

# Integration and Organization of Trauma Memories and Posttraumatic Symptoms

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*To examine the connection between trauma memory integration in personal memory, memory organization, and posttraumatic symptom severity, 47 trauma-exposed adults undertook an event-cuing task for their trauma memory and for a memorable nontraumatic negative event. Measures of integration provided by self-endorsement, rated by naïve judges, or calculated from the language of the memories, did not significantly predict posttraumatic stress disorder symptom severity after adjusting for age, time since the event, anxiety when disclosing, familiarity of the memory, and integration of nontrauma memory. Less use of casual connectives in the trauma memory narrative was associated with higher trauma-related avoidance ( $r = .33$ ;  $p = .03$ ), whereas self-rating of the trauma memory as disorganized was associated with higher overall symptom severity ( $r = .42$ ;  $p = .006$ ).*

There are divergent views about the connection between posttraumatic adjustment and how the memory for the trauma is integrated within autobiographical memory. Some (Ehlers & Clark, 2000; Foa & Rothbaum, 1998) propose that isolation of memories of the trauma from other personal memories is critical in the maintenance of symptoms. Ehlers and Clark (2000) argue that in posttraumatic stress disorder (PTSD) “one of the main problems is that the trauma memory is poorly elaborated and inadequately integrated into its context in time, place, subsequent and previous information and other autobiographical memories” (p. 325). Others (Berntsen & Rubin, 2007; Berntsen, Willert, & Rubin, 2003) argue that trauma memories can act as landmarks in autobiographical memory and “rather than poorly integrated...traumatic memory stays highly accessible and may form a cognitive reference point for the organisation of autobiographical knowledge” (Berntsen & Rubin, 2007, p. 418). For people with PTSD, the trauma memories are central components of autobiographical memory.

Findings cited for the claim that inadequate integration relates to poor adjustment include observations that memory for the trauma in PTSD is dominated by perceptual and sensory impressions (Hellawell & Brewin, 2002), is disorganized (Jones, Harvey,

& Brewin, 2006; Jelinek, Randjbar, Seifert, Kellner, & Mortiz, 2009), lacks a temporal perspective (Hellawell & Brewin, 2002), and is less conceptually connected (Ehlers, Hackmann, & Michael, 2004; Krans, Näring, Holmes, & Becker, 2009). It has not, however, been shown that these characteristics of the trauma memory itself means that it is isolated within autobiographical memory. The evidence for the landmark view comes from several studies showing that self-report Centrality of Events Scale scores are positively related to severity of PTSD symptoms (Berntsen & Rubin, 2007, 2006). Given this disparity in views, and the limitations of memory self-reports (Kindt & van den Hout, 2003), we believe it is critical to develop multimethod approaches to assess the link between trauma memory integration within autobiographical memory and PTSD symptoms.

We know of only one experimental study that has examined this connection. Kleim, Wallott, and Ehlers (2008) asked assault victims with and without PTSD questions from the Autobiographical Memory Inventory while they undertook script-driven imagining of the assault and another negative event. Kleim et al. (2008) found that those with PTSD took significantly longer to retrieve autobiographical memories during the most disturbing parts in their trauma script than during hot spots of the negative event script. The participants with PTSD were also significantly slower in responding during trauma memory than those without PTSD. The results indicated disruption in speed of memory responses during trauma memory hot spots for those with PTSD. It is not certain, however, that slower responses to the inventory imply poor integration of the trauma memory into autobiographical memory. Inventory response slowing may reflect additional cognitive resources required by the PTSD group to inhibit their trauma remembering or

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factors such as between-group differences “in physiological arousal or transitory attention” (Klein et al., 2008, p. 232) during the hot spots.

The current study provides an additional direct examination of the link between posttraumatic stress symptoms and trauma memory integration. We use the method of event cueing, which assesses whether specific event memories are embedded in structures that organize autobiographical information into clusters of related events (Brown, 2005; Brown & Schopflocher, 1998). In event cueing, participants first narrate a specific personal event memory that is used to cue a second autobiographical memory. Participants then indicate how the cueing and cued narratives are related by endorsing relationship domains, i.e., one event was part of the other, both part of a larger story, both have same theme, or they took place in the same location, involved the same people, describe the same activity, or same period (Brown & Schopflocher, 1998). The relationship endorsement task is used to classify memory pairs into those which are subsumed or integrated within a larger autobiographical structure (general story, theme), and pairs that are not integrated (only share specific components, e.g., people, location, time). The classification is consistent with approaches to personal memory that propose organizing structures within autobiographical memory such as themes (Conway, 2005; Conway & Pleydell-Pearce, 2000), self-narratives (Robinson & Taylor, 1998) or narrative episodes (Radvansky, Copeland, & Zwaan, 2005). From this perspective, integration is understood as how well the memory system incorporates specific event memories into the larger structure (Conway, 2005). An event memory that is integrated will be more likely than a nonintegrated memory to cue another personal event related by theme or story. The event-cueing task, therefore, provides a face-valid way to assess how the integration of the trauma memory in autobiographical memory relates to PTSD symptoms.

Two other methods are added here to assess integration of the memory pair generated from the cueing task. The first of these is naïve judges' ratings of the degree of relationship between the pair of narratives in the relationship domains. The second is a measure of the semantic similarity between the two narrative memories using latent semantic analysis. Latent semantic analysis is a statistical characterization of narrative to narrative relations using participants' word choice and provides an index of the strength of their semantic similarity (Landauer, Foltz, & Laham, 1998). This triangulation of methods provides a categorical measure of whether the cued and cueing memories are integrated (self-endorsement), a continuous measure of the degree to which the pairs are integrated (judges' ratings), and a continuous measure of the strength of the semantic similarity between the two narratives.

Besides inadequate integration, the deficit view proposes that a disorganized quality of the trauma memory itself predicts PTSD symptom severity (Ehlers et al., 2004). Memory organization refers to the internal, structural integrity of the memory itself regardless of its integration within autobiographical memory. When critically appraised, the evidence about the association of trauma memory

organization and PTSD symptoms is inconclusive (O'Kearney & Perrott, 2006; Rubin, 2011). The inconsistency arises in part from the considerable heterogeneity in the definition and measurement of disorganization. Studies have used self-report as well as memory narrative coding and judges' ratings. The measures often combine incongruent understandings of narrative (dis)organization. For example, Evans, Ehlers, Mezey, and Clark's (2007) global rating of disorganization ask judges to combine how well the narrative is organized as a sequence of events (temporal organization) with how much detail the narrative has without separate consideration of the role of detail in the overall measure of organization. Similarly, some narrative coding schemes measure disorganization by combining repetitions in the narrative with well-formed expressions of uncertainty (disorganized thoughts) and expressions indicating lack of understanding (organized thoughts—reversed). Repetitions in narratives may indicate discontinuity, but can also be used to emphasize or to conceal thoughts or emotions. In addition, although expressions of uncertainty (“I don't remember. . .”; “I don't know. . .”) indicate cognitive confusion (a semantic distinction) they can be well organized, i.e., a person can describe their uncertainty about what happened in an organized way. A deficit in organized thoughts on the other hand is judged by the paucity of syntactic connection within the trauma narrative.

The current study uses measures of disorganization informed by knowledge of the formal organization of personal event narratives (Graesser, McNarama, Louwerse, & Cai, 2004; Petersen & McCabe, 1983). From this vantage (dis)organization is understood as reflected in two language domains: narrative cohesion and narrative coherence. Cohesion focuses on objective linguistic structures or connections between sentences or clauses and is a direct linguistic measure of the narrative organization. The current study focuses on linguistic devices (connectives) that establish spatiotemporal and causal cohesion. These conjunctions organize sentences and clauses within a narrative via addition (and, also), comparison (but, however), temporality (after, before, when), and causality (so, because, that is). Coherence, on the other hand, focuses on discourse about participants' understanding of goals, actions, and outcomes, or topics within the narrative and depends on the knowledge that the participants bring to the situation (Graesser et al., 2004). It is assessed here by judge's rating. We have previously found that the narrative cohesion measured by the proportion of temporal and causal connectives within the trauma narrative was related to higher levels of intrusive symptoms in children and youth after an accident requiring hospitalization (O'Kearney, Speyer, & Kenardy, 2007).

The present study has two aims. First, it examines the relationship between PTSD symptom severity and the integration of the trauma memory using three indices of integration from the event-cueing task: self-endorsement of memory pairs as integrated, judges' integration rating of the pairs, and their semantic similarity. Second, the study assesses the relationship between PTSD symptom severity and trauma memory organization using

measures of narrative organization: participants' self-report of memory disorganization; the proportion of additive, comparative, temporal, and causal connectives in the narratives; and the rating of the narratives' coherence by naïve judges.

## METHOD

### Participants and Procedure

The study was approved by the Australian National University Human Research Ethics Committee. The sample comprised 47 fluent English speakers (9 men) who reported exposure to a traumatic event meeting *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., *DSM-IV*; American Psychiatric Association, 1994) Criterion A and who did not have a history of psychoses, head injury with loss of consciousness, drug or alcohol addiction, or any neurological disorder. Trauma types included witnessing the death of family member/friend (15/47; 31.9%), diagnosis of a severe illness (8/47; 17.0%), accident or disaster (9/47; 19.1%), sexual assault (7/47; 14.9%), nonsexual assault (5/47; 10.6%), and exposure to war-like combat (1/47; 2.1%). The mean age of participants was 22.83 ( $SD = 8.19$ ).

Participants were seen individually and asked to nominate a significant traumatic event they have experienced and then complete the Impact of Event Scale (IES) in regard to this event. They then undertook the narrative generation and event-cueing tasks for two types of memories: (a) the IES traumatic event, and (b) a nontraumatic but negative personal event. Participants were given the following instructions adapted from Jones et al. (2006): "In a moment I'm going to ask you to recall the traumatic event. Please describe the memories of the event as vividly as possible. I'd like you to close your eyes and tell me what happened in as much detail as you remember as if it were happening right now. This includes details about the surroundings, your activities, how you felt and what your thoughts were during the event." For the nontraumatic event, participants were given the same instructions except introduced by: "In a moment I'm going to ask you to recall a negative memorable event that happened to you." An audiotape of the narrative was replayed to the participant and participants were asked, using the same narrative generation instructions, to describe another memory "somehow related" to the cueing event. After the administration of a WAIS-III vocabulary test, the event generation and event-cueing procedure was repeated for the other event type (trauma or nontrauma). The order of generation of narrative event type was counterbalanced across participants.

After each event-cueing task, participants nominated whether the cueing and cued events were related in regard to two categories: integrated (one was part of the other; both were part of a broader event, story, or theme); not integrated (events only share the same people, activity, location, time). Participants were asked to date each event and rate each on a 5-point scale of personal importance

(1 = *not important at all* to 5 = *extremely important*). Participants then completed the remainder of the self-report measures.

### Measures

Memory narratives were transcribed and total number of words and utterances, defined as a language unit conveying meaning, were calculated. A judge blind to the study's aims and to the PTSD symptom severity of participants rated the overall strength of similarities (1 = *not at all* to 5 = *extremely similar*) between narrative pairs for the integrated relationship (one was part of the other; both were part of a broader event, story, or theme). A second naïve judge rated 30% of narrative pairs. Agreement between the judges was acceptable (one-way layout intraclass coefficient = .79).

The measure of narrative pairs' semantic relatedness was generated using pair wise latent semantic analysis (LSA). Term-to-term semantic similarity for the two texts for each pair was estimated using latent semantic analysis software (Latent Semantic Analysis @ CU Boulder, 2010). Higher scores indicate stronger semantic similarity.

The largest class of cohesive devices is connectives, which link sentences and clauses via addition (e.g., and, also), comparison (e.g., but, however), temporality (e.g., after, before, now), and causality (e.g., so, because). The number of references in each category (additive, comparative, temporal, causal) was converted to a proportion of total number of connectives. Some words (e.g., and) serve additive or temporal functions. In such cases, the narrative context was used to determine the function. A second judge scored 25% of the narratives. There was agreement between the two judges in the proportion of connectives identified:  $r = .82$  for additive,  $r = .94$  for comparative,  $r = .91$  for temporal, and  $r = .90$  for causal.

Narrative coherence was rated by a naïve judge on a 6-point scale using standard criteria (Petersen & McCabe, 1983): (1) Disoriented—the narrative is too disoriented for the listener to understand; (2) Impoverished—the narrative consists of too few sentences for a pattern to be recognized; (3) Chronological—the narrative is a simple description of consecutive, successive events; (4) Leap-frogging—the narrative moves from one event to another connecting later segments to earlier ones within an integrated experience; (5) Ending-at-the-high-point—the narrative builds up to a high point and then ends, but there is no resolution; (6) Mature—the narrative builds to a high point, dwells on it, and then resolves it. Agreement between judges for coherence ratings was acceptable, one-way layout ICC = .72.

The Disorganization subscale of the Trauma Memory Questionnaire (TMQ; Halligan, Michael, Clark, & Ehlers, 2003) was used to measure self-reported disorganization of the trauma memory. In the current study  $\alpha = .93$ .

The severity of PTSD symptoms overall was assessed with the Posttraumatic Stress Diagnostic Scale using the specific trauma

(PDS; Foa, 1995). In the current study, PDS had high internal consistency for the total severity score ( $\alpha = .90$ ). Severity of trauma-specific intrusive and avoidant symptoms related to the specific trauma were measured using the Impact of Event Scale (IES; Horowitz, Wilner, & Alvarez, 1979). The IES in the current study had acceptable internal consistency ( $\alpha = .76$  for Intrusion and  $\alpha = .75$  for Avoidance).

The Depression subscale (14 items) of the Depression Anxiety Stress Scale (DASS; Lovibond & Lovibond, 1993) was used to assess current depression severity. Internal consistency in the current study was  $\alpha = .92$ .

The Confidence, Familiarity, and Anxiety in Disclosing measure developed for this study required participants to endorse on a 5-point Likert scale single items assessing level of confidence in the completeness of their memories, frequency of previous recountings of the trauma (familiarity), and anxiety when disclosing the memory during the event-cuing task. This measure is available from the first author.

The Vocabulary subtest of the Wechsler Adult Intelligence Scale-Third Edition (WAIS-III; Wechsler, 1997) was used to assess verbal abilities. Participants were required to define a series of orally presented words of ascending difficulty until all words in the list were defined or until six successive words were answered incorrectly or not at all. The Vocabulary subtest had a reliability in this study of  $\alpha = .83$ .

## Data Analyses

Hierarchical multiple regression analyses were used to test whether the measures of the integration of the trauma memory could predict PTSD symptom severity. Separate models were investigated for overall severity and for severity of intrusive and avoidant symptoms. The three measures of trauma memory integration were included in the model as well as variables with modest ( $p < .1$ ) first-order association with at least one PTSD symptom severity measure were included. The first step of the model included time since trauma, age, anxiety when disclosing the trauma, and familiarity. In the second step, nontrauma narrative pair semantic similarity score was added. In the final step, trauma memory integration measures were entered. A second set of hierarchical multiple regression analyses tested whether the measures of trauma memory organization could predict severity of PTSD symptoms overall and intrusive and avoidance symptoms. Measures of trauma memory organization and other variables were included in the model if they had modest ( $p < .1$ ) first-order association with one PTSD symptom measure. List-wise deletion of variables was used to deal with missing variables on participants' self-report measures.

## RESULTS

Severity of PTSD symptoms on the PDS ranged from 1 to 45 with a mean score of 13.0 ( $SD = 9.9$ ). The mean score on the

Intrusion subscale for the trauma event on the IES was 13.96 ( $SD = 7.29$ ); the mean Avoidance subscale score was 15.70 ( $SD = 9.43$ ). The participants had a mean DASS depression score of 7.98 ( $SD = 6.44$ ) and a mean TMQ Disorganization score of 7.38 ( $SD = 5.98$ ). The mean WAIS-III Vocabulary scaled score for the participants was 13.51 ( $SD = 2.40$ ).

Table 1 presents participant and narrative characteristics. The trauma event was significantly more distant in time than the non-trauma event and had more words and utterances. Participants rated their trauma memory as significantly more important, that they had significantly less confidence in the completeness of their trauma memory, and had significantly more anxiety when disclosing the trauma event. There was no significant difference between narratives on self-endorsement, but trauma narrative pairs were judged as significantly more integrated and were significantly more semantically similar. The narratives did not differ significantly on judged coherence, but the trauma narrative had a statistically significant lower proportion of additive cohesive markers and higher proportion of comparative markers.

Correlations between posttraumatic stress symptom severity, depression, participant factors, trauma narrative characteristics, confidence, familiarity, and anxiety in disclosing scale, measures of integration of the trauma pair, and measures of organization of the trauma narrative are presented in Table 2. The PTSD symptom measures show strong positive association with one another and with depression. Age and anxiety when disclosing the trauma had moderate to strong positive associations with symptom severity as well as with the proportion of temporal markers in the narrative. Familiarity had a moderate negative correlation with avoidant symptoms and confidence in the memory a moderate negative correlation with depression. Confidence in reporting was associated with lower self-reported disorganization (TMQ) and moderately with judge's rating of the coherence of the trauma narrative. Self-reported trauma memory disorganization showed a significant moderate positive association with the degree to which the trauma pair was rated as integrated. TMQ Disorganized score was also positively related to semantic similarity score for the trauma pairs.

Judges' rating of integration of the trauma pairs were moderately and significantly correlated with the trauma pair's semantic similarity scores. In addition, trauma memory pairs endorsed by the participants as integrated were rated by the judges as significantly more integrated, Integrated  $M = 3.79$ ,  $SD = 1.00$ ; Non-integrated  $M = 2.37$ ,  $SD = .67$ ,  $t(44) = 4.01$ ,  $p < .001$ . They were also significantly higher on semantic similarity, Integrated  $M = .99$ ,  $SD = .005$ ; Nonintegrated  $M = .98$ ,  $SD = .006$ ,  $t(44) = 2.28$ ,  $p = .01$ . The measures of integration showed little association with PTSD symptom severity and depression. The TMQ disorganization was moderately associated with overall symptom severity and depression, but only weakly with severity of avoidant symptoms and not with intrusive symptoms. Participants' use of fewer casual connectives in their trauma narrative was

**Table 1.** Characteristics of Trauma and Nontrauma Narratives

Variable	Trauma narrative		Nontrauma narrative		<i>t</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Months since narrative event	54.24	45.81	14.39	12.01	65.87**
Importance of narrative event	4.81	0.50	4.09	0.97	4.89**
Confidence in memory	3.83	1.01	4.28	0.90	-2.49*
Familiarity	2.96	1.14	3.02	1.11	-0.25
Anxiety in disclosing event	3.23	0.98	1.23	0.52	14.35**
Word count	670.32	417.37	426.28	312.71	4.06**
Total number of utterances	69.04	46.09	42.85	28.12	3.91**
Prop (%) integrated	36/47	(76.6)	29/47	(61.7%)	$\chi^2 = 1.76$
Judge's rating as integrated	3.51	1.10	2.99	1.30	2.69*
Semantic similarity	.99	0.005	.98	0.011	2.79*
Judge's coherence rating	5.06	0.92	4.87	1.58	0.912
Additive	.57	0.14	.65	.11	-2.69*
Comparative	.12	0.09	.08	0.07	2.63*
Temporal	.13	0.08	.12	0.10	0.66
Casual	.16	0.08	.15	0.07	0.34

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

associated with higher intrusive and avoidance scores, but not with overall symptom severity and depression. None of the other measures of cohesion or the rating of coherence was notably associated with PTSD symptom severity.

Of the measures of integration from the nontrauma pairs only semantic similarity score showed a moderate correlation with intrusion score,  $r(46) = .32$ ;  $p = .03$  with neither of the other measures of nontrauma narrative integration associated with any symptom severity. Of the measures of organization of the nontrauma narrative only the rating of narrative coherence showed a moderate correlation with avoidance,  $r(47) = -.31$ ;  $p = .04$ , whereas none of the cohesion measures for the nontrauma narrative were associated with any symptom severity.

Table 3 presents the outcomes for the first set of regression analyses. Neither the overall model nor the steps accounted for a significant proportion of the variance in overall symptom severity. Variables in the first step accounted for a significant proportion of the variance in severity of intrusions,  $F(4, 40) = 2.74$ ,  $p = .04$ , and avoidance,  $F(4, 41) = 4.26$ ,  $p = .006$ , with anxiety when disclosing for intrusions and anxiety when disclosing and familiarity for avoidance significant individual contributors. Most importantly, the addition of the trauma integration variables did not significantly add to the prediction of the severity of intrusive or avoidance symptoms after controlling for step one variables and the relevant nontrauma pair integration measure.

Table 4 presents the results of the second set of regression analyses. In the first step of the model, time since trauma, age, anxiety when disclosing, and familiarity were entered. In the second step, nontrauma narrative coherence rating was added. In the final step,

memory organization measures (TMQ; causal connectives) were entered. Higher self-reported disorganization score significantly added to the prediction of overall severity of symptoms,  $F(2, 39) = 4.43$ ,  $p = .02$ , but not severity of avoidance symptoms whereas a lower proportion of causal connectives in the trauma memory narrative predicted higher avoidance,  $F(2, 39) = 3.25$ ,  $p = .05$ , but not overall symptom severity. Neither measure of disorganization added significantly to the prediction of intrusion severity.

## DISCUSSION

This study used an event cueing task to generate three measures (self-endorsement, judges' ratings, and linguistic) of the integration of event memories into personal memory. The better integration of trauma memories than nontrauma memories may be due to the higher salience of trauma memories compared to emotional but nontraumatic memories. We found no evidence, however, consistent with the views that either inadequate (Ehlers et al., 2000) or enhanced (Berntsen & Rubin, 2007) integration of trauma memories is associated with severity of posttraumatic stress symptoms overall or intrusive or avoidant symptoms. Degree of anxiety experienced when disclosing the trauma event predicted intrusive symptom severity and anxiety when disclosing, and fewer previous recountings of the event predicted avoidance severity. The measures of integration did not add to the prediction of the severity of posttraumatic stress symptoms.

Our results document interesting connections between measures of the organization of the trauma memory and posttraumatic stress symptoms. First, participants' self-report of the

**Table 2.** Correlations of Participant, Symptom, Trauma Narrative Integration, and Organization Measures

Variable	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. Gender	-.04	-.08	-.13	-.09	.09	.15	.05	-.14	-.08	.05	-.13	-.11	.10	-.01	.14	-.19	.05	.32	.13	.33
2. Age	-	-.22	-.20	-.23	-.28	.23	.31	.17	.33	-.23	.46	.10	.24	-.37	.03	.11	-.04	-.21	-.02	-.32
3. PDS	-	-	.62	.58	.66	-.24	-.08	.05	-.24	.31	-.07	.03	-.11	.22	-.12	.04	-.02	-.06	-.13	.33
4. Intrusion	-	-	-	.62	.45	-.20	-.15	.15	-.16	.40	-.13	.02	-.07	.11	.10	.13	.01	.00	-.30	.01
5. Avoidance	-	-	-	-	.45	-.08	-.01	-.20	-.16	.44	-.33	-.09	-.26	-.07	.03	.07	.04	.15	-.38	.17
6. Depression	-	-	-	-	-	-.03	-.06	.14	-.33	.23	-.14	.05	.13	.24	.04	.00	.07	.10	-.19	.45
7. Time since trauma	-	-	-	-	-	-	.14	-.21	-.19	-.04	-.15	.16	.13	-.09	.01	-.17	.08	.01	.27	.29
8. Vocab.	-	-	-	-	-	-	-	.05	.01	.07	.14	.10	.24	.06	.03	-.04	.04	.01	-.01	.12
9. Importance	-	-	-	-	-	-	-	-	.33	.14	.18	.09	.17	.34	.17	.09	-.28	.21	-.02	-.08
10. Confidence	-	-	-	-	-	-	-	-	-	-.05	-.01	-.15	-.29	-.13	.29	.21	-.25	-.07	.01	-.64
11. Anxiety	-	-	-	-	-	-	-	-	-	-	-.07	.03	-.13	.08	.22	-.07	-.09	.36	.01	.09
12. Familiarity	-	-	-	-	-	-	-	-	-	-	-	.11	.02	.10	-.02	-.19	.10	.08	.20	.06
13. Endorsed	-	-	-	-	-	-	-	-	-	-	-	-	.51	.29	-.07	-.19	.12	.11	.07	.25
14. Rating	-	-	-	-	-	-	-	-	-	-	-	-	-	.35	-.19	-.13	.05	.06	.07	.37
15. LSA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-.06	-.14	.03	.13	.16	.26
16. Coherence	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.09	-.21	.16	-.04	-.21
17. Additive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-.71	-.42	-.51	-.37
18. Comparative	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-.10	.09	.23
19. Temporal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.05	.17
20. Causal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.15
21. TMQ Dis.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Note.*  $N = 47$ . PDS = Posttraumatic Stress Diagnostic Scale severity score; Vocab. = Wechsler Adult Intelligence Scale-Third Edition Vocabulary score; LSA = latent semantic analysis similarity score; TMQ Dis. = Trauma Memory Questionnaire Disorganization score.  
Critical  $r$  for  $p < .05 = 0.29$ ; for  $p < .01 = 0.38$ ; for  $p < .001 = .51$ .

**Table 3.** Hierarchical Regression Analysis for Integration Measures Predicting PTSD Symptom Severity

Variable	$\Delta R^2$	$t$	$B$	$SE$	$\beta$
Dependent variable: Overall severity					
Step 1	.16				
Time since trauma		−0.14	−0.05	0.03	−.22
Age		−0.69	−0.13	0.18	−.11
Anxiety disclosing		1.79	2.71	1.51	.26
Familiarity		−0.53	−0.69	1.31	−.01
Step 2	.00				
LSA nontrauma		0.37	56.80	154.45	.06
Step 3	.05				
Self-endorsement		−0.59	−0.82	1.39	−0.9
Rating integrated		0.38	58.76	156.40	.06
LSA trauma		−0.29	−0.38	1.35	−0.4
Dependent variable: Intrusions					
Step 1	.22*				
Time since trauma		−1.36	−0.03	0.20	−.20
Age		−0.39	−0.05	0.13	−.06
Anxiety disclosing		2.56*	2.77	1.08	.37
Familiarity		−0.92	−0.85	0.93	−.13
Step 2	.06				
LSA nontrauma		1.76	199.14	113.44	.28
Step 3	.01				
Self-endorsement		1.73	199.65	115.32	−.07
Rating integrated		−0.53	−0.05	0.93	−.01
Dependent variable: Avoidance					
Step 1	.29**				
Time since trauma		−0.67	−0.02	.03	−.09
Age		−0.72	−0.12	.16	−.01
Anxiety disclosing		2.88**	3.77	1.3	.39
Familiarity		−2.31**	−2.62	1.13	−.31
Step 2	.01				
LSA nontrauma		0.80	107.4	132.92	.12
Step 3	.05				
Self-endorsement		−2.44	−2.83	1.16	.09
Rating integrated		0.89	115.90	130.99	−.23
LSA trauma		−1.50	−1.70	1.13	−.05

Note.  $N = 47$ . PTSD = posttraumatic stress disorder; LSA = latent semantic analysis; LSA nontrauma = semantic similarity for nontrauma pair; LSA trauma = semantic similarity for trauma pair.

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

disorganization of their trauma memory significantly enhanced the prediction of overall symptom severity after controlling for age, time since the event, anxiety when disclosing, familiarity of the memory, and the organization of the nontrauma narrative memory. Self-reported disorganization was not, however, a significant predictor of severity of intrusive or avoidant symptoms. In contrast, a linguistic measure of organization added to the specific prediction of severity of posttraumatic avoidance but not

overall symptom severity. In particular, trauma memory narratives that contained a smaller proportion of causal connectives (because, therefore) were associated with higher levels of self-reported trauma-related avoidant symptoms. These data suggest the poor causal organization of the trauma memory is one way in which avoidant strategies are enacted in effortful trauma remembering. Constructing casually disconnected pieces of the memory may enable avoidant participants to satisfy goals related to task demands,

**Table 4.** Hierarchical Regression Analysis for Organization Measures Predicting PTSD Symptom Severity

Variable	$\Delta R^2$	<i>t</i>	<i>B</i>	<i>SE</i>	$\beta$
Dependent variable: Overall severity					
Step 1	.16				
Time since trauma		−0.15	−0.05	0.03	−.22
Age		−0.71	−0.13	0.18	−.11
Anxiety disclosing		1.84	2.70	1.47	.26
Familiarity		−0.55	−0.68	1.25	−.01
Step 2	.01				
Coherence nontrauma		−0.71	−0.65	0.90	−.10
Step 3	.15*				
Causal Connectives		−0.45	−0.08	0.19	−.07
Disorganization TMQ		2.92**	0.74	0.25	.45
Dependent variable: Intrusions					
Step 1	.22*				
Time since trauma		−1.36	−0.30	0.20	−.20
Age		−0.39	−0.05	0.13	−.06
Anxiety disclosing		2.56*	2.76	1.05	.37
Familiarity		−0.95	−0.84	0.89	−.13
Step 2	.01				
Coherence nontrauma		−0.49	−0.33	0.68	−.07
Step 3	.05				
Causal connectives		−0.16	−0.24	0.15	−.26
Disorganization TMQ		0.17	0.03	.19	−.03
Dependent variable: Avoidance					
Step 1	.29**				
Time since trauma		−0.67	−0.02	0.03	−.09
Age		−0.75	−0.12	0.16	−.01
Anxiety disclosing		2.96**	3.74	1.27	.39
Familiarity		−2.40*	−2.60	1.08	−.31
Step 2	.06				
Coherence nontrauma		−1.97	−1.49	0.76	−.25
Step 3	.09*				
Causal connectives		−2.31*	−0.37	0.16	−.31
Disorganization TMQ		1.20	0.26	0.22	.17

Note. *N* = 47. PTSD = Posttraumatic stress disorder; TMQ = Trauma Memory Questionnaire.

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

i.e., to “tell me what happened as if it were happening right now,” but also to maintain distance from the threat that the trauma memory represents. This account suggests that trauma information is encoded self-referentially within personal memory, but when retrieved the causal organization of the trauma memory will be an outcome of approach or avoidant strategies.

The inconsistency between our results and Kleim et al.’s (2008) may be explained by the differences between the studies in how memory integration is understood. The current study used the whole trauma event memory to cue a related personal memory, whereas Kleim et al. (2008) focused on specific, highly distressing

segments of the memory. Undoubtedly, particular segments of the trauma memory may lack connection within the narrative. It is not clear, however, to what degree such disjunction impacts on the integration of the trauma memory with the rest of autobiographical memory. Even though our integration measures refer to the trauma event memory, we would expect that hot spots in the remembering of the event would impact on one of the measures and its association with severity of posttraumatic stress symptoms. Nevertheless, we acknowledge that because we measured integration of the event memory our results do not directly address proposals about the link between posttraumatic symptoms and integration



of specific segments of the memory. One of the major challenges for future research is to develop valid conceptualization and measures of trauma memory integration to allow this distinction to be investigated empirically.

The moderate correlations between our two continuous measures of integration together with the significantly higher integrated rating and LSA score for trauma memory pairs endorsed as integrated compared to those not endorsed indicates commonality in the construct assessed by the three measures. In addition, using the event-cuing procedure in the standard way provides a link between clinical models of trauma memory and current theoretical approaches to examining the hierarchical structure of autobiographical remembering (Brown, 2005; Conway, 2005). We believe that such links are critical to the validity of empirical investigation of proposals about the nature of trauma memories in PTSD. At the same time, the procedure of event cueing has not been used in PTSD memory research before and the measures of integration are novel and require additional validation in this context. In addition, the narrative generation instructions used here, although similar to some studies (Jones et al., 2006) differs from others as they did not specify that the participants recount the event in sequence chronologically. For these reasons, our results need to be compared to those of other studies cautiously.

There were a number of other limitations of the study. Inclusion of the Centrality of Events Scale as a self-report measure of integration would have helped in drawing inference about the enhancement of trauma memory integration and symptom severity. Similarly, inclusion of a self-report measure of organization of the nontrauma memory would have completed the multimethod approach. Although all the participants had experienced a Criterion A trauma they were not currently seeking help and the intensity of their symptoms may not have been as high as in other studies. The participants described a mixture of types of traumatic events. It is possible that self-relevant information from certain types of trauma such as interpersonal abuse may be particularly difficult to reconcile with existing autobiographical information. Using a mix of types of traumas may have reduced the chances of observing symptom-specific problems or enhancements in memory integration. The small sample of our study presents statistical limitations. Although we reduced the number of predictors in standard ways, the regression analyses may have still been underpowered to detect real increments in prediction.

Overall, the results of the current study do not support claims that inhibition or enhancement of the integration of the trauma memory within autobiographical memory is associated with severity of posttraumatic symptoms. The results show, however, that overall posttraumatic stress symptom severity is associated with self-reported disorganization of the trauma memory and that severity of avoidant symptoms is associated with memories for the trauma, which are impoverished in regard to attempts to provide a casual account of the traumatic event.

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