MEMORY AND POSTTRAUMATIC STRESS DISORDER

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Introduction
Posttraumatic stress disorder (PTSD) has been a controversial disorder ever since its introduction into the American Psychiatric Association's Diagnostic and Statistical Manual in 1980. It has been criticized, among other things, for being a politically inspired diagnosis that was not distinct from existing disorders. Today there is considerable empirical evidence to suggest that, although these criticisms are not without some merit, PTSD is a psychologically and neurobiologically distinct disorder.¹ It is characterised by several types of symptoms including a particular type of intrusive memory (the "flashback"). By studying these symptoms and relating them to basic research in neuroscience it is possible to develop a plausible model of why PTSD occurs and therefore why certain forms of treatment are effective.

Among the phenomena that need explanation are the different types of memory observed in PTSD, specifically the difference between flashbacks and normal autobiographical memory (that used in everyday life for remembering ordinary past events). These symptoms occur commonly following traumatic experiences, but in the vast majority of cases they resolve spontaneously. What goes wrong in PTSD? Some treatment modalities that appear to be most effective involve creating a narrative of the traumatic experience, putting it into some type of context. Why is this so?

Flashbacks
Flashbacks are perceptions or images rather than verbal descriptions. They incorporate bodily reactions such as pain. They are experienced in the present, not the past – the patient feels as though they are happening now. They are vivid, and the person becomes involved in the entire experience. Sometimes detail can be seen that is not available in other memories of the incident. Flashbacks are all-or-nothing. They switch on and off, and the person has little control. Sufferers might try consciously to change the events, but that is not possible.²
Effective treatment involves replacing the re-experiencing of events in the present with ordinary recollection whereby events are experienced as belonging to the past. Many people try to avoid flashbacks because they are extremely unpleasant or remind them of an event that challenged their beliefs about the world, but some acknowledgement of and confrontation with the traumatic images is usually required for recovery. Problems may arise both because of primary emotions (those like fear or horror that were experienced at the time and are re-experienced in flashbacks) and because of secondary emotions (those like guilt or anger triggered by thinking about the traumatic experience after it is over). Events that may have happened in a short time can take a long time to be incorporated into ordinary autobiographical memory.

Two memory systems
In the brain there are thought to be two main ways of remembering traumatic incidents (the dual representation model – see diagram below). The non-verbal (situationally accessible memory – SAM) system is evolutionarily quite primitive. The sense organs are able to pass messages very rapidly, using subcortical pathways, to the part of the brain called the amygdala, which triggers the emotion of fear. This transmission route is “quick and dirty” in the sense that information travels rapidly but is only crudely analysed. Memories created in this way are indelible, but can be superseded by new memories involving higher (cortical) brain areas. There is little discrimination of detail or context in the SAM system. Once a particular combination of stimuli is associated with a fear response, a low-level pattern matching system will recreate that fear when those stimuli are re-encountered. In PTSD, the triggers for the fear response are relatively non-specific: thus, for a torture survivor seeing a television programme involving aggression or helplessness may be sufficient to trigger flashbacks and primary emotions.

By contrast the verbally accessible memory system (VAM) is much more complex. The same signals are picked up by the sense organs and are passed to the cerebral cortex of the brain which is evolutionarily much more recent. This information is analysed in much more detail and is processed by the hippocampus, a structure in the temporal lobe. Information is thought to be stored temporarily in the hippocampus and, if sufficiently rehearsed, to be slowly transferred to the long-term autobiographical memory store.
Brain systems controlling fear responses

The operation of the VAM system is much slower than the SAM system, but allows detail and context to be encoded with the memory of the incident. For example, the VAM system permits classification of an incident as something that happened in the past. It is enhanced by moderate levels of arousal, but inhibited at very high levels. Thus it does not function well in very traumatic situations. When provided with additional information the VAM system is able to evaluate the context and increase or decrease the fear response as appropriate.

Normal recovery
Under normal circumstances, the memory of a specific trauma is stored both in the SAM system and the VAM system. The VAM system contains information that received sufficient attention at the time to be stored as part of a person's conscious recollection of the trauma.
This can be retrieved when the person is asked what happened to them. The SAM system contains more detailed sensory information about sights, sounds etc. that was so briefly attended to that it was not recorded in a deliberately accessible form. This information is retrieved automatically when the person encounters reminders of the trauma. Because this more primitive memory system has little facility for recording context, the brain is unable to distinguish between what was threatening in the past and what is threatening now. Flashbacks over the first few days after the incident reflect the activation of images stored in the SAM system. If the person consciously attends to the images and does not try to distract themselves or block them out, the information they contain will be re-encoded into the VAM system. Here the images will be provided with a spatial and temporal context, so that the brain is able to locate them in a time and place where there is no longer an immediate threat. There is little capacity to consciously attend to images, so not much information is transferred each time.

In the presence of trauma reminders memories in the two systems compete to be retrieved. As VAM memories become more comprehensive, they are able to inhibit activation of the SAM system. For example, assume (as shown in the diagram) that

![Diagram](image-url)

F1-F20 are 20 different features identified by the sense organs during the trauma and now re-encountered in some later context. If only a few of these features are present in the VAM system, the SAM system predominates and the fear system is triggered. Once the critical information has been transferred from SAM to VAM, and the memory is complete (as shown in the next diagram), an encounter with these same reminders will lead to the retrieval of the
VAM memory. Because this memory locates the danger in the past the trauma reminders no longer activate the fear system and the person no longer becomes anxious and panicky.

PTSD
In PTSD, this normal response does not occur because the VAM system fails to make a good copy of the information in the SAM system, for example because the person is deliberately avoiding flashbacks or trauma reminders. The information remains isolated in the SAM system and, when it is triggered, there are no corresponding VAM memories to tell the brain the danger is past and inhibit the fear response.

One very common reason flashbacks are avoided and the memory system does not self-correct is because the traumatic event has challenged important aspects of the victim’s identity. Identity involves long-held and often unquestioned assumptions about the self and its relation to others. For example, trauma may overturn a positive identity such that the world suddenly seems unsafe or unfair, and other people hostile, untrustworthy, or careless of the victim’s welfare. The victim may perceive themselves as being weak or bad, and so somehow deserving of the incident or of the bad outcomes that follow. Alternatively, the victim may blame themselves for not recovering more quickly. In this way trauma may involve both a challenge to previous positive aspects of identity or an unwelcome confirmation of previous negative aspects of identity that the person would rather disown. It is these very individual ways in which identity is threatened, as much as the actual traumatic moments themselves,
that have the potential to create psychological havoc. As the trauma is related to wider aspects of the person’s identity an increasing number of things may come to remind them of the trauma. With all these additional negative connotations, flashbacks become even more aversive and recovery even more difficult.

One response is to try to deny the significance of the event, his or her own actions, or the actions of others, and to rehearse to oneself or others an incomplete, neutralised version of events that omits many of the most critical aspects. This produces a partial memory in the VAM system which may be sufficient to inhibit fear in the presence of weak trauma reminders. By avoiding conversations about the trauma, and people or places who are potent reminders, flashbacks can be kept to a minimum. The disadvantage of this strategy is that detailed VAM memories are not developed, so that when trauma reminders cannot be avoided the full SAM fear response occurs.

**Therapy**

Effective forms of psychological therapy allow the gaps in the VAM system to be filled with forgotten or evaded information. Discussing events in detail over a prolonged period of time allows the VAM system slowly to incorporate this information. Flashbacks when they occur can be used to provide additional contextual information. They often correspond to the worst moments of the trauma, sometimes known as “hotspots”.

It is often necessary to use cognitive techniques to challenge the threat to identity provoked by the trauma, as simply recalling extra details may be insufficient for this purpose. These techniques involve eliciting maladaptive beliefs and the evidence supporting them, and then systematically challenging this evidence and collecting new evidence. For example, the belief that the person is weak because they have not been able to shrug off the event and continue as though nothing has happened can be challenged by having them find out how others have been affected by the same or similar events. The belief that the person must be strong even if everyone else has been affected by it can be challenged by investigating the justification for having different rules applying to self and others. In this way traumatic events may stimulate far-reaching changes in people’s core sense of themselves.
Conclusion
Much of the detailed information about a traumatic event is processed by a “quick and dirty” pathway that is rapid, but does not lead to it being stored together with a spatial and temporal context, and does not allow it to be accessed readily through everyday remembering processes. Normally this information is incorporated into regular autobiographical memory over a period of weeks, as the person replays the events and attends to flashbacks. In PTSD this transferral does not occur, often because the primary emotions stimulated by remembering are too painful and the patient avoids triggers that would otherwise assist with the process. Thus, for patients with PTSD, memories of the traumatic event tend to be fragmented and incomplete. Only parts of the memory may be accessible, and different parts on different occasions, depending on the context. With treatment, these memories can be integrated with their context, thus enabling the patient to give a much more coherent account of the experiences, including aspects that had previously only been re-experienced as flashbacks. There are therefore several good reasons why patients who have been through very traumatic experiences and have developed PTSD may give differing, incomplete accounts of their trauma on different occasions, and why with treatment the account is likely to become more complete and accurate.

References