

Stuck in the past

On the prediction and explanation of post-trauma
symptomatology

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On the prediction and explanation of post-trauma symptomatology

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Contents

Introduction	7
Part 1: Predicting the development of post-trauma symptomatology	29
Study 1: Predisposing vulnerability factors and persistent posttrauma factors predict post-trauma symptomatology	31
Study 2: Psychometric properties of the Trauma Relevant Assumptions Scale	53
Part 2: Explaining the development of post-trauma symptomatology	81
Study 3: Effects of state dissociation on objectively and subjectively assessed memory disturbances	83
Study 4: Perceptual memory representations and memory fragmentation as predictors of post-trauma symptoms	105
Study 5: The effects of emotional processing versus avoidance on PTSD-like symptoms after a distressing event	125
General discussion	143
Dutch Summary	168
Appendix A: TRAS + scoring manual (study 2)	177
Appendix B: Scoring manual perceptual and conceptual memory representations (study 3)	184
Appendix C: Scoring manual perceptual and conceptual memory representations (study 4)	187
Dankwoord	189
Curriculum Vitae	191

Introduction

Posttraumatic Stress Disorder

Many people experience one or more traumatic events in their life and a certain percentage develop a so-called Posttraumatic Stress Disorder (PTSD). PTSD is characterized by symptoms from three symptom clusters: 1) persistent re-experiencing of the traumatic event; 2) persistent avoidance of stimuli associated with the trauma and numbing; and 3) persistent symptoms of increased arousal. These symptoms must be present for at least one month, and must cause clinically significant distress or impairment in social, occupational or other important areas of functioning (APA, 2000). PTSD is only diagnosed if a person has experienced a traumatic event. According to DSM-IV-TR (APA, 2000), an event is traumatic when the individual personally experiences or witnesses an event that involves actual or threatened death or serious injury. Also learning about such an event happening to a family member or close associate defines as a traumatic experience. Finally, the persons' response to this event must involve intense fear, helplessness, or horror.

Although most people who have experienced a traumatic event develop emotional problems, symptoms tend to decline over the next three months, even without therapeutic treatment. The number of people who report severe symptoms depends on the nature of the traumatic event. That is, within three weeks after a traumatic event, 50-71% of nonsexual assault victims and 94% of sexual assault victims report PTSD symptoms. Three to four months post-trauma, 0-21% of nonsexual assault victims and 47% of sexual assault victims are still symptomatic (Riggs, Rothbaum & Foa, 1995; Rothbaum, Foa, Riggs, Murdock & Walsh, 1992).

A characteristic of people who develop chronic PTSD is that they have a sense of current threat. They are unable to see the trauma as a time-limited event that happened in the past. Rather, whenever they have memories about the event, these are experienced as if they are happening again in the present rather

Introduction

than in the past (Ehlers & Clark, 2000). A victim of an air crash expressed this feeling in a short poem:

There is no present
Only a future and a past
Now my future has been taken away
I'm stuck in the past, completely astray
(C. ten Hove, 2005)

Many research projects have studied which factors predict who will develop PTSD after a traumatic event, and who will resume his or her life shortly after a traumatic event. In addition to PTSD, depression is another common disorder after a traumatic event (e.g. Galea et al., 2002; Kessler, Sonnega, Bromet, Hughes & Nelson, 1995). Still, most studies have focussed on predicting PTSD. During the past two decades, a number of variables that predict chronic PTSD have been identified. However, in many cases it is not entirely clear why these factors are predictive of chronic PTSD. Knowing why these factors are predictive may give some insight in the mechanisms that should be the focus of change in prevention or early treatment of PTSD. The aim of the present dissertation is three-fold: 1) studying the relative predictive power of pre- and post-trauma variables to the prediction of PTSD symptom severity, 2) testing the specificity of these variables in predicting PTSD as compared to depression symptoms, and 3) testing some specific hypotheses about pathogenic ways of trauma processing that may explain the relation between predictors of PTSD and chronic post-trauma symptomatology.

Pre-trauma vulnerability factors and post-trauma predictors of PTSD

In order to study who among the trauma exposed is most likely to develop PTSD (see for a review Brewin, Andrews & Valentine, 2000; McNally,

Ehlers & Bryant, 2003), researchers have discriminated between vulnerability or pre-trauma factors (e.g. cognitive ability and neuroticism), and post-trauma factors (e.g. negative appraisals of symptoms and (peri-traumatic) dissociation). The pre- and post-trauma factors will be discussed in more detail below.

Pre-trauma predictors

During the last two decades research on PTSD received growing interest resulting in a plethora of studies aimed at discovering predictors of PTSD. In the eighties, most research on PTSD focused predominantly on Vietnam veterans and used cross-sectional designs. Recently, several longitudinal studies have been done in the immediate aftermath of diverging traumatic events such as motor vehicle accidents, train crashes, physical assaults etc. But still, most studies on PTSD are cross-sectional showing correlates of the disorder that are supposed to constitute plausible risk factors, even though these variables were measured after individuals had developed PTSD (see for a review McNally et al., 2003). As a starting point, such studies may be highly informative, especially when PTSD patients are compared with trauma victims who did not develop PTSD. In the past ten years, the number of longitudinal studies increased markedly. Most longitudinal studies assessed predictor variables after the traumatic event. Only a handful of studies assessed predictors before the trauma took place. From these pre-trauma prospective studies, two factors appeared to be reliably related to PTSD: Cognitive Ability (IQ) and neuroticism (Engelhard, van den Hout & Kindt, 2003a; McNally et al., 2003).

Cognitive Ability. Cognitive ability or IQ is strongly related to PTSD. Several studies found that people with low IQ are more likely to develop PTSD (e.g. Brandes et al., 2002; McNally & Shin, 1995). Since most studies assessed IQ after the traumatic event, it could have been possible that the traumatic event influenced cognitive ability rather than that cognitive ability influenced the maintenance of PTSD symptoms. However, Macklin et al. (1998) and Kaplan et al. (2002) studied the relation between cognitive ability and PTSD symptoms using data from an IQ test which was administered before soldiers were sent to a war zone. Both studies found that IQ was negatively related to PTSD, indicating

Introduction

that in general, soldiers with a low IQ reported more PTSD symptoms. Moreover, Macklin et al. (1998) found that current intelligence did not change the relation between cognitive ability and PTSD over and above pre-trauma intelligence.

Several studies assessed educational level (Brodaty, Jofe, Luscombe & Thompson, 2004; Engelhard, van den Hout & Schouten, 2004; Livanou, Basoglu, Salcioglu & Kalender, 2002) or years of education (Halligan, Michael, Clark & Ehlers, 2003; Kaplan, et al., 2002; McNally & Shin, 1995) as an index of cognitive ability. In line with studies that assessed IQ, these studies found that lower education level and less years of education are related to more PTSD symptoms (but see Engelhard, van den Hout, Kindt, Arntz & Schouten, 2003b).

Neuroticism. Neuroticism is a personality trait that refers to a temperamental sensitivity to negative stimuli, emotional instability and maladjustment (Goldberg, 1992 in Cox, MacPherson, Enns & McWilliams, 2004). It is a stable and enduring trait (Santor, Bagby & Joffe, 1997; Watson & Clark, 1984). Several studies demonstrated that neuroticism is associated with the development of PTSD (e.g. Cox et al., 2004; Holeva & Tarrier, 2001). Although neuroticism is described as a pre-trauma variable, most studies were not able to assess neuroticism prior to the traumatic event. However, Engelhard et al. (2003a) actually assessed pre-trauma neuroticism in women who had had a pregnancy loss. They also found that neuroticism level predicted PTSD symptoms, especially the arousal symptoms of PTSD. Note however that women who scored high on neuroticism prior to the trauma already reported more pre-trauma arousal symptoms. After controlling for these pre-trauma arousal symptoms, neuroticism no longer predicted post-trauma PTSD. Apparently, there is some content-overlap between arousal symptoms assessed with neuroticism scales and PTSD-arousal symptoms. People with high neuroticism have more trauma (arousal) symptoms after the trauma, but they had so too pre-trauma, and the increase in symptoms is comparable in high and low neuroticism individuals. Meanwhile, pre-trauma high neuroticism increases the risk of post-trauma symptoms being so intense that the person qualifies as a clinical PTSD case.

IQ and Neuroticism. Only one study tested whether IQ and neuroticism that were actually assessed pre-trauma, predicted chronic PTSD. Engelhard et al.

(2004) tested whether a combination of IQ and neuroticism predict the chance that a woman will develop PTSD after pregnancy loss. Neuroticism was dichotomized in low and high levels of neuroticism. Given a certain educational level, the chance for developing PTSD was more than twice as high in women who scored high on neuroticism, as compared to women who scored low on neuroticism. Least likely to develop PTSD with 4% chance, were women who had completed university and who scored low on neuroticism. Women with only the most basic education and the highest neuroticism scores were most likely to develop PTSD with 73% chance.

In sum, previous findings show that IQ and neuroticism are strong predictors of PTSD. Since these predictor variables are supposed to be rather stable, they can reliably be assessed post-trauma. Indeed, several studies showed that post-trauma assessments of neuroticism and IQ were predictive of later PTSD (e.g. Holeva & TARRIER, 2001; Lauterbach & Vrana, 2001; McNally & Shin, 1995; Silva et al., 2000; Vasterling et al., 2002).

Post-trauma predictors

Longitudinal studies focussing on the predictive value of post-trauma variables were performed among motor vehicle accident victims, assault victims and emergency room patients. Most of these studies assessed post-trauma variables three months post-trauma or even later. Obviously, this creates the risk that scores on the predictor variables are contaminated with scores on the criterion variable (PTSD) rendering predictions spurious. Fewer studies assessed predictor variables in the immediate aftermath of the traumatic event. Longitudinal prospective studies that either assessed predictors shortly after the traumatic event or several months later revealed that the following variables reliably predicted PTSD: negative appraisals of intrusions, peri-traumatic dissociation, and persistent dissociation.

Negative appraisals of intrusive memories. Intrusive memories are thought to be a sign of a normal adaptation process (Horowitz, 1986). However, some trauma victims interpret their intrusive memories as indications that they have permanently changed for the worse or as a threat to their physical or mental

Introduction

well being (e.g. Ehlers & Clark, 2000; Ehlers & Steil, 1995; Foa & Riggs, 1993). For example, people may think that their intrusions are a sign that they are going mad or will never get over the experience (Ehlers & Clark, 2000; Ehlers & Steil, 1995).

Several studies have indeed shown that negative interpretations or negative appraisals of intrusions reliably predict PTSD in ambulance service workers (Clohessy & Ehlers, 1999), emergency room patients (Ehlers, Mayou & Bryant, 1998; Mayou, Bryant & Ehlers, 2001), physical and sexual assault victims (Dunmore, Clark & Ehlers, 1999, 2001; Halligan et al., 2003), and motor vehicle accident victims (Steil & Ehlers, 2000). These findings suggest that negative appraisals of intrusions are a strong predictor of PTSD. However, negative appraisals of intrusions were usually not assessed before three months after the traumatic event. Therefore, the question remains whether earlier assessments of negative appraisals (i.e. immediately after the traumatic event) predict chronic PTSD just as well. It should further be noted that the relation between negative appraisals of intrusions and PTSD might be tautological. There may be conceptual overlap between PTSD diagnosis and negative appraisals of intrusions. Note that the DSM-IV states that recollections of the traumatic event must be distressing (DSM-IV-TR; APA, 2000). In line with the DSM-IV criteria, both the Posttraumatic Symptom Scale (Foa, Riggs, Dancu & Rothbaum, 1993) and the Posttraumatic Diagnostic Scale, (Foa, Cashman, Jaycox & Perry, 1997), which are the two most widely used PTSD symptom scales, assess whether intrusions are emotionally upsetting.

Dissociation. Dissociation refers to depersonalisation, derealisation, altered time perception and numbing (see Marmar et al., 1994). DSM-IV-TR (APA, 2000) defines dissociation as a separation in the normally integrative functions of identity, memory, and consciousness. The hallmark of dissociative disorders is an inability to recall important personal information, usually of a traumatic or stressful nature (APA, 2000). Initially, researchers assessed peri-traumatic dissociation, referring to dissociation during or immediately following a traumatic event. Although in most studies peri-traumatic dissociation proved to be a strong predictor of PTSD (e.g. Bremner & Brett, 1997; Koopman, Classen

& Spiegel, 1994; Marmar et al., 1999), some studies have failed to replicate this relation (Dancu, Riggs, Hearst-Ikeda, Shoyer & Foa, 1996; Marshall & Shell, 2002). Lately, persistent dissociation has been found to be a better predictor of PTSD than initial dissociation (Halligan et al., 2003; Murray, Ehlers & Mayou, 2002; Panasetis & Bryant, 2003). Together, dissociation seems to be a strong predictor of PTSD. However, it remains unclear whether dissociation predicts PTSD best when it is assessed immediately after the traumatic event, or several weeks post-trauma.

Relation between pre-trauma predictors, post-trauma predictors and PTSD

Since most longitudinal studies focused either on predisposing vulnerability factors (pre-trauma) or on post-trauma factors, it remains unclear to what degree these factors contribute independently to the development of chronic PTSD. Moreover, there may be conceptual overlap between several predictors. For example, neuroticism is a stable predisposition to see the world and oneself in a negative way (Clark, Watson & Mineka, 1994). Neuroticism then may overlap with negative appraisals of intrusions (see also van den Hout & Engelhard, 2004). For both theoretical and clinical reasons it is important to know the relative prognostic validity of pre- and post trauma predictors. E.g. would post-trauma variables predict anything over and above IQ and neuroticism? In the present dissertation (study 1), this research question will be addressed by assessing both the most prominent post-trauma predictors (i.e. dissociation and negative appraisals of intrusions), and pre-trauma predictors (i.e. IQ and neuroticism) of PTSD in a single study.

Further, previous studies did not differentiate between initial and sustained post-trauma symptoms. Note that immediately after the traumatic event the presence of, for example, intrusive memories are supposed to be normal and may therefore not be predictive of chronic PTSD. In this dissertation it will be assessed whether the most prominent post-trauma predictors (i.e. dissociation and negative appraisals of intrusions) of PTSD explain more PTSD variance when assessed immediately after the traumatic event, or when assessed several months later (see study 1).

Specificity of predictors of PTSD

Although the most commonly studied symptoms after a traumatic event are PTSD symptoms, one should be aware of the prevalence of depression as a common result of traumatic experiences (e.g. Galea et al., 2002; Kessler et al., 1995). For example, after the terrorist attack of September 11, 2001, 7.5% of 988 Manhattan residents reported symptoms that met criteria of PTSD, and 9.7% reported symptoms that met criteria of depression. About 4% reported symptoms that met both criteria (Galea et al., 2002). However, information about pre-trauma prevalence of depression symptoms is lacking. This makes it questionable whether depression symptoms were actually increased after the September 11th attack.

The co-morbidity between PTSD and depression may partly be explained by overlap in diagnostic criteria as described in DSM-IV-TR. Both disorders include aspects of numbing and a diminished interest in significant activities (APA, 2000).

Only few studies investigated the relative contribution of predictors of PTSD to depression symptoms (Halligan et al., 2003; Mayou et al., 2001). Study 1 tests whether the variables that were shown to be strong predictors of PTSD (i.e. IQ, neuroticism, dissociation and negative appraisals of intrusions) specifically predict PTSD as compared to post-trauma depression symptoms.

Pre-trauma beliefs

Another potentially interesting factor that may predict post-trauma symptomatology are the pre-trauma beliefs of trauma victims (e.g. Ehlers & Clark, 2000; Foa and Riggs, 1993; Janoff-Bulman, 1992). The central tenet of this hypothesis is that pre-trauma beliefs hinder successful processing resulting in memory disturbances of the traumatic event (e.g. Ehlers & Clark, 2000; Foa and Riggs, 1993; Janoff-Bulman, 1992). Although there is evidence that pre-trauma beliefs are related to post-trauma symptomatology (e.g. Dunmore et al., 1999, 2001), it is unclear whether this effect is mediated by dysfunctional processing. Dysfunctional trauma processing refers to processing the traumatic event without giving meaning to the event, so that the memory of the traumatic event

cannot be integrated with other autobiographical memories. Beneficial or functional trauma processing refers to thinking over the trauma despite the pain this gives and integrating what the trauma may imply and does not imply into ones autobiographical data base.

Another shortcoming of previous research on the relationship between pre-trauma beliefs and post-trauma symptoms is that these studies only focussed on the presence of negative beliefs. Janoff-Bulman (1992) hypothesized that also extreme positive pre-trauma beliefs may be detrimental to the development of post-trauma symptomatology. The hypothesis states that traumatic experiences may shatter the worldview with respect to the benevolence of the world and the self as worthy in individuals with extremely positive pre-trauma beliefs (see also Foa & Riggs, 1993). Therefore, not only valence (negative beliefs), but also rigidity of pre-trauma beliefs (rigid positive or rigid negative) is thought to be predictive of post-trauma symptomatology. Foa and Riggs (1993) proposed a curvilinear relation between pre-trauma beliefs and PTSD symptoms. They suggest that the presence of rigid concepts about self and the world (positive or negative) renders individuals vulnerable to develop PTSD. In contrast, people with more flexible beliefs about safety ("The world is sometimes safe and sometimes dangerous") will be most likely to recover after a traumatic event. This is an intriguing hypothesis that justifies thorough testing. The existing measures on trauma beliefs only assess the negativity of the beliefs. No measure is available that enables the assessment of positivity and rigidity (positive or negative) of pre-trauma beliefs. The present dissertation includes a study aimed at developing such a measure (study 2).

The relevance of such measure is that the assessment of pre-trauma beliefs may select among individuals likely to be exposed to a traumatic event (e.g. militaries, ambulance personnel), who will be likely to develop post-trauma symptomatology. Moreover, such measure can also be used in the direct aftermath of a trauma to test whether rigid negative or rigid positive beliefs are present that may predict the development of chronic post-trauma symptomatology.

Introduction

Trauma processing

Although many prospective studies have shown that IQ, neuroticism, negative appraisals of intrusions and dissociation are strong predictors of PTSD, few studies examined the pathogenic mechanisms underlying these variables in the development of chronic post-trauma symptomatology. Several researchers have suggested that the processing style of the traumatic event may be such an underlying mechanism that may explain the relation between predictors of PTSD and later post-trauma symptoms. Several information-processing theories have been proposed to explain the development of PTSD (Brewin, Dalgleish & Joseph, 1996; Ehlers & Clark, 2000; Foa & Riggs, 1993; Foa & Rothbaum, 1998; Horowitz, 1976; 1986). Although information-processing theories on PTSD diverge in their conceptualisations of dysfunctional processing, they share the view that a lack of elaboration or conceptual processing is crucial for the development of chronic symptomatology (Brewin & Holmes, 2003; Ehlers & Clark, 2000; Foa, Steketee & Rothbaum, 1989; Horowitz, 1976; 1986). Note that conceptual processing has conceptual overlap with emotional processing. Conceptual processing refers to processing the meaning of the situation with the result that PTSD symptom and its accompanying emotions decline (Ehlers & Clark, 2000). Emotional processing refers to “a process whereby emotional disturbances are absorbed and decline to the extent that other experiences and behavior can proceed without disruption” (Rachman, 1980, p51). Thus, both processing styles reduce the emotional valence associated with reminders of the traumatic event. Surprisingly, only a few experimental studies have tested the effects of disturbances in trauma processing on the development of PTSD (Halligan, Clark & Ehlers, 2002; Holmes, Brewin & Hennessy, 2004; Kindt, van den Hout, Arntz & Drost, submitted). The second aim of the present dissertation is to test the pathogenic mechanisms underlying the most prominent predictors of PTSD in the development of chronic post-trauma symptomatology. More specifically, it will be examined whether the pathogenic mechanism includes disturbances in trauma processing.

Disturbances in Trauma Memory

Typically, two memory disturbances have been identified in traumatized individuals: intrusive memories and impoverished memory functioning or memory fragmentation (APA, 2000). Trauma victims are supposed to have difficulty to intentionally retrieve a complete memory of the traumatic event. This intentional recall is supposed to be fragmented, details may be missing and they are uncertain about the exact temporal order of the events (Ehlers & Clark, 2000; Foa, Molnar & Cashman, 1995; Foa & Riggs, 1993; van de Kolk & Fisler, 1995). Their intrusive memories on the other hand, are supposed to be very detailed and vivid (Ehlers & Clark, 2000). Research on the quality of intrusive memories of trauma victims showed that intrusions mainly consist of sensory fragments of the traumatic experience rather than of whole memories (Brewin, 1998; Ehlers et al., 2002; Ehlers & Steil, 1995; van der Kolk & Fisler, 1995). Moreover, intrusions are often experienced as a reliving of the event with 'here and now' qualities, rather than that it is experienced as a memory of the past (Ehlers, et al., 2002).

Several researchers hypothesize that memory disturbances characteristic of PTSD result from disturbances in trauma processing (e.g. Brewin, 2001; Ehlers & Clark, 2000; Foa & Rothbaum, 1998). If the supposed memory disturbances are the result of dysfunctional information processing, not only subjectively assessed memory disturbances but also objectively assessed memory disturbances should be observed.

Study 3 tests with objective measures whether dissociation is related to subjective memory disturbances (i.e. intrusions and subjective memory fragmentation), and objective memory disturbances (e.g. objective memory fragmentation).

Data-driven processing: Both types of memory disturbances (fragmentation and intrusive memories) are thought to be the result of insufficient elaboration, resulting in a lack of integration of the traumatic event in the autobiographical memory knowledge base (e.g. Brewin, 2001; Ehlers & Clark, 2000; Foa & Rothbaum, 1998). Ehlers and Clark (2000) introduced the distinction between

Introduction

data-driven (or bottom-up) and conceptually-driven (or top-down) processing, which are derived from the work of Roediger (1990) to explain the lack of integration of the traumatic event. Data-driven processing refers to processing the sensory impressions of the event, which results in a poorly elaborated, perceptually encoded memory trace. The opposite, conceptually-driven processing refers to processing the meaning of the situation and placing it in a context, which results in contextualized memory representations. Conceptually-driven processing will facilitate the integration of the traumatic event with other autobiographical memories (Ehlers & Clark, 2000; Roediger, 1990). These two processing modes are inversely related; thus, the more data-driven processing, the less conceptually-driven processing and vice versa (see also Johnston & Hawley, 1994).

It is likely that during and immediately after a traumatic experience most people will process this event data-driven. That is, most traumatic events are by its nature schema-incongruent experiences, which are thought to elicit data-driven processing (Johnston and Hawley, 1994). As a result of data-driven processing, the traumatic event is laid down in very detailed perceptual memory representations of these stimuli. This may explain why intrusive memories are so detailed and vivid. Further, when stimuli have been processed conceptually-driven, they are incorporated in a schema. The latter facilitates intentional retrieval of these stimuli (Johnston & Hawley, 1994). When the event is not processed conceptually-driven, the memory is likely to be poorly organized and details may be missing. These disturbances in trauma memory interfere with the exact recall of the temporal order of events.

Ehlers and Clark (2000) propose that as a result of conditioning many irrelevant stimuli present during the traumatic event may be associated with the event, and thus elicit anxiety. However, in case of conceptually-driven processing, the person may realize that many stimuli are not reliably related to the occurrence of the traumatic event. Rather, they happened to be there and have no further consequences for why or how the event happened. After conceptually-driven processing, these stimuli may no longer be associated with the traumatic event and therefore no longer elicit anxiety. For example, a person

who was robbed in a dark alley by a man wearing a blue jacket may be afraid whenever he sees a person wearing a blue jacket, because it reminds him of the robbery. But when that person starts to process the robbery conceptually-driven, and thus starts to place the event in a context, he may realize that being alone in a dark alley is a dangerous situation. But also, that not every blue jacket indicates danger. As a result, fewer stimuli will remind him about the robbery, leaving him less often afraid.

Indeed, several studies showed that data-driven processing is related to PTSD symptoms in assault victims (Halligan et al., 2003), road traffic accident victims (Murray et al., 2002) and to analogue PTSD symptoms in students who watched a distressing film (Halligan et al., 2002). However, so far, data-driven processing has only been assessed subjectively by a questionnaire. Note that self-reports on cognitive processes are usually inaccurate and unreliable (Nisbett & Wilson, 1977). Therefore, more objective assessments of data-driven processing should be developed, enabling its objective assessment. In the present dissertation, the data-driven/conceptually-driven distinction will be assessed with objective measures. A predominantly data-driven processing style is supposed to result in memory representations characteristic of this processing style: perceptual memory representations. Examples of perceptual memory representations are descriptions like “He grabbed me from behind”, “He had a knife with a black handle”, “It was a sunny day”, “He smelled”. In the present dissertation, perceptual memory representations are considered as the objective operationalizations of data-driven processing. Although this is an indirect measurement, perceptual memory representations are supposed to be the result of data-driven processing. This allows us to test whether a predominance of data-driven processing is related to post-trauma symptomatology (study 4).

Excessive avoidance: In addition to a predominance of data-driven processing, also excessive avoidance may inhibit conceptually-driven processing. This implies that also excessive avoidance may be detrimental in that it may maintain initial PTSD symptoms (Ehlers & Clark, 2000; Foa & Riggs, 1993; Horowitz, 1976; McNally et al., 2003). However, recently researchers have begun to scrutinize the

Introduction

assumption that avoidance is always detrimental (McNally et al., 2003) pointing to the fact that this hypothesis is inferred from studies in selective samples of trauma victims who typically suffer from chronic PTSD and who seek therapeutic help (Bonanno, 2004).

There are recent indications that avoidance isn't as detrimental as has always been believed (e.g. Bonanno, Keltner, Holen & Horowitz, 1995; Bonanno, Noll, Putnam, O'Neill & Trickett, 2003) and that it is not necessarily better to confront distressing experiences than to avoid them (Stroebe & Stroebe, 1991). Interventions aimed at working through the negative thoughts and emotions may even be harmful to many bereaved individuals (Neimeyer, 2000). Therefore, an alternative hypothesis may be that for some trauma victims symptoms may well decline despite avoiding thoughts and reminders about the traumatic event.

Most indications that avoidance is not always detrimental come from studies on grief (e.g. Neimeyer, 2000; Stroebe & Stroebe, 1991). The validity of the hypothesis that emotional processing immediately after a distressing event is more successful than avoidance in reducing analogue PTSD should therefore also be tested in traumatized individuals. However, for ethical reasons it is impossible to test this hypothesis in traumatized individuals. Therefore, the present dissertation includes a study that will test in a laboratory study whether the supposedly most successful processing style (i.e. emotional or conceptual processing) immediately after a distressing experience will result in fewer analogue PTSD symptoms than avoidance (study 5).

Figure 1 represents the hypothesized pathogenic ways of trauma processing that may explain the relation between predictors of PTSD and chronic post-trauma symptomatology.

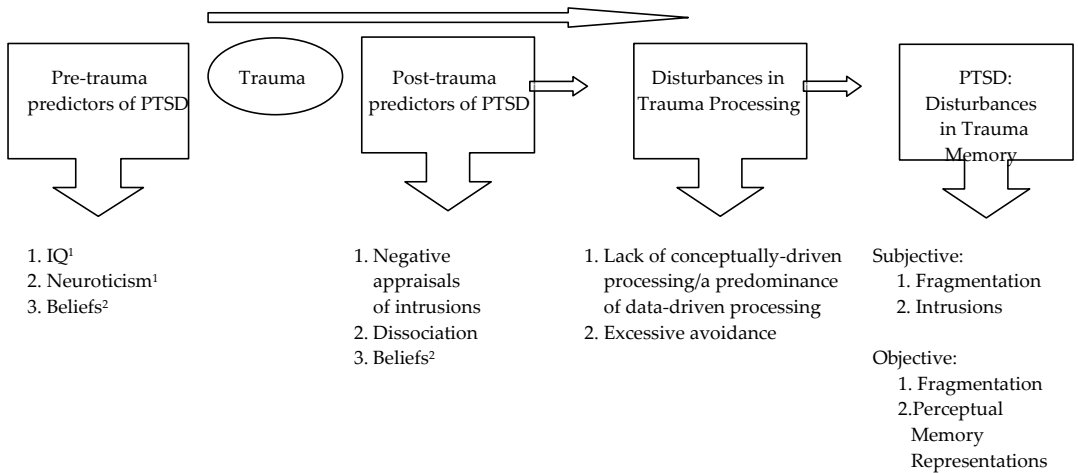


Figure 1. Schematic presentation of how disturbances in trauma processing may mediate the relation between predictors of PTSD and memory disturbances

¹ Note that the pre-trauma variables were assessed post-trauma in the present studies.

² Note that the present dissertation describes a psychometric study on a new questionnaire that allows testing the predictive power of pre-or post-trauma beliefs in the development of PTSD

Outline of dissertation

This dissertation consists of two parts. The first part focuses on predictors of PTSD and includes two studies. Study 1 investigates the relative predictive power of pre- and post-trauma variables to the prediction of PTSD symptom severity. As pre-trauma predictors, IQ and neuroticism will be assessed and as post-trauma predictors, dissociation and negative appraisals of intrusions will be assessed. In a prospective study among patients discharged from the Intensive Care Unit, it is tested whether these post-trauma variables predict PTSD over and above the pre-trauma predictors. In study 1 it is further tested whether these pre- and post-trauma variables specifically predict PTSD symptoms as compared to

Introduction

depression symptoms. As pre-trauma beliefs are considered to be a promising predictor of PTSD, study 2 describes the development of a questionnaire that enables to test whether a curvilinear relation exists between TRAS scores assessed before trauma and later PTSD symptoms, or not. More specifically, this questionnaire may test the hypothesis that not only rigid negative but also rigid positive beliefs are related to later PTSD symptoms.

The second part of this dissertation focuses on trauma processing as an explanation for the relation between predictors of PTSD and post-trauma symptomatology. This part consists of three studies. Study 3 tests in a quasi-experimental study among individuals afraid of spiders, whether dissociation is related to memory disturbances. If the supposed memory disturbances are the result of dysfunctional information processing, not only subjectively assessed memory disturbances but also objectively assessed memory disturbances should be observed.

As stated in the introduction, we hypothesize that post-trauma symptomatology may result from two types of dysfunctional processing styles: a predominance of data-driven processing and excessive avoidance. Study 4 tests in a prospective study among patients discharged from the Intensive Care Unit, whether a predominance of data-driven or a lack of conceptually-driven processing predicts later post-trauma symptomatology (PTSD and depression). The data-driven/conceptually driven distinction is measured objectively by assessing percentage of perceptual memories as compared to conceptual memories, and memory fragmentation. Study 5 tests in an analogue laboratory study whether excessive avoidance immediately after a distressing film predicts analogue PTSD symptoms four hours later.

In the General Discussion, the main conclusions of the preceding studies are summarized. Also some limitations of these studies are acknowledged. Finally, based on studies conducted in the last ten years, a state of the art will be presented on the supposed role of trauma processing in explaining the relation between predictors of PTSD and memory disturbances (see also the schematic presentation of this supposed relation in Figure 1 on p21).

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Part 1:

Predicting the development of post-trauma symptomatology



Study 1

Predisposing Vulnerability Factors and Persistent Post-trauma Factors Predict Post-trauma Symptomatology: A Preliminary Study

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Abstract

One of the puzzles surrounding PTSD is understanding which factors predict PTSD. IQ, neuroticism, dissociation and negative appraisals of intrusions have all shown to be good candidates for predicting post-trauma symptomatology. The present study tested whether initial and persistent levels of dissociation and negative appraisals predict post-trauma symptomatology over and above IQ and neuroticism. Twenty-six patients discharged from the Intensive Care (IC) were assessed within two weeks after IC discharge and at four months follow-up. Merely persistent variables predicted PTSD symptoms over and above IQ and neuroticism. The persistent variables specifically predicted PTSD symptoms as compared to depression symptoms. Persistent risk factors seem to be much better than initial post-trauma factors in selecting trauma victims who are at risk for developing chronic PTSD. The predisposing vulnerability factors IQ and neuroticism combined with the persistent post-trauma factors negative appraisals and dissociation explained an unusual and marked percentage of PTSD variance of 78%. Although the observed effects are strong, the findings must be regarded as preliminary due to the small sample size.

Study 1

Introduction

Although most trauma victims report post-traumatic stress disorder (PTSD) symptoms immediately after experiencing a trauma, only one-third of the trauma victims show persistent symptoms and develop chronic PTSD (Kessler, Sonnega, Bromet, Hughes & Nelson, 1995; Rothbaum, Foa, Riggs, Murdock, & Walsh, 1992). Traumatized individuals may benefit from early interventions. It is not desirable to offer these early interventions to all trauma victims, but rather only to those most likely to develop chronic PTSD. However, one of the puzzles surrounding PTSD is understanding which factors determine the maintenance of PTSD symptoms (see also Ehlers & Steil, 1995). So, in order to select individuals who will benefit most from interventions, it is desirable to discover predictors of PTSD that can be assessed in the direct aftermath of the traumatic event.

Recently, several longitudinal studies assessed predictors of PTSD either pre-trauma, i.e. prospective, or in the immediate aftermath of diverse traumatic events such as motor vehicle accidents, train crashes and physical assaults (e.g. Engelhard, van den Hout, Arntz & McNally, 2002; Murray, Ehlers & Mayou, 2002; Ursano et al., 1999). From the handful of prospective studies, IQ and neuroticism may be considered as the best predictors of PTSD (see for a review McNally, Bryant & Ehlers, 2003). For example, lower pre-trauma IQ scores predicted greater severity of PTSD symptoms in Vietnam veterans (Kaplan et al., 2002; Macklin et al., 1998), and higher neuroticism was related to higher PTSD scores after miscarriage and road traffic accidents (e.g. Engelhard, van den Hout & Kindt, 2003; Holeva & Tarrier, 2001). A lot more studies have been performed on post-trauma predictors of PTSD (e.g. Ehlers, Mayou & Bryant, 1998; Shalev, Freedman, Peri, Brandes & Sahar, 1997; Shalev, Peri, Canetti & Schreiber, 1996). From a recent meta-analysis on predictors of PTSD, peri-traumatic dissociation was the single best predictor of PTSD (Ozer, Best, Lipsey & Weiss, 2003). Note, however, that only 12% of the variance of PTSD symptoms ($r = .35$) is explained by this concept. From other studies, negative appraisals of both the traumatic event and the individual's responses are shown to be strongly predictive of chronic PTSD (e.g. van den Hout & Engelhard, 2004; Steil & Ehlers, 2000). Since

most longitudinal studies focused either on predisposing vulnerability factors (pre-trauma) or on post-trauma factors, they are silent about the relative predictive power of pre- and post-trauma variables to the prediction of PTSD symptom severity. The first aim of the present study then, is to clarify the contribution of both predisposing vulnerability factors, i.e. IQ and neuroticism, as well as post-trauma factors, i.e. dissociation and negative appraisals of intrusions, all of which have been shown to be predictive with respect to the development of post-trauma symptomatology.

Initially, it was supposed that dissociation in the direct aftermath of a trauma, defined as peri-traumatic dissociation, was the best predictor of chronic PTSD (see Ozer et al., 2003). However, several recent studies have shown that persistent dissociation predicts PTSD symptoms over and above peri-traumatic dissociation in assault victims (Halligan, Michael, Clark & Ehlers, 2003; Murray et al., 2002; Panasetis & Bryant, 2003). Note that these studies did not control for sustained PTSD symptom severity. Persistent dissociation may well reflect symptom severity. In that case, persistent symptom severity rather than persistent dissociation might well predict PTSD symptoms a few months later. Germane to this issue is the fact that it is still unclear whether initial negative appraisals of intrusions can predict the development of later PTSD. That is, in all studies showing a relationship between negative appraisals of intrusions and PTSD, assessments were usually done around three months post-trauma. To our knowledge, assessments have never taken place previous to one month post-trauma.

Thus, a second aim of the present study is to test whether initial dissociation and negative appraisals predict post-trauma symptomatology or whether only persistent dissociation and negative appraisals predict post-trauma symptomatology. Given the marked co-morbidity between PTSD and depression symptoms, a third aim of this study is to investigate whether IQ, neuroticism, dissociation and negative appraisals specifically predict PTSD symptoms as compared to depression symptoms. PTSD not only occurs after motor vehicle accidents, war or assault, but also after medical interventions (Tedstone & Tarrier, 2003). A substantial proportion of intensive care patients (15-27,5%) meet

Study 1

criteria for PTSD years after discharge from the Intensive Care Unit (ICU) (Kapfhammer, Rothenhäusler, Krauseneck, Stoll & Schelling, 2004; Schelling et al, 1998; Scragg, Jones and Fauvel, 2001). An even higher percentage (38%) report significant symptoms of PTSD years after ICU discharge (Scragg et al., 2001). In the present study, the traumatized sample consisted of people who had been discharged from the ICU. Patients were assessed within the first month after ICU discharge, with a follow-up after four months. The predisposing vulnerability factors, IQ and neuroticism, were not assessed pre-trauma, but post-trauma, that is on average two weeks or four months after ICU discharge. But given that these factors are relatively stable, they may still be considered as predisposing vulnerability factors.

Method

Participants

Participants (9 males, 17 females) were ICU patients in the Maastricht University Hospital. Their mean age was 49.9 years ($SD = 15$; range = 23-71). By definition, traumatic experiences mostly involve events that are new and unexpected. Therefore, a further inclusion criterion was that participants had to have been admitted to the ICU unexpectedly and had never been admitted to an ICU in the past. Exclusion criteria were the following: psychiatric history, insufficient comprehension of the Dutch language and factors that might influence the patients' recollection of the ICU other than the traumatic experience itself. These factors included head trauma, brain damage, having been more than ten minutes unconscious as a result of the accident that caused the ICU admission, as well as alcohol and/or drug abuse. Finally, participants who had only briefly been monitored (<24 hrs) in the ICU were also excluded.

Thirty-five patients enrolled in this study. Three participants did not complete the IQ test since they were unable to write, an ability necessary for some parts of the test. These participants were not included in the analyses. Six participants dropped out before follow-up assessments were complete. Reasons

for dropout were death (n=1), refusal (n=2), too ill (n=2), and inability to contact the participant for the follow-up assessments (n=1). Twenty-six patients completed all follow-up assessments four months after ICU discharge. Participants were paid €7.50 for each assessment. Based on the more conservative scoring criterion¹ for the Posttraumatic stress disorder Symptom Scale, immediately after ICU discharge six out of twenty-six participants met the criteria for PTSD. At four months follow-up, three participants still met the criteria for PTSD, three participants no longer met the criteria for PTSD, and two participants met the PTSD criteria at four months post-trauma whereas they had not met these criteria one month post-trauma. See Table 1 for demography, diagnostic grouping and post-trauma symptomatology. Note that in the present study the dependent variable was not whether or not participants had PTSD or serious depression symptoms, but rather, the level of severity of post-trauma symptomatology.

Materials

Symptom Measures

Posttraumatic stress disorder. The Posttraumatic stress disorder Symptom Scale (PSS-SR; Foa, Riggs, Dancu & Rothbaum, 1993; Arntz, 1993) corresponds to the seventeen DSM-IV symptoms of PTSD. The severity of these symptoms, are rated on a 4-point severity scale (0 = not at all, 3 = almost always). The items provide both diagnostic and severity data. Based on a more conservative scoring criterion, participants would meet criteria for PTSD when they rated *at least* six questions as 2 or 3, which in this case meant rating 2 or 3 in at least one out of five questions about intrusions (item 1-5), in at least three out of seven questions about avoidance (item 6-12), and in at least two out of five questions about arousal and irritability (item 13-17). The PSS-SR is highly accurate when it comes to identifying PTSD cases (Wohlfarth, van den Brink, Winkel & Smitten, 2003).

¹ Foa et al. (1993, 1997) score a symptom as present if it is rated at least 1 (“once in a while”). Other researchers (e.g., Brewin et al., 2000; Engelhard et al., 2001) use a more conservative scoring criterion of at least 2 (“half the time”).

Study 1

The sum score of the seventeen items assesses severity of PTSD symptoms. Scores range from 0 to 51.

Table 1
Demography and diagnostic grouping

N	26
Length of ICU stay (days) ^a	10.4 (9.5), 1-44
Days on mechanical ventilatory support ^a	9.8 (9.9), 0-42
Level of education ^{ab}	6.3 (2.5), 3-11
Reason for ICU admission (n)	
Acute OK	2
Blowout	1
Complications during or after planned surgery	4
Diverticulitis	2
Dyspnoea	2
Gastric haemorrhage	1
HELLP syndrome	1
Malignant hypertension	1
Necrotizing appendicitis	1
Pancreatitis	1
Pneumonia	4
Sepsis	3
Trauma	3
Posttraumatic stress disorder at 4 month FU(%)	19.2
symptom cluster intrusions (%)	30.8
symptom cluster avoidance (%)	19.2
symptom cluster irritability (%)	30.8
Depression at 4 month FU	
minimal depression (%)	77
mild to moderate depression (%)	8
moderate to severe depression (%)	15

Note: ICU = Intensive Care Unit

^a Median (Standard Deviation), range

^b based on the Dutch educational system ranging from elementary school (score 1) to university (11). Score 6 refers to lower general secondary education.

Depression. The Beck Depression Inventory (BDI; Beck, Ward, Mendelsohn, Mock & Erbauch, 1961) is a 21-item self-report measure, which has been shown to have good reliability and validity and to correlate highly with clinical ratings of depression. For the present sample, item 19 (which asks about the amount of weight lost) was omitted, for almost all participants had lost weight due to their illness rather than as a result of depression. The sum score of the final twenty items assesses the severity of the depression symptoms. Scores range from 0 to 60.

Predisposing predictors

Neuroticism was assessed with the Eysenck Personality Questionnaire (short version) (EPQ; Eysenck & Eysenck, 1975). Scores range from 0 to 22. *IQ* scores were assessed with a short version of the GIT (Groninger Intelligentie Test; Luteijn & van der Ploeg, 1983). The short version consists of the word matrix (twenty items), the jigsaw puzzle (twenty items) and addition sums (twenty-four items). Scores range from 0 to 64.

Post-trauma predictors

Both peri-traumatic and persistent dissociation were assessed with the Peri-traumatic Dissociative Experience Scale (PDEQ; Marmar, Weiss & Metzler, 1997). The PDEQ is suitable for assessing state dissociation after traumatic or other unexpected experiences, and was adapted to refer to the patients' stay at the ICU. The original questionnaire consists of ten questions about dissociative experiences that the participant might have experienced during the ICU stay. However, for the assessment of peri-traumatic dissociation, the number of items was reduced to six. The following items were omitted: item 1 (I had moments of losing track of what was going on – I “blanked out” or “spaced out” or in some way felt that I was not part of what was going on), item 2 (I found that I was on “automatic pilot”- I ended up doing things that I later realized I hadn't actively decided to do), item 8 (I was surprised to find out afterward that a lot of things had happened at the time that I was not aware of, especially things that I ordinarily would have noticed) and item 9 (I felt confused – that is, there were

Study 1

moments when I had difficulty making sense of what was happening). These items were omitted since they were more likely to have been the result of the participants stay on the ICU and narcotics, rather than to have been the result of having been overwhelmed by the experience. The mean score of the six items were used in the analyses. Scores range from 1 to 5. Persistent dissociation was assessed by a mean score of all ten items. Scores range from 1 to 5. The instruction for persistent dissociation was changed so that the questions referred to the present state as opposed to retrospective ratings referring to the time participants had been on the ICU (see also Panasetis & Bryant, 2003).

Initial and persistent negative appraisals of intrusions were assessed with a questionnaire "The interpretation of reactions since the assault", developed by Halligan et al. (2003). The questionnaire comprises seven items (e.g. "My intrusive memories about my ICU stay mean that I must be losing my mind"), which are rated on a five-point Likert scale (0 = not at all, 4 = very strongly). Questions referred to the negative appraisals of intrusions at the time participants were interviewed. Scores range from 0 to 28.

Procedure

Participants were assessed twice. The first assessment was as soon as possible after discharge from the ICU, which was on average 9.7 days (1-2 weeks) after ICU discharge ($SD = 7$, range = 2-31 days/1-5 weeks). The second assessment was at four months follow-up, which was on average 117.2 days (16-17 weeks) after ICU discharge ($SD = 13.6$, range = 90-144 days/12-21 weeks). Immediately after the ICU stay, patients were tested in the hospital ($n=25$) or at home ($n=1$). At four months follow-up, participants were tested at home ($n=25$) or in a rehabilitation center ($n=1$).

Immediately after ICU discharge, the following variables were assessed: initial negative appraisals of intrusions, peri-traumatic dissociation and neuroticism. At four months follow-up the following variables were assessed: PTSD-symptom severity, persistent negative appraisals of intrusions, persistent dissociation, depression-symptom severity and IQ. Note that the predisposing

vulnerability factors, IQ and neuroticism, were not assessed pre-trauma, but post-trauma. Given that these factors are relatively stable, they may still be considered as predisposing vulnerability factors. IQ was not assessed during the first session because shortly after IC discharge, people were still being affected by narcotics administered in the ICU, making it hard for them to concentrate for longer periods of time. Approval was obtained from the medical ethics committee of Maastricht University Hospital. In addition to the measures described in the present paper, participants completed a number of other questionnaires and gave a narrative account of their experiences in the ICU. These results will be reported elsewhere.

Data analysis

SPSS (11.5) estimated the few missing values by means of regression with residual estimation adjustment. PTSD and depression symptoms at four months were a bit skewed to the right (PTSD: *Skewness* = 1.25, *Kurtosis* = .38; Depression: *Skewness* = 1.11, *Kurtosis* = .40), and were therefore subjected to a square-root transformation. Initial negative appraisals of intrusions (*Skewness* = 2.31, *Kurtosis* = 4.92) and persistent negative appraisals of intrusions (*Skewness* = 2.19, *Kurtosis* = 4.22) were ranked because they were not normally distributed. Stepwise linear regression analysis tested whether post-trauma factors predicted PTSD symptoms over and above predisposing vulnerability factors. Due to a small sample size, the variables that could be included in a single regression analysis were limited to three. In order to test whether initial post-trauma factors (i.e. peri-traumatic dissociation and initial negative appraisals of intrusions) and post-trauma factors (i.e. persistent dissociation and persistent negative appraisals of intrusions) predict PTSD symptoms over and above IQ and neuroticism, four regression analyses were performed. It was calculated how much variance could be explained over and above IQ and neuroticism by 1) peri-traumatic dissociation, 2) initial negative appraisals of intrusions, 3) persistent dissociation and 4) persistent negative appraisals of intrusions. A fifth exploratory regression analysis was performed including all post-trauma variables that significantly

Study 1

predicted PTSD over and above IQ and neuroticism. This exploratory analysis tested whether negative appraisals of intrusions and dissociation add independently to the development of PTSD.

Next, two sets of two stepwise linear regression analyses were performed in order to test the specificity of the predisposing and post-trauma factors for the prediction of PTSD symptoms as compared to depression symptoms. Only those variables that significantly predicted PTSD over and above IQ and neuroticism were tested for specificity. The two sets of regression analyses mirrored each other. That is, the first set of regression analyses was performed in order to test whether variables that significantly predicted PTSD (i.e. IQ, neuroticism, persistent dissociation and persistent negative appraisals of intrusions) were related to PTSD symptoms while controlling for depression symptoms at four months post-trauma. The second set of regression analyses tested whether variables that significantly predicted PTSD were related to depression symptoms while controlling for PTSD symptoms at four months post-trauma. Variables that are specifically related to PTSD symptoms will contribute to the explained variance of PTSD symptoms (first set of regression analyses), but will not contribute to the explained variance of depression symptoms (second set of regression analyses).

Results

Relative contribution of predisposing (IQ and neuroticism) and post-trauma factors (dissociation and negative appraisals)

Four stepwise linear regression analyses were performed in order to test the relative contributions of the predisposing factors (i.e. IQ and neuroticism) and the post-trauma factors (i.e. peri-traumatic dissociation, initial negative appraisals of intrusions, persistent dissociation, persistent negative appraisals of intrusions) in the prediction of PTSD four months post-trauma. See Table 2 for means, standard deviations and range of the dependent and independent variables. IQ and neuroticism explained 20.9% of PTSD-symptom severity

reported at four months (F change (2,23) = 3.04, p = .068). The first regression analysis showed that the inclusion of peri-traumatic dissociation did not increase the explained variance over and above IQ and neuroticism (R^2 = 21.1, F change (1,22) = .06, p = n.s.). The second regression analysis showed that initial negative appraisals did not significantly increase the explained variance over and above IQ and neuroticism (R^2 = 30.7, F change (1,22) = 3.11, p = .09). The third regression

Table 2
Means, standard deviations (SD) and range of the dependent and independent variables

	Mean	SD	Range
PTSD at 4 months	8	8.5	0 - 28
Depression at four months	8.5	7.5	0 - 27
IQ	29.6	7.9	12 - 46
Neuroticism	7.5	5.5	1 - 21
Peri-traumatic dissociation	2	0.7	1 - 3.5
Initial negative appraisals of intrusions	2.8	5.3	0 - 20
Persistent dissociation	1.9	1.0	1 - 4.2
Persistent negative appraisals of intrusions	1.7	3.2	0 - 12

analysis showed that persistent dissociation increased the explained variance over and above the variance explained by IQ and neuroticism to 65.2% (F change (1,22) = 28.03, p < .001). The fourth regression analysis showed that persistent negative appraisals of intrusions increased the explained variance over and above the variance explained by IQ and neuroticism to 60.8% (F change (1,22) = 22.39, p < .001)

A fifth exploratory regression analysis was performed to test whether persistent negative appraisals and dissociation add independently to the development of PTSD. This is an exploratory regression analysis because the number of participants does not allow a regression analysis with more than 3 variables entered. IQ and neuroticism explained 20.9% of PTSD-symptom severity reported at four months (F change (2,23) = 3.04, p = .068). The inclusion of

Study 1

persistent dissociation and persistent negative appraisals of intrusions increased the explained variance to 78.3% (F change (2,21) = 27.71, $p < .001$). The standardized beta shows that persistent dissociation (standardized beta = .48) and persistent negative appraisals of intrusions (standardized beta = .42) contribute independently of each other to the prediction of PTSD symptoms at four months. The results of the regression analysis are summarized in Table 3.

Table 3
Exploratory regression analysis: predicting PTSD symptoms reported at 4 months post-trauma

Step	variable entered	R ²	ΔR ²	ΔF	df	p	Step 4 standardized β Coefficient	SE β standardized
1	IQ + Neuroticism	.209	.209	3.04	2,23	.068	-.26*	.105
2	persistent dissociation + persistent negative appraisals of intrusions	.783	.574	27.71	2,21	.000	.48* .42*	.107 .118 .117

* $p < .05$

Specificity of predisposing and post-trauma factors

Four stepwise linear regression analyses were performed to test the specificity of predisposing and post-trauma factors in predicting post-trauma symptomatology. The first two stepwise linear regression analyses were performed in order to test whether persistent dissociation and persistent negative appraisals of intrusions can increase the explained variance of PTSD symptoms at four months over and above the variance explained by depression symptoms at four months, IQ and neuroticism. The following two regression analyses were performed in order to test whether persistent dissociation and persistent negative appraisals of intrusions can increase the explained variance of depression symptoms at four months over and above the variance explained by PTSD symptoms at four months, IQ and neuroticism. The results are summarized in

Table 4. Persistent negative interpretations of intrusions and persistent dissociation specifically predict PTSD symptoms as compared to depression symptoms.

Table 4
Results of regression analyses: testing the specificity of predisposing and post-trauma factors as predictors of PTSD as compared to depression symptoms

Step	Variables entered	PTSD	Depression
1a	Depression symptoms at four months	1. $R^2 = .45$, F change (1,24) = 19.40, $p < .001$	
1b	PTSD symptoms at four months are entered		1. $R^2 = .45$, F change (1,24) = 19.40, $p < .001$
2	IQ + Neuroticism	2. $R^2 = .46$, F change (2,22) = .22, $p = .81$	2. $R^2 = .53$, F change (2,22) = 1.83, $p = .18$
3a	Persistent dissociation	3a. $R^2 = .69$, F change (1,21) = 15.54, $p = .001$	3a. $R^2 = .54$, F change (1,21) = .48, $p = .50$
3b	Persistent negative appraisals of intrusions	3b. $R^2 = .65$, F change (1,21) = 11.77, $p = .003$	3b. $R^2 = .54$, F change (1,21) = .66, $p = .43$

Note: 3a and 3b represent separate regression analyses in which the increase in explained variance over and above PTSD or depression symptoms at four months, IQ and neuroticism is calculated

Discussion

The results of the present study clearly show that persistent dissociation and persistent negative appraisals of intrusions predict PTSD symptoms over and above IQ and neuroticism. Although IQ and neuroticism explained 21% of the variance of PTSD symptoms four months post-trauma, this effect was marginally significant. Note however that an explained variance of 21% is quite high. The fact that it was marginally significant in the present study is probably due to the small sample size. Persistent post-trauma factors increased the explanatory power to 78%. Note that both persistent dissociation and persistent negative appraisals of intrusions contribute to the prediction of PTSD symptoms at four months independently of each other. On the other hand, initial post-trauma factors i.e. peri-traumatic dissociation and initial negative appraisals, did not contribute to the prediction of PTSD symptoms at four months over and

Study 1

above IQ and neuroticism. With respect to the specificity of predisposing and post-trauma factors, the results showed that persistent dissociation and persistent negative appraisals of intrusions specifically predicted PTSD symptoms as compared to depression symptoms. Note that the present study was partly a cross-sectional and partly a predictive longitudinal study. Thus, the present persistent post-trauma factors were not a predictor in a temporal sense (i.e. persistent post-trauma factors were not assessed before the dependent variables), but only in a statistical sense. Therefore it may be questioned whether persistent post-trauma variables are actually predictive of post-trauma symptoms. Note however that other studies that were truly predictive have also shown that persistent dissociation is a strong predictor of PTSD (Halligan et al., 2003; Murray et al., 2002; Panasetis & Bryant, 2003).

Negative appraisals assessed at four months post-trauma were reliably related to PTSD symptoms. In contrast to the hypothesis that negative appraisals of intrusions are dysfunctional and predictive of PTSD, the present study did not find evidence for a strong contribution of initial negative appraisals over and above IQ and Neuroticism. Note however, that in line with the theory of Ehlers and Clark (2000), the relationship between initial negative appraisals of intrusions and PTSD symptoms reported at four months was strong ($r = .45, p = .01$). So, even though initial negative appraisals of intrusions are strongly related to PTSD symptoms at four months post-trauma, they do not significantly add to the prediction of PTSD symptoms over and above IQ and neuroticism. Future studies should assess whether the increase in explained variance by initial negative appraisals is indeed not significant, or whether the marginally significant finding in the present study is due to the small sample size.

Although peri-traumatic dissociation is considered to be one of the best predictors of PTSD (see Ozer et al., 2003), this relationship was absent in the present study. Even though this finding is consistent with some other studies (Dancu, Riggs, Hearst-Ikeda, Shoyer & Foa, 1996; Marshall & Shell, 2002) there were also several weaknesses in the present study that may explain this result. As was mentioned before, the small sample size may have obscured potential correlations between initial post-trauma factors and PTSD symptoms. On the

other hand, the finding that all other predictors included in this study were strongly related to PTSD suggests that small sample size may not provide a valid explanation. Another weakness of the present study was that we were unable to use all items from the PDEQ to assess dissociation due to the mental state of the participants during the first two weeks after an ICU stay. This may also have influenced the results regarding the relationship between initial post-trauma factors and PTSD symptoms. Another possibility is that the previously observed relationship between peri-traumatic dissociation and PTSD was overestimated due to a lack of control variables. In line with this suggestion is the contention that initial reactions like peri-traumatic dissociation may be a common response to a distressing experience and are initially functional rather than dysfunctional (Bryant & Harvey, 2000; Panasetis & Bryant, 2003). Dissociation may help the trauma victim separate himself from the full impact of the trauma (Spiegel, 1991). Dissociation may only be detrimental when it is sustained, and therefore disturbs the required information processing in the aftermath of a traumatic event (e.g. Foa & Hearst-Ikeda, 1996; Spiegel & Cardena, 1991). There are indeed indications that peri-traumatic dissociation hinders information processing. Recent studies have shown that dissociation is related to dysfunctional processing, i.e. data-driven processing of distressing events. Moreover, data-driven processing has been shown to predict PTSD-like symptoms (Buck, Kindt & van den Hout, 2006; Halligan, Clark & Ehlers, 2002; Kindt, van den Hout, Arntz & Drost, submitted). Although IQ and neuroticism were assessed post-trauma in the present study, it is noteworthy that we found similar results as in the studies that assessed these factors prior to the traumatic event (Engelhard, et al., 2003; Kaplan et al., 2002; Macklin, et al., 1998). Moreover, the present findings are also in line with the observations obtained by studies in which neuroticism and/or IQ were assessed post-trauma (e.g. Jaycox, Marshall & Orlando, 2003; Halligan et al., 2003; Holeva & Tarrier, 2001, Lauterbach & Vrana, 2001; Silva et al., 2000; Vasterling et al., 1997). Notwithstanding the post-trauma assessments, both IQ and neuroticism may be regarded as predisposing vulnerability factors in that they are relatively stable factors, especially when assessed very shortly after the traumatic event. Neuroticism was assessed within one month post-trauma, and IQ, which is an

Study 1

even more stable factor, was assessed four months post-trauma. Although pre-trauma assessments of these predisposing vulnerability factors are desirable, researchers do not always have the opportunity to design such studies.

Strong effects were found despite the small sample size. Thus, acknowledging the limitations of the present study, the results suggest that initial negative appraisals of intrusions and peri-traumatic dissociation do not predict PTSD symptoms over and above IQ and neuroticism. Initial post-trauma factors, then, seem not to be the most appropriate measures for selecting trauma victims who are at high risk for developing chronic PTSD. Persistent risk factors seem to be much better at predicting who is likely to develop chronic PTSD. In order to substantiate these findings, a replication should be performed with at least 10 individuals for each independent variable.

Although prospective studies may shed light on the predictors of PTSD, which are of great interest in a clinical sense, the results may well not end up clarifying on a theoretical level why a certain predictor is related to the development of chronic symptoms. The post-trauma variables that predicted PTSD in the present study may well stimulate dysfunctional processing strategies. That is, persistent dissociation may be enhancing data-driven processing which is related to PTSD (Halligan et al., 2002; 2003; Murray et al., 2002). Persistent negative appraisals of intrusions may well be encouraging individuals to engage in dysfunctional coping strategies like avoidance (see also Ehlers & Clark, 2000). Cognitive ability may also affect successful processing since a certain IQ level may be required for the contextualization of traumatic events (see also Ehlers & Clark, 2000). Although the relationship between neuroticism and PTSD may be explained partly by content overlap (Engelhard et al., 2003), even this predictor affects trauma processing by means of catastrophic interpretations that are characteristic of neuroticism. In order to prevent people from using dysfunctional processing strategies, interventions should start as soon as possible but should only be provided to those who need them. That is, early interventions like debriefing which are generally provided to all trauma victims are not successful (Emmerik, Kamphuis, Hulsbosch & Emmelkamp, 2002; Mayou, Ehlers & Hobbs, 2000). A possible explanation is that they interfere with

natural recovery processes in people who may successfully process the event on their own (Brewin, 2001; Ehlers & Clark, 2003; McNally et al., 2003). Thus, future studies should focus not only on why post-trauma factors are predictive, but also on when they become predictive of chronic PTSD symptoms. The present study would suggest that this lies somewhere between one month and four months post-trauma.

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Study 2

Psychometric Properties of the Trauma Relevant Assumptions Scale

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Abstract

Foa and Riggs (1993) hypothesize that rigid negative and rigid positive beliefs are related to PTSD, whereas people with flexible beliefs will be most likely to recover after a trauma. To date, no questionnaire exists that can assess this hypothesis. This article describes the psychometric properties of the Trauma Relevant Assumptions Scale (TRAS), which is able to measure valence and rigidity of beliefs simultaneously. For the exploratory factor analysis, the TRAS was administered to 309 adult volunteers. Principal components analysis yielded two factors: Assumptions about Self and Assumptions about the World. Their existence was confirmed in a sample of 185 traumatized individuals. The TRAS seems to be a valid and reliable instrument, which is strongly related to symptoms of PTSD, depression and general psychopathology. By testing a curvilinear relation between TRAS scores assessed before trauma and later PTSD symptoms, the hypothesis that both rigid positive and rigid negative beliefs are related to PTSD symptoms can be put to the test. Preliminary results with TRAS scores assessed *after* traumatic events suggest however that only rigid negative beliefs correlate with PTSD symptoms.

Study 2

Introduction

Although a majority of people experience traumatic events in their lives and initially suffer from symptoms of Posttraumatic Stress Disorder (PTSD), only a minority of these individuals develop PTSD (Blanchard et al., 1996; Breslau, Davis, Andreski & Peterson, 1991; Kessler, Sonnega, Bromet, Hughes & Nelson, 1995; Rothbaum, Foa, Riggs, Murdock, & Walsh, 1992). One of the puzzles surrounding PTSD is which factors determine the development of chronic PTSD (Ehlers & Steil, 1995). In addition to variables like dissociation and trauma severity (see Brewin, Andrews & Valentine, 2000; McNally, Bryant & Ehlers, 2003; Ozer, Best, Lipsey & Weiss, 2003), pre-trauma beliefs are thought to be predictive of the development of chronic PTSD symptoms (e.g. Calhoun & Resick, 1993; Ehlers & Clark, 2000; Foa & Riggs, 1993; Horowitz & Reidbord, 1992; Janoff Bulman, 1992). The hypothesis states that dysfunctional pre-trauma beliefs with respect to the self, others or the world may disturb successful post-trauma processing and are therefore predictive of post-trauma symptomatology. Moreover, it is stated that not only the degree of negativity/positivity of the held assumptions is crucial for the development of posttraumatic symptoms, but also the degree of flexibility/rigidity. Although several questionnaires are available to assess pre- and post-trauma cognitions (e.g. Foa, Ehlers, Clark, Tolin, & Orsillo, 1999; Janoff-Bulman, 1992), no questionnaire exists that can successfully assess the flexibility and rigidity of pre-trauma beliefs. The aim of the present study was to develop such a questionnaire.

Foa and colleagues (1992, 1993, 1999) proposed a curvilinear relation between beliefs and PTSD symptoms. PTSD may develop when rigid negative pre-trauma schemas ("The world is never safe", "I am always incompetent") are confirmed, or when rigid positive pre-trauma schemas ("The world is always safe", "I am never incompetent") are violated. Thus, Foa et al. (1999) suggest that the presence of rigid concepts about self and the world (positive or negative) renders individuals vulnerable to develop PTSD. In contrast, people with more flexible beliefs about safety ("The world is sometimes safe and sometimes dangerous") will be most likely to recover after a traumatic event. Although it

can be argued that people with negative pre-trauma schemas already suffer from some kind of psychopathology, Foa and Riggs (1993) suggest that these negative schemas may have resided in long-term memory with high activation thresholds and therefore may not have resulted in severe psychopathology. Data bearing on these hypotheses are limited. Recent studies have indeed found that negative pre-trauma beliefs are related to PTSD symptoms (Ali, Dunmore, Clark & Ehlers, 2002; Dunmore, Clark & Ehlers, 1999), even when PTSD symptom severity at initial assessment was controlled for (Dunmore, Clark & Ehlers, 2001). Further, negative pre-trauma beliefs became more negative after a trauma in those victims who had developed PTSD (Dunmore et al., 1999). Note however that in these studies pre-trauma beliefs were assessed *after* the traumatic experience. Moreover, these studies did not assess positivity of beliefs. Neither did these studies assess the degree of flexibility/rigidity of the beliefs or assumptions.

Not only pre-trauma beliefs may play a role in the development of PTSD symptoms, but also post-trauma beliefs in the direct aftermath of a traumatic event. One of the core features of individuals with persistent PTSD is that they are unable to see the traumatic event as a time-limited event without negative implications for the future (Ehlers & Clark, 2000). Rather, these individuals have a sense of serious current threat, which may result from idiosyncratic negative appraisals of the traumatic event and/or its sequelae (Ehlers & Clark, 2000). Thus, trauma victims with rigid negative post-trauma beliefs are more likely to develop chronic PTSD symptoms than people with flexible or positive beliefs. Flexible post-trauma beliefs indicate that the persons core beliefs were not shattered by the traumatic event and thus do not induce a sense of current threat. They may also show evidence that the traumatic event has already been successfully integrated or can successfully be integrated in the persons core belief system. Individuals that hold rigid positive beliefs in the direct aftermath of a trauma may have problems in processing the traumatic event and may therefore be more vulnerable to develop PTSD (see also Newman, Riggs & Roth, 1997).

Several questionnaires are available that measure trauma related beliefs. These include the World Assumptions Scale (WAS; Janoff-Bulman, 1992), the Posttraumatic Cognitions Inventory (PTCI; Foa et al., 1999) and the Personal

Study 2

Beliefs and Reactions Scale (PBRS; Resick, Schnicke & Markway, 1991). These questionnaires are useful to assess the negative beliefs of trauma victims after a traumatic experience. Further, these questionnaires were shown to be reliable and valid in assessing beliefs and change in strength of beliefs, which appeared to be related to PTSD status (e.g. Foa & Rauch, 2004). However, a disadvantage of these questionnaires is that several beliefs refer to a traumatic experience (e.g. 10 out of 36 items of the PTCL). These items have to be changed or removed from the questionnaire if they are to assess pre-trauma beliefs. Moreover, the existing belief questionnaires are not appropriate to measure the flexibility-rigidity dimension of the beliefs. Although participants can rate to what degree they hold certain beliefs, this does not necessarily indicate the degree of flexibility-rigidity. For example, rating an item like "People can't be trusted" (item 7 in the PTCL) on a scale from 1 (totally disagree) to 7 (totally agree), gives no information about the rigidity of this belief, because the wording of the items does not refer to a rigid state. An extreme score of 7 to this item suggests that at the moment of filling in the scale, the agreement is very high, which says little about rigidity. We propose that rigidity can better be measured when the items are rigid. This can be accomplished by adding the word "always" or "never" to the item. (e.g. "The world is never a good place" versus "The world is always a good place" or "People can never be trusted" versus "People can always be trusted"). Finally, a further disadvantage of previous belief questionnaires is that they focussed just on negative beliefs, as compared to both negative and positive beliefs.

The present study describes the psychometric properties of a newly developed questionnaire enabling to assess pre-trauma beliefs in terms of negativity/positivity and flexibility/rigidity. The content of the items was based on existing belief and assumption questionnaires (e.g. PTCL, WAS). However, the items were reworded, such that the beliefs were split into two rigid and opposing (positive versus negative) assumptions, which were placed on either side of a Visual Analogue Scale (VAS). The rating scales of previous belief measures range from dysfunctional ("I strongly agree with the statement that nobody can be trusted") to functional ("I strongly disagree with the statement that nobody can be trusted"). Previous belief measures focussed on negative beliefs. The newly

developed questionnaire focuses on negative and positive beliefs. Moreover, the rating scale of the new questionnaire ranges from dysfunctional (rigid negative: "People can never be trusted"), to functional (flexible assumption when the VAS is marked in the middle: "People can sometimes be trusted and sometimes not"), to dysfunctional (rigid positive: "People can always be trusted"). This enables researchers to finally test whether pre-trauma beliefs and post-trauma symptomatology are related curvilinearly as suggested by Foa and colleagues (1992, 1993, 1999). Note that rigidity and valence of assumptions are suitable to be assessed pre-trauma to test whether the assumptions are shattered or confirmed by a traumatic event. This questionnaire can also be used in the direct aftermath of a trauma to test whether rigid negative or rigid positive beliefs are present that may predict the development of chronic post-trauma symptomatology.

This article describes two studies. The first study assesses the psychometric properties of this new measure, the Trauma Relevant Assumptions Scale (TRAS), in adult volunteers. Because many items of the TRAS are based on the PTCI, we hypothesize that the TRAS will consist of two subscales similar to the PTCI: Self and World. The PTCI consists of a third subscale whose items were not included in the TRAS, because they refer to the traumatic event. The Self-scale of the Miskimins Self-Goal Other Discrepancy Scale was included in order to assess the convergent validity of the expected subscale Self. It is hypothesized that the supposed subscale Self of the TRAS is strongly related to the Self-scale of the MSGO. Moreover, it will be tested whether scoring negatively in a rigid way is indeed strongly related to a high level of general psychopathology (see Foa & Riggs, 1993). Since neuroticism refers to a temperamental sensitivity to negative stimuli, emotional instability and maladjustment (Goldberg, 1992), it may also be expected that scoring rigid negative relates to neuroticism.

The second study tests whether the psychometric properties as obtained in the first study are confirmed in a traumatized sample. Next, it will be tested whether a curvilinear relation between beliefs and PTSD symptoms post-trauma can be observed or not. A further aim is to test the specificity of the assumptions for PTSD as compared to depression, anxiety and general psychopathology.

Study 1

Method

Participants

Three hundred and nine adult volunteers participated in this study. Participants included mainly university students (79.6%). Mean age of the participants (98 males, 211 women) was 26.5 (SD = 9.1; range 17-61). Among the participants, who had responded to flyers, ten gift vouchers at €50,- were raffled off.

The test-retest sample consisted of thirty-nine participants (8 males, 31 females) with a mean age of 28.2 (SD = 9.7; range 20-59). Participants included again mainly university students (77%). These individuals completed the TRAS twice, with a retest interval of 5 to 6 weeks.

Development of the Trauma Relevant Assumptions Scale (TRAS)

Many items of the TRAS were based on the items in the PTCI (Foa et al., 1999). Other items were based on the World Assumptions Scale (Janoff-Bulman, 1992) and on questionnaires used by Dunmore et al. (1999; 2001) and McCann, Sakheim and Abrahamson (1988). The item pool consisted of thirty-seven items, which were developed around five themes: "self" (18 items), "others" (5 items), "world" (4 items), "controllability" (5 items) and "justice" (5 items). The TRAS was developed in such a way that participants will not be asked to rate their agreement or disagreement with a certain assumption. Instead, two opposite and rigid versions of each assumption (a rigid negative version and a rigid positive version) were placed at the ends of a 100 mm visual analogue scale (VAS). By marking the line, participants can indicate to what extent they agree with this assumption. For example, the rigid positive version of the assumption ("The world is always safe") was placed at one end, and the rigid negative version of the assumption ("The world is never safe") was placed at the other end of the

VAS. People who mark the line around the centre are thought to have more flexible views about the safety of the world: The world is neither always safe, nor never safe, but instead somewhere in the middle. Scores ranged from -50 (rigid negative) to +50 (rigid positive). The assumptions were counterbalanced so that the positive version was at the left end in half of the items and on the right end in the other half of the items. In the wording of the items, no references were made to a traumatic event, making the questionnaire appropriate to assess beliefs or assumptions that are present prior to a trauma. Participants were told that the aim of the questionnaire is to find out to what extent the statements apply to them.

Materials

The Self-scale of the Miskimins Self-Goal Other (MSGO) Discrepancy Scale (Miskimins, Wilson, Braucht & Berry, 1971) assessed the self-concept. The MSGO is a 15-item scale. Each item consist of two opposite personality characteristics (happy-sad; good looking-ugly), which are placed at the ends of 100 mm VAS. Scores ranged from -50 (negative self) to +50 (positive self). The reliability and validity of the MSGO are well established (Miskimins & Braucht, 1971).

The Symptom Check List-90 (SCL90; Arrindell & Ettema, 1981) assessed general psychopathology. The SCL90 is a 90-item self-report inventory designed to measure fear, agoraphobia, depression, somatic complaints, distrust and interpersonal sensitivity, insufficiency of thoughts and actions, sleep problems and anger-hostility in the last three months. Answers are rated on a 5-point Likert scale (1 = not at all, 5 = very much). Scores ranged from 90 to 450. A higher score indicates a higher general level of psychological-somatic dysfunction over the last three months. Psychometric properties of the Dutch version of the SCL-90 have shown to be excellent (Arrindell & Ettema, 1981).

The shortened Eysenck Personality Questionnaire (EPQ; Eysenck & Eysenck, 1975) was used to measure neuroticism. The EPQ is a 22-item questionnaire with yes or no answers. Scores ranged from 0 to 22. A higher score

Study 2

indicated that the person was more neurotic. Psychometric properties of the Dutch version of the EPQ have shown to be good (Sanderman, Eysenck & Arrindell, 1991).

Results

Exploratory factor analysis

The original pool of 37 items was subjected to a principal component analysis with direct oblimin rotation. Visual examination of the scree plot suggested a three-factor solution. However, only four items, of which two items also loaded on factor two, loaded on factor three. Therefore, the final analysis was performed with a two-factor model, which is described here. Table 1 presents the items and their loadings on these two factors. The first factor (eigenvalue 9.09, 24.59% explained variance) was loaded by nineteen items. The items referred to 'self-image' and 'trust in oneself'. This factor was named 'Assumptions about Self' (ASelf). The second factor (eigenvalue 2.83, 7.65% explained variance) was loaded by twelve items. The items referred to 'safety and justice in the world', 'trustworthiness of others' and 'controllability of negative events'. This factor was named 'Assumptions about the World' (AWorld). Six items did not load on either factor (non-loadings). The items of the TRAS load to a great extent on similar subscales of the PTCI (Foa et al., 1999) on which most items of the TRAS are based.

Reliability of the TRAS

Internal consistency and interrelations of the subscales. The Cronbach's Alpha's estimates of the internal consistency of the subscales are good (AWorld, Cronbach's alpha = .80) to excellent (ASelf, Cronbach's alpha = .91). The correlation between the two subscales was .20 (.52 when corrected for attenuation). This implies that two separate subscales are justified.

Table 1

Factor loadings of TRAS items as obtained by exploratory and confirmatory factor analysis

Item	Description (positive version)	Factor 1		Factor 2	
		EFA	CFA	EFA	CFA
1	I can always trust myself to do the right thing ¹	.63	.69		
2	I am always a strong person ¹	.52	.73		
7	I can always deal with upsets, even when the upsets are huge ¹	.58	.66		
8	I am always happy ¹	.62	.80		
11	I never feel miserable ¹	.63	.75		
13	I never feel dead inside ¹	.59	.75		
14	I always feel capable of doing anything ¹	.64	.76		
15	I am always in control of what happens to me ³	.60	.67		
17	I will always be able to feel normal emotions ¹	.67	.71		
19	I have a future ¹	.66	.71		
20	Everything about me is good ¹	.64	.78		
23	I can always deal with negative events ¹	.70	.71		
25	I can always rely on myself ¹	.83	.71		
26	Good things can always happen to me ¹	.43	.69		
27	I am always in control of the situation I'm in ³	.69	.64		
28	I never feel isolated and alienated from others ¹	.60	.73		
31	I always feel that I know myself ¹	.60	.56		
33	I can always trust my own judgment ⁴	.74	.59		
35	I am never disgusting ⁴	.52	.63		
4	I will always be able to prevent bad things from happening to me ¹			.44	.52
5	I can always trust people ¹			.46	.72
9	I never have to be on guard ¹			.51	.68
16	You always know who will harm you ¹			.53	.52
18	I never have to be careful ¹			.55	.64
21	I will always be able to prevent something terrible from happening ³			.45	.49
22	I can always rely on other people ¹			.47	.69
29	The world is always a safe place ³			.72	.73
30	There is always justice in the world ⁴			.47	.54
32	Terrible things can never happen to me ¹			.50	.45
34	People are always exactly how they present themselves ¹			.52	.55
37	The world is never a dangerous place ¹			.69	.70
Non Loadings					
3	I am always able to control my anger ¹				
6	Misfortune never strikes worthy, decent people ²				
10	When bad things happen to people, it's always their own fault ⁴				
12	People always get what they deserve ²				
24	Good people always experience good things ²				
36	People who have emotional difficulties are never inferior ⁴				

Note: Only factor loadings $\geq .32$ are shown.

EFA = Exploratory factor analysis, CFA = Confirmatory factor analysis

¹ Items based on the Posttraumatic Cognitions Inventory (Foa et al., 19999),² Items based on the World Assumptions Scale (Janoff- Bulman, 1992)³ Items based on McCann et al. (1988)⁴ Items based on Dunmore et al. (1999, 2001)

Study 2

Test-retest reliability. Intraclass correlation coefficients (absolute agreement) were calculated to examine the temporal stability of the subscales of the TRAS. The correlations between test and retest five weeks later were generally good and significant ($p < .001$) for ASelf (.87) and AWorld (.73).

Convergent validity

To examine the convergent validity, a correlation was calculated between the factor ASelf of the TRAS and the subscale Self of the MSGO. It was hypothesized that there would be a strong relation between these two scales. The correlation supports this hypothesis ($r = .85, p < .001$). It was further hypothesized that the relation between the factor AWorld of the TRAS and the subscale Self of the MSGO would be small. This correlation was indeed substantially smaller ($r = .39, p < .001$).

Relation to Psychopathology and Neuroticism

To examine whether rigid negative scorings are related to psychopathology, correlations were calculated between the subscales of the TRAS and the total score of the SCL-90 (ASelf: *Spearman* $r = -.53, p < .001$; Aworld: *Spearman* $r = -.48, p < .001$), and between the subscales of the TRAS and the subscales of the SCL-90 (ASelf: $-.52 < \textit{Spearman } r < -.20, p < .001$; AWorld: $-.42 < \textit{Spearman } r < -.28, p < .001$). The relations were moderate to strong and all were in the predicted direction. Spearman's rho correlations were calculated since the subscales and the total score of the SCL-90 were not normally distributed ($2 < \textit{Skewness} < 6.5$; and $4.8 < \textit{Kurtosis} < 64.8$).

To examine whether scoring rigid negative is related to neuroticism, Pearson correlations were calculated between the subscales of the TRAS and the EPQ (ASelf: $r = -.64, p < .001$; Aworld: $r = -.45, p < .001$). The relations were strong and in the predicted direction.

Discussion

The TRAS was developed to test both whether rigid negative and rigid positive beliefs are related to PTSD. The TRAS was tested in a sample of adult volunteers rather than traumatized individuals, because the TRAS should also be suitable for pre-trauma assessment in non-patient groups. Principal components analysis yielded two factors: 'Assumptions about Self' and 'Assumptions about the World'. The items of ASelf refer to 'self-image' and 'trust in oneself'. The items of AWorld refer to 'safety and justice in the world', 'trustworthiness of others' and 'controllability of negative events'. The TRAS showed good test-retest reliability and good internal consistency for all subscales. As hypothesized, more general psychopathology and neuroticism was reflected in more rigid negative scores on both subscales of the TRAS.

Although the items of the TRAS were mainly based on items of the PTCL, the present study found a two-factor solution, whereas Foa et al. (1999) found a three-factor solution. But most items in the third subscale of the PTCL were not included in the TRAS. In a replication study testing the psychometric properties of the PTCL, Beck et al. (2004) found that the third subscale (Self-Blame) had poor concurrent and discriminant validity.

In order to test whether the assumptions as assessed by the TRAS are indeed trauma-relevant and thus related to post-trauma symptomatology, a second study was performed to test whether the psychometric properties as obtained in the first study are confirmed in a traumatized sample. Next, it was tested whether a curvilinear relation between beliefs and PTSD symptoms can be observed post-trauma or not. Moreover, the second study investigated whether the TRAS is specific for PTSD as opposed to post-trauma depression, anxiety or general psychopathology.

Study 2

Method

Participants

One hundred and eighty-five traumatized adult volunteers participated in this study. See Table 2 for sample characteristics. Participants had responded to advertisements published in a local weekly newspaper and advertisements placed on the Internet on Dutch sites by and for victims of sexual assault, domestic violence, and road traffic accidents. Participants received €10,- for their participation.

The participants were divided into three categories: 1) traumatized individuals with PTSD according to a more conservative scoring rule (see below) ($n = 69$), 2) traumatized individuals with PTSD according to the scoring rule of the Posttraumatic Symptom Scale (Foa et al., 1993, see below) ($n = 60$), and 3) traumatized individuals without PTSD ($n = 56$). Demographic information for the three groups is presented in Table 2.

Materials

Questionnaires included again the TRAS, MSGO, SCL-90 and EPQ. In addition, the Posttraumatic Symptom Scale, the Beck Depression Inventory, and the Spielberger state anxiety scale of the State/Trait Anxiety Inventory were administered.

The Posttraumatic stress disorder Symptom Scale (PSS-SR; Foa et al., 1993; Arntz, 1993; Engelhard & Arntz, submitted) corresponds to the seventeen DSM-IV symptoms of PTSD. The severity of these symptoms is rated on a 4-point severity scale (0 = not at all, 1 = a little bit, 2 = somewhat, 3 = very much). The items provide both diagnostic and severity data. The PSS-SR is highly accurate when it comes to identifying PTSD cases (Wohlfarth, van den Brink, Winkel &

Table 2
Sample characteristics by diagnostic group of study 2

	PTSD conservative scoring	PTSD according to PSS scoring rule	Trauma but no PTSD
N	69	60	56
Gender male/female	8/61 ^a	10/50 ^a	26/30 ^b
Age	33 (11.4) ^a	35.4 (11.7) ^{ab}	41 (11.3) ^b
Educational Level*	7.2 (2.1) ^a	7.8 (1.8) ^{ab}	8.2 (1.9) ^b
Type of event			
Sexual assault	23	16	5
Nonsexual assault	10	9	12
Childhood sexual abuse	8	5	0
Illness	1	3	1
Domestic violence	5	4	3
Traffic accident	4	10	14
Other	10	10	18
Missing	8	3	3
Number of traumatic events			
1	18 ^a	25 ^{ab}	28 ^b
2	16	12	10
>2	30	23	14
Missing	5	0	4
Time since most recent event			
1-6 months	10	6	10
6 months – 3 years	30	21	12
> 3 years	22	29	32
Missing	7	4	2
PTSD Symptom Scale	33.7 (5.9) ^a	18.6 (5.7) ^b	6.1 (5.4) ^c
Beck Depression Inventory	28.6 (9.8) ^a	15.4 (7.3) ^b	6.3 (6) ^c
State-Trait Anxiety Inventory			
Inventory	59.9 (10.6) ^a	45.7 (11) ^b	33.7 (9) ^c
State	49.3 (3.5) ^a	50.4 (3.3) ^{ab}	51 (2.8) ^b
Trait			
SCL-90	265 (56.7) ^a	182 (44.7) ^b	128.7 (38.7)

Note: According to the PSS scoring rule (Foa et al., 1993), a symptom is scored as present if it is rated at least 1 (“once in a while”). According to the more conservative scoring rule (e.g. Brewin et al., 2000; Engelhard et al., 2001), a symptom is present if it is rated at least 2 (“half the time”).

Four participants did not report their depressive and anxiety symptoms. Another participant did not report the trait anxiety symptoms. Within each row, superscripts ^a, ^b, and ^c are significantly different from each other ($p < .05$). The number behind “Missing” refers to the number of participants that did not answer or rate that question.

* Educational level is based on the Dutch educational system ranging from elementary school (score 1) to university (11). Score 7 refers to higher general secondary education and score 8 refers to intermediate vocational education.

Study 2

Smitten, 2003). The sum score of the seventeen items assesses severity of PTSD symptoms. In the present study, two scoring rules were applied to diagnose participants: the PSS scoring rule and a more conservative scoring rule. According to the PSS scoring rule, participants would meet criteria for PTSD when they rated *at least* six questions as 1, which in this case meant rating 1 in at least one out of five questions about intrusions (item 1-5), in at least three out of seven questions about avoidance (item 6-12), and in at least two out of five questions about arousal and irritability (item 13-17). According to the more conservative scoring rule (e.g. Brewin et al., 2000; Engelhard et al., 2001), participants would meet criteria for PTSD when they rated at least six questions as at least 2 or 3, instead of rating them as at least 1.

The Beck Depression Inventory (BDI; Beck, Ward, Mendelsohn, Mock & Erbauch, 1961) is a 21-item self-report measure, which has been shown to have good reliability and validity and to correlate highly with clinical ratings of depression. The sum score of the final twenty items assesses the severity of the depression symptoms. Scores ranged from 21 to 84, with higher scores indicating more severity of depression symptoms. The reliability of the Dutch version of the BDI has shown to be good (Bouman, Luteijn, Abersnagel & van der Ploeg, 1985).

The Spielberger state anxiety scale of the State/Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, & Luthene, 1970) is a 20-item scale. Sum scores ranged from 20 –80. A higher score refers to more state anxiety. The reliability and validity of the Dutch translation of the STAI have shown to be good (van der Ploeg, 1980).

Results

Confirmatory factor analysis

The factor structure derived in study 1 was tested in study 2 by a confirmatory factor analysis using Structured Equation Modelling. Models are thought to fit the data when the standardized root mean square residual

(SRMSR) is less than .09 and the comparative fit index (CFI) is at least .90 (Hu & Bentler, 1999). The SRMSR in the present study was .07, and the CFI was .90, indicating an adequate fit. See Table 1 for the factor loadings.

Internal consistency and interrelations of subscales

The Cronbach's alpha's estimates of the internal consistency of subscales are excellent (Cronbach's alpha of ASelf = .95; Cronbach's alpha of AWorld = .88). The correlation between the two subscales is .68 (.78 when corrected for attenuation). This confirms that separation of the two subscales is justified.

Convergent validity of the TRAS

To examine the convergent validity, a correlation was calculated between the factor ASelf of the TRAS and the subscale Self of the MSGO. It was hypothesized that there would be a strong relation between these two scales. The correlation supports this supposition ($r = .92, p < .001$). It was further hypothesized that the relation between the factor AWorld of the TRAS and the subscale Self of the MSGO would be small. This correlation was considerable ($r = .64, p < .001$), but it is still much smaller than the relation between ASelf of the TRAS and the subscale Self of the MSGO (85% (ASelf) versus 41% (AWorld) explained variance).

Study 2

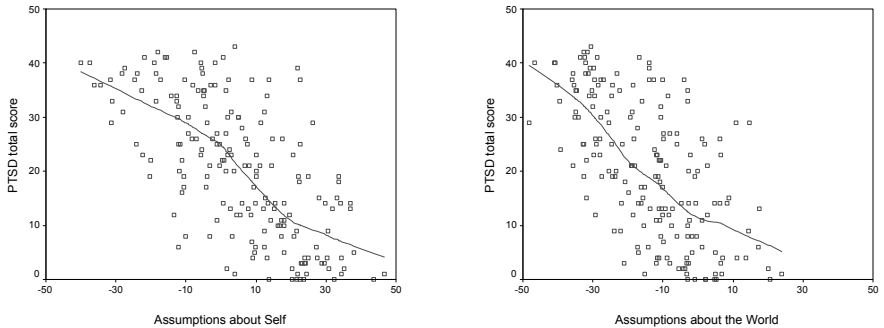


Figure 1. Relation between post-trauma beliefs (Assumptions about Self and Assumptions about the World) and PTSD symptoms. Assumptions range from -50 (rigid negative) to +50 (rigid positive). The line represents the Lowess-fit.

Relation between beliefs and PTSD symptoms

The relation between post-trauma beliefs and PTSD symptoms is presented in Figure 1, which shows a monotonous decreasing association for both ASelf and AWorld, rather than a curvilinear relation. The curvilinear relations were assessed with curve estimation (quadratic model) and were not significant (ASelf: $t = -.54$, $p = n.s.$, AWorld: $t = 1.54$, $p = n.s.$). On the other hand, the linear relations were highly significant (ASelf: $t = -11.5$, $p < .001$, AWorld: $t = -4.8$, $p < .001$). Note that the absence of the curvilinear relation for ASelf is not the result of a restriction of range of the ratings of the beliefs, since participants rated the beliefs in the full range. For the AWorld however, extreme positive ratings were lacking.

The left figure (Assumptions about Self) in Figure 1 suggests that the variance in PTSD symptoms on the positive end of the TRAS is larger as compared to the variance in PTSD symptoms on the negative end of the TRAS. In order to explore this further, the ratings on the TRAS were categorized into 4 categories: Category 1 included those ratings on Aself that ranged from -50 to -

24.99; Category 2 included those ratings on Aself that ranged from -25 to -.01; Category 3 included those ratings on Aself that ranged from 0 to 24.99; Category 4 included those ratings on Aself that ranged from 25 to 50. Figure 2 shows the box plots of the total score of PTSD symptoms for each category. Note that the variance in category 4 is much larger than the variance in category 1, suggesting that there may be a minority of individuals in which rigid positive beliefs are correlated with a high PTSD symptom level, whereas the majority reports rigid positive beliefs together with few PTSD symptoms.

Ratings on Aworld were also divided into four categories. Because ratings on Aworld ranged from -48.1 to 24, the categories were as follows: Category 1 included those ratings on Aself that ranged from -50 to -30.01; Category 2

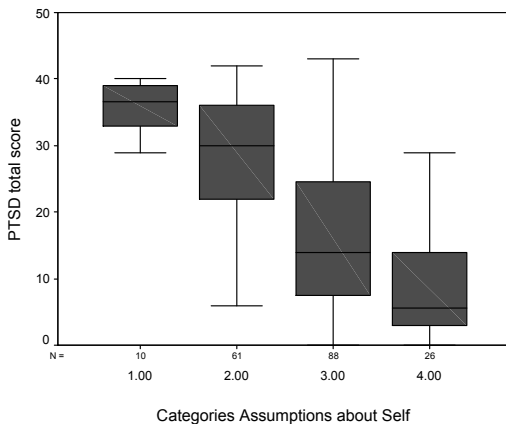


Figure 2. Box plot of variance in PTSD symptoms for each category based on ratings about Assumptions about Self. Category 1 includes those ratings on Assumptions about Self that ranged from -50 to -24.99; Category 2: -25 to -.01; Category 3: 0 to 24.99; Category 4: 25 to 50.

Study 2

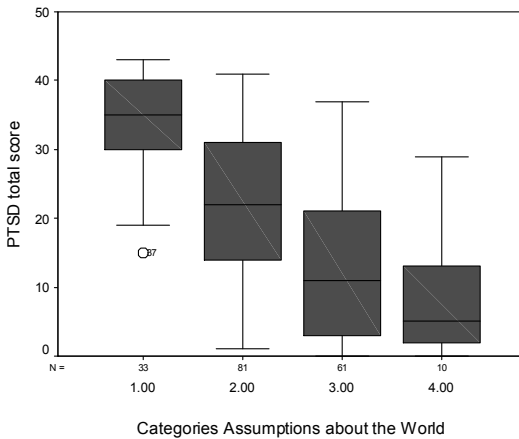


Figure 3. Box plot of variance in PTSD symptoms for each category based on ratings on Assumptions about the World. Category 1 included those ratings on Assumptions about the World that ranged from -50 to -30.01 ; Category 2: -30 to -10.01 ; Category 3: -10 to 9.99 ; Category 4: 10 to 30 .

included those ratings on Aself that ranged from -30 to -10.01 ; Category 3 included those ratings on Aself that ranged from -10 to 9.99 ; Category 4 included those ratings on Aself that ranged from 10 to 30 . Figure 3 shows the box plots of the total scores of PTSD symptoms for each category. Note that the variance in category 4 is still larger than the variance in category 1, although the difference is only small.

Specificity of the TRAS

In order to examine the specificity of the assumptions for PTSD as opposed to post-trauma depression, anxiety and general psychopathology, correlations were calculated between the TRAS on the one hand, and PSS, BDI, STAI and SCL-90 on the other hand. Because no curvilinear relation was observed between assumptions and PTSD symptoms, correlations were

calculated rather than curve estimations. Table 3 shows that the subscales of the TRAS correlate strongly to all psychopathology measures.

To examine whether there is a relationship between the subscales of the TRAS and PTSD symptoms when variation in depression is controlled for, partial correlations were calculated between the subscales of the TRAS and the PSS,

Table 3
Correlations between the subscales of the TRAS, PSS, BDI and STAI in the traumatized sample

	Assumptions about Self	Assumptions about the World
PSS (Pearson)	-.67**	-.63**
BDI (Pearson)	-.81**	-.67**
STAI-state (Pearson)	-.76**	-.67**
STAI-trait (Spearman)	.17*	.22*
SCL-90 total (Pearson)	-.78**	-.68**

** $p < .001$

* $p \leq .01$

partialling out BDI scores. No relation was found between the subscale ASelf and PSS ($r = -.07$, $p = n.s.$). The relation between AWorld and PSS dropped but remained significant ($r = -.24$, $p = .001$). Similarly, it was examined whether there is a relationship between the subscales of the TRAS and depression symptoms when variation in PTSD symptoms is controlled for. Partial correlations were calculated between the subscales of the TRAS and the BDI, partialling out PSS scores. The relation between the subscales of the TRAS and BDI symptoms remained strong and significant (ASelf: $r = -.60$, $p < .001$; AWorld: $r = -.32$, $p < .001$).

To examine whether there is a relationship between the subscales of the TRAS and PTSD symptoms when variation in state anxiety is controlled for, partial correlations were calculated between the subscales of the TRAS and the PSS, partialling out STAI-states scores. The relation between the subscales of the TRAS and PSS dropped but remained significant (ASelf: $r = -.20$, $p = .004$;

Study 2

AWorld: $r = -.24, p < .001$). Similarly, it was examined whether there is a relationship between the subscales of the TRAS and anxiety when variation in PTSD symptoms is controlled for. Partial correlations were calculated between the subscales of the TRAS and the STAI-state, partialling out PSS scores. The relation between the subscales of the TRAS and STAI-scores remained strong and significant (ASelf: $r = -.50, p < .001$; AWorld: $r = -.35, p < .001$).

To examine whether there is a relationship between the subscales of the TRAS and PTSD symptoms when variation in general psychopathology is controlled for, partial correlations were calculated between the subscales of the TRAS and the PSS, partialling out the total score of the SCL-90. No relation was found between the subscale ASelf and PTSD symptoms ($r = -.12, p = n.s.$). The relation between AWorld and PTSD symptoms dropped but remained significant ($r = -.20, p = .003$). Similarly, it was examined whether there is a relationship between the subscales of the TRAS and general psychopathology when variation in PTSD symptoms is controlled for. Partial correlations were calculated between the subscales of the TRAS and the SCL-90, partialling out PSS scores. The relation between the subscales of the TRAS and general psychopathology dropped but remained significant (ASelf: $r = -.52, p < .001$; AWorld: $r = -.34, p < .001$).

Additional Analyses. The relation between ASelf and PTSD symptoms disappeared after controlling for depression symptoms. This may be explained by the shared variance between PTSD symptoms and depression symptoms. To test whether depression symptoms were a mediator, it was tested with the Sobel test (Baron & Kenney, 1986) whether the relation between ASelf and PTSD symptoms (standardized $Beta = -.67$) dropped significantly when the mediator (depression symptoms) was taken into account (standardized $Beta = -.07$). The Sobel test showed that this drop was significant, (*Sobel test* = $-9.05, p < .001$), suggesting that depression symptoms mediate the relation between ASelf and PTSD symptoms.

It was also tested whether general psychopathology mediates the relation between ASelf and PTSD symptoms. Thus whether the relation between ASelf and PTSD symptoms (standardized $Beta = -.67$) dropped significantly when the mediator (symptoms of general psychopathology) was taken into account

(standardized $Beta = -.129$). The Sobel test showed that this drop was significant ($Sobel\ test = -8.5, p < .001$), suggesting that although ASelf is still related to PTSD symptoms, symptoms of general psychopathology largely mediated the relation between PTSD symptoms and ASelf.

These findings seem to imply that ASelf is related to depression and general psychopathology rather than to PTSD symptoms. BDI, SCL-90 and PSS scores together explain 67% of variance of ASelf ($F(3,176) = 117.3, p < .001$). Part correlations show that PSS scores do not significantly contribute to the relation with ASelf ($r_{part} = .005, t = .12, p = .91$), whereas BDI scores ($r_{part} = -.25, t = -5.65, p < .001$) and total SCL-90 scores ($r_{part} = -.13, t = -3.07, p = .02$) do. PSS scores do significantly contribute to the relation with AWorld ($r_{part} = .11, t = -2.1, p = .46$), as well as BDI scores ($r_{part} = -.10, t = -1.94, p = .05$) and total SCL-90 scores ($r_{part} = -.14, t = -2.56, p = .01$). Together they explain 49% of variance of AWorld ($F(3,176) = 57.34, p < .001$).

General discussion

A thought-provoking hypothesis states that both valence and rigidity of pre-trauma beliefs are related to the development of chronic posttraumatic symptomatology (Foa et al., 1992; Foa & Riggs, 1993). Foa and colleagues propose that individuals with either rigid positive beliefs about safety and invulnerability as well as people with rigid negative beliefs about a dangerous world and their own vulnerability will be especially at risk to develop PTSD. On the other hand, people with more flexible beliefs about safety and vulnerability are supposed to be most likely to recover after a traumatic event. These suppositions suggest a curvilinear relation between PTSD symptom level and beliefs. So far, no instrument was developed that could test this hypothesis. The present study examined the reliability and validity of a new belief questionnaire (TRAS), which is able to assess valence and rigidity of beliefs simultaneously. The TRAS assesses trauma relevant assumptions, and is suitable to assess these assumptions both pre-trauma and in the direct aftermath post-trauma.

Study 2

The TRAS was initially tested in a community sample of students. The TRAS yielded two factors: Assumptions about Self (nineteen items) and Assumptions about the World (twelve items). These two factors had good internal consistencies. Convergent validity of the subscale Assumptions about Self was supported by high correlations with the Miskimins Self-Goal Other Discrepancy Scale. In addition, negative scores on the TRAS were related to high levels of psychopathology and neuroticism as predicted.

The items in the TRAS were based on items from other questionnaires assessing trauma-related beliefs. Still, several items did not load on any factor. This may be due to the rewording of the item, or to the nature of the sample on which the exploratory factor analysis was performed. The PTCI, on which many items in the present study were based, was tested in a traumatized sample. We chose to perform the exploratory factor analysis on a sample of adult volunteers as compared to a traumatized sample, because the TRAS was developed in order to be suitable to assess also pre-trauma beliefs, thus in non-traumatized individuals. If the exploratory factor analysis was performed on a traumatized sample, the non-loadings might well have loaded on one of the two factors.

In order to test whether the assumptions of the TRAS were indeed trauma-relevant and thus related to post-trauma symptomatology, the TRAS was tested in a traumatized population. The existence of the two factors (i.e. Assumptions about Self and Assumptions about the World) was confirmed in the traumatized sample. Internal consistencies were high. Convergent validity of the subscale Assumptions about Self was supported by high correlations with the Miskimins Self-Goal Other Discrepancy Scale.

A curvilinear relation was not visible in our data. Although this might suggest that the supposition by Foa and colleagues (1992, 1993, 1999) is not correct, it is more likely that the lack of evidence for the curvilinear relation is due to the timing of the assessment of the beliefs. That is, Foa and colleagues hypothesize that there is a curvilinear relation between PTSD symptom level and pre-trauma beliefs. The present study assessed post-trauma beliefs. Moreover, in the majority of the participants, the traumatic event occurred several months or even a few years before their beliefs were assessed. Future studies may test

whether there is a curvilinear relation between PTSD symptom level and pre-trauma beliefs, and between PTSD symptom level and post-trauma beliefs, which are assessed in the direct aftermath of a traumatic event.

Additional analyses suggested that the variance in PTSD symptoms is much larger in traumatized individuals with more rigid positive beliefs than in traumatized individuals with more rigid negative beliefs. This may suggest that rigid positive beliefs are detrimental in some individuals and beneficial in most individuals. On the one hand, rigid positive beliefs are likely to be shattered after a traumatic event, which may result in a high PTSD symptom level (see also Janoff-Bulman, 1992). On the other hand, it is also possible that rigid positive beliefs function as a buffer. After all, rigid positive beliefs are probably based on positive experiences. As a result, a single negative experience may not be enough to shatter rigid positive beliefs.

The subscale Assumptions about Self of the TRAS appeared not to be specific for PTSD as compared to depression symptoms and symptoms of general psychopathology. Moreover, PTSD symptoms had no unique relation with the subscale Assumptions about Self over and above depression symptoms and symptoms of general psychopathology. The relation between Assumptions about Self and PTSD symptoms is mediated by post-trauma depression symptoms and by symptoms of general psychopathology. Foa et al. (1999) found that the relation between PTSD symptoms and the subscales Negative Cognitions about Self and Negative Cognitions about the World of the PTCI remained significant once depression symptoms were controlled for. On the other hand, Beck et al. (2004) found that the relation between PTSD symptoms and Negative Cognitions about the World was no longer significant after controlling for depression symptoms. However, both Foa et al. (1999) and Beck et al. (2004) found that the relation between PTSD symptoms and Negative Cognitions about Self was still moderate and significant after controlling for depression symptoms. Nevertheless, it is not surprising that the relation between PTSD symptoms and Assumptions about Self disappeared in the present study after controlling for depression symptoms. For depression is characterized by a negative view of the self (APA, 1994). Further, because the negative statements of the TRAS items are

Study 2

posed *extremely* negative, the TRAS may be more sensitive to assess negativity of beliefs than the PTCI. This may explain why depression symptoms were so strongly related to the subscale Self in the present study. However, the results have to be interpreted with care since the present study was not a prospective study, but a cross-sectional study.

The number of items of both subscales can probably be reduced without compromising the psychometric properties of the scale. However, as also posited by Foa et al. (1999), the wide range of items may prove useful in clinical settings. The items of the TRAS may identify dysfunctional cognitions that can be targeted in cognitive-behavioural treatment, and may further be useful to assess therapy progress. Thus, the TRAS may not only be useful to study the relation between pre- and post-trauma beliefs and the development of PTSD, but may also be useful in therapeutic settings. An advantage of the TRAS over the PTCI is that whereas the PTCI focuses mainly on the presence of *negative* cognitions, the TRAS is able to assess the presence of *positive* assumptions as well. Therefore, the TRAS is able to assess the progress in shift from the presence of negative assumptions to the presence of positive assumptions.

In sum, the TRAS seems to be a reliable and valid instrument to assess trauma-relevant beliefs or assumptions. Contrary to the existing questionnaires, the TRAS is able to assess both negativity and positivity of trauma relevant beliefs in combination with rigidity. By developing the TRAS, we have now opened the way to thoroughly test whether a curvilinear relation exists between pre-trauma beliefs (or beliefs assessed in the direct aftermath of a traumatic event) and post-trauma symptomatology. The TRAS may further be suitable in therapeutic settings where it can be used as a tool to identify the severity of dysfunctional assumptions and may therefore be used for assessment of therapy progress.

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Study 2

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Part 2:

Explaining the development of post-trauma
symptomatology



Study 3

Effects of State Dissociation on Objectively and Subjectively assessed Memory Disturbances

Buck, N., Kindt, M., & van den Hout, M. (2006). *Behavioural and Cognitive Psychotherapy*, 34, 319-331.

Abstract

Dissociation often occurs after a traumatic experience and has detrimental effects on memory. If these supposed detrimental effects are the result of disturbances in information processing, not only subjectively assessed but also objectively assessed memory disturbances should be observed. Most studies assessing dissociation and memory in the context of trauma have studied trauma victims. However, this study takes a new approach in that the impact of experimentally induced state dissociation on memory is investigated in people with spider phobia. Note that the aim of the present study was not to test the effect of trauma on memory disturbances. We found indeed significant relations between state dissociation and subjectively assessed memory disturbances: intrusions and self-rated memory fragmentation. Moreover, although no relation was found between state dissociation and experimenter-rated memory fragmentation, we observed a relation between state dissociation and experimenter-rated perceptual memory representations. These results show that state dissociation indeed has detrimental effects on the processing of aversive events.

Study 3

Introduction

Dissociation has detrimental effects on memory (Halligan, Michael, Clark & Ehlers, 2003), which is clinically relevant to dissociative disorders, acute stress disorder and posttraumatic stress disorder. In this study, dissociation refers to depersonalisation, derealisation, altered time perception and numbing (see Marmar et al., 1994). The hallmark of dissociative disorders is an inability to recall important personal information, usually of a traumatic or stressful nature (APA, p478). In acute stress disorder and posttraumatic stress disorder (PTSD), trauma victims often have difficulty intentionally retrieving all aspects of the traumatic event (Ehlers & Clark, 2000). It is assumed that the detrimental effects of dissociation on memory are due to disturbances in information processing of the traumatic event, resulting in memory disturbances. Typically, two memory disturbances have been identified in traumatized individuals: intrusive memories and impoverished memory functioning or memory fragmentation (APA, 1994). For example, trauma victims who develop chronic PTSD are supposed to suffer from intrusive memories on the one hand and from fragmented memories of the traumatic event on the other (Ehlers & Clark, 2000; Foa & Riggs, 1993; van der Kolk & Fisler, 1995). It should be noted that observations of fragmentary traumatic memories are mainly based on subjectively assessed memory disturbances, that is clinical reports without experimental control of the memorised material (see also Shobe & Kihlstrom, 1997 for a critical review). If the supposed memory disturbances are the result of disturbances in information processing, not only subjectively assessed memory disturbances but also objectively assessed memory disturbances should be observed.

Recently, laboratory studies showed that state dissociation was indeed related to intrusive memories and memory fragmentation (Kindt & van den Hout, 2003; Kindt, van den Hout & Buck, 2005). However, the effect on memory fragmentation was restricted to subjective evaluation of the memory performance ("meta-memory"). Although this observation is in line with clinical reports given by trauma victims, no fragmentation was observed in actual memory performance. A disadvantage of these studies is that state dissociation was

induced by a highly aversive film. The lack of personal involvement while watching a distressing film does not allow generalisation of the results to real-life situations that may induce dissociation such as traumas or other unexpected experiences. In the present study, the relation between state dissociation and memory disturbances is further studied, taking the two above-mentioned disadvantages into account. Firstly, memory disturbances will not only be assessed by subjective measurements, but also by objective measurements. Secondly, in contrast to the previous experimental studies on state dissociation (Kindt & van den Hout, 2003; Kindt, van den Hout & Buck, 2005), in the present study personal involvement is assured by an Exposure in Vivo treatment.

Although there is no single definition of dissociation, there is a consensus that dissociation disturbs information processing (Ehlers & Clark, 2000; Foa & Hearst-Ikeda, 1996; Marmar, Weiss, Metzler & Delucchi, 1996; Spiegel & Cardena, 1991). We suppose that dissociation refers to the subjective experience of data-driven processing as opposed to conceptually-driven processing (see also Ehlers & Clark, 2000). Data-driven processing means that mainly the physical features of the event are processed, resulting in exact memory representations or perceptual memory representations of stimuli that have previously been perceived (Roediger, 1990). The opposite of data-driven processing is conceptually-driven processing. Conceptually-driven processing refers to processing the meaning of the situation and placing it into a context (Ehlers & Clark, 2000; Roediger, 1990). Initially, novel stimuli are processed mainly data-driven. After they have become more familiar, they will be processed more conceptually-driven and thus less data-driven (Johnston & Hawley, 1994). So, a shift takes place from data-driven to conceptually-driven processing as stimuli become more familiar. Ehlers and Clark (2000) suggest that people who process the trauma in a mainly data-driven way *during* the traumatic event will be more likely to develop chronic PTSD. We suggest that not only data-driven processing *during*, but also data-driven processing *after* a traumatic event may have detrimental effects.

It is suggested that state dissociation is enhanced during schema-incongruent situations (Johnston & Hawley, 1994; Siegel, 1996). In this study, a

Study 3

schema-incongruent situation refers to a situation for which people have no schema due to the unexpectedness, newness or the aversiveness of the situation. In this experiment, a one-session Exposure in Vivo for spider phobic patients was used as a schema-incongruent setting. Participants did something they never would have thought possible: instead of avoidance or escape, they stayed in close proximity to a live spider and allowed different-sized spiders to walk over their hands during a period of 2½ hours! The suggestion that a one-session treatment for people afraid of spiders may elicit state dissociation has already been pursued by Öst (1989), who stated that “some of the patients may afterwards experience the treatment as something unreal, a dream etc.” (p4). We would like to emphasize that we fully acknowledge that a one-session Exposure in Vivo is not traumatic for spider phobic patients. But the purpose of this study is not to study the effects of *trauma* on memory disturbances but the effect of *state dissociation* on memory disturbances in a schema incongruent setting. And a one-session Exposure in Vivo is schema-incongruent for spider phobic patients and may for that reason induce state dissociation during the treatment. Note, however that state dissociation is often experienced in the context of traumatic experiences. Therefore, the results of this study may be relevant to the field of trauma research.

In sum, the aim of the present study was to investigate in individuals with spider phobia, whether there is a relation between state dissociation and memory disturbances. Moreover, it was investigated whether this relation is observed not only for subjectively assessed memory performance, but also for objectively assessed memory performance. Subjectively assessed memory disturbances include intrusions and memory fragmentation, the two typical memory disturbances identified in traumatised individuals (APA, 1994). The objectively assessed memory disturbances include experimenter-rated perceptual memory representations and experimenter-rated memory fragmentation. Furthermore, detrimental effects of state dissociation on other symptoms were studied, i.e. self-reported fear and dysfunctional beliefs related to spiders (e.g. “a spider is uncontrollable”) and assessment of behavioural fear. For successful exposure treatment, dysfunctional beliefs like “This spider spies on me” must be

changed into functional beliefs like “This spider doesn’t harm me”. We hypothesize that this change in beliefs may be hindered when people dissociate during the exposure. For beliefs to change, it is very important that the person is convinced that he or she actually handled the spiders him/herself. People who dissociate during the Exposure in Vivo may experience the exposure session as unrealistic. As a result, dissociation during exposure may hinder that dysfunctional beliefs will be replaced by functional beliefs such that fear of spiders won’t diminish.

The following hypotheses are formulated: state dissociation is related to 1) intrusive memories, 2) memory fragmentation, 3) experimenter-rated perceptual memory representations, 4) experimenter-rated memory fragmentation and 5) less reduction of both spider fear and strength of spider-related beliefs. Prior research has shown a relation between state dissociation and neuroticism (Holeva & Tarrier, 2001) and between trait dissociation and neuroticism (e.g. De Silva & Ward, 1993; Goldberg, 1999; Kindt & van den Hout, 2003). Further, dissociation may be the result of high emotional arousal (Spiegel, 1991). In addition, IQ scores have appeared to be inversely related to PTSD symptoms (McNally & Shin, 1995). Therefore, in the present experiment we will control for neuroticism, arousal, education level and a sub-score of the IQ-test. Instead of a complete IQ test, only the subtest “Picture Arrangement Test” of the WAIS (Stinissen, Willems, Coetsier & Hulsman, 1970) will be included; this reflects the capacity to find coherence in a story.

Method

Participants

Thirty-four people participated in the study (32 women, 2 men). They were either recruited from a waiting list for treatment (n = 19), had responded to an advertisement or a flyer (n = 9), or were referred by friends and colleagues (n = 6). They were asked to participate in a study in return for a free treatment. They

Study 3

were told that the aim of the study was to assess how people experience distressing situations. Four women did not complete the whole study and were excluded from further analyses. Reasons for drop-out were lack of time ($n=3$) and disagreement with method of treatment ($n=1$). Mean age of the participants was 36.4 years ($SD = 14.5$, range 17 – 68). They received a “free” 2½ hour treatment in return for participating in this study. The participants met DSM-IV (APA, 1994) criteria for specific phobia, which in this case refers to spider phobia. The mean score on the Spider Phobia Questionnaire (SPQ; Klorman, Weerts, Hastings, Melamed & Lang, 1974) was 24.0 ($SD = 3.0$), which is comparable to mean SPQ scores reported in other studies (Lavy, van den Hout & Arntz, 1993; Mayer, Merckelbach, De Jong & Leeuw, 1999). Participants were classified according to the level of education completed under the Dutch educational system. Four percent completed only some form of primary education. Forty-four percent completed some form of secondary education. Thirty-two percent completed some form of intermediate vocational education. Twenty percent completed some form of higher education such as university or business training.

Materials

State Dissociation

State dissociation was measured by the Peri-traumatic Dissociative Experience Scale (PDEQ; Marmar, Weiss & Metzler, 1997), a questionnaire that is suitable to assess state dissociation after traumatic or other unexpected experiences. The PDEQ was adapted to refer to the Exposure in Vivo. The questionnaire consists of 10 questions about dissociative experiences that the participant might have experienced during the treatment. The participant is asked to rate these experiences, which include altered time perception, derealisation and depersonalisation, on a 5-point severity scale (1 = not at all, 5 = extremely). Mean item scores range from 1 to 5. A higher score indicates more state dissociation. In a study with Veteran combat veterans, the PDEQ (rater version) has demonstrated to be internally consistent (Cronbach’s $\alpha = .81$), associated with measures of traumatic stress response (mean correlation = .48; range = .39 to .60),

associated with measures of general dissociative tendencies ($r = .41$; $p < .001$), associated with levels of stress exposure ($r = .48$, $p < .001$) and unassociated with measures of general psychopathology (mean correlation = $-.06$; range $-.17$ to $.12$) (Marmar, Weiss, Schlenger, Fairbank, Jordan, Kulka & Hough, 1994). Marmar et al. (1996) suggested a cut-off score of 1.50. That is, people are thought to have experienced no clinically meaningful dissociation when they have a mean item score of 1.50 or lower. Whereas those with mean item scores above 1.50 are considered to have clinically salient levels of state dissociation.

Subjectively assessed memory disturbances

The subjectively assessed memory disturbances include intrusive memories and self-rated memory fragmentation.

Several aspects of intrusions, as a result of the Exposure in Vivo, were measured with Visual Analogue Scales (0-100 mm VAS). That is, Frequency of Intrusions, Fearfulness of Intrusions, Suppression of Intrusions and the degree to which the intrusions were experienced as if participants Relived the Exposure in Vivo. The instruction to the questions was as follows: The items in this questionnaire refer to thoughts and images regarding spiders and the treatment for spider phobia, which you may have had during the week following the treatment. The items were as follows: 1) Did you have frightening thoughts or images about spiders during the day or night? 2) How frightening were these thoughts/images? 3) Have you tried to suppress these thoughts/images? 4) Did the thoughts/images feel as if you experienced everything again? After the exposure, participants were given a diary in which they had to rate these four questions daily during seven days. For each of the four questions, the mean score of seven days was used in further analyses.

Self-rated memory fragmentation was measured by a 100-mm VAS. Subjects rated the fragmentary quality of their recollections by indicating to what degree their recollections had a snap-shot character from 0 (not at all) to 100 (very much).

Study 3

Objectively assessed memory disturbances

The objectively assessed memory disturbances include experimenter-rated perceptual memory representations and experimenter-rated memory fragmentation. Note, however, that the narratives are scored by the subjective evaluations of two experimenters. This scoring system is still considered as objective compared to the subjective evaluations of the participant's own judgments of their memory quality. Moreover, a detailed manual was developed to score the narratives to minimise the subjectivity of the raters. If the inter-rater reliability is sufficient, the objectivity of this scoring system is warranted.

Experimenter-rated perceptual memory representations were measured by scoring the reaction to the following task: "Tell what you can remember about the treatment. Tell everything that comes to your mind. Don't think too long before answering". The answer was audio taped, transcribed verbatim, and scored on a 9-point scale from 1 (exclusively conceptual memory representations and/or contextualisations) to 9 (exclusively perceptual memory representations) by two raters. Thus, a higher score refers to more perceptual memory representations. The raters were the first author (N.B) and a student (J.R). All raters were ignorant to the status of the judged participant. Raters practised scoring with narratives of participants who dropped out. The narratives were chunked into separate utterance units. Each utterance that represented a physical feature (perceptual memory representations) was marked and each utterance that represented a conceptualisation was marked differently. All references to time of day, date or location, were scored as contextual information. Indications of specific spiders were also scored as contextual information, in that it showed that participants were able to indicate what action occurred in the context of a specific spider. The scoring manual is available upon request. The intraclass correlation coefficient between the two raters was .90. For each individual a single mean score was calculated.

Experimenter-rated fragmentation was scored by N.B. and M.K. They were blind to scores on all other variables. The intra-class correlation coefficient between the two raters was .93. The scripts, which were also used to measure the degree of perceptual versus conceptual memory representations, were similar to

Halligan et al. (2003), rated on a 10-point-scale from 1 (not fragmented at all) to 10 (extremely fragmented/disorganized). Fragmentation or disorganisation was reflected in rambling from one subject to another, unfinished sentences, single words instead of sentences, and an incomplete or inaccurate order of events. Raters practised with scripts from participants who dropped out.

Fear of spiders

Fear of spiders was measured with the Spider Phobia Questionnaire (SPQ, Klorman et al., 1974), a 31-item self-report questionnaire. Scores ranged from 0-31 and a higher score indicated more fear of spiders. In addition, spider fear was also assessed using a Behavioural Approach Test (BAT) in order to assess avoidance behaviour for spiders. During the BAT, participants are asked to perform several steps (e.g. approaching a medium-sized spider, touching it with a stick, touching it with a finger, having the spider walk over one's hands), which they can refuse at any time. BAT performance was coded using an 8-point scale, ranging from 1 (approaching a medium-sized spider which is enclosed in a jar) to 8 (the medium-sized spider walks on the hand). A higher score indicated less avoidance of spiders. The BAT lasts about 3-7 minutes.

Spider-related beliefs

Spider-related beliefs were measured with the Spider Belief Questionnaire (SBQ; Arntz, Lavy, van den Berg & van Rijnsoort, 1993). This questionnaire assesses (catastrophic) beliefs related to spiders and (catastrophic) beliefs related to the subjects' reactions when confronted with a spider. Subjects indicated the strength of each belief by filling in a percentage (0-100%). Scores ranged from 0 – 78. A higher score indicated a stronger subjective belief in the statements.

Neuroticism

Neuroticism was assessed by the shortened Eysenck Personality Questionnaire (EPQ; Eysenck & Eysenck, 1975). This is a 22-item questionnaire

Study 3

with yes or no answers. Scores ranged from 0 to 22 and a higher score indicated that the person was more neurotic.

Arousal

Arousal was assessed by asking participants to rate their fear every 10 minutes during the Exposure in Vivo treatment from 1 (not at all afraid) to 10 (very afraid). Participants rated their fear verbally when requested. The therapist wrote the score down. Mean scores were calculated

Picture Arrangement Test

In the present study, only a subscale of the IQ-test was administered, appealing to the ability to find coherence among perceptual stimuli. This was measured by the Picture Arrangement Test from the Wechsler Adult Intelligence Scale (W.A.I.S.; Stinissen et al., 1970). This test consisted of 10 sets of drawn pictures, which the participants had to place in a logical order within a given time. The sets consisted of 3 to 6 pictures. Scores ranged from 0 to 20. A higher score indicated a higher ability to find coherence.

Procedure

The study was approved by the Medical Ethical Commission of Maastricht University and the Academic Hospital of Maastricht.

Participants were tested individually and attended two sessions, one week apart. For two participants the two sessions were two weeks apart, and for one participant, the two sessions were three weeks apart.

Session 1 started with the BAT, which was followed by some questionnaires (biographical information, EPQ and Picture Arrangement Test from the W.A.I.S.). Then the exposure started, which lasted 2½ hours maximum. During the exposure, arousal was assessed. The exposure was immediately followed by the PDEQ. Finally they were given a diary in which they answered the questions relating to intrusions during the following seven days after the Exposure in Vivo.

Session 2 started by assessing experimenter-rated perceptual memory representations and experimenter-rated memory fragmentation. Then, self-rated fragmentation, the BAT and the fear questionnaires (SPQ and SBQ) were assessed. At this time the participants also returned the diary.

Exposure in Vivo

A one session Exposure in Vivo has been shown to produce just as good results in the treatment of spider phobia as treatments with multiple sessions do and should be the treatment of choice (Arntz & Lavy, 1993; Hellström and Öst, 1995; Öst, 1996; Öst, Ferebee & Furmark, 1997).

The Exposure in Vivo involves that people move gradually from looking at a spider to touching a spider with a stick, having a spider walk over one to several fingers and finally handling a spider solo. The patient makes a commitment to remain in the exposure situation until the anxiety fades away, and never escape from the situation during treatment. When anxiety has decreased, the patient moves on to the next step. The therapist will never do anything in treatment without first describing it to the patient, modelling it, and get the patient's permission to perform that part of the treatment (Öst, 1989).

Design

Data were recruited from one group of spider phobic patients. The independent variable (dissociation) was assessed immediately after the Exposure in Vivo. The dependent variables (experimenter-rated perceptual memory representations, experimenter-rated memory fragmentation, self-rated memory fragmentation, spider fear and spider beliefs) were assessed at one-week follow-up. Intrusions were rated daily by the participants in the week following the Exposure in Vivo. Control variables (neuroticism, sub-score of the IQ-test, and education level) were assessed before the exposure. Arousal (a control variable) was assessed during the exposure. Pre-treatment scores of spider fear (SPQ, SBQ and BAT) were assessed before the Exposure in Vivo, enabling the hypothesis to

Study 3

be tested whether dissociation was related to less reduction of fear and less reduction in strength of beliefs. The questionnaires (SPQ and SBQ) were sent by mail several weeks before the Exposure in Vivo session took place. SPQ at pre-treatment will further be referred to as SPQ⁰. SPQ at one-week follow-up will be referred to as SPQ¹. The same notation also applies to BAT and SBQ scores.

Data reduction and data analyses

SPSS (10.0.7) estimated the few missing values by regression with residual estimation adjustment.

One outlier was excluded from further analyses, because her PDEQ score was more than three standard deviations away from the group's mean: she scored 34 whereas the maximum score among the other participants was 24 (mean = 17.1, *SD* = 4.0). First it was verified whether the control variables were related to the experimental variables as predicted based on the literature. If this was not the case, they were not controlled for. Dissociation was predicted to be positively related to neuroticism and arousal. The sub-score of the IQ test and education level were both predicted to be inversely related to perceptual memory representations and memory fragmentation. Further, education level was also predicted to be inversely related to intrusions. Finally, it was verified whether it was necessary to control for the number of spiders that walked over the participants' hand. This variable will further be referred to as 'number of spiders'. It was predicted that 'number of spiders' would be positively related to decline of fear and change in spider-related beliefs. The variable 'number of spiders' differed between participants (range 0-5 spiders, mean = 3.5, *SD* = 1.4). 'Number of spiders' was converted into 5 dummy variables because it is not a linear variable. The step from handling 0 to 1 spider is very different from the step between handling 2 or 3 spiders or 3 and 4 spiders. After the first spider has walked over the hands of the participant, it takes far less time before the participant allows the second spider to walk over her hands. Dummy 1 referred to having handled 1 spider, dummy 2 referred to having handled 2 spiders etc. These 5 dummy variables were entered in a regression analysis to calculate

R^2_{change} . R^2_{change} represents the strength of the relation between the variable 'number of spiders' and *change* in fear of spiders or *change* in strength of spider-related beliefs.

Paired comparison t-tests were performed to test whether spider fear and strength of spider-related beliefs, declined significantly. Pearson correlations were calculated to test whether relations between control and experimental variables and between dissociation and dependent variables, were significant. Partial correlations were calculated when a control variable was included. Pre-treatment level of spider fear and beliefs were controlled for when correlations were calculated between dissociation and spider fear or spider-related beliefs. All paired comparison t-tests and correlations were tested one-tailed.

Due to a technical failure, in four participants, data of the objective memory assessments were missing. These participants were excluded from further analysis.

Results

Manipulation check

The schema incongruent setting accomplished by a one-session Exposure in Vivo was successful in inducing different levels of mean scores of state dissociation (mean = 1.7; $SD = .4$; range 1.1-2.4). Based on a mean item cut-off score of 1.5 (Marmar et al., 1996), fourteen subjects (56%) had clinically salient levels of state dissociation.

Treatment was effective as indicated by a highly significant decrease in SPQ and SBQ scores and a significant increase in BAT score from pre-treatment to post-treatment. See Table 1 for the means and standard deviations of SPQ, SBQ and BAT at pre-treatment and 1 week follow-up. Paired comparison t-tests revealed that decrease of spider fear assessed by SPQ was significant ($t(24) = 5.4$, $p < .001$). Similarly, decrease of strength of spider beliefs as assessed by SBQ was significant ($t(24) = 8.6$, $p < .001$). Finally, decrease of spider fear as assessed by increase of performance on the BAT was also significant ($t(24) = -9.3$, $p < .001$).

Study 3

Control Variables

Except for arousal, none of the control variables was related to any of the experimental variables in the predicted direction. The relation between dissociation and arousal was in the predicted direction although marginally significant ($r = .30, p = .07$). Nevertheless, arousal will be included as control variables since there are indications in the literature that it is related to

Table 1
Means and standard deviations at pre-treatment and 1-week follow-up

	Pre-treatment $M^0 (SD^0)$	One-week follow-up $M^1 (SD^1)$
SPQ	24.1 (2.9)	17.2 (7.6)
SBQ	41.1 (10.2)	19.7 (12.6)
BAT	4.6 (1.6)	6.9 (1.0)

Note: SPQ = Spider Phobia Questionnaire, SBQ = Spider Belief Questionnaire and BAT = Behavioural Approach Test

dissociation (Spiegel, 1991). Neuroticism was not related to dissociation ($r = -.25, p = n.s.$). The sub-score of the IQ test was neither related to perceptual memory representations ($r = -.18, p = n.s.$), nor to self-rated memory fragmentation ($r = -.03, p = n.s.$) or experimenter-rated memory fragmentation ($r = -.28, p = n.s.$). Education level was not related to several aspects of intrusions ($-.16 < r < -.22, p = n.s.$), nor to self-rated memory fragmentation ($r = -.08, p = n.s.$) or experimenter-rated memory fragmentation ($r = -.19, p = n.s.$). Education level was related to perceptual memory representations, but not in the hypothesized direction ($r = .40, p < .05$) and thus will not be included as a control variable. 'Number of spiders' was not related to decline of spider fear assessed with the SPQ ($R^2_{change} = .21, p = n.s.$) or the BAT ($R^2_{change} = .16, p = n.s.$). Nor was it related to decline of strength of spider-related beliefs ($R^2_{change} = .30, p = n.s.$).

Relation between state dissociation and subjectively assessed memory disturbances

As hypothesized, state dissociation was positively related to frequency of intrusions ($r_{\text{partial, arousal}}(22) = .47, p = .01$), fearfulness of intrusions ($r_{\text{partial, arousal}}(22) = .44, p = .02$), suppression of intrusions ($r_{\text{partial, arousal}}(22) = .40, p = .03$) and the degree to which the intrusions were experienced as if participants relived the Exposure in Vivo ($r_{\text{partial, arousal}}(22) = .36, p = .04$).

State dissociation was also related to self-rated memory fragmentation as hypothesized ($r_{\text{partial, arousal}}(22) = .34, p = .05$).

Relation between state dissociation and objectively assessed memory disturbances

Dissociation is related to experimenter-rated perceptual memory representations as was hypothesized ($r_{\text{partial, arousal}}(22) = .59, p = .001$). No relation was found between state dissociation and experimenter-rated memory fragmentation ($r_{\text{partial, arousal}}(25) = -.10, p = n.s.$).

Relation between state dissociation and other symptoms

No significant relations were found between state dissociation on the one hand and change in SPQ, BAT or SBQ scores on the other. That is, change in SPQ scores at one-week follow-up ($SPQ^0 - SPQ^1; r_{\text{partial, arousal}} = .10, p = n.s.$), change in BAT performance at one-week follow-up ($BAT^0 - BAT^1; r_{\text{partial, arousal}} = -.06, p = n.s.$) and change in spider-related beliefs at one-week follow-up ($SBQ^0 - SBQ^1; r_{\text{partial, arousal}} = -.08, p = n.s.$).

Discussion

First, we would like to emphasize again that it was not our intent to study the effects of *trauma* on memory disturbances. We fully acknowledge that a one-session Exposure in Vivo is not traumatic for spider phobic patients. Instead, the aim of the present study was to investigate in individuals with spider phobia,

Study 3

whether state dissociation is not just related to subjectively assessed memory disturbances, but also to objectively assessed memory disturbances. The main results can be summarized as follows. First, in line with previous studies (Halligan et al., 2003; Kindt & van den Hout, 2003; Kindt et al., 2005; Murray, Ehlers & Mayou, 2002), a relation was found between state dissociation and subjectively assessed memory disturbances. That is intrusions and self-rated memory fragmentation. Second, although Halligan et al. (2003) reported a relation between dissociation and objectively assessed memory fragmentation, several other studies (Kindt & van den Hout, 2003; Kindt et al., 2005; Murray, et al., 2002) were not able to find a relation. In line with the latter studies, no relation was found between state dissociation and experimenter-rated memory fragmentation in the present study. However, a relation was found between state dissociation and another objective measure of memory disturbances: experimenter-rated perceptual memory representations. Since perceptual memory representations are thought to be the result of sustained data-driven processing, the present results suggest that dissociation has detrimental effects on information processing. However, these detrimental effects of dissociation on information processing had no effect on therapy outcome. That is, the relations between state dissociation and reduction of spider fear or strength of spider beliefs after the Exposure in Vivo were not significant.

Some remarks are in order with regard to the assessment of state dissociation. It may be possible that the induction of state dissociation occurred early in the treatment process, and then dissipated by the end of the 2½ hour treatment. Since the Exposure in Vivo was successful in that fear of spiders declined, the positive effects of the treatment could have reduced the dissociative experiences enough, so it resulted in null correlations with experimenter-rated memory fragmentation and decline of fear symptoms. On the other hand, it is also possible that we should not only have assessed *state* dissociation during and directly after the Exposure in Vivo, but also '*persistent*' dissociation at one week follow-up. According to Spiegel (1991), dissociation may exert a dual function. First, dissociation may help participants to separate themselves from the full impact of the trauma. Second, dissociation may delay the necessary emotional

processing and therefore hinder the contextualisation of the traumatic experience. This may imply that in the short term, the first function of dissociation will help participants to endure the exposure treatment, resulting in a decline of fear. However, dissociation in the long run may be dysfunctional, in that 'emotional processing' will not occur. In line with this suggestion are observations by Murray et al. (2002). They observed that persistent dissociation assessed at 4 weeks after the traumatic event is a better predictor of PTSD symptoms at 6 months than dissociation during and immediately after the traumatic event. Panasetis and Bryant (2003) found similar results in acute stress disorder patients.

Although a previous study reported a positive relation between state dissociation and neuroticism (Holeva & TARRIER, 2001), we did not observe a similar relation. The same holds for the other control variables, i.e. educational level and the sub-score of the IQ test. That is, McNally and Shin (1995) have shown that IQ scores are inversely related to PTSD symptoms. However, in the present study, educational level and the sub-score on the IQ test were not related to PTSD-like symptoms (intrusions and memory fragmentation). One explanation for these divergences is that the present study differed in several respects from these previous studies. Although the current study was designed to test the effects of dissociation on several PTSD-like symptoms, we did not test our hypotheses in a trauma sample and thus did not assess PTSD symptoms, rather PTSD-like symptoms.

Although Halligan et al. (2003) report a positive relation between dissociation and experimenter-rated memory disorganisation in assault victims, other studies have failed to find this relation in road traffic accident victims (Murray et al., 2002) and in three laboratory studies (Kindt and van den Hout, 2003; Kindt et al., 2005). A disadvantage of the laboratory studies was the lack of personal involvement. But, even though participants were personally involved in the present study, and memory fragmentation was scored on a 10-point scale following Halligan et al. (2003), no relation was found between dissociation and experimenter-rated memory fragmentation. But, in these previous studies, as well as in the present study, a narrative was scored as very fragmented when the

Study 3

narrative itself was very disorganized. But this may not be the best operationalisation of memory fragmentation. Mandler (1979) distinguishes two dimensions of organisation to interpret a variety of different, often disparate appearing phenomena. First, the *integration dimension*, refers to the degree to which the to-be-remembered items form functional units of thought and/or action; a highly integrated item is one in which the constituent elements of the response form a highly coherent unit. Second, the *elaborative dimension* refers to the degree of inter-relatedness of the to-be-remembered item with other units in memory. Thus, integration measures the within-unit organisation, whereas elaboration measures the between-unit organisation. In the above-mentioned studies, memory fragmentation has been investigated by focusing on the *integrative dimension* as opposed to the *elaborative dimension*. However, the elaborative dimension may be the most relevant dimension in understanding dysfunctional trauma processing, since it involves the formation and strengthening of associations between the trauma representation and other associated representations in memory. And the deficient embedding or contextualisation of the traumatic event in autobiographical memory is thought to be one of the main problems in PTSD (see also Brewin & Holmes, 2003; Ehlers & Clark, 2000). Future research on trauma memory should focus on the contextualisation of the trauma as opposed to the coherence of the trauma narrative per se.

In sum, it was assumed that if the detrimental effects of state dissociation are the result of disturbances in information processing, the observed memory disturbances should not be confined to subjectively assessed memory disturbances. Our findings tend to partly confirm this hypothesis. Firstly, in line with previous findings and clinical reports, state dissociation was again related to subjectively assessed memory disturbances. That is intrusions and self-rated memory fragmentation. However, no relation was found between dissociation and experimenter-rated memory fragmentation. But, more importantly, objective assessments show detrimental effects of state dissociation on perceptual memory representations. Future studies should examine whether data-driven processing

mediates the relation between state dissociation and memory disturbances by manipulating the processing style directly.

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Study 3

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Study 4

Perceptual Memory Representations and Memory Fragmentation as Predictors of Post-trauma Symptoms

Buck, N., Kindt, M., van den Hout, M., Steens, L. & Linders, C. (in press). *Behavioural and Cognitive Psychotherapy*.

Abstract

Ehlers and Clark (2000) hypothesize that persistent PTSD is explained by a predominance of data-driven processing and a lack of conceptually-driven processing of the trauma. Data-driven/conceptually-driven processing is thought to relate to perceptual memory representations and memory fragmentation. The present study measured the result of data-driven/conceptually-driven processing in three ways: on utterance level by assessing 1) the ratio between perceptual and conceptual memory representations and 2) narrative disorganization, and 3) on narrative level by assessing the incoherence of the trauma narrative. Twenty-nine patients discharged from the Intensive Care (IC) were assessed within two weeks after IC discharge and at four months follow-up. The present study tested whether perceptual memory representations, narrative disorganization and narrative incoherence immediately after IC discharge are related to post-trauma symptomatology. If so, whether these variables are specific for PTSD as compared to depression. Data-driven/conceptually-driven processing was related to PTSD and Depression symptoms on utterance level. Although narrative incoherence did not predict PTSD symptoms, it was predictive of depression symptoms. The present study showed the viability of the data-driven/conceptually-driven conceptualisation in explaining post-trauma symptomatology.

Study 4

Introduction

Trauma victims with Post-traumatic Stress Disorder (PTSD) are characterized by a sense of serious current threat. Ehlers and Clark (2000) pose that this sense of serious current threat is the result of how the traumatic event is processed. It is generally believed that for successful processing, the traumatic event must be elaborated on, such that it can be integrated into its context in time, and with other autobiographical memories (Ehlers & Clark, 2000; Horowitz, 1976). Ehlers and Clark (2000) specified (dys)functional processing by distinguishing two processing modes, i.e. data-driven (or bottom-up) and conceptually-driven (or top-down) processing. This conceptual framework is derived from the work of Roediger (1990), who stated that data-driven processing results in a poorly elaborated, perceptually encoded memory trace, whereas conceptual processing results in contextualized memory representations. Conceptually-driven processing and data-driven processing are inversely related, thus the more data-driven processing, the less conceptually-driven processing and vice versa (see also Johnston & Hawley, 1994). Studies have indeed found that data-driven processing is related to the maintenance of PTSD symptoms up to six months post-trauma (Halligan, Michael, Clark & Ehlers, 2003; Murray, Ehlers & Mayou, 2002). Note that these results are based on a subjective measure, that is a self-report measure of data-driven processing. However, self-reports on cognitive processes are usually inaccurate and unreliable (Nisbett & Wilson, 1977). The present study will use objective measures as indices of data-driven and conceptually-driven processing to test the hypothesis that these processing styles are related to the maintenance of PTSD symptoms.

A processing style can be measured objectively by assessing the supposed result of a given processing style, that is memory representations of that processing style. A predominance of data-driven processing and a lack of conceptually driven processing are thought to result in more perceptual memory representations as compared to conceptual memory representations (see Buck, Kindt & van den Hout, 2006). A predominance of data-driven processing and a

lack of conceptually driven processing are also thought to result in unorganized memories (see also Ehlers & Clark, 2000). This implies that the fragmented nature of the memory representations can be applied as a further index of the data-driven/conceptually-driven conceptualisation. Although previous studies (e.g. Foa, Molnar & Cashman, 1995; Halligan et al., 2003; Harvey & Bryant, 1999; Murray et al., 2002) assessed fragmentation by use of objective measurements, so far no studies have considered the fragmented nature of the trauma memory as an index of the data-driven/conceptually-driven distinction. Several objective assessments of fragmentation have been used, including assessment of the incoherence of the trauma narrative (Halligan et al., 2003; Murray et al., 2002) and assessment of the disorganization within an utterance (Halligan et al., 2003). An utterance is a sentence or part of a sentence in a narrative, containing only one thought or action. Both objective assessments of memory fragmentation have been shown to predict PTSD and depression symptoms (Halligan et al., 2003; Murray et al., 2002).

The first aim of the present study was to test whether perceptual memory representations and memory fragmentation predict PTSD symptoms. Previous studies used a subjective measure to assess the degree of data-driven processing, that is a questionnaire about the used processing style, rated by the trauma victim. The advantage of the present study over these previous studies is that several objective measures were used to assess the data-driven/conceptually-driven distinction: perceptual memory representations and memory fragmentation. Note that peri-traumatic dissociation appears as one of the most reliable predictors of PTSD symptoms (Ozer, Best, Lipsey & Weiss, 2003, but see also Dancu, Riggs, Hearst-Ikeda, Shoyer & Foa, 1996; Laposo & Alden, 2003; Marshall & Shell, 2002). Since dissociation has been described as the subjective experience of data-driven processing (Kindt & van den Hout, 2003), and has been shown to overlap with data-driven processing (Buck et al., 2006; Halligan et al., 2003), the present study will test the independent contribution of data-driven processing. Traumatic experiences not only result in PTSD, but also in serious depression symptoms (Galea et al., 2002). Moreover, predictors of PTSD like data-driven processing, dissociation, fragmentation, and negative appraisals

Study 4

have shown to be related to depression symptoms as well (Halligan et al., 2003). Therefore, the second aim of this study was to test whether perceptual memory representations and memory fragmentation specifically predict PTSD symptoms as compared to depression symptoms.

A substantial proportion of intensive care patients (15-27,5%) meet criteria for PTSD years after discharge from the Intensive Care Unit (ICU) (Kapfhammer, Rothenhäusler, Krauseneck, Stoll & Schelling, 2004; Schelling et al, 1998; Scragg, Jones & Fauvel, 2001). An even higher percentage (38%) report significant symptoms of PTSD years after ICU discharge (Scragg et al., 2001). In the present study, the traumatized sample consisted of people who had been discharged from the ICU. Patients were assessed within the first month after ICU discharge, with a follow-up after four months. In the present study, the data-driven/conceptually-driven conceptualisation was operationalized on two levels, i.e. on utterance level and on narrative level. On utterance level, it was tested whether perceptual memory representations and utterance disorganization were related to post-trauma symptomatology. Perceptual memory representations were measured by scoring the ratio between perceptual and conceptual memory representations in each utterance (see also Buck et al., 2006). Narrative disorganization was measured by the ratio between organized and disorganized utterances (see also Foa et al., 1995; Halligan, et al., 2003; van Minnen, Wessel, Dijkstra & Roelofs, 2002). On narrative level, it was tested whether incoherence of the trauma memory was related to post-trauma symptomatology. Incoherence of the trauma memory was measured by assessing the incoherence of the trauma narrative on a 10-point scale (see also Halligan et al., 2003, Murray et al., 2002).

Method

Participants

Participants (nine males, twenty females) were ICU patients in the Maastricht University Hospital. The Maastricht University Hospital also has a Medium Care Unit, so only the most severe patients are admitted to the ICU.

This is reflected by a high mortality rate of 22% on the ICU. The mean age of the participants was 50.8 years ($SD = 14.9$; range = 23-71). By definition, traumatic experiences mostly involve events that are new and unexpected. Therefore, a further inclusion criterion was that participants had never been admitted to an ICU in the past and that they were admitted to the ICU unexpectedly, even when suffering from a chronic illness (e.g. chronic obstructive pulmonary disease). Exclusion criteria were the following: psychiatric history, insufficient comprehension of the Dutch language and factors that might influence the patients' recollection of the ICU other than the traumatic experience itself. These factors included head trauma, brain damage, having been more than ten minutes unconscious as a result of the accident that caused the ICU admission, as well as alcohol and/or drug abuse. Finally, participants who had only briefly been monitored (< 24 hrs) in the ICU were also excluded.

During one year, an Intensive Care research nurse contacted all ICU patients who met the in- and exclusion criteria. The patients were contacted when still in the hospital but dismissed from the ICU. Thirty-five patients enrolled in this study. Six participants dropped out before follow-up assessments were complete. Reasons for drop-out were death ($n = 1$), refusal ($n = 2$), too ill ($n = 2$), and inability to contact the participant for the follow up assessments ($n = 1$). Twenty-nine patients completed all follow-up assessments four months after ICU discharge. Participants were paid €7.50 for each assessment. See Table 1 for demography and diagnostic grouping. Note that in the present study, the dependent variable was not whether or not participants had PTSD, but rather the severity of PTSD symptoms.

Materials

Symptom Measures.

Posttraumatic stress disorder. The Posttraumatic stress disorder Symptom Scale (PSS-SR; Foa, Riggs, Dancu & Rothbaum, 1993; Arntz, 1993) corresponds to the seventeen DSM-IV symptoms of PTSD. The severity of these symptoms are

Study 4

Table 1
Demography and diagnostic grouping

N	29
Length of ICU stay (days) ^a	10.4 (9.3), 1-44
Days on mechanical ventilatory support ^a	10.1 (96), 0-42
Level of education ^{ab}	6.3 (2.4), 3-11
Reason for ICU admission (n)	
Acute OK	2
Blowout	1
Complications during or after planned surgery	6
Chronic obstructive pulmonary disease	1
Diverticulitis	2
Dyspnoea	2
Gastric haemorrhage	1
HELLP syndrome	1
Malignant hypertension	1
Necrotizing appendicitis	1
Pancreatitis	1
Pneumonia	4
Sepsis	3
Trauma	3
PTSD at 4 month follow-up (%)	10.3
symptom cluster intrusions (%)	27.6
symptom cluster avoidance (%)	13.8
symptom cluster irritability (%)	27.6
Depression at 4 month FU ^c	
minimal depression (%)	72
mild to moderate depression (%)	7
moderate to severe depression (%)	21
severe depression (%)	0

Note: ICU = Intensive Care Unit; PTSD = Post-traumatic Stress Disorder

^a Median (Standard Deviation), range

^b Level of education is based on the Dutch educational system ranging from elementary school (score 1) to university (11). Score 6 refers to lower general secondary education

^c This classification was based on Beck, Steer and Garbin (1988)

rated on a 4-point severity scale (0 = not at all, 3 = almost always). The items provide both diagnostic and severity data. Based on a more conservative scoring criterion (Brewin, Andrews & Rose, 2000; Engelhard, van den Hout & Arntz, 2001), participants would meet criteria for PTSD when they rated *at least* six questions as 2 or 3, which in this case meant rating 2 or 3 in at least one out of

five questions about intrusions (item 1-5), in at least three out of seven questions about avoidance (item 6-12), and in at least two out of five questions about arousal and irritability (item 13-17). The sum score of the seventeen items assesses severity of PTSD symptoms.

Depression. The Beck Depression Inventory (BDI; Beck, Ward, Mendelsohn, Mock & Erbauch, 1961) is a 21-item self-report measure, which has been shown to have good reliability and validity and to correlate highly with clinical ratings of depression. For the present sample, item 19 (which asks about the amount of weight lost) was omitted, for almost all participants had lost weight due to their illness rather than as a result of depression. The sum score of the final twenty items assesses the severity of the depression symptoms.

Perceptual memory representations. Participants were asked to give a detailed verbal narrative of their stay on the ICU and the events leading to their admission in the presence of the experimenter. The instruction for the narratives was as follows: "Tell as much as possible about the event which resulted in your admission to the Intensive Care, as well as about your stay on the Intensive Care. I'd like you to start with the cause of your admission to the Intensive Care. Next, I'd like you to tell about your stay on the Intensive Care. Try to visualize the events as detailed and vividly as possible. Tell the events as detailed as possible in the order in which they occurred". This instruction is similar to the instruction given by Halligan et al. (2003). The participants were not only asked about their experiences on the ICU, but also about the cause of their ICU admission. The cause of their ICU admission is very likely to be traumatic as well, bearing in mind that the ICU admission was unexpected. Participants were given 45 minutes maximum to tell their experiences. The responses were audio taped and transcribed verbatim. The narratives were chunked into separate utterance units containing only one thought or action. Perceptual memory representations were measured by rating each utterance on a 9-point scale from 1 (exclusively conceptual memory representations and/or contextualisations) to 9 (exclusively perceptual memory representations) by two raters. Thus, a higher score refers to

Study 4

more perceptual memory representations. Each part of the utterance that represented a physical feature (perceptual memory representations) was marked and each part of the utterance that represented a conceptualisation was marked differently. All references to time of day, date or location, were scored as contextual information (see also Buck et al., 2006). For example, the utterance “I remember that I woke up with an oxygen mask on my face” was scored as a perceptual memory representation (score 9). Another example (which consists of two utterances) is: a) The first day, they kept me asleep, b) because I was in too much pain. “The first day” was scored as a contextualization. “They kept me asleep” was scored as a perceptual memory representation. Thus utterance “a” received a score of 6. Utterance “b” was scored as a conceptual memory representation (score 1). The scoring manual is available upon request. The raters were the first author (N.B) and a student (N.S.). All raters were ignorant to the status of the judged participant. Raters practiced scoring with narratives of participants who had dropped out. The intraclass correlation coefficient between the two raters was .71 for ten narratives. For each individual a single mean score was calculated of the ratings of the utterances, indicating the amount of perceptual memory representations relative to the amount of conceptual memory representations. By calculating a mean score, we controlled for differences in narrative length.

Memory fragmentation was assessed on utterance level and on coherence level.

Utterance Disorganization. A ratio was calculated between disorganized and organized thoughts, based on three indices of utterance disorganization: 1) utterances containing repetitions (disorganized thoughts), 2) utterances with clear expressions of uncertainty with regard to memory, confusion, or non-consecutive utterances (disorganized thoughts), 3) clauses indicating understanding of what was happening (organized thoughts) (see also Foa et al., 1995; Halligan et al., 2003; van Minnen et al., 2002). Each score was z transformed. The utterance disorganisation score was calculated as $z(\text{number of utterances rated as 1}) + z(\text{number of utterances rated as 2}) - z(\text{number of utterances rated as 3})$. A positive score refers to more utterance disorganization,

indicating more confusion about what happened. A negative score refers to more utterance organization, indicating understanding of what happened. Utterance disorganization was scored by the first author (N.B.) and a student (R.H). Raters practised scoring with narratives of participants who had dropped out. The intra-class correlation coefficient between the two raters was .87 based on all narratives.

Narrative incoherence. The trauma narrative was rated on a 10-point scale from 1 (extremely coherent) to 10 (extremely incoherent). Incoherence was reflected in rambling from one subject to another, unfinished sentences, single words instead of sentences, and an incomplete or inaccurate order of events. Narrative incoherence was scored by the first author (N.B.) and a student (R.H). The raters were blind to scores on all other variables. Raters practised scoring with narratives of participants who had dropped out. The intra-class correlation coefficient between the two raters was .84 based on all narratives.

Peri-traumatic dissociation. Peri-traumatic dissociation was assessed with the Peri-traumatic Dissociative Experience Scale (PDEQ; Marmar, Weiss & Metzler, 1997). The PDEQ is suitable for assessing state dissociation after traumatic or other unexpected experiences, and was adapted to refer to the patients' stay at the ICU. The original questionnaire consists of ten questions about dissociative experiences that the participant might have experienced during the ICU stay. However, for the assessment of peri-traumatic dissociation in the present study, the number of items was reduced to six. The following items were omitted: item 1 (I had moments of losing track of what was going on – I “blanked out” or “spaced out” or in some way felt that I was not part of what was going on), item 2 (I found that I was on “automatic pilot”- I ended up doing things that I later realized I hadn't actively decided to do), item 8 (I was surprised to find out afterward that a lot of things had happened at the time that I was not aware of, especially things that I ordinarily would have noticed) and item 9 (I felt confused – that is, there were moments when I had difficulty making sense of what was happening). These items were omitted since they were more likely to have been

Study 4

the results of the participants stay on the ICU and narcotics, rather than to have been the result of having been overwhelmed by the experience.

Procedure

Participants were assessed twice. The first assessment was as soon as possible after ICU discharge, which was on average 9.8 days (1-2 weeks) after ICU discharge ($SD = 6.7$, range = 2-31 days). The second assessment was at four months follow-up, which was on average 115.6 days (16-17 weeks) after ICU discharge ($SD = 13.6$, range = 90-144 days/12-21 weeks). Immediately after the ICU stay, patients were tested in the hospital ($n=28$) or at home ($n=1$). At four months follow-up, participants were tested at home ($n=28$) or in a rehabilitation center ($n=1$).

Immediately after ICU discharge, the following variables were assessed: initial PTSD symptoms, perceptual memory representations, narrative incoherence, narrative organization and peri-traumatic dissociation. At four months follow-up, PTSD and depression symptoms were assessed again. Approval was obtained from the medical ethics committee of Maastricht University Hospital. In addition to the measures described in the present paper, participants completed a number of other questionnaires. These results will be reported elsewhere (Buck, Kindt, van den Hout, Steens & Linders, submitted).

Data reduction and data analysis

Correlations were calculated between PTSD symptoms and 1) perceptual memory representations, 2) utterance disorganization, and 3) narrative incoherence. Partial correlations were calculated when controlling for initial PTSD symptoms and partialling out dissociation. Further, several (partial) correlations were calculated to test the specificity of perceptual memory representations, utterance disorganization, and narrative incoherence in predicting PTSD symptoms as compared to depression symptoms. The first three correlations tested whether perceptual memory representations, utterance

disorganization, and narrative incoherence predict depression symptoms at four months. Then partial correlations were computed to test whether variables that were related to depression symptoms were still predictive of depression symptoms when PTSD symptoms at four months were controlled for. The last partial correlations were computed to test whether variables that were related to PTSD symptoms were still predictive of PTSD symptoms at four months when depression symptoms at four months were controlled for. PTSD symptoms at four months were a bit skewed to the right (*Skewness* = 1.089, *Kurtosis* = -.035), and were therefore subjected to a square-root transformation. Utterance disorganization (*Skewness* = .35, *Kurtosis* = 1.79), and narrative incoherence (*Skewness* = .45, *Kurtosis* = -1.37) were not normally distributed, and therefore ranked. As a result of ranking the distribution will be symmetrical. This enables calculating partial correlations with ranked variables. All relations were tested one-tailed.

Results

Perceptual memory representations, utterance disorganization, and narrative incoherence as predictors of PTSD symptoms.

Perceptual memory representations predicted PTSD symptoms at four months post-trauma ($r = .46, p = .006$), even after controlling for initial PTSD symptoms ($r_{\text{partial,initial PTSD}} = .44, p = .009$). Utterance disorganization also predicted PTSD symptoms at four months ($r = .32, p = .050$). However, after controlling for initial PTSD symptoms, the relation between utterance disorganization and PTSD symptoms at four months post-trauma was no longer significant ($r = .29, p = .068$). Note that the utterance disorganization score is a composite score of organized thoughts (utterances indicating understanding of what was happening) and disorganized thoughts (utterances containing repetitions or clear expressions of uncertainty). Additional analyses were performed on both components separately. The results showed that more organized thoughts were indeed related to less PTSD symptoms ($r_{\text{Spearman}} = -.44, p = .008$), whereas the

Study 4

disorganization score was not related to PTSD symptoms ($r^{\text{Spearman}} = -.27, p = .08$). If anything, the relation between disorganization and PTSD symptoms was in the opposite direction: the more disorganization, the less PTSD symptoms. Narrative incoherence did not predict PTSD symptoms at four months post-trauma ($r = .08, p = n.s.$). Neither after controlling for initial PTSD symptoms ($r^{\text{partial, initial PTSD}} = .00, p = n.s.$).

Since perceptual memory representations were predictive of PTSD symptoms, it was tested whether this relation could be explained by dissociation. Peri-traumatic dissociation was related to perceptual memory representations ($r = .34, p = .037$). However, the relation between perceptual memory representations and PTSD symptoms remained significant after controlling for dissociation ($r^{\text{partial, initial PTSD, dissociation}} = .41, p = .018$). Thus, the relation between perceptual memory representations and PTSD symptoms could not be explained by dissociation.

Specificity of memory assessments in predicting post trauma symptoms.

Symptoms of PTSD and depression were strongly related in the present study ($r = .78, p < .001$). Perceptual memory representations and narrative incoherence predicted depression symptoms at four months post-trauma ($r = .57, p = .001$ and $r = .33, p = .041$, respectively). No relation was observed between utterance disorganization and depression symptoms at four months ($r = .26, p = n.s.$).

Perceptual memory representations and narrative incoherence still predicted depression symptoms at four months, after partialling out PTSD symptoms at four months ($r^{\text{partial, PTSD at 4 months}} = .39, p = .020$ and $r^{\text{partial, PTSD at 4 months}} = .40, p = .017$, respectively).

Perceptual memory representations and utterance disorganization no longer predicted PTSD symptoms at four months, after partialling out depression symptoms at four months ($r^{\text{partial, depression at 4 months}} = .07, p = n.s.$ and $r^{\text{partial, depression at 4 months}} = .19, p = n.s.$, respectively).

The relation between perceptual memory representations and PTSD symptoms disappeared after controlling for depression symptoms. Additional analyses

were performed to test whether depression symptoms mediate the relation between perceptual memory representations and PTSD symptoms. The Sobel test (Baron & Kenney, 1986) showed that depression symptoms indeed mediate this relation (*Sobel test* = 3.05, $p = .002$).

Discussion

The main finding is that the objective assessments of the trauma memory predicted post-trauma symptoms four months later. Both perceptual memory representations and memory disorganization as assessed on utterance level predicted PTSD symptoms. Although peri-traumatic dissociation was related to perceptual memory representations, the relation between perceptual memory representations and PTSD symptoms was not mediated by peri-traumatic dissociation. Hence, it may be concluded that both perceptual memory representations and peri-traumatic dissociation contribute independently to the prediction of PTSD symptoms. Moreover, the relation between perceptual memory representation and dissociation were not strong enough to confirm the hypothesis put forward by Kindt and van den Hout (2003), that peri-traumatic dissociation is essentially the subjective experience of data driven processing.

The objectively assessed memory disturbances did not specifically predict PTSD symptoms. Note that the relation between perceptual memory representations and PTSD symptoms was mediated by depression symptoms. It may be postulated that perceptual memory representations are related to depression symptoms resulting from a traumatic experience rather than to general depression symptoms. However this hypothesis has to be confirmed in future studies. The relation between perceptual memory representations and depression symptoms may be explained by a lack of contextualizing the traumatic event. This may result in over-generalized negative beliefs regarding the self and the world. Further, the relation between depression and PTSD may be explained by conceptual overlap of the two disorders. Both disorders include

Study 4

aspects of numbing, like markedly diminished interest or participation in significant activities (APA, 2000).

Further narrative incoherence was only predictive of depression symptoms. Halligan et al. (2003) observed a relation between narrative incoherence and initial depression symptoms as well. Narrative incoherence of the trauma narrative indicated the degree to which the ICU stay was predictable and temporally ordered. A possible explanation for the strong relation between narrative incoherence and depression symptoms is that the incoherent memories do not make sense and increase the sense of uncontrollability and unpredictability. These factors are typically related to depression (see also Shustack & West, 1985). In contrast to perceptual memory representations and memory incoherence, utterance disorganisation was specifically related to PTSD. Especially the component of utterance disorganisation indicating understanding of what was happening was strongly related to PTSD.

The present study provided no evidence for a relation between narrative incoherence and PTSD symptoms. It should be noted that narrative incoherence differs from the other two memory assessments, which encompassed perceptual and conceptual memory representations. Rather, narrative incoherence reflected the inter-relatedness of the experiences on the ICU, that is the temporal order of the events and the unity of the individuals' memory of the events. Contrary to the other two memory assessments, narrative incoherence may be a less valid indication of the degree to which the meaning of the traumatic event is processed. In line with this reasoning was the finding that for the disorganization score, only the organization component was related to PTSD. The organization component reflected understanding of what was happening, whereas the disorganization component indicated confusion or an incapability to remember the exact temporal order of the events. These findings suggest that the most relevant aspect of the data-driven/conceptually-driven conceptualisation in relation to PTSD is the ratio between perceptual and conceptual memory representations. Indices of confusion or not being able to remember the exact temporal order of the events may not be relevant to the maintenance of PTSD symptoms. It may even be suggested that the coherence of the trauma narrative

is only an epiphenomenon of PTSD. This is also in line with the finding that disorganized thoughts (thoughts implying confusion or disjointed thinking) decreased after therapy in both improved and non-improved patients (van Minnen et al., 2002). Van Minnen et al. suggested that a decrease in disorganized thoughts after therapy may be a side effect of therapy rather than a predictor of the decrease of PTSD symptoms.

The finding that narrative incoherence did not predict PTSD symptoms contradicts findings of previous studies (Halligan et al., 2003; Murray et al., 2002). Note that we assessed narrative incoherence in a similar way to previous studies. Of course, the lack of a significant effect may be due to the small sample size of our study. On the other hand, the relationship between perceptual memory representations and narrative organization on the one hand, and PTSD symptoms on the other hand, was reliably shown in this sample. An alternative explanation for the lack of predictive power of the narrative incoherence is that the degree of coherence is only an epiphenomenon of PTSD and does in itself not contribute to the development of PTSD symptoms (see the argument given above). Rather than studying the coherence within the trauma narrative, it may be more relevant to study the trauma victim's inability to integrate the traumatic experience within other autobiographical memories in time. Ehlers and Clark (2000) refer to this as an inability to establish a self-referential perspective. When traumatic experiences are not placed into its context in time, the sense of current threat, a core characteristic of PTSD, is held to be retained, thereby maintaining PTSD symptoms (Ehlers & Clark, 2000). It may be worthwhile that trauma researchers study the inability of the trauma victim to establish a self-referential perspective (see Ehlers & Clark, 2000). It should be stated however, that a lack of self-referential perspective is difficult to measure by objective assessments.

A limitation of the present study was the small sample size. This restricts the generalizability of the findings and increases the chance of type II errors. However, note that the observed relations were rather strong and are largely in line with previous findings. An added value of the present study is that the trauma population diverges from other prospective studies, which tested the relation between data-driven/conceptually driven processing and the

Study 4

maintenance of PTSD in assault victims (Halligan et al., 2003) and road traffic accident victims (Murray et al., 2002). This increases the external validity of the data-driven/conceptually-driven conceptualisation in explaining PTSD. Still, the results of the present study should be confirmed in a larger sample. Another weakness of the present study was the correlational nature of the study, which does not allow being conclusive regarding causality between processing styles and the development of PTSD symptoms. Future studies should test whether a predominance of data-driven processing and a lack of conceptually driven processing are predictive of PTSD symptoms and depression, by manipulating the processing styles directly. Note that we did not study the possible effects of narcotics on memory performance. However, the possible influence of narcotics on trauma memories does not have implications for the finding that the data-driven/conceptually-driven distinction is related to post-trauma symptomatology. Although narcotics may somehow have favored either processing style, the present study was not aimed at discovering causes of the observed processing styles. For now it is important that the relation between the data-driven/conceptually-driven conceptualisation and post-trauma symptomatology has been demonstrated with objective measures.

In sum, several prospective studies have shown that data-driven processing predicts later PTSD (Halligan et al., 2003; Murray et al., 2002). However, this relation has so far mainly been demonstrated with a subjective measure, that is, these studies assessed data-driven processing by a questionnaire rated by the trauma victim. The advantage of the present study over previous studies is that merely objective measures were used to assess the data-driven/conceptually-driven distinction. By studying the nature of the trauma memory as an index of the data-driven/conceptually-driven conceptualisation, the present study confirmed that data-driven processing and a lack of conceptually driven processing contribute indeed to the development of post-trauma symptoms. Most attention on post-trauma symptomatology has been focussed on PTSD. However, depression symptoms are not uncommon after a traumatic event. The results of the present study suggest that several predictors of PTSD symptoms may also be predictive of other post-trauma symptoms.

Moreover, depression symptoms mediated the relation between perceptual memory representations and PTSD. If more predictors of PTSD do not appear to be specific predictors of PTSD as compared to depression, it may be seriously questioned whether the highly specific diagnosis of PTSD, which includes an etiological criterion of traumatic experiences, is still worthwhile. Future studies may focus on general post-trauma symptoms rather than on the highly specific diagnosis of PTSD. Now that a relation between data-driven processing and post-trauma symptomatology has been demonstrated with subjective and objective measures, future studies may focus on the causes of this dysfunctional processing style.

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Study 4

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Study 5

The Effects of Emotional Processing versus Avoidance on PTSD-like Symptoms after a Distressing Event

Buck, N., Kindt, M., & van den Hout, M. (submitted).

Abstract

Researchers have begun to scrutinize the assumption that emotional processing in response to a traumatic event is beneficial whereas avoidance is detrimental. Indications that avoidance isn't always detrimental come from studies on grief and debriefing. In an analogue experimental study, the hypothesis was tested that emotional processing immediately after a distressing event is more successful in reducing analogue PTSD symptoms than avoidance. Ninety students watched a distressing film after which they were instructed to either elaborate on the meaning of the film (emotional processing), avoid all thoughts and images of the film, or were given no instruction. Four hours later, analogue PTSD symptoms were assessed. The results showed that emotional processing does not result in fewer analogue PTSD symptoms than avoidance. Implications for short-term interventions like debriefing are discussed.

Study 5

Introduction

Post-traumatic stress disorder (PTSD) appears to result from disturbed processing of the traumatic event. Successful processing involves expressing thoughts and feelings about the trauma so that the traumatic event can be integrated with other autobiographical memories (Ehlers & Clark, 2000), while excessive avoidance of such thoughts and feelings is supposed to contribute to the maintenance of PTSD symptoms after a traumatic event (Ehlers & Clark, 2000; Foa & Riggs, 1993; Horowitz, 1976; McNally, Bryant & Ehlers, 2003). However, this hypothesis is inferred from studies in highly select samples of trauma victims. That is, trauma victims who suffer from persistent PTSD and who seek therapeutic help (Bonanno, 2004). Note that for most trauma victims, symptoms decline in the first months after a traumatic event without therapeutic intervention (Kessler, Sonnega, Bromet, Hughes & Nelson, 1995; Rothbaum, Foa, Riggs, Murdock, & Walsh, 1992). There are indications that avoidance may not be as detrimental as is often held (e.g. Bonanno, Keltner, Holen & Horowitz, 1995; Bonanno, Noll, Putnam, O'Neill & Trickett, 2003), and that it is not necessarily better to confront distressing experiences than to avoid them (Stroebe & Stroebe, 1991). At least some trauma victims may in fact be helped by keeping a stiff upper lip, that is, by avoiding thoughts, emotions and reminders about the traumatic event. In line with this hypothesis are findings from debriefing studies. Debriefing, that is designed to normalize reactions to the trauma and to promote the expression of feelings and thoughts connected to the trauma (Ehlers & Clark, 2003) does not prevent the development of chronic PTSD and may even be detrimental (e.g. Emmerik, Kamphuis, Hulsbosch & Emmelkamp, 2002; Mayou, Ehlers & Hobbs, 2000). As a result, researchers have begun to scrutinize the assumption that emotional processing is beneficial, whereas avoidance is detrimental (McNally et al., 2003).

Emotional processing is thought to involve expressing thoughts and feelings about the trauma so that the traumatic event can be integrated with other autobiographical memories. More specifically, Ehlers and Clark (2000) argue that traumatic events should be processed in a conceptually-driven manner, that is by

processing the meaning of the situation and putting it into context. The opposite is data-driven processing which refers to processing the sensory impressions of the event. Conceptually-driven processing and data-driven processing are inversely related; thus, the more data-driven processing, the less conceptually-driven processing and vice versa (Johnston & Hawley, 1994; Roediger, 1990). People who process the event in a data-driven manner are supposed to develop chronic PTSD (Ehlers & Clark, 2000). Indeed, data-driven processing has been related to PTSD symptoms in assault victims (Halligan, Michael, Clark & Ehlers, 2003), road traffic accident victims (Murray, Ehlers & Mayou, 2002) and to analogue PTSD symptoms in students who watched a distressing film (Halligan, Clark & Ehlers, 2002; Kindt, van den Hout, Arntz & Drost, submitted).

A popular view of the function of intrusions has been put forward by (Horowitz, 1976, 1993). He asserted that successful processing may benefit from the presence of intrusions because these trauma memories may stimulate information processing. A possible explanation for this supposed beneficial effect of intrusions is that they provide information about what happened during the event. Note that trauma victims often have difficulty to retrieve intentionally parts of the traumatic event, whereas intrusive memories are very detailed and vivid (Ehlers & Clark, 2000). Therefore, it might be suggested that intrusions form a database of information that may well help trauma victims to elaborate on the event. However, intrusive memories can also be very overwhelming. Accordingly, trauma victims appear to alternate between tolerating and avoiding intrusions (Horowitz, 1986). Although avoidance in itself is not necessarily dysfunctional, excessive avoidance is thought to be detrimental for it prevents successful emotional processing (e.g. Ehlers & Clark, 2000; Foa & Riggs, 1993; Horowitz, 1976).

In sum, most PTSD theories assume that emotional processing is beneficial, and avoidance is detrimental. Some studies, however, suggest the opposite, that is, avoidance may be functional (Bonanno et al., 1995) whereas talking and thinking about the event is detrimental (Neimeyer, 2000). The present study will test whether emotional processing immediately after a distressing event is more successful than avoidance in reducing immediate analogue PTSD

Study 5

symptoms. Emotional processing and avoidance were manipulated in an experimental setting during which normal participants were shown an extremely aversive film. The film is a twenty-nine minutes compilation of “Salò o le 120 giornate di Sodoma” directed by Passolini, and has shown to be valid in eliciting analogue PTSD symptoms in previous studies (Kindt & van den Hout, 2003; Kindt, van den Hout & Buck, 2005). Participants were assigned to 1) an emotional processing condition, 2) an avoidance condition or 3) a control condition. Emotional processing was stimulated by urging participants to give a rationale for the horrible scenes, to think about the director’s intention with the film and to put the film and the events in the film into context. Intrusions are assumed to be beneficial in that they may provide a database, which may facilitate emotional processing. Therefore, participants in the emotional processing condition were provided with detailed descriptions of the scenes, which they were instructed to visualize as vividly and in as great a detail as possible. Note that this manipulation can also be regarded as exposure, which is an established treatment for traumatized victims (e.g. Bryant, Moulds, Guthrie, Dang & Nixon, 2003). Avoidance was induced by hindering the activation of both intrusive memories and elaborative thoughts. This was accomplished by occupying working memory capacity (Baddeley & Hitch, 1974; Toms, Morris & Ward, 1993) with the Random Interval Repetition task (RIR-task; Vandierendonck, De Vooght & van der Goten, 1998). Participants performed the RIR-task whenever they had thoughts or images about the film, leaving less capacity to process intrusive memories or to elaborate. In the control condition, participants received the instruction to leave the laboratory. Four hours later, analogue PTSD symptoms were assessed. These included state anxiety, memory fragmentation and several aspects of intrusions and avoidance.

Method

Participants

Participants were mostly university students, aged 17 to 34 (mean = 22.3, $SD = 3.6$). They received €15 in return for their participation. Individuals were excluded from participation if they had suffered from sexual or physical assault in the past, or if they had already seen the distressing film. Participants were assigned to one of the following three conditions: 1) emotional processing condition ($n = 31$; 25 females, 6 males); 2) avoidance condition ($n = 29$; 24 females, 5 males); 3) control condition ($n = 30$; 24 females, 6 males).

Materials

Stimulus material

Stimulus material consisted of a five minutes neutral film and a twenty-nine minutes distressing film. The neutral film consisted of landscape images accompanied by restful music. The distressing film was a compilation of “Salò o le 120 giornate di Sodoma” directed by Passolini. The aversive film has proven to be successful in eliciting analogue PTSD symptoms like intrusive memories in previous studies (Kindt & van den Hout, 2003; Kindt et al., 2005). It contains scenes showing various kinds of sexual and physical abuse. The film looks like a documentary and the essence of the story and the chronological order were preserved in the twenty-nine minute compilation. Participants did not realize that they saw only parts of the original. In the first phase, the different characters were introduced. This was followed by sexual and physical violence, which eventually ended in torture.

Manipulation check

In order to check whether the manipulation was successful, participants were asked to rate the frequency and duration of their elaborative and intrusive thoughts. First, participants were explained the distinction between elaborative and intrusive thoughts by the following instruction: “In the past forty-five

Study 5

minutes you may have thought about the film several times or continuously. Memories can come up as thoughts and/or images about the film. You may have thought back to the film *intentionally*. You may also have had thoughts or images about the film that came up *spontaneously*, maybe even *against your will*. In this case, the thoughts and images *intruded*. The first two questions are about thoughts and/or images that popped up *spontaneously and were intrusive*. The following two questions are about *intentional* thoughts and/or images about the film." Note that we did not define elaborative thoughts as thoughts about the meaning or context of the film. This was omitted since we did not want to inspire participants in the avoidance condition to start elaborating in the following four hours before assessment of the dependent variables. The questions were as follows: 1) How often during the past forty-five minutes did you have intrusive thoughts and/or images? 2) What was the mean duration of these intrusive thoughts and or images? 3) How often during the past forty-five minutes did you think back to the film intentionally? 4) What was the mean duration of intentional thoughts and/or images about the film? Answers were rated on 100 mm visual analogue scales (VAS's). A higher score refers to more frequent and longer lasting thoughts.

In order to check whether the film was distressing, participants were asked to rate the Spielberger state anxiety scale of the State/Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, & Lushene, 1970). Scores ranged from 20–80. A higher score refers to more state anxiety.

Analogue PTSD symptoms

Analogue PTSD symptoms consisted of state anxiety, memory fragmentation, several aspects of intrusions and several aspects of avoidance.

State Anxiety was also assessed as a dependent variable by the STAI.

Memory fragmentation was assessed subjectively on a 100 mm Visual Analogue Scale (VAS). Participants rated the fragmentary quality of their recollections of the film by indicating to what degree their recollections had a snap-shot character from 0 (not at all) to 100 (very much).

Intrusive memories were assessed by means of several aspects of intrusive thoughts and images on separate VAS's, that is frequency, duration, vividness, distress and suppression of intrusions during the past four hours. Higher scores refer to more frequent intrusions, longer-lasting intrusions, more vivid intrusions, more distress caused by the intrusions and more attempts to suppress the intrusions. A mean single score was calculated for the five intrusion items (Cronbach's $\alpha = .73$).

Avoidance was assessed by means of three variables: 1) avoidance of the present film, 2) avoidance of a similar film, and 3) escape from specific scenes from the present film. For the two avoidance variables, participants were asked to rate on a 100 mm VAS to what degree they were willing to view the film again (0 = I want to view this film / a similar film again; 100 = I don't want to view this film / a similar film again). The escape variable was assessed by eight items, which refer to eight scenes from the film. In a pilot study it was found that these scenes generated the most intrusions during one week following exposure to the film. In the escape items, participants were given a short description of each scene and asked to rate for every scene to what degree they thought they would like to escape from this scene if this scene were to be shown again. Escape was rated on a 100 mm VAS from 0 (I want to view this scene again) to 100 (I don't want to view this scene again). Thus, higher scores indicate more avoidance and escape. A mean single score was calculated for the three avoidance variables (Cronbach's $\alpha = .80$).

Emotional processing manipulation

Participants were presented with a detailed description of ten scenes in order to imitate the possible beneficial effect of intrusive memories. Note that the aim was not to simulate intrusions, but only to simulate the possible beneficial effect of intrusions, that is, providing a database that may be a prerequisite for emotional processing. This is also in line with the supposed beneficial effects of exposure, which often precedes the transformation of meaning assigned to the traumatic event itself or its consequences. Participants were instructed to visualize the scenes that were described as vividly and in as great a detail as

Study 5

possible. After each description, participants were presented with two or three questions about the film. There were twenty-eight questions in total. The questions asked for a rationale of the horrible scenes and what the director aimed to communicate with the scenes. Further questions asked to provide a context for the film with respect to European history. The questions were presented in paper and pencil format. Participants were told that it was very important that they answer all questions.

Avoidance manipulation

Avoidance was induced by the hindrance of intrusive memories and elaborative thoughts. This was accomplished by occupying the central executive of working memory (Baddeley & Hitch, 1974; Toms et al., 1993). The Random-Interval-Repetition task was used for this purpose (RIR-task; Vandierendonck, et al., 1998). The RIR-task involves responding as fast as possible to two different tones, which are presented at random intervals by pressing one of two buttons.

Participants were instructed to start the Random Interval Repetition task whenever they had thoughts or images about the film, irrespective of whether these thoughts were voluntary or involuntary. Voluntary thoughts refer to elaborative thoughts and involuntary thoughts or images refer to intrusive thoughts. They had to distinguish between a high pitch tone (1000 Hz) and a low pitch tone (500 Hz). The tones lasted 100 msec. The tones were presented on a computer and the interval was variable (500 or 800 msec). The presentation of the tones and intervals were semi-random in that no more than three subsequent tones had the same pitch or interval. The participant could start the tones by pressing a button. Whenever the task was started it lasted for thirty seconds. Participants were instructed to perform the task during the entire thirty seconds.

Control manipulation

The aim of the control condition was to simulate the immediate aftermath of a traumatic event. Immediately after a traumatic event traumatized individuals may either think about the event or suppress thoughts about the event by cognitive strategies or by engaging in other activities. Therefore, after

the distressing film participants in the control condition were allowed to leave the laboratory during 45 minutes.

Procedure

Participants were tested twice: during a morning session and four hours later in the afternoon. In the morning session, participants started by watching the neutral film in order to establish a relaxed baseline. They then filled in the STAI, watched the distressing film and then filled in the STAI once more. Participants were then assigned to one of the three conditions. The manipulation lasted forty-five minutes. Immediately after the manipulation, the manipulation check was presented. In the afternoon session, four hours later, participants filled in the STAI and rated questions referring to memory fragmentation, intrusions and avoidance. Participants were tested individually.

Design

The dependent variables (state anxiety, memory fragmentation, intrusions and avoidance) were assessed four hours after the manipulation. Note that state anxiety was also assessed before and after the distressing film in order to verify that the stimulus film was distressing. Thus the STAI was administered three times. Also note that frequency and duration of intrusions were also assessed after the manipulation in order to check whether the manipulation was successful.

Statistical Analysis

The assessment of the STAI directly after the neutral film was not normally distributed (*Kurtosis* = 3.97; *Skewness* = 1.03). To verify that the aversive film was distressing, the STAI scores after the neutral and aversive films were compared with the Wilcoxon signed ranks test. Further it was tested whether the three groups were similar in STAI scores after the neutral film (which was tested with the Kruskal Wallis test) and after the distressing film (which was tested with

Study 5

an ANOVA. Moreover, a paired sample t-test was performed to test whether STAI scores assessed four hours after the manipulation were still higher than STAI scores assessed after the neutral film. Next, an ANOVA with Bonferroni correction tested whether the manipulation was effective. That is, whether participants in the emotional processing condition reported more frequent and more time-consuming elaborative and intrusive thoughts than participants in the avoidance condition and whether they differed from participants in the control condition. Finally, an ANOVA with Bonferroni correction tested whether the three conditions differed with respect to the dependent variables. All tests were two-tailed.

Results

Manipulation check

The distressing film was indeed distressing as was shown by an elevated score on the STAI after exposure to the film (mean = 45.8, $SD = 11.2$) as compared to the neutral film (mean = 30.6, $SD = 5.3$) ($Z = -8.10$, $p < .001$). The three groups did not differ in STAI scores after the neutral film ($\chi^2(2) = 1.65$, $p = .44$), nor after the distressing film ($F(2,87) = .556$, $p = .58$). STAI scores assessed four hours after the manipulation were still elevated over STAI scores assessed after the baseline film ($t(89) = -2.70$, $p = .008$). This implies that the induction of distress was still present when analogue PTSD symptoms were assessed.

Table 1 presents the means and standard deviations of the intrusive and elaborative thoughts for the three conditions that were assessed for the manipulation check. The three groups did not differ on *frequency of intrusions* ($F(2,87) = 2.48$, $p = .09$), but they did differ on *duration of intrusive thoughts and images* ($F(2,87) = 3.83$, $p = .03$), that is, participants in the emotional processing condition reported longer lasting intrusive thoughts than participants in the avoidance condition ($t(87) = -2.73$, $p = .02$). Comparisons with the control condition were not significant, that is, no differences were found between the emotional processing condition and the control condition ($t(87) = 1.74$, $p = n.s.$),

Table 1
Means and standard deviations of intrusions and elaborative thoughts in the three conditions

	EPC	AC	CC
Frequency of intrusions	5.6 (3)	4.6 (2.9)	4.0 (2.7)
Duration of intrusions	3.2 (2.1) ^a	1.9 (1.6) ^b	2.3 (1.7)
Frequency of elaborative thoughts	6.8 (2.9) ^a	4.3 (2.6) ^b	4.3 (2.8) ^b
Duration of elaborative thoughts	5.0 (3.0) ^a	3.2 (2.6) ^b	3.2 (2.5) ^b

Within each row, superscripts ^a and ^b are significantly different from each other ($p < .05$).

Note: EPC = emotional processing condition, AC = avoidance condition, CC = control condition

neither between the avoidance condition and control condition ($t(87) = 0.99, p = n.s.$).

The groups differed also on *frequency of elaborative thoughts* ($F(2,87) = 8.16, p = .001$), that is, participants in the emotional processing condition reported more frequent elaborative thoughts than participants in the avoidance condition ($t(87) = -3.25, p = .002$) and in the control condition ($t(87) = 3.48, p = .002$). No difference was found between participants in the avoidance condition and the control condition ($t(87) = -.03, p = n.s.$). Finally, the groups also differed on *duration of elaborative thoughts* ($F(2,87) = 4.18, p = .02$), that is, participants in the emotional processing condition also reported longer lasting elaborative thoughts than participants in the avoidance condition ($t(87) = 2.51, p = .04$) and in the control condition ($t(87) = 2.48, p = .046$). No difference was found between participants in the avoidance condition and in the control condition ($t(87) = .06, p = n.s.$).

The manipulation of stimulating elaborative thoughts in the emotional processing condition as compared to the avoidance condition was successful. Even though participants in the emotional processing condition did not report more intrusions than participants in the avoidance condition, they did report longer lasting intrusive thoughts. The RIR-task may have ended the duration of intrusions instead of having lessened the number of intrusions. Therefore, the manipulation of inhibiting intrusive thoughts and images in the avoidance

Study 5

condition as compared to the emotional processing condition was also regarded as successful.

Emotional processing versus avoidance

No differences were found between the three conditions regarding state anxiety ($F(2.87) = .36, p = n.s.$); self-rated fragmentation of the film ($F(2.87) = 1.05; p = n.s.$); the mean score of intrusions ($F(2.87) = .06, p = n.s.$), or the mean score of avoidance ($F(2.87) = 2.32, p = .10$). See Table 2 for means and standard deviations of the dependent variables in the three conditions.

Table 2
Means and standard deviations of dependent variables in the three conditions

	EPC	AC	CC
State Anxiety	31.3 (6.4)	32.4 (7.3)	32.7 (7.1)
Fragmentation	6.5 (2.3)	5.6 (2.8)	6.0 (2.7)
Intrusions	2.9 (1.7)	2.8 (1.8)	2.8 (1.5)
Avoidance	7.9 (1.7)	6.8 (2.5)	7.6 (1.8)
Intrusions			
- Frequency	2.5 (2.0)	2.2 (2.1)	2.1 (1.8)
- Duration	1.6 (1.4)	1.5 (1.5)	1.6 (1.8)
- Vividness	4.7 (3.4)	4.1 (3.1)	4.4 (2.8)
- Distress	2.3 (2.0)	2.7 (2.4)	3.0 (2.5)
- Suppression	3.6 (2.8)	3.3 (2.9)	3.0 (2.9)
Avoidance			
- Present film	8.8 (1.4)	7.5 (2.8)	8.3 (2.3)
- Similar film	8.2 (2.1)	7.5 (2.7)	8.6 (1.7)
- Specific scenes	6.7 (2.5)	5.5 (3.2)	5.8 (2.5)

Note: EPC = emotional processing condition, AC = avoidance condition, CC = control condition

Because no differences were found between the conditions regarding the mean scores of intrusions and avoidance, we also tested whether a difference could be observed for the separate items using Bonferroni corrections. However, again no differences were found between the conditions with respect to frequency of intrusions ($F(2.87) = .40; p = n.s.$), duration of intrusions ($F(2.87) = .10; p = n.s.$), vividness of intrusions ($F(2.87) = .28; p = n.s.$), distress of intrusions ($F(2.87) = .86; p = n.s.$) and suppression of intrusions ($F(2.87) = .30; p = n.s.$). Also,

with respect to the avoidance items, no significant effects were observed for future avoidance of a similar film ($F(2.87) = 2.03$; $p = n.s.$) and future escape from specific scenes from the present film ($F(2.87) = 1.58$; $p = n.s.$). However, future avoidance of the present film approached significance ($F(2.87) = 2.91$; $p = .06$), that is, participants in the emotional processing condition reported *more* future avoidance of the present film (mean = 8.84, $SD = 1.38$) than participants in the avoidance condition (mean = 7.47, $SD = 2.77$; $t(87) = -2.40$, $p = .056$). The difference between the avoidance condition and the control condition was not significant ($t(87) = -1.47$, $p = n.s.$), nor was the difference between the emotional processing condition and the control condition ($t(87) = .092$, $p = n.s.$).

Discussion

The main finding is that emotional processing in combination with detailed descriptions of the scenes does not result in fewer symptoms than avoidance. If anything, subjects in the avoidance condition reported less future avoidance of distressing stimuli than participants in the emotional processing condition ($p = .056$, tested two-tailed). Thus, immediately after a distressing event it may not be crucial to actively process the distressing event. Moreover, although we can't be conclusive, avoidance may have been the immediate coping-style of choice in that participants in the control conditions responded similarly to participants in the avoidance condition. That is, they reported less frequent and shorter elaborative thoughts than participants in the emotional processing condition. This may indicate that participants in the control condition preferred to avoid rather than dwell on the distressing film. However, we don't know whether these participants purposely did not think about the film or whether they were distracted.

Given that we did not observe a beneficial effect of emotional processing over avoidance, the results of the present study seem incompatible with studies by Pennebaker and colleagues (e.g. Pennebaker & Francis, 1996; Pennebaker & Seagal, 1999). These studies showed that talking and writing about a distressing

Study 5

event and expressing one's emotions reduced the levels of symptoms. At face value, the present results also seem somewhat at odd with studies showing that an avoidant coping style is detrimental (e.g. Ehlers, Mayou & Bryant, 1998) and that therapies based on exposure and active cognitive processing reduce PTSD symptoms (e.g. Bradley, Greene, Russ, Dutra & Westen, 2005; Foa & Rothbaum, 1998). Based on the results of these and similar studies, it has been assumed that talking about a distressing event is beneficial, whereas avoiding thoughts and feelings about the event is detrimental. However, as was already mentioned in the introduction, these studies have mostly included participants who have already developed chronic PTSD. Extrapolation from observations in trauma victims who developed chronic PTSD to all trauma victims may not be justified. It may well be that for trauma victims who are vulnerable for developing chronic PTSD, avoidance is highly dysfunctional. That is, prospective studies have shown that negative interpretation of intrusions is one of the best predictors of chronic PTSD (Halligan et al., 2003). In these specific cases, avoidance will be detrimental because the trauma-related beliefs are not corrected by disconfirming information. Emotional processing, on the other hand, may help these victims to restructure their negative interpretations. However, victims without dysfunctional beliefs may have nothing to gain from extensive elaborations. In these cases, avoidance may not be detrimental, but may even help these individuals resume their lives.

Lately, studies on debriefing show that this intervention does not reduce PTSD symptoms (e.g. Emmerik et al., 2002) and may even be detrimental, at least if provided to *all* trauma victims (Emmerik et al., 2002; Mayou, et al., 2000). One may speculate that debriefing may be helpful for those victims who misinterpret the nature of the trauma or their responses to the trauma. If one tries to inhibit for example crying because one believes crying may make one lose one's mind, debriefing which fosters non-avoidance, may be highly informative and helpful. If no such misinterpretations are being made, non-avoidance may merely provide victims with reliving episodes which are intrinsically aversive and from which nothing is gained.

The results of the present study should be interpreted with care since watching a distressing film is not really traumatic. However, the advantage of an experimental setting over a real trauma setting is that emotional processing can be manipulated in order to test causality between processing style and analogue PTSD symptoms. Manipulation in trauma samples is possible when the manipulation is thought to be beneficial, but is problematic when the manipulation is thought to be detrimental (for instance, in avoidance). Obviously, laboratory studies do not allow one to be conclusive about the causality between processing styles and the development of PTSD. Yet, together with clinical studies, they do contribute to the understanding of which processing styles after a traumatic event are successful.

A limitation of the present study was that the RIR task was not able to reduce the number of intrusive memories in the avoidance condition. On the other hand, intrusive memories didn't last as long in the avoidance condition as they did in the emotional processing condition, indicating that the RIR task ended intrusive memories rather than inhibited their occurrence. Moreover, emotional processing was inhibited successfully in the avoidance condition since elaborative thoughts were less frequent and did not last as long as in the emotional processing condition.

In sum, together with studies on grief and debriefing, the results of the present study show that in normal individuals, avoidance is not necessarily detrimental as compared to emotional processing. As already stated, analogue studies of the present type are suggestive but not conclusive about the contribution of processing styles on the development of clinical PTSD. Additive clinical studies may focus on post-trauma risk factors such that more extensive interventions can be offered to vulnerable victims. A plausible and clinically relevant option is that debriefing, like interventions that foster non-avoidance and emotional processing, may be helpful for the sub-group of victims who misinterpret the meaning of the trauma and/or their trauma responses. In victims with realistic appraisals, debriefing, however well intended, may add misery instead of help.

Study 5

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General Discussion

Introduction and aims of dissertation

This thesis was designed to 1) study the relative predictive power of pre- and post-trauma variables to the prediction of PTSD symptom severity, 2) test the specificity of these variables in predicting PTSD as compared to depression symptoms, and 3) to test some specific hypotheses about pathogenic ways of trauma processing that may explain the relation between predictors of PTSD and chronic post-trauma symptomatology.

These questions were investigated in prospective studies (studies 1 & 4) and in (quasi) experimental analogue studies (studies 3 & 5). Furthermore, study 2 described the development of a questionnaire that enables the assessment of rigidity and valence of pre-trauma beliefs or of post-trauma beliefs in the immediate aftermath of a traumatic event. The general findings of the studies are discussed below, and are evaluated in the light of other relevant findings from trauma research. Limitations of the studies are discussed and ideas for future studies are presented.

Predictors of PTSD: Relations between PTSD predictors

Post-trauma help to victims is costly. For that reason, relief work may be aimed at trauma victims most likely to develop chronic PTSD. Relief workers may benefit from a short and efficient assessment tool to identify those victims who are most likely to develop chronic PTSD. Acute Stress Disorder (ASD), which can be diagnosed within one month post-trauma, was thought to be a strong predictor of PTSD. However, although the majority of people who display ASD subsequently develop PTSD, only a minority of individuals who developed PTSD initially met criteria for ASD (see Bryant for a review, 2003). Further strong predictors of PTSD are IQ, neuroticism, perceived social support, perceived life

General Discussion

threat, peri-traumatic dissociation, and negative appraisals of the traumatic event and its consequences (e.g. Brewin, Andrews & Valentine, 2000; Ozer, Best, Lipsey, & Weiss, 2003; McNally, Bryant & Ehlers, 2004). In the present dissertation the power of some of the strongest predictors of PTSD (i.e. IQ, neuroticism, persistent dissociation and persistent negative appraisals) was tested in a single study (study 1). Together these variables predict no less than 78% of PTSD variance. Initial post-trauma variables (i.e. dissociation and negative appraisals of intrusions assessed within two weeks post-trauma) were not able to predict PTSD over and above IQ and neuroticism. Thus, if one wishes to predict PTSD with great certainty, one has to postpone this prediction until four months post-trauma. IQ and neuroticism as assessed post-trauma may be a good starting point if one wishes to predict PTSD immediately after the traumatic event. Note that data on pre-trauma levels of IQ and neuroticism will only rarely be available. Given that the findings of this dissertation show that initial post-trauma symptoms do not predict chronic PTSD over and above IQ and neuroticism, there is no need to assess those variables as well. Thus, based on these findings, the preferred selection measures to identify traumatized individuals who are likely to develop chronic PTSD may be IQ, neuroticism and *persistent* predictors.

Although IQ and neuroticism are regarded as pre-trauma variables, the present dissertation as well as several previous studies (e.g. McNally & Shin, 1995; Silva et al., 2000; Vasterling et al., 2002; Lauterbach & Vrana, 2001; Holeva & Tarrier, 2001) assessed these variables post-trauma. These studies all showed that post-trauma assessments of these variables are still predictive of PTSD symptoms. Studies assessing IQ and neuroticism *post*-trauma are important, for relief workers rarely have access to *pre*-trauma data of IQ and neuroticism levels.

Unfortunately, the findings of the first study (i.e. the study on the relative predictive power of pre- and post-trauma variables to the prediction of post-trauma symptomatology) are based on a small sample. Although the relations between pre- and post-trauma variables on the one hand, and PTSD symptoms on the other hand are strong, they did not always reach significance. Some of the conducted analyses were exploratory, which necessitates a similar study with a

much larger sample. Power analysis based on the results of study 1 suggests that N should be at least 72. We recommend that this study will be replicated in another trauma sample. A disadvantage of testing patients discharged from the ICU is that many patients can not be included due to high mortality rates or other health related complications (e.g. brain damage).

Predictors of PTSD: The Trauma Relevant Assumptions Scale

The Trauma Relevant Assumptions Scale (TRAS) was developed to test the thought-provoking hypothesis put forward by Foa and Riggs (1993). These authors suggest that PTSD may develop when rigid positive pre-trauma schemas are violated or when rigid negative pre-trauma schemas are confirmed. In contrast, individuals with more flexible beliefs about safety and vulnerability are held to be relatively likely to recover after a traumatic event. Thus, Foa and Riggs (1993) proposed a curvilinear relation between beliefs and PTSD symptoms.

Several studies have shown that negative beliefs are detrimental to the development of PTSD (Dunmore, Clark & Ehlers, 1999; 2001; Ali, Dunmore, Clark & Ehlers, 2002). For a traumatized individual who held negative beliefs *before* the traumatic event, the traumatic event may be the last drop that makes the cup run over, resulting in post-trauma psychopathology (see also Foa, Ehlers, Clark, Tolin & Orsillo, 1999). Negative beliefs are thought to be even more detrimental when they are also very rigid (Foa & Riggs, 1993, Foa et al., 1999). Rigid negative beliefs may have resulted from insufficient elaboration of previous negative events. Therefore, the person may be likely to process the latest distressing event insufficiently as well, resulting in PTSD. Another possibility may be that individuals with rigid negative beliefs already suffer from some depression symptoms pre-trauma. Note that depression is characterized by a negative view of the self (APA, 2000). If an individual with pre-trauma sub-clinical depression symptoms experiences a further negative event (like a traumatic event), this may result in the development of full-blown depression rather than PTSD.

General Discussion

Rigid *positive* beliefs may not necessarily be detrimental. Note that thus far researchers assumed that positive pre-trauma beliefs would be shattered after a traumatic event (Janoff-Bulman, 1992; Foa & Riggs, 1993). Once beliefs are shattered trauma victims have to rebuild their belief-system. Consequently, they are more likely to process the event in a data-driven way. As was demonstrated in study 3, data-driven processing is related to PTSD symptoms (see also Halligan, Michael, Ehlers & Clark, 2003; Murray, Ehlers & Mayou, 2002). However, an alternative scenario may be that rigid positive beliefs are protective. These positive beliefs are likely to be the result of positive experiences. And a single distressing event like a traumatic experience may not be able to shatter pre-trauma positive beliefs. Rather, the trauma victim may respond with the notion that the world and the self are generally good, and that the traumatic event was just an exception to the rule with no further implications for the individual's view on the self and the world. Future studies should test the plausibility of the following scenarios: 1) whether rigid positive pre-trauma beliefs will be shattered after a traumatic experience resulting in post-trauma symptomatology, 2) whether rigid positive pre-trauma beliefs will be protective resulting in no psychopathology, or 3) whether positive beliefs will be shattered in some and protective in others.

Beliefs may not only be predictive of post-trauma symptomatology when assessed pre-trauma, but also when assessed in the immediate aftermath of the traumatic event. Problems with post-trauma assessments of beliefs may only arise in those victims whose beliefs were shattered by the traumatic event. Once beliefs are shattered individuals may over-accomodate, which in this case refers to endorsing rigid negative beliefs. In that case, rather than asking about current beliefs, it may be better to ask trauma victims whether a shift took place in the valence and rigidity of their beliefs from pre- to post-trauma.

By developing the TRAS, the way is open to thoroughly test whether a curvilinear relation exists between TRAS scores assessed before trauma and later post-trauma symptomatology. This questionnaire may further be used to test the process of change in the presence of beliefs, either in the natural course of trauma processing, or during treatment.

Predictors of PTSD: Specificity

The most studied disorder after a traumatic event is Post-traumatic Stress Disorder. Another common, but less studied, post-trauma disorder is depression. This dissertation focused on both PTSD and depression symptoms after a traumatic event. It was tested whether IQ, neuroticism, dissociation, negative appraisals of intrusions (study 1), assumptions about Self and assumptions about the World (study 2), and perceptual memories and memory fragmentation (study 4) were specifically related to PTSD as compared to depression symptoms. The findings in this dissertation show that, with the exception of narrative incoherence and utterance disorganization, all tested variables were predictive of not only PTSD symptoms, but also of depression symptoms. However, persistent negative appraisals of intrusions and persistent dissociation were related to depression due to the shared variance between PTSD symptoms and depression symptoms (study 1).

The question regarding the specificity of PTSD predictors was new when we started study 1 and 4 (but see Halligan et al., 2003). The findings of this dissertation show that several variables predict PTSD symptoms as well as post-trauma depression symptoms. Moreover, the relation between two variables that were studied in this dissertation (Assumptions about Self in study 2, and perceptual memory representations in study 4) and PTSD symptoms is mediated by symptoms of depression. Future studies may focus more on post-trauma depression symptoms. It would be appealing to detect which variables predict the development of chronic PTSD, and which variables predict the development of post-trauma depression symptoms. Feelings of loss after a traumatic event may be predictive of depression, whereas fear or horror may be predictive of PTSD (see also Ozer et al., 2003). As already noted, we hypothesize that rigid positive pre-trauma beliefs may be related to the development of PTSD due to shattering of the world views, which may result in data-driven processing. Negative pre-trauma beliefs may be related to the development of both PTSD and depression. If specific variables can be revealed with respect to the prediction of either PTSD or depression, this may imply that also concomitant

General Discussion

different interventions should be applied. If on the other hand no specificity can be revealed for the predictors of PTSD or depression, it may be seriously questioned whether the highly specific diagnosis of PTSD, which includes an etiological criterion of traumatic experiences, is still worthwhile.

Disturbances in trauma processing

A third aim of this dissertation was to test whether disturbances in trauma processing mediate the relation between PTSD predictors and PTSD symptoms. Although trauma researchers have identified a number of variables that predict PTSD, it is still unclear why these variables are related to PTSD or other post-trauma symptoms like depression. Knowing *why* a certain variable is a predictor may increase our understanding of the underlying mechanisms of PTSD, and in the end, may improve treatment provided to trauma victims.

The findings of this dissertation show that a predominance of data-driven processing is detrimental to the development of PTSD symptoms, but that avoidance immediately after a distressing event is not necessarily detrimental. An issue that deserves some discussion here is the controversy between the beneficial effect of exposure and the supposedly detrimental effect of data-driven processing. We hypothesize that data-driven processing is only detrimental when it persists and thereby inhibits conceptual processing. Initially data-driven processing may be functional or may even be a necessary means to realize a transformation of meaning. The same applies to exposure. In order to enable the traumatized individual to integrate in ones autobiographical database what the trauma may imply and what it does not imply, he or she needs information about what exactly happened during the event. This information may become explicit during exposure or data-driven processing. For example, a woman who has been raped may feel guilty. Telling her not to feel guilty will not make a difference. However, having her go over the whole experience again (exposure) may convince her that at the time of the trauma, there was nothing that she did or did not do that caused the rape.

The finding of study 5 showing that avoidance immediately after a traumatic event is not necessarily detrimental needs to be confirmed in a traumatized sample. Due to ethical restrictions, it is impossible to instruct individuals who experienced a real-life trauma to adopt a potential harmful processing style. Thus, the results of study 5 can only be tested among traumatized participants in a correlational study by assessing the natural manifestations of avoidant processing styles. Note that we do not suggest that avoidance is *never* detrimental. Prospective studies have shown that negative interpretation of intrusions is among the best predictors of chronic PTSD (Halligan et al., 2003). We hypothesize that avoidance will be detrimental when traumatized individuals interpret post-trauma symptoms like intrusions negatively. When individuals avoid all thoughts and reminders of the traumatic event, the negative interpretations of their intrusive memories cannot be corrected, because these individuals lack disconfirming information. In contrast, emotional processing may help these victims to correct their negative interpretations. However, victims without dysfunctional beliefs may have nothing to gain from extensive elaborations. In these cases, avoidance may not be detrimental, but may even help these individuals to resume their lives. Currently, we (Buck, Kindt, van den Hout & Pemberton) are conducting a study to test in a traumatized sample the hypothesis that avoidance will only be detrimental in those victims who hold dysfunctional beliefs about post-trauma symptoms, themselves and/or the world. The trauma sample consists of traumatized individuals who received no intervention after the traumatic event.

Relation between predictors of PTSD, disturbances in trauma processing and disturbances in trauma memory: State of the Art

In the introduction of this dissertation, the relation between predictors of PTSD, disturbances in trauma processing and disturbances in trauma memory or PTSD was presented schematically (see Figure 1 in introduction, page 21). In this section, the state of the art of this schematic presentation will be discussed

including studies described in this dissertation, as well as other studies about this subject that have been completed in the past decade. Note that so far only the relation between dissociation and memory disturbances has been studied, and not the relation between other strong predictors of PTSD (e.g. IQ, neuroticism, negative appraisals of intrusions) and memory disturbances. Similarly, so far only the relation between dissociation and disturbances in trauma processing was tested.

A. Relation between dissociation and disturbances in trauma memory

Although many studies have focused on the relation between dissociation and PTSD (see Ozer et al., 2003), only a limited number of studies focused on the pathogenic mechanism of dissociation. Those studies that did do so mostly studied the connection between dissociation and memory fragmentation. In line with the claim by traumatized individuals that their memory of the traumatic event is fragmented (e.g. van der Kolk & Fisler, 1995), studies indeed found an association between dissociation and subjective ratings of fragmentation (e.g. Halligan et al., 2003, Murray et al., 2002). However, laboratory studies show that although dissociation was related to subjective ratings of fragmentation, this association could not be observed with objective tests like a sequential memory task or a free recall test (Kindt & van den Hout, 2003; Kindt, van den Hout & Buck, 2005). Although Halligan et al. (2003) and Harvey and Bryant (1999) observed a connection between dissociation and objective assessments of fragmentation in traumatized individuals, Murray et al. (2002) did not observe this relationship in motor vehicle accident victims. Note that in the study by Harvey and Bryant, both dissociation and fragmentation scores were based on the same narrative. This increases the likelihood that a tautological element is introduced making their results somewhat hard to interpret. The mixed findings regarding the relation between dissociation and objective assessments of fragmentation may have resulted from differences in the methods to assess fragmentation. The mixed findings may further result from differences in

personal involvement of the participants (but see also Murray et al., 2002). Personal involvement in a distressing situation may induce higher levels of dissociation and may also increase the fragmented nature of the memory. In a situation in which the participant is not personally involved, for example when watching a film (Kindt & van den Hout, 2003; Kindt et al., 2005), it is rather easy for the participants to focus on all the events and surroundings in the film, making it less fragmented. However, in a situation in which one is personally involved, participants may have more trouble to conceptualize all the events and surroundings at that moment, which in turn may result in memory fragmentation. In order to exclude the possibility that personal involvement may explain the lack of relation between dissociation and objective memory fragmentation (Kindt & van den Hout, 2003; Kindt et al., 2005), a quasi-experimental study was performed in which participants were personally involved. This study, in which spider phobic participants were given an Exposure-in Vivo treatment for their spider phobia, was described in study 3. But again, although an association was observed between dissociation and self-rated memory fragmentation, no relation was observed between dissociation and experimenter-rated memory fragmentation. Based on the results of these studies, we are sceptical about the existence of a relation between dissociation and actual memory fragmentation. The connection between dissociation and memory-fragmentation may be confined to meta-memory (see also Kindt & van den Hout, 2003). Possibly, some aspects of the traumatic event are remembered more vividly, which may give the individual the impression that the trauma memory has a snapshot character. However, another possibility is that fragmentation is merely an epiphenomenon of PTSD. Rather than studying the coherence *within* the trauma narrative, it may be more relevant to study the trauma victim's inability to integrate the traumatic experience within other autobiographical memories in time. Ehlers and Clark (2000) refer to this as an inability to establish a self-referential perspective. A self-referential perspective involves processing experiences with respect to oneself and relating them to other autobiographical information. When traumatic experiences are not placed into its context in time,

General Discussion

the sense of current threat, a core characteristic of PTSD, will persist and serve to maintain PTSD symptoms.

Apart from the relation between dissociation and memory fragmentation, several studies have tested the association between dissociation and intrusive memories. Panasetis and Bryant (2003) found a moderate relationship between dissociation and intrusive memories in trauma victims. Kindt and colleagues tested the connection between dissociation and intrusive memories in the laboratory. Although Kindt and van den Hout (2003) failed to find an association between dissociation and frequency of intrusions reported four hours after watching a distressing film, in a replication study Kindt et al. (2005) observed that dissociation was strongly related to frequency of intrusions assessed four hours and one week after the distressing film. The findings of study 3 in this dissertation also show that dissociation and frequency of intrusive memories are related.

In this dissertation, the connection between dissociation and perceptual memory representations was tested for the first time. The results of study 3 show that dissociation is indeed related to perceptual memory representations. This finding supports the supposed association between dissociation and memory disturbances in that this relation has now been demonstrated not merely by use of subjective measures, but also by use of objective measures.

In sum, the relationship between dissociation and memory disturbances has been demonstrated with both subjective and objective measurements (intrusions, subjective fragmentation and perceptual memory representations). However, the connection between dissociation and objective measurements of memory fragmentation are mixed. These mixed results may depend on differences in methods used. Possibly differences in the sample studied (i.e. traumatized individuals versus non-traumatized individuals in analogue studies), or differences in the assessment methods are involved. Another possibility is that memory fragmentation should not be operationalized as fragmentation *within* the trauma memory.

B. Relation between dissociation and disturbances in trauma processing

As far as we know, three studies described the association between peritraumatic dissociation and data-driven processing. Two studies were performed by Halligan and colleagues (2002; 2003), and the other study is described in the present dissertation (study 4). In a study among assault victims, Halligan et al. (2003) found that dissociation was strongly related to data-driven processing ($.64 < r < .79$). In a laboratory study, Halligan, Clark and Ehlers (2002) found that participants with a natural tendency to process events data-driven also report more trait dissociation as opposed to participants with a natural tendency to process events conceptually-driven. However, it should be noted that Ehlers and Clark (2000) suggest that data-driven processing partly overlaps with dissociation. This is reflected in the questionnaire they developed to assess data-driven processing, which was also used by Halligan et al. (2002; 2003). This questionnaire includes items that are very similar to dissociative experiences (for example “I was confused and could not fully make sense of what was happening”). This content-overlap may explain the strong relation between dissociation and data-driven processing in their studies. Another issue that makes these findings questionable is that self-reports on cognitive processes are usually inaccurate and unreliable (Nisbett & Wilson, 1977). Thus, in order to be conclusive about this relation, objective assessments of data-driven processing are required.

Contrary to the studies by Halligan and colleagues (2002; 2003), the study in the present dissertation used more objective measures of data-driven processing. Data-driven processing was measured by the number of perceptual memory representations as compared to conceptual memory representations. In a study among traumatized individuals (people discharged from the Intensive Care Unit), dissociation was related to a predominance of perceptual memory representations ($r = .34$) (study 4).

In sum, the relation between dissociation and data-driven processing has been demonstrated both with subjective and objective measures. It should be noted that perceptual memory representations do not measure the processing

style itself. Rather, they indicate the supposed result of a predominance of data-driven processing of an event. Although it may be hard to think of an alternative cause of perceptual memory representations, future studies should test whether data-driven processing indeed results in perceptual memory representations.

C. Relation between disturbances in trauma processing and disturbances in trauma memory

This dissertation focussed on two supposedly dysfunctional processing styles: data-driven processing and avoidance. Firstly, studies on the association between data-driven processing and memory disturbances will be reviewed. Next, we will review studies on the association between avoidance and memory disturbances.

Relation between data-driven processing and memory disturbances: Two studies have tested the relation between data-driven processing and memory disturbances in traumatized individuals (Halligan et al., 2003; Murray et al., 2002). Both studies found that data-driven processing was related to subjective ratings of memory fragmentation. Further, Halligan et al. (2005) also observed a relation between data-driven processing and an objective assessment of memory fragmentation, i.e. experimenter-rated fragmentation. These two studies did not assess the relation between a data-driven processing style and frequency of intrusive memories. Further note that assessments of data-driven processing were subjective.

Another disadvantage of these studies is that they were correlational and thus do not allow any conclusions about the supposed causality of dysfunctional processing on the development of memory disturbances. Causality was studied in several laboratory studies by selecting participants on their natural processing style (Halligan et al., 2002), or by manipulating the processing style directly (Halligan et al., 2002; Kindt, van den Hout, Arntz & Drost, submitted). When processing style was manipulated, participants were allocated to the data-driven or conceptually-driven processing group based on their *actual* processing style.

Halligan et al. (2002) relied on participants' self-reports on processing styles, whereas Kindt et al. (submitted) used a more objective method: they instructed participants to write about the film in a data-driven or conceptually-driven way, and then rated these narratives in terms of perceptual/conceptual features. In all studies, participants watched a distressing film. Memory disturbances were assessed 15 minutes later (Kindt et al., submitted), one week later (Halligan et al., 2002), or daily during one week (Kindt et al., submitted). All studies measured intrusive memories. Whereas Halligan et al. (2002) measured memory fragmentation with objective measures, Kindt et al. (submitted) assessed self-reports of memory fragmentation. Data-driven processing was related to more frequent intrusions (Halligan et al., 2002; Kindt et al., submitted) and to more memory fragmentation as assessed by the proportion of events that were recalled in the correct order (Halligan et al., 2002). However, participants in the data-driven processing group did not perform worse on free recall of the events in the film, and did not make more mistakes in recalling the order of the events (Halligan et al., 2002). With respect to subjective memory fragmentation, participants who processed the film in a data-driven way reported more subjective memory fragmentation than participants who processed the film in a conceptually-driven way. This effect was marginally significant (Kindt et al., submitted).

Together, correlational studies among trauma victims suggest that data-driven processing is related to self-rated and experimenter-rated memory fragmentation (Halligan et al., 2003; Murray et al., 2002). The findings are mixed with respect to the relation between data-driven processing and objective assessments of fragmentation (Halligan et al., 2002; Murray et al., 2002). Note that the laboratory studies used objective measures of memory fragmentation (i.e. the proportion of events that were recalled in the correct order, free recall of the events in the film, and mistakes made when recalling the order of the events), whereas in the traumatized sample memory fragmentation was assessed by quasi objective measures (narratives were subjectively rated by the experimenter on a 4-point or 10-point scale). Thus, it is not yet clear whether memory fragmentation results from data-driven processing, dissociation, or from neither

General Discussion

of the two. An alternative hypothesis reads that memory fragmentation is caused by avoidance or suppression of the trauma memory (Wegner, Quillian & Houston 1996; Rassin, Merckelbach & Muris, 2001).

Relation between excessive avoidance and memory disturbances: excessive avoidance can be operationalized as experiential avoidance, as an avoidant or repressive coping style or as thought suppression. Experiential avoidance refers to the unwillingness to experience unwanted thoughts, emotions, or bodily sensations, and an individual's attempt to alter, avoid or escape those experiences (Plumb, Orsillo & Luterek, 2004). An avoidant or repressive coping style refers to the cognitive and emotional effort to ignore or divert attention from threatening stimuli, whether internal or external (Ginzburg, Solomon & Bleich, 2002). Thought suppression refers to cognitive activities designed to avoid or end particular thoughts, images or memories (Steil & Ehlers, 2000).

Many studies found that thought suppression is related to an increase of unwanted memories (e.g. Wegner, 1989; Trinder & Salkovski's, 1994). Three studies tested this relation in trauma victims (Shipherd & Beck, 1999; Shipherd & Beck, 2005; Steil & Ehlers, 2000). These studies also showed that suppression of trauma related thoughts was related to an increased frequency of these thoughts after the suppression period (rebound effect). However, note that Shipherd and Beck (1999, 2005) observed this rebound effect only in participants *with* PTSD. Only one study assessed the effect of thought suppression on intrusive memories of a distressing event in the laboratory (Davies & Clark, 1998). Davies and Clark observed that suppression resulted in an immediate decrease of the intrusions. After a few minutes, participants were told that they no longer had to suppress thoughts about the distressing film. This resulted in an immediate rebound effect of intrusions. So far studies have only tested the relation between dysfunctional processing styles (i.e. avoidance or thought suppression) and frequency of intrusions. But causality of supposedly functional processing styles (e.g. cognitive or emotional processing) on frequency of intrusive memories has not yet been tested. In this dissertation, an analogue study contrasted the effect of avoidance and conceptual processing of a distressing film on frequency of

intrusive memories (study 5). The findings suggest that avoidance may not be detrimental. At least, avoidance did not result in more intrusive memories than conceptual processing. Because the film was not traumatic, generalizations from these laboratory findings to real life traumas should be made with caution.

To our knowledge, the relation between avoidance and memory fragmentation was tested in only one study. Harvey and Bryant (1999) found a relation between the avoidance cluster of Acute Stress Disorder and disorganization of the trauma memory, which was defined as disjointedness, confusion and repetition of utterances. Note that this study is silent about whether or not avoidance *caused* memory disorganization. Wegner et al. (1996) tested whether memory fragmentation is caused by suppression. They hypothesized that trauma victims suppress memories of the traumatic event by redirecting their attention to a distracter. Over time, this kind of suppression may result in a memory that is clipped into various frames. As a result, the memory may have become associated with distracters used to suppress these memories, simultaneously dissociating it from the other frames that originally preceded and followed it. Wegner et al. (1996) tested this hypothesis and found that participants who were instructed to suppress thoughts about a distressing film had no generally impaired retrieval of the events as assessed by recognition, free recall, and cued recall. Still, these participants were less able to retrieve the order of events than were participants who were instructed to think about the film, or than those who were given no instruction. Further, the suppression group scored higher on subjective ratings of a snapshot character of the memory (subjective memory fragmentation) as compared to the other two groups combined. This finding was confirmed for suppression of memories of the most traumatic event experienced by students (Rassin et al., 2001). So far researchers have merely focussed on the effect of dysfunctional processing styles on memory fragmentation. Study 5 in the present dissertation contrasted the effect of a dysfunctional processing style (i.e. avoidance) on subjective memory fragmentation, to the effect of a functional processing style (i.e. emotional processing). The two processing styles did not differ in their effect on subjective memory fragmentation.

General Discussion

In sum, avoidance long after a traumatic event may be detrimental for individuals who are still symptomatic. Unfortunately, we don't have any data on the use of avoidance strategies of non-symptomatic individuals immediately after a traumatic event. Therefore, we cannot conclude that avoidance is harmful for (all) traumatized individuals. Moreover, this dissertation showed that avoidance immediately after an aversive event is not more detrimental than conceptual processing (study 5). But again note that this study assessed avoidance after a non-traumatic event. Furthermore, the findings of a study by Allen (1998) suggest that avoidance of thinking about events has negative effects when individuals who use an avoidant coping style believe that avoidance is harmful (see also McNally, Ehlers & Bryant, 2003). Perhaps avoidance is not detrimental as long as people don't interpret their avoidant coping style negatively. These days the general assumption is that people must not avoid their thoughts and images of their traumatic event. Therefore it is likely that many trauma victims who actually avoid thinking or talking about the traumatic experience feel uncomfortable. They may feel that avoiding these thoughts means that they will never fully process the event and thus will stay symptomatic. Future studies may test whether negative meta-cognitions on avoidance mediate the relation between an avoidant processing style and post-trauma symptomatology. Apart from negative meta-cognitions, also negative appraisals of intrusions are thought to mediate this relation. Individuals who appraise their intrusions negatively are thought to avoid them (Ehlers & Clark, 2000). Therefore, when testing whether meta-cognitions on avoidance mediate the relation between an avoidant processing style and post-trauma symptomatology one should also control for negative appraisals of intrusions.

Conclusion

The studies conducted so far have shown that disturbances in trauma processing are plausible candidates to explain the relation between dissociation and memory disturbances. Several studies provide reasonably

Table 1
 Summary of findings on the relation between dissociation, trauma processing and memory disturbances: State of the Art

Relation studied	Studies	Relation observed
A. Dissociation and Disturbances in Trauma Memory		
Intrusive memories	Kindt & van den Hout, 2003	-
	Panasetis & Bryant, 2003	+
	Buck, Kindt & van den Hout, 2006 (study3)	+
	Kindt, van den Hout & Buck, 2005	+
Fragmentation (subjective assessment)	Kindt & van den Hout, 2003	+
	Kindt, van den Hout & Buck, 2005	+
	Buck, Kindt & van den Hout, 2006 (study3)	+
Fragmentation (objective assessment)	Harvey & Bryant, 1999	+
	Murray, Ehlers & Mayou, 2002	-
	Halligan, Michael, Clark & Ehlers, 2003	+
	Kindt & van den Hout, 2003	-
	Buck, Kindt & van den Hout, 2006 (study3)	-
Kindt, van den Hout & Buck, 2005	-	
Perceptual memory representations	Buck, Kindt & van den Hout, 2006 (study3)	+
B. Dissociation and Disturbances in Trauma Processing		
Data-driven Processing	Murray, Ehlers & Mayou, 2002	+
	Halligan, Michael, Clark & Ehlers, 2003	+
	Buck, Kindt, van den Hout, Steens & Linders, in press (study 4)	+
Excessive avoidance	Has not yet been studied	
C. Disturbances in Trauma Processing and Disturbances in Trauma Memory		
Intrusive memories	Data-driven processing:	
	Halligan, Clark & Ehlers, 2002	+
	Kindt, van den Hout, Arntz & Drost, subm.	+
	Excessive avoidance:	
	Thought suppression:	
	Davies & Clark, 1998	+
	Shipherd & Beck, 1999	+
	Steil and Ehlers, 2000	+
Shipherd & Beck, 2005	-	
Buck, Kindt & van den Hout, (study 5)		

General Discussion

Fragmentation (subjective assessment)	Data-driven processing:	
	Murray, Ehlers & Mayou, 2002	+
	Halligan, Michael, Clark & Ehlers, 2003	+
	Kindt, van den Hout, Arntz & Drost, subm.	+
	Excessive avoidance:	
	Thought suppression:	+
	Wegner, Quillian & Houston, 1996	+
	Rassin, Merckelbach & Muris, 2001	-
	Buck, Kindt & van den Hout, (study 5)	
Fragmentation (objective assessment)	Data-driven processing:	
	Halligan, Clark & Ehlers, 2002	+/-
	Halligan, Michael, Clark & Ehlers, 2003	+/-
	Excessive avoidance:	
	Harvey & Bryant, 1999	+
Thought suppression:		
	Wegner, Quillian & Houston, 1996	+/-
Perceptual memory representations	Has not yet been studied	

Note: no relation observed (-), a relation was observed (+), mixed results (+/-).

consistent evidence that dissociation is related to a data-driven processing style, and that this processing style is indeed implicated in the development of subjective memory disturbances and PTSD (Murray et al., 2002; Halligan et al., 2003). Dissociation has some conceptual overlap with avoidance. Both dissociation and avoidance are strategies that may help people to separate themselves from the full impact of the trauma, thereby delaying the necessary emotional processing (Spiegel, 1991). However, only one study tested whether avoidance may be a further variable mediating the relation between dissociation and PTSD. Kindt and van den Hout (2003) tested whether suppression of intrusions (which is an expression of avoidance) mediates the relation between dissociation and self-rated memory fragmentation. No mediating effect of suppression of intrusions was found.

Together, these studies have contributed to our understanding of why dissociation predicts PTSD. However, there are still many unresolved issues. Although the cognitive model of PTSD by Ehlers and Clark (2000) predicts that

disturbances in trauma processing also mediate the relation between pre-trauma variables (IQ, neuroticism and beliefs) and PTSD, this has yet to be studied. The results of the above review are summarized in Table 1.

Implications for Early Interventions

Previous studies have shown that early interventions like debriefing, which are designed to normalize reactions to the trauma and to promote the expression of feelings and thoughts connected to the trauma (Ehlers & Clark, 2003), are not effective (e.g. Emmerik, Kamphuis, Hulsbosch & Emmelkamp, 2002; Mayou, Ehlers & Hobbs, 2000). An explanation for this finding may be that these studies did not treat a selected sample of traumatized individuals, but treated all trauma victims. It is not far-fetched that debriefing is only effective for a subgroup of traumatized individuals, that is victims who misinterpret the meaning of the trauma and/or their trauma responses. On the other hand, if no such misinterpretations are being made, debriefing may merely provide victims with reliving episodes which are intrinsically aversive and from which nothing can be gained. Note that the results of study 5 suggest that avoidance immediately after an aversive event is not necessarily detrimental. However, this hypothesis has yet to be tested in real-life traumatized individuals.

For now it seems likely that debriefing is not beneficial for all trauma victims. Debriefing, or other forms of early intervention may best be offered solely to those individuals who will not be able to successfully process the traumatic event on their own. Individuals who do not succeed in successful processing of the traumatic event may benefit more from cognitive behaviour therapy (CBT) than debriefing, in that CBT directly addresses dysfunctional trauma processing. A possible explanation for the finding that CBT is more effective than debriefing, may be that debriefing impedes with natural recovery processes because it is offered immediately after the traumatic event. CBT on the other hand, starts one or two months after the traumatic event (Ehlers & Clark, 2003).

General Discussion

The findings of study 1 suggest that early post-trauma variables like negative appraisals of intrusions and peri-traumatic dissociation are not valid in predicting post trauma symptoms like PTSD or depression. However, IQ, neuroticism, persistent negative appraisals of intrusions and persistent dissociation together predict 78% of PTSD variance. Unfortunately, in this study persistent post-trauma variables were assessed only after four months post-trauma. Future studies may test whether persistent post-trauma variables that are assessed before post-trauma symptomatology has become fully developed, are as powerful in predicting PTSD and/or depression. If so, interventions can be offered soon after the traumatic event, and solely to a select sample of trauma victims.

Finally, there are no studies indicating that avoidance in the immediate aftermath of a traumatic event is generally detrimental, and the current view that avoidance is bad is not based on solid evidence. The view may not only be wrong, but may have negative consequences: it may needlessly upset people as they are “forced” to be confronted with their traumatic experience.

Future Research Directions

Research limitations and suggestions for future research have been discussed where relevant throughout this discussion. However, there are several others that deserve to be mentioned.

The first study described in this dissertation may be repeated in order to further increase our understanding of the relative power of pre- and post-trauma variables in the prediction of PTSD symptom severity. It would be desirable to include at least 10 participants for every independent variable included. Post-trauma symptoms may be assessed several times – for instance every month-between one month and four months post-trauma. This enables researchers to assess at what time in the aftermath of a trauma these factors become predictors of PTSD. With regard to the post-trauma symptomatology, PTSD and depression may also be assessed at 6 months and 12 months, such that also the effect of

predictors on *chronic* psychopathology can be determined. The latter assessment assures a prospective rather than a cross-sectional design, and will be more in line with other studies testing possible predictors of post-trauma symptoms.

Further, focusing on memory fragmentation by assessing the coherence of the trauma narrative may not be a fruitful path to better understand the pathogenic mechanism of PTSD. Although it may be complex, assessment of integration of the event into the autobiographical memory may be a more promising way to study the dysfunctional trauma processing and the resulting memory disturbances characteristic of PTSD.

A further study may test the hypothesis postulated by Foa and colleagues (1992, 1993, 1999) regarding the curvilinear relation between pre-trauma beliefs and post-trauma symptomatology. Now that an instrument is available to assess valence and rigidity of beliefs simultaneously (the TRAS), this may be a tool to test post-trauma beliefs in the direct aftermath of a trauma. The TRAS may also assess processes of change in the natural course after traumatic experiences or during treatment.

Most studies focus on dysfunctional processing styles. However, in order to improve treatments for trauma victims, it is also very important to learn more about beneficial processing styles. Studying pre-trauma beliefs in combination with trauma processing may elucidate protective characteristics of trauma processing that may prevent trauma victims from being stuck in the past.

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General Discussion

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Na een traumatische gebeurtenis ontwikkelen de meeste slachtoffers psychische klachten. Traumatische ervaringen zijn gebeurtenissen waarbij iemand bedreigd wordt met lichamelijk letsel of de dood, of waarbij iemand daadwerkelijk is overleden. Voorbeelden van traumatische ervaringen zijn een cafébrand, een auto-ongeluk, een verkrachting, een verblijf op een intensive care en een vulkaanuitbarsting. Ook het aanschouwen van een dergelijke gebeurtenis kan traumatisch zijn. Niet zozeer de gebeurtenis zelf als wel de individuele reacties op een trauma zijn bepalend voor het al dan niet ontwikkelen van chronische klachten. Na een traumatische ervaring rapporteert vrijwel iedereen klachten. Bij de meeste traumaslachtoffers verdwijnen deze klachten binnen enkele maanden. Bij een minderheid worden de klachten chronisch. Een belangrijke theoretische en klinische vraag is dan ook welke factoren voorspellend zijn voor de ontwikkeling van chronische klachten na een trauma. Een tweede relevante vraag is hoe de relatie tussen voorspellende factoren en posttrauma klachten verklaard kan worden.

De meest voorkomende stoornis die volgt op een trauma is de Post-Traumatische Stress Stoornis (PTSS). PTSS klachten bestaan onder andere uit 1) verontrustende en zeer levendige herinneringen aan de gebeurtenis die zich aan de persoon opdringen (intrusies). Intrusies kunnen zich onder andere voordoen in de vorm van gedachten, beelden, geuren, geluiden en tactiele waarnemingen, 2) vermijding van gedachten en/of handelingen die herinneringen aan de gebeurtenis oproepen, en 3) gevoelens van prikkelbaarheid en verhoogde waakzaamheid. Daarnaast is ook depressie een stoornis die vaak volgt op een traumatische ervaring.

Gedurende de eerste maanden treedt er een differentiatie op tussen traumaslachtoffers die herstellen en traumaslachtoffers waarbij de angst klachten (PTSS) of depressieve klachten aanhouden. Dit doet vermoeden dat er iets mis gaat in de traumaverwerking van de traumaslachtoffers waarbij de klachten niet afnemen. Een mogelijke verklaring voor de relatie tussen voorspellers en posttrauma klachten is dan ook een disfunctionele traumaverwerking. Meer kennis omtrent functionele en disfunctionele traumaverwerking geeft een aangrijpingspunt voor therapie. Het doel van dit proefschrift is drievoudig: 1)

bestuderen welke factoren posttrauma klachten (PTSS en/of depressie) voorspellen, 2) bestuderen of deze factoren specifiek zijn voor PTSS of dat ze ook depressie voorspellen, en 3) het testen van enkele specifieke hypothesen met betrekking tot disfunctionele traumaverwerking die de relatie tussen voorspellende factoren en posttrauma klachten kan verklaren.

Wanneer iemand een trauma heeft meegemaakt willen hulpverleners graag weten op basis van welke factoren ze kunnen voorspellen wie een grote kans loopt chronische klachten te ontwikkelen. Zij weten dan bij wie ze snel moeten ingrijpen om te voorkomen dat de klachten chronisch worden. Van een aantal factoren is bekend dat het goede voorspellers zijn voor PTSS. Zo hebben mensen die laag scoren op neuroticisme (ofwel positief denken over de wereld en zichzelf) en een hoge IQ-score hebben, relatief weinig kans om PTSS te ontwikkelen. Verder is gebleken dat mensen die hun intrusies negatief plegen te interpreteren (bijv. "het feit dat ik telkens herinneringen heb aan dat auto ongeluk, betekent dat ik gek aan het worden ben") een verhoogde kans hebben om PTSS te ontwikkelen. Daarnaast is ook dissociatie een sterke voorspeller van PTSS. Dissociatie verwijst onder andere naar depersonalisatie. Dat wil zeggen dat een individu het idee heeft dat de gebeurtenis iemand anders overkomt in plaats van hemzelf, waarbij de persoon het gevoel heeft dat hij er als toeschouwer bij staat. De hoogte van het IQ en de mate van neuroticisme zijn stabiele factoren die al aanwezig waren voordat het trauma plaatsvond. Deze factoren worden dan ook pre-trauma factoren genoemd. Posttrauma factoren zijn factoren die pas zichtbaar worden na het trauma en derhalve pas na het trauma het verdere klachtenverloop kunnen beïnvloeden. Dit zijn bijvoorbeeld negatieve interpretatie van intrusies en dissociatie. Het vermoeden bestaat dat pre- en posttrauma factoren de traumaverwerking verstoren en daardoor in belangrijke mate bijdragen aan de ontwikkeling van chronische klachten..

Tot nu toe is vooral onderzocht in hoeverre IQ, neuroticisme, negatieve interpretatie van intrusies en dissociatie elk afzonderlijk PTSS voorspellen. Het doel van het eerste onderzoek (studie 1) was om na te gaan of posttrauma factoren een substantiële hoeveelheid variantie van posttrauma klachten (PTSS en depressie) kunnen verklaren bovenop de variantie die al verklaard wordt

door pretrauma factoren. Dit onderzoek werd uitgevoerd onder mensen die op een Intensive Care (IC) waren opgenomen. Binnen de eerste twee weken na ontslag van de IC werd neuroticisme, negatieve interpretatie van intrusies en dissociatie gemeten. Vier maanden na ontslag van de IC werden IQ, aanhoudende negatieve interpretatie van intrusies, aanhoudende dissociatie, PTSS klachten en depressie klachten gemeten. De bevindingen van dit onderzoek tonen aan dat IQ, neuroticisme, aanhoudende negatieve interpretaties van intrusies en aanhoudende dissociatie samen een aanzienlijk deel van de variantie (78%) van PTSS klachten voorspellen. Daarnaast bleek dat aanhoudende negatieve interpretatie van intrusies en aanhoudende dissociatie specifiek PTSS klachten voorspelden. Deze factoren waren niet voorspellend voor depressie nadat gecontroleerd was voor PTSS klachten.

Een aantal onderzoekers suggereren dat de aard van overtuigingen die mensen al voor het trauma hebben over zichzelf ("ik ben een sterk/zwak persoon") en de wereld ("iedereen/niemand is te vertrouwen", "de wereld is veilig/onveilig") ook voorspellend is voor het klachtenverloop. Men denkt dat er een U-vormig verband bestaat tussen overtuigingen en de ontwikkeling van klachten na een trauma. Zowel mensen met rigide negatieve overtuigingen ("de wereld is nooit veilig"), als mensen met rigide positieve overtuigingen ("de wereld is altijd veilig") zouden meer kans lopen chronische PTSS te ontwikkelen. Terwijl mensen met flexibele overtuigingen ("de wereld is soms gevaarlijk en soms veilig") waarschijnlijk niet of nauwelijks klachten zullen ontwikkelen. Een verklaring hiervoor is dat mensen met rigide negatieve overtuigingen al een negatief beeld hebben van de wereld. Als deze mensen dan ook nog eens een traumatische ervaring mee maken onderstreept dit hun negatieve opvattingen, welke kunnen resulteren in PTSS en/of depressie. Mensen met rigide positieve overtuigingen ("de wereld is altijd veilig") zouden ook veel kans lopen om PTSS te ontwikkelen, omdat het voor hen heel moeilijk zou zijn om een extreem negatieve gebeurtenis (het trauma) te rijmen met hun extreem positieve opvattingen. Dit kan ertoe leiden dat deze traumaslachtoffers niet meer geloven in hun positieve opvattingen over zichzelf, anderen en de wereld en hiervoor in de plaats negatieve opvattingen zullen ontwikkelen. Als gevolg van het instorten

van hun wereld- en zelfbeeld kunnen PTSS klachten ontstaan. Mensen met flexibele overtuigingen (“de wereld kan soms gevaarlijk zijn, en soms veilig”) zouden minder moeite hebben om een extreem negatieve ervaring te rijmen met hun overtuigingen. Immers, het ervaren van een trauma heeft waarschijnlijk amper gevolgen voor de overtuigingen van de persoon die de wereld beschouwt als “soms veilig en soms gevaarlijk”. Tot nu toe bestond er geen meetinstrument om deze hypothese te toetsen. In de tweede studie van dit proefschrift wordt de ontwikkeling van een vragenlijst beschreven, de Trauma Relevant Assumptions Scale (TRAS). De TRAS lijkt een valide en betrouwbaar instrument te zijn dat sterk samenhangt met o.a. PTSS en depressie klachten. In de toekomst kan deze vragenlijst gebruikt worden om de hypothese te toetsen dat zowel rigide negatieve als rigide positieve overtuigingen PTSS voorspellen. Daarnaast is deze vragenlijst ook toepasbaar als procesmaat bij therapie. Met behulp van de TRAS kan worden vastgesteld welke overtuigingen extreem negatief zijn en dus aangepast moeten worden.

Het derde doel van dit proefschrift was het verklaren van de relatie tussen voorspellende factoren en posttrauma klachten. Negatieve interpretaties van intrusies zouden PTSS voorspellen omdat ze leiden tot vermijding van gedachten aan het trauma. Individuen die intrusies ervaren als een teken dat ze gek aan het worden zijn zullen deze intrusies kosten wat het kost willen vermijden. Vermijding heeft echter het paradoxale effect dat intrusies versterkt worden. Vermijding van intrusies houdt de klachten dus in stand. Momenteel is er nog geen verklaring voor de relatie tussen dissociatie en posttrauma klachten. Verschillende wetenschappers vermoeden dat dissociatie de traumaverwerking verstoort en daardoor klachten in stand houdt. In dit proefschrift is getest of dissociatie samenhangt met een disfunctionele vorm van traumaverwerking, namelijk perceptuele verwerking. Perceptuele verwerking zou resulteren in perceptuele geheugenrepresentaties. Wij veronderstellen dat als dissociatie inderdaad samenhangt met een disfunctionele verwerkingsstrategie, dit tot uitdrukking zal komen in een relatie tussen dissociatie en objectief gemeten verstoringen van het traumageheugen (o.a. perceptuele geheugenrepresentaties).

Een onderscheid tussen functionele en disfunctionele verwerkingsstrategieën kan mogelijk verklaren waarom sommige traumaslachtoffers chronische klachten ontwikkelen, en aldus de traumatische ervaringen verstoord opslaan in het geheugen. Een hypothese stelt dat perceptuele verwerking, waarbij vooral de fysieke elementen van de gebeurtenis verwerkt worden, zou leiden tot chronische PTSS klachten. Deze hypothese stelt verder dat conceptuele verwerking van het trauma vereist is om de gebeurtenis op haar juiste waarde te schatten waardoor de impact minder zal zijn dan wanneer traumatische gebeurtenissen louter perceptueel worden verwerkt. Bijvoorbeeld, een persoon is op vakantie in Mexico en ziet hoe een Mexicaan gekleed in een geel joggingpak een vrouw dood schiet. Door de gebeurtenis perceptueel te verwerken onthoudt deze persoon bijvoorbeeld “man in geel joggingpak – harde knal”. Alle (personen in) gele joggingpakken en harde knallen zullen voortaan angst opwekken. Door de gebeurtenis conceptueel te verwerken kan de persoon zich realiseren dat deze moord plaats vond in een zeer onzure buurt in Mexico stad (contextualisatie). En verder dat niet elke harde knal en niet elke persoon in een geel joggingpak gevaar betekent.

In de derde studie is onderzocht of dissociatie samenhangt met perceptuele verwerking. Enkele eerdere studies hebben reeds de relatie tussen dissociatie en perceptuele verwerking gemeten. Een nadeel van deze studies is dat perceptuele verwerking tot nu toe werd gemeten door proefpersonen te vragen naar hun verwerkingsstijl. Omdat het twijfelachtig is of zelf-rapportage van verwerkingsstijlen betrouwbare gegevens oplevert hebben we de verwerkingsstijl objectief gemeten. Allereerst vertelden proefpersonen over de traumatische gebeurtenis. Vervolgens werd objectief bepaald door twee onafhankelijke beoordelaars hoeveel fragmenten in het verhaal bestonden uit perceptuele geheugenrepresentaties (bv “De man had een bruine jas aan.” “Ik rende weg.”), conceptuele geheugenrepresentaties (“Ik dacht dat ik dood ging, omdat hij me zo hard sloeg”) en geheugenrepresentaties die contextualisatie weerspiegelen (“die ochtend”, “toen ik op de gang stond”). De hypothese die werd getoetst was dat als dissociatie inderdaad de verwerking zou verstoren, dit zou moeten resulteren in niet alleen door de proefpersoon gerapporteerde

verstoringen van het geheugen (intrusies en zelf-gerapporteerde geheugenfragmentatie) maar ook in objectief meetbare verstoringen van het geheugen (door de onderzoeker gescoorde geheugenfragmentatie en perceptuele geheugenrepresentaties). Om deze hypothese te toetsen moesten proefpersonen in een situatie gebracht worden waarin ze zouden dissociëren (een onwerkelijk gevoel krijgen). Dissociatie komt niet alleen voor tijdens en na een traumatische gebeurtenis, maar ook tijdens en na gebeurtenissen die onverwacht zijn en die de betrokkene niet voor mogelijk had gehouden. Dergelijke gebeurtenissen noemen we schema-incongruente gebeurtenissen. Een voorbeeld van een schema-incongruente gebeurtenis is het winnen van €1.000.000 bij de staatsloterij of het over je hand laten lopen van een spin als je er doodsbang voor bent. In de derde studie kregen mensen die bang waren voor spinnen een exposure-in vivo behandeling voor hun spinnen angst. Dat wil zeggen dat deze mensen binnen 2 ½ uur verschillende stappen doorliepen waarbij ze begonnen met het aanraken van een pot waar een kleine spin in zat, en uiteindelijk een middelgrote tot grote spin over hun handen lieten lopen. Een week later werden herinneringen aan de behandeling gemeten. Uit de resultaten van dit onderzoek bleek dat dissociatie samenhangt met zowel subjectieve als objectieve verstoringen van het geheugen. Deze resultaten suggereren dan ook dat dissociatie tijdens of direct na een vervelende gebeurtenis de verwerking van deze gebeurtenis verstoort. Verder suggereren deze resultaten dat dissociatie samenhangt met perceptuele verwerking hetgeen aldus de eigenaardige levendigheid van traumatische ervaringen kan verklaren.

De vierde studie is opgezet om te testen of perceptuele verwerking inderdaad voorspellend is voor PTSS klachten. Eerdere studies hadden deze relatie al aangetoond door proefpersonen te vragen naar hun verwerkingsstijl. Maar zoals al eerder vermeld, levert zelfrapportage over verwerkingsstijlen geen betrouwbare gegevens op. Daarom bestond de noodzaak om te onderzoeken of de relatie tussen perceptuele verwerking en PTSS klachten ook zou worden gevonden wanneer perceptuele verwerking op een objectieve manier werd gemeten. Omdat een overheersend perceptuele verwerkingsstijl niet alleen resulteert in perceptuele geheugenrepresentaties maar ook in gefragmenteerde

geheugenrepresentaties werden beide geheugenverstoringen gemeten. Mensen die op een IC gelegen hadden werden meteen na ontslag van de IC gevraagd hun traumaverhaal te vertellen. Vier maanden later werden PTSS en depressie klachten gemeten. De resultaten van deze studie toonden aan dat perceptuele verwerking gemeten middels perceptuele geheugenrepresentaties en fragmentatie inderdaad voorspellend zijn voor PTSS. De conclusie van deze studie is dan ook dat een perceptuele verwerkingsstijl voorspellend is voor posttrauma klachten (PTSS en depressie). Meerdere studies hebben aangetoond dat er een sterke relatie bestaat tussen PTSS en posttrauma depressie. Als meerdere onderzoeken aantonen dat PTSS en posttrauma depressie door vrijwel dezelfde factoren voorspeld kunnen worden, is het wenselijk dat meer onderzoek gedaan wordt naar de aard en co-morbiditeit van posttrauma klachten. Verder zouden er ook vraagtekens geplaatst moeten worden bij het etiologisch criterium (een traumatische ervaring) als voorwaarde voor de diagnose PTSS. Immers, PTSS klachten kunnen zich ook voordoen na bijvoorbeeld de natuurlijke dood van een dierbare, waarbij dit overlijden niet voldoet aan de criteria van een trauma. Met andere woorden, het is onduidelijk of de opvattingen gerechtvaardigd zijn dat enerzijds een trauma specifiek gerelateerd is aan PTSS klachten, en anderzijds dat PTSS klachten altijd voorafgegaan worden door een traumatische gebeurtenis.

Niet alleen perceptuele verwerking, maar ook vermijding van herinneringen aan het trauma is een vermeende disfunctionele verwerkingsstrategie. Beiden beletten conceptuele verwerking. Hoewel verschillende onderzoeken inderdaad aangetoond hebben dat vermijding PTSS symptomen in stand houdt, wordt er de laatste tijd steeds meer getwijfeld of dit wel klopt. Deze twijfels zijn onder andere gebaseerd op het feit dat de meeste onderzoeken naar vermijding gebaseerd zijn op traumaslachtoffers die al langdurig klachten hebben en daarvoor therapeutische hulp krijgen. Voor deze mensen is vermijding vermoedelijk slecht omdat ze zich op deze manier niet bloot stellen aan de traumatische gebeurtenis waardoor ze geen juiste betekenis kunnen geven aan de gebeurtenis. Bovendien kunnen de eventueel aanwezige irreële ofwel disfunctionele interpretaties van hun klachten zo niet omgevormd

worden tot functionele interpretaties. Omdat de relatie tussen vermijding en PTSS klachten voornamelijk onderzocht is in deze subgroep, is het nog maar de vraag of vermijding slecht is voor alle traumaslachtoffers.

De vijfde studie is opgezet om te testen of emotionele verwerking onmiddellijk na een verontrustende gebeurtenis resulteert in minder klachten dan een verwerkingsstijl waarbij herinneringen aan de verontrustende gebeurtenis vermeden worden. Een dergelijk onderzoek kan onmogelijk uitgevoerd worden bij echte traumaslachtoffers, aangezien het onethisch is mensen te instrueren om te vermijden als dit mogelijk negatieve gevolgen kan hebben voor hun klachten verloop. In dit onderzoek betrof de verontrustende gebeurtenis een aversieve film. In plaats van PTSS klachten, zijn wederom analoge PTSS klachten gemeten (intrusies, zelf-gerapporteerde geheugen fragmentatie, het verwachte vermijdings- en vlucht gedrag). Nadat studenten de aversieve film gezien hadden werden ze verdeeld in drie groepen. Studenten werden geïnstrueerd om ofwel betekenis te geven aan de inhoud van de film, ofwel gedachten aan de film te vermijden, ofwel de testruimte te verlaten. Vier uur later werden klachten gemeten. Uit niets bleek dat vermijding slecht was. Mogelijk is vermijding alleen nadelig voor die mensen die hun klachten negatief interpreteren. Traumaslachtoffers die hun klachten niet negatief interpreteren zouden er weinig baat bij hebben om steeds terug te denken aan de gebeurtenis. Deze mensen zouden hun leven weer kunnen oppakken door herinneringen aan het trauma te vermijden. Maar dit is een hypothese die nog getoetst moet worden in de praktijk bij mensen die werkelijke trauma's hebben meegemaakt.

Conclusie

Het doel van dit proefschrift was allereerst het achterhalen van voorspellende factoren voor posttrauma klachten, en vervolgens het testen van de hypothese dat de relatie tussen dissociatie en posttrauma klachten verklaard kan worden door verstoringen in de verwerking. IQ, neuroticisme, aanhoudende negatieve interpretaties van intrusies en aanhoudende dissociatie zijn sterke voorspellers van PTSS en depressie klachten. Omdat PTSS en posttrauma depressie zo sterk samenhangen zou toekomstig onderzoek zich beter kunnen

richten op posttrauma klachten in plaats van zich enkel te richten op PTSS klachten.

Een mogelijke verklaring voor de sterke relatie tussen dissociatie en PTSS is dat dissociatie de verwerking verstoort. Wanneer traumaslachtoffers dissociëren wordt de traumatische gebeurtenis meer perceptueel verwerkt. Het gevolg van perceptuele verwerking is dat PTSS klachten na een trauma niet of nauwelijks afnemen.

Hoewel het idee bestaat dat men na een traumatische gebeurtenis vooral niet alle gedachten aan deze gebeurtenis moet onderdrukken, is het nog maar de vraag of vermijding inderdaad zo slecht is. Het is goed mogelijk dat vermijding alleen slecht is voor die mensen die irreële gedachten hebben over hun klachten. Wanneer deze mensen vermijden kunnen deze irreële gedachten niet ontkracht worden, met als gevolg dat PTSS klachten in stand worden gehouden.

Tot nu toe zijn de meeste studies gericht op de verwerkingsstijlen van traumaslachtoffers met klachten. Deze studies hebben onze kennis vergroot met betrekking tot disfunctionele verwerkingsstijlen, maar geven weinig informatie over functionele verwerkingsstijlen. Informatie over functionele verwerking kan verkregen worden door de verwerkingsstijl te bestuderen van traumaslachtoffers die geen chronische klachten ontwikkelen en deze te vergelijken met de verwerkingssijl van traumaslachtoffers waarbij de klachten wel aanhouden. Meer kennis over wat functionele verwerkingsstrategieën zijn levert mogelijk meer aangrijpingspunten voor therapie dan informatie over verwerkingsstijlen die klachten in stand houden. Door het aanleren van een functionele verwerkingsstijl kunnen traumaslachtoffers zich los maken van hun traumatisch verleden en weer leven in het heden.

Trauma Relevant Assumptions Scale

Below we will present the final version of the Trauma Relevant Assumptions Scale and its scoring key. Because the items that did not load on either subscale were omitted from the questionnaire, the item numbers do not overlap with the item numbers in Table 1 of Study 2.

Scoring key for the Trauma Relevant Assumptions Scale

Items are rated from -50 to + 50.

The following items have to be recoded such that negative beliefs are on the left side (-50) of the scale and positive beliefs are on the right side (+50) of the scale:
items 1, 4, 5, 8, 10, 11, 13, 15, 16, 19, 20, 22, 25, 27, 28, 30, 31

The score of the subscale Assumptions about Self can be calculated as follows:
(Sum of 1, 2, 5, 6, 8, 9, 10, 11, 13, 15, 16, 19, 20, 21, 22, 23, 26, 28, 30) / 19

The score of the subscale Assumptions about the World can be calculated as follows:
(Sum of 3, 4, 7, 12, 14, 17, 18, 24, 25, 27, 29, 31) / 12

Trauma Relevant Assumptions Scale

The aim of this questionnaire is to find out to what extent the statements below apply to you. In each question two opposite statements are presented. Please indicate to what degree either statement applies to you by marking the line.

Example

If you feel that the left or right statement applies to you very strongly, mark the line as follows:

I am always very spontaneous _____ I am never very spontaneous

Or here:

I am always very spontaneous _____ I am never very spontaneous

If you feel that the left or right statement applies to you to some extent, mark the line as follows:

I am always very spontaneous _____ | _____ I am never very spontaneous

Or here:

I am always very spontaneous _____ | _____ I am never very spontaneous

If you hold a neutral position regarding the two statements, mark the line as follows:

I am always very spontaneous _____ | _____ I am never very spontaneous

Important

1. You may mark the line anywhere, also at the ends. It's important that your mark corresponds to the extent to which either statement applies to you.
2. Please work from top to bottom and don't skip any questions.
3. Please mark each line only once.
4. Don't think about the statement too long. Mark the line so it represents your first impression. However be accurate.
5. Please read both statements before marking the line.

1 I can always trust myself to do the right thing

I can never trust myself to do the right thing

2 I am always a weak person

I am always a strong person

3 I will never be able to prevent bad things from happening to me

I will always be able to prevent bad things from happening to me

4 I can always trust people

I can never trust people

5 I can always deal with upsets, even when the upsets are huge

I can never deal with even the slightest upset

6 I am always unhappy

I am always happy

7 I always have to be on guard

I never have to be on guard

8 I never feel miserable

I always feel miserable

9 I always feel dead inside

I never feel dead inside

10 I always feel capable of doing anything

I never feel capable of doing anything

11 I am always in control of what happens to me

I am never in control of what happens to me

12 You never know who will harm you

You always know who will harm you

13 I will always be able to feel normal emotions

I will never be able to feel normal emotions

14 I always have to be careful

I never have to be careful

15 I have a future

I have no future

16 Everything about me is good _____ Everything about me is bad

17 I will never be able to prevent something terrible from happening _____ I will always be able to prevent something terrible from happening

18 I can never rely on other people _____ I can always rely on other people

19 I can always deal with negative events _____ I can never deal with negative events

20 I can always rely on myself _____ I can never rely on myself

21 Nothing good can ever happen to me _____ Good things can always happen to me

22 I am always in control of the situation I'm in _____ I am never in control of the situation I'm in

23 I always feel isolated and alienated from others _____ I never feel isolated and alienated from others

24 The world is never a safe place

The world is always a safe place

25 There is always justice in the world

There is never justice in the world

26 I never feel that I know myself

I always feel that I know myself

27 Terrible things can never happen to me

Terrible things can always happen to me

28 I can always trust my own judgment

I can never trust my own judgment

29 People always turn out to be different
than how they present themselves

People are always exactly how they
present themselves

30 I am never disgusting

I am always disgusting

31 The world is never a dangerous place

The world is always a dangerous place

Scoring Manual study 3

First the narrative is divided in utterances. An utterance is a clause, which includes only one thought or action. Causal statements such as “if-then”, “in order to”, “because”, “but”, etc. are considered as two utterances.

Then the narrative is rated to the degree in which the utterances reflect a perceptual memory representation or a conceptual memory representation:

Perceptual memory representations

1. descriptions of the proceedings and actions of the participant and the spider during the exposure. (e.g. I touched the spider with my finger; the spider moved fast)
2. physical descriptions of the spiders. (e.g. the spider was black; the spider was large)

Conceptual memory representations

1. (possible) explanations for why something happened or why they felt as they did (these utterances mostly start with: so, therefore, because, since)
2. realisations (e.g. I realised I was more relaxed when touching the spider)
3. plans and intentions (e.g. I had said to myself that I would not touch a spider)
4. reflections of emotions (I was scared; I was excited)
5. evaluations (It was OK.; I did well; I didn't make it).

Contextualizations

1. all indications to place and time (in the afternoon, at 4 o'clock, Monday, next, thereafter)
2. all indications of specifications.

The first spider I touched with a finger. The cross spider frightened me. When I saw the last spider I thought.....

The words underlined are scored as contextualisation.

The following words/sentences are not scored

- 1 repetitions of utterances
- 2 sentences which are not about the exposure in vivo session

Finally, each utterance is rated on a **9-point scale**:

- 1 only conceptual memory representations
- 2 mainly conceptual memory representations
- 3 about 2/3 conceptual memory representations and 1/3 perceptual
- 4 a bit more conceptual memory representations than perceptual
- 5 half of the memory representations are perceptual, the other half are conceptual
- 6 a bit more perceptual memory representations than conceptual
- 7 about 2/3 perceptual memory representations and 1/3 conceptual
- 8 mainly perceptual memory representations
- 9 only perceptual memory representations

Example 1

“The first spider walked over my hand quickly”.

“The first spider” was scored as contextual information (which is scored as a conceptual memory representation).

“Walked over my hand quickly” was scored as a perceptual memory representation

The utterance is scored as 7

Appendix B

Example 2

“I thought the last spider was scary / because it was so large and black”.

This sentence consists of two utterances.

“Last spider” was scored as contextual information.

The parts “I thought” and “was scary” were scored as conceptualisations

“because it was so large and scary” was scored as conceptualisation since it gives an explanation for why the spider was regarded as “scary”.

Both utterances were scored as 1

Buck, N., Kindt, M., & van den Hout, M. (2006). Effects of state dissociation on objectively and subjectively assessed memory disturbances. *Behavioural and Cognitive Psychotherapy*, 34, 319-331.

Scoring Manual study 4

First the narrative is divided in utterances. An utterance is a clause, which includes only one thought or action. Causal statements such as “if-then”, “in order to”, “because”, “but”, etc. are considered as two utterances.

Then the narrative is rated to the degree in which the utterances reflect a perceptual memory representation or a conceptual/contextual memory representation:

Perceptual memory representations

1. descriptions of the events at the Intensive Care Unit (ICU) and actions of the patient (e.g. they washed my hands; I saw two doctors)
2. descriptions of the surroundings (e.g. there was a clock, cards were pinned to the wall)
3. things learned about afterwards (e.g. my sister told me that)
4. explanations given by others (e.g. the doctor said: “you have to go to the ICU because ...”)

Conceptual memory representations

1. (possible) explanations for why something happened or why they felt as they did (these utterances mostly start with: so, therefore, because, since)
2. realisations (e.g. I realised I was in Maastricht)
3. plans and intentions (e.g. I wanted to beat up the nurse as soon as I could get out of bed)
4. explanations for why the event happened to them (e.g. It was not my time to go yet; This was a warning)
5. explanations for feelings (e.g. I was afraid because I was all alone. Note: only the part of the utterance that is underlined was scored)

Appendix C

Contextualizations

1. all indications of time (e.g. in the afternoon, at 4 o'clock, Monday, next, thereafter, when my husband was there)
2. all indications to place (e.g. in bed, next to me, at the ICU, on the toilet)

Not scored were

- a. reflections of emotions (e.g. I was scared; I was excited)
- b. events that the patient can not remember (e.g. I can't remember that they checked on me)
- c. uncertainties about events (e.g. Did they do this or did they do that? I can't remember)

Finally, each utterance is rated on a **9-point scale**:

- 1 only conceptual memory representations
- 2 mainly conceptual memory representations
- 3 about 2/3 conceptual memory representations and 1/3 perceptual
- 4 a bit more conceptual memory representations than perceptual
- 5 half of the memory representations are perceptual, the other half are conceptual
- 6 a bit more perceptual memory representations than conceptual
- 7 about 2/3 perceptual memory representations and 1/3 conceptual
- 8 mainly perceptual memory representations
- 9 only perceptual memory representations

Buck, N., Kindt, M., & van den Hout, M. (in press). Perceptual memory representations and memory fragmentation as predictors of post-trauma symptoms *Behavioural and Cognitive Psychotherapy*.

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Curriculum Vitae

Nicole Maria Leonarda Buck werd op 7 februari 1977 geboren te Heerlen. In 1995 begon zij met haar studie Psychologie in Nijmegen. In 2000 studeerde zij af in de richting Vergelijkende en Fysiologische Psychologie (Biologische Psychologie). Van 2001 tot 2005 werkte zij als AIO bij het Departement Medische Klinische en Experimentele Psychologie aan de Universiteit Maastricht. In deze periode voerde zij de studies uit beschreven in dit proefschrift. Tevens had zij in 2005 en 2006 een aanstelling als docent bij het Departement Medische Klinische en Experimentele Psychologie. Sinds juli 2006 werkt zij als post-doc forensische psychiatrie aan de faculteit psychiatrie van het Erasmus MC te Rotterdam.

