

Autobiographical Memories for Very Negative Events: The Effects of Thinking About and Rating Memories

David C. Rubin · Adriel Boals · Kitty Klein

Published online: 28 December 2008
© Springer Science+Business Media, LLC 2008

Abstract In three related experiments, 250 participants rated properties of their autobiographical memory of a very negative event before and after writing about either their deepest thoughts and emotions of the event or a control topic. Levels of emotional intensity of the event, distress associated with the event, intrusive symptoms, and other phenomenological memory properties decreased over the course of the experiment, but did not differ by writing condition. We argue that the act of answering our extensive questions about a very negative event led to the decrease, thereby masking the effects of expressive writing. To show that the changes could not be explained by the mere passage of time, we replicated our findings in a fourth experiment in which all 208 participants nominated a very negative event, but only half the participants rated properties of their memory in the first session. Implications for reducing the effects of negative autobiographical memories are discussed.

Keywords Autobiographical memory · Narrative · Emotion · Expressive writing · Stress

Introduction

Many treatments for PTSD, such as exposure therapy and cognitive behavior therapy, as well as treatments to reduce the effects of more general stressful events, such as expressive writing, rely on people thinking about their traumatic or stressful events. We undertook to examine the properties of autobiographical memories for stressful events that might be changed by such procedures. For practical and ethical reasons, we started with non-clinical undergraduate samples and with non-clinical manipulations. We had two manipulations. One was the minimal manipulation we could include while still measuring changes in the properties of memories of stressful events: the act of rating the stressful memories twice. The second manipulation added expressive writing between the two times the participants rated their stressful events. The procedure we used to provide a comprehensive description of the properties of very negative memories asked people to think about these memories in novel ways, and so some of the ratings require reflections that are not common when people casually think about their memories.

In order to provide a comprehensive set of measures of the properties of autobiographical memory, we used the Autobiographical Memory Questionnaire (AMQ). It includes ratings of the sensory components of the memory including visual imagery, spatial imagery or setting, and auditory imagery. There are ratings of the emotional properties, including general cognitive assessments of whether the emotion was the same and of equal intensity as it was originally and reports of visceral reactions while remembering the event. There are ratings of how often the memory has been thought about and whether it has come unbidden, and ratings of whether the memory is a coherent narrative. Finally, there are ratings designed to assess

D. C. Rubin (✉)
Psychology and Neuroscience, Duke University,
Box 90086, Durham, NC 27708-0086, USA
e-mail: david.rubin@duke.edu

A. Boals
University of North Texas, Denton, TX, USA

K. Klein
North Carolina State University, Raleigh, NC, USA

metacognitive judgments of recollection and belief in the accuracy of the memory. Thus, the AMQ samples a wide range of properties of autobiographical memories, with emphasis on the narrative and emotional properties that are stressed in the literature on expressive writing.

The AMQ has two main advantages as an inventory of autobiographical memory. First, variants of the AMQ have been widely used with college undergraduates like those used here (e.g. Rubin et al. 2003), in other cultures (Rubin et al. 2007), in other studies of emotional and stressful memories (e.g. Talarico and Rubin 2003), in studies of PTSD (Rubin et al. 2003), and in studies varying PTSD symptom severity (e.g. Rubin et al. 2008a). Thus, we know a great deal about its properties and the relations among its measures. Second, the choice of properties is theoretically motivated, providing reasons why individual properties are included (Rubin 2006) and providing information about the neural basis of the systems underlying the properties and ratings (Daselaar et al. 2008; Greenberg and Rubin 2003).

In addition to the AMQ, we included measures related to the troubling nature of a negative event to further probe the stressful nature of the memories involved. The Impact of Event Scale (IES; Horowitz et al. 1979) measures the stress response using PTSD-like symptoms of an event including avoiding situations that make one think about the event and intrusive memories of the event.

Our second manipulation added expressive writing (Pennebaker 1997). Expressive writing involves having participants write about their deepest thoughts and feelings about a negative event, usually three times over the course of a week. The mechanism behind expressive writing's utility remains somewhat of a mystery (Sloan and Marx 2004). Early theories about how writing about stress leads to better health focused on the emotional release and cathartic effect of expressive writing (Pennebaker 1997). Other theories include the development of a coherent narrative story (Smyth et al. 2001), cognitive adaptation, self-regulation, social integration, and exposure therapy (Frattaroli 2006).

Of these theories, a recent meta-analysis concluded that exposure therapy has received the most empirical support to explain the effects of expressive writing (Frattaroli 2006; Sloan et al. 2005). One mechanism behind the efficacy of exposure therapy appears to be extinction. The repeated reliving of a stressful memory in a safe environment eventually leads to extinction, or in terms of the cognitive measures used here, to a reduction in the negative valence, intensity, and availability of the stressful autobiographical memory. Reliving the event in a safe environment is believed to give people a sense of competence, mastery, and safety and allows them to no longer avoid the stressful experience (Nemeroff et al. 2006). Thus part of the efficacy of expressive writing may be that it affords the writer an opportunity to recall, think about, and relive the stressful

event in a safe environment. Such active reliving and examination of the event in a safe environment is also the basis of any exposure-based therapy (Foa and Rothbaum 1998) and even a very mild form may have effects. In fact, one study found that as little as 4 min of expressive writing lead to health benefits (Burton and King 2008). Other mechanisms could also be functioning here, especially because of the added rating tasks (e.g. Ehlers and Clark 2000).

We designed a series of four experiments to study our two manipulations. In our first three experiments, participants nominated a very negative event from their lives, rated the nominated memory using the AMQ, answered questions about intrusive memories from the event using the IES, and then completed either an expressive writing task about the nominated memory or a control writing task. Approximately 6 weeks after writing, participants completed the AMQ and IES again so that we could compare differences from our expressive writing manipulation.

Participants completed the AMQ and IES in reference to a stressful event at each of two sessions 6 weeks apart. Between these sessions, half did expressive writing and half had a control task. Participants in both groups had consistent and substantial reductions in the negative emotional intensity and reported intrusive memories, which secondary analyses revealed could not be explained by the mere passage of time. However, the reduction in these measures was equivalent across the two groups. We therefore designed a fourth experiment to test directly that the AMQ and IES were responsible for the reductions. We discuss the first three experiments together, before considering the fourth.

Experiment 1

Participants

Credit towards an undergraduate course requirement was given to 92 North Carolina State University undergraduates (57 female); 57 participants were in the expressive writing condition.

Materials

The IES (Horowitz et al. 1979) is a 15-item questionnaire that measures the frequency of intrusive and avoidant thoughts associated with each nominated memory. The IES consists of two subscales, intrusiveness, and avoidance. We added a question at the end of the IES to measure the level of current distress associated with the event by asking "I am still distressed by it". Participants responded from 0 "not at all" to 5 "often".

We used items from the AMQ (Rubin et al. 2003) to measure properties of each nominated memory. A list of the items and which experiments each item was included in is shown in Table 1. All items used a 7-point scale, except *once* and *merged*, which used 3-point scales.

Procedure

We followed standard procedures used in the study of expressive writing (Pennebaker et al. 1990). We have used similar procedures earlier to show the effectiveness of expressive writing on working memory capacity (Klein and Boals 2001). Participants were tested in groups of between one and eight. Participants were randomly assigned to either an expressive writing or a control writing manipulation condition. During the first session, all participants nominated “a very negative event” from their life. Participants in the expressive writing condition next wrote a 5-min description of the nominated event. All participants then completed the IES and AMQ.

Participants returned to the lab three times during the subsequent week to complete their writing sessions. Each of the three sessions lasted 20 min in length. Participants in the expressive writing group were given the following writing instructions: “During today’s session, I want you to let go and write about your very deepest thoughts and feelings about the negative event you described during the first session. In your writing, you might want to explore your emotions and thoughts about the negative event.... You do not have to turn in what you’ve written.... The important thing is that you really let go and dig down to your very deepest emotions and thoughts about the negative event and explore them in your writing.”

Participants in the minimal manipulation condition were given the following writing instructions: “The purpose of today’s writing assignment is to get you to think about how you spent your time yesterday. I would like you to write, in detail, everything you did yesterday. Avoid including any emotional content or feelings you may have had about your day. Your description should be as objective as possible.” Although participants in the control condition did not write about the negative event, they did return to the same context and same experimenter for whom they recorded the negative event. This may have also caused thoughts about the negative event.

Six weeks subsequent to their final experimental writing session, participants returned to the lab and completed the AMQ, the IES, and a 5-min description if one was given earlier.

Results

Experiment 1 yielded four basic findings, which are replicated in the following two experiments. The first is a

consistent change from pre- to post-writing in measures of emotion, intrusiveness of the memories, recollection, and distress associated with the memories. The second is a consistent lack of change in measures of language, narrative, and specificity. The third is a lack of modulation of this effect by the expressive writing condition. The fourth is that the passage of time does not affect most of the memory properties that change over session and when there is a change with time, it is too small to account for the effect of session. Thus, the observed effects of session cannot be caused by the simple passage of time, but rather are a result of participation in our experiments, which involves the task of thinking about a very negative memory in many different ways in order to complete the AMQ and IES.

For ANOVA analyses, we do tests on the 29 measures listed in Table 1. We have 30 measures in Experiments 2, and 4 and 23 in Experiment 3. We therefore correct for multiple comparisons throughout the paper by adopting a *P* level of 0.002 ($0.05/30 = 0.0017$, $0.05/23 = 0.0022$). We report any results that are significant at the 0.01 level to ensure that we are not setting our *P* level so high that we are hiding systematic results that are consistent with the alternatives we wish to reject. From a statistical perspective, we do not wish to claim that results that are significant at the lower levels are necessary reliable, but we also do not want to suppress theoretically relevant results that may prove to be replicable. From a theoretical perspective, when we argue that effects that others may expect to occur actually do not occur, we want to give those effects every chance to emerge. We do not want to hide them if they are small but reliable by requiring a higher *P* level because we included many other tests. Although not reported in the paper, we dropped the *P* level to 0.05 when investigating the effects of expressive writing, but no clear pattern of results emerged. Tables of results include the usual *P*-levels of 0.05, 0.01 and 0.001, as well as the 0.002 level, as descriptive statistics to show the pattern of results, in part because such reporting takes no additional room and is informative and familiar to most readers.

For each of the measures we did an ANOVA with gender, and condition as between subject variables and session as a within subject variable. All interactions were examined. Because the most frequently observed effect, and the effect that turns out to be the theoretically most important, was that of session, we present it in Table 2. There are effects over the two sessions on variables measuring *emotions*, *availability*, and IES *intrusions* and no significant effects on variables measuring *language*, *narrative*, and *specificity*. It should be noted that the marginal effect of *story* that occurs here and in later experiments is caused by a decrease in narrative coherence over time, not the increase that would be expected with writing about the

Table 1 Items from the autobiographical memory questionnaire and Impact of Event Scale

Item	Brief description of rating scale	Experiments
<i>Recollection and belief</i>		
Reliving	I am reliving the original event	1, 2, 3, 4
Back in time	I travel back to the time when it happened	1, 2, 4
Remember/Know	I remember it rather than just knowing it happened	1, 2, 4
Real/Imagine	I believe the event in my memory really occurred	1, 2, 3, 4
Persuade	I could be persuaded that my memory was wrong	1, 2, 4
<i>Sensory</i>		
See	I can see it in my mind	1, 2, 3, 4
Field/Observer	I see it out of my own eyes	1, 2, 3, 4
Setting	I can recall the setting where it occurred	1, 2, 3, 4
Hear	I can hear it in my mind	1, 2, 3, 4
<i>Emotions</i>		
Same emotions	I feel the same emotions I felt then	1, 2, 3, 4
Same strength	I feel the emotions as strongly as I did then	1, 2, 4
Intensity	The emotions are extremely intense	1, 2, 3, 4
Positive	The emotions are extremely positive	1, 2, 4
Negative	The emotions are extremely negative	1, 2, 4
Valence	The emotions are extremely positive/negative	3
Heart	I feel my heart pound or race	1, 2, 4
Tense	I feel tense all over	1, 2, 4
Sweaty	I feel sweaty or clammy	1, 2, 4
Butterflies	I feel knots, cramps, or butterflies in my stomach	1, 2, 4
Reaction	I had a physical reaction	3
<i>Availability</i>		
Out of the blue	This memory has come to me out of the blue	1, 2, 4
Evoke	Things may unexpectedly evoke my memory	3
Thought about	I have thought about this event	1, 2, 4
Talked about	I have talked about this event	1, 2, 4
Thought or talked	I have thought or talked about this event	3
<i>Coping and identity</i>		
Think as little	I think as little as possible of the event	3
Elaborate	I elaborate the event to myself and others	3
Part of identity	The event has become part of my identity	3
See connections	I see connections b/w the event and experiences	3
<i>Language, narrative, and specificity</i>		
In words	It comes to me in words	1, 2, 3, 4
Story	It comes to me as a coherent story	1, 2, 3, 4
Pieces	It comes to me in pieces with missing bits	1, 2, 3, 4
Specific to me	My memory is based on details specific to my life	1, 2, 4
Occurred once	It occurred once within a day	1, 2, 3, 4
Merged events	It was merging of events not an extended event	1, 2, 3, 4
<i>Impact of Event Scale and current stress question</i>		
Current stress	I am still distressed by it. (0 to 5 scale used in IES)	2, 3, 4
IES	Measures PTSD-like symptoms of an event	1, 2, 3, 4
IES: avoidance	Subscale measuring avoidance of memory of event	1, 2, 3, 4
IES: intrusions	Subscale measuring intrusions of memory of event	1, 2, 3, 4

Table 2 Change over sessions of autobiographical memory questionnaire and IES

Variable	$F(1, df)$	Session means	
		1	2
<i>Recollection and belief</i>			
Reliving	4.47*	4.35	3.87
Back in time	3.16	4.97	4.62
Remember/know	1.61	6.03	5.83
Real/imagine	7.24**	6.60	6.31
Persuade	3.38	1.85	2.11
<i>Sensory</i>			
See	13.18***	5.97	5.42
Field/observer	0.26	5.55	5.41
Setting	10.56** ²	6.51	6.20
Hear	0.75	4.71	4.48
<i>Emotions</i>			
Same emotion	9.85**	4.73	4.27
Same strength	4.06*	4.05	3.65
Intensity	13.94***	4.66	4.10
Positive	8.14**	1.88	2.29
Negative	2.92	5.55	5.27
Heart	23.74****	3.76	3.08
Tense	9.52**	3.61	2.98
Sweaty	4.64*	2.74	2.23
Butterflies	8.12**	3.20	2.63
<i>Availability</i>			
Out of the blue	6.80*	4.07	3.68
Thought about	22.31****	5.01	4.34
Talked about	12.73***	4.29	3.73
<i>Language, narrative, and specificity</i>			
In words	3.35	3.92	3.66
Story	6.71*	5.37	4.85
Pieces	0.52	3.16	3.03
Specific to me	1.31	5.80	5.89
Occurred once	0.03	0.52	0.49
Merged events	0.00	0.64	0.61
<i>IES</i>			
IES	6.36*	14.97	14.61
IES: avoidance	0.72	9.78	9.13
IES: intrusions	16.75****	11.32	7.89

* $P < 0.05$ ** $P < 0.01$ **² $P < 0.002$ *** $P < 0.001$ **** $P < 0.0001$ $df = 86-88$, except merged which had 29

event. Measures of *recollection and belief* and *sensory* tend to decrease over sessions, with *see* and *setting* being significant.

There are 60 main effects not shown in Table 2 (30 measures by the 2 main effects of gender, and expressive writing), 120 two-way interactions (30 measures by 4 two-way interactions), and 30 three-way interactions (one for each measure). However, there are no significant effects at the 0.002 level, except for those shown on Table 2. Thus the results are extremely simple in that the only clearly statistically significant and theoretically interesting effects are those of session. Moreover, if we lower the critical P level to 0.01 we get only one effect not on Table 2, a gender by expressive writing on the *persuade* measure, so this conclusion is not just an arbitrary cut on a power test.

Experiment 2: Participants Varying in PTSD Symptom Severity

We wanted to check our results on participants who varied in the degree to which their most stressful event currently bothered them. To measure the seriousness of the aftereffects of their stressful event, we used a standard paper and pencil test of PTSD symptom severity on the assumption that a similar, but milder, stress response would occur to stressful events whether or not they were traumatic by current diagnostic standards (Boals and Schuettler 2008b; Horowitz 1976; Rubin et al. 2008).

Participants

Credit towards an undergraduate course requirement was given to 120 Duke University undergraduates (76 female); 71 were in the expressive writing condition. We selected students from a group testing session who scored high ($n = 63$, $m = 51$, range = 40–73, 49 with scores of above 43) or low ($n = 57$, $m = 18.8$, range = 17–22, where 17 is the minimum score of 1 on all 17 items) on the PTSD Checklist (PCL; Weathers et al. 1994). The PCL asks participants to nominate a “negative event or experience from your life that is most troubling and stressful to you now” and then answer 17 items designed to measure PTSD symptoms associated with the event such as repetitive disturbing thoughts of the event. The most sensitive cutoff level on the PCL for PTSD is 44 (Blanchard et al. 1996), so the scores of our high group indicate that their symptoms were high enough for many potentially to qualify for a diagnosis of PTSD if a full diagnosis were done. However, it should be stressed that no clinical diagnosis was made and the range of stressful events and peritraumatic emotions were not limited to those that fulfill the requirements of PTSD.

Procedure

The procedure was identical to Experiment 1.

Results

We measured the same properties of memories using the AMQ and IES measures that were used in Experiment 1, and we added a current stress question to the IES. For each measure we did an ANOVA with high versus low PCL score, gender, and experimental writing versus minimal manipulation conditions as between subject variables and session as a within subject variable. All interactions were examined. As expected, the largest and most consistent effects are of PCL group and these results are shown in Table 3. Consistent with Rubin et al. (2008b) and Berntsen et al. (2003) there are large effects for measures of *emotions*, small effects of measures of *language, narrative, and specificity* and moderate effects of *sensory* variables. The *real/imagine* measure is lower for the high PCL group, there is no effect on *setting*, and the *talked about* measure has a much smaller effect than the *thought about* variable. Both *thought about* and *talked about* can be seen as measures of rehearsal, one public and one private, and the difference in the magnitude of the effects is a confirmation of Pennebaker's assumption that extremely negative events are not often talked about even though they come to mind (Pennebaker 1997). There is no evidence here that the nominated very negative memories associated with PTSD symptoms are less coherent than the nominated very negative memories not associated with PTSD symptoms, though they are more emotionally intense and negative. We also expected and found effects on the *current stress* and IES variable because these measures are directly related to the symptoms of PTSD on which the participants were selected.

The effect of session was similar to that of Experiment 1, though with somewhat fewer significant effects at the 0.002 level. All the significant effects were in variables measuring emotion and in *setting*. The pattern of results is also similar to that of the PCL group in that the same measures that drop across sessions tend to be the ones that are higher in participants with PTSD symptoms. This suggests that the difference between participants with and without PTSD symptoms are in the same variables and in the same direction as the differences between session 1 and session 2, and thus the changes we note across sessions may be of theoretical and practical importance. If we could lower the variables we did here on a long-term basis, we would make the properties of stressful memories of people with PTSD symptoms more like those of people without the symptoms.

There are 93 main effects, 124 two-way interactions, 31 three-way interactions, and 1 four-way interaction not shown in Table 3. However, there are no significant effects

at the 0.002 level, except for those shown on Table 2. To ensure that this is not caused by setting the *P* level too high, we note that at the 0.01 level, there are only three other effects: a PCL group by expressive writing interaction for the IES overall measure and for IES *intrusions*, and a gender by expressive writing interaction for *setting*.

Experiment 3: Multiple Testing Over 4 Months

Involuntary memories are a symptom of the effects of a stressful event, as indicated by the inclusion of intrusive involuntary memories in the IES and the symptoms of PTSD. Experiment 3 was designed to study involuntary memories in more detail. Because involuntary memories of the particular very negative event a participant nominates to write about may be infrequent, we had participants keep diaries of involuntary memories for three separate one-week periods. Participants kept diaries 1 week immediately before writing, 1 week immediately after writing, and 1 week approximately 4 months after writing. Nonetheless, there were too few involuntary memories related to the nominated stressful events to produce any consistent results in our non-clinical population, and so we report on only the laboratory sessions.

Participants

We used a campus flyer to recruit 38 members of the Duke community (24 female) were paid \$200 for their participation; 17 were in the expressive writing condition.

Procedure

The procedure for the laboratory sessions followed Experiment 1 except that testing continued for more sessions and the AMQ questions were modified to probe differences between involuntary and voluntary memories. Participants completed the AMQ and IES for both events each of the five times they came to the laboratory. The times were: (1) 1 week prior to writing, at which time the diary was given out for the first week long period, (2) immediately prior to the three writing sessions, when the first week's diary was returned, (3) immediately after the three writing sessions, at which time the diary was given out for the second week long period, (4) 1 week post-writing, when the second diary was returned, and (5) 16 weeks post-writing, at which time the diary was returned after the third week long period.

Results of 5 Sessions Spaced Over 4 Months

Participants filled in the AMQ and the IES for their two very negative memories five different times: (1) 1 week

Table 3 Differences in high and low PCL groups on autobiographical memory questionnaire and IES

Variable	F(1, df)			Means			
	PCL	Session	Interaction	PCL low		PCL high	
				Session 1	Session 2	Session 1	Session 2
<i>Recollection and belief</i>							
Reliving	3.96*	0.00	3.99	3.13	3.39	4.00	3.65
Back in time	4.23*	4.29*	1.25	3.82	3.71	4.42	4.06
Remember/know	0.18	0.67	0.22	5.24	5.49	5.55	5.47
Real/imagine	5.68*	6.72*	0.59	6.31	6.11	6.13	5.79
Persuade	0.49	0.98	0.42	2.44	2.50	2.41	2.56
<i>Sensory</i>							
See	4.98*	1.58	9.28**	4.53	4.75	5.48	5.11
Field/observer	1.14	0.23	0.38	5.25	5.09	4.84	4.85
Setting	1.27	10.10*** ²	4.36*	6.09	5.95	6.11	5.84
Hear	9.43*	2.08	1.60	3.35	3.31	4.60	4.32
<i>Emotions</i>							
Same emotion	4.31*	12.00***	3.48	3.84	3.55	4.51	3.98
Same strength	30.26****	9.64**	5.60*	2.40	2.29	4.06	3.56
Intensity	49.77****	18.48****	1.70	2.93	2.53	5.06	4.55
Positive	2.64	0.08	0.22	2.24	2.15	1.66	1.64
Negative	23.93****	6.23*	2.05	4.45	4.29	6.11	5.73
Heart	25.67****	9.12**	2.27	1.91	1.65	3.74	3.08
Tense	38.58****	16.54****	4.24*	1.98	1.67	4.15	3.45
Sweaty	26.38****	5.96*	2.24	1.36	1.25	2.74	2.27
Butterflies	41.92****	11.94***	4.14*	1.71	1.47	3.98	3.10
<i>Availability</i>							
Out of the blue	57.04****	4.38*	2.44	2.51	2.49	5.00	4.53
Thought about	55.98****	0.44	6.96**	3.80	3.98	5.92	5.60
Talked about	7.07**	2.68	1.80	3.56	3.56	4.29	4.73
<i>Language, narrative, and specificity</i>							
In words	6.16*	0.05	0.54	2.76	2.84	3.27	3.37
Story	0.07	1.30	1.86	4.38	4.40	4.30	4.10
Pieces	1.90	1.75	0.31	3.43	3.56	3.90	3.89
Specific to me	2.56	3.22	1.30	5.09	5.58	5.62	5.72
Occurred once	5.83*	0.54	0.54	0.51	0.51	0.29	0.27
Merged events	0.15	1.13	0.24	0.59	0.64	0.58	0.72
<i>Current stress and the IES</i>							
Current stress	71.30****	13.18****	4.61*	0.62	0.35	3.13	2.44
IES	88.53****	8.57**	8.20**	6.40	6.75	35.10	25.44
IES: avoidance	88.91****	4.89*	5.12*	3.18	3.42	17.68	13.68
IES: intrusions	56.75****	9.44**	8.48**	3.23	3.33	17.41	11.72

* $P < 0.05$ ** $P < 0.01$ *** $P < 0.001$ **** $P < 0.0001$ $df = 108-111$, except merged which had 54

prior to writing, (2) immediately prior to writing, (3) immediately after writing, (4) 1 week post-writing, and (5) 16 weeks post-writing. One of the very negative memories was randomly selected to be a critical memory and participants in the writing condition wrote about that memory. We analyzed this data using an ANOVA with gender and experimental writing condition as between factors and the five sessions and critical versus non-critical memory as

within factors. There were consistent effects of session, which are shown in Table 4 for all five sessions. As in earlier experiments, the largest decreases tend to be in *emotions, current stress, and the IES* and the smallest in *language, narrative, and specificity*. The ANOVA's for the effect of session test only whether there are differences among the means, not whether there is a consistent trend. However, our argument for a drop with rating is supported

Table 4 Change over sessions of autobiographical memory questionnaire and IES

Variable	<i>F</i> (4, <i>df</i>)	<i>df</i>	Session means				
			1	2	3	4	5
<i>Recollection and belief</i>							
Reliving	3.96**	88	4.52	4.38	4.04	4.08	3.73
Real/imagine	0.45	88	6.02	5.94	5.90	5.94	5.79
<i>Sensory</i>							
See	4.40**	88	5.60	5.42	5.38	5.21	4.93
Field/observer	4.51**	88	5.61	5.46	5.27	5.17	4.77
Setting	10.55*****	84	6.40	5.82	5.84	5.66	5.40
Hear	2.89*	88	4.62	4.40	4.12	4.21	3.90
<i>Emotions</i>							
Same emotion	6.62****	88	4.56	4.37	3.98	3.88	3.58
Intensity	9.72****	88	5.27	4.79	4.48	4.42	4.17
Valence	2.13	88	−1.83	−1.83	−1.77	−1.58	−1.61
Reaction	14.68*****	88	5.23	4.31	3.73	3.79	3.44
<i>Availability</i>							
Evoke	6.58****	88	4.62	4.40	4.15	4.12	3.60
Thought or talked	2.22	88	4.87	4.69	4.40	4.35	4.46
<i>Coping and identity</i>							
Think as little	3.02*	88	3.79	3.50	3.21	3.29	3.15
Elaborate	3.73*	88	3.50	3.19	3.06	3.13	2.79
Part of identity	1.32	88	4.12	4.46	4.27	4.38	4.12
See connections	3.15*	88	4.21	3.92	3.88	4.10	3.58
<i>Language, narrative, and specificity</i>							
In words	1.81	88	3.85	3.40	3.50	3.65	3.31
Story	4.28**	88	5.37	4.79	5.06	5.08	4.65
Pieces	1.92	88	3.62	3.94	4.27	3.94	4.19
Occurred once	2.34	80	0.54	0.65	0.65	0.69	0.71
<i>Current stress and the IES</i>							
Current stress	9.81****	88	1.79	1.50	1.33	1.21	0.83
IES	13.46****	80	22.46	22.02	17.17	14.50	11.73
IES: avoidance	8.14****	80	10.77	10.40	8.65	7.21	5.69
IES: intrusions	12.67****	80	11.69	11.62	8.52	7.29	6.04

* $P < 0.05$ ** $P < 0.01$ **** $P < 0.0001$

by consistent drop in ratings. Of the 17 measures that have a significant effect at the $P < 0.05$ level, 9 have a strict monotonic decrease and 6 have one exception to a monotonic decrease. Moreover, the drops are substantial.

There are 24 measures each with a 5 (session) by 2 (expressive writing) by 2 (critical memory) by 2 (gender) ANOVA, yielding by 96 main effects and numerous 2, 3 and 4-way interaction. However, there are no significant effects at the 0.002 level, except for those shown on Table 2. To ensure that the lack of effects is not caused by setting the P level too high, we looked for effects at the 0.01 level. There are only five other effects, all interactions involving whether the memory was the critical memory randomly selected to be written about in the expressive writing condition or randomly selected to be designated as the comparison memory in the control condition.

Effects of Time Since the Very Negative Event

The claim that reinstating the memory and answering our questionnaires produced changes in the nominated memories, we need to demonstrate that the magnitude of the changes we observed in Tables 2, 3 and 4 are greater than the magnitude expected by the passage of time. To estimate the magnitude of change caused by the mere passage of time for the very negative memories nominated in our experiments, we correlated the change in each measure with the age of the memory. Estimates of the age of autobiographical memories across the lifespan tend to be quite accurate when checked against diaries, providing a good basis for the analysis (Rubin 1982). If the mere passage of time had an effect on the memories nominated in our experiments, we would expect memories of recent

events to change more. For example, a very negative event from the day before the experiment began should decrease more in the kind of measures we used over the 6 weeks of our experiment than a very negative event from a year before the experiment began. To provide this competing explanation the maximum power, we pooled the data from Experiments 1, 2, and 3 using the critical memories and 6-week period of Experiment 3.

We therefore correlated the number of months reported between the nominated events and the start of the experiment with the change scores of all variables. The expected result of a drop from session 1 to session 2 in memories for older events being less than memories for more recent events would yield positive correlations. There were six small, but significant at the 0.05 level, correlations in the right direction for a decrease caused by the passage of time: *see*, $r(247) = 0.14$; *setting*, $r(245) = 0.14$; *thought*, $r(209) = 0.14$; *out of the blue*, $r(209) = 0.22$; *stress*, $r(151) = 0.18$; and the *intrusiveness* scale of the IES, $r(240) = 0.19$. Of the 30 variables, 24, including all the emotion variables, did not show a correlation between the change across session and the time between the event and the start of the experiment, even at the 0.05 level. For these 24 measures, the mere passage of time cannot explain the change over sessions. In addition, for the mere passage of time to be an explanation, the decrease observed over 6 weeks should not be different from the 6-week intervals that occurred before it. Many of the decreases in our experiments are approximately 0.5 units on a 7-point scale, which is too large a decrease for this to be the case.

Discussion of Experiments 1 Through 3

We conducted three experiments to investigate how rating and writing about the memories of stressful events changed the memories of those events. We failed to find substantial differences between groups that did expressive writing and our minimal manipulation group, but we did find effects of simply participating in our studies. Our basic conclusion is that, rating the memories on a broad and theoretically motivated collection of properties and filling out an IES scale for them has similar effects on the memories as doing these two tasks and expressive writing.

We found minimal effects of expressive writing on phenomenal properties of the nominated memories beyond our minimal manipulation of rating the memories. There are two possible reasons for the lack of an effect for expressive writing. First, whatever the effects of expressive writing are, they do not occur because they change very negative memories into ones that are perceived in a different way as measured by the AMQ and IES. That is, the

effects of expressive writing may not be mediated by changes in the phenomenological properties or intrusiveness of the memories. Second, it could be that expressive writing functions by changing the memory but that the task of reinstating a memory and thinking about it in the ways required to answer our extensive set of ratings, or perhaps just some subset of them, has a similar effect to expressive writing. Thus once participants answer our questionnaires about the memory, expressive writing would add little more change. In essence, the second possibility is that the act of measuring properties of memories changes them and so we cannot both measure them and measure change in them that is different from the change caused by expressive writing.

Why would answering a questionnaire about very negative events affect memories for them? The questions we asked required participants to reinstate the memory and to consider sensory, narrative, and emotional properties of the memory. The questionnaire was developed as part of the basic systems theory of autobiographical memory (Rubin 2006). In this theory, memories are not considered as abstract or homogenized information, but as assembled from information that is kept in separate systems of the mind and brain which include, vision, audition, other senses, spatial imagery, language, emotion, and narrative (Greenberg and Rubin 2003; Rubin et al. 2003). As all of these systems are accessed and considered in the questionnaire, all aspects of the memory are activated. This activation of different aspects of the stressful memory is very similar to what occurs during exposure therapy, albeit in a shorter and less intensive manner. Indeed, exposure theory has received the most empirical support to explain the benefits of expressive writing (Bootzin 1997; Frattaroli 2006; Sloan et al. 2005). Moreover, we included questions to probe the emotional aspects of those memories especially well. Participants also filled in the IES, which required them to note recent avoidance and intrusive memory symptoms. This experience, which emphasized emotional aspects of the memories, might have left little for expressive writing to add. Most people are able to recover from a stressful or traumatic experience without any formal or professional assistance (Bonanno 2004) and most people underestimate their own ability to cope with negative events (Gilbert et al. 1998). A strong possibility is that although the actual completion of the AMQ is beneficial and is responsible for most of the observed effects, participants leave the lab thinking about their nominated event and the healing process continues. In other words, our results are not simply a product of completing the AMQ, but rather completion of this questionnaire also encourages the processes involved for individuals to recover on their own.

Experiment 4

If our reasoning is correct, it should be possible to test it experimentally by removing the ratings of the negative memory in the initial session for half of the participants, thereby providing a control group that was lacking in Experiments 1 through 3. To do this, we had participants complete the AMQ and IES for a very negative personal event, but added a control group that did not fill in the AMQ or IES during the first session. As there were no expressive writing sessions, we omitted the three 20 min writing sessions. We were aware that even in our earlier control groups these three sessions could have served to remind the participants about the negative event that they rated, and so our effects might be smaller without these three sessions. We added the nomination and rating of a second very negative event in the second session, after measurements on the first very negative event were made, to ensure that any differences in ratings between groups would be limited to the negative events we manipulated experimentally. Finally, we used both a 2- and a 6-week delay to examine the effects of delay and ensure a particular delay was not crucial to our findings.

Participants

Eighty-one (28 males) volunteers were recruited from Duke and North Carolina State Universities using campus flyers and were paid \$10 for participation. An additional 126 volunteers (34 males) who were recruited from the University of North Texas received partial course credit for participation.

Procedure

The study consisted of two sessions, separated by 2 weeks at Duke and North Carolina State Universities and 6 weeks at the University of North Texas. Participants were randomly assigned to either the experimental or the control condition. During the first session all participants were asked to nominate a very negative personal event from their lives and write a brief one to two sentence description of the event. Participants in the experimental group then completed the AMQ and IES in reference to their nominated negative event. Participants in the control group did not complete any further questionnaires about their nominated negative event. Rather, they were asked to nominate and write a brief one to two sentence description of five more events (an event from high school, first week of college, a vacation, elementary school, and a time they went shopping). The controls nominated and gave brief descriptions of these events to ensure that they spent a similar amount of time in the lab as the experimental group

and to take their minds off their nominated negative event. Two or six weeks later, all participants returned to the lab and completed the AMQ and IES for the negative event they had nominated during the first session. Afterwards, all participants nominated a second very negative personal event and completed the AMQ and IES in reference to this negative event. After completing these questionnaires, all participants completed a questionnaire about demographics and were debriefed.

Results

The logic of the experiment suggests a slightly different analysis for Experiment 4. First, we had to replicate our earlier finding. That is, the decreases in ratings in the experimental group in the AMQ and IES items from session 1 to session 2 would have to follow the same pattern as those in the combined data from Experiments 1 to 3. The magnitude of the drop might be smaller because the participants did not visit the laboratory three times between Sessions 1 and 2, but the pattern of decrease would have to be the same. Thus, for instance, we need to show decreases in our emotion measures but not our narrative coherence measures. Second, and of more theoretical interest, we predicted that the means will not differ between the experimental condition's first recording of the AMQ and IES, and the control condition's first recording, even though the control condition's first recording occurs 2 or 6 weeks after the experimental condition's first recording. That is, there should be no effects of just nominating an event coupled with the mere passage of time. This condition is needed to show that in Experiments 1–3, the drop we observed was not simply due to the passage of time, but was caused by filling out the AMQ and IES. Third, as an added check we expected that an additional negative memory nominated and rated during Session 2 would not differ between the groups.

Because we make specific predictions, and most crucially because we wanted to see effects in one comparison but not in another, we did not adopt a conservative P level as in the earlier experiments, but use the more conventional $P < 0.05$. Based on our earlier work we have specific predictions for each of our measures—each should do what it did earlier for the experimental condition and show no differences in the control condition. In particular, in the experimental group we should observe the biggest and most consistent changes in the *emotions*, the *thoughts*, and the *current stress and the IES* categories, no changes in the *language, narrative, and specificity* category, and possible changes in the *recollection and belief* and the *sensory* categories, except for *remember/know* and *field/observers*. The control group should show no changes, which we test by comparing the control group's first ratings, which

occurred in session 2 to the experimental group's first ratings which occurred in session 1.

With few exceptions, the results shown in Table 5 agree with the predictions. In particular, the within subject analysis based only on the experimental group produces results very similar to those of Experiments 1, 2 and 3, with fewer significant results, probably for the reasons suggested earlier. The only interaction with the two delays was that the increase in *positive* was greater for the 6-week than the 2-week delay ($F(1,97) = 7.18$, $P < 0.01$). The only

main effects of the two delays were that *thought* and *talked* were greater at the 6-week delay and the memories were less *specific* ($F(1,96) = 4.45$, $F(1,97) = 5.30$, and $F(1,96) = 5.66$, respectively, all P s < 0.05).

The only significant result of comparing the first ratings of the experimental and control groups is on *in words*, which was not significant in the earlier experiments. With the exception of the IES measures, most of the F 's that compare the two-first ratings were less than 1. The larger, though still not significant, F 's for the IES first rating

Table 5 Change over sessions of autobiographical memory questionnaire and IES in experiment 4

Variable	Means			ANOVAs $F(1, df)$	
	Exp S1	Con S2	Exp S2	Experimental group	First writing
<i>Recollection and belief</i>					
Reliving	3.75	3.86	3.36	5.96*	0.21
Back in time	4.57	4.54	4.45	0.62	0.01
Remember/know	5.62	5.69	5.50	0.75	0.18
Real/imagine	6.62	5.59	6.10	2.58	2.01
Persuade	2.21	2.23	2.13	0.08	0.05
<i>Sensory</i>					
See	5.47	5.37	5.09	7.59**	0.18
Field/observer	5.38	5.10	5.27	1.25	0.75
Setting	6.16	6.30	5.92	2.87	0.40
Hear	4.49	4.15	4.19	2.46	1.52
<i>Emotions</i>					
Same emotion	4.12	4.18	3.73	6.87*	0.14
Same strength	3.68	3.59	3.43	3.23	0.06
Intensity	4.33	4.29	3.83	14.93***	0.01
Positive	2.04	2.13	2.42	5.53*	0.03
Negative	5.37	5.44	5.03	7.17**	0.28
Heart	3.27	3.31	2.70	14.94**	0.13
Tense	3.26	3.53	2.89	6.27*	1.63
Sweaty	2.34	2.12	2.01	7.31**	0.75
Butterflies	2.87	2.55	2.47	7.94**	1.01
<i>Availability</i>					
Out of the blue	3.97	3.25	3.69	2.88	0.35
Thought about	4.80	4.55	4.17	27.13****	1.13
Talked about	4.18	4.11	3.61	11.41**	0.01
<i>Language, narrative, and specificity</i>					
In words	3.69	3.25	3.69	0.00	4.17*
Story	4.89	4.82	4.38	6.37*	0.07
Pieces	3.51	3.52	3.56	0.00	0.08
Specific to me	5.47	5.56	5.46	0.03	0.22
Occurred once	0.53	0.43	0.55	0.07	2.26
Merged events	0.56	0.56	0.57	0.22	0.39
<i>Current stress and the IES</i>					
Current stress	1.66	1.48	1.31	4.64*	0.42
IES	22.94	18.32	18.04	5.60*	2.86
IES: avoidance	11.62	9.32	9.92	1.98	2.63
IES: intrusions	11.16	9.02	8.23	7.38**	1.71

* $P < 0.05$

** $P < 0.01$

*** $P < 0.001$

**** $P < 0.0001$

Exp is experimental, *Con* is control, S1 is session 1 and S2 is session 2. The experimental group analyses had either 96 or 97 *df* in the denominator, the first writing analyses had between 194 and 204

measures appear to be due to memories for very recent events being affected by the mere passage of time. If we remove all events that were less than 3 months ago, the F 's for the IES total and IES Intrusion measures for the experimental group comparison remain significant, but all IES measures for the first rating comparison drop below one.

Finally, we asked all participants in Session 2 to nominate and rate a second very negative personal event. There were no significant differences between participants in the experimental and control groups in any of our AMQ or IES measures. In sum, the results of Experiment 5 demonstrate that participants who complete the AMQ evidence significant drops in ratings of emotional distress and intrusive and avoidant thoughts, whereas a control group who waits 2 or 6 weeks after nominating their negative event evidence little to no change in these measures.

General Discussion

A review of the basic results is given to help focus the discussion. Our main finding is that a selective set of measures of the autobiographical memory of a very negative event and the IES and its subscales showed large changes across the sessions of our experiments. Measures of the emotional properties of the event, measures of the frequency of thoughts about the event and involuntary memories concerning the event, the IES and its subscales showed this change. None of our measures of language and narrative properties or the specificity of the event showed a change across sessions. This extremely clear pattern of results indicates that the change over session was reasonable and not caused by some overall response bias. Nonetheless, we could find only minimal effects of the additional expressive writing task, effects that use the same error term as the effects of session.

We then conducted a series of analyses to verify that the effect of session was more than time curing some wounds and that our data was otherwise sound. We conducted analyses to demonstrate that the changes over sessions were not caused by just the 6-week delay between the two sessions. The decrease over time does not occur for most measures that show an effect of session, and the change between sessions is too large to have occurred in other 6-week periods outside the time of the experiment.

In Experiment 4, we used an experimental design instead of reanalysis of our data to demonstrate that our results were not just due to the passage of time. Participants who just waited 2 or 6 weeks after nominating a very stressful negative event did not show the decrease that participants who completed the AMQ and IES after nominating the event did. In addition, these two groups did not

differ in AMQ or IES ratings of a second nominated negative event, for which neither group had previously completed any questionnaires. Thus, the changes we observed were restricted to the memories for which participants completed the questionnaires for, which would be predicted by exposure theory.

The variations in the individual experiments contributed to the generalizability of our results in several ways. Experiment 2 demonstrated that the effects held for participants for whom the very negative events produced high or low levels of PTSD symptoms. The differences in our measures, shown in Table 3, between participants who had high or low levels of symptoms were, as would be expected from the PTSD literature. These same variables changed across the two sessions, as shown in Tables 2 and 3. Thus, the changes caused by our experimental manipulations were for the most part the same measures that distinguish participants with high and low levels of PTSD symptoms. The reduction over sessions of these same autobiographical memory properties is consistent with our suggestion that filling out our extensive set of questions may have similar effects on autobiographical memories as expressive writing and suggests that in some extended form it might become a part of a more standard exposure therapy.

Although the effects of expressive writing in the current studies were minimal, we do not claim that the expressive writing procedure is ineffective. Rather, we believe that most of the effects of expressive writing are due to exposure and extinction. In the current studies, completing the AMQ provided similar exposure and extinction, thereby leaving little for expressive writing to add.

The idea that making explicit one's memories of very negative events could change them and even be therapeutic is not new. It is the basis of talking cure therapies, of exposure therapies, and of the advise of friends from the time of antiquity. Here we have demonstrated that again. However, we do not yet know exactly which parts of our AMQ plus IES procedure changed which aspect of the memories. We also do not know if these changes would produce any therapeutic effects beyond lowering the IES scale. The answers to these questions and to the development and testing of efficient therapeutic protocols, however, is a very difficult task involving an extremely large number of careful manipulations. Because the effects observed are not always large, the number of participants involved would have to be. A possible insight into what is occurring comes from what changes and what does not change. The effect of our experiment was on the emotional properties and intrusiveness of the memories, not on their narrative coherence. Even participants with higher levels of PTSD symptoms did not report less coherent memories of their very negative event, consistent with what we have noted in other studies of traumatic memories and of

populations that differ in PTSD symptoms (Berntsen et al. 2003; Rubin et al. 2008a, b, 2003).

The results of applying the wide set of properties measured by the AMQ to very negative autobiographical memories were informative. What was most interesting is the way in which multiple measures intended to measure different aspects of the same system changed or did not change together over sessions. Thus, we had consistent changes over session in measures of emotion and a consistent lack of changes in measures of language and narrative. Combined these results show the merit of viewing autobiographical memories of being produced from a well-documented set of systems, each with their own properties as opposed to being unitary memories (Rubin 2006).

Our results also have methodological implications for the study of expressive writing. Sometimes expressive writing shows effects and sometimes not. However, our study raises a serious question about these tests. Our results argue that previous results have to be examined for exactly what the control group did. To the extent that the control group reinstated a very negative event and thought about it, the ability of expressive writing to elicit additional processing of the negative event may be reduced. Perhaps the most important methodological implication of our results is the suggestion that measuring properties of memories like those used here, along with other properties specific to the theory being tested, should be added to studies of exposure therapy and similar treatments. The minimal manipulation task would provide a great deal of information about what properties of the memory changed and would probably produce desired changes on its own.

The AMQ was designed to measure phenomenological aspects of any autobiographical memory. However, the data from the current set of studies suggest that completing the AMQ for a memory of a past experience promotes an active reliving of the event. This active reliving of a past *stressful* event in a safe environment is similar to what occurs during imaginal exposure. Although the AMQ was not designed as a therapeutic tool, our data suggest that simply completing the AMQ for a stressful memory leads to significant reductions in the levels of distress associated with the event.

Acknowledgments We wish to thank Dorthe Berntsen for her advice on the involuntary memory diaries and Jennie Grammar, Jennifer Sorenson, Catharine Luo, Karen Burns, and Matt Hays for their help in data collection. Funding was provided by National Institute of Mental Health grant numbers R01 MH066079 and NRSA F32-MH066569.

References

Berntsen, D., Willert, M., & Rubin, D. C. (2003). Splintered memories or vivid landmarks? Qualities and organization of traumatic memories with and without PTSD. *Applied Cognitive Psychology*, *17*, 675–693. doi:10.1002/acp.894.

- Blanchard, E. B., Jones-Alexander, J., Buckley, T. C., & Forneris, C. A. (1996). Psychometric properties of the PTSD checklist (PCL). *Behaviour Research and Therapy*, *34*, 669–673. doi:10.1016/0005-7967(96)00033-2.
- Boals, A., & Schuettler, D. (2008). PTSD symptoms in response to traumatic and non-traumatic events: The role of respondent perception and A2 criterion. *Journal of Anxiety Disorders* (in press).
- Bonanno, G. A. (2004). Loss, trauma, and human resilience: Have we underestimated the human capacity to thrive after extremely aversive events? *The American Psychologist*, *59*, 20–28. doi:10.1037/0003-066X.59.1.20.
- Bootzin, R. R. (1997). Examining the theory and clinical utility of writing about emotional experiences. *Psychological Science*, *8*, 167–169.
- Burton, C. M., & King, L. A. (2008). Effects of very brief writing on health: The two-minute miracle. *British Journal of Health Psychology*, *13*, 9–14. doi:10.1348/135910707X250910.
- Daselaar, S. M., Rice, H. J., Greenberg, D. L., Cabeza, R., LaBar, K. S., & Rubin, D. C. (2008). The spatiotemporal dynamics of autobiographical memory: Neural correlates of recall, emotional intensity, and reliving. *Cerebral Cortex* (New York, N.Y.), *18*, 217–229. doi:10.1093/cercor/bhm048.
- Ehlers, A., & Clark, D. M. (2000). A cognitive model of posttraumatic stress disorder. *Behaviour Research and Therapy*, *38*, 319–345. doi:10.1016/S0005-7967(99)00123-0.
- Foa, E. B., & Rothbaum, B. O. (1998). *Treating the trauma of rape*. New York: Guilford Press.
- Frattaroli, J. (2006). Experimental disclosure and its moderators: A meta-analysis. *Psychological Bulletin*, *132*, 823–865. doi:10.1037/0033-2909.132.6.823.
- Gilbert, D. T., Pinel, E. C., Wilson, T. D., Blumberg, S. J., & Wheatley, T. P. (1998). Immune neglect: A source of durability bias in affective forecasting. *Journal of Personality and Social Psychology*, *75*, 617–638. doi:10.1037/0022-3514.75.3.617.
- Greenberg, D. L., & Rubin, D. C. (2003). The neuropsychology of autobiographical memory. *Cortex*, *39*, 687–728. doi:10.1016/S0010-9452(08)70860-8.
- Horowitz, M. J. (1976). *Stress response syndromes*. New York: Jason Aronson.
- Horowitz, M. J., Wilner, N., & Alvarez, W. (1979). Impact of event scale: A measure of subjective stress. *Psychosomatic Medicine*, *41*, 209–218.
- Klein, K., & Boals, A. (2001). Expressive writing can increase working memory capacity. *Journal of Experimental Psychology: General*, *130*, 520–533. doi:10.1037/0096-3445.130.3.520.
- Nemeroff, C. B., Bremner, J. D., Foa, E. B., Mayberg, H. S., North, C. S., & Stein, M. B. (2006). Posttraumatic stress disorder: A state-of-the-science review. *Journal of Psychiatric Research*, *40*, 1–21. doi:10.1016/j.jpsychires.2005.07.005.
- Pennebaker, J. W. (1997). Writing about emotional experiences as a therapeutic process. *Psychological Science*, *8*, 162–166. doi:10.1111/j.1467-9280.1997.tb00403.x.
- Pennebaker, J. W., Colder, M., & Sharp, L. K. (1990). Accelerating the coping process. *Journal of Personality and Social Psychology*, *58*, 528–537. doi:10.1037/0022-3514.58.3.528.
- Rubin, D. C. (1982). On the retention function for autobiographical memory. *Journal of Verbal Learning and Verbal Behavior*, *21*, 21–38. doi:10.1016/S0022-5371(82)90423-6.
- Rubin, D. C. (2006). The basic-systems model of episodic memory. *Perspectives on Psychological Science*, *1*, 277–311.
- Rubin, D. C., Feldman, M. E., & Beckham, J. C. (2003a). Reliving, emotions, and fragmentation in the autobiographical memories of veterans diagnosed with PTSD. *Applied Cognitive Psychology*, *18*, 17–35. doi:10.1002/acp.950.

- Rubin, D. C., Schrauf, R. W., & Greenberg, D. L. (2003b). Belief and recollection of autobiographical memories. *Memory & Cognition*, *31*, 887–901.
- Rubin, D. C., Schrauf, R. W., Gulgoz, S., & Naka, M. (2007). On the cross-cultural variability of component processes in autobiographical remembering: Japan, Turkey and the USA. *Memory (Hove, England)*, *15*, 536–547. doi:[10.1080/09658210701332679](https://doi.org/10.1080/09658210701332679).
- Rubin, D. C., Berntsen, D., & Bohni, M. K. (2008a). A mnemonic model of posttraumatic stress disorder: Evaluating basic assumptions underlying the PTSD diagnosis. *Psychological Review*, *115*, 1099–1106. doi:[10.1037/a0013397](https://doi.org/10.1037/a0013397).
- Rubin, D. C., Boals, A., & Berntsen, D. (2008b). Memory in posttraumatic stress disorder: Properties of voluntary and involuntary, traumatic and non-traumatic autobiographical memories in people with and without PTSD symptoms. *Journal of Experimental Psychology: General*, *137*, 591–614. doi:[10.1037/a0013165](https://doi.org/10.1037/a0013165).
- Sloan, D. M., & Marx, B. P. (2004). Taking pen to hand: Evaluating theories underlying the written disclosure paradigm. *Clinical Psychology: Science and Practice*, *11*, 121–137. doi:[10.1093/clipsy/bph062](https://doi.org/10.1093/clipsy/bph062).
- Sloan, D. M., Marx, B. P., & Epstein, E. M. (2005). Further examination of the exposure model underlying the efficacy of written emotional disclosure. *Journal of Consulting and Clinical Psychology*, *73*, 549–554. doi:[10.1037/0022-006X.73.3.549](https://doi.org/10.1037/0022-006X.73.3.549).
- Smyth, J., True, N., & Souto, J. (2001). Effects of writing about traumatic experiences: The necessity for narrative structure. *Journal of Social and Clinical Psychology*, *20*, 161–172. doi:[10.1521/jsocp.20.2.161.22266](https://doi.org/10.1521/jsocp.20.2.161.22266).
- Talarico, J. M., & Rubin, D. C. (2003). Confidence, not consistency, characterizes flashbulb memories. *Psychological Science*, *14*, 455–461. doi:[10.1111/1467-9280.02453](https://doi.org/10.1111/1467-9280.02453).
- Weathers, F. W., Litz, B. T., Huska, J. A., & Keane, T. M. (1994). *The PTSD checklist (PCL)*. Unpublished scale available from the National Center for PTSD.