

Retrieving, Assessing, and Classifying Traumatic Memories: A Preliminary Report on Three Case Studies of a New Standardized Method

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SUMMARY. The study of traumatic memories is still an emerging field, both methodologically and theoretically. Previous questionnaire and interview methods for studying traumatic memories have been limited in their ability to evoke and assess remembrances with the characteristics long observed by clinicians. In this paper, we introduce a new standardized method that incorporates a laboratory procedure for retrieving memories of traumatic events and a clinically informed measure for assessing these memories' characteristics. We present three case studies to demonstrate the data yielded by script-driven remembering and the Traumatic Memory Inventory – Post-Script Version (TMI-PS). We then discuss subjects' script-driven remembrances in terms of methodology, theoretical classification of traumatic memories, and the interplay

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between the two. Finally, we critique our method in detail and offer suggestions for future research. If validated as a method for evoking and assessing traumatic memories, and shown to yield reliable data, this integrative method shows great promise for advancing both clinical and cognitive research on traumatic memories. [Article copies available for a fee from The Haworth Document Delivery Service: 1-800-342-9678. E-mail address: getinfo@haworthpressinc.com> Website: <http://www.HaworthPress.com>> © 2001 Haworth Press, Inc. All rights reserved.]

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In recent years, much of the research on traumatic memories has focused on recovered memories, true or false, and much of the theory on speculations about encoding and storage processes responsible for amnesia and delayed recall. This state of affairs has largely been a function of social and cultural factors. Scientifically speaking, however, the cart may have been put before the horse. That is, even though research on episodic traumatic memories is dependent on subjects' reports of memories they have just retrieved, research has shed little light on the processes and contents of memory retrieval in traumatized individuals. In this paper, we present a new method for evoking traumatic memories and assessing some of their basic characteristics. Our method brings together a laboratory procedure for standardized retrieval of memories, and a semi-structured interview for assessing memory characteristics based on well-established observations by clinicians dealing with traumatized patients. We offer this easily adapted approach to promote controlled research on the characteristics of traumatic memories, particularly prospective studies of their transformations over time.

Endel Tulving's (1972) classic chapter on episodic and semantic memory begins, "One of the unmistakable signs of an immature science is the looseness of definition and use of its major concepts" (p.381). This certainly appears to be the case today for the scientific study of traumatic memories. Use of the unitary construct of "traumatic memory" is common, though clinical experience and recent empirical and theoretical work suggest that memories for traumatic experiences are complex and heterogeneous phenomena, which change over time in a variety of ways. At this early stage, it might be more helpful to use the super-ordinate and plural construct of "traumatic memories" and methodically build a definitional taxonomy – just as traditional memory researchers have done since Tulving's incisive statement nearly 30 years ago.

A primary goal of this paper is to demonstrate that progress toward an empirically derived taxonomy of traumatic memories will be advanced by more

attention to the following: (1) memory retrieval or evocation methods, and (2) instruments for assessing memory characteristics. We also aim to show that the former must draw more from laboratory research, and the latter from clinical experience and understanding – otherwise a shift in emphasis from encoding and storage to the processes and contents of retrieval cannot realize its potential. We believe such changes in shared theoretical and methodological frameworks can foster the understanding, communication and collaboration needed to advance the field.¹

Pierre Janet (1889, 1919/1925) was the first clinician to clearly articulate differences between ordinary and traumatic memories. He described memories that were inaccessible to retrieval under ordinary conditions and beyond conscious control. The memories of his patients, he noted, consisted of sensory experiences, emotional states, intrusive recollections, and behavioral reenactments (Janet, 1889, 1919/1925; van der Kolk & van der Hart, 1989, 1991). Janet wrote of memory fragments that were remembered with particular vividness, yet resisted integration into existing mental structures, leaving the person “incapable of making the necessary narrative which we call memory regarding the event...” (Janet, 1919/1925, p.663). It is important to note, however, that Janet’s lucid descriptions were limited to the kinds of traumatic memories he could observe in his severely traumatized patients.

In the literature review that follows, we begin by examining the work of three research groups that have investigated the characteristics of traumatic memories in some depth. Next we outline a recent theory of posttraumatic stress disorder which offers a framework for classifying traumatic memories and points to a critical limitation of current methods for assessing those memories’ characteristics. We then recount our discovery of a procedure that overcomes this limitation through standardized evocation and assessment of traumatic memories, particularly their somatosensory and affective characteristics.

PRIOR METHODS FOR RETRIEVING AND ASSESSING CHARACTERISTICS OF TRAUMATIC MEMORIES

To date, few researchers have studied in depth the characteristics that, according to clinicians, distinguish many traumatic memories from non-traumatic memories. Fewer still have investigated the characteristics of memories for traumatic events in non-clinical samples. During the last decade three research groups have attempted to capture the nature of traumatic memories by investigating qualities such as intensity and vividness of somatosensory and affective components, fragmentation and disorganization, and the ability to share memories as coherent narratives. Table 1 provides an

overview of their studies, and Table 2 details how they have assessed traumatic memory characteristics. The following brief review is not focused on study results, but on some strengths and limitations of these investigators’ methods for retrieving traumatic memories and assessing their characteristics.

Two studies by Koss, Tromp and colleagues (Koss et al., 1996; Tromp et al., 1995) compared characteristics of rape memories and memories for other unpleasant events. Both studies were conducted on the same two samples of respondents to surveys mailed to all female employees of a medical center ($N = 1,047$) and all female employees of a university ($N = 2,142$). Such large non-clinical samples offered these researchers the possibility of discovering characteristics of traumatic memories that have not been observed in clinical populations. The other major strength of this work was the use of a detailed measure for assessing memory characteristics (see Table 2). It consisted of 23 items, most taken from a measure proven useful for differentiating real from imagined memories (Suengas & Johnson, 1988), and six items relating to flashbulb memory qualities. Each item was rated on a 1 to 7 scale, which makes for greater sensitivity (than dichotomous or categorical scoring) to gradations of difference between types of memories. Continuous scoring also permitted factor analyses, and four distinct but correlated factors were confirmed: Clarity, Affect, Reexperiencing, and Nonvisual Sensory.

The major limitation of these studies concerns the conditions for retrieval of memories. Subjects first read a series of detailed behavioral descriptions of

TABLE 1. Overview of In-Depth Studies of Traumatic Memory Characteristics

Research Group and Study	Type of Event	Method of Cueing	Memories Assessed
Tromp, Koss, et al. (1995)	rape	questionnaire	current memory of event
Koss, Tromp, et al. (1996)	rape	questionnaire	current memory of event
Reynolds & Brewin (1998)	various stressful and traumatic	interview	current most disturbing intrusion initial most disturbing intrusion (cognitions as well as memories)
Reynolds & Brewin (1999)	various stressful and traumatic	interview	current two most disturbing intrusive memories
van der Kolk & Fisler (1995)	various adult and childhood traumas	interview	current memory of event most distressing memory of event initial memory of the event
van der Kolk, et al. (1997)	same as above	interview	same as above
van der Kolk et al. (2000)	awareness under general anesthesia	interview	same as above

TABLE 2. Memory Characteristics Assessed and Types of Variables Used in In-Depth Studies

Characteristics	Research group, measure used, and coding of variables		
	van der Kolk et al. Traumatic Memory Inventory	Tromp, Koss et al. Memory Characteristics Questionnaire (adapted)	Reynolds & Brewin Life Events and Memories Interview
Visual memory	dichotomous		
Affective/emotional memory	dichotomous		
Auditory/sound memory	dichotomous	continuous	
Bodily memory	[incl. in "tactile"]		
Tactile/touch memory	dichotomous	continuous	
Taste memory		continuous	
Olfactory/smell memory	dichotomous	continuous	
Components together	dichotomous		
Able to tell coherent story	dichotomous		
Order of events		continuous	
Feelings at time		continuous	free recall
Feelings now		continuous	free recall
Affect intensity then		continuous	
Reexperiencing physical	[incl. in "tactile"]	continuous	
Reexperiencing feelings	[incl. in "affective"]	continuous	
Memory clarity		continuous	
Visual detail		continuous	
Color/BW memory		continuous	
Vividness of memory		continuous	
Affect intensity now		continuous	
Unexpectedness		continuous	
Consequences, valence		continuous	
Thoughts about since		continuous	
Overall memory		continuous	
Talked about since		continuous	
How long memory lasted			graded categorical (5 levels)
Frequency of memory			graded categorical (2 levels)
Clarity and vividness			graded categorical (3 levels)
Strong physical sensations			dichotomous
Feeling of reliving			dichotomous
How distressing			continuous
Specific associated emotions		free recall	
Accompanied by out-of-body experience			dichotomous

possible experiences of attempted and completed rape, and indicated if they had experienced any of them. For subjects victimized in this way, that section of the survey constituted a cued recall intervention. In contrast, respondents who did not report sexual victimization were simply asked to pick another significant memory – i.e., to engage in free recall – then to rate its emotional valence as pleasant or unpleasant, and to respond to the same memory items as the victimized subjects. These different recall strategies may have fostered better retrieval of rape memories than other pleasant or unpleasant ones (Tulving, 1976), and in turn may have biased their comparative data on memory characteristics. Researchers using questionnaire or interview measures to assess and compare traumatic memories and non-traumatic memories need to be alert to this potential problem, and whenever possible to control for recall strategy across types of memories. The other limitation related to conditions of retrieval is that subjects were asked to rate characteristics of their memory as called up and experienced while filling out the questionnaire. A remembrance cued via survey questions is not likely to be representative of some traumatic memories, i.e., flashbacks and other reexperiencing phenomena associated with posttraumatic stress disorder. To summarize, behaviorally descriptive recall cues for the rape memories would be expected to enhance their retrieval relative to unpleasant memories; and traumatic remembrances evoked by survey items should yield less retrieval of somatosensory and affective components than, for example, a method capable of evoking a flashback. Both features are likely to shape these researchers' findings.

The most important finding of the Tromp et al. (1995) study, that the Clarity factor best discriminated between rape and other unpleasant memories, was both against their prediction and in the opposite direction of the divergent recall biases for the two types of memories. That is, they reported that rape memories "were *less* clear and vivid, *less* likely to occur in a meaningful order, *less* well-remembered, *less* thought about and *less* talked about" (Tromp et al., 1995, p. 622, italics in original). These findings were unexpected. In the clinical literature, from Janet (1889, 1919/1925) to the present (e.g., van der Kolk & van der Hart, 1989, 1991), *more* clarity and vividness have tended to be associated with less meaningful ordering and incompleteness. However, this discrepancy could be partly an artifact of methodology and semantics. First, the items of the Clarity factor associated with these researchers' terms "clear" and "vivid" were phrased in terms of the memory *as a whole*, while the clinical literature has focused on the clarity and vividness of memory *fragments* in the *absence* of an overall clear and vivid memory. Second, questionnaire cueing would not be expected to evoke the types of remembrances described by clinicians. Tromp and colleagues (1995) interpreted their findings primarily in terms of avoidance coping. However, from a methodological perspective attentive to factors

influencing memory retrieval, it may be that surveys in general, even when they involve numerous cues to recall, tend to *reveal, but not challenge* avoidant coping strategies that constrain the accessibility of traumatic memories – particularly distressing somatosensory and affective aspects. Indeed, this could be true of many interview measures as well.

Taking a different approach, Reynolds and Brewin developed (1998) and revised (1999) a structured interview to assess relationships among several phenomena: the type of event recalled, diagnosis of posttraumatic stress disorder (PTSD) versus major depression, and the contents and characteristics of intrusive memories (Table 2). In their second study, in contrast to the approach of Koss and colleagues (Koss et al., 1996; Tromp et al., 1995), Reynolds and Brewin (1999) had subjects identify actual intrusive memories they had experienced over the past week, then answer questions about each of the two most prominent ones. The memories retrieved with this method are more likely than survey-evoked ones to be flashbacks or other memories characterized by intense somatosensory and affective representations. In addition, their revised interview included a simple yet powerful feature: a free recall item that asked subjects to “name any emotions they associated with” their intrusive memory (Reynolds & Brewin, 1999, p.206). Responses to this item revealed that memories associated with fear were not associated with sadness and vice versa. This finding suggests that assessing a memory’s general “emotional intensity,” without *also* assessing the presence and intensity of certain key emotions, may obscure important characteristics of traumatic memories and their transformations over time.

Our research group has always assumed that to document the characteristics that distinguish traumatic memories from non-traumatic memories, it would be necessary to show changes in memory characteristics over time. To that end, we developed a retrospective interview measure, the Traumatic Memory Inventory (TMI; van der Kolk & Fisler, 1995; see Table 2). Subjects were asked about how they had remembered the trauma at three times: initially, peak (i.e., when it was most distressing), and at the time of the study. The idea was to investigate the characteristics of particular remembrances over the entire “life of the memory.” The TMI’s focus on assessing changes in the characteristics of traumatic memories over time is its greatest strength *and* weakness. In terms of the heterogeneity of traumatic memories, this constitutes a strength because, as clinicians know, traumatic memories may change over time, and they can be transformed into relatively normal memories, sometimes very slowly and at others quite rapidly (e.g., with effective treatment). Yet the biggest weakness of the TMI is the *extent* to which it asks subjects to look back over time. It requires subjects to *remember how they remembered up to years or decades in the past*. This sort of retrieval task increases the threats to validity and reliability already

associated with retrospective reports and their potentials for inaccuracy and distortion.

In the first two studies using the TMI (van der Kolk & Fisler, 1995; van der Kolk, Burbridge, & Suzuki, 1997), both conducted with subjects currently suffering from PTSD, the findings corresponded to classical clinical knowledge about the characteristics of traumatic memories. Many subjects reported that they initially had no narrative memory at all for the event. They could not tell a story about what had happened, regardless of whether they always knew that the trauma had happened, or whether they retrieved memories of the trauma at a later date. Further, the TMI data suggested that all of these subjects initially “remembered” the trauma in the form of flashback experiences in a variety of modalities: visual, affective, auditory, olfactory and kinesthetic. At the same time, subjects reported that these modalities initially tended not to occur together. Finally, the TMI data suggested that as the traumatic memories came into consciousness with greater intensity, more sensory modalities were activated along with the affective component, and over time there emerged a capacity to tell others about what had happened in narrative form.

However, the most recent TMI study (van der Kolk, Hopper, & Osterman, this volume) failed to replicate some key findings of the earlier studies. In a sample of subjects who had experienced the trauma of awareness of surgery under general anesthesia, some with PTSD and some without, no differences were found between groups in the prevalence of sensory and affective memory modalities for reports over time, i.e., initial, peak, and current memories. Nor were significant differences found between the memory characteristics of subjects with and without PTSD at any of the stages of remembering. We concluded that these negative findings stemmed, in part, from a limitation of the TMI: constrained by a dichotomous scoring system, it assessed only whether sensory and affective memory components were present or absent, not the *intensity* with which these components were experienced.

From this brief review, it is clear that these three research groups have already revealed – in their methods, their findings, and evidence of interplay between the two – several of the complexities of traumatic memories and attempts to study them. To make sense of such complexities, and to think clearly about the challenges to research methodology that they pose, we must draw on theory. Given this paper’s primary concern with methods for retrieving and assessing characteristics of traumatic memories, the theoretical focus will be limited to the work of Brewin and his colleagues (Brewin, Dalgleish, & Joseph, 1996). Their theory is accessible to cognitive scientists, clinical researchers and clinicians; relevant to memory retrieval and assessment methodology; and contributes to the development of more refined definitions and classifications of traumatic memories.

**DUAL REPRESENTATION THEORY:
MEMORY REPRESENTATION SYSTEMS
AND PROCESSING OUTCOMES**

Brewin and colleagues (Brewin et al., 1996), in line with earlier descriptions (van der Kolk & van der Hart, 1991), formulated a “dual representation theory” of PTSD. They cite lines of well-established research in several areas of cognitive psychology, social psychology, clinical psychology and neuropsychology which support the view that sensory input is subject to both conscious and nonconscious processing. They propose that two types of memory representations are the “minimum cognitive architecture” within which the complex memory and other phenomena of PTSD can be understood: verbally accessible memories and situationally accessible memories. By verbally accessible memories of trauma, Brewin and colleagues mean a set of representations of a person’s conscious experience of the trauma, which consists of “a series of autobiographical memories that can be deliberately and progressively edited” (Brewin et al., 1996, p.677). Situationally accessible memories, in contrast, are defined as a different set of representations that cannot be accessed deliberately, but may be accessed automatically when sufficient retrieval cues are present.²

The other major feature of Brewin and colleagues’ (1996) theory consists of three proposed outcomes of the emotional processing of traumatic events: completed processing, chronic emotional processing, and premature inhibition of processing. They characterize completed processing or integration, well-described in clinical literature from Janet to the present, as “the ideal stage in which the memories of trauma have been fully processed, or worked through, and integrated with the person’s other memories and sense of self in the world” (Brewin et al., 1996, p.679). At this stage, a person may still experience situationally accessible somatosensory memories that are unexpected and distressing, but these will not be overwhelming or strongly avoided; rather, they can be placed within a network of organized and personally meaningful verbally accessible memories, and processed further if needed or desired. As Janet noted, “It is not enough to be aware of a memory that occurs automatically in response to particular current events; it is also necessary that the personal perception ‘knows’ this image and attaches it to other memories” (translation from Janet, 1898, p.135).

The second outcome described by Brewin and colleagues (1996), chronic emotional processing, is when both verbally and situationally accessible memories of the trauma are chronically processed, and the person is preoccupied with the trauma and its consequences. Whether ruminating about a past trauma, flooded with intrusive memories, or consciously and deliberately restricting one’s life to avoid such memories being triggered, one is preoccupied with the trauma. People in this stage have classic PTSD reexperiencing symptoms and/or

avoidance symptoms, and are more likely to seek therapy or volunteer for research on PTSD.

The notion of prematurely inhibited processing of traumatic memories, that is, the *sustained and automatic* suppression of situationally accessible or intrusive fragmentary memories, is an uncommon one in the literature on psychological trauma. An exception is the work of Creamer and colleagues (Creamer, Burgess, & Pattison, 1990, 1992), who like Brewin et al. (1996), describe this outcome as the result of long-sustained efforts to avoid both verbally and situationally accessible memories. But while Creamer et al. (1992) propose a general theory of posttraumatic outcomes based on this concept, Brewin and colleagues (1996) view prematurely inhibited processing as a particular outcome that can result from combinations of psychological and social factors. Creamer and colleagues’ (1992) theory is largely based on their longitudinal study of office-shooting victims, a sample less likely than clinical ones to include subjects who chronically or completely process the trauma. Similarly, many of the rape victims whose memories were studied by Koss, Tromp and colleagues (Koss et al., 1996; Tromp et al., 1995) may have fit into this category. Indeed, Tromp et al. (1995) cited Creamer and colleagues’ (1992) work in their discussion of avoidance coping as an explanation of their findings.

Brewin and colleagues’ (1996) theory, with its two types of traumatic memory representations (situationally and verbally accessible) and three processing outcomes (premature inhibition, chronic and completed), can provide a preliminary framework for classifying traumatic memories. However, dual representation theory focuses on the two memory systems as corresponding to distinct types of remembrance (Brewin et al., 1996; Reynolds & Brewin, 1999, p.204). In contrast, we focus on how these different types of representations can also be mixed together within particular remembrances, and this perspective informs our framework for describing traumatic memories and investigating their characteristics. That is, each processing outcome can be described in the following terms: (1) the nature of the relationship between the memory systems, and (2) how situationally and verbally accessible traumatic memories are experienced. The chronic processing outcome is characterized by (1) dominance of situationally accessible memory, or fluctuating dominance of situationally accessible memories and verbally accessible memories marked by intense secondary emotions like sadness, shame or anger, and (2) both forms of memory being experienced as distressing, and situationally accessible as very dangerous. In the case of premature inhibited processing, (1) verbally accessible memory is dominant and situationally accessible memory is suppressed, but more as one would control a violent prisoner who could some day attack with terrible consequences, and (2) neither form of traumatic memory is consciously experienced as dangerous. Finally, with completion/integration, (1) verbally

accessible memories are dominant, and situationally accessible memories arise seldom, only with strong cueing, and are easily coded into narrative memory, while (2) neither form of memory is experienced as dangerous, and verbally accessible memory is experienced as a vehicle for mastery. Not only processing *outcomes*, however, but every stage of memory processing should be the focus of research on characteristics of traumatic memories and their transformations over time. There is a great need for prospective research of this kind.

Many critical methodological issues stem from potential interactions among key factors: *sample type* (e.g., clinical vs. non-clinical), *traumatic event type* (e.g., single incident vs. chronic exposure, accident vs. interpersonal violence), *memory representation type* (verbally vs. situationally accessible), *memory retrieval method* (e.g., questionnaire vs. interview) and *instrument for assessing memory characteristics* (e.g., questionnaire vs. interview, probing primarily for verbally accessible vs. situationally accessible representations). For example, because “existing scales do not capture” the distinction between situationally and verbally accessible traumatic memories, Brewin and colleagues suggested “it may be profitable to examine the phenomenology of intrusive memories in more detail, with a view to developing more comprehensive data” (Brewin et al., 1996, p.683).

HOW MEMORIES ARE RETRIEVED DETERMINES THE MEMORY CHARACTERISTICS AVAILABLE FOR ASSESSMENT

While we agree that new measures are needed to assess the characteristics of traumatic memories, the creation of better *scales* – whether questionnaires or interviews, however strong the psychometric properties – is insufficient. Our position is best summed up in two questions:

1. What kind of instruments enable valid and reliable assessment of the characteristics of both (a) verbally accessible and (b) situationally accessible somatosensory and affective traumatic memory representations?
2. Which retrieval-facilitation methods enable valid and reliable *evocation* of these two types of memory systems, particularly situationally accessible somatosensory and affective representations, so that they *can* be assessed with appropriate instruments?

One possible answer to the second question emerged from our Positron Emission Tomography (PET) study of PTSD (Rauch, van der Kolk, et al., 1996), which we conducted in an attempt to elucidate neurobiological substrates of the

traumatic memory characteristics we had previously investigated with the TMI (van der Kolk & Fisler, 1995). This neuroimaging study incorporated “script-driven imagery,” a laboratory research method, to retrieve both traumatic and control neutral memories in an individualized yet standardized way. Script-driven imagery is a method pioneered in the field of psychophysiology by Lang and colleagues (e.g., Lang, Levin, Miller, & Kozac, 1983) and later applied to the psychophysiology of PTSD by Pitman, Orr and colleagues (e.g., Pitman, Orr, Forgue, de Jong, & Clairborn, 1987), who were co-investigators on the PET study. This study taught us that researchers can exert considerable control over the retrieval of traumatic memories, and that a standardized retrieval-facilitation method can provide an excellent opportunity to gather phenomenological data on the characteristics of memories. We realized that, when linked to such a method, the TMI or a similar instrument could be used to assess how subjects remembered their trauma *immediately after a controlled retrieval process*, which we saw as an advance over prior methods.

THREE CASE STUDIES USING A NEW METHOD FOR STANDARDIZED RETRIEVAL AND ASSESSMENT

We present three cases of subjects whose script-driven traumatic memories were assessed with an adapted version of the TMI, before and after treatment with Eye Movement Desensitization and Reprocessing (EMDR; Shapiro, 1995), an intervention that fosters processing of traumatic memories. Our aim is to provide sufficient preliminary data for readers to evaluate whether this new method warrants further study.

Method

Design. Characteristics of traumatic memories were prospectively assessed by script-driven remembering and a brief structured interview, and compared for differences between pre- and post-treatment. Data on three cases were qualitatively analyzed. There were comparisons of responses to free-recall questions, and continuous indices of the intensity of somatosensory and affective memory components.

Participants. Three of 12 participants in a functional neuroimaging study of treatment outcome of PTSD were given the Traumatic Memory Inventory – Post-Script Version (TMI-PS) immediately after script-driven remembering, both before and after a course of three 90-minute sessions of EMDR treatment. Subjects were recruited via advertisements in newspapers and fliers posted in public spaces. As in previous research with the TMI (van der Kolk & Fisler,

1995), the advertisements and fliers prominently featured descriptions of intrusive PTSD reexperiencing symptoms, and all subjects were men and women 18 years of age or older who met DSM-IV criteria for PTSD. All had continuously remembered the traumatic experiences for which memories were retrieved and assessed. Procedures were conducted at an outpatient psychiatric clinic specializing in the treatment of traumatized populations and at the nuclear medicine department of an academic hospital. Human subjects approval was obtained from both institutions where the study was performed, and written informed consent was obtained from all subjects. Exclusion criteria included scores over 35 on the Dissociative Experiences Scale, suicidal or self-mutilating behaviors in the past six months, and active substance abuse in the past six months (DSM-IV criteria).

Materials. Subjects were assessed by trained interviewers for PTSD diagnosis and severity of PTSD symptoms with the Clinician Administer PTSD Scale (CAPS; Blake et al., 1995), a structured interview which has been shown to yield reliable data and has been validated for the purpose of assessing PTSD symptoms and their severity. The CAPS was administered at the initial assessment, and immediately before and after treatment. Comorbidity of DSM-III-R Axis I disorders was assessed with the SCID-I for DSM-III-R (Spitzer, Williams, & Gibbon, 1987).

Procedure. Subjects completed all eight visits of the neuroimaging study. These visits included (1) initial assessment, (2) laboratory psychophysiology assessment, (3) pre-treatment SPECT scan of neutral memory, (4) pre-treatment assessment, including SPECT scan of script-driven remembering, (5-7) three EMDR sessions, and (8) post-treatment assessment, including a SPECT scan of script-driven remembering. Data reported below were gathered in the fourth and eighth visits, when SPECT scans were conducted to assess CNS correlates of script-driven remembrance of the trauma addressed in treatment.

Script-driven remembering. At visit 1 the subject and a research assistant composed an individualized script portraying the most traumatic experience the subject could recall, after the method of Lang's group (e.g., Lang et al., 1983), as adapted for PTSD psychophysiology research by Pitman, Orr, and colleagues (for details of the methodology, see Pitman et al., 1987, and Orr, Pitman, Lasko, & Herz, 1993). Subjects were asked to describe their target traumatic experience in writing on script preparation forms (for current version, see Appendix A). Each form has two pages. The first page has directions for writing a description that includes contextual information, sensations, bodily experiences, emotions, and cognitions. The second page consists of a "menu" of subjective visceral and muscular reactions (associated with physiological arousal), from which subjects select those they remembered having accompanied the experiences. The research

assistant reviewed subjects' forms and asked them to clarify or expand on the details where necessary for script construction.

The research assistant then composed a written script of the traumatic experience, which portrayed the experiences in the second person and present tense. Scripts were written to maximize accessibility of episodic, situationally accessible memory representations. Each script began with information that set the context of time, place and situation. Then it narrated the event by incorporating, in the sequence specified by the subject, sensory, affective, cognitive and physiological details from the subject's description (including five visceral and muscular reactions, or as many as the subject selected, whichever was less). Each script, approximately 30 seconds in length when read aloud, was then narrated onto an audiotape for later playback.

The subject was seated in a comfortable chair in an examination room that did not include scanning equipment. After a baseline rest period, the subject listened to the taped script with eyes closed. The subject was instructed to "remember the experience as vividly as you can, in all of its details – all the sensations, feelings, etc.," while the tape played, and to continue remembering in this way until signaled to "relax" by a research assistant. In this study subjects received an intravenously administered injection of a radioactively labeled tracer immediately before the tape started, and had a script-driven remembering period of 3 minutes, including 2½ minutes after the tape. (This long post-tape period may not be optimal, but was necessary because it takes nearly 3 minutes for 80% of the tracer to absorb into brain tissue.)

Administration of the Traumatic Memory Inventory – Post-Script Version. Immediately after a memory was evoked by the standardized script method, the TMI-PS was administered (for current version, see Appendix B). First, subjects were asked a free-recall question, "When you remembered the traumatic experience today, listening to the tape and/or during the imaging phase, how did you remember it?" Next, they were asked to report whether or not their experience included content in various modalities (visual, etc.), and if so, what they had experienced. At the level of the whole memory, these modality-specific inquiries constitute cued recall prompts; at the level of the memory modalities, they are free recall questions. In contrast to the original TMI, which only has subjects report the absence or specific content of each memory component, the TMI-PS followed up on these responses by having subjects go back and provide intensity/vividness ratings for each component. The interviewer said, "Now I'd like you to go back and rate the intensity of each aspect of the memory, with 0 being not at all present and 10 being as intense or vivid as the original event." This rating is intended to allow more valid and reliable determination of the extent to which contents of a particular memory modality were experienced as relived sensory or affective fragments versus less intense and vivid recollections

(perhaps partly derived from a semantic memory schema). Subjects were next asked three questions related to fragmentation and narrative incoherence (see Appendix B). As a validity check on subjects' compliance with the task, and to probe for additional important but unexpected data, subjects were then asked, "Were you thinking about or remembering anything else while listening to the tape and/or during the imagining phase?" (Please note: The TMI-PS in Appendix B is a revision of this earlier version, with changes in the wording and ordering of some items; as discussed below, ethical considerations may also dictate modifications, e.g., removing free-recall questions if the data will not be analyzed).

Eye Movement Desensitization and Reprocessing. EMDR is a comprehensive treatment approach to PTSD (Shapiro, 1995) that involves exposing people to memories of their trauma (Chemtob, Tolin, van der Kolk, & Pitman, 2000). Patients rapidly move their eyes back and forth during exposure to their traumatic memories, including visual, affective and physiological components. "Desensitization and reprocessing" refers to reducing the distress associated with a traumatic memory and integrating it into autobiographical memory. A memory previously experienced as a traumatizing intrusion to be assiduously avoided should become, after successful EMDR, a less painful or even painless memory that one can remember without being overwhelmed, or choose to stop remembering without engaging in debilitating avoidance. Successful treatment should render a memory less intense and fragmented in its somatosensory and affective aspects, and more dominated by verbal narrative constructions. In short, successful and completed treatment is indicated by transformation of a traumatic memory into a more normal memory. Subjects received three EMDR sessions, which were expected to transform their memories to varying degrees partly dependent on the severity of their trauma histories and PTSD.

Results

Three cases are presented, each beginning with identifying information and CAPS scores indicating severity of PTSD symptoms before and after treatment (measured the same day memory characteristics were assessed). Then TMI-PS data are presented, in the following order: first, quotations from responses to the first, open-ended TMI-PS question about how the subject remembered; second, verbatim descriptions of the reported contents of memory components (no subject reported an olfactory memory component); third, a bar graph depicting intensity ratings for somatosensory and affective modalities. And finally, one subject's particularly illuminating responses to TMI-PS questions about whether (a) she experienced the components of the memory separately or together, and (b) she could "tell it to someone as a coherent story."

Subject 1 was a 50 year old married man who worked as a computer

programmer. He had experienced repeated sexual abuse by a 19 year old male babysitter over a period of 2 years. His script narrated an incident that occurred when he was 5 years old, the incident he found most upsetting and remembered most vividly. Subject 1 had a history of alcohol abuse from adolescence to age 38, and he continued to struggle with compulsive sexual behaviors, a source of intense shame. He had been in psychotherapy for 1½ years before entering the study, and though he had discussed his traumatic experiences and their effects often in therapy, he had no prior experience with any exposure therapies, including EMDR. He had been on 60mg of fluoxetine (Prozac) since 3½ months prior to entering the study. When entering the study he met criteria for Dysthymia and Obsessive Compulsive Disorder, though neither condition was severe. On the day of his pre-treatment memory assessment, his CAPS score was 54, indicating PTSD of mild to moderate severity, and at post-treatment it was 16, a sub-clinical level of symptomatology.

In his responses to the initial, open-ended TMI-PS question about his experience of the memory, this subject focused on his reactions to the memory.

Pre-treatment: "Pretty much the way I always do, as far as the pictures. I didn't feel as intense or as involved as I normally do.... I think there was an undercurrent of knowledge where I was. But, I'm not sure. It was a very strange feeling for me to hear it being narrated.... In one respect I think it was almost lifting some burden, hearing it, but on the other hand I wanted to run away from hearing it. I felt like I wanted to escape..."

Post-treatment: "I remembered it as though it was a real memory, but it was a little distant, and more manageable. There wasn't the vividness I am used to having. And there wasn't the bright light – remember the bright light? I guess a clear way of putting that very simply is, I typically drown in it, and this time I was floating on top.

"....There's another thing that was very foreign to me in terms of this particular memory. I'm reluctant to say it: There was a certain *power* in calling up the memory. I didn't feel as helpless. Right now I'm feeling angry" (spoken emphasis).

"I felt difficulty in connecting to it. I was remembering the emotions as opposed to experiencing the emotions. I didn't feel like it was happening all over again. That's probably where the power came from."

In response to specific probes about each potential sensory and affective modality, he only reported experiences of visual and affective components (intensity ratings are in parentheses):

Pre-treatment visual (8): “I swear there was a multi-colored comforter. I saw my baby-sitter next to me – same thing as I always see. I think what strikes me is that the room is incredibly bright.”

Post-treatment visual (3): “No bright light. I saw the same snapshot I always see. It was subdued, darker. It was harder to connect with it in terms of getting emotionally involved with it. And it didn't feel as real as it used to.”

Pre-treatment affective (8): “Embarrassed, frightened, helpless. Maybe disgust. Upset.”

Post-treatment affective (1): “I felt sad. If I had to say there was one consistent emotion, it was sadness. I really didn't seem to get involved. It was pretty difficult for me to connect with it. But some anger. I am still feeling that. Intensifies and subsides.”

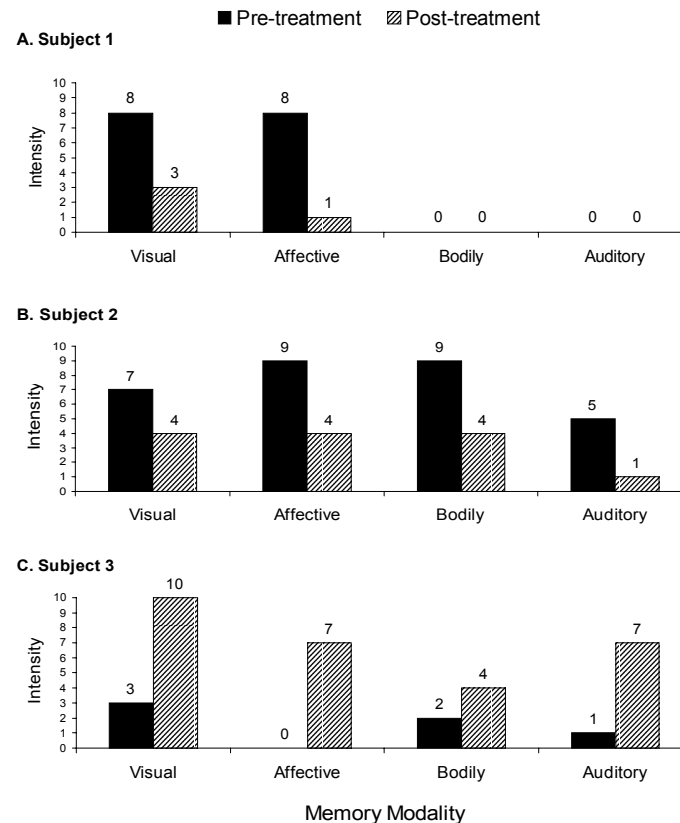
Bar graph A of Figure 1 visually depicts differences between his pre- and post-treatment remembrances, i.e., greater intensity ratings in the visual and affective modalities for the pre-treatment than the post-treatment remembrance.

Subject 2 was a 55 year old single woman who worked as a childcare provider and had been collecting disability since 1994. She used the EMDR sessions to address the effects of a brutal rape by her ex-husband at age 33. She had experienced significant emotional abuse by both parents in childhood, and had a history of substance abuse (alcohol, amphetamines and marijuana) which began immediately after the rape and ended at age 39. Subject 2 had been in supportive therapy several times, and had seen her current therapist bi-weekly for 5 years. That therapy had focused sporadically on how the rape continued to affect her and how to manage related symptoms, but little progress had been made in terms of her intrusive symptoms and intense shame and self-hate. When entering the study she met criteria for Dysthymia and Past Major Depressive Episode, for which she had been taking 300 mg of bupropion (Wellbutrin) daily for 2 years. At pre-treatment her CAPS score was 64, and at post-treatment it had dropped to 30.

For this case, we include her traumatic script, which ends moments before her ex-husband initiates the rape, to illustrate this method:

It is October of 1976, and after coming home late you are taking a shower in the bathroom off the master bedroom. You have locked the door, but suddenly hear your husband smashing through it. You are seized with terror and your heart pounds as he breaks through the door, piece by piece. You are unable to escape and can only freeze. He pulls you from the shower, throws you on the floor, kicks you and drags you into the bedroom. Your body is shaking and he's got you up against the wall. You're naked though he's clothed, and he's punching you.

FIGURE 1. Transformations of Traumatic Memories as Measured by TMI-PS Intensity Ratings



Both before and after treatment, this subject's response to the initial open-ended TMI-PS question focused on affective aspects of the memory. Her post-treatment response to this question also addressed the issue of fragmentation versus cohesion over time.

Pre-treatment: “As soon as I heard it, just the date, I got really anxious and sad. I got all choked up. I think that's masked anger. Powerless. Real powerless. Part of it was kind-of a reenactment. I was definitely there.”

“There aren't too many incidents where I haven't been able to take control. You know what, I just flashed back to a drunk experience. Woke up with someone, there were these attack dogs growling at me, he had me

in a headlock. I was around 35.... I think I was so traumatized and freaked out that I've chosen not to remember that."

Post-treatment: "Vividly, pretty vividly. And I was surprised that it stirred me to the degree it did. But my body didn't tremble and shake like it did the first time... Less traumatic. I don't think I've cried – it's the first time I've cried about it...."

"More sadness than horror. It was unsettling, mostly because I thought I was gonna sail through, which was unrealistic."

"This time it was like a cohesive unit. You know what I mean? Before, I felt each and every step of it. Now it's like an event. It's like a whole instead of fragments, so it's more manageable. In the past, five years ago, I would *think* of it as an event, but wouldn't allow myself to go there" (spoken emphasis).

Asked specifically about each sensory and affective modality, she reported experiences in each modality except olfactory:

Pre-treatment visual (7): "I saw myself really skinny and naked in the shower. What I saw was trouble coming. I just see me with my skin kind of glistening. He was dressed and I wasn't. He was dressed and waiting for me."

Post-treatment visual (4): "It wasn't as vivid. I didn't see myself on the floor, skinny and wet and frightened. I just kind of listened to it and didn't see anything, until he slammed me against the wall. I saw him clothed on top of me, which the tape brought back. So the beating part was blurrier, but the rape was clear."

Pre-treatment affective (9): "I was only conscious of how I was feeling today. Just this horrible overwhelming sadness."

Post-treatment affective (4): "I said there wasn't any horror. I think it's more sadness. I didn't feel disgust. I didn't feel anger.... I think the other part of the sadness is that I waited 22 years to go through this...."

Pre-treatment bodily (9): "I was trying not to just burst out crying. My whole body was pulsing!" [Interviewer asks, "Did you remember how your body felt then?"] "No. I think I try to block that out. I sort-of won't go there."

Post-treatment bodily (4): "I felt myself kind of shaking, but nothing like the first time."

Pre-treatment auditory (5): "Not many, not real vivid. I did hear the wood breaking and cracking."

Post-treatment auditory (1): "I didn't hear him crashing the door. I didn't hear much. I guess I did hear him say, 'You're just like my mother.' I heard less, and it was less significant. No grunting, no animal sounds."

Bar graph B of Figure 1 conveys significant differences between pre- and post-treatment intensity ratings for the sensory, bodily and affective representations in subject 2's remembrances.

Subject 3 was a 25 year old woman severely physically and emotionally abused by both parents throughout childhood and adolescence. She had no prior psychotherapy experience and entered the study hoping to reduce posttraumatic symptoms, particularly intrusive memories of an incident of sadistic emotional abuse by her mother. Thus, the event she focused on was not a "Criterion A event," that is, not traumatic according to the DSM-IV definition, but experienced by her as traumatic because of its *meaning* to her and its thematic linkage to many other traumatic experiences involving her mother. Subject 3 was employed as a temporary office worker at the time of the study, and was struggling to finish a senior thesis, her final requirement at a prestigious college. She met criteria for current major depressive disorder (recurrent), past simple phobia, and agoraphobia without panic, but had never taken psychiatric medications. She entered the study with an extremely high CAPS score of 122 (maximum score is 136), which after three EMDR sessions had dropped to 75, still in the moderate to severe range of PTSD symptomatology.

This subject had a very different pre-treatment script-driven memory experience than the other two subjects. Theirs were primarily characterized by reexperiencing phenomena (i.e., PTSD Criterion B). Her response to the opening TMI-PS question indicates that her pre-treatment response to the script was a numbing one (i.e., PTSD Criterion C). However, on the same day as the pre-treatment memory assessment, she reported frequent and severe reexperiencing symptoms for the past week on the CAPS, including flashbacks with extremely intense visual and affective components. Thus the comparisons she draws below in her post-treatment comments refer to her more typical intrusive memories.

Pre-treatment: "It was hard to get into it this time. It can be hardest to psych into it if I'm feeling safe...."

"Either I'm really worked up, or I'm really calm. But there's nothing else. I felt more numb."

"When I'm calm about it, I don't feel anything and I can function. But I don't *feel* anything. Like in high school... I really had a grip on things, but in gym class I couldn't function... (spoken emphasis)."

"The decision I made [only recently]: I'd rather be fucked up but feel something... I didn't react to anything in the past."

Post-treatment: "Just calmer. That's the biggest thing. I can think of it and it's not gripping me. Be able to think about it, and not be controlled when it's happening. It's like, I feel fine now, like, I feel safer about it is

probably the biggest thing. Like if I walk outside it's not going to happen again. But it's still there. It's going to be there a long time."

In terms of specific sensory and affective components, the contrast between the pre- and post-treatment remembrances is quite striking, though again a reversal of the pattern for the other two subjects.

Pre-treatment visual (3): "I tried to hold an image of her in front of me of her looking at me. It was silence, looking at her through a glass wall, so it couldn't affect me, couldn't touch me."

Post-treatment visual (10): "Her, looking at me, not from the outside, more her in front of me. I think I saw her body more so, not just her face. I can remember her body now – it didn't remain as part of the memory. It's not realistic, a lot of darks and lights."

Pre-treatment affective (0): "It was like an anti-emotional effect, total calmness like wanting really badly to sleep. Feeling of emptiness."

Post-treatment affective (7): "I feel like I'm in the memory now, instead of her totally taking over the situation. I felt sorry for myself. I usually don't feel bad for myself. I felt kind-of a little bit sad, sad for myself."

Pre-treatment bodily (2): "Just stiff, and sometimes really calm. There's part of me that feels it will totally psychologically destroy me."

Post-treatment bodily (4): "I could feel myself breathing. I felt a lot more stable physically. Usually I don't feel there, but this time I felt physically calm, like I was there, calm in a settled way. Sometimes I feel calm in a numb way."

Pre-treatment auditory (1): "Silence. Nothingness. Instead of hearing her talking to me, it was coming from me."

Post-treatment auditory (7): "Her voice. More background noise. Her voice was dimmed. It's like it used to be like in movies, that overvoice, thunderous, but now it's less like that."

Bar graph C of Figure 1 depicts the intensity ratings of subject 3, which are quite different from those of subjects 1 and 2, both in terms of magnitudes at pre- and post-treatment and which of the two remembrances had higher ratings.

Finally, this subject, who still had a relatively high CAPS score of 75 at post-treatment, gave the following answers to TMI-PS questions about whether she had experienced the memory components together and whether she could tell someone the experience as a "coherent story":

Post-treatment, components together? (No): "It's not cohesive. It's definitely pretty fragmented. I just don't see it being any other way for a

while, because personally I just want to deal with a little at a time. Like I don't want to get overwhelmed by it again. Only recently have I felt like I can choose not to get into it. There's actual distance now. It's so little, but very significant. I feel like I have a little layer of skin on me now."

Post-treatment, tell coherent narrative? (No): "I think I'd start crying. But I'd much rather cry than laugh about it. No. Too much. I'd have to stop."

DISCUSSION

What are the characteristics of traumatic memories? Are there different subtypes? How are traumatic memories different from normal memories? How do we know when traumatic memories have *become* normal memories, or have changed in less dramatic but clinically significant ways? Traumatized individuals and the clinicians who treat them continually attempt to answer such questions, and the clinical literature addressing these issues is over a century old (e.g., Breuer & Freud, 1893; Janet, 1889, 1898). Yet valid and reliable methods for answering these questions with empirical research are just beginning to be developed. The cases presented here demonstrate that a clinically informed memory assessment instrument, when combined with a laboratory science method for retrieving memories, can yield phenomenological data that are complex, true to the experiences of traumatized people, yet quantifiable. Such integrative methods – if shown to yield reliable data and validated as assessments of traumatic memories – could provide a sound basis for more systematic and comprehensive classification traumatic memories, for distinguishing them from non-traumatic ones, and for discerning stages and outcomes of processing.

Retrieving Traumatic Memories

Distressing memories are the hallmark of posttraumatic stress disorder. "Reexperiencing" symptoms are listed first in the DSM-IV (APA, 1994), and all of them involve distress associated with remembering or being reminded of the traumatic event. Just as people with panic disorder suffer mainly from panic attacks, people with PTSD, as Breuer and Freud commented over a century ago, when the disorder had a different name, "suffer mainly from reminiscences" (1893, p.7). Though not every remembrance of a traumatic event is a *traumatic remembrance*, such remembrances are important types of traumatic memories – and the characteristics of such memories (not only recovered ones) have been a

topic of heated debate between psychological trauma researchers and cognitive scientists (e.g., Shobe & Kihlstrom, 1997).

To investigate *these* sorts of traumatic memories the procedures for memory retrieval are crucial. In research on panic disorder, researchers have developed methods to provoke panic attacks so they can assess their phenomenology and biological correlates (e.g., Lindsay, Saqi, & Bass, 1991; Reiman et al., 1989; Verburg, Pols, de Leeuw, & Griez, 1998). In contrast, for the study of traumatic memories, *how to evoke the memories to be assessed* is neither obvious nor straightforward. A questionnaire or interview can be used to assess characteristics of a memory evoked by the questionnaire or interview itself (e.g., Koss et al., 1996; Tromp et al., 1995), or a remembrance the subject experienced in the past week (e.g., Reynolds & Brewin, 1999). An interview might have subjects “call the memory to mind,” and then pose questions about its characteristics, or it might direct and redirect subjects to narrate the trauma out loud, in the present tense, as if it were happening again (e.g., Foa et al., 1995). Clearly each method utilizes very different strategies to evoke remembrances of traumatic events, and we should not be surprised if assessment of identical characteristics yields data that are different or apparently contradictory.

Several features of script-driven remembering appear to make this a uniquely effective method for evoking traumatic memories in the laboratory. The method is both individualized and standardized, thus capable of evoking memories for unique events using highly structured procedures. Three features of script-driven remembering are designed to channel the retrieval process rapidly from contextual information directly into situationally accessible event-specific knowledge: (1) the directions given to the subject, (2) the present-tense narration of the script, and (3) the sequential specification of somatosensory and affective details. When subjects listen to the tape, they experience a memory evocation procedure that is directive rather than interrogative, and that employs detailed and sequentially unfolding cues to retrieve an episodic memory that is “script-driven.” The fundamental goal of script-driven remembering is not perfect matching between cue and memory store, but as full as possible activation of the episodic memory system under well-controlled conditions. That is a task for which questionnaire and interview measures alone are not well suited. The superficial cueing of questionnaires is likely to undermine their validity, and interviews are likely to lack reliability because an interactive conversation of several minutes cannot approach the standardization of listening to a brief and formulaic script. This individualized, standardized and adaptable method warrants further research to determine its validity as a method for evoking traumatic memories, and the reliability of the data it yields.

The greatest strength of the TMI-PS, the “assessment side” of our evocation-

assessment methodology, is its “delegation” of memory retrieval to the preliminary procedure of script-driven remembering. In prior research, the procedure for evoking a remembrance has been embedded in the instrument used to assess the same remembrance’s characteristics. The TMI-PS acquires data on particular remembrances *already* evoked under very controlled conditions, and is minimally retrospective – minutes at most. Further, its intensity ratings of somatosensory and affective modalities are meant to provide data on characteristics of traumatic memories long observed by clinicians. Thus we also believe that the TMI-PS warrants further research on its validity as a measure of these memory characteristics and the reliability of the data it yields.

Script-Driven Remembrances and the Classification of Traumatic Memories

In the absence of empirical research demonstrating the validity and reliability of our method, we cannot draw definitive conclusions from the case data presented here. We do not know whether these subjects’ pre- or post-treatment responses to script-driven remembering would have demonstrated stability over time. And even if we did, we would have no way of knowing, for example, whether a simple habituation effect accounted for any differences between observed pre- and post-treatment remembrances. Indeed, strictly speaking, we cannot even say that we measured characteristics of memories, only that *we evoked remembrances with certain characteristics, some of which we attempted to measure*. Therefore, in discussing our case data, we only *describe* these subjects’ remembrances, sparingly using theoretical constructs in order to suggest how researchers might approach the interpretation of such findings. Only the unexpected pre-treatment numb remembrance of subject 3 is used for tentative theoretical speculation, and in that case, mainly because of the possible implications of such remembrances for the research required to establish the reliability of script-driven remembering.

Though designed to assess script-driven remembrances, the TMI-PS itself is necessarily a collection of memory retrieval methods. These methods include an opening free recall question, several items concerning the contents of somatosensory and affective modalities, and cues that elicit intensity ratings for the contents of each modality. Besides its delegation of memory evocation to script-driven remembering and its minimally retrospective nature, the major advance of the TMP-PS (over the original TMI) is the elicitation of somatosensory and affective intensity ratings in addition to modality contents reports. Therefore, we focus our discussion on the data yielded by this section of the instrument.

Figure 1's bar graphs warrant two observations: First, for all subjects the pre-treatment traumatic memory does not resemble the post-treatment memory on somatosensory and affective intensity ratings. Second, subject 3's pre-treatment memory is strikingly different from those of subjects 1 and 2. As the validity of the method and the reliability of these data are not established, causality cannot be established either. However, we believe it is worthwhile to describe differences between each subject's pre- and post-treatment remembrances. Thus we will not discuss "changes in memories" from pre- to post-treatment, but "differences in remembrances" assessed at two times.

Subject 1's reports of modality contents and intensities suggest two differences between the remembrances, in terms of relative dominance of verbally versus situationally accessible memories. First, the intensity ratings for visual and affective modalities were less in the post- than the pre-treatment remembrance; second, different affective experiences were reported for each memory. At pre-treatment, subject 1 referred to a "bright light" and at post-treatment to its absence, and he gave visual intensity ratings of 8 and 3, respectively. His affective intensity rating at pre-treatment was 8, compared to 1 at post-treatment. However, the *types* of affects he experienced were different as well: "frightened" and "upset" at pre-treatment versus "sadness" and "some anger" at post-treatment – that is, feelings experienced *during* the original event versus feelings *about* the event based on what it means to him now. This distinction fits with that of Brewin and colleagues' between "conditioned emotional reactions corresponding to the activation of specific emotional states... experienced during the trauma," and "secondary emotions," which "follow from the consequences and implications of the trauma," and are part of verbally accessible memories (Brewin et al., p.677). The different types of affects experienced by subject 1 at pre- and post-treatment also fit with an empirical finding (Reynolds & Brewin, 1999), that memories associated with fear were not associated with sadness, and vice versa. Any future research with this method should probably evaluate the utility of the *combination* of the affective intensity rating and content report, particularly for categorizing traumatic memories into different types.

Subject 2 described her pre-treatment auditory memory of "wood breaking and cracking" as "not real vivid," but gave an intensity rating of 5, much higher than the rating of 1 at post-treatment, when she "didn't hear him crashing the door." It is notable that those sounds were missing from the memory evoked at post-treatment, even though the script *suggested* that she hear them. For the bodily modality, at pre-treatment subject 2 reported "trying not to burst out crying," and exclaimed, "My whole body was pulsing!" Interestingly, she did not report that fear accompanied these intense somatosensory representations, but that she was "only conscious of what I was feeling today... horrible over-

whelming sadness." Recall that for subject 1, a pre- versus post-treatment difference in the affective intensity rating (8 versus 1) corresponded to a difference in affective content, of primarily fear in the first remembrance and sadness and anger in the second. In contrast, subject 2 reported different intensities of 9 at pre-treatment versus 4 at post-treatment in both affective and bodily modalities, but with *consistency* of content: "horrible overwhelming sadness" versus "sadness" but not "horror;" and "whole body...pulsing" versus "kind of shaking." It appears, then, that the relationships of sadness and fear to somatosensory and affective contents may be quite complex within and across remembrances. The finding of sadness co-occurring with intense somatosensory representations also suggests that situationally and verbally accessible memory representations may be simultaneously activated and blended together within the same remembrance.

Before discussing subject 3's data, two tentative conclusions are warranted concerning methodology. First, script-driven remembering appears capable of *eliciting* remembrances that are characterized by (a) intensely experienced somatosensory and affective contents, and (b) the presence of affects associated either with the traumatic event or subsequent interpretations of its meaning. Second, the TMI-PS appears capable of *detecting*, in particular script-driven remembrances, gradations in the intensities of sensations, bodily experiences and emotions.

Subject 3's pre-treatment remembrance can be interpreted in two ways: (1) as evidence that our method lacks validity and/or reliability; (2) as an example of a type of traumatic memory not adequately addressed by current theories of PTSD or traumatic memory. It is worth considering each interpretation to shed light on methodological and theoretical issues related to our method. How does her pre-treatment remembrance cast doubt on script-driven remembering as a method for evoking traumatic memories? Subject 3 was found to have extremely severe PTSD, including *frequent and intense intrusive memories*, on a validated and reliable measure for assessing PTSD diagnostic status and symptom severity (i.e., a CAPS score of 122). If someone with such extreme reexperiencing symptoms does not respond or does not consistently respond to script-driven remembering with an intrusive memory characterized by intense somatosensory and affective experiences, then there may be something wrong with the method.

On the other hand, subject 3 herself said spontaneously that her pre-treatment remembrance was familiar to her, indeed, as familiar as having an intense intrusive memory. That is, responding to the opening free-recall question of the TMI-PS, she said, "Either I'm really worked up, or I'm really calm. But there's nothing else. I felt more numb." Subject 3 presents a clear picture of extreme numbing. Of the visual images she said, "It was silence, looking at her through a glass wall," and rated their intensity at 3. Asked what she felt

emotionally, she began, “It was like an anti-emotional effect,” and gave *zero* as the intensity. For the auditory modality, she rated it a 1 and began, “Silence. Nothingness.” If this sort of remembrance is fairly typical for this subject, then at least two possible explanations arise: (1) script-driven remembering may be an effective method for evoking such a remembrance; (2) her numbing may only be *incidentally* related to the procedure, i.e., she was numb before, during and afterward. Only controlled studies with sufficient power to detect such possible effects are adequate to investigate these sorts of remembrances in people who have experienced traumatic events.

However, *it may not be possible* to separate the issue of numb remembrances from the studies required to establish the validity and reliability of script-driven remembering and the TMI-PS. If numb remembrances *are* a type of traumatic remembrance, then their occurrence *despite* the script-driven remembering procedure – a method designed to evoke intense somatosensory and affective representations – might constitute a robust phenomenon measurable by the TMI-PS (or other measures). In that case, subjects who exhibit such remembrances *and* classic intrusive remembrances would not be expected to provide data supporting the test-retest reliability of script-driven remembering – but neither should their data be considered evidence of the *unreliability* of script-driven remembering. Clinicians have long noted the tendency of some traumatized people to alternate between intrusive remembrances characterized by intense somatosensory and affective fragments, on the one hand, and highly schematized memories that, when spoken, are superficial narratives devoid of feeling, on the other. Two passages from Breuer and Freud’s classic 1893 paper capture this paradoxical situation:

At first sight it seems extraordinary that events experienced so long ago should continue to operate so intensely—that their recollection should not be liable to the wearing away process to which, after all, we see all our memories succumb....

We must, however, mention another remarkable fact,... *these experiences are completely absent from the patient’s memory when they are in a normal psychological state, or are only present in a highly summary form* (1893, pp.7 & 10, italics in original).

The dual representation theory (Brewin et al., 1996) offers a clear framework with its two types of memory representations and three processing outcomes. However, it does not clearly articulate a place for numb remembrances among people in the *chronic emotional processing outcome*, the outcome that includes people with PTSD. Thus “trauma-related scripts” (Brewin et al., 1996, p.679) are described as effectively and *continually* preventing the activation of situationally accessible intrusive memories, and only associated

with the prematurely inhibited processing outcome. Their theory does not address numbing or dissociative symptoms in detail, and they only propose in passing that numbing or dissociative responses to a specific trauma may be “coded within” situationally accessible memories and reinstated when triggered by an appropriate cue (Brewin et al., 1996, p.680). In our prior work (e.g., van der Kolk & van der Hart, 1991; van der Kolk & Fisler, 1995), we have focused on relationships between peritraumatic dissociation and later retrieval of intense and intrusive fragmentary memories, but not posttraumatic remembrances characterized by numbing and *lack* of intensity in somatosensory and affective modalities. Therefore, the *possibility* needs to be kept in mind that numb remembrances are a distinct type of traumatic remembrance. Failure to consider this possibility could result in misinterpreting data from such remembrances as indicating the unreliability of script-driven remembering.

A Preliminary Taxonomy of Traumatic Memories

To guard against this potential threat to valid interpretation of data generated by script-driven remembering and the TMI-PS, and to clarify relationships between methodology and theory in the study of traumatic memories, we offer in Table 3 a preliminary taxonomy of traumatic memories. This classification scheme has four major features. First, the framework is organized around the three processing outcomes and the two types of memory systems described in dual representation theory. Second, each processing outcome has different types of remembrances associated with it. Third, the relationship between situationally and verbally accessible memories, and how these are experienced in particular forms of remembrance, delineate the basic phenomenological parameters of the model. Finally, based on our experience with subject 3 (as well as clinical experience and data from other subjects not presented), we conceptualize the chronic processing outcome as encompassing two basic types of remembrance: “over-aroused remembrance” and “under-aroused remembrance.” While the typical reexperiencing symptoms of PTSD are associated with the “over-aroused remembrance” category, subject 3’s pre-treatment remembrance belongs to the category of “under-aroused remembrance.”

At the heart of this preliminary classification system is our conviction that distinguishing the constructs of memories and remembrances is essential for sound research and theory in the study of traumatic memories. *Researchers can only infer the nature of encoded and stored memories for particular traumatic events by evoking and assessing particular remembrances under particular conditions.* Our taxonomy of traumatic memories is admittedly speculative and incomplete, but our main purpose here is to stimulate new empirical and theoretical work. Our goal is to help advance the study of traumatic memories, so

TABLE 3. A Preliminary Taxonomy of Traumatic Memories

Characteristics of Memories Evoked with Script-Driven Remembering				
Processing Outcomes and Remembrance Categories	Situationally Accessible	Verbally Accessible	Relationship of SA to VA	Subject Descriptions
1. Prematurely inhibited processing Superficial remembrance	suppressed	schematized "script" with no emotions	VAMs dominant	"I would <i>think</i> of it as an event, but wouldn't allow myself to go there."
2. Chronic emotional processing				
A. Over-aroused remembrance (i.e., typical reexperiencing symptoms of PTSD)	intense and easily accessed	suppressed or preoccupation with secondary emotions and attributions	SAMs dominant or alternating dominance of SAMs and VAMs	"a reenactment. I was definitely there." "wood breaking and cracking"
B. Under-aroused remembrance (i.e., numbing and/or dissociation as chronic symptoms, responses to triggers or memories, or reexperiencing phenomenon)	relatively muted, suppressed, or inaccessible	relatively suppressed, schematized script, or inaccessible	both relatively "shut down" in context of numbing or dissociation	"anti-emotional effect" "numb" "through a glass wall"
3. Successful completed processing				
Integrated remembrance	seldom emerges; no longer overwhelming	narrative that integrates event into life story; not preoccupied	VAMs dominant without suppressing SAMs or secondary emotions	[no data from current sample]

that it might progress beyond the current "looseness of definition and use of its major concepts," just as the study of non-traumatic memory has since Tulving (1972) made his observation and introduced the distinction between episodic and semantic memory.

Methodological Issues and Limitations

In this section, we critically evaluate script-driven remembering and the TMI-PS as research methods, particularly ways that specific components of each may enhance or threaten validity and reliability in a variety of research contexts.

Script-driven remembering. A few features of the script-driven remembering method, besides those discussed as strengths above, could have significant effects on characteristics of the evoked memories subsequently assessed with the TMI-PS. These call out for critical appraisal and component analyses, which could help others who adopt this approach to avert unnecessary problems.

The first potential limitation of the method is that the data for making scripts were collected *in writing*, which could reduce subjects' access to nonverbal situationally accessible memory representations. The script construction form does employ a recognition format for selection and inclusion of physiological responses in the written account, increasing the likelihood that these nonverbal representations will be retrieved. (The current version [see Appendix A] explicitly directs subjects to review and circle physiological response items on the second page *before* writing their description.) Still, an interview procedure in which subjects are directed to talk about the traumatic event as if it were happening (Foa, Molnar, & Cashman, 1995; Harvey & Bryant, 1999) could yield more somatosensory and affective representations for incorporation into scripts. However, subjects may not feel comfortable saying key details out loud, and the cases presented here suggest that form-derived scripts can effectively retrieve intense sensory, bodily and emotional representations.

Because the 30-second scripts are designed to end right at the worst part of the memory, researchers must choose between inquiring about (a) the entire remembering experience across both the "script listening" and the "post-script remembering" periods, (b) only one period, or (c) each period separately. Certainly these two periods are different conditions. Some subjects report experiencing the most intense and vivid sensations and emotions during the script-listening period, while others say things like, "I had to wait for the tape to end before I could really get into the memory." We chose to inquire about the whole experience for two reasons. First, we did not want to overburden subjects by inquiring about both separately. Second, we were not confident in the reliability of recall for the two periods separately (given the longer interview and

potential for contamination effects). Finally, shorter tapes with fewer cues provide fewer opportunities for distraction and distortion of memory content or sequencing, and we believed this consideration trumped the two-period problem.

Indeed, the potential for script-driven remembering to introduce suggestion and distortion into memories should be considered very thoughtfully. In some ways, the method is inherently suggestive, from the second-person present-tense language (i.e., “You are...”) to the fact that the script only selectively incorporates somatosensory and affective contents written on the form. Subjects having difficulty accessing situationally accessible memories may write sensations and emotions that they believe they “probably,” “must have” or “should have” experienced during the event. To prevent this, the directions on the script construction form should include instructions not to guess, and researchers can inquire about this after its completion (included in current version; see Appendix A). If a subject’s memory is already distorted, the problem could be reinforced or worsened by a script incorporating the errors. Such uncertainties about accuracy are endemic to research on traumatic and many other memories, but this method’s potential for reinforcing distortions should be kept in mind and guarded against. Strictly speaking, the scripts provided a “narrative,” but only of an unfolding temporal sequence. They did *not* suggest that the subject experience a “narrative memory” – that is, memories organized by meaning propositions that thematically integrate the event with other autobiographical memories. Finally, subsequent playings of the script may suggest sensory, bodily or emotional representations that have been neutralized by desensitization or memory processing. In that sense, a suggestive aspect of script-driven remembering could make it a conservative test of treatment outcome.

Probably a greater threat to validity than suggestion is *habituation to the script*. In general each subsequent playing should be less effective at retrieving situationally accessible memory representations. This could threaten both validity and test-retest reliability. In treatment outcome studies, researchers should use two pre-treatment and two post-treatment assessments, and a matched non-treatment group. Control non-traumatic memories can indicate whether habituation effects differ for traumatic and non-traumatic memories of different kinds (stressful, non-stressful, etc.) However, as demonstrated by subject 3, other factors may mask or counter the habituation effect, including symptomatic responses such as numbing, avoidance or dissociation. Clearly the issue is not simple, and appropriate reliability studies are needed.

Other components of the method might be systematically manipulated to understand better its mechanisms for shaping the characteristics of evoked memories. How might remembrances differ if somatosensory and affective representations were played to subjects *without* initial contextual information

(i.e., time and place), *without* a particular order, or both? How might remembrances differ if the script were to suggest an emotion that was *not* named on the script form, but which follows from the event? Indeed, experiments with these dimensions of memory scripts may reveal the extent to which traumatized individuals are vulnerable to suggestion, and their remembrances to distortion.

Traumatic Memory Inventory – Post-Script Version. We selected subsets of original TMI items for the TMI-PS, and added three new features. The opening free-recall question was new, and allowed subjects to make unexpected and valuable observations about their memories and how they changed over time. Items focused on the *contents* of somatosensory and affective representations were retained from the original TMI; the modality *intensity* ratings were new. Together these features of the interview provided rich qualitative data and continuous variables that show promise for quantitative analyses.

A closer and more critical look, however, suggests that the language for eliciting intensity ratings should be refined and that a dichotomous “reliving” item should be added. We have revised the TMI-PS in light of these issues. We replaced the phrase “intense or vivid” with “intense,” because the contents of a modality might be experienced quite intensely but given a lower rating if lacking in clarity of detail. These ratings are now followed by inquiries about remembering versus reliving contents of particular modalities, to better assess a characteristic of some traumatic memories cited in the clinical literature (e.g., van der Kolk & van der Hart, 1991) and assessed by Reynolds and Brewin (1999). (See Appendix B for the revised TMI-PS.)

Three conceptually related TMI-PS items that we retained from the original TMI share limitations that undermine their validity as measures of their respective constructs. These were the questions concerning fragmentation of memory components and capacity to tell the experience as a coherent story and without interruption. The meaning of “all at the same time” is not clear in the question, “Of the components present, did you remember them all at the same time?” Any memory lasting more than a few moments will necessarily include different sensations and emotions being experienced at different times. Similar lack of clarity characterizes the other two questions, meant to assess for “narrative memory.” Thus more valid measures are necessary for investigation of memory fragmentation and narrative incoherence. Fortunately, two studies have been published that used systems for coding the “utterance units” of narrated traumatic memories on indices of fragmentation and disorganization, both with positive results. Foa and colleagues’ (Foa, Molnar, & Cashman, 1995) study of rape victims with PTSD, the first prospective study of treatment-induced transformations of traumatic memories, found that decreases on indices of narrative memory fragmentation were highly associated with improvement in

PTSD symptoms. Harvey and Bryant (1999), in a study of motor vehicle accident survivors, found greater disorganization in the narratives of subjects with acute stress disorder (ASD) than those without, and significant relationships between disorganized memory structure, severity of ASD, and meeting criteria for the dissociative symptom cluster of ASD. Perhaps before dropping the related TMI-PS questions, subjects who give “yes” and “no” responses could be compared on fragmentation and disorganization indices derived from their *actual* spoken narratives.

We believe it is important to retain the last two TMI-PS questions. One question asked subjects if their “response to the memory” was “typical” or “different than” how they usually “respond to a strong reminder.” The final question inquired about whether they were “thinking about or remembering anything else while listening to the tape and/or during the post-tape remembering phase?” These questions can provide a validity check on the previously collected data, and are potential sources of unexpected information that could spur refinements of methodology or theory. Objective rules should be developed for deciding when to discard TMI-PS data based on answers to these questions.

Ethical issues. For with subjects with PTSD and those with prematurely inhibited processing, it is possible that reexperiencing and other PTSD symptoms will be triggered or exacerbated by script-driven remembering. Subjects can find TMI-PS questions about details of their traumatic remembrances quite intrusive and distressing. If researchers are not confident they will be using data on the *contents* of somatosensory modalities (i.e., particular images, sounds, etc.) this information should not be gathered. Fortunately, with its intensity ratings and reliving/remembering items, the TMI-PS can gather valuable data *without* asking about particular sensations and bodily experiences. However, inquiring about particular emotions is less intrusive, and the distinction between primary and secondary emotions, for example fear and sadness, may provide important information about the memory.

Future Directions

A top priority for future research on this method is to determine the validity of script-driven remembering and the TMI-PS as methods for evoking and measuring characteristics of traumatic memories long observed by clinicians. To establish the divergent and convergent validity of script-driven remembering, the TMI-PS and other assessment measures might be used to compare characteristics of remembrances evoked by script-driven remembrance with those evoked by (1) completing a memory assessment questionnaire and (2) narrating the trauma out loud in an interview. Convergent validity could also be assessed by whether changes in pre- and post-treatment script-driven remembrances are paralleled by similar changes in PTSD symptoms. Reliability studies should be informed by an

appreciation of individuals’ potentially complex and variable responses to traumatic reminders. Indeed, for some subjects with PTSD, a reexperiencing response to the first script might be *expected* to lead to an avoidant, numb or dissociative response the second time. To assess for distinct types of traumatic remembrances shaped by such symptoms, we are developing the Responses to Script-Driven Remembering Scale (RSDR; Hopper, unpublished), a brief structured interview which assesses PTSD reexperiencing, avoidant and numbing symptoms, and dissociative symptoms. Finally, if validity and appropriate indications of reliability are established, the use of this method in prospective studies could significantly advance the study of traumatic memories. Naturalistic longitudinal studies could reveal how experiences of traumatic events lead to the creation of traumatic memories, and treatment outcome studies how traumatic memories can be transformed into more normal memories.

CONCLUSION

In order for the study of traumatic memories to become a mature field, capable of fostering more systematic classification and comprehensive understanding of the varieties of traumatic memories and remembrances, more researchers must draw on clinical *and* scientific experience and knowledge, and employ more integrative methods of retrieval and assessment. We offer this new method as a step in that direction.

NOTES

1. For the purposes of this introduction, “traumatic memories” refers to autobiographical memories of events originally encoded under conditions meeting the definition of “extreme trauma,” specified under Criterion A for acute and posttraumatic stress disorders (ASD & PTSD), in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV; APA, 1994). Case data below will address some limitations of this definition.

2. See also Brewin and Andrews’ (1998) more recent paper, in which they make the case, in effect, that the barrier between verbally and situationally accessible representations is maintained in part by processes familiar to cognitive psychologists, including not only the commonly cited implicit memory, but also retrieval inhibition and post-retrieval decisional processes.

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APPENDIX A

Traumatic Scene Form

We would like you to write a description of the most traumatic event you have experienced in your life. We may ask you more detail about this experience later.

If you find it difficult to think of something to write, it may help to close your eyes and imagine yourself back in the situation. Try to generate the same sensations and feelings that you experienced at the time. While the image is vivid in your memory, jot down the details of the scene and the sensations you experienced at the time. Also, on the next page are bodily experiences you may have had; please circle any that apply.

Describe the traumatic situation. Include such details as when it happened (age and date), where you were, who was there (names), what you were doing, how things looked, what you heard, what you were feeling, etc. Please do not guess or include anything about which you are not positive.

Please write things in the order they happened, and include bodily sensations from the next page at the appropriate times (turn to that page first). Continue your description on the reverse side of this page if necessary.

[page 2]

Listed below are a number of bodily sensations that people may experience in various situations. Please circle all of the responses that you experienced in the situation you described, and include several in your description.

APPENDIX A (continued)

heart stops	breath faster	whole body shakes
heart pounds	breath slower	eye twitches
heart beats slower	pant	eyes burn
heart skips a beat	shallow breathing	eyes wide open
heart races	labored breathing	eyes water
heart quickens	gasping for air	body feels heavy
feel sweaty	feel tense all over	feel hot all over
palms are clammy	feel relaxed all over	blood rushing to
head		
beads of perspiration and relaxed	tension in forehead	arms and legs warm
sweat pours out		
feel warm	clenched fist	flushed face
nauseous	tension in back	head pounds
stomach is in a knot	grit my teeth	feel restless
butterflies in stomach	clenched jaw	jittery
cramps in stomach	tension in the arms	calm
constriction in chest	tightness in face	
	hands trembling	

APPENDIX B

Traumatic Memory Inventory - Post-Script Version

Hopper & van der Kolk, 2000

Subject ID: ____ Interviewer: _____ Date of assessment: ____/____/____

When you remembered the traumatic experience today, how did you remember it? (Listen for subject's report, and write below. Ask follow-up clarifying questions sparingly, and record them as well.)

[page 2]

Memories can have a variety of components. They may include visual images, physical sensations, sounds, etc. The next questions are about these possible components of your memory.

Int Re

____ Were there visual images? Y N (Visual) What did you see? _____

____ Were there physical sensations? Y N (Bodily) What did you feel in your body? _____

____ Were there smells? Y N (Olfactory) What did you smell? _____

___ Were there sounds? Y N (Auditory) What did you hear? _____

___ Were there emotions? Y N (Affective) How did you feel emotionally? _____

Y N Were there thoughts about the situation? (Cognitive) What did you remember thinking? _____

Y N Components together? Of those components present, did you remember all of them at the same time? _____

Y N As a story? (Narrative) Could you tell it to someone as a coherent story? _____

Y N Would you be able to talk about what happened today, without being interrupted by associated feelings or perceptions? Explain _____

I'm going to ask you two questions about some components of the memory. First, I will ask you to rate their intensity, with 0 being not at all present, and 10 being the most intense possible.

Now, I'm going to ask you whether you re-lived any images, sensations, etc., as opposed to just remembering them. For example, you may have felt like you were hearing the same sound all over again, or just remembering hearing that sound. Do you understand the difference?

Summary:	Intensity	Reliving	Coherence
	___ Visual	___	Y N Components together
	___ Tactile	___	Y N Narrative
	___ Olfactory	___	Y N Without interruptions
	___ Auditory	___	
	___ Affective	___	
	Y N Cognitive		

Was your response to the memory today a typical response for you, or was it different than how you usually respond to a strong reminder?

Typical Not typical How? (Listen for subject's report, and write below. Ask follow-up clarifying questions sparingly, and record them as well.)

Were you thinking about or remembering anything else while listening to the tape and/or during post-tape remembering phase? (Listen for subject's report first...)