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The organisation and content of trauma memories in survivors of road traffic accidents

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Abstract

We investigated the trauma narratives of 131 road traffic accident survivors prospectively, at 1 week, 6 weeks, and 3 months post-trauma. At 1 and 6 weeks, narratives of survivors with acute stress disorder (ASD) or post-traumatic stress disorder (PTSD) were less coherent and included more dissociation content. By 3 months, their narratives also contained more repetition, more non-consecutive chunks, and more sensory words. Traumatic brain injury was associated with a separate characteristic, confusion, at all three time points. Three aspects of narrative organisation at 1 week—repetition, non-consecutive chunks, and coherence—predicted PTSD severity at 3 months after controlling for initial symptoms. The results suggest both a strong concurrent and predictive relationship between narrative disorganisation and ASD/PTSD but that as people *recover* from ASD, their narratives do not necessarily become less disorganised.

Keywords: PTSD; ASD; Narrative memory; Traumatic brain injury

Introduction

It is often claimed that trauma memories, or narratives, provided by participants diagnosed with post-traumatic stress disorder (PTSD) are disorganised and fragmented when compared to those of trauma victims without this disorder. For example, Halligan, Michael, Clark, and Ehlers (2003) demonstrated disorganisation and fragmentation to be characteristic of PTSD at 3 and 6 months post-trauma in their study of assault victims. In a study of road traffic accident (RTA) victims, Murray, Ehlers, and Mayou (2002) found evidence for a relationship between greater fragmentation of narratives and PTSD severity at 6 months post-trauma. Moreover, Harvey and Bryant (1999) reported that within 1 month post-trauma, RTA survivors with acute stress disorder (ASD) reported more disorganised narratives, relative to RTA survivors without ASD.

It has been suggested that disorganisation maintains PTSD by impeding the processing and resolution of the trauma memory (Ehlers & Clark, 2000; Foa & Rothbaum, 1998). Two types of study are useful in

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evaluating this proposal: (1) the analysis of trauma narratives before and after treatment for PTSD and (2) the analysis of naturalistic change in trauma narratives over time. Two studies have analysed the organisation of trauma narratives pre- and post-treatment. First, as part of exposure therapy, sexual assault victims provided trauma narratives which were coded for fragmentation and disorganisation by independent raters (Foa, Molnar, & Cashman, 1995). Participants who exhibited a decrease in narrative fragmentation over time reported a reduction in trauma-related anxiety, but symptom improvement was not related to a change in disorganisation. In a second study, also of exposure therapy, van Minnen, Wessel, Dijkstra, and Roelofs (2002) found that the narratives of participants whose PTSD symptoms improved became less disorganised, relative to those of non-improvers. However, there was no difference between the narratives of 'improvers' and 'non-improvers' on a separate measure of fragmentation.

In a prospective study (Halligan et al., 2003), individuals provided a trauma narrative and were assessed for PTSD within 3 months of an assault and again at 6 months post-trauma. At both assessments, narrative disorganisation was associated with more severe PTSD. In addition, narrative disorganisation at 3 months post-trauma predicted PTSD symptom severity at 6 months post-trauma. However, in contrast to the treatment studies (Foa et al., 1995; van Minnen et al., 2002), there was no association between decrease in PTSD severity and decrease in narrative disorganisation over time (Halligan et al., 2003).

To summarise these three studies, there is mixed evidence as to the relationship between recovery from PTSD and a change (decrease) in narrative disorganisation. There are at least two possible accounts of this mixed evidence. First, as noted by Halligan et al. (2003), their longitudinal sample showed very little symptom change between the two assessments, in contrast to the large symptom changes found in treatment studies. Second, it is possible that decreased narrative disorganisation following exposure therapy is epiphenomenal, rather than causal, to recovery (van Minnen et al., 2002).

An important limitation of the research conducted thus far is that there have been differences across studies in the measures of fragmentation and disorganisation employed. For example, in Murray et al.'s (2002) study, an expert rated fragmentation on a four point scale ranging from 'very coherent' to 'very incoherent'. Harvey and Bryant (1999) operationalised narrative disorganisation as any evidence of disjointedness, confusion or repetition. Foa et al. (1995) operationalised fragmentation as evidence of repetition of the same utterance, and disorganisation as confusion or disjointed thinking. van Minnen et al. (2002) explored participants' use of disorganised thoughts in their narratives and, like in Foa et al. (1995), took note of repetition in narratives as evidence of fragmentation. Finally, Halligan et al. (2003) employed two measures of disorganisation based on expert ratings. First, evidence of repetition, expressions of uncertainty and non-consecutive chunks were rated. These ratings were then z-transformed and combined to produce an overall disorganisation score. Second, the raters gave each narrative a global rating of coherence, from 'not at all disorganised' 'to extremely disorganised'. In the present study, we aimed to build on previous research by investigating these different indices separately, rather than combining them.

The present study provided an opportunity to clarify the association between narrative disorganisation and recovery from ASD/PTSD. In addition, we have gone further than previous studies by addressing three additional questions. First, the development of trauma narratives from the first week post-trauma across the next 3 months has not yet been investigated. Second, traumatic brain injury (TBI) is a common consequence of trauma (e.g., Harvey, Brewin, Jones, & Kopelman, 2003). In the United States, it is estimated that more than half of brain injuries are caused by RTAs (Kraus & McArthur, 1996). TBI is known to impair the encoding of the trauma memory and is associated with disorientation and confusion (e.g., Grigsby & Kaye, 1993; Schacter & Crovitz, 1977). Hence, it is important to know whether TBI can have the same effects on narrative disorganisation that are ascribed to ASD/PTSD symptomatology. Third, relative to narrative organisation, narrative *content* has received little empirical scrutiny. In one study of trauma narratives written by participants with PTSD, 'flashback periods' were found to comprise high levels of sensory content and emotions such as fear and helplessness, in contrast to non-flashback periods (Hellawell & Brewin, 2004). These findings are consistent with cognitive theories of PTSD that describe the reexperiencing of trauma as being rich in sensory and emotional content (e.g., Brewin, Dalgleish, & Joseph, 1996; Ehlers & Clark, 2000). In another study, participants with PTSD who reported high levels of dissociation at the time of the trauma provided narratives which exhibited more dissociative content, relative to participants who reported low levels of dissociation at the time of the trauma (Zoellner, Alvarez-Conrad, & Foa, 2002). To the best of the authors'

knowledge, there has not been a longitudinal study comparing the content of trauma narratives in trauma survivors with and without PTSD.

The broad aim of the present study was to address the four gaps in knowledge identified. We conducted a cross-sectional and prospective investigation of the organisation and content of narrative memories of trauma. In the cross-sectional investigation, there were two aims. The first was to investigate the narrative organisation and content of participants who were and were not diagnosed with ASD and PTSD. Based on previous research and theory, it was hypothesised that the narrative memories of RTA survivors who were diagnosed with ASD and PTSD would be more disorganised (e.g., Halligan et al., 2003; Harvey & Bryant, 1999; Murray et al., 2002) and exhibit more dissociative, sensory and emotional content (Brewin et al., 1996; Hellawell & Brewin, 2004; Zoellner et al., 2002), relative to participants who were not diagnosed with ASD and PTSD. The second aim was to investigate the trauma narratives of participants who did and did not sustain a TBI. On the basis of the deleterious effects of TBI on memory encoding at the time of the trauma (e.g., Grigsby & Kaye, 1993), it was hypothesised that narratives of participants who sustained a TBI would be more disorganised and exhibit less emotional and sensory content, relative to the narratives of participants who did not sustain a TBI. In the prospective investigation there were two aims. The first aim was an attempt to extend the important finding of Halligan et al. (2003) that narrative disorganisation predicts subsequent PTSD severity: we investigated whether narrative variables assessed as soon as possible post-trauma would predict subsequent PTSD at 3 months post-trauma. The second aim was to address the discrepant findings in the literature concerning the association between recovery from trauma and decrease in narrative disorganisation. We investigated the organisation of narratives in participants who developed chronic PTSD following ASD, compared to a group of participants who recovered from ASD.

Method

Participants

The sample has previously been described in an article that focused on the prevalence of ASD and PTSD symptoms in trauma survivors with and without traumatic brain injury (Jones, Harvey, & Brewin, 2005). Consecutive attendees of the Accident and Emergency Department (A & E) of the John Radcliffe Hospital, Oxford, following a RTA were assessed for their eligibility. The inclusion criteria were: fluent English, age between 18 and 65, medically well enough to take part in an interview within 14 days of the trauma, resident within 30 km of Oxford city centre, post-traumatic amnesia (PTA) of less than 24 h, not under the influence of alcohol or drugs at the time of the RTA (as this confounds the assessment of PTA), not currently receiving medical attention for a pre-existing psychiatric disorder, and the RTA must not have involved a fatality (the latter was a specification of the local ethics committee). Two methods were used to recruit eligible patients. First, those who were discharged from A & E were invited to participate by a letter (RTA-letter interval was 0–3 days) followed by a phone call (RTA-phone call interval was 3–5 days). Second, those who had been admitted to the Trauma Ward from A & E were invited to participate by personal approach (range 1–12 days post-trauma, $M = 5.34$, $SD = 2.59$).

The study recruitment phase started in April, 2002 and ceased in July, 2003. During this period, 824 patients were discharged from A & E following a RTA (first recruitment method), of whom 363 (44.1%) were women and 461 (55.9%) were men. The A & E register indicated that 351 patients were ineligible for the following reasons: too old ($n = 45$), too young ($n = 86$), resident too far from Oxford ($n = 196$), no telephone ($n = 23$), or prison inmate ($n = 1$). The remaining 473 individuals were sent letters of invitation to participate and then telephoned. Of these, 18 further patients were excluded for the following reasons: non-fluent English ($n = 12$), currently receiving medication for pre-existing psychiatric disorder ($n = 1$), and under the influence of alcohol or drugs at the time of the RTA ($n = 5$). Two hundred and twenty-eight patients could not be contacted. Of the remaining 227 patients, 131 (57.7%) declined, leaving 96 patients who agreed to participate (42.3%).

Seventy-eight patients were admitted to the Trauma Ward following a RTA (second recruitment method) of whom 29 were women (37.2%), and 49 were men (62.8%). Thirty-six patients were ineligible for the following reasons: too old ($n = 2$), resident too far from Oxford ($n = 6$), non-fluent English ($n = 3$), under the influence of alcohol or drugs at the time of the RTA ($n = 6$), RTA involved a fatality ($n = 2$), PTA greater than 24 h

($n = 13$) and medically not well enough to be interviewed ($n = 4$). This left 42 eligible patients of whom seven (16.7%) declined, leaving 35 patients admitted to the Trauma Ward who agreed to participate (83.3%).

Therefore, the total sample was 131. Seventy-one were car drivers, 12 passengers, 26 motorcyclists, 13 cyclists, and nine were pedestrians. Participants ranged in age from 18 to 65 (M = 36.75, SD = 12.77). The gender distribution was 39.7% ($n = 52$) male and 60.3% ($n = 79$) female. The mean age of participants in our sample did not differ significantly from the mean age of either patients who were discharged from A & E (M = 34.63, SD = 15.04), or those who were admitted to the Trauma Ward (M = 36.59, SD = 12.70). However, the gender distribution of our sample differed from the gender distribution of patients both who were discharged from A & E (44.1% female), χ^2 (1, $n = 955$) = 12.01, $p < 0.001$, and those who were admitted to the Trauma Ward (37.2% female), χ^2 (1, $n = 209$) = 10.47, $p < 0.001$. The gender distribution of the sample recruited from A & E did not differ from that recruited from the Trauma Ward, nor was there a difference in age between the two streams of recruitment. However, participants from the Trauma Ward were more likely to have sustained a TBI, relative to participants recruited from A & E, χ^2 (1, $n = 131$) = 4.49, $p < 0.05$.

Measures

Acute stress disorder

The presence of ASD was assessed using the Acute Stress Disorder Interview (ASDI; Bryant, Harvey, Dang, & Sackville, 1998). The ASDI is a structured clinical interview based on the ASD criteria specified in the DSM-IV (APA, 1994). It has good test–retest reliability ($r = 0.92$), sensitivity (92%), and specificity (93%) (Bryant et al., 1998). It comprises 19 dichotomously scored items and provides a total score of ASD severity (range = 1–19). The items of the ASDI are organised in accordance with the five clusters of the ASD diagnosis, namely, exposure to trauma, dissociation, reexperiencing, avoidance and arousal.

The assessment of the dissociation symptom cluster of the ASDI was altered in line with previous research (Bryant & Harvey, 1998, 1999; Harvey & Bryant, 2000): we excluded the dissociative amnesia item (*Item B5: have you been unable to recall a certain aspect of the trauma?*) as a possible symptom of ASD because of the direct overlap between this item and the post-traumatic amnesia associated with TBI. TBI was indexed by measuring the duration of the gap in a participant's memory for the RTA (further details included below), and so all participants classified as 'TBI' are necessarily unable to recall a certain aspect of the trauma memory. This exclusion left four items to assess dissociation in the ASDI. To fulfil criteria for the dissociation cluster in this study, participants were required to have reported two out of four, rather than the usual three out of five symptoms. This decision was taken to compensate for the exclusion of dissociative amnesia and to make our findings regarding incidence of ASD comparable to previous research. To summarise, the four items employed to index dissociation were: (1) During/since the accident, have you felt numb or distant from your own emotions? (2) During/since the accident, have you felt less aware of your surroundings? (3) During/since the accident, have things around you felt unreal? (4) During/since the accident, have you felt distant from your normal self or have you felt as though you were looking at yourself from the outside?

Post-traumatic stress disorder

Participants were assessed for the presence of PTSD with the interview version of the PTSD Symptom Scale (PSS; Foa, Riggs, Dancu, & Rothbaum, 1993). The PSS has adequate test–retest reliability (range $r = 0.66-0.77$), and good inter-rater reliability (range $r = 0.93-0.95$; Foa et al., 1993). The PSS comprises 17 items corresponding to the experience of the 17 reexperiencing, avoidance and arousal symptoms outlined in DSM-IV. Each item requires participants to rate the frequency of a particular symptom in the last month, and is scored on a four point scale, from 0 (not at all) to 3 (five or more times per week, almost always). Consistent with the ASDI, the amnesia item from the avoidance cluster of the PSS was excluded as a possible PTSD symptom. To compensate for the exclusion of this item, participants required two out of six, rather than the usual three out of seven symptoms, to fulfil criteria for the avoidance cluster.

Traumatic brain injury

Extent of TBI was indexed by duration of PTA, using the procedure prescribed by Gronwall and Wrightson (1980). Duration of PTA was determined by asking participants "What is the first thing you remember after

the accident?''. The answer is followed by ''And what happened then?'' until the account given reflected a continuous memory, defined as the point from which an individual gave an accurate and ongoing account of happenings in the environment (Symonds & Russell, 1943), marking the end of the PTA period. Those patients who were able to give a wholly continuous account of their RTA, were considered not to have experienced PTA and were classified as 'non-TBI'. Following the most widely used definition from the trauma literature, PTA of less than 24 h constituted a 'mild TBI' (referred to as the 'TBI group'), whereas PTA of more than 24 h indicated that a participant had sustained a more severe TBI (Ameican Congress of Rehabilitation Medicine (ACRM), 1993), and such participants were excluded.

In this study, we focussed only on patients who experienced PTA for less than 24 h for two reasons. First, mild TBI has the highest incidence among the varying severities of TBI (Jennett & McMillan, 1981), which maximised the potential sample size for the study. Second, as an important aspect of the study was capturing the post-traumatic response as soon as possible following trauma, it was not possible to obtain informed consent from individuals experiencing ongoing PTA.

Narrative memory

Participants were given the following instructions, based on Foa et al. (1995), in order to elicit a narrative memory of trauma: 'in a moment I will ask you to tell me about the day of your accident, what you were doing and the events leading up to the accident. Then, I'd like you to tell me about the accident, how you felt, what you saw, everything that you can remember. In other words, I'm going to ask you to relive the day, as if it were happening now, right here, including the accident itself, the preceding and following events, and your experience with medical staff in hospital. I would like you to tell me what happened in as much detail as you remember. This includes details about the surroundings, your activities, how you felt and what your thoughts were during the accident'.

Narrative memories were audiotaped and then transcribed verbatim. Based on previous research, the beginning of the narrative memory was defined as the first expression of danger and the end was defined as an expression that danger had terminated (e.g., Foa et al., 1995; Halligan et al., 2003; Harvey & Bryant, 1999). Narratives were broken up into utterance units, defined as clauses that include only one thought, idea or action (Foa et al., 1995; Harvey & Bryant, 1999).

Independent ratings

Narrative memories were rated for a series of specific constructs. Unless otherwise stated, the narrative constructs described below were coded as 'present' or 'absent' for each utterance unit. Following Foa et al. (1995), as the length of the narratives varied between and within participants, the frequencies with which each narrative construct were present were converted into percentages (of total utterance units).

Narratives were coded for disorganisation using four constructs. First, repetition was coded for when an utterance unit, or a large proportion of an utterance unit, was repeated within the space of five utterance units. Repetition was coded for on the basis that it is ''the most direct index of fragmentation'' (Foa et al., 1995, p. 681). Second, non-consecutive chunks were coded for when utterance units were out of order, or were incongruous with each other (Halligan et al., 2003; Harvey & Bryant, 1999). Third, confusion was coded for when a participant was uncertain about his or her memory for events (Halligan et al., 2003; Harvey & Bryant, 1999). Finally, following Halligan et al. (2003), a global coherence rating was given to each narrative as a whole, ranging from 0 (extremely coherent) to 10 (extremely incoherent). Narratives were also coded for dissociative content. Dissociation was coded as present when an utterance unit indicated that a participant experienced any of the four ASD dissociation items (Harvey & Bryant, 1999).

The coder for the four constructs of disorganisation, and dissociation, was blind to participants' diagnoses and symptom scores. An independent rater was trained to code a random sample of 30 narratives. Pearson's correlations indicated that scores for the two raters showed high agreement; for repetition, $r = 0.85$; for non-consecutive utterance units, $r = 0.89$; for confusion, $r = 0.91$; for the global coherence rating, $r = 0.80$, and for dissociation, $r = 0.92$ (all $ps < 0.0005$).

Objective measure

The sensory and emotional content of narratives was analysed with Linguistic Inquiry and Word Count (LIWC), a software package which provides an objective method for analysing verbal and written text (Pennebaker, Francis, & Booth, 2001). LIWC is designed to analyse text on a word by word basis and to calculate the percentage of words in text that match up to specifically defined dimensions of language in LIWC's database. 'Sensory words' (e.g., see, hear) and 'negative emotion words' (e.g., afraid, threat) were the dimensions of language selected from LIWC's database to index the sensory and emotional content of the trauma narratives.

Procedure

Following written informed consent, participants were interviewed at three time points; as soon as possible after admission (M = 5.98 days, SD = 1.88 days), at approximately 6 weeks (M = 44.03 days, SD = 2.55 days) and at approximately 3 months (M = 94.31 days, SD = 2.91 days) post-trauma. One hundred and thirty-one participants completed the first interview, 118 (90.9%) completed the second interview, and 119 (90.9%) completed the third interview. At the first interview, the ASDI (Bryant et al., 1998) was administered, and all participants were assessed for the presence and extent of TBI. At the second and third interviews, the PSS (Foa et al., 1993) was administered. At all three interviews, participants were asked to provide a narrative memory of trauma, following the instructions detailed already in this section. The first interview yielded 130 narratives (one participant declined to provide a narrative), the second interview yielded 115 narratives (three recordings were inaudible) and the third interview yielded 115 narratives (three recordings were inaudible and there was one equipment failure). All interviews were conducted by a Masters level psychologist (C.J.) trained to administer the ASDI and the PSS by a chartered clinical psychologist with more than 10 years experience in trauma assessment (A.G.H.). All interviews were conducted in participants' homes, with the exception of the first interview of participants who were admitted to the Trauma Ward, which were conducted in hospital.

Results

As reported in more detail by Jones et al. (2005), there were no significant differences between non-TBI and TBI groups in the incidence with which ASD was diagnosed at the first interview, or with which PTSD was diagnosed at the 6 week or 3 month interview.

Cross-sectional analysis

For each of the three interviews, group comparisons in narrative organisation and content were conducted using 2 (Diagnostic Group: ASD/PTSD vs. no ASD/PTSD) × 2 (TBI Status: non-TBI vs. TBI) analyses of variance (ANOVAs), with each of the individual narrative constructs entered as dependent variables. To control for multiple analyses, the alpha level was set at $p<0.01$. Means and standard deviations are displayed in Table 1.

The results showed that soon after the trauma, participants diagnosed with ASD provided narratives characterised by significantly less coherence, $F(1,126)=20.69$, $p<0.001$, and which exhibited more dissociation content, $F(1,126)=16.01$, $p<0.001$, relative to participants not diagnosed with ASD. The narratives of the TBI group were characterised by significantly more confusion, $F(1,126)=12.38$, $p<0.01$, relative to the non-TBI group. At 6 weeks post-trauma, there was a similar pattern of results. Participants diagnosed with PTSD provided narratives characterised by significantly less coherence, $F(1,111)=8.53$, $p<0.01$, and which exhibited more dissociation content, $F(1,111)=12.19$, $p<0.001$, relative to participants not diagnosed with PTSD. The narratives of the TBI group were characterised by significantly more confusion, $F(1,111)=10.19$, $p<0.01$, relative to the non-TBI group. At 3 months post-trauma, the results showed a different pattern. Participants diagnosed with PTSD provided narratives characterised by more repetition, $F(1,111)=10.76$, $p<0.01$, more non-consecutive chunks, $F(1,111)=22.22$, $p<0.001$, less coherence, $F(1,111)=30.43$, $p<0.001$, and which exhibited more dissociation content, $F(1,111)=6.93$, $p<0.01$, and more sensory words, $F(1,111)=14.46$, $p<0.001$, relative to participants not diagnosed with

Table 1
Mean scores for narrative content and organisation variables

	Time 1				Time 2				Time 3			
	Non-TBI		TBI		Non-TBI		TBI		Non-TBI		TBI	
	ASD	Non-ASD	ASD	Non-ASD	PTSD	Non-PTSD	PTSD	Non-PTSD	PTSD	Non-PTSD	PTSD	Non-PTSD
	($n = 13$)	($n = 52$)	($n = 14$)	($n = 51$)	($n = 17$)	($n = 44$)	($n = 17$)	($n = 37$)	($n = 11$)	($n = 50$)	($n = 10$)	($n = 44$)
Negative emotion	1.28 (0.86)	0.99 (0.68)	1.40 (0.85)	1.17 (0.82)	1.52 (0.89)	1.23 (0.79)	1.48 (1.32)	0.92 (0.73)	1.02 (1.04)	1.29 (1.06)	1.71 (1.34)	1.30 (1.01)
Senses	2.65 (1.08)	2.95 (1.28)	3.27 (1.74)	2.34 (1.22)	3.14 (1.23)	2.61 (1.33)	2.65 (1.36)	2.17 (1.29)	3.69 (1.10)	2.52 (1.19)	3.03 (1.90)	1.88 (1.21)
Dissociation	2.50 (2.76)	0.67 (1.64)	2.36 (4.07)	0.56 (1.49)	2.53 (5.00)	0.40 (1.46)	2.62 (4.80)	0.56 (1.72)	1.34 (3.62)	0.71 (1.92)	2.13 (3.04)	0.29 (0.76)
Repetition	2.33 (1.95)	1.09 (2.88)	1.42 (1.48)	1.24 (2.03)	2.80 (4.24)	0.92 (3.79)	1.07 (1.74)	0.91 (2.62)	2.95 (6.90)	0.53 (1.36)	1.78 (1.65)	0.28 (1.31)
Non-consecutive chunks	2.22 (2.56)	1.06 (2.52)	2.01 (2.61)	0.72 (1.66)	1.42 (3.08)	0.68 (1.68)	1.27 (1.82)	0.69 (1.60)	3.74 (6.04)	0.49 (1.07)	1.95 (2.98)	0.23 (0.80)
Confusion	1.77 (2.40)	1.67 (2.67)	4.60 (5.67)	6.70 (7.08)	3.17 (5.54)	1.75 (5.69)	7.42 (8.40)	6.58 (7.66)	1.20 (1.72)	1.40 (3.00)	5.88 (4.79)	5.95 (8.39)
Global coherence	2.54 (1.81)	1.04 (1.08)	2.00 (0.96)	1.22 (1.08)	1.63 (2.06)	0.69 (0.73)	1.38 (1.09)	0.97 (0.88)	2.09 (2.59)	0.52 (0.54)	1.70 (0.95)	0.59 (0.73)

PTSD. Again, the narratives of the TBI group were characterised by more confusion, $F(1, 111) = 10.93$, $p < 0.01$, relative to the non-TBI group. There were no interactions between ASD/PTSD and TBI at any of the three time points.

Inter-correlations between the disorganisation constructs

A series of Pearson's correlations were conducted to investigate the inter-correlations between the four constructs of disorganisation. Soon after trauma, the global coherence construct was positively correlated with repetition, $r = 0.63$, $p < 0.001$, and with non-consecutive chunks, $r = 0.67$, $p < 0.001$. In addition, there was a significant correlation between repetition and non-consecutive chunks, $r = 0.43$, $p < 0.001$. There were no significant correlations between confusion and any of the other three constructs (i.e., global coherence, non-consecutive chunks or repetition). Exactly the same pattern of results was found at 6 weeks and 3 months post-trauma. At 6 weeks post-trauma, the global coherence construct was positively correlated with repetition, $r = 0.59$, $p < 0.001$, and with non-consecutive chunks, $r = 0.56$, $p < 0.001$, and there was a significant correlation between repetition and non-consecutive chunks, $r = 0.28$, $p < 0.01$. At 3 months post-trauma, the global coherence construct was positively correlated with repetition, $r = 0.59$, $p < 0.001$, and with non-consecutive chunks, $r = 0.83$, $p < 0.001$, and there was a significant correlation between repetition and non-consecutive chunks, $r = 0.41$, $p < 0.001$.

Prospective analysis

In view of the minimal differences to have emerged between the non-TBI and TBI groups in the cross-sectional analysis, for the prospective analysis these groups were combined. The narrative construct for which there was a main effect of TBI Status (confusion) was excluded from the prospective analyses.

Do initial narrative variables predict PTSD at 3 months post-trauma?

A series of multiple regression analyses were conducted to investigate the extent to which the narrative variables assessed at the first interview predicted PTSD symptom severity score at 3 months post-trauma. ASD severity was entered into each regression in the first step in order to control for any differences between participants in initial ASD severity. In the second step of each regression, each narrative variable of interest was then added. The results of the regression analyses are shown in Table 2. As shown in Table 2, overall, ASD severity significantly predicted PTSD severity at 3 months post-trauma, accounting for 22% of the variance. Three narrative variables predicted *additional* variance in PTSD severity: repetition of utterance units (11%), non-consecutive chunks (11%) and global coherence (10%). None of the narrative content variables predicted any variance in PTSD symptom severity over and above that predicted by ASD severity.

To investigate the relative contributions to PTSD severity of the variables repetition, non-consecutive chunks and global coherence, we conducted a hierarchical regression analysis. Again, ASD severity was

Table 2
Multiple regression analysis investigating predictors of PTSD severity at 3 months post-trauma

Step 1 (ASD severity)				Step 2 (ASD Severity + Narrative variables)					Change in R^2 with Step 2			
R^2	F	df	p	Narrative variable	R^2	F	df	p	R^2 change	F	df	p
0.22	32.18	1,116	< 0.001	Negative emotion	0.22	15.98	2,115	<0.001	0.00	0.05	1,115	ns
				Senses	0.22	16.49	2,115	<0.001	0.00	0.85	1,115	ns
				Dissociation	0.22	16.58	2,115	<0.001	0.00	0.99	1,115	ns
				Repetition	0.33	27.82	2,115	<0.001	0.11	18.59	1,115	< 0.001
				Non-consecutive	0.33	27.95	2,115	<0.001	0.11	18.78	1,115	< 0.001
				Global coherence	0.31	26.28	2,115	<0.001	0.10	16.18	1,115	< 0.001

Note: ASD = Acute stress disorder. PTSD = Post-traumatic stress disorder.

entered in the first step. Then in the second step, repetition, non-consecutive chunks and global coherence were entered together. The results indicated a model in which non-consecutive chunks accounted for the most additional variance in PTSD severity (11%) after initial ASD severity had been entered in Step 1, $F(1, 115) = 18.78$, $p < 0.001$, followed by repetition (a further 4%), $F(1, 114) = 6.85$, $p < 0.01$. Global coherence did not significantly predict any further variance in PTSD severity.

Is recovery following trauma associated with a decrease in narrative disorganisation?

To address this question, participants were divided into two groups: (1) a 'chronic PTSD' group was defined as participants who were diagnosed with ASD soon after trauma, followed by PTSD at 3 months post-trauma ($n = 10$) and (2) a 'recovered' group which was defined as participants who were diagnosed with ASD soon after trauma, followed by *no* PTSD at 3 months post-trauma ($n = 12$). By way of a validity check on these two new sub-groups, independent *t*-tests indicated that soon after trauma there was no evidence of a difference in ASD severity between the chronic PTSD (M = 13.30, SD = 2.26) and recovered (M = 11.75, SD = 3.11) groups. But at 3 months post-trauma, there was significantly greater PTSD symptom severity in the chronic PTSD group (M = 19.40, SD = 9.08), relative to the recovered group (M = 5.33, SD = 3.60), t (20) = 4.94, $p < 0.001$. A series of repeated measures ANOVAs were conducted with Group (chronic PTSD vs. recovered) as the between subjects variable, Time as the within subjects variable, and each narrative organisation construct as the dependent variable in each ANOVA. As evident in Table 3, there were two main effects of Group ($p < 0.05$), such that the narratives of the chronic PTSD group exhibited significantly more repetition and were rated as significantly less coherent, relative to the narratives of the recovered group. There were two main effects of Time such that across all participants, narratives became shorter in length (total utterance units) and were rated as increasingly coherent, over time. There were no significant interactions between Group and Time.

To determine if this pattern of results would remain the same if we used less strict criteria for defining 'recovered' and 'chronic PTSD' groups, we redefined the two groups as follows: (1) a 'chronic PTSD' group was defined as participants who met criteria for 'PTSD' soon after trauma, except for the 1-month duration criterion (one reexperiencing, two avoidance and two arousal criteria), followed by PTSD at 3 months post-trauma ($n = 12$) and (2) a 'recovered' group which was defined as participants who met criteria for 'PTSD' soon after trauma, followed by *no* PTSD at 3 months post-trauma ($n = 16$). A series of repeated measures ANOVAs using these new groups was conducted. The results were identical to those above with the exception of an additional main effect of Group, such that the narratives of the chronic PTSD group exhibited significantly more non-consecutive chunks, $F(1, 24) = 4.93$, $p < 0.05$, relative to the narratives of the recovered group.

Table 3
Narrative organisation variables in 'chronic PTSD' and 'recovered' groups, at each of the three interviews

Narrative construct	Mean values of narrative constructs				Repeated measures ANOVA		
	Group	Soon after trauma	Six weeks post-trauma	Three months post-trauma	Group (1, 20)	Time (2, 40)	Interaction (2, 40)
Total utterance units	Chronic PTSD	74.40 (41.69)	58.50 (34.84)	51.00 (27.82)	0.01	12.62**	0.03
	Recovered	74.67 (37.00)	57.67 (40.98)	49.00 (29.90)			
Repetition	Chronic PTSD	2.71 (1.88)	3.53 (2.92)	3.49 (7.15)	4.38*	0.13	0.63
	Recovered	1.32 (1.59)	1.07 (2.22)	0.39 (0.76)			
Non-consecutive chunks	Chronic PTSD	2.50 (2.47)	2.51 (3.26)	3.12 (4.20)	2.88	1.26	1.66
	Recovered	2.39 (2.94)	0.39 (0.75)	1.02 (1.65)			
Global coherence	Chronic PTSD	2.70 (1.83)	2.40 (1.90)	2.30 (1.89)	3.98*	6.86**	1.12
	Recovered	1.92 (1.08)	1.17 (0.83)	1.00 (0.43)			

Note: ASD = Acute stress disorder. PTSD = Post-traumatic stress disorder. Mean percentage values are presented with standard deviations in parentheses.
*$p < 0.05$. **$p < 0.01$.

Discussion

Survivors of road traffic accidents ($N = 131$) provided narrative memories of their trauma soon after, at 6 weeks, and at 3 months post-trauma. We conducted a cross-sectional and prospective investigation of the organisation and content of the trauma narrative in participants who were and were not diagnosed with ASD and PTSD, and who did and did not sustain a TBI. This study was the first to investigate the content and organisation of trauma narratives in the first 3 months post-trauma.

In the cross-sectional investigation, the first aim was to investigate the trauma narratives of participants who were and were not diagnosed with ASD and PTSD. The results indicated that participants who were diagnosed with ASD at the first interview and with PTSD at the second and third interviews provided narratives which were rated as less coherent and which, at the third interview, exhibited more repetition and non-consecutive chunks, relative to the narratives of participants not diagnosed with ASD or PTSD. These findings support previous research linking ASD and PTSD to disorganisation in trauma narratives (e.g., Halligan et al., 2003; Harvey & Bryant, 1999). In terms of narrative content, at all three interviews, participants diagnosed with ASD or PTSD provided narratives which exhibited more dissociation, relative to the narratives of participants not diagnosed with ASD or PTSD, consistent with previous research (Harvey & Bryant, 1999; Zoellner et al., 2002). In addition, at the third interview, the narratives of participants diagnosed with PTSD exhibited more sensory words, relative to the narratives of participants not diagnosed with PTSD. These findings are consistent with the idea that some trauma-related symptoms are normative immediately following a severe event but remit over the next few months except in those who go on to suffer from chronic PTSD (Brewin, 2003; Brewin et al., 1996). Taken together, those results suggest that differences in trauma narratives between individuals who do or do not suffer from ASD/PTSD are more limited immediately post-trauma and emerge more clearly as symptoms gradually subside in the healthy group.

The second aim of the cross-sectional investigation was to investigate the trauma narratives of participants who did and did not sustain a TBI. At all three interviews participants who sustained a TBI provided narratives that exhibited more confusion, relative to the non-TBI group. 'Confusion' was coded for in trauma narratives when an utterance unit indicated that a participant was uncertain about his or her memory for events. This finding is consistent with the proposal that PTA involves a period of disorientation and an impairment to the encoding of information into memory (e.g., Grigsby & Kaye, 1993) and extends previous research by suggesting a role for TBI in producing this one specific source of disorganisation in narrative memory. However, TBI was not associated with the other three indices of disorganisation employed in the current study. In addition, it is interesting that confusion was the only construct which was not significantly correlated with any of the other three constructs of disorganisation, suggesting that confusion may be a specific type of disorganisation, whereas the other three constructs showed a clear overlap. Halligan et al. (2003) employed a *combination* of non-consecutive chunks and confusion as an index of narrative disorganisation. Our findings suggest that non-consecutive chunks and confusion are perhaps better considered as separate indices of narrative organisation. TBI was not associated with narrative content, contrary to our hypothesis based on Schacter and Crovitz (1977) that narratives of participants who sustained a TBI would reflect a degraded content indicative of an impaired memory at the time of the trauma. One possible explanation for this discrepancy is that in recounting the events of the trauma, participants with an impaired memory may extend their own fragments with information obtained from police or witness reports (e.g., Rynearson & McCreery, 1993).

In the prospective analyses, the first aim was to investigate if narrative variables assessed as soon as possible post-trauma predicted PTSD severity at 3 months post-trauma. The results showed that, after controlling for initial differences in ASD severity, the narrative variables repetition, non-consecutive chunks and global coherence all significantly predicted PTSD severity at 3 months post-trauma. An additional hierarchical regression indicated that non-consecutive chunks may predict the most variance in PTSD severity, followed by repetition. These findings extend those of Halligan et al. (2003) who found that narrative disorganisation within the first 3 months post-trauma predicted PTSD severity at 6 months post-trauma.

The second aim was to investigate the organisation and content of trauma narratives in a 'chronic PTSD' group and a 'recovered' group of participants. It is recognised that the number of participants in the chronic PTSD ($n = 10$) and recovered ($n = 12$) groups was low. However, these sample sizes compared favourably

with the two previous studies which investigated the relationship between narrative disorganisation and recovery from trauma (Foa et al., 1995; van Minnen et al., 2002). In addition, we reanalysed the data using less strict criteria for defining the 'chronic PTSD' and 'recovered' groups and a similar pattern of results was found. Across the three interviews, the narratives of the chronic PTSD group included more repetition and were rated as less coherent, relative to those of the recovered group. Again, these findings support previous research linking disorganisation in narratives to the development of chronic PTSD (e.g., Foa et al., 1995; Halligan et al., 2003). Across all participants, narrative memories became significantly more coherent over time, consistent with previous research (e.g., van Minnen et al., 2002). In addition, across all participants, narrative memories became significantly shorter over time. It is possible that as narratives become more coherent, redundant information is omitted resulting in shorter narratives. However, no evidence was found in support of an *interaction* between Group and Time for indices of narrative disorganisation. In other words, there was no evidence that narrative disorganisation decreased over time in the recovered group, relative to the chronic PTSD group. These findings are consistent with the naturalistic follow-up study of Halligan et al. (2003), but are inconsistent with the treatment studies of Foa et al. (1995) and van Minnen et al. (2002), which reported an association between recovery from PTSD and decrease in narrative disorganisation. It is possible that the findings of these latter authors were due to a side effect of repeated re-telling of the narrative during exposure therapy (i.e., epiphenomenal), rather than being causally implicated in recovery, as pointed out by van Minnen et al. (2002). In terms of narrative content, there were no differences between the narratives of participants in the chronic PTSD and recovered groups.

It is perhaps worth clarifying the association between narrative disorganisation and ASD, PTSD and recovery. We have presented evidence that suggests both a strong concurrent and predictive relationship between narrative disorganisation and ASD/PTSD. Despite this, our findings suggest that as people *recover* from ASD, their narratives do not necessarily become less disorganised.

The conclusions that can be drawn from this study are restricted by a number of important limitations. First, we acknowledge that there may be a concern regarding generalisability from our sample. For example, many patients could not be contacted or refused to participate in the study, and there was a difference in gender distribution between our sample and the whole RTA population. However, we note that our study sample was matched on age to the RTA population as a whole. Also, not surprisingly, there was a difference in the rate of TBI between participants recruited from A & E and participants recruited from the Trauma Ward. It is recognised that our findings cannot be generalised to patients who sustain severe TBI (PTA of more than 24 h), where a more lengthy period of amnesia or organic neurological damage might influence the post-traumatic response (see, Bryant, 2001). We also acknowledge that there were other factors, not assessed in this study, such as the experience of previous trauma or ongoing litigation, which may have influenced the post-traumatic response. In addition, it is possible that a selection bias may have influenced the representativeness of our sample. Second, we excluded the amnesia item from both the ASDI and PSS due to the difficulty distinguishing between amnesia due to TBI and amnesia due to dissociation. We acknowledge that we cannot totally rule out the possibility that the four remaining ASDI items designed to assess dissociation are overlapping with TBI, and this issue remains a predicament to researchers in this field. Third, we recognise that at least two alternative accounts of the findings reported here might be possible: trauma survivors may be "just as inarticulate about neutral and positive experiences" (p. 135; McNally, 2003), and differences in coherence or readability between participants' narratives may reflect underlying differences in verbal intelligence (Ehlers, Hackmann, & Michael, 2004). These possibilities should be explored in future research. Finally, we are aware that we conducted multiple comparisons in this study, which may have contributed to a high level of experimenter-wise statistical error. However, as noted by Perneger (1998), the expected experimenter-wise error rate is attenuated by conducting correlated, as opposed to uncorrelated, comparisons.

In conclusion, this paper has reported that ASD, chronic PTSD and TBI are associated with different patterns of disorganisation in narrative memory of trauma. Narrative disorganisation soon after trauma predicts PTSD severity at 3 months post-trauma. However, no evidence was found to support the proposal that recovery from ASD is specifically associated with a decrease in the extent to which narrative memory is disorganised.

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References

American Congress of Rehabilitation Medicine. (1993). Definition of mild traumatic brain injury. *Journal of Head Rehabilitation*, *8*, 86–87.

Brewin, C. R. (2003). *Posttraumatic stress disorder: Malady or myth?*. New Haven: Yale University Press.

Brewin, C. R., Dalgleish, T., & Joseph, S. (1996). A dual-representation theory of posttraumatic stress disorder. *Psychological Review*, *103*, 670–686.

Bryant, R. A. (2001). PTSD and traumatic brain injury: Can they coexist? *Clinical Psychology Review*, *21*, 931–948.

Bryant, R. A., & Harvey, A. G. (1998). Relationship between acute stress disorder and posttraumatic stress disorder following mild traumatic brain injury. *American Journal of Psychiatry*, *155*(5), 625–629.

Bryant, R. A., & Harvey, A. G. (1999). Postconcussive symptoms and posttraumatic stress disorder after mild traumatic brain injury. *Journal of Nervous and Mental Disease*, *187*(5), 302–305.

Bryant, R. A., Harvey, A. G., Dang, S. T., & Sackville, T. (1998). Assessing acute stress disorder: Psychometric properties of a structured clinical interview. *Psychological Assessment*, *10*, 215–220.

Ehlers, A., & Clark, D. M. (2000). A cognitive model of post-traumatic stress disorder. *Behaviour Research and Therapy*, *38*, 319–345.

Ehlers, A., Hackmann, A., & Michael, T. (2004). Intrusive reexperiencing in posttraumatic stress disorder: Phenomenology, theory and therapy. *Memory*, *12*, 403–415.

Foa, E. B., Molnar, C., & Cashman, L. (1995). Change in rape narratives during exposure therapy for posttraumatic stress disorder. *Journal of Traumatic Stress*, *8*(4), 675–690.

Foa, E. B., Riggs, D. S., Dancu, C. V., & Rothbaum, B. O. (1993). Reliability and validity of a brief instrument for assessing posttraumatic stress disorder. *Journal of Traumatic Stress*, *6*, 459–473.

Foa, E. B., & Rothbaum, B. O. (1998). *Treating the trauma of rape: Cognitive-behavioral therapy for PTSD*. New York: Guilford Press.

Grigsby, J., & Kaye, K. (1993). Incidence and correlates of depersonalisation following head trauma. *Brain Injury*, *7*, 507–513.

Gronwall, D., & Wrightson, P. (1980). Duration of posttraumatic amnesia after mild head injury. *Journal of Clinical Neuropsychology*, *2*, 51–60.

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*(3), 419–431.

Harvey, A. G., & Bryant, R. A. (1999). A qualitative investigation into the organisation of traumatic memories. *British Journal of Clinical Psychology*, *38*, 401–405.

Harvey, A. G., & Bryant, R. A. (2000). Memory for acute stress disorder symptoms: A two year prospective study. *Journal of Nervous and Mental Disease*, *188*, 602–607.

Harvey, A. G., Brewin, C. R., Jones, C., & Kopelman, M. D. (2003). Coexistence of posttraumatic stress disorder and traumatic brain injury: Towards a resolution of the paradox. *Journal of the International Neuropsychological Society*, *9*(4), 663–676.

Hellawell, S. J., & Brewin, C. R. (2004). A comparison of flashbacks and ordinary autobiographical memories of trauma: Content and language. *Behaviour Research and Therapy*, *42*(1), 1–12.

Jennett, B., & McMillan, R. (1981). Epidemiology of head injury. *British Medical Journal*, *282*, 101–104.

Jones, C., Harvey, A. G., & Brewin, C. R. (2005). Traumatic brain injury, dissociation, and posttraumatic stress disorder in road traffic accident survivors. *Journal of Traumatic Stress*, *18*, 181–191.

Kraus, J., & McArthur, D. (1996). Epidemiology of brain injury. In R. Evans (Ed.), *Neurology and Trauma* (pp. 3–17). Philadelphia: Saunders.

McNally, R. J. (2003). *Remembering Trauma*. Cambridge: Harvard University Press.

Murray, J., Ehlers, A., & Mayou, R. A. (2002). Dissociation and post-traumatic stress disorder: Two prospective studies of road traffic accident survivors. *British Journal of Psychiatry*, *180*, 363–368.

Pennebaker, J. W., Francis, M. E., & Booth, R. J. (2001). *Linguistic inquiry and word count*. Mahwah, NJ: Erlbaum.

Perneger, T. V. (1998). What's wrong with Bonferroni adjustments? *British Medical Journal*, *316*, 1236–1238.

Rynearson, E. K., & McCreery, J. M. (1993). Bereavement after homicide: A synergism of trauma and loss. *American Journal of Psychiatry*, *150*, 258–261.

Schacter, D. L., & Crovitz, H. F. (1977). Memory function after closed head injury: A review of the quantitative research. *Cortex*, *13*, 150–176.

Symonds, C. P., & Russell, W. R. (1943). Accidental head injuries: Prognosis in service patients. *Lancet*, *1*, 7–10.

van Minnen, A., Wessel, I., Dijkstra, T., & Roelofs, K. (2002). Changes in PTSD patients' narratives during prolonged exposure therapy: A replication and extension. *Journal of Traumatic Stress*, *15*(3), 255–258.

Zoellner, L. A., Alvarez-Conrad, J., & Foa, E. B. (2002). Peritraumatic dissociative experiences, trauma narratives, and trauma pathology. *Journal of Traumatic Stress*, *15*, 49–57.