06$, $p = .63$) into the model (figures not shown). Subsequent bootstrapping indicated a significant indirect effect of distress at T0 through rumination at T2 on fear at T4 (β indirect effect = .03; 99% BCI = .01 - .06). The indirect effect through worry at T2, however, was not significant (β indirect effect = .03; 95% BCI = -.01 - .06).

Discussion

Our findings indicate that 1) repetitive negative thinking in the form of rumination and worry partly accounts for the concurrence of distress and fear disorders; 2) baseline fear disorders predicted changes in distress disorders and vice versa; and 3) changes in rumination mediated these longitudinal associations, and changes in worry mediated the fear $\rightarrow$ distress association but not the distress $\rightarrow$ fear association.

Our baseline findings showed that worry and rumination scores were elevated in both the fear and distress group when compared to participants with no current emotional disorder. Moreover, participants with distress disorders obtained higher scores than participants with fear disorders. This is not surprising as the disorders typified by the presence of worry (GAD) and rumination (MDD) were both represented in the distress disorder group. Critically, worry and rumination levels were particularly high in those with comorbid fear and distress diagnoses. This finding is in line with results from the McEvoy et al. (2013) study and supports the transdiagnostic hypothesis, which assumes that higher levels of RNT are associated with higher levels of comorbidity.

An additional step in exploring whether worry and rumination are transdiagnostic factors was to determine whether both cognitive processes explained the cross-sectional and longitudinal associations between fear and distress disorders. Cross-sectional results revealed that worry and rumination partly mediated the co-occurrence of fear and distress disorders. Although promising, this does not shed light on the direction of the relationship and whether changes in worry or rumination mediate the longitudinal relationship between fear and distress disorders and vice versa. Our longitudinal data provided more insight into this question. Worry and rumination both significantly mediated the longitudinal association between baseline (T0) fear disorders and later (T4) distress disorders. Importantly, the three time-point set up of our study allowed for the mediator to reflect *change* in worry/rumination scores. So, fear disorders (T0) predicted change (T0-T2) in worry/rumination scores, and this change in worry/rumination scores subsequently predicted changes in distress disorders (T4). These mediation results suggest that the increased risk of a future distress disorder when suffering from a fear disorder is partly attributable to worry and rumination. Partly attributable, as the mediation effects are small. The same applies for the longitudinal distress (T0) $\rightarrow$ fear (T4) association with the exception that only rumination significantly mediated this association and worry did not.

The results from the present study suggest that RNT in the form of worry and rumination is indeed involved in the high comorbidity between fear and distress disorders.

This support for the transdiagnostic account suggests that transdiagnostic treatments could benefit from including interventions aimed at reducing RNT. With regards to treatments specifically targeting worry and rumination, several options are available. Worry has received most attention, probably because it is the key feature of GAD. The most well-known treatment targeting worry is metacognitive therapy (Wells, 1999), which has proven to be reasonably successful (e.g. Wells & King, 2006; Van der Heiden, Muris, Van der Molen, 2012). Rumination on the other hand has only recently started to receive attention as a specific element that needs to be targeted in therapy. Results from rumination focussed cognitive behavioural therapy (Watkins et al., 2007) are promising, and in line with the transdiagnostic hypothesis, also reduced the prevalence of comorbid disorders (Watkins et al., 2011). These positive therapeutic results combined with findings on the role of worry and ruminations in the onset, maintenance and recurrence of emotional disorders indicate that RNT is an important candidate transdiagnostic process, which should be seriously considered when developing transdiagnostic therapies for emotional disorders. As yet it is still unclear where transdiagnostic therapies fit within the present therapeutic landscape and how they relate to the popular evidence based disorder specific interventions. There are several options: they could (i) replace disorder specific therapies, (ii) be used as a pre-therapy preceding the 'real' disorder focussed therapy, or (iii) function as the main therapy followed by a few sessions targeting disorder specific elements. Currently, the overall consensus seems to be that they should be complementary as they are very unlikely to outperform disorder specific, tailored, interventions (Clark, 2009).

The present study has several strengths. It has a longitudinal design and a representative sample of participants with depressive and / or anxiety disorder(s) from different recruitment settings. Furthermore, structured diagnostic interviews are used to assess presence of depressive and anxiety disorders instead of using only self-report measures of psychopathology.

Our study also has a few limitations that should be kept in mind when interpreting the results. Most importantly, mediation effects are relatively small. This is in line with findings from the McLaughlin and Nolen-Hoeksema (2011) study where the indirect effect was of a comparable small magnitude. Thus although RNT seems to be a factor involved in explaining comorbidity, it only accounts for a part of it. These results therefore warrant the search for additional factors influencing the occurrence of comorbidity. Secondly, we used a fear-distress measurement model to categorize the disorders as this model showed the best fit to repeated CIDI diagnoses in NESDA, but a DSM-IV based anxiety-depression measurement model might have yielded different results due to the high comorbidity between GAD and MDD (now both subsumed under distress disorders). A third limitation concerns the limited number of clinical diagnoses included in the present study. Emotional disorders such as PTSD and OCD were not represented, neither were other disorders known for elevated levels of RNT among which pain disorders, eating disorders and hypochondria (for an overview of disorders with elevated RNT levels see Ehring & Watkins, 2008). Finally, the present study did not include a generic RNT instrument. Therefore, our findings may not be representative of all types of repetitive negative thinking such as

post-event processing. Also, we did not measure other candidate transdiagnostic factors like perfectionism (for an overview see Egan, Wade, & Shafran, 2011) and intolerance of uncertainty (e.g. Mahoney & McEvoy, 2012).

Overall, the findings from the present study suggest that repetitive negative thinking in the form of rumination or worry constitutes an important transdiagnostic factor responsible for the co-occurrence of emotional disorders. In transdiagnostic treatment interventions for emotional disorders it seems warranted to include interventions specifically targeting this transdiagnostic factor.

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Chapter 5

**The influence of abstract/concrete thinking on social
problem solving in high and low worriers**

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Abstract

The reduced concreteness theory (Stöber, 1998) postulates that worry is characterized by an abstract, predominantly verbal, thinking style which interferes with successful emotional processing of threat-related material and impairs social problem solving (SPS). Experiment 1 investigated whether high trait worriers (N = 40) adopt a more abstract thinking style compared to low trait worriers (N = 40) during the phase of solution generation and whether concreteness training improves SPS. Experiment 2 was a replication of the first study (high trait worriers N = 49, low trait worriers N = 48) extended to examine other aspects of SPS related to worry: problem orientation, problem solving style and problem solving confidence. Results did not confirm the reduced concreteness hypothesis but did reveal differences in problem solving orientation, style, and confidence. These results, combined with results from previous studies showing reduced concreteness in the problem analysis phase, suggest that high trait worriers' SPS skills are intact and that impairments lie within the early stages of SPS.

Introduction

Worry, both pathological and non-pathological, has been subject to an extensive debate about its functions, dysfunctions, and underpinning mechanisms. One of the main theories in the field is the Avoidance Theory of worry (Borkovec, Ray, & Stöber, 1998). This theory postulates that worry is a form of cognitive avoidance, which operates via the reduction of aversive imagery with the purpose to avoid somatic anxiety reactions. This process of avoidance however interferes with successful emotional processing of threat related material (Foa & Kozak, 1986) and, thereby, inhibits closure on worry topics, maintaining anxiety/worry. The theory is based upon studies showing that worry is a predominantly verbal thought (rather than imagery-based) activity, and that the percentage of imagery is greatly reduced when engaging in worry instead of a relaxation condition (Borkovec & Inz, 1990; East & Watts, 1994; Freeston, Dugas, & Ladouceur, 1996). Moreover, individuals with Generalized Anxiety Disorder (GAD) report less imagery than non-psychiatric controls both during worry and relaxation (Borkovec & Inz, 1990). In turn, it has been found that verbal thought activity yields significantly less cardiovascular fear responses than imagery (Vrana, Cuthbert, & Lang, 1986) leading to the hypothesis that verbal worry might be an attempt to avoid the physiological sensations that accompany aversive imagery.

However, the avoidance theory does not address the question of how worrying leads to reduced imagery. A possible explanation comes from the Reduced Concreteness theory of worry (Stöber, 1998; Stöber & Borkovec, 2002). This theory posits that the mediator between worrying and reduced imagery is reduced concrete thinking (increased abstract thinking), which is presumed to be characteristic of worry. *Concrete thinking* is defined as "distinct, situationally specific, unequivocal, clear, singular" whereas *abstract thinking* is described as "indistinct, cross-situational, equivocal, unclear, aggregated" (Stöber & Borkovec, 2002, p. 92). Paivio and Marschark (1991) found that the concreteness of words and sentences is related to the quality of imagery and that abstract thinking not only evokes less imagery but also less vivid imagery. Hence, the Reduced Concreteness theory hypothesizes that it is the relatively abstract style of thinking during worry which is responsible for reduced aversive visual imagery, which in turn contributes to the maintenance of worry.

Empirical evidence for a relatively abstract thinking style during worry comes from a series of experiments by Stöber et al. (1996; 2000). These studies revealed that problem elaborations of worry-topics were less concrete than those of non-worry topics and that concreteness showed an inverse linear relation with the level of worry (Stöber, et al., 2000). These findings in nonclinical student samples were extended to a clinical GAD sample. Pre-treatment problem descriptions of GAD patients were less concrete than those of normal controls (Stöber & Borkovec, 2002), consistent with the Reduced Concreteness theory. However, all of these studies focussed on concreteness of problem elaboration or brief worry descriptions during the problem analysis phase. Two recent studies by Goldwin and Behar (2012) and Behar et al. (2012) focussed

on concreteness of thought during periods of idiographic worry. Results were mixed. Although findings confirmed the assertion that worry is characterized by reduced concreteness, only one of the studies found that level of concreteness was related to imagery-based activity.

The focus on concreteness during problem solving is also consistent with another putative function of worry – as an attempted social problem solving (SPS) strategy (e.g. Borkovec, Robinson, Pruzinsky, & Depree, 1983). In its pathological form, worry has been hypothesized to reflect thwarted problem solving (Davey, Hampton, Farrell, & Davidson, 1992; Davey, 1994). Successful problem solving is believed to require a number of elements including an accurate problem analysis, the generation, and then evaluation and implementation of accurate problem solving steps (D’Zurilla & Nezu, 1982). Concrete thinking is a prerequisite for these elements: Concrete problem definitions and well-tailored solutions are indispensable for problem solving success. Although the Reduced Concreteness theory was originally formulated in reference to worry, the considerable similarities and overlap between worry and rumination led Stöber and Borkovec (2002) to hypothesize that the theory also applied to depression. This view was shared by Watkins and Moulds (2005), who examined the effects of inducing abstract versus concrete ruminative thinking prior to solution generation in patients with depression versus never-depressed controls. Before the induction, depressed individuals provided more abstract and less effective solutions than never depressed individuals. Furthermore, relative to the abstract thinking style, the concrete thinking style enhanced problem solving in the depressed patients.

In light of the hypothesis that pathological worry is a thwarted problem solving attempt and the robust observation of reduced concreteness in the problem analysis phase in worriers (Stöber, 1996; Stöber et al., 2000; Stöber & Borkovec, 2002), a logical next step is to investigate the influence of reduced concreteness on the next phase within the problem solving process: i.e., the solution generation phase. Critically, although the reduced concreteness theory predicts that reduced concreteness of thinking during worry will impair problem-solving, this prediction has not yet been directly tested. To date, the only evidence that concreteness of thinking influences problem solving is in patients with depression (Watkins & Baracaia, 2002; Watkins & Moulds, 2005). The current study will therefore provide the first test of this key prediction of the reduced concreteness theory in worry. The present study has two main aims. Firstly, to investigate whether high and low trait worriers differ in the thinking style they adopt during the problem solving phase of solution generation. Secondly, to examine whether inducing a concrete thinking style results in improved problem solving skills relative to an abstract thinking style. Following Watkins and Moulds (2005), we hypothesize that high trait worriers will adopt a relatively abstract thinking style during solution generation and will produce relatively abstract and less effective solutions compared to low trait worriers. Furthermore, we hypothesize that the concreteness training will improve problem solving in high trait worriers relative to abstract thinking.

Experiment 1

Method

Participants and design

A total of 317 students were screened using the Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990) and the depression subscale of the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983). Those with a HADS-depression score of 8 or higher and those using anti-depressant medication were excluded. In order to compare a control group with low levels of worry with a group of high levels of worry similar to GAD patients, only students scoring at one of the extreme ends of the PSWQ (bottom/top quartiles) were invited to participate. In total 80 participants were included, 40 in each group. They were randomly allocated to one of the manipulation conditions (abstract versus concrete conditions), resulting in a 2×2 factorial between-subject design with 20 participants in each cell.

Materials

Questionnaires

PSWQ

The Penn State Worry Questionnaire (PSWQ; Meyer, et al., 1990) is a commonly used measure of trait worry consisting of 16-items rated on a 5 point Likert scale (1 = not at all typical of me, to 5 = very typical of me). The PSWQ has been proven to be a valid measure of trait worry unaffected by the content of the worry (Davey, 1993; Molina & Borkovec, 1994) with high internal consistency, good test-retest reliability, and unaffected by social desirability (Meyer, et al., 1990). Internal consistency in the present study was high, namely $\alpha = .96$ in the total sample.

HADS

The Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) is a 14-item self-report questionnaire consisting of two subscales measuring anxiety (7-items) and depression (7-items). Internal consistency, discriminant and concurrent validity, and test-retest reliability are satisfactory (Bjelland, Dahl, Haug, & Neckelmann, 2002; Spinhoven, et al., 1997). In the present study internal consistency (total sample) of HADS-A was $\alpha = .70$ and of HADS-D $\alpha = .69$.

Thinking style measures (VAS)

Visual Analogue Scales (VAS, 100 mm) were used to assess abstractness of thinking style before and after the experimental task (cp Watkins & Teasdale, 2001). One scale measured the *proportion of thoughts concerned with trying to understand, explain, or make sense of things* (not at all – extremely) and the other measured to what extent *thoughts were of a verbal form as opposed to visual images* (completely verbal/not at all visual – not at all verbal/completely visual). Assessment prior to the experimental task referred to thinking ‘right now’ and the second assessment to thinking ‘during the task’.

Manipulation

Unlike Watkins and Moulds (2005) who applied a depression-relevant manipulation that induced abstract/concrete ruminative thinking, the present study used a previously validated manipulation to induce an abstract/concrete thinking style (Watkins, Moberly, & Moulds, 2008). Training material consisted of 15 positive and 15 negatively valenced scenarios; each approximately three sentences in length. Scenarios were balanced for valence to ensure that the training condition was not a mood induction and more importantly, to train participants in applying the thinking style method in both positive and negative situations. Participants were instructed to spend one minute concentrating on each event. In line with Watkins et al. (2008), the order of the written scenarios was randomized with the constraint that there were no more than three scenarios of the same valence presented consecutively.

Participants in the abstract condition were instructed as follows for each scenario: "I would like you to think about why it happened, and to analyze the causes, meanings, and implications of this event." In the concrete condition, participants received the following instruction for each scenario: "I would like you to focus on how it happened, and to imagine in your mind as vividly and concretely as possible a 'movie' of how this event unfolded." Training conditions were not expected to differ in their influence on self-focus as conditions were matched for degree of self-reference.

The main training was preceded by a practice phase during which participants applied their assigned thinking style on the same (negative) practice scenario and described what they were thinking. Where necessary, further feedback and practice were given before the main training started.

Worry Domain – Means-Ends Problem Solving task (WD-MEPS)

The Means Ends Problem Solving task (MEPS) examines social problem solving skills by measuring the ability to conceptualize step-by-step means (strategies) when attempting to achieve a given goal. Participants are presented with a problem situation and asked to find the ideal strategy for overcoming the problem situation and thereby reach a given ending (Marx, Williams, & Claridge, 1992). The MEPS has shown satisfactory internal consistency (from .80 to .84) and construct validity (e.g. Platt & Spivack, 1972, 1975).

In the present study a modified version was used; the Worry Domain-MEPS (WD-MEPS). It is based on four worry domains common in GAD patients: rejection, responsibility, confrontation and relationships. The structure of the scenarios was kept as similar as possible to the original version. A pilot study showed that when conducted in a random student sample ($N = 20$) scores on the original MEPS and WD-MEPS did not differ significantly. To ensure personal relevance which is important for worry in GAD (Stöber, et al., 2000), each individual rated themes of twelve different scenarios (three in each domain) on relevance to their personal situation. The 7 point Likert rating scale ranged from 1 *completely irrelevant* to 7 *completely relevant*. The four scenarios with the highest scores were then selected for the experiment. An example scenario is:

"One day at work your boss announces that pretty soon you are going to take on a quite innovative project. You feel that this will be a rather challenging experience for you, as it concerns a field you are not familiar with. Furthermore, you will be in charge of a sizeable group of colleagues. The story ends with your boss being satisfied with your work. Begin the story after the announcement of the new project."

The experimental phase was preceded by a practice phase to ensure understanding of the task. Instructions and scenarios were presented in written format and participants were requested to provide written answers. These were scored for the *number of discrete steps* that are effective in enabling them to reach the goal and for *effectiveness of the strategy*. Effectiveness was rated on a 7-point Likert-type scale ranging from 1 (*not at all effective*) to 7 (*extremely effective*) (e.g. Marx, et al., 1992). A solution was considered effective if it maximized positive and minimized negative short- and long-term consequences, both personally and socially (D'Zurilla & Goldfried, 1971). In order to assess the thinking style applied during the task, answers were also rated for how abstract/concrete they were. This was rated on a 5-point Likert scale ranging from 1 (*abstract*) to 5 (*concrete*) (Stöber, et al., 2000). There was moderate to good inter-rater reliability with an independent second judge, both unaware of group or condition (ICC means: .902, ICC effectiveness: .830 and for abstract/concrete ratings the ICC was .687, based on agreement on a random selection of 10% of responses).

Procedure

Participants signed an informed consent and completed the HADS anxiety and depression scale. A practice item and two of the selected WD-MEPS-stories were completed at pre-manipulation followed by VASs measuring thinking style. Participants then received a practice phase of the manipulation task. Once an adequate level of understanding had been reached they worked through either the abstract or concrete thinking style manipulation (their allocated thinking style manipulation). Post- manipulation participants were again presented with VASs measuring thinking style followed by the two remaining WD-MEPS scenarios. The order of the WD-MEPS scenarios presented at pre and post manipulation was pseudo-random with the two most relevant scenarios always divided over pre and post. Participants were debriefed, thanked for their participation and received either course credits or a small payment.

Statistical Analyses

The main hypotheses were tested using: (1) ANCOVA to compare baseline abstract/concreteness scores between high and low worriers; (2) repeated measures ANOVAs investigating if alterations to the thinking style generated the expected changes in problem solving skills. An alpha level of .05 was used for all statistical tests and all analyses were corrected for gender differences (see below). Analyses were conducted using PASW Statistics package 17.0 (SPSS, INC, Chicago, Illinois, 2009).

Table 1: Experiment 1- Means and standard deviations for measures of abstract/concreteness and problem solving skills

Dependent Variable	Time	High trait worriers				Low trait worriers			
		Abstract		Concrete		Abstract		Concrete	
		M	SD	M	SD	M	SD	M	SD
VAS 1	Premanipulation	51.70	26.49	48.35	24.22	53.10	25.32	52.05	27.16
	Postmanipulation	44.30	30.46	59.75	22.75	39.60	25.87	67.40	22.11
VAS 2	Premanipulation	70.15	22.53	59.40	23.39	57.90	25.13	65.30	22.85
	Postmanipulation	79.95	12.54	48.05	20.10	78.45	13.02	57.85	22.38
Concreteness ^a	Premanipulation	2.38	0.58	2.50	0.65	2.28	0.97	2.60	0.62
	Postmanipulation	2.20	0.50	2.45	0.81	1.95	0.54	2.25	0.75
Number of Means ^a	Premanipulation	3.48	1.23	3.70	0.90	3.76	1.08	3.95	1.47
	Postmanipulation	3.05	1.28	3.25	1.19	2.89	0.63	3.24	1.38
Effectiveness ^a	Premanipulation	4.18	0.97	4.33	0.67	4.34	0.98	4.38	1.19
	Postmanipulation	3.79	1.16	3.85	0.99	3.71	0.68	3.81	1.32

VAS 1: *imagery/verbal thinking*; VAS 2: *“trying to understand, explain, or make sense of things”*

^a based on WD-MEPS ratings

Results

Sample Description

The 80 participants selected for participation (see above) consisted of 40 high (PSWQ: $M = 62.92$, $SD = 4.10$) and 40 low (PSWQ: $M = 30.86$, $SD = 4.80$) trait worriers. The scores of the high trait worriers are similar to those reported in clinical samples (e.g. Meyer, et al., 1990; Molina & Borkovec, 1994). As expected, the high trait worry group was characterized by higher scores on the HADS-anxiety, $t(78) = -9.33$, $p < .001$, $d = 2.11$, and HADS-depression scale $t(78) = -3.38$, $p < .01$, $d = .77$. The average age of the sample was 21.2 years ($SD = 3.4$) and 67.5 % was female. The high worry group contained more females than the low worry group ($\chi^2(1) = 5.70$, $p = .02$). No differences in age were found.

Thinking Style Differences Between High versus Low Worriers at Baseline

ANCOVA analyses revealed no significant differences between high and low trait worriers on the VASs "trying to understand, explain, or make sense of things" $F(1, 77) = .48$, $p = .49$ and "imagery vs verbal thinking" $F(1, 77) = .07$, $p = .80$. The WD-MEPS abstract-concrete ratings showed a similar pattern $F(1, 77) = .001$, $p = .97$. There were also no significant effects for Manipulation or the Manipulation $\times$ Worry Group interaction.

Problem Solving Skills at Baseline

Contrary to expectations, the WD-MEPS ratings revealed no significant differences for number of means (low: 3.86 ± 1.28 , high: 3.59 ± 1.07) $F(1, 77) = 1.86$, $p = .177$, nor for effectiveness (low: 4.36 ± 1.07 , high: 4.25 ± 0.82) $F(1, 77) = .84$, $p = .364$. There were also no significant effects for Manipulation or the Manipulation $\times$ Worry Group interaction.

Manipulation Checks

Repeated measures ANOVAs showed a main effect for manipulation regards VAS 1 (imagery/verbal thinking: $F(1, 75) = 5.38$, $p = .023$, $d = 0.53$; VAS 2 (trying to understand, explain or make sense of things: $F(1, 75) = 16.13$, $p < .001$, $d = .91$; and WD-MEPS abstract/concrete: $F(1, 75) = 4.01$, $p = .049$, $d = 0.45$) with the group receiving the concrete training reporting more concrete thoughts than the group receiving the abstract training. In addition significant Time $\times$ Manipulation interaction effects were found for VAS1: $F(1, 75) = 10.01$, $p = .002$ and for VAS 2: $F(1, 75) = 16.76$, $p < .001$. These interactions reflect increases in ratings for the abstract manipulation relative to the concrete manipulation (see Table 1 for details). This interaction effect was however, not found for the WD-MEPS abstract/concrete measure ($p = .652$). Closer inspection of the two manipulation groups using ANCOVA analyses revealed that pre-manipulation the abstract and concrete condition did not differ significantly $F(1, 77) = 1.95$, $p = .167$, whilst there was a trend in the expected direction for the post-manipulation $F(1, 77) = 3.85$, $p = .053$, $d = 0.45$.

Effects of Manipulation on Problem Solving Skills (WD-MEPS)

Repeated measures ANOVAs revealed significant main effects of Time for *Number of Means* $F(1, 75) = 7.94$, $p = .006$, $d = 0.76$ and for *Effectiveness of generated problem*

solutions $F(1, 75) = 7.91, p = .006, d = 0.72$, reflecting decreases on both measures. No other significant main effects or interaction effects were found for number of means (all p 's $> .08$) or effectiveness (all p 's $> .311$).

Discussion

The main focus of the first experiment was to examine the effect of thinking style on problem solving skills. Based on research conducted in the area of depression (Watkins & Moulds, 2005), combined with the predictions of the reduced concreteness theory of worry (e.g. Stöber & Borkovec, 2002), it was predicted that high trait worriers would display worse problem solving skills compared to low trait worriers as a result of their relatively abstract thinking style. Hence, one would expect that making the thinking style of high worriers more concrete would result in enhanced problem solving skills.

Contrary to expectations, baseline scores showed no differences in thinking style between high and low trait worriers. This is surprising considering previous studies revealed differences in thinking style between high-low worriers during the problem analysis phase (Stöber & Borkovec, 2002) and between previously-never depressed groups (Watkins & Moulds, 2005). Results are therefore in need of replication. Baseline problem solving skills did not differ between worry groups either. This would be in line with expectations assuming that the notion of abstract/concrete thinking influencing problem solving is correct. However, an alternative explanation could be that worriers do possess the skills to solve problems but are hindered in other ways such as through their lack of *confidence* in their own problem solving abilities. Although theoretically it is expected that high trait worriers/ persons with GAD possess poorer problem solving skills, actual evidence to support this is limited. Based on his findings, Davey (1994) hinted that the problem solving skills in high worriers appeared to be intact and that lack of confidence seemed to be a bigger problem. However, this was not followed by more elaborate studies confirming this view.

In addition to the non-significant baseline results on problem solving skills, altering the thinking style did not result in the predicted changes in problem solving. Closer examination of the manipulation showed that the effect of the induction was more pronounced in the explicit self-report measures (VASs) than the abstract/concrete ratings of the WD-MEPS task. Considering the latter is a more direct measure of concreteness, the success of the manipulation has to be questioned. The mixed results could be due to social desirability bias on the VASs or could mean that the induction was not strong enough to generate an effect on the WD-MEPS. The manipulation task was identical to the version which was successfully applied in participants with a depressive disorder by Watkins et al. (2008) and thus was a logical choice. However, scenarios referred to loss/reward as opposed to threat/safety themes which are characteristic of anxiety. In addition the WD-MEPS was conducted in a written as opposed to verbal format and this may have resulted in suboptimal task engagement. Furthermore, previous successful manipulations of social problem-solving in depression manipulated thinking style in the context of ruminative self-focus. The cumulative effect of these aspects might have contributed to the lack of results in the problem solving skills measures. Findings should therefore be interpreted with caution.

Experiment 2

Building on the results of the first experiment, the WD-MEPS task was adjusted from a written to a spoken format (in line with the original MEPS) to accommodate easier assessment for the participant. Furthermore the manipulation task which was originally geared towards depression was modified for anxiety themes and strengthened by intensifying the application of the task (see below). Using a similar design as in Experiment 1 we tried to replicate the results of the first experiment.

In addition, the second study expanded the focus from merely problem solving *skills* to other aspects involved in successful problem solving. More emphasis was put on three aspects which could influence successful problem solving and could be impaired by worry: problem orientation, problem solving confidence, and problem solving style. Problem orientation and problem solving style were measured by means of a questionnaire. Problem solving confidence was assessed using VASs at both pre and post manipulation allowing for insight into possible effects of the manipulation on confidence. We expected a positive association of worry with dysfunctional problem solving related measures (e.g., negative problem orientation and problem solving confidence). We further speculated that a concrete thinking style helping participants to clearly envision problem solutions would also make them more confident in the solutions generated.

Method

Participants

Selection criteria were the same as in experiment 1. A total of 400 students were screened. After applying exclusion criteria, the bottom and top quartiles were invited to participate, of which 100 participated: 50 high and 50 low trait worriers. They were randomly allocated to one of the manipulation conditions, resulting in a 2×2 factorial between subject design with 25 participants in each cell.

Materials

Questionnaires

PSWQ and HADS

For descriptions see experiment 1.

SPSI-R

The Social Problem-Solving Inventory – Revised (SPSI-R; D’Zurilla, Nezu, & Maydeu-Olivares, 2002) assesses individual’s strengths and weaknesses in their problem-solving abilities. It is a self-report measure consisting of 52 self-statements reflecting either a positive (facilitative) or negative (dysfunctional) cognitive, affective, or behavioural response to real-life problem solving situations. Each item is scored on a 5-point Likert scale ranging from ‘not at all true of me’ to ‘extremely true of me’. The SPSI-R contains five subscales: Positive Problem Orientation (PPO), Negative Problem Orientation (NPO), Rational Problem Solving (RPS), Impulsivity/Carelessness Style (IMP) and Avoidance Style

(AVO). Internal consistency in the present study was adequate: PPO $\alpha = .67$, NPO $\alpha = .93$, RPS $\alpha = .87$, IMP $\alpha = .83$, AVO $\alpha = .89$. Further evidence supporting the reliability and validity of the SPSI-R is reported in D’Zurilla, et al., (2002).

Problem solving confidence (VAS)

Each time after reading a WD-MEPS problem scenario (without end goal), participants were asked how confident they were that they could solve the situation (1), once completed they were asked how confident they were about their provided solution (2) and at the end of the pre and post WD-MEPS assessment their confidence concerning solving future problems (3) was measured. All ratings were done using 100mm VASs (not at all certain – very certain) and repeated before and after the manipulation task.

Experimental Task/Manipulation

Paralleling Experiment 1, the manipulation task by Watkins et al. (2008) was used. However, some alterations in the content and procedure were made to optimize its effect. Themes of the scenarios were modified from reward/loss to safety/threat. In addition, the practice phase was intensified and participants were asked to think out loud during the practice scenarios as well as during scenarios 1, 2, 15, 16, 29 and 30 of the manipulation task in order to check whether the thinking style was applied correctly.

Worry Domain – Means-Ends Problem Solving task (WD-MEPS)

Interrater reliability with an independent second judge was fair to good: ICC means: .705, ICC effectiveness: .794 and for abstract/concrete ratings the ICC was .470, based on agreement on a random selection of 10% of responses.

Procedure

After signing an informed consent participants completed the MCQ and SPSI-R. This was followed by the same procedure as in Experiment 1 with two exceptions: the HADS was now completed at the end of the experiment and problem solving confidence (VASs) was assessed both at the pre and post WD-MEPS task instead of once at the end of the experiment.

Statistical Analyses

Data analyses were similar to Experiment 1, including the application of a .05 alpha level for statistical significance and corrections for gender (see below).

Results

Sample Description

Following the screening of 400 students, 100 of them were selected and tested. Three of the participants were later excluded based on insufficient compliance with the manipulation task. Thus, the final sample consisted of 97 participants: 48 low (PSWQ: $M = 31.65$, $SD = 3.75$) and 49 high trait worriers (PSWQ: $M = 63.61$, $SD = 4.77$). Note

Table 2: Experiment 2 – Differences between high and low trait worriers in problem solving orientation, and style

Questionnaire	High Trait Worry Mean (sd) ^a	Low Trait Worry Mean (sd) ^a	F-value ^b (1, 94)	p-value ^b	Effectsize Cohen's <i>d</i> ^b
SPSI					
PPO	10.6 (3.1)	13.5 (2.2)	22.497	***	1.04
NPO	21.6 (7.3)	9.1 (4.9)	62.123	***	1.73
RPS	44.8 (9.5)	43.9 (10.3)	.304	.583	
IMP	14.6 (6.3)	15.7 (6.0)	.650	.422	
AVO	12.1 (6.0)	9.8 (4.8)	3.815	.054	0.43

ANCOVA's corrected for gender * $p < .05$, ** $p < .01$, *** $p < .001$

Social Problem-Solving Inventory - Revised (SPSI-R) PPO: Positive Problem Orientation, NPO: Negative Problem Orientation, RPS: Rational Problem Solving, IMP: Impulsivity/Carelessness Style, AVO: Avoidance Style

^a unadjusted scores

^b based on EMM + SE

that scores of the high trait worriers are similar to those reported in clinical samples (e.g. Meyer, et al., 1990; Molina & Borkovec, 1994). The average age of the sample was 20.4 years ($SD = 2.6$) and 71.1 % was female. The high worry group contained more females than the low worry group ($\chi^2(1) = 24.95$, $p < .001$). As expected the high trait worry group was characterized by higher scores on the HADS-anxiety, $t(95) = -9.02$, $p < .001$, $d = 1.85$, and HADS-depression scale $t(94) = -2.14$, $p = .035$, $d = .44$.

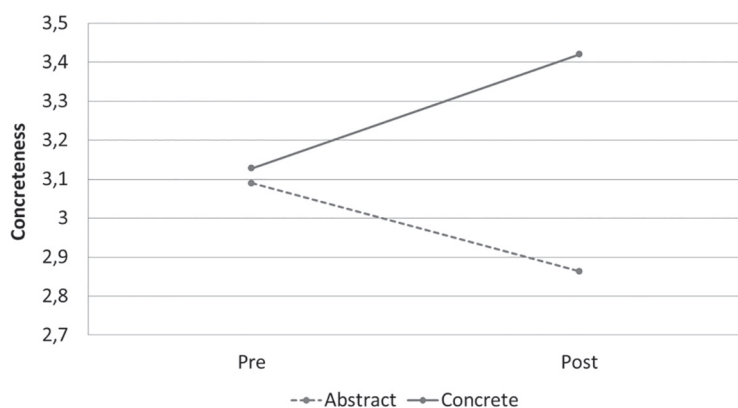
Problem Solving Orientation and Style

Results of the ANCOVA analyses reveal an overall less positive attitude towards problems and the application of a more avoidant problem solving style in high compared to low trait worriers (see Table 2 for details).

Problem Solving Confidence at Baseline (VAS)

Confidence levels just prior to completing the WD-MEPS scenarios showed a trend for a main effect of Group indicating higher confidence levels in low worriers relative to high worriers, $F(1, 94) = 3.31$, $p = .072$. No significant differences in confidence about provided solutions were found after completion of WD-MEPS scenarios, $F(1, 94) = .13$, $p = .720$. However when asked at the end of the task to rate their confidence levels concerning their ability to solve future problems, high worriers were significantly less confident than low worriers, $F(1, 94) = 10.10$, $p < .05$. It has to be noted that there was a significant effect ($p = .005$) of manipulation for 'confidence about provided solutions' indicating that the random allocation to the abstract-concrete training condition did

Figure 1: Experiment 2- Manipulation check based on the WD-MEPS abstract/concrete rating



Note: Scores are based on EMM

not result in comparable groups on this variable. Participants in the abstract condition had higher scores than those allocated to the concrete condition. There were no other significant effects for Manipulation or the Manipulation $\times$ Worry Group interaction.

Thinking Style Differences Between High versus Low Worriers at Baseline

Pre-manipulation WD-MEPS stories were rated on abstractness-concreteness to establish thinking style at baseline. As in experiment 1, ANCOVA analyses revealed no significant differences between high and low trait worriers, $F(1, 94) = .01, p = .92$. There were also no significant effects for Manipulation or the Manipulation $\times$ Worry Group interaction.

Problem Solving Skills at Baseline

Problem solving skills at baseline were examined using ANCOVA analyses. Similar to Experiment 1, the WD-MEPS ratings revealed no significant differences between high and low trait worriers for number of means, $F(1, 94) = .57, p = .452$, nor for effectiveness $F(1, 94) = .53, p = .467$. There were also no significant effects for Manipulation or the Manipulation $\times$ Worry Group interaction.

Manipulation Checks

Repeated measures ANOVAs of scores for thinking style (abstract-concrete WD-MEPS scores) revealed a main effect for manipulation, $F(1, 92) = 9.12, p = .003, d = 0.63$ with the group receiving the concrete training reporting more concrete thoughts than the group receiving the abstract training. In addition there was a significant Time $\times$ Manipulation interaction, $F(1, 92) = 8.13, p = .005$ (see Figure 1). Closer inspection of

the two manipulation groups using ANCOVA analyses revealed that pre-manipulation the abstract and concrete condition did not differ significantly, $F(1, 94) = .11, p = .746$, whilst post-manipulation there was a significant difference with the concrete group scoring higher on concreteness relative to the group receiving the abstract training, $F(1, 94) = 11.86, p < .001, d = 0.71$. These results indicate that the manipulation yielded the intended effect. See Table 3 for an overview of the abstract/concreteness rating scores.

Effects of Manipulation on Problem Solving Skills (WD-MEPS)

Repeated measures ANOVAs of scores for *number of means* revealed a significant main effect of Time $F(1, 92) = 5.70, p = .019, d = 0.39$, reflecting an overall decrease between pre and post manipulation. Further, a marginally significant Time $\times$ Manipulation interaction was found, $F(1, 92) = 3.82, p = .054$. Closer inspection of the two manipulation groups using ANCOVA analyses revealed that pre-manipulation the abstract and concrete condition did not differ significantly, $F(1, 94) = .00, p = .987$. Across time there was a general reduction in problem solving –possibly reflecting boredom or fatigue- which was mitigated by processing style. Post manipulation scores revealed that more means were generated in the concrete versus abstract condition, $F(1, 94) = 4.47, p < .05, d = 0.44$.

For *effectiveness of generated problem solutions* there was a main effect of Time $F(1, 92) = 4.52, p = .036, d = 0.28$, and a marginally significant main effect for worry Group, $F(1, 92) = 3.84, p = .053, d = 0.43$. Contrary to our expectations, high worriers provided more effective solutions than low worriers.

No other significant main or interaction effects were found for number of means (all p 's $> .16$) or effectiveness (all p 's $> .13$).

Problem Solving Confidence (VAS)

Repeated measures ANOVAs showed that ratings for *confidence to solve the presented problem scenario* showed a main effect for Worry Group: low trait worriers were more certain than high trait worriers, $F(1, 92) = 4.51, p = .036, d = 0.47$. Confidence ratings regarding their *provided solutions* revealed a main effect for Manipulation with higher confidence levels in the abstract condition relative to the concrete condition, $F(1, 92) = 10.66, p = .002, d = 0.68$. However this effect was no longer significant ($p = .12$) when analyzing post measurement confidence ratings with baseline scores as a covariate. No main effect of Worry Group was found $F(1, 92) = 0.16, p = .692$. Confidence concerning ability to solve *future problems* demonstrated main effects of Time, $F(1, 92) = 13.883, p < .01, d = 0.35$, reflecting an increase in confidence over time and of Worry Group, $F(1, 92) = 4.67, p = .033, d = 0.48$, with low trait worriers being more confident than high trait worriers. These main effects were secondary to a Time $\times$ Worry Group interaction, $F(1, 92) = 4.88, p = .030$, which reflected confidence levels for low worriers staying stable over time, but confidence increasing over time in the high worry group. See Table 3 for an overview of the problem solving confidence scores.

Table 3: Experiment 2- Means and standard deviations of the WD-MEPS measuring abstract/concreteness and problem solving skills

Dependent Variable	Time	High trait worriers				Low trait worriers			
		Abstract		Concrete		Abstract		Concrete	
		M	SD	M	SD	M	SD	M	SD
Concreteness ^a	Premanipulation	3.27	0.44	3.14	0.55	2.98	0.40	3.04	0.59
	Postmanipulation	2.94	0.58	3.54	1.07	2.90	0.78	3.19	0.73
Number of Means ^a	Premanipulation	3.56	1.19	3.80	1.63	3.69	1.49	3.50	1.27
	Postmanipulation	2.96	1.07	3.70	1.52	2.75	0.91	3.06	1.45
Effectiveness ^a	Premanipulation	4.40	1.02	4.38	1.04	4.42	1.34	4.38	1.11
	Postmanipulation	4.21	1.02	4.58	1.22	3.65	0.90	3.88	1.44
<i>Problem solving confidence:</i>									
Before completion	Premanipulation	62.83	13.98	61.90	13.65	69.50	12.21	68.52	14.20
	Postmanipulation	63.29	13.89	60.08	14.19	69.46	14.21	65.58	12.76
After completion	Premanipulation	75.44	12.51	69.84	12.67	76.13	11.37	67.94	13.23
	Postmanipulation	76.65	9.78	71.00	11.37	78.33	10.55	74.52	13.57
Future problems	Premanipulation	67.08	11.07	67.92	12.61	77.58	9.14	72.13	10.83
	Postmanipulation	74.42	8.46	70.96	14.31	78.54	8.57	76.42	12.18

^a based on WD-MEPS ratings

Discussion

In line with the first experiment, we predicted that (1) high trait worriers would display worse problem solving skills compared to low trait worriers as a result of their relatively abstract thinking style and (2) that making the thinking style of high worriers more concrete would result in enhanced problem solving skills. In addition to examining problem solving skills the second experiment also focussed on other aspects of successful problem solving: problem orientation, problem solving confidence, and problem solving style.

Similar to the first experiment and in contrast with our predictions, there were no differences in thinking style or problem solving skills between high and low trait worriers at baseline. The thinking style manipulation was however successful this time as reflected in the manipulation check. Whilst in the first experiment, changes in thinking style were only evident on self-report measures, the current paradigm was able to transfer the effect onto a more objective measure, namely, the WD-MEPS abstract-concreteness ratings. As expected, the concreteness training had a positive effect on problem solving (number of means) relative to the abstract training, supporting the claim that level of concreteness has a causal effect on problem solving. Effectiveness scores showed a similar pattern but this did not reach significance.

Problem solving confidence baseline scores revealed a general tendency for high trait worriers to be less confident when anticipating problem solving situations. Interestingly, this difference was not observed immediately after completion of the problem solving task. This could imply that low problem solving confidence is a hindrance mainly prior to the generation of a problem solving strategy perhaps resulting in avoidance or termination of dealing with the situation. Once solutions are completed however, their 'normal' confidence levels suggest that they do not dwell on the solutions provided. Whether these confidence levels drop again over time causing high trait worriers to revisit their solutions or reactivate their worry strategy remains to be seen. In general it seems that problem solving skills of high trait worriers are not impaired but that they have other problem solving related aspects which are suboptimal. Besides low problem solving confidence, high worriers possess an overall avoidant problem solving style characterized by passivity and inaction as reflected in their scores on the Avoidance Style subscale of the SPSI-R.

An even more pronounced obstacle to successful problem solving is the dysfunctional problem orientation deployed by high trait worriers. Their relatively low positive problem orientation (PPO) and, in particular, their high negative problem orientation (NPO) scores indicate an overall tendency to appraise problems as threatening as opposed to challenging. This perception of problems might affect problem solving in different ways, such as discouraging the initiation of problem-solving attempts or by increasing anxiety levels and decreasing concentration.

General discussion

These two experiments were designed to address the question of whether thinking style (abstract-concrete) influences problem solving skills in high trait worriers. In line with the reduced concreteness theory (Stöber, 1998; Stöber & Borkovec, 2002), problem solving skills were expected to be impaired in the high trait worry group relative to the low trait worry group, due to the deployment of a relatively abstract thinking style. Amelioration of the latter would therefore logically, and in accordance with results from Watkins and Moulds (2005) in depression, improve problem solving success. Results partially confirmed these expectations.

High trait worriers did *not* report a more abstract thinking style than low trait worriers *nor* poorer problem solving skills. These findings were replicated in the second experiment. Hence, *both* studies failed to replicate Stöber's findings of a more abstract thinking style in high trait worriers compared to low trait worriers (Stöber & Borkovec, 2002). Abstract-concreteness was rated using the same criteria and scale as applied by Stöber and colleagues (Stöber & Borkovec, 2002; Stöber, et al., 2000). The focus lay however on different phases of the problem solving process. Stöber focussed in his series of experiments on the phase of problem analysis. In contrast to Stöber's experiments, the present studies focussed on the step following problem analysis: the generation of solutions. Hence, the conflicting results could be explained by the positioning within the problem solving process. It is possible that worriers adopt a more abstract style of thinking when assessing a problem situation but that they possess the mental flexibility to shift to a more concrete level when explicitly instructed to actively address the problem at hand. Although a plausible option we cannot disregard the possibility that the different results could also be related to the fact that we used different problem scenarios and had a non-clinical sample.

The current results on thinking style and problem solving skills are in contrast with findings in depressed subjects who showed both a more abstract thinking style and poorer problem solving skills than a never-depressed group (Watkins & Moulds, 2005). When comparing the results in depressed subjects to the present findings it appears that the process of abstract ruminative thinking in depression might interfere more with the generation of solutions than inducing an abstract thinking style in anxiety. This methodological difference between inducing a processing style versus manipulating processing style during self-focused rumination may be important in influencing the distinct findings. An alternative explanation could be that depressive rumination interferes more with laboratory studies than does worry. Andrews and Thomson (2009) claim that during laboratory tasks depressive rumination on issues other than those central to the particular study interfere with the ability to perform well on the task at hand. This could lead to the possible premature conclusion that depressed subjects lack problem solving skills. Considering that problem solving skills in high trait worriers seem to be intact this interference does not seem to occur in the present sample.

Our study is not the first to find worriers' problem solving skills to be intact (e.g.

Davey, 1994; Ladouceur, Blais, Freeston, & Dugas, 1998; Marx, et al., 1992). Marx et al. (1992) reported that patients with anxiety disorders were able to produce problem solving strategies which were equally effective as those produced by non-clinical subjects. This idea was further explored in relation to worry by Davey (1994) who, in an analogue student sample, found no relationship between worrying and problem solving ability as assessed on a standard MEPS task. However, although worry level was taken into account, GAD symptomatology was not. Ladouceur et al. (1998) addressed this issue in a questionnaire based assessment revealing that self reported problem solving skills did not vary with either level of GAD symptoms or clinical status. These studies however, used either self-report measures of problem solving ability (questionnaires) or a standard/uniform problem solving task (MEPS) even though personal relevance is believed to be of particular importance in worriers/GAD (Stöber, et al., 2000). The present findings confirm and extend the previous findings by showing that problem solving skills did not differ between high and low trait worriers even when the problem-solving task contained personally relevant topics. Considering these results it is no surprise that the concreteness training task –although successful- did not result in the hypothesized Time $\times$ Group $\times$ Manipulation interaction.

On the other hand, the second prediction of the current studies –that concreteness training would positively affect problem solving- can largely be confirmed. The concreteness training had a positive effect on problem solving (number of means) relative to the abstract training. This supports the idea that level of concreteness has a causal effect on problem solving. Ratings of effectiveness showed a similar pattern but this did not reach significance. Overall the scores on means and effectiveness as well as the general tendency for scores to drop over time appear to best resemble the pattern found by Watkins and Moulds (2005) in never depressed individuals. With problem solving skills seemingly intact it seems only logical to move away from attempts to further improve these skills and to shift attention to other more promising avenues to improve problem solving success rates.

The second study additionally focused on problem solving confidence, problem solving style and problem orientation. Results showed that high trait worriers tend to appraise problems as threatening as opposed to challenging as reflected in the large effect sizes for differences on both PPO and NPO between groups. These results are in line with previous research on problem orientation in non-clinical populations (e.g. Dugas, Freeston, & Ladouceur, 1997; Dugas, Letarte, Rheaume, Freeston, & Ladouceur, 1995) and in a clinical GAD sample (Ladouceur, et al., 1998). Besides a poor problem orientation compared to low trait worriers, high trait worriers also deploy a dysfunctional problem solving style as indicated by the (near) significant ($p = 0.54$, $d = .43$) differences on the SPSI-R-avoidance subscale. This style is characterized by passivity (waiting for problems to resolve by themselves), procrastination (putting off dealing with problems) and dependency (attempting to shift responsibility for problem-solving to others). Lack of problem solving confidence is an aspect related to poor problem orientation. In the second experiment extra attention was given to this aspect by directly measuring

confidence levels (as opposed to general attitude) at different stages during the problem solving task. The results confirmed a lack of problem solving confidence in high worriers at the time of confrontation with a problem. This is in line with previous studies showing lower problem solving confidence (e.g. Davey, 1994) and poorer problem orientation in high compared to low worriers. Surprisingly, confidence levels normalized straight after the generation of solutions, suggesting it is mainly the phase of anticipation hindering problem solving success. Once participants do overcome the obstacle of perceived threat and low confidence in their own abilities, a subsequent successful problem solving attempt still does not lead to 'normal' confidence levels with regard to solving *future* problems. The latter suggests that their confidence does not generalize easily.

These results are in need of replication. Future research should focus on how confidence levels change, or do not change, in the aftermath of solving a problem: do confidence levels remain similar to those of low trait worriers enabling participants to move on, or do confidence levels drop again possibly motivating participants to revisit the problem and question the solutions they previously provided? Another aspect of social problem solving not addressed by this study is whether worriers experience difficulties at the implementation phase. It is one thing generating solutions but another to actually execute them. In addition to the possible rising anxiety levels during the implementation phase, it also remains to be seen whether high trait worriers are successful executors: Can they transfer their ideas into actions?

The present studies have several limitations. Firstly, these studies are conducted using non- clinical samples. Although PSWQ scores were in the clinical range, it is possible that a clinical GAD status is accompanied by characteristics which are not captured when merely measuring worry levels. On the other hand, as mentioned above, previous research has shown that knowledge of problem solving skills does not vary with GAD symptomatology and clinical GAD status (Ladouceur, et al., 1998). Although this research was questionnaire based, it gives grounds to believe that the current research based on worry levels does resemble results in clinical GAD populations.

Secondly, although scenario selection for the WD-MEPS was based on personal relevance to the participant, they were still hypothetical situations. It is possible that worriers adopt their more abstract way of thinking only when in the midst of an actual real-life personally relevant situation, leaving impaired problem solving undetected in laboratory studies. Inconsistent with this idea are results from a study by Anderson et al. (2009). They found differences between real-life problem solving behaviour and hypothetical MEPS situations to be specific to depressed but not anxious individuals.

Finally, it needs to be noted that inter-rater agreement (ICC) on the abstract/concrete WD-MEPS ratings was moderate especially in the second study. However, there was little variation between the scores of both raters and 2-point differences on the 5-point Likert scale of thinking style were rare (3.1% experiment 1; 2.5% experiment 2).

Overall the results of the present studies were partly in line with the reduced concreteness hypothesis of worry. High trait worriers did not possess more abstract thinking styles when generating solutions; however, increasing levels of concreteness did

improve problem solving. Moreover from the perspective of the impaired social problem solving account of worry results were mixed. Problem solving *skills* were intact, however problem solving confidence, style and orientation revealed patterns characteristic of high trait worriers which could affect the problem solving process. These obstacles appear to lie in the anticipation-analysis phase and not in the phase of solution generation.

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Chapter 6

The influence of worry and avoidance on the Iowa Gambling Task

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Abstract

Background: It has been proposed that worry in individuals with Generalized Anxiety Disorder may be reinforced by a positive effect of worry on decision making, as reflected by a steeper learning curve on the Iowa Gambling Task (IGT). We hypothesized that this apparent positive effect of worry is dependent on the IGT parameters, in particular the absence of an opportunity to avoid decisions.

Objective: (1) To replicate previous findings on the effect of worry on IGT performance. (2) To examine the influence of avoidance opportunity on IGT performance. We hypothesized that the positive effect of worry on learning would be abolished or reversed by the opportunity to avoid.

Method: A standard IGT and a new IGT version that includes a pass (avoidance) option was completed by 78 and 79 participants, respectively.

Results: A beneficial effect of worry on learning in the *standard version* of the IGT was not observed. In the *pass version* of the IGT, worry status and avoidance were negatively associated with performance. Worry was not related, however, to pass usage. The hypothesized mediating effect of avoidance was non-significant.

Limitations: It is unclear to what extent these findings generalize to real-life decision making and how clinical status affects results.

Conclusion: The possibility to avoid a decision results in poorer IGT performance in high relative to low trait worriers. Possible explanations for these findings are discussed.

Introduction

Within its 'normal' range, worrying is considered an ordinary and adaptive process containing positive and constructive aspects (e.g. Davey et al., 1992; Borkovec & Roemer, 1995). Yet in its pathological form the downsides overshadow or undermine these benefits and cause severe impairment (e.g. Wittchen et al., 2000). Patients with generalized anxiety disorder (GAD) engage in this type of perseverative thinking despite its negative effects. There appear to be two possible reasons for continued worrying: (1) patients do not experience benefits (anymore) but simply do not know how to terminate this type of thinking even if they want to; and/or (2) there is a certain payoff (although maybe not recognized by the individual) like the reduction of anxiety due to the belief that one should prepare for every possible scenario.

It has even been suggested that worrying leads to improved decision making (Mueller et al., 2010) on the Iowa Gambling Task (IGT). In the IGT (Bechara et al., 1994), four decks of cards are simultaneously presented to the participant. Each selection of a card leads to either an addition or subtraction of points (money). The task is designed in such a way that repeated selection of card decks A and B leads to long term net loss and repeated play of decks C and D leads to long term net gain. Participants are instructed to maximize their winnings. The reinforcement schedule is too complicated for participants to figure it out but they typically develop an intuitive preference for decks C and D.

People with GAD are hypervigilant and highly aware of any cues signalling potential danger (Mathews & MacLeod, 1986). It seems logical that these future oriented characteristics can have a beneficial effect on IGT performance. According to the Somatic Marker Hypothesis (SMH; Damasio, 1994, 1996), emotions and their accompanying bodily signals leave a trace in memory which directs our learning even before certain knowledge or patterns enter consciousness. Reactivation of this memory trace occurs when one is faced with a similar situation. This is hypothesized to influence decision making by encouraging advantageous and discouraging disadvantageous choices. From a SMH perspective one could argue that higher levels of (anticipatory) anxiety will install stronger somatic markers and therefore more quickly lead to successful performance on the IGT (Damasio 1994, 1996; see also Werner et al., 2009, p. 263).

So far, studies concerning anxiety have shown mixed results. Miu et al. (2008) compared high and low trait anxious individuals and concluded that despite the fact that some of the anticipatory physical reactions were stronger in high trait anxious individuals, the low trait anxious group outperformed the high trait anxious group on the IGT. Werner et al. (2009), however, found that higher trait anxiety levels are associated with better IGT performance. These two studies measured trait anxiety, which overlaps with worry, but is not the same.

In the domain of worry/GAD two recent studies stand out. Pajkossy et al. (2009) targeted the influence of state anxiety, trait anxiety and *worry* on IGT performance in a student sample (N = 50). For each construct of interest low, medium, and high groups were formed. The authors concluded that state anxiety and worry had a positive effect on

IGT performance whereas trait anxiety had a negative influence. This pattern is difficult to understand and may be a chance effect in a relatively small sample in which post hoc tests did not reveal significant differences unless Bonferroni corrections were ignored. Mueller et al. (2010) selected 27 participants meeting GAD criteria (assessed through questionnaire) and compared their IGT performance to that of a control group ($n = 20$). The GAD group learned to choose the advantageous decks (C and D) over the disadvantageous decks (A and B) significantly faster than the control group. GAD patients therefore seem to benefit from their future-oriented hypervigilant characteristics in this form of decision making. This could constitute a potential mechanism underpinning the recurrent engagement in worry by positively reinforcing worry as a constructive strategy.

If this effect is replicable, the question remains to what extent this is relevant for real-life decision making. Studies have shown, for instance, that high trait worriers possess the ability to successfully solve problem solving tasks when forced to do so, but they seem to never arrive at this stage of problem solving in real life, because worrying and avoidance undermine the preceding stages of problem solving. High worriers have a negative problem orientation, tend to avoid problems and lack confidence in their own problem solving abilities (e.g. Davey, 1994; Drost et al., submitted).

The IGT in its standard form is one of a somewhat artificial nature and does not involve decision in a social context. In particular, the IGT represents a forced-choice decision making process. The lack of option to not make a decision makes it less suitable for studying disorders in which avoidance is a main mechanism of maintenance. The mental procrastination and dwelling on certain issues that is characteristic of worriers may lead them to avoid making decisions. In order to examine the role of such avoidance behaviour in decision making, the current study used both the standard IGT and a newly developed adaptation of the IGT that included a pass option (IGT-P).

The aim of the present study was to investigate whether worriers will engage in passing on the IGT-P and how this influences their performance. In the standard IGT condition we expected to replicate Mueller et al.'s (2010) findings of high worriers learning significantly faster than controls to choose the advantageous decks. For the IGT-P, we hypothesized that worriers out of uncertainty will choose the pass (i.e. avoid) option more often than low-worriers and that this will negatively influence their learning process. Anxiety symptoms were also measured, in order to check whether any results are specific to worry.

Materials and methods

Participants

Inclusion criteria were an age of between 17-35 years, good command of the Dutch language and being from Middle or North-West European descent (because of genetic analyses that will be reported elsewhere). Participants were recruited through advertisements at the university.

Materials

Questionnaires

The Penn State Worry Questionnaire (PSWQ; Meyer, et al., 1990) consists of 16 items rated on a 5-point Likert scale and measures trait worry independently from the content of the worry (Davey, 1993; Molina & Borkovec, 1994). It has high internal consistency, good test-retest reliability and is unaffected by social desirability (Meyer, et al., 1990). Internal consistency in the present study was high, namely $\alpha = .92$ in the total sample. The Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) is a 14-item self-report questionnaire consisting of two subscales measuring anxiety (7-items) and depression (7-items) symptoms during the last week. Internal consistency, discriminant and concurrent validity, and test-retest reliability are satisfactory (Bjelland, Dahl, Haug, & Neckelmann, 2002; Spinhoven, et al., 1997). In the present study internal consistency (total sample) of HADS-A was $\alpha = 0.74$ and of HADS-D $\alpha = 0.77$.

Iowa Gambling Task (IGT)

The standard IGT as proposed by Bechara et al. (1994) consisted of 100 trials divided over 5 blocks (20 trials each). Each trial started with a display of 4 decks of cards (A,B,C,D) on a computer screen of which participants selected a card by clicking the cursor on the deck of interest. Once a card was selected feedback was given on the amount won and lost in that trial and the total amount left was shown. Each card simultaneously consisted of a gain and a loss. Decks A and B had a fixed gain of 100 as opposed to 50 in decks C and D. The amount that was lost varied across decks and was non-systematic (A: either 0 or between 150-350, B: 0 or 1250, C: 0 or between 25-50, D: 0 or 250). Choosing exclusively from decks A or B led to a net loss of 250 over 10 card selections and was therefore *disadvantageous*. Decks C and D resulted in a net gain of 250 when selected exclusively during 10 trials. The IGT-P (pass version) had exactly the same setup, but each trial also included a pass button. The pass choice was visualized on the screen by the top 4 cards being removed without revealing their value. In reality no "pass" took place and the cards/decks were merely put on hold. The total number of trials remained 100.

Procedure

Participants were tested in a laboratory setting. They signed an informed consent form before the data collection started. The PSWQ, HADS and IGT were all completed on a computer. Participants were assigned to either the standard IGT or the IGT-P based on their participant number, which was assigned in order of testing. Overall time spent on the data collection (including the data for the other experiments) was up to 90 minutes per person. Participants could choose to receive course credits or a small payment for their participation. In addition, participants also received their possible gains (but not losses) on the IGT at a rate of 1 eurocent per 10 points gained.

Statistical analyses

Two-level multilevel random slope models were used to test the main hypotheses. Parameters were estimated using maximum likelihood estimation; variance structure was set to identity. Time was set as the logarithm of the block number to allow for a

linear model (see Lutz, Martinovich, & Howard, 1999) and PSWQ-scores were grand mean centered. Data screening further revealed that the number of passes was skewed and therefore was log-transformed as well. All analyses were controlled for gender as a previous study (Mueller et al., 2010) had shown an effect of this variable.

Analyses consisted of several phases. Firstly, the overall sample was examined for an effect of condition on percentage of advantageous choices (dependent variable). An unconditional growth model was built followed by an extended model containing the additional main effects 'Condition', Worry and a Condition*Worry interaction term. Secondly, separate analyses in the no-pass and pass condition subsamples were conducted. In both subsamples unconditional growth models were established which were thereafter extended by adding Worry (no-pass condition), and Worry and Pass usage (pass condition). Finally, to allow for further exploration of the mediating role of Pass, the effect of Worry on Pass use (dependent variable) was examined with two-level random intercept, random slope multilevel models.

The best model is the one that provides an adequate account of the data while using a minimum number of parameters. We used the Akaike information criterion (AIC; see Akaike, 1981) to choose the best model in terms of descriptive accuracy and parsimony. More specifically, we calculated Akaike weights (Burnham, & Anderson, 2002), which can be interpreted as conditional probabilities for competing nonnested models as well as evidence ratio's (Weight of evidence of full model (W_F) / Weight of evidence reduced model (W_R) (Long, 2012). In this way we could directly evaluate whether models involving Worry as an additional main effect or interaction effect are better in terms of descriptive accuracy and parsimony than models which do not include this variable of crucial interest for the present study.

Finally, an additional two-level multilevel random slope model with a fixed intercept for percentage of advantageous choices and a random intercept for Pass usage was performed to directly test the presupposed indirect effect (Passing mediating the relation between worry and IGT learning curve). Parameters were estimated using maximum likelihood estimation and bootstrapping was set to 10.000.

Linear Mixed Modelling was favoured over repeated measures ANOVA as it allows for time-varying continuous covariates (West, 2009). In our study the 'pass' variable was such a time-varying predictor and a crucial part in testing our hypotheses. All analyses were performed using PASW version 18 for Windows except for the direct testing of mediation using Mplus version 7 (Muthén & Muthén, 1998-2012).

Results

Sample description

One hundred and sixty participants signed up. Three participants were excluded: one did not meet inclusion criteria, one was excluded due to a technical problem and another participant used the "pass" option more than 50% within one block, exceeding the average by over six

Table 1: Predicting the rate of change of % of advantageous choices over Time in the overall sample: investigating the effect of Condition

Overall sample		Unconditional Growth Model		Final Model	
	Parameter	Estimate (SE)	<i>p</i>	Estimate (SE)	<i>p</i>
Fixed effects					
Initial status	Intercept	37.56 (1.22)	< 0.001	37.56 (1.22)	< 0.001
Rate of change	Time	14.63 (1.32)	< 0.001	13.09 (2.94)	< 0.001
	Gender			1.04 (2.71)	0.703
	Condition			1.64 (1.85)	0.376
	Worry			0.03 (0.12)	0.815
	Worry*Condition			-0.26 (0.15)	0.075
Variance components					
Level 1	Within subject	302.65 (17.08)	< 0.001	302.65 (17.08)	< 0.001
Level 2	Slope	85.78 (15.44)	< 0.001	80.97 (14.91)	< 0.001
Goodness of fit	Deviance	6871		6866	
	AIC	6879		6882	
	<i>N</i> of estimated parameters	4		8	

Condition was coded as a dummy variable (0 = no-pass, 1 = pass)

Variance structure was set to identity and Time was set as the logarithm of the block number to allow for a linear model.

times the *SD*. The final sample (*N* = 157) consisted of 23 men (14.6%). The average age was 20.2 years (*SD* = 2.9) and PSWQ scores ranged from 20 to 74 with an average of 50.1 (*SD* = 12.6). The standard no-pass IGT (*N* = 78; 70 women, 8 men) and the adjusted IGT-P condition (*N* = 79; 64 women, 15 men) did not significantly differ regarding their male-female ratio ($\chi^2(1) = 2.39$, *p* = .12), age ($t(155) = -.38$, *p* = .70) or PSWQ scores ($t(155) = -1.30$, *p* = .20). To rule out a priori IGT performance differences between conditions, baseline score (block 1, % advantageous) comparisons were made and no significant differences were found ($t(155) = -.05$, *p* = .96). The other independent variable of interest (PSWQ) was checked for a priori associations with IGT scores as well. Correlations between baseline IGT scores (block 1) and PSWQ scores were non-significant ($r = -.08$, *p* = .33).

Anxiety and IGT performance: exploratory analyses

We conducted some exploratory analyses to examine the influence of anxiety symptoms on the IGT learning curve. HADS-A scores did not differ between the IGT conditions (HADS-A $t(155) = -.11$, *p* = .29). Correlations between HADS-A and overall IGT

Table 2: Predicting the rate of change of % of advantageous choices over Time in the standard (no-pass) IGT condition

No-pass condition		Unconditional Growth Model		Final Model	
	Parameter	Estimate (SE)	p	Estimate (SE)	p
Fixed effects					
Initial status	Intercept	37.28 (1.67)	< 0.001	37.28 (1.67)	< 0.001
Rate of change	Time	14.20 (1.79)	< 0.001	17.00 (4.29)	<0.001
	Gender			-3.03 (4.29)	0.482
	Worry			0.06 (0.11)	0.590
Variance components					
Level 1	Within subject	281.76 (22.56)	< 0.001	281.76 (22.56)	< 0.001
Level 2	Slope	74.15 (19.49)	< 0.001	73.23 (19.35)	< 0.001
Goodness of fit	Deviance	3382		3382	
	AIC	3390		3394	
	N of estimated parameters	4		6	

Variance structure was set to identity and Time was set as the logarithm of the block number to allow for a linear model.

performance (% advantageous) were not significant in the no-pass (HADS-A $r = -.19$, $p = .10$) and pass (HADS-A $r = -.09$, $p = .45$) condition. In addition, conducting the Linear Mixed Modelling (LMM) analyses with HADS-A as the main predictor of interest did not result in any significant main or interaction effects of anxiety symptoms (data not shown). Subsequently, anxiety was not controlled for in the final LMM analyses reported below.

Trait worry and IGT performance: linear growth models

Overall sample: effect of condition on IGT learning effect

In the overall sample there was a significant effect of Time, representing an increase in the percentage of advantageous choices as the experimental task progressed. No significant effect of Condition or Worry on the rate of change was found. Inclusion of the main effect of Worry and the interaction of Worry*Condition into the final model resulted in a ΔAIC of 1.23. The probability that the full model was the best model was .65 and the probability that the reduced model was the best model was .35 (evidence ratio = 1.85). Based on these AIC results we further explored ‘change over time’ in the separate IGT conditions, although note that the negative effect of Worry in the IGT–P (Table 1, final model) was not significant ($p = .075$).

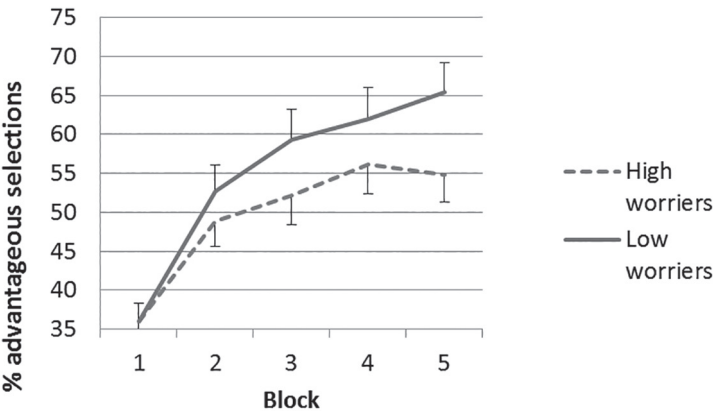
Table 3: Predicting the rate of change of both % of advantageous choices and pass usage over Time in the modified (pass) IGT-P condition

Pass condition		Unconditional Growth Model		Final Model	
<i>Dependent: % advantageous</i>	<i>Parameter</i>	<i>Estimate (SE)</i>	<i>p</i>	<i>Estimate (SE)</i>	<i>p</i>
Fixed effects					
Initial status	Intercept	37.83 (1.77)	< 0.001	37.36 (1.75)	< 0.001
Rate of change	Time	15.05 (1.94)	< 0.001	12.56 (3.26)	< 0.001
	Gender			3.06 (3.36)	0.365
	Worry			-0.22 (0.10)	0.035
	Pass			-5.69 (1.37)	< 0.001
Variance components					
Level 1	Within subject	323.22 (25.71)	< 0.001	313.58 (24.95)	< 0.001
Level 2	Slope	96.45 (24.00)	< 0.001	75.92 (20.53)	< 0.001
Goodness of fit	Deviance	3486		3464	
	AIC	3494		3478	
	N of estimated parameters	4		7	

		Unconditional Growth Model		Final Model	
<i>Dependent: pass ^a</i>	<i>Parameter</i>	<i>Estimate (SE)</i>	<i>p</i>	<i>Estimate (SE)</i>	<i>p</i>
Fixed effects					
Initial status	Intercept	-0.61 (0.07)	< 0.001	-0.61 (0.07)	< 0.001
Rate of change	Time	0.12 (0.02)	< 0.001	0.12 (0.04)	0.005
	Gender			-0.003 (0.05)	0.941
	Worry			0.001 (0.001)	0.398
Variance components					
Level 1	Within subject	0.22 (0.02)	< 0.001	0.22 (.02)	< 0.001
Level 2	Intercept	0.17 (0.07)	0.013	0.17 (.07)	0.013
	Slope	-0.01 (0.02)	0.468	-0.01 (.02)	0.451
	Covariance	0.02 (0.01)	0.011	0.02 (.01)	0.012
Goodness of fit	Deviance	706		705	
	AIC	718		721	
	N of estimated parameters	6		8	

^a Note that an unstructured variance structure was used and that Time was not transformed as growth model testing yielded this not necessary.

Figure 1: Learning curves on the IGT-P for high and low worriers



Note: This figure is for illustrative purposes. Depicted are the percentage of cards selected from advantageous decks (C and D) in each block of 20 cards. Scores reflect EMM's based on raw data corrected for gender.

No-pass (standard) IGT condition: effect of worry on IGT performance

In line with the overall sample there was a significant effect of Time reflecting an increase in the advantageous choices during the IGT. No significant effect of Worry¹ on the rate of change was found (Table 2, final model). Inclusion of Worry into the model resulted in a higher AIC (Δ AIC = - 1.71; evidence ratio = .30) indicating that a model with only Time as main effect probably constitutes the best approximating model.

Pass condition: worry, pass and IGT performance

Besides the expected effect of Time, there was a significant negative effect of Pass, indicating that higher pass usage during the IGT negatively influenced the rate of change (Table 3, Final model). In addition a significant negative effect of Worry was found: a higher PSWQ score predicted a slower rate of change on IGT performance (see Figure 1 for an illustration of the learning curves). A lower AIC (Δ AIC = 2.46; evidence ratio = 3.42) for the model including Worry also suggests that inclusion of Worry in the final model results in a better model than a model with only Time and Pass as main effects.

This result was further explored in subsequent analyses investigating the effect of Worry on the rate of change in pass usage. The pass option was used by 62% of the participants: ranging from 1 to 32 times ($M = 4.9$, $SD = 5.5$). A significant effect of time revealed that pass usage increased as the experimental task progressed. However,

1 Similar results were found when analyses were conducted with rmANOVA. Whether high and low worry groups were defined by median split or whether only scores at the extreme ends of the spectrum were compared did not affect results; no differences in IGT performance were found.

there was no significant effect of Worry (Table 3, Final model). This was corroborated by a higher AIC of the final model also including Worry ($\Delta\text{AIC} = -1.288$; evidence ratio = .53) compared to a model with only Time as main effect.

Overall, results show that both Worry and Pass negatively influence IGT performance but that Worry is not significantly related to Pass usage. These results suggest that Pass usage is unlikely to mediate the relationship between Worry and IGT performance. This was confirmed in additional LMM analyses conducted in Mplus which had an acceptable model fit (RMSEA = 0.089 and CFI/TLI = 0.823) and showed that the indirect effect was non-significant (*Estimate (SE)* = -0.03 (0.07), $p = .68$, 95% CI: -0.16 – 0.10).

Post hoc analyses pass usage

Because contrary to expectations we did not find evidence for pass usage as a variable mediating the association of PSWQ with IGT performance, we performed some post hoc analyses in which we specified pass usage on the basis of net loss in the preceding trial and net loss over all preceding trials. We choose these operationalizations because we expected persons with higher levels of worry to be more inclined to pass in a situation of threat and loss. In total participants used the pass button 239 times. In 44 of these instances pass was preceded by a card with a net loss whilst over half (124) of the selections of the pass button occurred when the total score reflected a loss (i.e. below 2000 points). Mediation analyses showed that the indirect effect of Worry on IGT performance via pass usage following a card with a net loss was not significant (*Estimate (SE)* = -0.02 (0.04), $p = .65$, 95% CI: -0.10 – 0.06. Model fit RMSEA = 0.088, CFA/TLI = 0.667). Also, the indirect effect of Worry on IGT performance via pass usage at a time point when the net total score represented a loss i.e. below 2000 points was not significant (*Estimate (SE)* = -0.10 (0.07), $p = .14$, 95% CI: -0.23 – 0.03. Model fit RMSEA = 0.091, CFA/TLI = 0.778).

Discussion

The aim of the present study was to investigate whether worriers will engage in avoidance behaviour (i.e. pass) on the IGT-P and how this influences their performance. For the standard IGT condition we hypothesized that worry would have a positive effect on IGT performance and we would thus replicate Mueller et al.'s (2010) findings. For the IGT-P, we hypothesized that high worriers would choose the pass option (i.e. avoid) option more often than low worriers and that as a result the positive effect of worry on learning would be abolished or reversed. Results were mixed. The previously reported beneficial effects of worry in the standard IGT (Mueller et al., 2010) were not observed in the present study. However, in the adjusted IGT condition we found a negative effect of both worry and of avoidance behaviour (pass) on IGT performance. Contrary to expectations, the relationship between worry and performance on the IGT was not mediated by avoidance behaviour.

The non-significant findings concerning worry in the standard IGT were unexpected. Not only was no effect found in the LMM analyses but also not when using repeated

measures ANOVA in groups with extreme PSWQ scores of which the higher end resembled scores found in GAD patients. Based on previous findings as well as on theory (Damasio 1994, 1996), beneficial effects of worriers' hypervigilant and future-oriented characteristics were expected to enhance the learning curve. The current findings may be explained by another influential theory within worry/GAD research, the cognitive avoidance theory (Borkovec, Ray, & Stöber, 1998). This theory postulates that worry is a form of cognitive avoidance which operates via the reduction of aversive imagery with the purpose to avoid somatic anxiety reactions. Studies have indeed shown that worry is a predominantly verbal thought activity (as opposed to imagery-based) and that the percentage of imagery is greatly reduced when engaging in worry instead of relaxation (Borkovec & Inz, 1990; East & Watts, 1994; Freeston, Dugas, & Ladouceur, 1996). It has also been demonstrated that verbal thought activity is associated with significantly less intense cardiovascular fear responses than imagery (Vrana, Cuthbert, & Lang, 1986). So, whereas anxiety with its increased physiological activity may lead to stronger somatic markers, worry does the opposite by attenuating but also prolonging physiological sensations and hence may lead to relatively weaker somatic markers. This counterbalancing effect of worry may have been more pronounced in the present study than in Mueller et al.'s (2010) contributing to the non-replication. Both studies applied different inclusion criteria. Mueller et al. (2010) selected participants meeting GAD criteria of which anxiety and arousal are components. Anxiety levels might therefore have been too high to be compensated by worry. The present study did not have anxiety-based in- or exclusion criteria. Note that the pass-button does not represent cognitive avoidance but a different type of behavioural avoidance typical for GAD and described as 'inaction' by Roemer & Orsillo (2002). These two types of avoidance are not mutually exclusive and are likely to co-occur.

Another possible explanation for our non-significant findings on the standard IGT comes from Miu et al. (2008) who pointed out that distraction by emotions unrelated to the task might influence IGT performance. Even if worriers have stronger somatic markers there may be other processes (cognitive, emotional) at play which influence decision making. Previous research has for example shown that anticipatory stress –which is by definition closely linked to worry–, impairs IGT performance (Preston et al., 2007). Considering that worriers typically occupy themselves with numerous major and minor topics (Roemer, Molina, & Borkovec, 1997), it is very well conceivable that during the IGT such involvement with other stressors unrelated to the task resulted in the non-significant effect of worry as found in the present study.

The adjusted condition of the IGT, which included a pass option in each trial, revealed –as expected– that worry was related to a poorer learning curve on the IGT. Interestingly, anxiety symptoms were not related to poorer IGT performance suggesting that the effect of worry is specific. Pass usage also showed a negative relationship with IGT advantageous choices. In contrast with expectations however, worry was not significantly related to pass usage (i.e. avoidance behaviour) and the hypothesized mediating effect of pass was also non-significant. Additional post hoc analyses also showed that the negative effect of worry on IGT performance was unrelated to a presumed higher inclination of

high worriers to use the pass button in a situation of threat and uncertainty after net loss in the preceding trial or net loss over all preceding trials. It appears that having the option to pass does (negatively) influence learning but that for high worriers this influence is not entirely captured in the number of times or the particular situation in which one avoids a decision.

The obvious question is of course, what does cause this different reaction between high and low worriers to the possibility to avoid giving a response? The data do not provide a clear-cut answer, but we will discuss a few potential explanations. Firstly, it is possible that the added choice option exerts cognitive resources -especially in high worriers- and subsequently interferes with their learning process. Worriers are characterized by the tendency to prepare for the worst and to anticipate any impending danger. They carefully weigh up all possibilities, which in the instance of the IGT-P implies that the added choice option means more worry (more cognitive activity). A concept related to worry is Intolerance of Uncertainty (IU; Buhr & Dugas, 2006). IU has been defined as 'a dispositional characteristic that results from a set of negative beliefs about uncertainty and its implications' (Dugas & Robichaud, 2007, p.24). The added complexity of the task will increase uncertainty directly as there is an extra option to consider and indirectly through the absence of feedback after using the pass button. Moreover, research has shown that pathological worry and clinical GAD status are linked to increased error-related brain activity (Hajcak et al., 2003; Weinberg et al., 2010). This exaggerated processing of errors does however not per se lead to adequate behavioural changes (Hajcak et al., 2003; Weinberg et al., 2010). We expect that negative feedback in the IGT-P will have resulted in higher levels of error-related brain activity than in the standard IGT due to the fact that loss could have been averted if only the pass option had been used. In sum, we hypothesize that it is the added complexity of the task which increases uncertainty and is therefore more likely to negatively impact the high worriers.

Reversely, it could also be that low worriers benefit from the pass-option. The opportunity to pass might have increased their sense of control and heightened their task engagement. Or alternatively the added dimension might have made the task more interesting therefore increasing the attention given to the feedback provided during the task. Whether low worriers profit or high worriers are impaired by the possibility to engage in avoidance behaviour, the results clearly imply that they are affected by it in different ways.

Besides the apparent effect of merely having the option to refrain from making a decision, results also revealed a negative effect of actual 'pass' usage on IGT performance. Effectively, pass delays the information participants receive consequently delaying the learning process. Participants were led to believe, however, that pressing the pass button led to the removal of the next set of cards, while in reality the sequence was merely put on hold. So, the consequence of passing was that the same information would reach participants later – however, participants thought that by the 'removal' of the top four cards they had also missed out on information that could tell them whether the decks were advantageous or disadvantageous. This perceived loss of information and introduced uncertainty may have negatively influenced performance. Another

explanation for the negative effect of pass usage is that participants with poor IGT results retreat to the pass option in an attempt to shift from a losing situation to one in which they are winning.

The present study has a few limitations which should be kept in mind when interpreting the results. First of all a non-clinical sample was used. Conducting the experiment in a clinical, help-seeking, sample may yield different results. The range of PSWQ scores included quite a few participants (23%) with scores that are typically found in GAD patients ($PSWQ > 60$), however. Moreover, in the standard IGT condition rmANOVA analyses using only participants with PSWQ scores from both extreme ends of the scale did not change results. Secondly, the effect of the interaction of worry with condition on decision making did not reach conventional significance levels. However, we feel that the novelty of our findings and more importantly the fact that based on Akaike information criterion the full model including worry was determined to be the best approximating model sufficiently support our decision to execute additional analyses of worry in both conditions separately. A third limitation concerns the pass-button. Although designed to provide room for avoidance behaviour common in anxiety disorders (Barlow, 2004), we cannot exclude the possibility that participants turned to this option for different reasons (e.g. not out of uncertainty but as a deliberate strategy to avoid cards that they believe to contain high penalty losses). What pass usage exactly represents and how it establishes its negative effect needs to be further unravelled in future studies. Fourthly, worry research has shown that personal relevance is important in order to activate worry (Stöber, 2000). Hence it is possible that more pronounced effects would emerge when a more idiosyncratic decision making task would be used. Finally, due to the between-subject design it was not possible to establish whether the effect of worry found in the pass condition was due to the high worriers performing worse compared to the no-pass condition or that the low worriers somehow benefitted from the possibility to refrain from making a decision.

Overall, results from the present study do not support the notion of improved decision making in high worriers and therefore also do not provide evidence for the accompanying positive reinforcement hypothesis. On the contrary, when equipping the IGT with an option to avoid decision making and thus to more closely resemble real-life, performance is even worse in high compared to low worriers.

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Chapter 7

General discussion

General discussion

The main aim of this thesis was to clarify some of the pending issues surrounding the transdiagnostic nature of worry and rumination as well as whether they share the same underlying processes and functions. In accordance with this aim several studies were designed covering two lines of research; i) epidemiological studies comparing worry and rumination in their relationship with each other and with emotional disorders; ii) experimental studies examining worry at a more functional/process level.

In this general discussion I will once more highlight the criteria for a transdiagnostic process as well as those for a shared underlying process with reference to the previous chapters in which these criteria were addressed. A brief summary of the main findings of each chapter will be provided and discussed with respect to their contribution to the ongoing worry-rumination debate. This is followed by a discussion of more general theoretical and clinical implications of the findings reported in this thesis including the advantages and disadvantages of adopting a transdiagnostic approach and suggestions for future directions of research. Finally, limitations of the present thesis will be addressed followed by an overall conclusion.

Criteria transdiagnostic process

As stated in the introduction a **transdiagnostic process** should meet several criteria:

- 1) to be present *across* multiple disorders but not due to comorbidity with one specific disorder (chapter 2 & 3);
- 2) exhibit similar process characteristics *across* these disorders (chapter 5); and
- 3) contribute to the onset, maintenance and/or recurrence of psychopathology across disorders (chapter 4).

Criteria shared underlying process

Even if worry and rumination are indeed established to be transdiagnostic processes this does not necessarily mean that they share *the same* underlying process. In case of a **shared underlying process** between worry and rumination, it is to be expected that they

- 1) are present in the *same* disorders (chapters 2 & 3);
- 2) have the *same* causal status regarding these (emotional) disorders (chapter 4);
- 3) share the *same* process characteristics (chapters 5 & 6); and
- 4) are highly interrelated (chapter 3).

Overview of results

Part A: Worry & rumination: relations with emotional disorders

In **Chapters 2, 3 and 4** three studies are presented investigating the first main aim of this thesis (i.e., comparing worry and rumination in their relationship with each other and with emotional disorders). All three studies are conducted using epidemiological data from

the Netherlands Study of Depression and Anxiety (NESDA). This ongoing longitudinal cohort study includes 2981 participants who are followed for many years. The study has several important strengths among which a large sample size, prospective design and the inclusion of multiple waves.

Chapter 2 describes a study with a cross-sectional design examining the predictive utility of both worry and rumination. Specifically, it investigated whether worry and rumination have incremental validity in predicting the presence of a history or current occurrence of emotional disorders over and above more general personality traits while taking comorbidity into account. This was tested within the theoretical framework of the Integrative Hierarchical Model (Mineka, Watson, & Clark, 1998) which proposes that each of the emotional disorders contains general (common to all), specific (common to some) and unique components. To our knowledge, both worry and rumination have thus far not been tested as predictors in a hierarchical model. In the present study their role was investigated both in disordered patients ($n = 1111$) and in participants who were in remission ($n = 834$), hence exploring whether elevated scores on cognitive constructs merely reflect an epiphenomenon of current psychopathology or not. The sample consisted of participants taking part in the baseline assessment of NESDA. Disorders of interest were generalized anxiety disorder (GAD), panic disorder (PD), social anxiety disorder (SAD), major depressive disorder (MDD) and dysthymia (DYS) according to DSM-IV criteria as assessed with the CIDI. The study includes several cognitive measures: anxiety sensitivity, pathological worry and cognitive reactivity (including a subscale on rumination on sadness). In line with the aim of this thesis we will focus the discussion of the results on those concerning worry and rumination in particular.

Participants with a current disorder scored higher on worry and rumination than participants not currently meeting diagnostic criteria. Scores were elevated across all disorders. The same pattern of results was found when comparing participants in remission to a group with no history of psychopathology. Subsequently, hierarchical regression analyses were performed using a built in psychiatric control group. In the current disorder sample worry had additional predictive value over and above personality traits and the other cognitive constructs in predicting GAD. The same was true for rumination in predicting MDD. So, even though worry and rumination levels were elevated across emotional disorders worry had a more defining role in GAD and rumination in MDD. In the remission sample rumination had once again added predictive value for MDD. Worry on the other hand did not predict remitted GAD and was overruled by the influence of neuroticism. Results were replicated in analyses correcting for comorbidity.

These results suggest that worry and rumination are elevated across disorders (transdiagnostic criterion) both in the acute phase and once remitted. The data do not disclose whether elevated levels constitute a vulnerability factor or are for instance the result of scarring. Besides being present across disorders elevated scores are also present in the same disorders (precondition shared process). Results of the hierarchical regression analyses however, ascribe a more prominent role for worry in predicting GAD (acute

phase) and for rumination in predicting MDD (acute and remitted phase). Note that these predictive roles are relative and not absolute. Overall, our findings reveal that cognitive constructs have additional value in understanding anxiety and depressive disorders over and above personality traits. Moreover, they prove to be more than mere epiphenomena of current disorders. .

Chapter 3 describes a study with a longitudinal design including three-waves and focusses on the stability of worry, rumination and psychopathology over time as well as the reciprocal relationships among these three phenomena. So far most studies have focused on cross-sectional or uni-directional relationships of worry and rumination with each other and with particular emotional disorders, and did not examine reciprocal effects nor the temporal character of the effects. The present study overcomes this gap in the literature and contributes directly to the ongoing debate regarding the question whether worry and rumination are conceptualizations of the same underlying process and whether they are transdiagnostic or not.

In this study we used the entire NESDA sample consisting of 2981 participants. Participants were tested over two year time-intervals with T2 including 87.1% and T3 80.6% of the original sample. Confirmatory factor analyses revealed that the latent structure and stability of emotional disorders was best represented by the distress (GAD, MDD, DYS) - fear (SOC, PD, AGO) model which is in line with recent measurement model studies of psychopathology (for an overview see Beesdo-Baum et al., 2009). This division allowed us to study the relationships between worry/rumination and emotional disorders while taking comorbidity into account.

Using structural equation modelling trait-state models were fitted for worry, rumination, distress disorders and fear disorders. Results showed that both worry and rumination contain stable underlying trait components. So far test-retest periods were usually quite short and this study is the first to reveal that stability is present over longer periods of time. Moreover, results also showed that the stable components of worry and rumination were highly correlated (.76) which supports the notion of a solid, shared, base and thus provides the preconditions for a shared process. Also in line with the proposition of a shared process was the finding that worry and rumination show similar relationships with both fear and distress disorders; in other words, they are present in the same disorders and relate to them in the same way. Besides being present in the *same* disorders they were also present *across* both fear and distress disorders, although associations with the distress disorders were slightly stronger than with the fear disorders. This was expected as GAD and depression -typically linked to worry and rumination respectively- were both placed in the distress disorder category. However, differences were modest and correlations between the trait components of worry/rumination and psychopathology were strong in all four trait-state models investigated. This underlines worry/rumination's involvement across emotional disorders and is in line with criteria for a transdiagnostic process.

Another aspect examined in this study was whether worry/rumination and emotional disorders were mutually reinforcing each other over time resulting in a downward spiral.

Results did however not confirm this hypothesis. Changes in worry and rumination were not predictive of changes in fear or distress levels two years later. However the opposite effects –change in psychopathology on change in repetitive negative thinking- were significant albeit small to medium in strength.

Overall, the findings from this study highlight the similarities between worry and rumination and support their conceptualization as transdiagnostic processes. The fact that state changes in psychopathology are not preceded by state changes in worry/rumination but vice versa suggests that *fluctuations* in worry/rumination may merely be epiphenomena of emotional disorders. From a clinical perspective it therefore seems more pertinent to modify the *underlying trait* component(s) of worry and rumination in order to obtain enduring therapeutic benefits.

Chapter 4 describes a study in which both cross-sectional data and longitudinal data (three-waves) are used to examine the role of worry and rumination in the occurrence of comorbidity among emotional disorders. A prerequisite for a cognitive process to be considered a transdiagnostic factor is its presence among multiple disorders. It is generally assumed that such transdiagnostic factors not only contribute to the occurrence of a specific disorder but are also (in part) responsible for comorbidity among these disorders. Worry and rumination (also referred to by the overarching term repetitive negative thinking (RNT)) are such candidate transdiagnostic factors. However, if RNT truly contributes to the high comorbidity rates among emotional disorders it should not only cross-sectionally relate to comorbidity but also mediate the relationship between anxiety and depressive disorders and vice versa. McLaughlin and Nolen-Hoeksema (2011) found support for the involvement of rumination in the co-occurrence of anxiety and depressive symptoms. However, this study only examined symptoms, not clinical diagnoses; and furthermore, it only examined rumination and did not include other types of RNT (such as worry). The aim of this study was to test whether RNT also accounts for the comorbidity among emotional *disorders*, both cross-sectionally and longitudinally. In other words, this study is a conceptual replication of McLaughlin and Nolen-Hoeksema (2011), focusing on clinical diagnoses instead of symptoms and examining two types of RNT –worry and rumination. We expected that both rumination and worry would account for the cross-sectional overlap of emotional disorders at baseline and would mediate the prospective cross-disorder relations among emotional disorders.

The same three wave samples were used as in the chapter 3 study including 2981 participants at baseline, 87.1% of the original sample at the 2 year follow-up, and 80.6% at the 4 year follow-up. The cross-sectional baseline data were used to perform separate ANOVA's to compare worry/rumination levels between different groups with/without comorbidity. Structural equation modelling was used to fit the longitudinal mediation models. Like in chapter 3, the distress (GAD, MDD, DYS)-fear (SOC, PD, AGO) model was chosen to represent the latent structure and stability of emotional disorders as it had the best fit to the data. Two longitudinal mediation models were examined: one examining the role of rumination as a putative mediator of the longitudinal association of

distress with fear disorders (and vice versa) and one examining the role of worry in these longitudinal relations. In this way we could analyze whether baseline distress disorders predicted changes in rumination/worry and whether these changes predicted subsequent changes in fear disorders (and vice versa).

Our cross-sectional baseline findings showed that worry and rumination scores were elevated in both the fear and distress group when compared to participants with no current emotional disorder. Moreover, participants with distress disorders obtained higher scores than participants with fear disorders. Critically, worry and rumination levels were particularly high in those with comorbid fear and distress diagnoses. This finding is in line with results from the McEvoy et al. (2013) study and supports the transdiagnostic hypothesis, which assumes that higher levels of RNT are associated with higher levels of comorbidity.

Results of the longitudinal mediation models showed that worry and rumination both significantly mediated the longitudinal association between baseline fear disorders and later (4-year follow-up) distress disorders. These mediation results suggest that the increased risk of a future distress disorder when suffering from a fear disorder is partly attributable to worry and rumination. Partly attributable, as the mediation effects are small. The same applies for the longitudinal distress (baseline) → fear (4-year follow-up) association with the exception that only rumination significantly mediated this association and worry did not.

Overall, the findings from the present study suggest that repetitive negative thinking in the form of rumination or worry constitutes an important transdiagnostic factor responsible for the co-occurrence of emotional disorders. In transdiagnostic treatment interventions for emotional disorders it seems warranted to include interventions specifically targeting this transdiagnostic factor.

Part B: Mechanisms involved in worry: Avoidance

In **chapters 5 and 6** experimental studies are presented addressing the second main aim of this thesis (i.e., studying process and functional characteristics of worry). As the NESDA study is not designed to investigate worry at process level additional experimental studies were conducted to accommodate for this.

Chapter 5 presents two experimental studies examining worry at process level, specifically, whether reduced concreteness is a pivotal component in explaining the cognitive avoidance function of worry and indeed leads to poorer problem solving as is often suggested. The prevailing theory concerning worry's avoidance function is the Avoidance Theory of worry (Borkovec, Ray, & Stöber, 1998) which postulates that worry is a form of *cognitive avoidance* that operates via the reduction of aversive imagery with the purpose to avoid somatic anxiety reactions. However in doing so it is believed to undermine emotional processing and thereby contribute to the maintenance of worry. The two studies discussed in this chapter focussed on a caveat in the avoidance theory namely on *how* worrying leads to reduced imagery. The Reduced Concreteness theory

of worry (Stöber, 1998; Stöber & Borkovec, 2002) posits that the mediator between worrying and reduced imagery is reduced concrete thinking (increased abstract thinking), which is presumed to be characteristic of worry. Concrete thinking is defined as “distinct, situationally specific, unequivocal, clear, singular” whereas abstract thinking is described as “indistinct, cross-situational, equivocal, unclear, aggregated” (Stöber & Borkovec, 2002, p. 92). The Reduced Concreteness theory hypothesizes that it is the relatively abstract style of thinking during worry which is responsible for reduced aversive visual imagery. So far the presence of reduced concreteness in worriers has been established to occur in the problem analyses phase (Stöber, 1996; Stöber, Tepperwien, & Staak, 2000; Stöber & Borkovec, 2002), however not yet during the problem solution generation phase. The latter had thus far only been investigated, and found, in participants with depression (Watkins & Baracaia, 2002; Watkins & Moulds, 2005).

Experiment 1 investigated whether high trait worriers ($N = 40$) adopt a more abstract thinking style compared to low trait worriers ($N = 40$) during the phase of problem solution generation and whether concreteness training improves social problem solving (SPS). SPS skills were assessed with the Worry Domain Means-Ends Problem Solving task (WD-MEPS). In this task participants were presented with a problem situation relevant to their personal circumstances and asked to find the ideal strategy for overcoming the problem situation and thereby reach a given ending (Marx, Williams, & Claridge, 1992). Problem solutions were rated for the number of steps (means) provided and on their effectiveness. Experiment 2 was a replication of the first study (high trait worriers $N = 49$, low trait worriers $N = 48$) extended to examine other aspects of SPS related to worry: problem orientation, problem solving style and problem solving confidence.

Results from both studies indicated that there were no baseline differences in thinking style (abstract/concrete) or problem solving skills (means/effectiveness) between high and low trait worriers. The claim that level of concreteness has a causal effect on problem solving was partly supported as results from the second experiment revealed that concreteness training had a positive effect on problem solving (number of means) relative to the abstract training. Effectiveness scores showed a similar pattern but this did not reach significance. Although high worrier’s problem solving skills were not found to be impaired, compared to low worriers they did report low problem solving confidence, a dysfunctional (negative) problem orientation and an overall avoidant problem solving style. Overall these results, combined with results from previous studies showing reduced concreteness in the problem analysis phase, suggest that high trait worriers’ SPS skills are intact and that impairments lie within the early stages of SPS. Although results differ from those found in depressive samples differences in study characteristics could possibly account for that, leaving the matter as to whether worry and rumination share this mechanism of reduced concreteness only partly answered.

Chapter 6 presents an experimental study focussing on the presence of behavioural avoidance in decision making and how this affects the maintenance of worry. Findings from a previous study by Mueller et al. (2010) suggest that worrying leads to improved

decision making on the Iowa Gambling Task (IGT) as evident through a steeper learning curve. In the IGT (Bechara et al., 1994), four decks of cards are simultaneously presented to the participant. Each selection of a card leads to either an addition or subtraction of points (money). The task is designed in such a way that repeated selection of card decks A and B leads to long term net loss and repeated play of decks C and D leads to long term net gain. Participants are instructed to maximize their winnings. The reinforcement schedule is too complicated for participants to figure it out but they typically develop an intuitive preference for decks C and D. The positive effect of worry on decision making reported by Mueller et al. (2010) could pose a reinforcement mechanism underlying pathological worrying. However, the standard IGT does not reflect decision making in a social context and critically, due to the forced nature of the task, it does not accommodate for anxiety disorder's hallmark characteristic: avoidance. Pathological worriers tend to engage in mental procrastination and dwell on certain issues which may lead them to postpone or abandon decision making altogether. In order to examine the role of such avoidance behaviour or 'inaction' in decision making, the current study used both the standard IGT and a newly developed adaptation of the IGT that included a pass option (IGT-P). We expected high worriers to engage in avoidance behaviour (selection of the pass button) more often than low worriers and that this would mediate the relationship with their performance on the task i.e. whether they would select from the long term advantageous decks.

A total of 157 participants took part in the study of which 78 in the standard IGT and 79 in the adjusted IGT-P. Results were mixed. We did not replicate Mueller et al.'s (2010) findings on the standard IGT that high worriers outperform low worriers; no differences between groups were observed. On the IGT-P on the other hand we found –as expected– that high worriers performed worse than low worriers when given the option to avoid decision making. Also we found that pass usage led to poorer IGT performance. However, the relationship between worry and performance on the IGT was –to our surprise– not mediated by avoidance.

These results suggest that the mere option to avoid affects high worriers differently from low worriers. Explanations for this finding are speculative as the data do not provide a clear-cut answer. It is possible that the added complexity of the task by means of introducing a pass option increases uncertainty. With high worriers typically being intolerant of uncertainty (IU; Buhr & Dugas, 2006) it is possible that the impact was more pronounced in this group consequently fuelling worry related activity and exerting cognitive resources needed to unravel the task.

Overall, results from the present study do not support the notion of improved decision making in high worriers and therefore also do not provide evidence for the accompanying positive reinforcement hypothesis. On the contrary, when extending the IGT with an option to avoid decision making and thus to more closely resemble real-life, performance is even worse in high compared to low worriers. Whether the added complexity of the task affects ruminators in a similar way as worriers can not be determined from the present data and should be addressed in future studies.

Theoretical integration of findings

Worry and rumination have been proposed to be conceptualizations of the same shared underlying transdiagnostic process that in their definition only differ in their temporal orientation (worry-future; rumination-past). In order to qualify as being both transdiagnostic and as being reflections of the same underlying process several criteria (described at the start of this general discussion) should be met. In this section findings from the present thesis will be linked to these criteria and placed within a broader context. Overlapping criteria will be collapsed to avoid repetition.

Present across and in the same disorders

Thus far the assumption that worry and rumination are transdiagnostic processes was mainly based upon studies showing that both cognitive processes were present across multiple disorders (Harvey et al., 2004; Ehling & Watkins, 2008). However these studies did often not consider the option that comorbidity of disorders may be responsible for the observed elevated levels. The results from the present thesis show that levels are elevated during both the acute phase and the remitted phase of emotional disorders (chapter 2) and that even when taking comorbidity into account worry and rumination are both involved across fear and distress disorders (chapter 3). From a hierarchical point of view worry has a more defining role in GAD and rumination in MDD (chapter 2). This does not contradict the transdiagnostic nature of both concepts, it only means that they are more prominently present in some disorders than others. This may partly be due to the specific wording of the questionnaire items and repeating the analyses with a more generic RNT measure is advisable. In sum, the data presented in this thesis supports the first criterion of a transdiagnostic process as well as that of a shared underlying process.

Besides worry and rumination there are other candidate transdiagnostic thought processes that are likely to play an important role in all or some of the emotional disorders. In recent years, literature has for instance seen a real boost of articles proposing perfectionism (for an overview see Egan, Wade, & Shafran, 2011) and intolerance of uncertainty (e.g. Mahoney & McEvoy, 2012; Carleton, 2012) as transdiagnostic concepts. In addition to thought processes, there are also memory processes (e.g. explicit selective memory), reasoning processes (e.g. emotional reasoning), and behavioural processes (e.g. avoidance/safety behaviour) which are likely to meet transdiagnostic criteria (Harvey et al., 2004, p.270). Even with processes common to multiple (emotional) disorders, the way psychological disorders present themselves can vary greatly. Mansell et al. (2008) have proposed three possible explanations for this: (1) variations in idiosyncratic current concerns; (2) variations in the degree of shared processes and (3) distinct processes for specific disorders or groups of disorders (Mansell, Harvey, Watkins, & Shafran, 2008). Further examination of these propositions is necessary to get a better understanding of how transdiagnostic processes can be placed within existing frameworks and in order to more clearly define their role in understanding and treating psychological disorders.

Shared process characteristics across and in the same disorders

Worry and rumination have many similarities; they are both repetitive forms of thinking, negative in valence (e.g. Ehring & Watkins, 2008) and characterized by cognitive inflexibility and difficulty in switching attention from negative stimuli (Davis & Nolen-Hoeksema, 2000; Hazlett-Stevens, 2001). Another proposed central element of both worry and rumination is reduced concreteness. Previous studies have shown that reduced concreteness plays a pivotal role in dysphoric individuals and that increasing concreteness improves social problem solving (solution generation phase) (Watkins & Moulds, 2005) and reduces depressive symptomatology (Watkins, Baeyens, & Read, 2009; Watkins & Moberly, 2009; Watkins et al., 2012). In worry/GAD the presence of reduced concreteness has been found in the problem analyses phase (Stöber, Tepperwien, & Staak, 2000; Stöber & Borkovec, 2002) but not in the problem solution generation phase (chapter 5). These contrasting findings highlight a potential difference between worry and rumination, namely that there is a nuance to be made regarding the aspects they influence and consequently the moments in time during which their influence is most pronounced. This difference is not in line with the criterion that worry and rumination share the same process characteristics even though the mechanism itself (reduced concreteness) is essentially the same. More differences between worry and rumination have been articulated over the years (see Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008 for an overview), of which the most well-known is that of the direction of processing. Whereas worry is considered to be future oriented focussing on anticipated threats, rumination on the other hand is considered to be past-oriented focussing on issues of self-worth, meaning and themes of loss (Nolen-Hoeksema et al., 2008). Other differences concern the conscious and non-conscious motives underlying both cognitive processes. Whereas the conscious motive to worry is to prepare and anticipate for threat (Borkovec, Hazlett-Stevens, & Diaz, 1999), that of rumination is to gain insight, solve problems and to understand the deep meanings of events (Lyubomirsky & Nolen-Hoeksema, 1993; Papageorgiou & Wells, 2001; Watkins & Baracaia, 2002). The non-conscious motives of worry and rumination are both concerned with avoidance. In line with the Avoidance Theory of worry (Borkovec, Ray, & Stöber, 1998) the non-conscious motive of worry is thought to be the avoidance of somatic anxiety reactions and negative affect whereas that of rumination is the avoidance of aversive situations and the responsibility to take action (Nolen-Hoeksema et al., 2008). Although different, at a higher level both types of avoidance can be referred to by the overarching concept Experiential Avoidance. Experiential avoidance has been defined as the phenomenon that occurs when a person is unwilling to remain in contact with particular private experiences (e.g. bodily sensations, emotions, thoughts, memories, behavioral dispositions) and takes steps to alter the form or frequency of these events and the contexts that occasion them (Hayes, Wilson, Gifford, Folette & Strosahl, 1996). The term avoidance refers to both cognitive avoidance (chapter 5) and behavioural avoidance (chapter 6). Elevated levels of EA have indeed been reported in GAD and MDD (Cribb, Moulds, & Carter, 2006; Salters, Raffa, & Orsillo, 2005) and suggest a general inability to accept things as they are, and to just let things be. Interestingly, interventions such

as 'Mindfulness based therapy' (Segal, Williams, & Teasdale, 2002) and 'Acceptance and Commitment therapy' (Hayes, 2004; Hayes, Luoma, Bond, Masuda & Lillis, 2006) focus on skills to address these deficiencies. Overall, it seems that at a higher level worry and rumination seem very similar, even identical, but that once these aspects are dissected, differences emerge. Therapeutic interventions aimed at higher level processes may well be effective. However, it is likely that to really optimize clinical effects fine-tuning of interventions is needed to address the lower level differences.

Co-occurrence of worry and rumination, and their contributions to onset, maintenance and/or recurrence of psychopathology

Co-occurrence of anxiety and depressive disorders is very common (e.g. chapter 2, 3 and 4) and is associated with higher levels of worry and rumination than in the instance of a single diagnosis (McEvoy, Watson, Watkins, & Nathan, 2013; chapter 4). This link between heightened levels and comorbidity supports the hypothesis that worry and rumination are transdiagnostic concepts; however, it does not exclude the option that they are merely epiphenomena reflecting –in the instance of comorbidity- more severe psychopathology.

Findings reported in the present thesis confirmed the presence of heightened levels of worry and rumination during both the acute and remitted phase of emotional disorders, even when controlling for residual symptoms (chapter 2). Hence, these results do indicate that there is more to worry and rumination than just being epiphenomena. This conclusion is in line with longitudinal prospective studies that showed that rumination predicts the occurrence of both anxiety and depressive symptoms over time, including new onset of depressive disorders (Nolen-Hoeksema, 2000). Likewise, worry has been found to be a vulnerability factor predicting increments of anxiety and depressive symptoms over time (Hong, 2007). Furthermore, an extensive review of the literature on repetitive (negative) thinking (RNT) also revealed that RNT is a vulnerability factor for both anxiety and depressive disorders (Watkins, 2008). The present thesis adds to these longitudinal findings by showing that both worry and rumination mediate the relationship between the presence of fear disorders at baseline and the occurrence of distress disorders 4 years later. Moreover, the association between baseline distress disorders and changes in fear disorders is mediated by changes in rumination, although changes in worry as a mediator did not reach significance in this prospective analysis (chapter 4). Overall, it appears that the accumulating evidence on the causal status of worry and rumination reveals a very similar overall pattern for both cognitive constructs, hence in line with requirements for a shared underlying process. Nonetheless, it is an area which is still very much in progress and there is plenty of ground left to uncover.

High interrelatedness of worry and rumination

The assumption that worry and rumination share the same process is largely based on studies showing significant correlations between the two constructs (e.g. Segerstrom et al., 2000, $r = .32$ to $r = .46$; Muris et al., 2004, $r = .55$; Watkins, 2004, $r = .51$; Hong, 2007, $r = .42$). It is surprising how easily and frequently worry and rumination are referred to as

being one and the same considering that these correlations are –although significant- not as high as would be expected of processes that are hypothesized to be so similar. The reason for these relatively low correlations is not clear. Results from this thesis provide however a possible explanation. When disentangling trait and state components of worry and rumination it becomes clear that trait components are highly related (chapter 3, $r = .76$) whereas state level fluctuations are only moderately related (chapter 3, r 's varying between .39 and .45). The observed score correlations mentioned before, are lower than the trait correlations. However, the observed scores also include a state component which represents the effects of external circumstances and measurement error. This is likely an important contributing factor to the lower observed score correlation. However at trait level worry and rumination are highly interrelated and thus meet preconditions for a shared process.

Advantages and disadvantages of the transdiagnostic approach

The disorder specific approach has been really successful in elucidating the onset and maintenance of various psychiatric disorders and has resulted in the development of many (cognitive-behavioural) therapies that have proven to be very effective (e.g. Beck, Rush, Shaw, & Emery, 1979 [depression]; Clark & Ehlers, 2004 [posttraumatic-stress disorder]; Salkovskis, 1989 [obsessive-compulsive disorder]; Clark, 1988 [panic disorder]). However, the progress made within this perspective seems to be levelling off and there is still a large group of patients left that do not respond (sufficiently) to existing therapies. Furthermore, over time it has become evident that comorbidity among disorders is very common, while disorder specific therapies do not adequately address comorbidity among disorders. In cases where there is comorbidity the clinician has several options: 1) Treat one disorder with the idea that this will impact upon the comorbid disorder: this is indeed the case, however effects on the comorbid disorder are limited and there is propensity to relapse in the comorbid disorder; 2) Apply evidence based treatments sequentially: the downside to this approach is mainly the higher costs involved; 3) Combine evidence based treatments: this option is however at risk of diluting efficacy and has been reported to be less effective than applying one single disorder specific treatment; and 4) Apply a transdiagnostic approach addressing the shared maintaining mechanisms: this latter option has recently sparked a lot of interest and appears to be the most promising. For a more extensive overview and discussion of these four options in treating comorbid disorders we refer to McManus et al. (2010).

The recent interest in a transdiagnostic approach to psychiatric disorders has resulted in an ever increasing number of papers on candidate transdiagnostic processes (e.g. Harvey, Watkins, Mansell, & Shafran, 2004; Nolen-Hoeksema & Watkins, 2011) as well as on transdiagnostic therapies (e.g. McManus et al., 2010; Clark, 2009; Mansell et al., 2009; Clark & Taylor, 2009) in which some clear advantages, but also disadvantages are outlined. The most important ones are discussed below.

Transdiagnostic processes

Advantages

Firstly, many processes (e.g. worry, thought suppression, experiential avoidance) that were initially proposed to be specific to a certain disorder have turned out to be present across multiple disorders. Thus investigating transdiagnostic processes seems to fit better with the nature of psychopathology and therefore provides a better use of limited research resources. Secondly, the transdiagnostic approach holds promise in understanding and explaining the high comorbidity rates among disorders as well as why certain disorders in particular seem to group together. From a transdiagnostic point of view processes common to multiple disorders are the ones that may be (partly) responsible for the co-occurrence of disorders. A view supported by findings presented in the present thesis (chapter 4). Thirdly, insight into the different transdiagnostic processes as well as into how they are all interrelated provides new angles for therapeutic interventions. For a more extensive overview and discussion of these advantages of investigating transdiagnostic factors we refer to Nolen-Hoeksema and Watkins (2011).

Disadvantages

Firstly, and most importantly, although transdiagnostic processes may be very useful in explaining comorbidity among disorders, research has fallen behind in explaining how people characterized by the presence of the same process can suffer from different disorders. Harvey et al. (2004) suggested that the factor defining which disorder one develops is the topic of current concern. More recently however Nolen-Hoeksema and Watkins (2011) proposed a heuristic for developing transdiagnostic models of psychopathology, in which topic of current concern is only one factor in an elaborate model in which biological factors also have an important role. Their model includes different levels of transdiagnostic risk factors, mechanisms and mediators which all interact and contribute to the development of a certain disorder. This attempt to provide a framework in which to place transdiagnostic factors is promising but in need of further study. It is for instance not clear how the different levels of transdiagnostic (risk) factors are exactly related. A second disadvantage of the transdiagnostic approach is that it has thus far not succeeded in explaining how the presence of the same transdiagnostic factor can lead to the development of different disorders at different times in someone's life (Nolen-Hoeksema & Watkins, 2011). Especially between childhood/adolescence and adulthood there appears to be a shift in the presented symptoms. McLaughlin and Nolen-Hoeksema (2011) observed this in the instance of the transdiagnostic risk factor rumination and attributed the difference to the fact that internalized psychopathology in youths is less differentiated than in adults. However, what mechanisms or factors are responsible for this differentiation is not yet clear.

Research into candidate transdiagnostic processes, their causal role and the development of models explaining their interrelatedness is of fundamental importance for the development of new transdiagnostic therapies. In recent years research on transdiagnostic

processes has indeed received more attention. This is not only reflected in the large number of articles published in this area but for instance also by an announcement of NIMH in 2013 stating a new research framework that abandons the symptom focussed categories of DSM-5 and alternatively focuses on domains containing functions that transcend disorder categories. As mentioned before one of the questions that remains is which processes should be included as targets for therapeutic interventions. A process that is very likely to make the cut is repetitive negative thinking (worry/rumination), a choice which is supported by the findings in this thesis.

Transdiagnostic therapies

Advantages

Firstly, as mentioned above, a transdiagnostic approach may prove to be a good way to deal with comorbidity among disorders. Addressing the processes that are shared by the comorbid disorders might elicit positive changes across the board (e.g. Mansell et al., 2009; McManus, Shafran, & Cooper, 2010; Nolen-Hoeksema & Watkins, 2011). A second advantage concerns the costs involved. A transdiagnostic approach lends itself better for group therapy as it can be applied in heterogeneous groups. Considering group therapy is cheaper and with the pressure on mental health care to reduce its costs, this constitutes an important benefit (Clark, 2009). Thirdly, therapists will need to learn fewer techniques/protocols, which increases the chances of dissemination of the therapy and ultimately a higher rate of patients that receive evidence based treatments (e.g. McManus et al., 2010; Clark & Taylor, 2009). Fourthly, transdiagnostic treatments could be beneficial for patients who do not respond to disorder specific treatment and for those who suffer from disorders 'not otherwise specified' for which there is currently no clear specific treatment (Mansell et al., 2009). In addition transdiagnostic treatments may be useful in treating residual symptoms or in preventing people who are at risk of developing mental health problems (Clark, 2009; McManus et al., 2010).

Disadvantages

The main disadvantage of embracing the transdiagnostic perspective is the risk of losing the progress that has been made with the disorder specific approach. It should not be forgotten that the existing disorder specific therapies do yield positive effects for many; a result which is still questionable for the transdiagnostic approach (McManus et al., 2010; Clark & Taylor, 2009). Furthermore, the disorder specific therapies already include components that target transdiagnostic mechanisms (e.g. avoidance in anxiety disorders), thus the differences between the two perspectives is really one of degree (Clark & Taylor, 2009). Therefore the question remains whether a transdiagnostic approach will really add enough additional value to existing and well-established therapies. The second disadvantage is inherent to the early stage the transdiagnostic approach is currently in. Its (theoretical) concept and practical consequences are still rather vague and seem to include many different components. It is at risk of becoming too complex and failing to connect sufficiently to clinical practise (cp.

Nolen-Hoeksema & Watkins, 2011). Although clinical practise is erratic and relatively simple explanatory models do not always suffice, they do provide a working model that can be disseminated to clinical practise at large. With time, hopefully a clearer working model of the transdiagnostic perspective will be developed, overcoming these obstacles. Thirdly, therapies focussing on altering transdiagnostic processes may not appeal to patients consequently resulting in higher dropout rates and less motivation for therapy. After all, compared to interventions tackling general processes a disorder specific approach more closely resembles the patients' thoughts and experiences thus providing a feeling of being understood and implying expertise of the therapist. So even when using a transdiagnostic approach it may be important to add disorder specific and/or idiosyncratic elements.

Some efforts to develop new transdiagnostic therapies have already been made. Fairburn, Cooper and Shafran (2003) for instance proposed a general therapy for eating disorders (Fairburn et al., 2009), Barlow, Allen and Choate (2004) developed a unified treatment for emotional disorders and then there are treatments that target disorders in general such as mindfulness (Segal, Williams, & Teasdale, 2002) and acceptance and commitment therapy (ACT: Hayes, 2004; Hayes et al., 2006). Results of these interventions are somewhat mixed and reflect the early stages of transdiagnostic treatments as well as the bulk of work still needing to be done. So the question remains where in the therapeutic landscape the transdiagnostic treatment should be located? Should it replace disorder specific therapies? Is it best suited as a pre-therapy preceding the 'real' disorder focussed therapy? Or should it be regarded as the main therapy followed by a few sessions targeting disorder specific elements? These questions are not answered as yet but the overall consensus seems to be that it should be complementary as it is very unlikely to outperform disorder specific, tailored, interventions (Clark, 2009; Clark & Taylor, 2009).

Overall it can be concluded that the transdiagnostic approach is still in its infancy and a lot of work is still needed to be done. The importance of the advantages and the clear potential that this approach has warrants further research into this area.

Strengths and limitations

The studies described in this thesis all have certain strengths and limitations which are described in detail in the respective chapters. The most important ones will be repeated and elaborated upon here.

Strengths

Some of the main strengths of this thesis come from using data from the Netherlands Study of Depression and Anxiety (NESDA) (chapters 2, 3 and 4). The NESDA study provided us with the unique opportunity to examine worry and rumination in a large

population (power) coming from different health care settings (generalizability) within a longitudinal design including multiple waves. Thus far rumination and especially worry have mainly been studied using a cross-sectional design or prospectively with relatively short follow-up periods, limiting the interpretation of the findings. NESDA's longitudinal design allowed us to examine the stability, fluctuations, and interactions between worry and rumination as well as with emotional disorders over a four year period. Our studies further benefited from the inclusion of numerous disorders in NESDA, allowing us to add to the existing literature by examining the incremental validity of worry and rumination in predicting various emotional disorders as well as by investigating the transdiagnostic nature of both cognitive constructs while taking comorbidity into account.

Another strength concerns the tasks used in the experimental studies (chapters 5 and 6). Existing well established experimental paradigms were modified to tailor for worry specific characteristics subsequently allowing us to study worry at process level. The problem solving task MEPS-P used in chapter 5 was especially designed to meet an important prerequisite of worry, namely that topics need to have personal relevance (Stöber et al., 2000). Also, in the same study, the focus of the abstract/concreteness manipulation was altered to fit themes characteristic of anxiety disorders, i.e. fear-future. Another worry related modification was the added avoidance option in the decision making task (IGT) in chapter 6. Previous studies using the standard decision making task in a high worry population failed to feature this hallmark of anxiety disorders in their design. Our modified version provides a novel and crucial twist to the existing paradigm allowing for more accurate assessment of decision making in high trait worriers. A final strength of the experimental studies reported in this thesis is that we successfully included students with worry scores resembling those found in clinical GAD samples.

Limitations

The studies in this thesis have several general limitations. First of all our findings are limited to the repetitive negative thinking processes of worry and rumination. There are other forms of repetitive negative thinking (RNT) such as post event processing (Rachman, Gruter-Andrew, & Shafran, 2000; McEvoy, Mahoney, & Moulds, 2010). Whether our results can be generalized to these other processes has to be examined in future studies. In line with this is the absence of a generic measure of RNT that transcends specific content such as the Repetitive Thinking Questionnaire (RTQ; McEvoy, Mahoney, & Moulds, 2010) and the Perseverative Thinking Questionnaire (PTQ; Ehling et al., 2011). Inclusion of such a generic RNT measure could provide a more accurate picture of RNT's role in emotional disorders as current assessment of worry and rumination is coloured by the wording of questions and by the disorder it was based upon when originally designed. However available generic measures are also not entirely objective. The RTQ for instance, was developed from a pool of questions drawn from the Penn State Worry Questionnaire (PSWQ; Meyer et al, 1990), the Response Styles Questionnaire (RSQ; Nolen-Hoeksema & Morrow, 1991) and the Post-Event Processing Questionnaire-Revised (PEPQ-R; McEvoy & Kingsep, 2006); thus possibly restricting its scope to these three processes. This may be

an accurate resemblance of RNT if it turns out that RNT is only made up by these three processes. Because research of different type of processes involving RNT is still ongoing this decision to restrict the scope of RNT may be premature.

Another limitation concerns the assessment of worry and rumination. For rumination we used the subscale 'rumination on sadness' from the Leiden Index of Depression Sensitivity - Revised (LEIDS-R; Van der Does, 2002; Williams, et al., 2008); a questionnaire measuring cognitive reactivity to sad mood. Worry was determined by the PSWQ. Thus, both cognitive processes were assessed by a singular instrument. This was the result of a trade-off in order to obtain data from a large population by the NESDA study. There are however also other measures of rumination and worry and it cannot be excluded that these would yield slightly different results. It is for instance, with the current assessment of rumination on sadness, not possible to make the distinction between brooding and reflection.

A related and general limitation concerns the self-report measures used in the studies reported. One could question whether people are able to accurately indicate and reflect upon their psychological state of mind, cognitive processes they are engaging in, the vividness of their thoughts, etcetera. Also, self-report is more liable to be affected by social desirability bias as may have been the case in experiment 1 of chapter 5 where self-report VAS measuring the success of the manipulation did not match ratings by independent raters. In this particular situation we were able to overcome this by using the latter scores. Even though self-report measures have obvious downsides most of the instruments reported upon in this thesis are well established and accepted in research.

The use of data from the NESDA study has besides the aforementioned multiple major strengths, also a few limitations. Findings are for instance limited to the disorders assessed in the standard diagnostic procedures and consequently, some diagnostic categories such as PTSD and OCD in which RNT is believed to play a crucial role, are missing. Also, over the multiple waves, attrition was not entirely random. The response rate was 87.1% at wave 2 and 80.6% at wave 3, and non-response was significantly higher among those with younger age, lower education, higher levels of psychopathology, higher levels of worry, and among those with a history of abuse and neglect: i.e. the more severe group. Consequently generalizability of our study results is somewhat restricted.

Another limitation related to the longitudinal studies in this thesis concerns causality. Even though with a longitudinal design it is possible to get a better understanding of relations between certain factors and clinical disorders over time when compared to cross-sectional studies, it still does not give a conclusive answer regarding causality. In order to investigate causal relationships experimental studies are indispensable.

A final limitation that should be mentioned concerns the non-clinical samples used in the experimental studies. Although all experiments included participants scoring within the clinical range this is not the same as meeting diagnostic GAD criteria of which worry is only one aspect. It can therefore not be excluded that the same experiments would yield slightly different results when conducted in a clinical sample.

Future directions

In general, and in line with the limitations mentioned above, future studies should include: other candidate RNT processes such as post-event processing; other disorders in which RNT is expected to play an important role like PTSD and OCD; general RNT measures that are content independent like the RTQ and PTQ.

Regarding the criteria for a transdiagnostic process and those for a shared underlying process, there's still work to be done with regard to the causal status of worry and rumination i.e. do they contribute to the onset, maintenance and/or recurrence of psychopathology across disorders. The present thesis includes findings supporting worry and rumination as mediators for the prospective cross-disorder relations among emotional disorders (chapter 4). Although these findings are encouraging there are – as mentioned above – more aspects of causality in need of attention before firm conclusions on worry and ruminations causal status can be drawn. Overall, studies with longer follow-up periods consisting of multiple waves to obtain a better notion of worry and rumination's role in the onset, maintenance and recurrence of emotional disorders are warranted. The inclusion of multiple waves would also provide the opportunity to examine the presence of for instance scarring. Importantly, in order to get conclusive answers regarding causality, merely a longitudinal design does not suffice; the field is in need of more experimental studies investigating worry and rumination's causal status.

Another possible venture for future studies concerns the biological underpinning of RNT. The present thesis includes a series of experiments investigating worry at process level by focussing on how worry operates and establishes its negative effects from a cognitive perspective. An alternative angle from which to study similarities between worry and rumination and their transdiagnostic nature would be to tackle it at different levels focussing on for instance genetic influences or brain functioning. Given the complexity and intertwined nature of the biological underpinning of emotional disorders it seems likely that these do not correspond with the diagnostic boundaries of DSM-5 (APA, 2013) and that they will display many similarities across disorders and across processes. Studies have already shown for instance that rumination is linked to an imbalance in activity between different areas of the brain (Hamilton et al., 2011; Marchetti, 2012; Zhu et al., 2012) and that this imbalance may posit an underlying mechanism of rumination, impaired attentional control and cognitive reactivity (Marchetti et al., 2012). This example illustrates that worry and rumination may constitute endophenotypes for emotional disorders and that paying attention to their biological underpinning may provide us with a better understanding of the disorders which could help to develop alternative therapeutic interventions.

In Chapter 5 a study was presented where, in contrast with hypotheses, no differences were found between high and low worriers regarding their social problem solving skills. Considering that there is no defect needing fixing, it seems only logical to move on to those problem solving related aspects that are suboptimal. High worriers have low problem solving confidence, dysfunctional (negative) problem orientation and possess an overall avoidant problem solving style characterized by passivity and inaction (e.g. Dugas, Freeston,

& Ladouceur, 1997; Dugas, Letarte, Rheaume, Freeston, & Ladouceur, 1995; Davey, 1994; Ladouceur, Blais, Freeston, & Dugas, 1998; chapter 5). When aiming at improved social problem solving these aspects should be targeted in therapeutic interventions in order to yield clinically significant effects.

Finally, the Iowa Gambling Task with pass option (IGT-P) constitutes a novel twist of an existing and established decision making paradigm. Its novelty also implies that replication is needed, preferably also including replication in clinical populations. Also, it is still unclear how the option to avoid establishes its negative effect and why its influence is different in high worriers compared to low worriers. Several suggestions have been put forward in chapter 6, such as differential influences of distraction, intolerance of uncertainty, or increased exertion of cognitive resources; however additional studies will be needed to test their accuracy. In general the contrasting findings between using the traditional IGT and our modified IGT-P version (chapter 6) illustrate the importance of tailoring a paradigm according to the group of interest. Thus far this is not common practise in IGT research. Nonetheless studies conducted in MDD with the traditional IGT generally show impaired decision making in clinical MDD groups (e.g. Cella, Dymond, & Cooper, 2010; Han et al, 2012). Although MDD is more past than future oriented and therefore not in line with the goal of the pass option to avoid, it may still meet a characteristic process; rumination. As speculated in chapter 6 the pass button may also have a retrospective component. In instances of high loss it may trigger rumination due to the fact that loss could have been averted if only the pass option had been used. It would therefore be interesting to see whether the pass option would indeed negatively affect performance in people suffering from MDD.

Clinical implications

Overall, the studies presented in this thesis support worry and rumination as transdiagnostic processes. However, as the foregoing discussion on advantages and disadvantages surrounding the transdiagnostic approach has already laid out, the fact that worry and rumination can be considered transdiagnostic does not necessarily mean that transdiagnostic therapeutic interventions are clinically the most effective. Results from chapter 2 illustrate that processes like worry and rumination may be transdiagnostic but play a more defining role in one or a few specific disorders. Therefore, it seems only logical that these primary, for the specific disorder characteristic, processes deserve priority in clinical interventions. The awareness of the existence of these transdiagnostic processes is however helpful in making educated guesses as to the effects certain interventions will have on comorbid disorders sharing the same transdiagnostic process(es) while treating the primary disorder.

Clinical implications can also be taken from our studies regarding the similarities between worry and rumination. Both processes are very similar and more and more often they are regarded as the same as reflected in the increased use of the overarching term RNT and the introduction of new RNT measures like the PTQ and RTQ. This fusion may in

many instances be harmless or even favourable, however it is important to stay aware of the differences that are thereby ignored and how this affects clinical practise. For instance, the experiments conducted on abstract-concreteness in worriers revealed that reduced concreteness is not directly affecting the generation of problem solutions (chapter 5) but the preceding problem analyses phase (Stöber, Tepperwien, & Staak, 2000; Stöber & Borkovec, 2002). Rumination on the other hand does affect the solution generation phase and the therapeutic intervention 'Concreteness Training' has yielded positive effects in dysphoric participants (Watkins & Moberly, 2009; Watkins, Baeyens, & Read, 2009; Watkins et al., 2012). Tailoring Concreteness Training to tackle the affected problem solving phase in worry/GAD (i.e. problem analyses phase) may be necessary in order to establish any clinically significant changes. Finally, it has to be noted that Concreteness Training has not been directly compared to other therapeutic interventions such as mindfulness, traditional cognitive therapy, or competitive memory training and thus still needs to prove its added value for clinical practise; not only for GAD but also for MDD.

Another clinical implication that has spun from the findings in this thesis concerns the focus of CBT. Our state-trait model approach described in chapter 3 revealed that state level changes in worry/rumination are not responsible for state level changes in emotional disorders 2 years later but that levels rather seem to covary. Trait level components were on the other hand substantial and highly related. These results are in line with studies showing that change in cognitive content does not predict change in depressive symptoms (Jarrett, Vittengl, Doyle, & Clark, 2007) nor are a cause of improvement in anxiety symptoms (Smits, Julian, Rosenfield, & Powers, 2012). Translated to clinical practise our findings suggest that changes in state cognitions (such as negative automatic thoughts) may be primarily a reflection of changes at symptom level and that in order to establish long lasting changes in psychopathology it may well be necessary to alter underlying cognitive vulnerabilities (i.e., cognitive structures and schema's) which when activated are presumed to give rise to more momentary cognitive content c.q. negative automatic thoughts.

Overall conclusion

The main aim of the present thesis was to contribute to the worry-rumination debate by investigating whether worry and rumination are transdiagnostic processes and whether they represent a shared underlying process. Overall the studies presented in this thesis yielded support for both accounts: worry and rumination are highly related, are present across emotional disorders and show both similarities and differences at process level. Especially at a general, abstract, level similarities between worry and rumination seem to predominate. However, at a more concrete and specific level both similarities and differences are observed. Such differences can be relevant for research as well as therapeutic interventions. Depending on the questions in a certain research or clinical context emphasis on a more general-abstract or concrete-specific perspective on worry and rumination seems warranted.

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Nederlandse Samenvatting

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Piekeren (kenmerk gegeneraliseerde angststoornis) en rumineren (kenmerk depressie) zijn twee termen die refereren aan cognitieve processen die beide repetitief, oncontroleerbaar en negatief van aard zijn. De vele overeenkomsten hebben ertoe geleid dat beide vaak door elkaar gebruikt worden en dat ze in de laatste jaren ook steeds vaker onder één noemer geplaatst worden: repetitief negatief denken (RND; Ehring & Watkins, 2008). De vraag is echter of dit wel terecht is en of piekeren en rumineren daadwerkelijk representaties zijn van hetzelfde onderliggende proces. Er zijn namelijk ook verschillen waarvan de meest bekende de gerichtheid van het denkproces betreft: piekeren is meer toekomstgericht en rumineren richt zich juist overwegend op het verleden. Naast de discussie rondom de vraag of piekeren en rumineren nu al dan niet hetzelfde zijn is er de laatste decennia een ontwikkeling gaande waarbij piekeren en rumineren een steeds belangrijkere rol toebedeeld krijgen bij het ontstaan en voortduren van verschillende vormen van psychopathologie: angst- en stemmingsstoornissen in het bijzonder. Of het hier echter gaat om echt transdiagnostische processen is nog onduidelijk. Dit proefschrift richt zich op bovengenoemde twee discussiepunten. Om deze vragen te beantwoorden wordt uitgegaan van een aantal criteria welke onderzocht zullen worden in de daaraan gekoppelde hoofdstukken.

Criteria transdiagnostisch proces

Een transdiagnostisch proces wordt verwacht te voldoen aan de volgende criteria:

- 1) aanwezigheid bij meerdere stoornissen welke niet enkel is toe te schrijven aan comorbiditeit met één specifieke stoornis (hoofdstukken 2 en 3);
- 2) vergelijkbare proceskarakteristieken bij verschillende stoornissen (hoofdstuk 5);
- 3) bijdragen aan het ontstaan, in stand houden en/of recidiveren van psychopathologie bij verschillende stoornissen (hoofdstuk 4).

Criteria gemeenschappelijk onderliggend proces

Zelfs als piekeren en rumineren beide transdiagnostische processen zijn, dan betekent dit nog niet dat zij ook hetzelfde onderliggende proces vertegenwoordigen.

Criteria voor een gemeenschappelijk onderliggend proces zijn:

- 1) aanwezig zijn bij dezelfde stoornissen (hoofdstukken 2 en 3);
- 2) dezelfde causale status hebben voor deze stoornissen (hoofdstuk 4);
- 3) dezelfde proceskarakteristieken bezitten (hoofdstukken 5 en 6);
- 4) zeer sterk aan elkaar gerelateerd zijn (hoofdstuk 3).

Dit proefschrift bestaat uit twee delen. Het eerste deel van dit proefschrift, deel A (hoofdstukken 2, 3 en 4), maakt gebruik van data uit een longitudinale cohort studie. Centraal in dit gedeelte staat de vergelijking tussen piekeren en rumineren; zowel hoe zij zich tot elkaar verhouden evenals hoe zij zich tot angst- en stemmingsstoornissen verhouden.

Het tweede deel van dit proefschrift, deel B (hoofdstukken 5 en 6) bestaat uit experimentele studies. Deze studies richten zich op het procesmatige karakter van piekeren.

Bevindingen uit dit proefschrift

Deel A: Piekeren en rumineren: hoe verhouden zij zich tot de angst- en stemmingsstoornissen

In de hoofdstukken 2, 3, en 4 worden studies beschreven die allen uitgevoerd zijn met data van de Nederlandse Studie naar Depressie en Angst (NESDA). NESDA is een omvangrijke longitudinale cohortstudie waarvoor 2981 proefpersonen zijn geïnccludeerd die vele jaren gevolgd zijn. De stoornissen waar NESDA zich op richt zijn de angst- (paniekstoornis, gegeneraliseerde angststoornis, sociale angststoornis, agorafobie) en stemmingsstoornissen (dysthymie, depressie).

De opzet van NESDA kent een aantal sterke punten, zoals het grote aantal participanten, het prospectieve design en de inclusie van herhaalde metingen. Hierdoor levert NESDA unieke data op die het beantwoorden van een aantal belangrijke vragen op het gebied van piekeren en rumineren mogelijk maakt.

In **hoofdstuk 2** wordt een cross-sectionele studie beschreven waarin onderzocht wordt of piekeren en rumineren voorspellend zijn voor de aanwezigheid van een voorgeschiedenis van angst- en stemmingsklachten (remissie) dan wel de aanwezigheid van een huidige diagnose. Hierbij werd tevens gekeken of piekeren en rumineren als voorspellers wel iets toevoegden aan de meer algemene persoonlijkheidstrekken neuroticisme en extraversie.

Scores voor piekeren en rumineren waren verhoogd voor alle angst- en stemmingsstoornissen in zowel de huidige diagnose groep als in de in-remissie groep. Naast de aanwezigheid van piekeren en rumineren in meerdere stoornissen (criterium transdiagnostisch proces) waren ze ook aanwezig in dezelfde stoornissen (criterium gemeenschappelijk onderliggend proces). Verder bleek piekeren een relatief sterke voorspeller van de gegeneraliseerde angststoornis (huidige diagnose) en rumineren voor depressie (huidige diagnose en in remissie). Hierbij was de additionele voorspellende bijdrage ten opzichte van neuroticisme en extraversie substantieel. Deze resultaten bleven ook overeind staan wanneer er gecorrigeerd werd voor comorbiditeit. Kortom, piekeren en rumineren zijn interessante constructen die niet te reduceren zijn tot epifenomenen van een huidige diagnose.

Hoofdstuk 3 beschrijft een longitudinale studie bestaande uit drie herhaalde metingen: een meting bij de start, na 2 jaar en na 4 jaar. Centraal in deze studie staat de stabiliteit van piekeren, rumineren en psychopathologie in de tijd evenals de wederkerigheid van de relaties tussen deze drie componenten. Tot nu toe hebben de meeste studies enkel gekeken naar cross-sectionele of enkelvoudige relaties en deze studie is dan ook een belangrijke aanvulling op de bestaande literatuur. Ten behoeve van dit onderzoek werd er onderscheid gemaakt tussen stabiele trek-componenten (trait) en toestands-componenten (state) van piekeren, rumineren en psychopathologie.

Psychopathologie werd hierbij onderverdeeld in een 'vrees'-categorie (paniekstoornis)

nis, sociale angststoornis, agorafobie) en een 'dys-stress'²-categorie (depressie, dysthymie, gegeneraliseerde angststoornis).

Deze studie leidde tot een aantal belangrijke bevindingen. Ten eerste dat stabiele trekcomponenten van piekeren en rumineren sterk met elkaar samenhangen (criteria gemeenschappelijk onderliggend proces). Ten tweede dat fluctuaties van piekeren en rumineren op toestandsniveau samengaan (criteria gemeenschappelijk onderliggend proces). Ten derde dat piekeren en rumineren op vergelijkbare wijze gerelateerd zijn aan de psychopathologie categorieën vrees en dys-stress. Dit ondersteunt het idee dat ze beide een belangrijke rol spelen in meerdere vormen van psychopathologie (criteria transdiagnostisch proces). Tot slot dat er géén sprake is van een neerwaartse spiraal waarin er een elkaar versterkend effect is tussen piekeren en rumineren enerzijds en psychopathologie anderzijds. Fluctuaties van psychopathologie gaan vooraf aan fluctuaties van piekeren/rumineren maar niet vice versa. Deze bevindingen suggereren dat fluctuaties van piekeren en rumineren eerder een afspiegeling zijn van veranderingen in het toestandsbeeld: epifenomenen. Om langdurige therapeutische effecten te bewerkstelligen lijkt het dan ook van belang om veranderingen te bewerkstelligen op het niveau van de onderliggende stabiele trekcomponenten van piekeren en rumineren.

In **hoofdstuk 4** wordt een studie beschreven waarin gebruik wordt gemaakt van zowel cross-sectionele als longitudinale data om de rol van piekeren en rumineren bij comorbiditeit te onderzoeken. Meer specifiek kijkt deze studie of piekeren en rumineren de cross-sectioneel aanwezige overlap tussen verschillende angst- en stemmingsstoornissen kunnen verklaren en of ze longitudinaal gezien als mediators verantwoordelijk zijn voor de ontwikkeling van dys-stress stoornissen in personen met vrees stoornissen en vice versa, de ontwikkeling van vrees stoornissen in personen met dys-stress stoornissen. Wanneer piekeren en rumineren inderdaad transdiagnostische processen zijn dan is te verwachten dat zij deels verantwoordelijk zijn voor de hoge incidentie van comorbiditeit. Immers, als ze bij meerdere stoornissen een belangrijke rol spelen dan is het ook te verwachten dat ze eraan bijdragen dat dergelijke stoornissen vaker gelijktijdig, dan wel op elkaar volgend in de tijd, voorkomen.

De resultaten van deze studie waren in lijn met de verwachtingen. Pieker en ruminatie scores waren verhoogd in groepen met psychopathologie ten opzicht van een groep gezonde participanten. Cruciaal, de scores waren het hoogste wanneer er sprake was van comorbiditeit van vrees en dys-stress stoornissen. Verder bleken zowel piekeren als rumineren als mediators een rol te spelen in de longitudinale relatie tussen vrees en dys-stress stoornissen en vice versa.

Concluderend kan gesteld worden dat repetitief negatief denken in de vorm van piekeren en rumineren een belangrijke transdiagnostische factor is en deels verantwoordelijk is voor de comorbiditeit onder angst- en stemmingsstoornissen. Het lijkt dan ook van belang om in transdiagnostische therapieën interventies op te nemen die zich richten op deze processen.

2 Vrij vertaald uit het Engels (distress) bij ontbreken van geschikte Nederlandse vertaling

Deel B: Mechanismen die een rol spelen bij piekeren: Vermijding

In de hoofdstukken 5 en 6 worden experimentele studies beschreven die zich richten op de functionele karakteristieken en het procesmatige aspect van piekeren. Aangezien de NESDA studie niet geschikt is voor het onderzoeken van piekeren op proces niveau, zijn een aantal aanvullende experimentele studies uitgevoerd om in dit onderzoek te voorzien. In hoofdstuk 5 staat cognitieve vermijding centraal en in hoofdstuk 6 gedragsmatige vermijding.

In **hoofdstuk 5** worden twee experimenten beschreven waarin onderzocht wordt of 'verminderde concreetheid' een essentiële component is in de verklaring van de vermijdingsfunctie van piekeren en of het inderdaad leidt tot een verminderd probleemoplossend vermogen zoals wordt aangenomen. Tot op heden werd verondersteld dat hoge piekeraars verminderd concreet denken (meer in abstractheden) om zo vervelende fysiologische ervaringen, waarmee een concrete voorstelling van een probleemsituatie gepaard gaat, te vermijden. Deze vermijding c.q. verminderde concreetheid zou leiden tot een slechter probleemoplossend vermogen. Het is immers lastiger om een probleem goed te definiëren en geschikte oplossingen te genereren wanneer je in vage abstractheden blijft hangen.

In deze studies werd er geen verschil gevonden tussen hoge en lage piekeraars wat betreft de mate waarin zij abstract/concreet denken en hun probleemoplossend vermogen. Wel werd er gevonden dat proefpersonen die getraind werden in concreet denken een lichte verbetering vertoonden in hun probleemoplossend vermogen. Kortom, er lijkt wel een verband te zijn tussen mate van concreet denken en probleemoplossend vermogen, maar het is niet zo dat hoge piekeraars een verminderde concreetheid van het denken vertonen.

Alhoewel het probleemoplossend vermogen van hoge piekeraars niet onderdeeld voor dat van de lage piekeraars hadden ze wel minder vertrouwen in de door hen gegenereerde oplossingen, een negatieve probleemoriëntatie en een algeheel vermijdende houding ten aanzien van problemen.

Wanneer deze resultaten afgezet worden tegen vorige onderzoeken dat lijkt het erop dat de probleemoplossende vaardigheden van hoge piekeraars intact zijn (deze studie) maar dat ze wel, zoals in eerdere studies aangetoond, gehinderd worden door verminderde concreetheid in de hieraan voorafgaande fase, namelijk die van de probleemanalyse. Alhoewel deze resultaten niet overeenkomen met bevindingen van studies bij depressie is het nog te vroeg om te concluderen dat piekeren (gegeneraliseerde angststoornis) en rumineren (depressie) verschillen op procesmatig niveau, omdat de gevonden verschillen mogelijk te wijten zijn aan verschillen in de studieopzet.

In **hoofdstuk 6** wordt een experimentele studie besproken die de aanwezigheid van vermijding in het besluitvormingsproces onderzoekt alsook hoe deze vermijding van invloed is op het voortbestaan van piekeren. In een eerdere studie van Mueller en collega's (2010) werd gevonden dat piekeren leidt tot het maken van betere beslissingen op de Iowa

Gambling Task (IGT), wat zich vertaalde in een stijlere leercurve. Echter, in de betreffende studie werden participanten gedwongen tot het maken van keuzes terwijl voor angstige mensen -zoals piekeraars- vermijding nu juist zo kenmerkend is. In de huidige studie werd gepoogd de bevindingen van Mueller te repliceren en tevens om te onderzoeken of -wanneer er de mogelijkheid tot vermijding werd toegevoegd aan de taak- deze toevoeging de resultaten van hoge piekeraars in negatieve zin zou beïnvloeden.

De resultaten waren gemengd. Bij gebruik van de standaardversie van de IGT werden de resultaten van Mueller niet gerepliceerd: er was geen significant verschil tussen de leercurves van hoge en lage piekeraars. De versie waarbij vermijding van het nemen van een beslissing was toegestaan liet wel een verschil zien: hoge piekeraars maakten slechtere keuzes dan de lage piekeraars. Verrassend genoeg was het verschil echter niet te verklaren door de mate van vermijding.

Deze resultaten laten zien dat puur het hebben van de mogelijkheid om te vermijden een differentieel effect heeft op hoge en lage piekeraars. Mogelijk ligt de toegenomen complexiteit van de taak ten grondslag aan dit verschil doordat het ook meer onzekerheid introduceert, iets waar hoge piekeraars niet goed mee om kunnen gaan. Deze verklaring is echter speculatief en dient verder onderzocht te worden in toekomstige studies.

Wat betreft de invloed van rumineren op het besluitvormingsproces is er nog weinig bekend en de studies die er wel zijn laten geen eenduidig beeld zien. Vooralsnog is het dan ook nog te vroeg om te stellen dat piekeren en rumineren qua proceskarakteristieken overeenkomstig zijn (criteria gemeenschappelijk onderliggend proces).

Klinische implicaties

Over het geheel genomen onderschrijven de studies uit dit proefschrift piekeren en rumineren als zijnde transdiagnostische processen die tevens een gemeenschappelijk onderliggend proces lijken te delen. De belangrijke rol die piekeren en rumineren (oftewel repetitief negatief denken) lijken te spelen bij de angst- en stemmingsstoornissen maken het geschikte kandidaten om opgenomen te worden in transdiagnostische therapieën voor angst- en stemmingsstoornissen. Een transdiagnostische aanpak: biedt een oplossing voor situaties waarin er sprake is van comorbiditeit, is geschikt voor situaties waarin niet duidelijk voldaan wordt aan de criteria van een specifieke stoornis of in het geval van restsymptomen, en kan kostenbesparend zijn. Nu de rek er bij stoornisspecifieke therapieën langzaamaan uit is en er nog steeds niet voor iedereen geschikte behandelingen beschikbaar zijn, nemen transdiagnostische therapieën toe in populariteit. Echter, naast de voordelen zijn er ook enkele nadelen aan te wijzen en het is dan ook wenselijk dat de keuze voor transdiagnostische interventies niet zonder meer maar weloverwogen wordt gemaakt.

Een klinische implicatie die in het verlengde hiervan ligt betreft het feit dat piekeren en rumineren steeds vaker onder één noemer worden geschaard als zijnde hetzelfde. Nu is dit vaak onschadelijk en mogelijk zelfs gunstig, maar het is van belang dat men zich

bewust is van de verschillen die daarmee genegeerd worden en de effecten die dit kan hebben op klinisch niveau. De experimentele studies uit dit proefschrift lieten bijvoorbeeld zien dat er op procesniveau mogelijk toch enkele verschillen zijn tussen piekeren en rumineren en het kan dan ook in sommige situaties wenselijk zijn om interventies juist af te stemmen op deze verschillen om een optimaal effect te bereiken. Tot slot impliceren de bevindingen van dit proefschrift dat voor het bewerkstelligen van langdurige therapeutische effecten het noodzakelijk is om interventies te richten op de onderliggende cognitieve kwetsbaarheden (m.a.w. op cognitieve structuren en schema's) en niet enkel op toestandscomponenten (zoals bijvoorbeeld negatieve automatische gedachten).

Algemene conclusie

Over het geheel genomen ondersteunen de bevindingen van dit proefschrift piekeren en rumineren als zijnde transdiagnostische processen die tevens een gemeenschappelijk onderliggend proces vertegenwoordigen. Zo zijn piekeren en rumineren sterk aan elkaar gerelateerd, spelen ze een rol in meerdere angst- en stemmingsstoornissen en vertonen ze zowel procesmatige overeenkomsten als verschillen. De overeenkomsten tussen piekeren en rumineren overheersen in het bijzonder wanneer analyses uitgevoerd worden op een algemeen, abstract niveau. Op een meer specifiek en concreet niveau daarentegen zijn er zowel verschillen als overeenkomsten zichtbaar. Dergelijke verschillen kunnen relevant zijn voor zowel onderzoek als voor klinische interventies. Afhankelijk van de vraag die centraal staat in een bepaalde onderzoeks- dan wel klinische context is een algemeen-abstract dan wel concreet-specifiek perspectief op piekeren en rumineren te verkiezen.

Dankwoord

Curriculum Vitae

List of publications

Dankwoord

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Curriculum Vitae

Jolijn Drost was born on April 28th 1981 in The Hague, the Netherlands. In 2000, after completing secondary school (VWO) at the Herman Jordan Lyceum in Zeist, she studied Mental Health Sciences at Maastricht University where she discovered a passion for research. As part of her studies she spent 6 months at the University of Sussex in Brighton, United Kingdom, where she conducted her Masters research project on the topic of worry, under the supervision of Prof. Graham Davey. She obtained her degree in 2005.

In 2007, after spending a year traveling around the world, she started her PhD project entitled '*Worry and Rumination: Underlying processes and transdiagnostic characteristics*' at Leiden University under the supervision of Prof. Philip Spinhoven en Prof. Willem van der Does. Alongside her research and teaching activities she worked part-time as a psychologist at the anxiety disorder unit of PsyQ in The Hague from 2009 until 2011. As part of her PhD she also spent some time at the Moods Disorder Centre of the University of Exeter, United Kingdom where she worked under the supervision of Prof. Ed Watkins.

Jolijn currently works at G-kracht psychomedisch centrum in Delft where she is receiving her clinical training (GZ-opleiding). She combines this with a part-time position at Leiden University as a teacher/researcher.

Jolijn lives in Leiden with her partner Gary and daughter Rosalie; the arrival of a new addition to the family is expected this summer.

List of publications

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