

Dissociation and the Fragmentary Nature of Traumatic memories: Overview and Exploratory Study.

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Abstract

Since trauma is an inescapably stressful event that overwhelms people's coping mechanisms it is uncertain to what degree the results of laboratory studies of ordinary events have relevance to the understanding of traumatic memories. This paper first reviews the literature on the differences between recollections of stressful and of traumatic events. It then reviews the evidence implicating dissociative processes as the central pathogenic mechanisms that give rise to PTSD. We present the results of a systematic exploratory study of 46 subjects with PTSD which indicates that traumatic memories are 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 is discussed.

Key words: Trauma, memory, dissociation

Dissociation and the Fragmentary Nature of Traumatic Memories:

Overview and Exploratory Study.

by

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The nature and reliability of traumatic memories has been a controversial issue in psychiatry for over a century. Traumatic memories are difficult to study, since the profoundly upsetting emotional experiences that give rise to PTSD cannot be approximated in a laboratory setting: even viewing a movie depicting actual executions fails to precipitate post-traumatic symptoms in normal college students (Pitman, personal communication, 1994). If trauma is defined as an inescapably stressful event that overwhelms people'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 a meaningful guide 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 only limited options for the exploration of traumatic memories: 1) collecting retrospective reports from traumatized individuals, 2) post-hoc observations, or 3) provoking of traumatic memories and flashbacks in people with PTSD. Surprisingly, since the early part of this century, there have been very few

published systematic studies that explore the nature of traumatic memories based on detailed patient reports. Provocation studies of traumatic memories have been done in psychophysiology laboratories (e.g. Pitman, Orr, Foa, & Claiborn, 1987; Rauch et al., 1995), and in tests where patients with PTSD are given drugs that alter neurotransmitter function that seem to promote access to trauma-related memories (Rainey et al., 1987; Southwick, et al., 1993).

This paper first will review the studies that have collected data on people's memories of highly stressful and of traumatic experiences, and examine the differences between recollections of stressful and traumatic events. We will then review the evidence implicating dissociation as the central pathogenic mechanism that gives rise to PTSD and present evidence that traumatic memories are retrieved, at least initially, in the form of dissociated mental imprints of sensory and affective elements of the traumatic experience by presenting the results of a systematic exploratory study of 46 subjects who reported on their memories of childhood or adult trauma.

The Stability and Accuracy of Memories of Stressful Events

At least since 1889, when Pierre Janet (1889) 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 become distorted both by associated experiences, demand characteristics and the 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 generally find that their 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 two 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 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 even those memories are subject to some distortion and disintegration over time. For example, Neisser and Harsch (1990) found that people changed their recollections of the space shuttle Challenger disaster considerably after a number of years. However, these investigators did not measure the personal significance that their subjects attached to this event. Clinical observations of people who suffer

from PTSD suggest that there are salient differences between flashback memories and the post-traumatic perceptions characteristic of PTSD. As of early 1995, we could find no scientific literature that had demonstrated that intrusive recollections of traumatic events in patients suffering from PTSD become distorted over time.

The Complexity of Memory Systems

Contemporary memory research has demonstrated the existence of a great complexity of memory systems, with multiple components, most of which are outside of conscious awareness. Each one of these memory functions seems to operate with a relative degree of independence from the others. To summarize: 1) declarative, (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 (van der Kolk, 1994). 2) Non-declarative, 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). Schacter (1987) has referred to the descriptions of traumatic memories made by Pierre Janet as examples of implicit memory.

The Apparent Uniqueness of Traumatic Memories

The DSM definition of PTSD 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 own studies on post traumatic nightmares, subjects claimed that they saw the same traumatic scenes over and over again without modification over a fifteen 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, 1946; Kardiner, 1941; Terr, 1993). 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 of extreme emotional arousal interferes with hippocampal memory functions (Christianson, 1992; Heuer & Rausberg, 1992; Janet, 1889; LeDoux, 1992; McGaugh, 1992; Nillson & 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: a) traumatic amnesia, b) global memory impairment, c) dissociative processes, and d) the sensorimotor organization of traumatic memories

A. Traumatic amnesia. While the vivid intrusions of traumatic images and sensations are the most dramatic expressions of PTSD, the loss of recollections for traumatic experiences, followed by subsequent retrieval is well documented in the literature. Amnesias for some, or all, aspects of the trauma have consistently been noted in a wide variety of traumatized patients, starting with Pierre Janet (1889). Amnesia for the traumatic experience, with later return of memories for all, or parts of the trauma, has been noted following natural disasters and accidents (Janet, 1889; 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 1000 consecutively admitted combat soldiers to the Sutton Emergency Hospital during the second World War. Similar findings have been reported in other studies of combat soldiers (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), 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, 1992), and in people who have committed murder (Schacter, 1986). A recent general population study of 485 subjects by Elliot and Briere (unpublished) reported significant degrees of traumatic amnesia after virtually every form traumatic experience, with childhood sexual abuse, witnessing domestic violence as a child, 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.

B. Global memory impairment. While amnesias following adult trauma have been well-documented, the mechanisms for such memory impairment remains 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 both their past and current reality (Cole & Putnam, 1992). The combination of lack of autobiographical memory, continued dissociation and of meaning schemes 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.

C. Trauma and dissociation. Recent research has shown that having dissociative experiences at the moment of the trauma (peritraumatic dissociation) is the most important long term predictor for the ultimate development of PTSD (Holen, 1993; 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 seven months later. A prospective study of 51 injured trauma survivors in Israel (Shalev, Orr, & Pitman, 1994) found that peri-traumatic dissociation explained 30% of the variance in the six months follow-up PTSD symptoms, over and above the effects of gender, education, age, event-severity, and intrusion, avoidance anxiety and depression that followed the event. Peri-traumatic dissociation was the strongest predictor of PTSD status six months after the event.

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 and stored as sensory perceptions, affective states or as behavioral reenactments (Nemiah, 1998, van der Kolk & van der Hart, 1989, 1991). While dissociation may temporarily serve an adaptive function, in the long range, lack of integration of traumatic memories seems to be the critical element that leads to the development of the complex biobehavioral change that we call Post Traumatic Stress Disorder. Intense arousal seems to interfere with proper information processing and the storage of information into narrative (explicit) memory. This observation was first made by Pierre Janet, and is confirmed by a subsequent century of clinical and research data.

Christianson (1982) has described how, when people feel threatened, they experience a significant narrowing of consciousness, and remain merely 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 the person 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 eighty 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" (Janet, 1909b, 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 re-experiences such as anxiety reactions (Janet, 1909b, 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 responses 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 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 realization of the role of dissociation in the processing of traumatic memories was revived for contemporary psychiatry when Horowitz described an "acute catastrophic stress reaction" in civilian trauma victims, characterized by panic, cognitive disorganization, disorientation and dissociation (1976). 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). Ongoing dissociation in traumatized people.

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).

D. 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 twenty years, we frequently have heard both adults and children describe how traumatic experiences initially are organized without semantic representations. Clinical experience and reading 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 predominantly experienced 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).

Confirmatory Study

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

Method

Subjects Subjects were recruited in the local newspapers from advertisements that invited people who were haunted by memories of terrible life experiences to submit to a two hour interview about these memories. Subjects were paid \$10.00 for their participation. Subjects were screened by telephone, and again in one-on-one 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 CAPS. Ten of the subjects were men, 36 were women. Average age at time of the interview was 42.0 years (range 18-67).

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:

1. Traumatic Antecedents Questionnaire (self-rating version) (TAQ [S]), 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) and
2. The Dissociative Experiences Scale (DES- Bernstein & Putnam, 1986).
3. The interviewer and subject then together made an Inventory of Traumatic Experiences which systematically asked them about the circumstances and specifics of their trauma(s). After finishing these interviews, subjects were asked to indicate which particular traumatic experience that had had most effect on their lives, and to identify an intense, but non-

traumatic experience, that was used as the "control" experience.

4. Subjects were then given the Traumatic Memory Inventory, a 60 item structured interview that systematically collects data about the circumstances and means of memory retrieval of a traumatic memory, comparing those with the subjects' memories of a personally highly emotionally significant, but non-traumatic event. The TMI describes 1) nature of trauma(s), 2) duration, 3) whether subject has always been aware that trauma happened, and if not, when and where subject became conscious of trauma, 4) circumstances under which subject first experienced intrusive memories; and circumstances under which they occur presently, 5) sensory modalities in which memories were experienced 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?), f) as emotions (what did you feel, what was it like ?). These data were collected for how subjects remembered the trauma a) initially, b) while subject was most bothered by them, and c) currently. The interview also asked about 6) 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. 10) Confirmation: records: court or hospital, direct witness, relative went through same trauma, other.

All information was collected first for traumatic events, then for a non-traumatic event, like a wedding, vacation, graduation, the birth of a child, or an accomplishment in school or at work.

The interviews took about 2 hours and were conducted by staff of the Trauma Center. Information gathered from the TMI 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 non-traumatic memories.

Data Analysis Data analysis was conducted by means of cross-tabulation and Kendall's tau computation for ordinal by categorical variables. Student two tailed t-tests were used to compare ordinal data. Chi-Squared analyses were used to compare nominal data. General linear models procedure for step-wise linear regression with posthoc analysis for comparison of means was used for continuous variables. Pearson correlation coefficients were calculated for bivariate relationships.

Results

We interviewed 46 adults. Of these, 35 had experienced their most significant traumas in childhood, while 11 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- 56, (average 12.4). Only 11 subjects had their traumas start after age 18 (Adult Trauma - AT). DES scores ranged from 1- 99; 14 subjects scored 10 and under. The average DES score of the overall sample was 21.8; of the people who were first traumatized as adults the average was 30.9.

Non-traumatic Memory Subjects considered most questions related to the non-traumatic memory non-sensical: none had olfactory, visual, auditory, kinesthetic re-living experiences related to such events as high school graduations, birthdays, weddings, or births of their children. They denied having vivid dreams or flashbacks about these events. The subjects claimed not to have

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

Table 1: Type of Trauma Experienced *

* Note: Several subjects had more than one type of trauma.

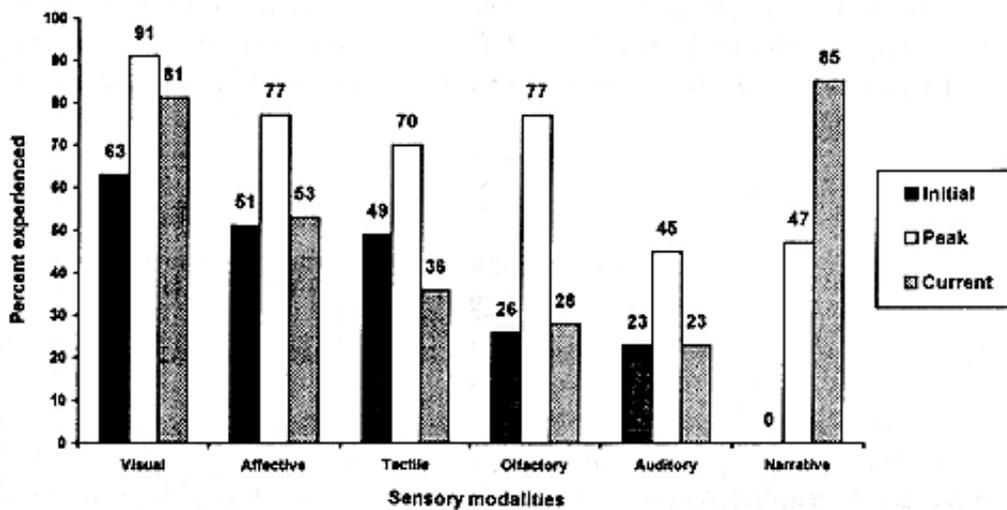
	Total Sample	Adult Trauma	Childhood Trauma
Sexual abuse/assault	30	1	29
Physical abuse/assault	11	0	11
Witnessing death of someone close	5	4	1
Being injured	4	3	1
Industrial or transportation accident	2	1	1
Imprisonment/torture	1	1	0
Combat related	1	1	0
Other	1	0	1

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. Automatically evoked in special circumstances	Evoked at will by narrator
No condensation in time	Can be condensed or expanded depending on social demands

Modalities Table 2 presents the sensory modalities which the subjects reported first having experienced when they first became aware of the trauma (whether they had always been aware of the trauma, or recovered the memory after a period of amnesia) . 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. There were no statistically significant differences between the subjects with childhood (CT) vs adult trauma (AT) in terms of the sensory modalities first experienced, although there was a trend towards more visual intrusions in the adult trauma group. Figure 1 indicate 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 while 41 (89)% were able to narrate a satisfactory story about what happened to them, 5 subjects (11%-all CT) continued to be unable to tell a coherent narrative, with a beginning, middle and end, even though all of them had outside confirmation of the reality of their trauma, i.e. a mother who knew, a perpetrator who confessed, hospital or court records.

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



Dissociation The DES score was significantly correlated with the following event-related variables: 1) duration of the trauma ($r = .52$, $p < .01$), 2) presence of physical abuse ($r = .56$, $p < .01$), and 3) presence of neglect ($r = .38$; $p < .05$). Also, dissociation was correlated with 1) 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 following self-soothing behaviors: talking things over, working, cleaning, sleeping or turning to religion).

Nightmares and Flashbacks Of the total sample, 36 (78%) reported current nightmares. Two (18%) of the 11 AT and 15 (42%) of the 35 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 (36%) of the AT and 11 (35%) 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 Of the 35 subjects with childhood trauma, 15 (43%) had suffered significant, or total amnesia for their trauma at some time of their lives. Twenty seven of the 35 subjects with childhood trauma (77%) reported confirmation of their childhood trauma- from a mother, sibling, or 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.

Discussion

Our study suggests that there are critical differences between the ways people experience traumatic memories versus other significant personal 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, non-traumatic experiences, the sensory elements of the experience are non-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 olfactory 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 sensory input, they generally automatically synthesize this incoming information into narrative form, without conscious awareness of the processes that translate sensory impressions into a personal story. Our research shows that traumatic experiences initially are imprinted as sensations or feeling states that are not immediately transcribed into personal narratives, in contrast with the way people seem to process ordinary information. This failure of information processing on a symbolic level, in which it is categorized and integrated with other experiences, 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 the memory study reported here. When these subjects had their flashbacks in the laboratory, there was a 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" 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. Finally, they are not condensed in order to fit social expectations. In contrast, according to Janet, 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.

The question 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 are subject to the laws that govern explicit memory: they become a socially communicable story that is subject to condensation, embellishment and contamination. 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 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 both traumatized children and adults to check for memory distortions over time, as well as the use of sophisticated 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 that do not overwhelm people's coping mechanisms.

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