

Dissociation and the Fragmentary Nature of Traumatic Memories: Overview and Exploratory Study

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Since trauma arises from an inescapable stressful event that overwhelms people's coping mechanisms, it is uncertain to what degree the results of laboratory studies of ordinary events are relevant to the understanding of traumatic memories. This paper reviews the literature on differences between recollections of stressful and of traumatic events. It then reviews the evidence implicating dissociation as the central pathogenic mechanism that gives rise to posttraumatic stress disorder (PTSD). A systematic exploratory study of 46 subjects with PTSD indicated that traumatic memories were retrieved, at least initially, in the form of dissociated mental imprints of sensory and affective elements of the traumatic experience: as visual, olfactory, affective, auditory, and kinesthetic experiences. Over time, subjects reported the gradual emergence of a personal narrative that can be properly referred to as "explicit memory." The implications of these findings for understanding the nature of traumatic memories are discussed.

KEY WORDS: trauma; memory; dissociation; posttraumatic stress disorder.

The nature and reliability of traumatic memories have been controversial issues in psychiatry for over a century. Traumatic memories are difficult to study, since the profoundly upsetting emotional experiences that may give rise to posttraumatic stress disorder (PTSD) and other trauma related outcomes cannot be approximated in a laboratory setting. For example, even viewing a movie depicting actual executions failed to precipitate post-traumatic symptoms in normal college students (Pitman, personal communica-

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tion, 1994). If trauma is defined as the experience of an inescapable stressful event that overwhelms one's existing coping mechanisms, it is questionable whether findings of memory distortions in normal subjects exposed to videotaped stresses in the laboratory can serve as meaningful guides to understanding traumatic memories. Clearly, there is little similarity between viewing a simulated car accident on a TV screen, and being the responsible driver in a car crash in which one's own children are killed. While stress evokes homeostatic mechanisms that lead to self-conservation and resource-re-allocation (e.g., Selye, 1956), PTSD involves a unique combination of learned conditioning, problems modulating arousal, and shattered meaning propositions. Shalev (1995) has proposed that this complexity is best understood as the co-occurrence of several interlocking pathogenic processes including (a) an alteration of neurobiological processes affecting stimulus discrimination (expressed as increased arousal and decreased attention), (b) the acquisition of conditioned fear responses to trauma-related stimuli, and (c) altered cognitive schemata and social apprehension.

Without the option of inflicting actual trauma in the laboratory, there are limited options for the exploration of traumatic memories. These include collecting retrospective reports from traumatized individuals, post-hoc observations, and provoking, then studying, traumatic memories and flashbacks in people with PTSD. Surprisingly, since the early part of this century, there have been very few published studies that systematically explore the nature of traumatic memories based on detailed patient reports. Provocation studies of traumatic memories in the laboratory have examined psychophysiologic responses to visual or auditory stimuli (e.g., Pitman, Orr, Foa, & Keane, 1987; Rauch et al., 1995), and biological agents have been shown to promote access to trauma-related memories as well (Rainey et al., 1987; Southwick et al., 1993).

This paper will first review studies of people's memories of highly stressful and of traumatic experiences, focusing on the differences between recollections of these two types of events. We will then review the evidence for dissociation as the central pathogenic mechanism that gives rise to PTSD. Finally, the results of a systematic exploratory study of 46 subjects who reported on their memories of childhood or adult trauma is presented and discussed.

Comparison of memories of Stressful Events and of Trauma

Contemporary memory research has demonstrated the complexity of memory systems, with many components and functions that operate outside of conscious awareness, and which seem to operate with a relative degree

of independence from each other. Declarative memory (also known as explicit memory) refers to conscious awareness of facts or events that have happened to the individual (Squire & Zola Morgan, 1991). This form of memory functioning is seriously affected by lesions of the frontal lobe and of the hippocampus, which also have been implicated in the neurobiology of PTSD (Bremner, Krystal, Southwick, & Charney, 1995; van der Kolk, 1994). Nondeclarative memory (implicit or procedural memory) refers to memories of skills and habits, emotional responses, reflexive actions, and classically conditioned responses. Each of these implicit memory systems is associated with particular areas in the central nervous system (Squire, 1994).

At least since 1889, when Janet first wrote about the relationship between trauma and memory, it has been widely accepted that what is now called declarative, or explicit, memory is an active and constructive process. What a person remembers depends on existing mental schemata: once an event or a particular bit of information is integrated into existing mental schemes, it is no longer available as a separate, immutable entity, but is liable to be altered by associated experiences, demand characteristics and emotional state at the time of recall (Janet, 1889; van der Kolk & van der Hart, 1991). As Schachtel (1947) defined it: "Memory as a function of the living personality can be understood as a capacity for the organization and reconstruction of past experiences and impressions in the service of present needs, fears, and interests."

However, accuracy of memory is affected by the emotional valence of an experience: studies of people's subjective reports of personally highly significant events have generally found that these memories are unusually accurate, and that they tend to remain stable over time (Bohannon, 1990; Christianson, 1992; Pillemer, 1984; Yuille & Cutshall, 1986). It appears that evolution favors the consolidation of personally relevant information. For example, Yuille and Cutshall (1989) interviewed 13 out of 22 witnesses to a murder 4–5 months after the event. All witnesses had provided information to the police within 2 days after the murder. These witnesses were found to have very accurate recall, with little apparent decline over time. The authors concluded that emotional memories of such shocking events are "detailed, accurate and persistent" (p. 181). They suggested that witnessing real "traumas" leads to "quantitatively different memories than innocuous laboratory events."

Researchers also have studied the accuracy of memories for less personal, but culturally significant events, such as the murder of President Kennedy and the space shuttle Challenger. Brown and Kulik (1977) first called memories for such events "flashbulb memories." While people report that these experiences are etched accurately in their minds, research has shown

that those memories are subject to some distortion and disintegration over time. For example, Neisser and Harsch (1992) found that people changed their recollections of the space shuttle Challenger disaster considerably after a number of years. These investigators did not measure the personal significance that their subjects attached to this event. However, clinical observations of people who suffer from PTSD suggest that there are salient differences between flashbulb memories for more distant events and the intrusive memories characteristic of PTSD. As of early 1995, we could find no scientific literature that reported changes in the intrusive recollections of traumatic events in patients suffering from PTSD.

The Apparent Uniqueness of Traumatic Memories

The Diagnostic and Statistical Manual definition of PTSD (DSM IV; APA, 1994) recognizes that trauma can lead to extremes of retention and forgetting: terrifying experiences may be remembered with extreme vividness, or totally resist integration. In many instances, traumatized individuals report a combination of both. While people seem to easily assimilate familiar and expectable experiences, and while memories of ordinary events disintegrate in clarity over time, some aspects of traumatic events appear to get fixed in the mind, unaltered by the passage of time or by the intervention of subsequent experience. For example, in our studies of post traumatic nightmares, subjects claimed that they saw the same traumatic scenes over and over again, without modification, over a 15-year period (van der Kolk, Blitz, Burr, & Hartmann, 1984). For the past century, many students of trauma have noted that the imprints of traumatic experiences seem to be qualitatively different from memories of ordinary events. Starting with Janet, accounts of the memories of traumatized patients consistently mention that emotional and perceptual elements tend to be more prominent than declarative components (e.g., Grinker & Spiegel, 1945; Kardiner, 1941; Terr, 1993). Schacter (1987) has referred to the descriptions of traumatic memories by Janet as examples of implicit memory. These recurrent observations about the nature of traumatic memories have given rise to the notion that traumatic memories may be encoded differently than memories for ordinary events, perhaps via alterations in attentional focusing, perhaps because extreme emotional arousal interferes with hippocampal memory functions (Christianson, 1992; Heuer & Rausberg, 1992; Janet, 1889; LeDoux, 1993; McGaugh et al., 1993; Nilson & Archer, 1992; Pitman, Orr, & Shalev, 1993; van der Kolk, 1994).

Amnesias and the Return of Traumatic Memories

Trauma can affect a wide variety of memory functions. For convenience sake, we will categorize these into four different sets of functional disturbances: traumatic amnesia, global memory impairment, dissociative processes, and the sensorimotor organization of traumatic memories.

Traumatic amnesia. While the vivid intrusions of traumatic images and sensations are the most dramatic expressions of PTSD, the loss or absence of recollections for traumatic experiences is well documented. Amnesias for some, or all, aspects of the trauma have been noted in a wide variety of traumatized patients, starting with reports by Janet (1889). More recently, amnesia, with later return of memories for all, or parts, of the trauma, has been noted following natural disasters and accidents (Madakasira & O'Brian, 1987; van der Kolk & Kadish, 1987; Wilkinson, 1983). Sargeant and Slater (1941) observed the presence of significant amnesia in 144 out of 1,000 consecutively admitted combat soldiers to the Sutton Emergency Hospital during the second World War. Amnesias have been reported in other studies of combat soldiers as well (Archibald & Tuddenham, 1956; Grinker & Spiegel, 1945; Hendin, Haas, & Singer, 1984; Kardiner, 1941; Kubie, 1943; Myers, 1915; Sonnenberg, Blank, & Talbott, 1985; Southard, 1919; Thom & Fenton, 1920), and in victims of kidnapping, torture and concentration camp experiences (Goldfield, Mollica, Pesavento, & Faraone, 1988; Kinzie, 1993; Nederland, 1968), in victims of physical and sexual abuse (Briere & Conte, 1993; Janet, 1893; Loftus, Polensky, & Fullilove, 1994; Williams, 1994), and in people who have committed murder (Schacter, 1986). A recent general population study by Elliot (1994) reported complete or partial traumatic amnesia after virtually every form traumatic experience, with childhood sexual abuse, witnessing murder or suicide of a family member, and combat exposure yielding the highest rates. Traumatic amnesias are age and dose related: the younger the age at the time of the trauma, and the more prolonged the traumatic event, the greater the likelihood of significant amnesia (Briere & Conte, 1993; Herman & Shatzow, 1987; van der Kolk, Roth, Pelcovitz, & Mandel, 1993).

Amnesia for these traumatic events may last for hours, weeks, or years. Generally, recall is triggered by exposure to sensory or affective stimuli that match sensory or affective elements associated with the trauma. It is generally accepted that the memory system is made up of networks of related information: activation of one aspect facilitates the recall of associated memories (Collins & Loftus, 1975; Leichtman, Ceci, & Ornstein, 1992). Affect seems to be a critical cue for the retrieval of information along these associative pathways. This means that the affective valence of any particular experience plays a major role in determining what cognitive

schemes will be activated. In this regard, it is relevant that many people with trauma histories, such as rape, spouse battering and child abuse, seem to function quite well as long as feelings related to traumatic memories are not stirred up. However, under particular conditions, they may feel, or act, as if they were traumatized all over again. Fear is not the only trigger for such recall: any affect related to a particular traumatic experience may serve as a cue for the retrieval of trauma-related sensations, including longing, intimacy and sexual arousal.

Global memory impairment. While amnesias following adult trauma have been well-documented, the mechanisms for such memory impairment remain insufficiently understood. This issue is even more complicated when it concerns childhood trauma, since children have fewer mental capacities to construct a coherent narrative out of traumatic events. More research is needed to explore the consistent clinical observation that adults who were chronically traumatized as children suffer from generalized impairment of memories for both cultural and autobiographical events. It is likely that the combination of autobiographical memory gaps and continued reliance on dissociation makes it very hard for these patients to reconstruct a precise account of either their past or their current reality (Cole & Putnam, 1992). The combination of lack of autobiographical memory, of continued dissociation and of meaning schemas that include victimization, helplessness and betrayal, is likely to make these individuals vulnerable to suggestion and to the construction of explanations for their trauma-related affects that may bear little relationship to the actual realities of their lives.

Trauma and dissociation. Dissociation refers to a compartmentalization of experience: elements of the experience are not integrated into a unitary whole, but are stored in memory as isolated fragments consisting of sensory perceptions or affective states (Nemiah, 1995; van der Kolk & van der Hart, 1989, 1991). However, the word dissociation is currently used to describe four distinct, but interrelated phenomena: (1) the sensory and emotional fragmentation of experience (as measured by the Traumatic Memory Inventory—see below), (2) depersonalization and derealization at the moment of the trauma (peritraumatic dissociation, as measured by the Peritraumatic Dissociation Experiences Questionnaire (PDEQ; Marmar et al., 1994), (3) ongoing depersonalization and “spacing out” in everyday life (as measured by the Dissociative Experiences Scale—Bernstein and Putnam, 1986) and (4) containing the traumatic memories within distinct ego-states (Dissociative Disorder, as measured by the Dissociative Disorders Interview Scale—Ross et al., 1989) or the SCID-D (Steinberg, Rounsaville, & Cicchetti, 1991). The precise interrelationships among these various phenomena remain to be spelled out: not all people who have vivid sensory intrusions of traumatic events also experience depersonalization, while only

a small proportion of people who have both of these experiences will go on to chronically dissociate, or to develop a full-blown dissociative disorder.

Recent research has shown that "spacing out" at the moment of the trauma (peritraumatic dissociation) is a significant long-term predictor for the ultimate development of PTSD (Holen, 1990; Marmar et al., 1994; Spiegel, 1991). Bremner et al. (1992) found that Vietnam veterans with PTSD reported having experienced higher levels of dissociative symptoms during combat than men who did not develop PTSD. Koopman, Classen, and Spiegel (1994) found that dissociative symptoms early in the course of a natural disaster predicted PTSD symptoms 7 months later. A prospective study of 51 injured trauma survivors in Israel (Shalev, Orr, & Pitman, 1993) found that peritraumatic dissociation was the strongest predictor of PTSD at 6-month follow-up, explaining 30% of the variance in PTSD symptoms over and above the effects of gender, education, age, event severity, and the intrusion, avoidance, anxiety and depression symptoms that followed the event.

Christianson (1982) has described how, when people feel threatened, they experience a significant narrowing of consciousness, and remain focussed on the central perceptual details. As people are being traumatized, this narrowing of consciousness sometimes evolves into amnesia for parts of the event, or for the entire experience. Students of traumatized individuals have repeatedly noted that during conditions of high arousal, "explicit memory" may fail. The individual is left in a state of "speechless terror" in which he or she lacks words to describe what has happened (van der Kolk, 1987). However, while traumatized individuals may be unable to give a coherent narrative of the incident, there may be no interference with implicit memory: they may "know" the emotional valence of a stimulus and be aware of associated perceptions, without being able to articulate the reasons for feeling or behaving in a particular way.

More than 80 years ago, Janet observed: "Forgetting the event which precipitated the emotion . . . has frequently been found to accompany intense emotional experiences in the form of continuous and retrograde amnesia" (1909, p. 1607). He claimed that when people experience intense emotions, memories cannot be transformed into a neutral narrative: a person is "unable to make the recital which we call narrative memory, and yet he remains confronted by (the) difficult situation" (Janet, 1919/1925, p. 660). This results in "a phobia of memory" (p. 661) that prevents the integration ("synthesis") of traumatic events and splits off the traumatic memories from ordinary consciousness. Janet claimed that the memory traces of the trauma linger as what he called "unconscious fixed ideas" that cannot be "liquidated" as long as they have not been translated into a personal narrative. Failure to organize the memory into a narrative leads

to the intrusion of elements of the trauma into consciousness as terrifying perceptions, obsessional preoccupations and as somatic reexperiences such as anxiety reactions (Janet, 1909; van der Kolk & van der Hart, 1991).

Similar observations have been made by other clinicians treating traumatized individuals. For example, in 1945 Grinker and Spiegel noted that some combat soldiers developed excessive emotionality under stress which they thought to be responsible for the development of a permanent disorder: "Fear and anger in small doses are stimulating and alert the ego, increasing efficacy. But, when stimulated by repeated psychological trauma the intensity of the emotion heightens until a point is reached at which the ego loses its effectiveness and may become altogether crippled . . ." (p. 82). Grinker and Spiegel described traumatic amnesias in these soldiers, accompanied by confusion, mutism and stupor. Kardiner, in describing the "Traumatic Neuroses of War" (1941) noted that when patients develop amnesia for the trauma, it tends to generalize to a large variety of symptomatic expressions: "(t)he subject acts as if the original traumatic situation were still in existence and engages in protective devices which failed on the original occasion" (p. 82). Kardiner noted that fixation occurs in dissociative fugue states: triggered by a sensory stimulus, a patient might lash out, employing language suggestive of his trying to defend himself during a military assault. He noted that many such patients, while riding a subway train that entered a tunnel, had flashbacks to being back in the trenches. Kardiner also viewed panic attacks and hysterical paralyses as the re-experiencing of fragments of the trauma. Piaget (1962) claimed that dissociation occurs when an active failure of semantic memory leads to the organization of memory on somatosensory or iconic levels. He pointed out: "It is precisely because there is no immediate accommodation that there is complete dissociation of the inner activity from the external world. As the external world is solely represented by images, it is assimilated without resistance (i.e., unattached to other memories) to the unconscious ego."

The recognition of the role of dissociation in the processing of traumatic memories was revived for contemporary psychiatry when Horowitz (1978) described an "acute catastrophic stress reaction" in civilian trauma victims, characterized by panic, cognitive disorganization, disorientation and dissociation. Such dissociative processing of traumatic experience complicates the capacity to communicate about the trauma. In some people the memories of trauma may have no verbal (explicit) component at all: the memory may be entirely organized on an implicit or perceptual level, without an accompanying narrative about what happened. Recent symptom provocation neuroimaging studies of people with PTSD support that clinical observation: during the provocation of traumatic memories there was

decreased activation of Broca's area, the part of the CNS most centrally involved in the transformation of subjective experience into speech. Simultaneously, the areas in the right hemisphere that are thought to process intense emotions and visual images had significantly increased activation (Rauch et al., 1995).

People who have learned to cope with trauma by dissociating are vulnerable to continue to do so in response to minor stresses. The continued use of dissociation as a way of coping with stress interferes with the capacity to fully attend to life's ongoing challenges. The severity of ongoing dissociative processes (often measured with the Dissociative Experiences Scale (DES; Bernstein & Putnam, 1986) has been correlated with a large variety of psychopathological conditions that are thought to be associated with histories of trauma and neglect: severity of sexual abuse in adolescents (Sanders & Giolas, 1991), somatization (Saxe et al., 1994), bulimia (Demitrack et al., 1990), self-mutilation (van der Kolk, Perry, & Herman, 1991) and borderline personality disorder (Herman, Perry, & van der Kolk, 1989). The most extreme example of this ongoing dissociation occurs in people who suffer from dissociative identity disorder (multiple personality disorder), who have the highest DES scores of all populations studied and in whom separate identities seem to contain the memories related to different traumatic incidents (Putnam, 1989).

The sensori-motor organization of traumatic experience. Numerous authors on trauma, for example Janet (1889; van der Kolk & van der Hart, 1991), Kardiner (1941) and Terr (1993), have observed that trauma is organized in memory on sensori-motor and affective levels. Having listened to the narratives of traumatic experiences from hundreds of traumatized children and adults over the past 20 years, we frequently have heard both adults and children describe how traumatic experiences initially are organized without semantic representations. Clinical experience and our reading of a century of observations by clinicians dealing with a variety of traumatized populations led us to postulate that "memories" of the trauma tend to, at least initially, be experienced primarily as fragments of the sensory components of the event: as visual images, olfactory, auditory, or kinesthetic sensations, or intense waves of feelings (which patients usually claim to be representations of elements of the original traumatic event). What is intriguing is that patients consistently claim that their perceptions are exact representations of sensations at the time of the trauma. For example, when Southwick and his group injected yohimbine into Vietnam veterans with PTSD, half of their subjects reported flashbacks that they claimed to be "just like it was" [in Vietnam] (Southwick et al., 1993).

Empirical Study

In the present study we designed a methodology for examining traumatic and nontraumatic memories in individuals with PTSD, in order to record whether, and how, memories of traumatic experiences are retrieved differently from memories of personally significant, nontraumatic events. In order to examine the retrieval of traumatic memories in a systematic way, we designed a structured interview, the Traumatic Memory Inventory (TMI), which inquires about sensory, affective and narrative ways of remembering, about triggers for unbidden recollections of traumatic memories, and about ways of mastering unwanted intrusions of traumatic memories in subjects' lives.

Method

Subjects

Subjects were recruited from advertisements in local newspapers that invited people who were haunted by memories of terrible life experiences to participate in a 2-hr interview about these memories. Subjects were screened by telephone, and again in face to face interviews, for exclusion criteria of organic mental disorders, schizophrenia, bipolar illness, substance abuse and alcoholism. All subjects met DSM III-R diagnostic criteria for PTSD, as measured on the Clinician Administered PTSD Scale (CAPS). Ten of the subjects were men, 36 were women. Average age at time of the interview was 42.0 years (range 18-67). Subjects were paid \$10.00 for their participation.

Instruments

Subjects were asked to sign an informed consent and filled out self-rated questionnaires, after which they participated in the interview. The instruments used were:

Traumatic Antecedents Questionnaire (Self-Rating Version) TAQ [S] is a 78-item questionnaire to identify exposure to traumatic life events (self-rated version of the TAQ, Herman, Perry, & van der Kolk, 1989, van der Kolk, Perry & Herman, 1991),

The Dissociative Experiences Scale (DES). DES (Bernstein & Putnam, 1986) is a 28-item questionnaire assessing the frequency of dissociative experiences in the daily lives of subjects. It is seen to measure dissociation

as a trait. The summary score is the average of the items, which range from 0 to 100% of time experiencing the symptoms.

Inventory of Traumatic Experiences. This inventory allowed the interviewer and subject together to systematically specify the circumstances and details of the subject's trauma(s). At the end of this process, subjects were asked to indicate which particular traumatic experience had had most effect on their lives, and to identify an intense, but nontraumatic experience, that was used as the "control" experience (e.g., wedding, graduation, birth of a child, accomplishment at work).

The Traumatic Memory Inventory (TMI). TMI is a 60-item structured interview that systematically collects data about the circumstances and means of memory retrieval of a target traumatic memory and a target memory of a personally highly emotionally significant, but non-traumatic, event. The TMI interview inquires about (1) nature of the trauma(s)/event(s), (2) duration, (3) whether the subject has always been aware that the trauma/event happened, and if not, when and where she/he became conscious of it, (4) circumstances under which subject first experienced intrusive memories; and circumstances under which they occur presently, (5) sensory modalities in which memories were experienced including (a) as a story (b) as an image (what did you see ?) (c) in sounds (what did you hear ?), (d) as a smell (what did you smell ?), (e) as feelings in your body (what did you feel ? where?), and (f) as emotions (what did you feel, what was it like ?). These data were collected for three time periods: initially, while subject was most bothered by the memory, and currently. The interview also asked about (6) the nature of flashbacks, (7) nature of nightmares, (8) precipitants of flashbacks and nightmares, (9) ways of mastering intrusive recollections (e.g., by eating, working, taking drugs or alcohol, cleaning, etc.), and (10) whether confirmation of the event was available through court or hospital records, direct witnesses, or other means. All information was collected first for the traumatic event, then for the nontraumatic event.

The interviews took about 2 hr and were conducted by staff of the Trauma Center. Information gathered from the TMI interview was presented to the members of the Trauma Center memory research group, who came to a consensus about the scoring of each item of the interviews. We were unable to establish a meaningful way for the raters to be blind to whether they were scoring the answers to traumatic or nontraumatic memories.

Data Analysis

Data analysis was conducted by means of cross-tabulation and Kendall's tau computation for ordinal by categorical variables. Two-tailed Stu-

dent *t*-tests were used to compare ordinal data. Chi-square analyses were used to compare nominal data. Pearson correlation coefficients were calculated for bivariate relationships.

Results

We interviewed 46 adults. Of these, 36 had experienced their most significant traumas in childhood, while 10 had their first traumatic experience after age 18. The traumas they had experienced are listed in Table 1. Several subjects had experienced more than one type of trauma. Age of onset ranged from 1 to 56, ($M = 12.4$). Only 10 subjects had their first significant trauma after age 18 (Adult Trauma—AT). Of the 36 subjects with childhood trauma, 15 (42%) had suffered significant or total amnesia for their trauma at some time in their lives.

Of the total sample, 36 (78%) reported current nightmares. Two (20%) of the 10 AT and 15 (42%) of the 36 CT reported that their nightmares were dreams; they included illogical combinations and aspects of non-trauma-related material ($X^2 = 11.0$, $df = 4$, $p = .02$). Four (40%) of the AT and 11 (31%) of the CT reported having nightmares that were identical to their flashbacks: they were life-like presentations of the entire trauma, or fragments thereof, without intermixture of other perceptual elements.

Confirmation

Twenty-seven of the 36 subjects with childhood trauma (75%) reported confirmation of their childhood trauma from a mother, sibling, or

Table 1. Type of Trauma Experienced^a

	Total Sample	Adult Trauma	Childhood Trauma
Sexual abuse/assault	30	1	29
Physical abuse/assault	11	0	11
Witnessing death of someone close	5	4	1
Being injured	4	3	1
Industrial or transportation accident	2	1	1
Imprisonment/torture	1	1	0
Combat related	1	1	0
Other	1	0	1

^aSeveral subjects had more than one type of trauma.

other source who knew about the abuse, from court or hospital records, or from confessions or convictions of the perpetrator(s). We did not ask them to produce records to prove that this confirmation actually existed.

Nontraumatic Memory

Subjects considered most questions related to the nontraumatic memory nonsensical: none had olfactory, visual, auditory, kinesthetic reliving experiences related to such events as high school graduations, birthdays, weddings, or births of their children. They also denied having vivid dreams or flashbacks about these events. Subjects claimed not to have had periods in their lives when they had amnesias for any of these events; none claimed to have photographic recollections of any of these events. Environmental triggers did not suddenly bring back vivid and detailed memories of these events, and none of the subjects felt a need to make special efforts to suppress memories of these events.

Modalities of Traumatic Memory

No subject reported having a narrative for the traumatic event as their initial mode of awareness (they claimed not having been able to tell a story about what had happened), regardless of whether they had continuous awareness of what had happened, or whether there had been a period of amnesia. Figure 1 shows that all subjects, regardless of age at which the first trauma occurred, reported that they initially "remembered" the trauma in the form of somatosensory or emotional flashback experiences. At the peak of their intrusive recollections all sensory modalities were enhanced, and a narrative memory started to emerge. Currently, most subjects continued to experience their trauma in sensorimotor modes, but 41 (89%) were able to narrate a satisfactory story about what happened to them. On the other hand, 5 subjects (11%—all CT) continued to be unable to tell a coherent narrative, with a beginning, middle and end, even though each of them reported outside confirmation of the reality of their trauma.

Dissociation

DES scores ranged from 1 to 99; 14 subjects scored 10 and under. The average DES score for the overall sample was 21.8. The DES score was significantly correlated with the event-related variables of duration of the trauma ($r = .52, p < .01$), presence of physical abuse ($r = .56, p <$

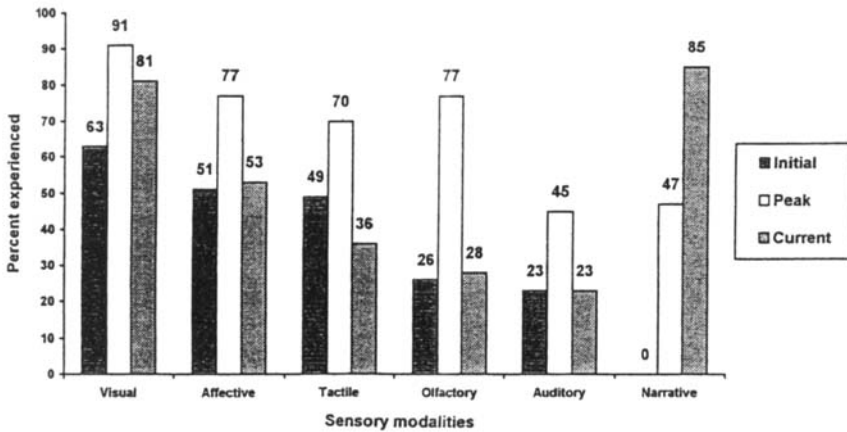


Figure 1. Sensory modalities reported when subjects first became aware of the trauma, when the recollections of the trauma were most intense, and currently.

.01), and presence of neglect ($r = .38; p < .05$). Also, level of dissociation was correlated with affective reliving ($r = .54, p < .01$), kinesthetic reliving ($r = .40, p < .05$), lack of current narrative memory ($r = .54, p < .01$) and with self-destructive self-soothing behaviors: bingeing and purging ($X^2 = 7.41, df = 1, p < .01$); use of alcohol and drugs ($X^2 = 2.75, df = 1, p < .10$); self-mutilation ($X^2 = 3.95, df = 1, p < .05$), and sexual activity ($X^2 = 3.0, df = 1, p < .05$). Dissociation was not correlated with the self-soothing behaviors of talking things over, working, cleaning, sleeping or turning to religion.

Discussion

Our study suggests that there are critical differences between the ways people experience traumatic memories versus other memories of significant personal but nontraumatic events. The study supports the idea that it is in the very nature of traumatic memory to be dissociated, and to be initially stored as sensory fragments without a coherent semantic component. All of the subjects in our study claimed that they only came to develop a narrative of their trauma over time. Five of the subjects who claimed to have been abused as children were, even as adults, unable to tell a complete narrative of what had happened to them. They merely had fragmentary memories that supported other people's stories and their own intuitive feelings that they had been abused.

All these subjects, regardless of the age at which the trauma occurred, claimed that they initially “remembered” the trauma in the form of somatosensory flashback experiences. These flashbacks occurred in a variety of modalities: visual, olfactory, affective, auditory, and kinesthetic, but initially these sensory modalities did not occur together. As the trauma came into consciousness with greater intensity, more sensory modalities came into awareness. Initially, the traumatic experiences were not condensed into a narrative. It appears that as people become aware of more and more elements of the traumatic experience, they construct a narrative that “explains” what happened to them. This transcription of the intrusive sensory elements of the trauma into a personal narrative does not necessarily have a one-to-one correspondence with what actually happened. This process of weaving a narrative out of the disparate sensory elements of an experience is probably not dissimilar from how people construct a narrative under ordinary conditions. However, when people have day-to-day, nontraumatic experiences, the sensory elements of the experience are not registered separately in consciousness, but are automatically integrated into the personal narrative.

This study supports Piaget’s notion that when memories cannot be integrated on a semantic/linguistic level, they tend to be organized more primitively as visual images or somatic sensations. Even after considerable periods of time, and even after acquiring a personal narrative for the traumatic experience, most subjects reported that these experiences continued to come back as sensory perceptions and as affective states. The persistence of intrusive sensations related to the trauma after the construction of a narrative contradicts the notion that learning to put the traumatic experience into words will reliably help abolish the occurrence of flashbacks.

There were some interesting trends between the adult onset trauma (AT) group and the childhood onset (CT) group. There were non-significant differences in the modalities in which the trauma was experienced, which a larger sample size might clarify further: the subjects first traumatized as children tended to first remember their abuse in the form of visual images and kinesthetic sensations. The CT group had significantly more pathological self-soothing behaviors than the adult group, including self-mutilation and bingeing. This supports the notion that childhood trauma gives rise to more pervasive biological dysregulation, and that patients with childhood trauma have greater difficulty regulating internal states than patients first traumatized as adults (van der Kolk & Fisler, 1994). Another interesting difference between the adult and the child group was that the AT group had nightmares that they reported to be exact replicas of the traumatic experience more often than did the CT group.

It was striking that some subjects, particularly those who never were able to construct a satisfactory narrative of their trauma, did not have visual flashbacks. Intuitively, it would appear to be difficult to construct a satisfactory narration that allows for the proper placement of the trauma in time and space if an individual cannot visualize what has happened. We are currently studying the mental organization of traumatic experiences in blind children and adults.

Conclusions

When people receive ordinary, nontraumatic sensory input, they synthesize this incoming information into symbolic form, without conscious awareness of the processes that translate sensory impressions into a personal story. Our research shows that, in contrast, traumatic experiences in people with PTSD are initially imprinted as sensations or feeling states that are not immediately transcribed into personal narratives. This failure to process information on a symbolic level following trauma is at the very core of the pathology of PTSD (van der Kolk & Ducey, 1989).

Recently we collaborated in a neuroimaging symptom provocation study of some of the subjects who were part of this memory study. When these subjects experienced flashbacks in the laboratory, there was significantly increased activity in the areas in the right hemisphere that are associated with the processing of emotional experiences, as well as in the right visual association cortex. At the same time, there was significantly decreased activity in Broca's area, in the left hemisphere (Rauch et al., 1995). These findings are in line with the results of this study: that traumatic "memories" per se consist of emotional and sensory states, with little verbal representation. In other work we have hypothesized that, under conditions of extreme stress, the hippocampally based memory categorization system fails, leaving memories to be stored as affective and perceptual states (van der Kolk, 1994). This hypothesis proposes that excessive arousal at the moment of the trauma interferes with the effective memory processing of the experience. The resulting "speechless terror" leaves memory traces that may remain unmodified by the passage of time, and by further experience.

We (van der Kolk & van der Hart, 1991) have earlier written about Janet's clear distinctions between traumatic and ordinary memory. According to Janet, traumatic memory consists of images, sensations, affective and behavioral states that are invariable and do not change over time. He suggested that these memories are highly state-dependent and cannot be evoked at will. They are not condensed in order to fit social expectations.

Table 2. Traumatic and Narrative Memory Compared

Traumatic memory	Narrative memory
Images, sensations, affective and behavioral states	Narrative: semantic and symbolic
Invariable—does not change over time	Social and adaptive
Highly state-dependent. Cannot be evoked at will.	Evoked at will by narrator
Automatically evoked in special circumstances	
No condensation in time	Can be condensed or expanded depending on social demands

In contrast, narrative (explicit) memory is semantic and symbolic, it is social, and adapted to the needs of both the narrator and the listener and can be expanded or contracted, according to social demands (see Table 2).

The question of whether the sensory perceptions reported by our subjects are accurate representations of the sensory imprints at the time of the trauma is intriguing. The study of flashbulb memories has shown that the relationship between emotionality, vividness and confidence is very complex, and does not necessarily reflect accuracy. While it is possible that these imprints are, in fact, reflections of the sensations experienced at the moment of the trauma, an alternative explanation is that increased activity of the amygdala at the moment of recall may be responsible for the subjective assignment of accuracy and personal significance. Once these sensations are transcribed into a personal narrative, they would presumably be subject to the laws that govern explicit memory: to become a socially communicable story that is subject to condensation, embellishment and contamination. Thus, while trauma may leave indelible sensory and affective imprints, once these are incorporated into a personal narrative this semantic memory, like all explicit memory, is likely subject to varying degrees of distortion.

In this study we have merely confirmed Janet's century-old clinical observations. The time now seems ripe for more detailed investigations. These should include careful follow-up of traumatized children and adults to check for changes in memory over time, as well as the use of techniques such as brain imaging, to gain further understanding about the ways the central nervous system processes traumatic memories. There clearly is a need for further studies of dissociative processes and their relationship to the development and maintenance of PTSD. However, in the process of trying to gain a deeper understanding of traumatic memories, great caution should be exercised against making careless generalizations that infer how traumatic memories are stored and retrieved from laboratory experiments involving less stressful experiences.

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