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# A transdiagnostic comparison of trauma and panic memories in PTSD, panic disorder, and healthy controls

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### ABSTRACT

Inadequate processing of trauma information is considered to lead to particularly vivid recollections and disorganized memories of the trauma. Although trauma memories have mainly been investigated in PTSD, memories in other psychiatric disorders may actually share some characteristics. This may particularly be true for patients with panic disorder with agoraphobia (PDA) as a first panic attack resembles trauma. To test this hypothesis, PTSD trauma memories ( $n=59$ ) were compared with PDA panic memories ( $n=58$ ), and trauma memories of healthy trauma victims ( $n=135$ ) on self-reported re-experiencing and disorganization. PTSD trauma memories had more re-experiencing elements than memories of the other two groups, although PDA memories had more re-experiencing elements than the controls' trauma memories. Relative to the controls, PTSD and PDA memories were disorganized. Peritraumatic dissociation and current memory-associated dissociation were also high in PTSD and PDA patients compared to the controls. Implications of these results are discussed.

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## 1. Introduction

The vivid, sensory-rich, and re-experiencing memories in posttraumatic stress disorder (PTSD) are considered to be the result of inadequate information processing (Brewin, 2001; Brewin, Dalgleish, & Joseph, 1996; Conway & Pleydell-Pearce, 2000; Ehlers & Clark, 2000), thereby making memory encoding and consolidation processes important factors in the development and maintenance of PTSD. For example, one contemporary neuroscience account for PTSD, the dual representation theory, describes the existence of two different memory systems that operate in parallel (Brewin, 2001; Brewin et al., 1996). In the verbally accessible memory system (VAM), the memory is integrated with other autobiographical memories and evaluations of the event and placed in context and time. VAM memories can deliberately be retrieved. The situationally accessible memory system (SAM) contains information that was obtained from lower level perceptual processing of the event and one's response to it. Information in the SAM is therefore thought to be more detailed and emotional. Normally, these two memory systems are both active and process information simultaneously. However, trauma can result in a shift away from VAM towards SAM processing. Ehlers and Clark (2000) suggest a similar shift in processing style during trauma in their cognitive model of PTSD. That is, during trauma it is possible that the individual lacks conceptual processing (providing meaning, organizing the event, and placing it into context), and data-driven processing (processing sensory impressions) becomes the dominant processing style, resulting in sensory-rich memories with a "here-and-now" quality that are difficult to retrieve intentionally. Theoretically, a distinction is made between involuntary memory and voluntary memory. Disorganization is considered to characterize voluntary memory especially (Brewin, 2007; Ehlers, Hackmann, & Michael, 2004). Re-experiencing elements like emotional intensity have been found to characterize both voluntary and involuntary memories though (e.g., Berntsen, 1998). Although in the present study participants were asked to rate their memory of the event without making a distinction between this memory being voluntary or involuntary, we assume these concern voluntary memories, because they had to deliberately retrieve the memory in order to describe it.

Inadequate processing is proposed to be elicited by the sudden, unpredictable and uncontrollable nature of the traumatic event and the person's overwhelming, emotional response to its threat. This causes a lack of time needed to consciously process information in a conceptual or verbally accessible way, leading to a shift towards perceptual processing.

Emotion was indeed found to be associated with enhanced perceptual memory in non-clinical participants (Arntz, De Groot, & Kindt, 2005). In addition, research in PTSD patients suggests that their trauma memories indeed show some features that are in line with contemporary PTSD theories. Findings are actually quite consistent with respect to what we will call "re-experiencing", which include characteristics like here-and-now quality, vividness, sensory elements, and intrusiveness. For example, it was found that intrusive memories in PTSD typically consisted of sensory information, mainly images and bodily sensations (e.g., Ehlers et al., 2002). Moreover, a sense of reliving (including sensory elements and emotion) increased with increased trauma-relatedness of voluntary memories and with increased PTSD severity (Rubin, Feldman, & Beckham, 2004), and was more present in voluntary trauma memories of individuals with compared to those without PTSD (Berntsen, Willert, & Rubin, 2003). In addition, the distress caused by the intrusive trauma recollections and their "here-and-now" quality predicted PTSD severity six months after the trauma (Michael, Ehlers, Halligan, & Clark, 2005), and gradually faded during therapy (Hackmann, Ehlers, Speckens, & Clark, 2004). Vividness of the trauma memory also gradually faded in the course of therapy (Hackmann et al., 2004; Rauch, Foa, Furr, & Filip, 2004), although the change in self-reported vividness was not related to a reduction in PTSD symptom severity (Rauch et al., 2004).

With respect to the disorganization, findings are contradictory. Several studies found voluntary trauma memories of individuals with PTSD to be disorganized compared to trauma memories of those without PTSD (e.g., Halligan, Michael, Clark, & Ehlers, 2003), but others found no difference between PTSD and non-PTSD individuals (e.g., Berntsen et al., 2003).

In sum, many of the theoretically assumed memory characteristics have been found in PTSD trauma memories, including vivid sensory impressions, intrusiveness, distress, and a "here-and-now" quality, suggesting indeed a dominant lower-level perceptual processing or lack of conceptual processing

during and after trauma. However, findings are inconclusive with respect to disorganization of the trauma memories (O'Kearney & Perrott, 2006).

The assumption of trauma memories having special properties as a result of distinctive processing of trauma information has also caused a lively debate (Shobe & Kihlstrom, 1997). Zoellner and Bittenger (2004) pointed out that in order to reliably establish whether memory mechanisms in PTSD are unique, PTSD trauma memory should be compared to and differ from memories of three control groups, i.e., (1) trauma memories of trauma victims without PTSD, (2) memories of other distressing, emotional but non-traumatic events, and (3) memories of events that are associated with the onset of other forms of psychopathology.

Research on memory characteristics in disorders other than PTSD is indeed emerging. For example, Reynolds and Brewin (1998) found that intrusive cognitions were more intrusive in PTSD than in depression, but their perceived controllability and associated emotions were remarkably similar in PTSD and depression. Birrer, Michael, and Munsch (2007) also found intrusive recollections to be equally distressing in patients with PTSD and depression. PTSD intrusions had a higher "here-and-now" quality though, and were experienced more visually. Intrusions have since long been reported in OCD and these also share some characteristics with PTSD trauma memories, like being distressing and uncontrollable and consisting of images (Clark & Rhyno, 2005). An interesting study in patients with agoraphobia showed that these patients experienced recurrent imagery involving several sensory modalities in agoraphobic situations, whereas control participants did not (Day, Holmes, & Hackmann, 2004). In most cases, the imagery was linked with unpleasant memories of earlier events.

In conclusion, contemporary PTSD theories have been able to predict specific memory characteristics in PTSD, like vivid sensory elements, intrusiveness, and a here-and-now quality. However, these may also characterize other psychiatric disorders, especially those starting with a single event. Transdiagnostic research, comparing memory characteristics across different psychiatric disorders, is interesting because it provides information about the specificity of trauma causing shifts in information processing. Such an approach may also increase our knowledge of memory and information processing. Clinically, treatments can be adjusted after specific knowledge of symptoms and their underlying mechanisms are better known. We opted to include patients with panic disorder with agoraphobia (PDA) in the current study, because just like traumatic experiences, panic attacks are perceived as sudden, overwhelming and subjectively life threatening events. In addition, PDA patients typically respond to a panic attack with intense fear and helplessness (see also PTSD criterion A2). Therefore, some of the memory characteristics in PTSD trauma memories should also characterize memories of a severe panic attack in PDA patients. The central aim of the present study was to investigate memory elements that characterize PTSD memories (re-experiencing and disorganization) in voluntary memories of PTSD patients as well as in other populations, namely PDA patients and healthy trauma victims. We expect no differences between both clinical groups, but hypothesize that they will differ from the healthy controls, because the latter apparently have processed the trauma adequately. In addition, because the trauma memories of PTSD patients include mainly visual and/or bodily sensations (Ehlers et al., 2002; Hackmann et al., 2004), and since memories of panic attacks are likely to contain bodily sensations as well, we decided to examine these two sensory qualities more closely in a separate analysis.

We also investigate another common element in PTSD and PD: dissociation. Peritraumatic dissociation is considered a risk factor for PTSD (Ozer, Best, Lipsey, & Weiss, 2003). Dissociation has also been found to occur in PTSD patients while remembering the event (Holmes, Grey, & Young, 2005). Fikretoglu et al. (2006) found that high levels of peritraumatic distress were associated with high levels of dissociation, suggesting it to occur as a result of emotional intensity. Indeed, dissociation is also one of the possible symptoms during a panic attack, involving high levels of distress (APA, 1994). However, dissociation did not receive that much attention in PDA research relative to PTSD research. It would therefore be interesting to compare PTSD, PDA and controls with respect to (peritraumatic and current) dissociation. In addition, as peritraumatic dissociation is thought to affect information processing, it might be related to memory characteristics like re-experiencing elements or disorganization. Having adequately processed the trauma and experiencing less current anxiety, the controls are expected to

report less peritraumatic dissociation and to experience less dissociation during memory retrieval (for brevity reasons we use the term “memory-associated dissociation”).

## 2. Method

### 2.1. Participants

A total of 263 adult volunteers participated. They consisted of three groups: 59 patients with PTSD without comorbid current or lifetime panic disorder with agoraphobia (PDA), 58 patients with PDA without comorbid current or lifetime PTSD, and 146 healthy trauma victims (further referred to as “controls”). The patients were waiting to start cognitive behavior therapy at an outpatient clinic specialized in anxiety disorders. Demographic and psychopathology variables are listed in Table 1. The controls were recruited at the university campus through advertisements and included if they ever experienced an overwhelmingly frightful experience that had occurred at least one month ago, of which its which trauma-nature was checked by two questions referring to the DSM-IV A1 and A2 trauma criteria. Controls were excluded if they met the DSM-IV criteria for PTSD or PD(A). Eleven

**Table 1**

The demographic and psychopathology variables for the PTSD and PDA patients and controls ( $N = 252$ ).

Variable	Group		
	PTSD $n = 59$	PDA $n = 58$	Controls $n = 135$
Gender**			
Male	35%	36%	16%
Age**			
<i>M</i> (years)	36	37	23
<i>SD</i> (years)	11	11	6
Education**			
Low	25.4%	31.0%	1.5%
Medium	41.7%	43.1%	0%
High	31.7%	25.9%	98.5%
Comorbidity			
One or more comorbid DSM-IV disorder(s)	44%	38%	–
PSS**			
<i>M</i>	22.41		3.17
<i>SD</i>	8.44		3.27
PAS**			
<i>M</i>		26.79	3.63
<i>SD</i>		11.96	2.39
Trauma			
Road traffic accidents	10.2%		13.3%
Other accidents	3.4%		11%
Witnessing death or serious accidents	3.4%		4.4%
Sexual assault**	30.5%		3.7%
Nonsexual assault	30.5%		19.3%
Witnessing (sexual) assault	5.1%		–
War	3.4%		–
Death of a loved one*	–		17.8%
Serious disease or surgery	–		9.6%
Miscellaneous	13.6%		20.7%

Note. PTSD = posttraumatic stress disorder; PDA = panic disorder with agoraphobia; PSS = PTSD Symptom Scale; PAS = Panic and Agoraphobia Scale.

\* $p < .05$ . \*\* $p < .01$

controls were excluded based on this criterion, resulting in a total number of 135 controls and a total sample of 252 participants. There were significant differences between the three groups in age ( $F(2, 249) = 72.17, p < .001$ ), education ( $F(2, 248) = 132.39, p < .001$ ), and gender ( $\chi^2(2, N = 252) = 11.83, p < .01$ ), with the controls being younger and more highly educated, and more likely to be female than the two patient groups. With respect to trauma type, controls experienced less sexual assault ( $\chi^2(1, N = 191) = 30.22, p < .001$ ) and more death of a loved one ( $\chi^2(1, N = 191) = 11.39, p = .01$ ) relative to PTSD patients, after Bonferroni correction. They did not differ in other trauma types (all  $ps > .07$ ; see also Table 1). There was no difference in the number of comorbid DSM-IV disorders between the PTSD and PDA patients ( $t(113) = -.83, p = .41$ ).

## 2.2. Measures

### 2.2.1. Mini-international neuropsychiatric interview (MINI)

DSM-IV diagnoses were established by means of the MINI (Sheehan et al., 1998), a structured interview based on DSM-IV and ICD-10 criteria. Interrater reliability of the MINI is good (all diagnostic subscales  $> .75$ ). In the current study all MINI interviews were conducted by trained psychologists.

### 2.2.2. PTSD symptom scale (PSS)

The PSS (Foa, Riggs, Dancu, & Rothbaum, 1993) is a 17 item self-report questionnaire used to assess PTSD as defined in the DSM-IV. The total score (range: 0–51) is the sum of the subscales re-experiencing, avoidance and arousal, and reflects the severity of PTSD symptoms. Psychometric properties of the Dutch PSS are reported by Engelhard, Arntz, and Van den Hout (2007). Internal consistency of the PSS was .95 in the present sample.

Trauma exposure was assessed by the items of the *Clinician-Administered PTSD Scale* (CAPS; Blake et al., 1995) that address the PTSD criteria A1 and A2.

### 2.2.3. Panic and agoraphobia scale–self-administered (PAS)

The PAS (Bandelow, 1999) was used to assess the severity of the panic disorder and agoraphobia. The 13 items are rated on a 5-point scale and measure panic attack frequency, agoraphobic avoidance, anticipatory anxiety, impairment in social and occupational functioning, and worries about health. Psychometric properties are excellent (Bandelow, 1995), although unknown for the Dutch version of the PAS. Internal consistency in our sample was .90.

### 2.2.4. Memory characteristics questionnaire

We gauged Re-experiencing and Disorganization using a self-report questionnaire, in accordance with the Intrusion and Disorganization subscales of Halligan et al. (2003). Participants were first asked to write down their trauma (PTSD), their first or most frightening panic attack (PDA), or the most frightening situation they had ever experienced (controls). They were asked to keep the trauma/panic attack/frightening situation [there were three versions of this questionnaire, MH] they had just written down in mind when filling out the questionnaire, because each item referred to their memory of that specific situation. The instructions for the controls referred to “frightening situation” instead of “trauma” in order to stay in line with their point of view, as these healthy participants did not always see the event as traumatic in that they did not experience any negative after-effects. Factor analyses showed the scale to comprise 2 factors: *Re-experiencing* (8 items) and *Disorganization* (6 items; items are listed in Appendix A). Subsequent reliability analyses revealed an alpha of .68 and .80 for the Re-experiencing and Disorganization scales, respectively. The sensory impressions-item of the Re-experiencing subscale actually listed 6 different senses, of which the mean score was counted as one item. For the further investigation concerning differences in sensory impression type, two of the sensory qualities listed here were analyzed separately: images and bodily sensations. In addition to the two subscales, one item of the Memory Characteristics Questionnaire assessed peritraumatic dissociation (following Ehlers, Mayou, & Bryant, 1998) and one item depersonalization and/or derealization during memory retrieval (memory-associated dissociation). All 16 items were rated on a 4-point scale ranging from 0 (*Never*) to 3 (*All the time*). Test–retest reliability was good for Re-experiencing ( $r = .86$ ), Disorganization ( $r = .82$ ), and the complete questionnaire ( $r = .86$ ).

### 2.3. Procedure

The participants that met the study's inclusion criteria were asked to complete the questionnaires after having given their written informed consent. One week later, they again completed the Memory Characteristics Questionnaire to establish test–retest reliability.

### 2.4. Statistical analyses

Multivariate and univariate analyses of variance were used to compare the memories on Re-experiencing and Disorganization. Age, gender, and education were entered as covariates because these variables differed significantly between groups. Where significant effects emerged, pairwise post-hoc comparisons with Bonferroni correction were performed.

## 3. Results

### 3.1. Re-experiencing and disorganization

MANCOVA analyses showed a significant overall main effect for group (Pillai's Trace  $F(4, 478) = 21.17, p < .001$ )<sup>1</sup>. Univariate analyses showed significant group differences for Re-experiencing ( $F(2, 239) = 45.91, p < .001$ ) and Disorganization ( $F(2, 239) = 4.54, p = .01$ ; see Table 2). Pairwise post-hoc comparisons showed the PTSD trauma memories to feature more re-experiencing elements than both the PDA panic memories and the trauma memories of the healthy controls ( $p < .001$  in both cases). Interestingly, the PDA panic memories showed more re-experiencing elements than the trauma memories of controls ( $p < .001$ ). The post-hoc comparisons revealed differences on Disorganization: the PTSD trauma memories did not differ from the PDA panic memories on this factor ( $p = 1.00$ ), but both types of memories were significantly more disorganized than the trauma memories of the controls (PTSD:  $p = .04$ ; PDA:  $p = .01$ ).

In addition, two sensory qualities were submitted to univariate analyses: *images* and *bodily sensations*. Groups were found to differ with respect to both variables (images,  $F(2, 244) = 19.59, p < .001$ ; bodily sensations,  $F(2, 244) = 77.98, p < .001$ ). Interestingly, pairwise post-hoc comparisons showed the trauma memories of both the PTSD patients and the controls to include significantly more images than the PDA panic memories ( $p < .001$  in both cases). The memories of the PTSD patients and the controls were comparable with respect to containing images ( $p = .18$ ). As to the differences in bodily sensations, the memories of PTSD and PDA patients both included more such sensations than the trauma memories of the controls ( $p < .001$  in both cases). There was no difference in bodily sensations between the memories of PTSD and PDA patients ( $p = 1.00$ ).

### 3.2. Dissociation

Groups differed on peritraumatic dissociation ( $F(2, 240) = 6.27, p < .01$ ). PTSD ( $p = .02$ ) and PDA patients ( $p < .01$ ) reported higher levels of peritraumatic dissociation than the controls, with these levels being similar in the two patient groups ( $p = 1.00$ ). The three groups also differed on memory-associated dissociation ( $F(2, 240) = 7.22, p < .01$ ). Again, both the PTSD and PDA patients experienced more dissociation while remembering the event than the controls ( $p < .01$  in both cases), while the two patient groups did not differ from each other ( $p = 1.00$ ).

Regression analyses were conducted across groups, entering memory-associated dissociation and peritraumatic dissociation as predictors, and Re-experiencing and Disorganization respectively as dependent variables. These revealed that memory-associated dissociation was related to Re-experiencing ( $\beta = .54$  and  $p < .001$ ), whereas peritraumatic dissociation was not ( $\beta = .05$  and  $p = .47$ ). Neither

<sup>1</sup> Similar results were obtained after analyses without covariates: an overall main effect for group (Pillai's Trace  $F(4, 486) = 27.85, p < .001$ ), and univariate effects for Intrusion characteristics ( $F(2, 243) = 67.71, p < .001$ ) and Disorganization ( $F(2, 243) = 3.51, p = .03$ ).

**Table 2**Estimated means (SDs) of all memory characteristics for each group ( $N = 252$ ).

Measure	Group					
	PTSD $n = 59$		PDA $n = 58$		Controls $n = 135$	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Re-experiencing**	1.63	.07	1.10	.07	.70	.05
Disorganization <sup>a</sup> **	.73	.08	.77	.08	.45	.06
Sensory impressions						
Images**	2.35	.12	1.35	.12	2.08	.08
Bodily sensations**	.99	.07	.92	.07	.11	.05
Memory-associated dissociation*	1.03	.14	.93	.14	.30	.10
Peritraumatic dissociation**	1.36	.16	1.49	.16	.73	.11

Note. PTSD = posttraumatic stress disorder; PDA = panic disorder with agoraphobia.

\* $p < .05$ . \*\* $p < .01$ <sup>a</sup> Higher scores indicate more disorganization.

peritraumatic dissociation ( $\beta = .11$ ,  $p = .15$ ), nor memory-associated dissociation ( $\beta = .07$ ,  $p = .37$ ) predicted Disorganization.

#### 4. Discussion

The current studies explored differences and similarities between trauma memories in PTSD, panic memories in PDA, and trauma memories in controls. It was found that PTSD trauma memories were characterized by more re-experiencing than PDA panic memories, which in turn had more re-experiencing elements than the trauma memories of controls. Interestingly, PTSD trauma memories and PDA panic memories were both disorganized compared to the controls' trauma memories.

The finding that the PTSD trauma memories contained relatively high levels of re-experiencing seems to be in line with theories on PTSD (Brewin et al., 1996; Ehlers & Clark, 2000) as well as theories on memory in general (Conway & Pleydell-Pearce, 2000). Conway and Pleydell-Pearce (2000), for instance, posits that the "working self" cannot adapt to the threat (to current plans and goals) that the trauma presents. Encoding of the information and integration into the autobiographical knowledge base cannot take place, and, as a result, the "event-specific knowledge" escapes the control processes that are associated with the autobiographical knowledge base. The event-specific knowledge is automatically activated and without control processes, vivid, sensory-perceptual details with a here-and-now quality intrude into awareness.

However, this still does not explain why the PDA panic memories contained fewer re-experiencing elements than the PTSD trauma memories, considering that their first or most intense panic attack also formed a "threat (to current plans and goals)". Moreover, Hagenaars, Van Minnen, and Hoogduin (in press) showed that PTSD trauma memories and PDA panic memories did not differ in rater-assessed reliving intensity, suggesting the PDA panic memories were as vivid and emotional as the PTSD trauma memories. Two factors may explain these different findings. First, patients in the Hagenaars et al. (in press) study were asked to recount their memories aloud, whereas participants in the present study were instructed to think about the event and then describe their memory of that event. Recounting may cause a more deliberate activation than thinking about the event does. Second, the Hagenaars et al. (in press) Reliving subscale closely resembles the Re-experiencing subscale used in the present study, except that the latter scale has two additional items: intrusiveness and control. Possibly, a sense of reliving is similar in PTSD and PDA memories, but PTSD patients experience their memories as more intrusive and experience less control over them. Although somewhat speculative, a difference in intrusiveness may be caused by the fact that PTSD patients typically appraise trauma memories negatively and try to avoid them, whereas PDA patients do not, and, by not avoiding the memories themselves, offer them a chance to be (partly) integrated into autobiographical memory. Indeed, initial appraisal of (re-experiencing) symptoms has been found to be related to later PTSD symptoms



(Hagenaars, Van Minnen, & Hoogduin, 2007; Halligan et al., 2003). Note that PDA panic memories in turn have more re-experiencing elements than trauma memories of healthy controls, suggesting a continuum of information processing.

Interestingly, memories of all three groups contained sensory elements, but they differed in the sort of sensory element that was dominantly present. That is, the trauma memories of the PTSD patients and those of the controls both included more images than the PDA panic memories. On the other hand, both PTSD memories and PDA memories included more bodily sensations than the trauma memories of the controls. The type of sensory impression thus seems to be uniquely connected to a specific event, and so the relative lack of images in the PDA group may be a consequence of the nature of the threatening event. A traumatic event typically occurs outside oneself, which suggests attention is drawn to the outer world, hence a vivid visual memory. In terms of evolution, focusing on sensory-visuospatial information when in danger may serve survival mechanisms, as it provides possible escape routes and important information with respect to avoiding future danger (Holmes & Bourne, 2008). Panic attacks typically occur inside oneself, drawing the attention to one's own physical symptoms, hence a vivid memory of bodily sensations. The fact that PTSD trauma memories contain more images than PDA panic memories does not necessarily suggest that PTSD patients experience greater reliving, but may simply be the result of different events leaving a different sort of sensory impression. In fact, as mentioned earlier, a narrative rating study did not find a difference between PTSD and PDA in reliving intensity (Hagenaars et al., *in press*), suggesting that at least deliberately provoked PDA panic memories are indeed equally vivid and real as PTSD trauma memories.

The finding that both PDA panic memories and PTSD trauma memories were characterized by disorganization suggests that disorganization is not uniquely associated with PTSD memories (Van der Kolk & Fisler, 1995). This may be because a panic attack has a similar impact on memory as a trauma. It is also plausible that not the traumatic event but rather the strong emotions evoked by recalling the event are responsible for the disorganization, for example by disabling adequate memory retrieval. The healthy participants probably did not experience similar strong emotions during retrieval, and indeed, their memories were not disorganized. Hence, memory disorganization or fragmentation may just be an epiphenomenon reflecting anxiety or fear experienced during recounting (Zoellner & Bittenger, 2004, p. 155). The literature on disorganization of PTSD trauma memories is quite contradictory, due to methodological differences and the fact that no valid instruments are available to assess disorganization (O'Kearney & Perrott, 2006). O'Kearney and Perrott (2006) therefore suggested to look at associations between memory characteristics and specific PTSD symptom clusters. Following this suggestion, some interesting findings came up. That is, Re-experiencing was associated with all PTSD symptom clusters (all  $r$ 's  $> .67$ , all  $p$ 's  $< .001$ ). However, Disorganization was related to the avoidance cluster ( $r = .21$ ,  $p < .01$ ), but not to the re-experiencing and arousal clusters ( $r = .08$  and  $r = .11$ , both  $p$ 's  $> .05$ ). Finally, note that the present study addressed voluntary memories. Although the distinction is not always made Disorganization may characterize voluntary or involuntary memories only (Brewin, 2007; Ehlers et al., 2004). It would therefore be interesting to compare both types of memories on disorganization in future research, preferably in different psychiatric disorders.

Another interesting finding concerns the fact that both PTSD and PDA patients experienced dissociation during the original event (being a trauma or a first panic attack). This is remarkable because, although in the DSM-IV it is mentioned among the symptoms of a panic attack, still, peritraumatic dissociation is often specifically linked to traumatic events (Van der Kolk, Van der Hart, & Marmar, 1996). However, dissociation could just be a symptom people experience while having strong emotions. Indeed, it has also been found to occur during highly positive events (Candel & Merckelbach, 2004). Of course, in the current study peritraumatic dissociation was measured retrospectively, which should be kept in mind when interpreting the results, as retrospective reports of peritraumatic dissociation may depend on present symptom severity (Marshall & Schell, 2002; Zoellner, Sacks, & Foa, 2001). Besides peritraumatic dissociation, PTSD and PDA patients also experienced depersonalization or derealization while remembering the traumatic event or panic attack. Again, this seems to indicate that dissociation is merely a symptom, indicator or epiphenomenon of intense emotions.



Across groups, memory-associated and not peritraumatic dissociation was associated with increased re-experiencing. This seems to be contradictory to the findings of [Engelhard, Van den Hout, Kindt, Arntz, and Schouten \(2003\)](#) who found peritraumatic dissociation to be associated with sensory impressions and emotional intensity of the memory. However, several methodological issues, such as differences in assessing relevant variables and retrospective assessment of peritraumatic dissociation, may explain the different findings. Furthermore, [Engelhard et al. \(2003\)](#) did not control for memory-associated dissociation, which proved highly correlated to peritraumatic dissociation ( $r = .42$ ,  $p < .001$ ), and made the effect of peritraumatic dissociation disappear after controlling for it in our study. Dissociation occurring while remembering an event may have an immediate effect on the characteristics of that particular memory, i.e., dissociation may have an effect on the retrieval of events, and may cause the memory to be (perceived as) intruding, uncontrollable, vivid, and happening here and now. Alternatively, if dissociation is seen as an epiphenomenon of strong emotions, memories featuring more re-experiencing and stronger emotions would be associated with more dissociation. Neither peritraumatic nor memory-associated dissociation was associated with memory disorganization.

The study has some limitations that need to be mentioned. For one, the traumas in the control group included less sexual and more death of a loved one than the traumas in the PTSD group. Also, the educational level of the controls was higher, and they were younger and more likely to be female than participants in the other two groups. Although we did control for these variables, the study still merits replication with matched groups that experienced similar kinds of trauma. Another limitation lays in the meta-memory approach, which does not necessarily correspond with external ratings ([Kindt & Van den Hout, 2003](#)). The results should therefore be replicated using different methods, for instance narrative rating. Unfortunately, it was impossible to use a validated measure for meta-memory characteristics. That is, some studies using a meta-memory approach addressed memory elements also used in the present study, like perceptual details, but these are usually assessed using a single specific question. To our knowledge, scales combining different memory elements do not exist, except for [Halligan et al. \(2003\)](#), who developed a scale measuring meta-memory intrusion and disorganization, but unfortunately, our study was already running when this instrument was published. The fact that there was a huge overlap in items of the questionnaire constructed by [Halligan et al. \(2003\)](#) and our own questionnaire, both assessing re-experiencing/intrusion elements and disorganization, suggests that these are indeed solid constructs, though.

On the other hand, the study is strong in that it included a large number of participants. Moreover, it compared the traumatic memories of adults with and without PTSD and the memories of patients diagnosed with PDA. Investigating symptoms across syndromes is useful in enhancing our understanding of these syndromes, as well as their underlying mechanisms. The choice to include PDA patients as a control group has some advantages, in that a panic attack resembles trauma. It has even been suggested that panic attacks may act like traumatic stressors and sometimes even provoke PTSD symptoms ([McNally & Lukach, 1992](#)). This would make the two disorders comparable concerning the development and specific features of the trauma and panic memories. The next challenge therefore is to study memory characteristics and memory development in both disorders in more detail. However, because it is possible that the original experience of a highly fearful event has caused the memories in both disorders to resemble each other, future research should also study so-called PTSD-specific memory characteristics in other disorders, like obsessive-compulsive disorder.

To conclude, PDA panic memories resembled PTSD trauma memories in the majority of characteristics studied. The current results suggest interesting transdiagnostic similarities, and differences, between PTSD trauma memories, PDA panic memories and trauma memories of healthy controls. To increase our understanding of memory processes, future research should further explore differences and similarities in memories across (anxiety) disorders.

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## Appendix A.

### Memory characteristics questionnaire\*

Please write down your *trauma/first or most frightening panic attack/most frightening situation* [there were three versions of this questionnaire, MH] in a few sentences.

.....

.....

Now indicate to what extend the following statements apply to the memory of the event you just described.

		No	A little	Moderately	Strongly
1	The memory is intrusive	0	1	2	3
2	The memory is vivid	0	1	2	3
3	The events in the memory have a logical order	0	1	2	3
4	I feel frightened during the memory	0	1	2	3
5	The memory is fragmented	0	1	2	3
6	I feel aroused during the memory	0	1	2	3
7	I have physical reactions during the memory	0	1	2	3
8	The memory contains essential information	0	1	2	3
9	The memory contains the following sensory impressions:				
	Smell	0	1	2	3
	Images	0	1	2	3
	Sounds	0	1	2	3
	Taste	0	1	2	3
	Bodily sensations	0	1	2	3
	Touch	0	1	2	3
10	The memory seems incomplete	0	1	2	3
11	The memory is coherent	0	1	2	3
12	During the memory it is like it is happening again, here and now	0	1	2	3
13	I have no control over the memory	0	1	2	3
14	The memory is disorganized	0	1	2	3

\*Re-experiencing items: 1, 2, 4, 6, 7, 9, 12, 13; Disorganization items: 3, 5, 8, 10, 11, 14.

## References

- American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: American Psychiatric Association.
- Arntz, A., De Groot, C., & Kindt, M. (2005). Emotional memory is perceptual. *Journal of Behavior Therapy and Experimental Psychology*, 36, 19–34.
- Bandelow, B. (1995). Assessing the efficacy of treatments for panic disorder and agoraphobia: the panic and agoraphobia scale. *International Clinical Psychopharmacology*, 10, 73–81.
- Bandelow, B. (1999). *Panic and agoraphobia scale (PAS)*. Ashland, OH, US: Hogrefe & Huber Publishers.
- Berntsen, D. (1998). Voluntary and involuntary access to autobiographic memory. *Memory*, 6, 113–141.
- Berntsen, D., Willert, M., & Rubin, D. C. (2003). Splintered memories or vivid landmarks? Qualities and organization of traumatic memories with and without PTSD. *Cognitive Psychology*, 17, 675–693.
- Birrer, E., Michael, T., & Munsch, S. (2007). Intrusive images in PTSD and in traumatized and non-traumatized depressed patients: a cross-sectional clinical study. *Behaviour Research and Therapy*, 45, 2053–2065.
- Blake, D. D., Weathers, F. W., Nagy, L. M., Kaloupek, D. G., Gusman, F. D., Charney, D. S., et al. (1995). The development of a clinician-administered PTSD scale. *Journal of Traumatic Stress*, 8, 75–90.
- Brewin, C. R. (2001). A cognitive neuroscience account of posttraumatic stress disorder and its treatment. *Behaviour Research and Therapy*, 39, 373–393.
- Brewin, C. R. (2007). Autobiographic memory for trauma: update on four controversies. *Memory*, 15, 227–248.
- Brewin, C. R., Dalgleish, T., & Joseph, S. (1996). A dual representation theory of post traumatic stress disorder. *Psychological Review*, 103, 670–686.
- Candel, I., & Merckelbach, H. (2004). Peritraumatic dissociation as a predictor of posttraumatic stress disorder: a critical review. *Comprehensive Psychiatry*, 45, 44–50.

- Clark, D. A., & Rhyno, S. (2005). Unwanted intrusive thoughts in nonclinical individuals. Implications for clinical disorders. In D. A. Clark (Ed.), *Intrusive thoughts in clinical disorders: Theory, research, and treatment* (pp. 1–29). NY: Guilford Publications.
- Conway, M. A., & Pleydell-Pearce, C. W. (2000). The construction of autobiographical memories in the self-memory system. *Psychological Review*, 107, 261–288.
- Day, S. J., Holmes, E. A., & Hackmann, A. (2004). Occurrence of imagery and its link with early memories in agoraphobia. *Memory*, 12, 416–427.
- Ehlers, A., & Clark, D. M. (2000). A cognitive model of posttraumatic stress disorder. *Behaviour Research and Therapy*, 38, 319–345.
- Ehlers, A., Hackmann, A., & Michael, T. (2004). Intrusive re-experiencing in post-traumatic stress disorder: phenomenology, theory, and therapy. *Memory*, 12, 403–415.
- Ehlers, A., Hackmann, A., Steil, R., Clohessy, S., Wenniger, K., & Winter, H. (2002). The nature of intrusive memories after trauma: the warning signal hypothesis. *Behaviour Research and Therapy*, 40, 995–1002.
- Ehlers, A., Mayou, R. A., & Bryant, B. (1998). Psychological predictors of chronic posttraumatic stress disorder after motor vehicle accidents. *Journal of Abnormal Psychology*, 107, 508–519.
- Engelhard, I., Arntz, A., & Van den Hout, M. A. (2007). Low specificity of post-traumatic stress disorder symptoms: a comparison of patients with post-traumatic stress disorder, patients with other anxiety disorders, and individuals without psychopathology. *British Journal of Clinical Psychology*, 46, 449–456.
- Engelhard, I. M., Van den Hout, M. A., Kindt, M., Arntz, A., & Schouten, E. (2003). Peritraumatic dissociation and posttraumatic stress after pregnancy loss: a prospective study. *Behaviour Research and Therapy*, 41, 67–78.
- Fikretoglu, D., Brunet, A., Best, S., Metzler, T., Delucchi, K., Weiss, D. S., et al. (2006). The relationship between peritraumatic distress and peritraumatic dissociation. *Journal of Nervous and Mental Disease*, 194, 853–858.
- Foa, E. B., Riggs, D. S., Dancu, C. V., & Rothbaum, B. O. (1993). Reliability and validity of a brief instrument for assessing post traumatic stress disorder. *Journal of Traumatic Stress*, 6, 454–473.
- Hackmann, A., Ehlers, A., Speckens, A., & Clark, D. M. (2004). Characteristics and content of intrusive memories in PTSD and their changes with treatment. *Journal of Traumatic Stress*, 17, 231–240.
- Hagenaars, M., Van Minnen, A., & Hoogduin, C. A. L. (2007). Peritraumatic dissociation and PTSD Symptoms: a prospective study. *Journal of Nervous and Mental Disease*, 195, 952–954.
- Hagenaars, M., Van Minnen, A., & Hoogduin, C. A. L. (in press). Reliving the original event: a narrative rating study of PTSD and panic disorder memories. *Journal of Nervous and Mental Disease*.
- Halligan, S. L., Michael, T., Clark, D. M., & Ehlers, A. (2003). Posttraumatic stress disorder following assault: the role of cognitive processing, trauma memory, and appraisals. *Journal of Consulting and Clinical Psychology*, 71, 419–431.
- Holmes, E. A., & Bourne, C. (2008). Inducing and modulating intrusive emotional memories: a review of the trauma film paradigm. *Acta Psychologica*, 127, 553–566.
- Holmes, E. A., Grey, N., & Young, K. A. D. (2005). Intrusive images and “hotspots” of trauma memories in posttraumatic stress disorder: an exploratory investigation of emotions and cognitive themes. *Journal of Behavioral Therapy and Experimental Psychiatry*, 36, 3–17.
- Kindt, M., & Van den Hout, M. (2003). Dissociation and memory fragmentation: experimental effects on meta-memory but not on actual memory performance. *Behaviour Research and Therapy*, 41, 167–178.
- McNally, R. J., & Lukach, B. M. (1992). Are panic attacks traumatic stressors? *American Journal of Psychiatry*, 149, 824–826.
- Marshall, G. N., & Schell, T. L. (2002). Reappraising the link between peritraumatic dissociation and PTSD symptom severity: evidence from a longitudinal study of community violence survivors. *Journal of Abnormal Psychology*, 111, 626–636.
- Michael, T., Ehlers, A., Halligan, S. L., & Clark, D. M. (2005). Unwanted memories of assault: what intrusion characteristics are associated with PTSD? *Behaviour Research and Therapy*, 43, 613–628.
- O’Kearney, R., & Perrott, K. (2006). Trauma narratives in posttraumatic stress disorder: a review. *Journal of Traumatic Stress*, 19, 81–93.
- Ozer, E. J., Best, S. R., Lipsey, T. I., & Weiss, D. S. (2003). Predictors of posttraumatic stress disorder and symptoms in adults: a meta-analysis. *Psychological Bulletin*, 129, 52–73.
- Rauch, S. A. M., Foa, E. B., Furr, J. M., & Filip, J. C. (2004). Imagery vividness and perceived anxious arousal in prolonged exposure treatment for PTSD. *Journal of Traumatic Stress*, 17, 461–465.
- Reynolds, M., & Brewin, C. R. (1998). Intrusive cognitions, coping strategies and emotional responses in depression, post-traumatic stress disorder and a non-clinical sample. *Behaviour Research and Therapy*, 36, 135–147.
- Rubin, D. C., Feldman, M. E., & Beckham, J. C. (2004). Reliving, emotions, and memory fragmentation in the autobiographical memories of veterans diagnosed with PTSD. *Applied Cognitive Psychology*, 18, 17–35.
- Sheehan, D. V., Lecrubier, Y., Sheehan, K. H., Amorim, P., Janavs, J., Weiller, E., et al. (1998). The Mini-International Neuropsychiatric Interview (M.I.N.I.): the development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. *Journal of Clinical Psychiatry*, 59, 34–57.
- Shobe, K. K., & Kihlstrom, J. F. (1997). Is traumatic memory special? *Current Directions in Psychological Science*, 6, 70–74.
- Van der Kolk, B. A., & Fisler, R. (1995). Dissociation and the fragmentary nature of traumatic memories: overview and exploratory study. *Journal of Traumatic Stress*, 8, 505–525.
- Van der Kolk, B. A., Van der Hart, O., & Marmar, C. R. (1996). Dissociation and information processing in posttraumatic stress disorder. In B. A. Van der Kolk, A. A. McFarlane, & L. Weisaeth (Eds.), *Traumatic stress* (pp. 303–330). NY: Guilford.
- Zoellner, L. A., & Bittenger, J. N. (2004). On the uniqueness of trauma memories in PTSD. In G. M. Rosen (Ed.), *Posttraumatic stress disorder: Issues and controversies* (pp. 147–162). Chichester, England: John Wiley & Sons, Ltd.
- Zoellner, L. A., Sacks, M. B., & Foa, E. B. (2001). Stability of emotions for traumatic memories in acute and chronic PTSD. *Behaviour Research and Therapy*, 39, 697–711.