A Theoretical Framework for Understanding Recovered Memory Experiences

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Abstract If recovered memory experiences appear counter-intuitive, this is in part due to misconceptions about trauma and memory, and to a failure to adopt a comprehensive model of memory that distinguishes personal semantic memory, autobiographical event memory, and memory appraisal. Memory performance is generally superior when events, including traumas, are central to identity. Prolonged trauma in childhood, however, can produce severe identity disturbances that may interfere with the encoding and later retrieval of personal semantic and autobiographical event information. High levels of emotion either at encoding or recall can also interfere with the creation of coherent narrative memories. For example, high levels of shock and fear when memories are recovered unexpectedly may lead to the experience of vivid flashbacks. Memory appraisals may also influence the sense that an event has been forgotten for a long time. Recovered memories, although unusual, do not contradict what we know about how memory works.

Keywords Childhood • Forgetting • Identity • Trauma

Introduction

Why has the idea that memories of trauma can be forgotten and then recovered attracted the controversy it has? Why have eminent clinicians and academics, not all of whom are experts on trauma and memory, felt qualified to join the advisory boards of false memory societies and lend their considerable weight to assertions that are either empirically unsupported or even run contrary to expert opinion? Undoubtedly one reason has been the framing of the debate in terms of mysterious

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and unverifiable processes, such as "repression" or "dissociative amnesia", rather than an observable phenomenon, "forgetting". Although dissociative processes are familiar to clinicians working in the trauma field, the phenomena are poorly understood and are rarely encountered in everyday life or, of course, in the laboratory. Use of unclear terms like "repression" by clinicians has invited skepticism from some experimental psychologists. Perhaps as a result, claimed forgetting of abuse has often been invalidated by linking it to the discredited process of "repression". In logic this is the 'straw person' fallacy.

Examples of the conflation of forgetting with repression are provided by Loftus and Davis (2006), who noted: "Most fundamentally, to demonstrate that memories can be repressed and later recovered, at least three things must be verified: (a) that the abuse did take place, (b) that it was forgotten and inaccessible for some period of time, and (c) that it was later remembered" (p. 471), and "Yet over the past couple of decades, many persons have reported having experienced massive abuse that was repressed and recovered, which raises the question of whether some or all such "memories" might be false" (p. 475). A recent edition of the False Memory Syndrome Foundation Newsletter (2010, Vol 19, no. 1, p. 1) similarly notes "Belief in the historical accuracy of "recovered repressed memories" continues its journey through our culture, its passage sometimes marked by incidents that seem discouraging, as though no progress had been made....a legal decision in Minnesota reinforces the understanding that there is a lack of scientific evidence for the theory of repressed and recovered memories".

Another reason for the controversy has been the widespread acceptance of a false premise, namely that traumatic events are not forgotten (see, for example, McNally, 2012, this volume). Typical claims include: "Traumatic events—those experienced as overwhelmingly terrifying at the time of their occurrence—are highly memorable and seldom, if ever, forgotten" (McNally, 2005); "Memories for trauma are distinctive, long-lasting, and easily retrieved" (Shobe & Kihlstrom, 1997). Although traumas are sometimes unforgettable, particularly by people suffering from posttraumatic stress disorder (PTSD), the evidence that they are invariably better remembered than non-traumas in healthy populations is equivocal (Brewin, 2007). To make this point more concrete, a landmark study found that only about a quarter of personally experienced and significant life events that were entered into monthly records were recalled when participants were given similar checklists at the end of a 10-month period (Raphael, Cloitre, & Dohrenwend, 1991). Desirable events and events involving significant loss were better recalled, but the effects were modest, and there was no advantage for events involving illness or injury.

Another, much smaller-scale, study found that participants recalled only half their visits to HMOs over the previous year, even when these were for serious events involving a problem that had a high probability of resulting in a major infection, debility, or death if not treated by a medical professional (Means & Loftus, 1991). Non-recurring events were better recalled than recurrent events but the effect, like that for seriousness, was not significant with the low numbers. Schraedley and colleagues investigated the effects of depression on reporting of traumatic events over an interval of 1 year (Schraedley, Turner, & Gotlib, 2002). Whereas worsening of

mood did not affect reporting, improvement in mood led to significantly fewer events being reported at the second time point. The results of these studies are consistent in emphasizing that, although traumatic events are likely to be better recalled than non-traumatic ones, a high degree of forgetting can be expected.

This culturally sanctioned myth concerning memory for trauma has led to several deductions that, although logically incorrect, may apply some of the time. For example, one deduction is that if the event was forgotten, it cannot have been traumatic. It *is* plausible that in some cases a forgotten event, such as child sexual molestation, may not have been understood and hence not experienced as traumatic at the time (Loftus, Garry, & Feldman, 1994; DePrince et al., 2012, this volume; McNally, 2003; McNally, 2012, this volume), although it may have been frightening, painful, and unpleasant. Another deduction is that if an apparently traumatic event was forgotten, it may not have occurred at all. There is indeed evidence that some recovered 'memories' do pertain to events that have been suggested or imagined, and do not correspond to reality (Loftus & Davis, 2006; McNally, 2003). A third deduction is that if a traumatic event appears to have been forgotten, the person may be mistaken about having forgotten it. This is supported by Schooler's observations that some individuals who claim to have forgotten trauma memories had in fact had conversations about the supposedly forgotten events in the recent past. This he termed the "forgot-it-all-along" effect (Schooler, 2001; see also Geraerts, 2012, this volume).

If traumas *are* often forgotten, how are we to explain this? The notion that "ordinary forgetting" (Loftus, Garry, et al., 1994) is a sufficient explanation implies that there is a satisfactory understanding of what forgetting is. But "ordinary forgetting" does not account for the fact that negative events tend to be forgotten more readily than positive ones (Walker, Skowronski, & Thompson, 2003). Moreover, traditional accounts of forgetting largely based on group studies of word list learning in the laboratory cannot be assumed to be adequate. For example, such studies focused mainly on passive forgetting and were not designed to account for stimuli or experiences a person actively wanted to forget. To understand recovered memory experiences, therefore, it is first necessary (a) to carefully document the phenomena themselves, (b) to have a model of memory that can accommodate the range of relevant observations, (c) to consider how disturbances produced by trauma, such as PTSD, can affect memory, and (d) to take due cognizance of individual differences in memory processing. Only then is an adequate understanding likely to emerge.

The Phenomenology of Recovered Trauma Memories

The starting point for any consideration of the recovered memory controversy must be a description of the phenomenon itself. Too often this description is based on unsubstantiated claims that caricature the data and skew the nature of the argument that follows. Among the facts that surveys of recovered trauma memories have established are that they are not just concerned with sexual abuse but also include

medical procedures, other child maltreatment, and witnessing violence or death (Andrews et al., 1999; Elliott, 1997; Feldman-Summers & Pope, 1994; Melchert, 1996). They do not just occur within a therapeutic context, but are often retrieved spontaneously (Andrews et al., 1995; Elliott & Briere, 1995; Feldman-Summers & Pope, 1994). Corroborative evidence of varying quality is often available, particularly when the memories have been recovered spontaneously outside of therapy (Andrews et al., 1999; Chu, Frey, Ganzel, & Matthews, 1999; Feldman-Summers & Pope, 1994; Geraerts et al., 2007; Williams, 1995). Finally, the degree of reported amnesia varies considerably, from total forgetting to some basic knowledge of the trauma being retained despite forgetting of many salient facts and episodes (Andrews et al., 2000; Elliott & Briere, 1995; Gold, Hughes, & Hohnecker, 1994; Harvey & Herman, 1994; Loftus, Polonsky, & Fullilove, 1994; Malmo & Laidlaw, 2010).

What is it like to recover a trauma memory that has been forgotten? There are no data from general population samples, which is a major drawback. In case studies and clinical samples the experience often appears to be accompanied by shock or surprise, and the majority of memories tend to be similar to those reported by patients with PTSD: they are fragmented, accompanied by high levels of emotion, and experienced as a reliving of the original event (Andrews et al., 2000; Hunter & Andrews, 2002; Malmo & Laidlaw, 2010; van der Hart, Bolt, & van der Kolk, 2005). Individuals recovering memories have used words and phrases like "stunned", "complete chaos in my emotions", "just this extreme emotion of fear and disbelief", "it was literally like a brick wall just hit me…I just started crying and screaming uncontrollably" (Schooler, 2001). This occurred despite evidence that, as noted above, in a subset of individuals the memories had in fact been previously recalled and even discussed with relatives.

In the Andrews et al. (2000) study the most commonly reported single trigger within therapy was a therapeutic technique although these accounted for less than half the instances of reported memory recovery. The most common triggers prior to therapy were events involving the client's children, or children reaching the same stage of development as the client was at the time of the supposed trauma, followed closely by events involving physical contact with the client, or physical danger to the client or another known person. Other studies have noted that even when clients are in therapy the triggers to memory recovery often occur outside sessions (Malmo & Laidlaw, 2010).

This, then, is the little we know about the experience of recovering a trauma memory. The variety in these accounts suggests that a number of different processes may be at work and that a broad approach to understanding memory will be needed.

A Model of Memory

It is convenient to enumerate three main aspects of memory: *capacity*, *content*, and *process*. *Capacity* refers to individual variability in the amount of information that can be learned, manipulated, and either recalled or used in some other way, and in

the efficiency with which this can be done: Measures include standardized tests of verbal and non-verbal learning, working memory capacity, and prospective memory. *Content* refers to what is remembered: Examples include semantic memory (memory for facts), episodic memory (memory for events), and autobiographical memory (memory for facts and events concerning the self). Memory *processes* may be described at a number of levels, including the molecular, neuropsychological, cognitive, and social. Cognitive processes are traditionally considered in terms of encoding, storage, and retrieval functions (for example, voluntary versus involuntary recall), but need to be expanded to consider active attempts to enhance or suppress memory. There is also an important role for judgment and appraisal, and for individual differences in the way memory is used.

These more subjective appraisal functions are critical in evaluating the operation and integrity of memory and arriving at conclusions about the source and veridicality of what comes to mind (Burgess & Shallice, 1996). The source-monitoring framework (Johnson, Hashtroudi, & Lindsay, 1993; Johnson, Raye, Mitchell, & Ankudowich, 2012, this volume) also emphasizes the central role of memory decisions involving the attribution of retrieved information to a source, for example actual or imagined. Understanding recovered memory experiences principally draws on knowledge and theory about the interplay of memory content and process, including appraisal.

An important subset of memory content concerns the self, and Conway (Conway, 2005) has proposed a hierarchical model of autobiographical memory in which overarching semantic knowledge about the self is at the apex. This conceptual level also contains information about overall themes, lifetime periods, and general events. At this level sits the knowledge that one has visited Istanbul, has three sisters, or has a father who sells insurance. This kind of knowledge is central to a person's identity and has been argued to be immediate, as opposed to episodic memory which requires a search (Tulving, 1983). It is now thought that individuals have a collection of multiple 'selves' that are experienced at different times and in different contexts (Harter, Bresnick, Bouchey, & Whitesell, 1997; Markus, & Sentis, 1982). These overlapping ways in which we experience our own identity correspond to a set of related structures in long-term memory that contain some constant features of the self (overarching semantic knowledge) but also contain information relating to the self at specific ages and in the performance of specific roles. Conway has made the valuable proposal that at any one time information is processed by a "working self", a limited subset of self-related memory structures analogous to the limited working memory system.

This higher-level content about the self needs to be distinguished from voluntary memory for specific autobiographical periods and episodes, the construction of which is typically accompanied by more detailed contextual information including time and place. As noted by Conway (Conway & Pleydell-Pearce, 2000), this level can be divided into schematic memory for sequences of similar experiences, in which recall may largely consist of a general summary of what typically happened, and memory for single specific events. Strategic mechanisms such as rehearsal and directed forgetting exist to influence these episodic memories in the service of the
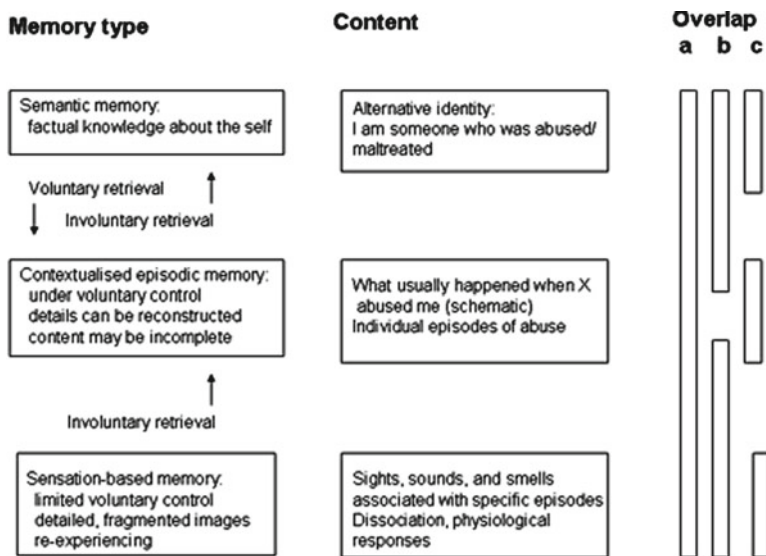
Memory type

Content

Overlap
a b c

Semantic memory:
factual knowledge about the self

Alternative identity:
I am someone who was abused/
maltreated

Voluntary retrieval ↑
↓ Involuntary retrieval

Contextualised episodic memory:
under voluntary control
details can be reconstructed
content may be incomplete

What usually happened when X
abused me (schematic)
Individual episodes of abuse

↑
Involuntary retrieval

Sensation-based memory:
limited voluntary control
detailed, fragmented images
re-experiencing

Sights, sounds, and smells
associated with specific episodes
Dissociation, physiological
responses

Fig. 1 Hierarchical organization of autobiographical memory in someone who knows he or she is an abuse survivor

person's goals. At the third level there is sensation-based information relating to individual events in the form of images that are automatically retrieved in response to internal or external cues (Brewin, Dalgleish, & Joseph, 1996; Brewin, Gregory, Lipton, & Burgess, 2010; Conway, 2009). Unlike contextualized episodic memories, these lower-level images are not subject to direct strategic control, and may be hard to access except in the presence of very specific cues.

Figure 1 illustrates this hierarchical organization of autobiographical memory using the example of someone who has always known they were abused as a child. The overarching self-narrative contains semantic information about being abused, maltreated, or however the person chooses to describe these experiences to themselves. At the next level down are schematic and individual episodic memories of abuse episodes, which can be voluntarily retrieved if desired but may also be retrieved automatically by internal or external reminders. At the level below are detailed sensory images of these events, linked to emotions such as fear and shame as well as patterns of physiological arousal. There is limited control over their retrieval, which occurs as a result of internal or external stimuli that match their content.

At the right of Fig. 1 are bars representing different degrees of overlap in autobiographical memory for abuse. The first bar (a) indicates that the person is fully aware of all episodes, detailed images, and emotions, and has good access to them. The second bar (b) indicates that the person is aware of some episodes of abuse, but that there are additional episodes and linked images and emotions that they are

unaware of. The third bar (c) indicates that autobiographical memory is fragmented, with the person being aware of little more than the fact of having been abused, and being unable to recall specific episodes. Likewise, episodic memories are not integrated with detailed images and emotional reactions.

Trauma and Personal Semantic Memory

It has been proposed that traumatization invariably involves structural changes to the personality to varying degrees (van der Hart, Nijenhuis, & Steele, 2005). Following the British psychologist Charles Myers (Myers, 1940), van der Hart and colleagues distinguished between the apparently normal part of the personality (ANP), driven by the action systems of daily life, and the emotional part of the personality (EP) driven by defensive action systems evoked by traumatic experiences including anxiously attached or avoidant attachment styles. Primary structural dissociation, characteristic of simple PTSD, involves alternation between the ANP and the EP, when the latter is elicited by trauma reminders. Secondary and tertiary structural dissociation involve greater degrees of fragmentation of the ANP and EP associated with repeated childhood or adult trauma. Similarly, it has been argued that episodic memories of trauma represent a threat to the coherence of the conceptual self and therefore tend to remain unintegrated with it (Conway, 2005).

Consistent with these theories, a large community survey found that reports of childhood abuse were associated with large perceived gaps in memory for childhood periods (Edwards, Fivush, Anda, Felitti, & Nordenberg, 2001). This phenomenon has been frequently reported (Malmo & Laidlaw, 2010). More specifically, personal semantic memory seems to be impaired in women reporting childhood abuse, even though episodic memory remains comparatively intact (Hunter & Andrews, 2002; Stokes, Dritschel, & Bekerian, 2008). In the study by Hunter and Andrews, women with recovered memories of childhood abuse, compared to those who had never been abused, found it harder to recall facts about their childhoods, such as home addresses and names of teachers, friends, and neighbors.

Effects of trauma on identity have also been addressed in the developmental literature. Exposure to abuse in childhood is associated from a very young age with dissociation, a fragmented identity (internal conflict between multiple selves), speaking less about internal states, and the development of a false self whereby there is a large discrepancy between the self presented to the outside world and the self experienced as "real" or "authentic" (Beeghly & Cicchetti, 1994; Crittenden & Dilalla, 1988; Ogawa, Sroufe, Weinfield, Carlson, & Egeland, 1997). In addition to the lack self-awareness, there are disruptions to the continuity of the self over time and to the sense of possessing an integrated self (Harter, 1998). In young adults exposure to violence is associated with discrepancies between who people feel they are and who they feel they ought to be (Brewin & Vallance, 1997).

Identity fragmentation is the defining characteristic of dissociative identity disorder, a condition often linked to experiencing severe levels of trauma (Lewis, Yeager,

Table 1 PTSD status and change in military veterans' perceptions of the world (adapted from Brewin, Garnett, et al., 2011)

	Physical disability% (n=33)	PTSD% (n=108)
No change	39	9
A small change	30	18
A large change	30	74

Swica, Pincus, & Lewis, 1997; Sar, Akyuz, & Dogan, 2007; Xiao et al., 2006). Both in this disorder (Dorahy et al., 2009) and in PTSD (Brewin & Patel, 2010), this fragmentation is often manifested in the form of hearing one's thoughts as voices, some of which are negative and accusatory. Enduring personality change after catastrophic experience is also recognized as a diagnostic category in the International Classification of Diseases, and more complex forms of PTSD have been described as involving an assault on the personality amounting to a form of 'mental death' (Ebert & Dyck, 2004).

With respect to traumatic events themselves, it has been argued that they are often highly memorable and can form turning points in people's construction of their own identity (Pillemer, 1998). Higher levels of posttraumatic symptoms are associated with seeing such events as a key to identity (Berntsen & Rubin, 2006). Consistent with this, 7–8 months after the 2005 London bombings, 61% of a sample of Londoners reported both positive and negative changes in their relation to the world and 23% in how they felt about themselves (Rubin, Brewin, Greenberg, Simpson, & Wessely, 2005).

As shown in Table 1, UK war veterans diagnosed with PTSD, compared to those with physical disabilities, saw service-related trauma as bringing about significant changes in their perception of the world and their relation to it (Brewin, Garnett, & Andrews, 2011). Veterans frequently repeated the belief that they were now seeing the world as it really was – "my blinkers have been taken off now" – and that the reality is that the world is not benign. Feelings of isolation and strangeness were compounded by a feeling of there being a stigma to having been in the armed forces: "the only people I have any time for really are people of the ex-service community; I just feel as though they're the only people that I trust".

Table 2 from the same study shows that war veterans also saw service-related trauma as bringing about significant changes in their perception of themselves. One veteran described how he found it difficult to look people in the eye: "because of my face, because my whole body's image and my facial image have been destroyed". For a number of veterans there was the sense of having been changed fundamentally, as a person, for the worse: the idea of having been tainted and diminished morally. Some veterans complained of an emotional numbing, having less ability and volition to express emotion. For example, one said: "Kissing the kids like, I can't kiss the kids. I can't hug my children; I find that difficult to be honest".

Given this apparent role of trauma memories in identity formation, it is of great interest that numerous longitudinal and retrospective studies have now found that a substantial proportion of people reporting child sexual abuse (somewhere between

Table 2 PTSD status and change in military veterans' perceptions of themselves (adapted from Brewin, Garnett, et al., 2011)

	Physical disability% (n = 33)	PTSD% (n = 108)
No change	27	4
A small change	33	12
A large change	39	84

15% and 60%) say they have had periods in their lives (often lasting for several years) when they had less memory of the abuse or could not remember that it had taken place (Brewin & Andrews, 1998; Brown, Scheflin, & Whitfield, 1999; Goodman, Quas, & Ogle, 2009). These answers, which we may call "subjective inaccessibility judgements", seem to indicate that there is a problem in accessing the fact of the abuse, not just details of the episodes; in other words, personal semantic memory is involved. The events have apparently not been central to the person's identity.

On what basis are people able to conclude that they have forgotten abuse or other traumas? It has been suggested that when people claim they had periods when they could not remember the trauma they may not mean they had forgotten the events but simply not thought about them (McNally, 2003; McNally, 2012, this volume). Of course some studies have asked more probing questions, such as "Was there ever a period when you would not have remembered this event, even if you were asked about it directly?" Although some individuals still agree that they would not have remembered (Ghetti et al., 2006; Joslyn, Carlin, & Loftus, 1997), answers to this kind of hypothetical question are far from compelling, to say the least. McNally argues that for statements concerning forgetting to make sense, individuals must have tried to think about the trauma but failed.

An alternative possibility has been identified from studies in which people have specifically been asked whether or not an event has happened to them. Researchers have suggested that there are two main ways in which a person reaches a conclusion that an event has *not* happened (Gallo, Bell, Beier, & Schacter, 2006). They may search for and retrieve logically inconsistent information that rules out event occurrence. Alternatively, they may use a distinctiveness heuristic: The more distinctive the event, the more likely they believe they would be able to retrieve a corresponding memory and hence, finding none, the more willing they are to say it did *not* happen (Ghetti, 2003; Strack & Bless, 1994).

This account of deciding about event non-occurrence can be applied to judgments of the subjective inaccessibility of childhood abuse memories. As people will probably not have been specifically questioned about them, they will not have had the opportunity to retrieve inconsistent information. By default, therefore, the account suggests the operation of a heuristic, namely that some facts, such as one's hair color or how many siblings one has, are so distinctive that they should be part of an ever-present personal semantic knowledge. If one cannot immediately recall being aware of having been abused, therefore, the inference is that it must have been forgotten.
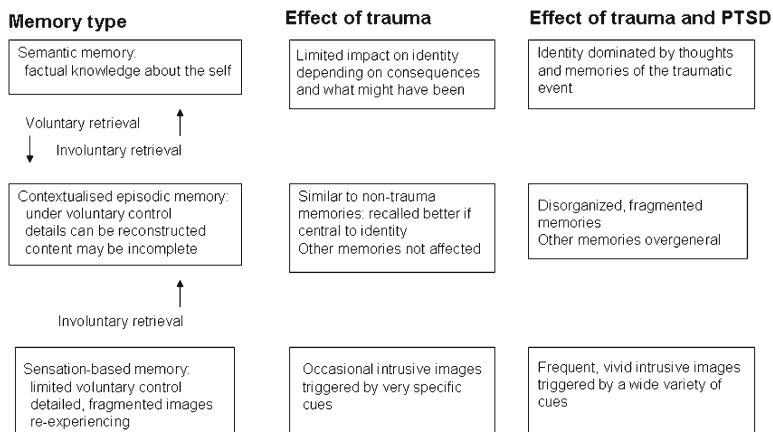
Memory type

Semantic memory:
factual knowledge about the self

Voluntary retrieval ↑
↓ Involuntary retrieval

Contextualised episodic memory:
under voluntary control
details can be reconstructed
content may be incomplete

↑ Involuntary retrieval

Sensation-based memory:
limited voluntary control
detailed, fragmented images
re-experiencing

Effect of trauma

Limited impact on identity
depending on consequences
and what might have been

Similar to non-trauma
memories: recalled better if
central to identity
Other memories not affected

Occasional intrusive images
triggered by very specific
cues

Effect of trauma and PTSD

Identity dominated by thoughts
and memories of the traumatic
event

Disorganized, fragmented
memories
Other memories overgeneral

Frequent, vivid intrusive images
triggered by a wide variety of
cues

Fig. 2 Effects of trauma and PTSD on different levels of autobiographical memory

One of the many weaknesses in this literature is the relative absence of comparisons of reported amnesia for abuse with amnesia for other traumatic and non-traumatic events from the same life period. One exception is evidence that partial and complete amnesia are also reported in connection with non-traumatic childhood events such as attending summer camps (Read & Lindsay, 2000). Attendance at summer camps would seem less likely than abuse to be represented in semantic memory, and so it would be surprising if retrieving memories of such events was accompanied by the same degree of shock and surprise as has been reported for childhood abuse. Nevertheless, these findings caution against assuming that reported amnesia for child abuse is as distinctive as has been claimed and therefore requiring of special explanation.

Summary. Exposure to repeated trauma, particularly in childhood, affects the coherence and integrity of identity and is associated with corresponding deficits in personal semantic memory. These deficits may enhance the ease with which traumatic events including abuse can be forgotten. The distinctiveness heuristic may also contribute to some people's willingness to agree they had forgotten an episode of abuse and to the shock often associated with recovery. In PTSD traumatic events appear to become much more central to sufferers' identity, an effect shown in the upper part of Fig. 2.

Trauma and Autobiographical Event Memories

Although, as noted earlier, there is little evidence that trauma and non-trauma memories behave differently in healthy populations, PTSD has a profound effect on memory. PTSD patients have general difficulties with episodic memories for neutral

material (Brewin, Kleiner, Vasterling, & Field, 2007), and in recalling specific details of events they have personally experienced (Moore & Zoellner, 2007). When it comes to personal trauma memories, both PTSD patients (Brewin et al., 1996) and individuals describing trauma memories recovered after a lengthy period of time (Andrews et al., 1999, 2000) have identified intrusive, emotion-laden memories and flashbacks.

A flashback is a form of memory characterized by a vivid sensory image, usually visual but not necessarily so. They tend to consist of fragmented snapshots or series of images, come to mind involuntarily, and are experienced as happening again in the present (Brewin, 2007; Ehlers, Hackmann, & Michael, Ehlers 2004). In flashbacks the recall of traumatic images appears to be disconnected from contextual information that normally associates a sensory memory with awareness of a corresponding time and place (Brewin, Gregory, et al., 2010). They can vary from relatively mild (there is a transient sense of the event reoccurring in the present) to extreme (the person loses all connection with their current autobiographical self and present surroundings while reexperiencing the memory). Importantly, these intrusions do not invariably reproduce an event that actually took place (Hackmann, Ehlers, Speckens, & Clark, 2004; Reynolds & Brewin, 1998), and reminders of imagined events can also elicit strong physiological arousal.

According to the dual representation theory of PTSD (Brewin et al., 1996), the disorder is caused by a failure to form a complete contextualized autobiographical memory of the traumatic event. These contextualized memories are referred to as "verbally accessible memories" in the theory. This is not the same as the concept of a "narrative" memory that contains a verbal account of the trauma (Van der Kolk & Fisler, 1995). Rather, the key idea is that information needs to receive sufficient conscious attention at encoding for contextualization to occur, and this would incidentally make it available for the construction of a narrative if required. The theory proposes that in PTSD important information is only represented in the form of images ("situationally accessible memories"), and that their lack of context is responsible for memories being experienced as flashbacks. Contextualization, achieved for example by trauma-focused cognitive- behavior therapy, conversely results in the corresponding images becoming harder to retrieve. A revised version of the theory (Brewin, Gregory, Lipton & Burgess (2010) grounds these observations in specific neural processes, proposing that information is contextualized by the ventral visual stream connecting the occipital with medial and inferior temporal areas. Flashbacks are thought to be produced by processing that occurs predominantly in the dorsal visual stream, connecting the occipital and parietal cortex, insufficiently modulated by ventral stream processing.

Although PTSD patients experience vivid involuntary imagery and retain excellent memory for the fact of the trauma having happened to them (Rubin, Berntsen, & Bohni, 2008), there is considerable evidence that these patients have difficulties in deliberately bringing to mind coherent, well-integrated autobiographical memories of the traumatic event (Harvey & Bryant, 1999; Jelinek, Randjbar, Seifert, Kellner, & Moritz, 2009). These difficulties have often been found to be related to self-reported dissociation either during or after the traumatic event (Brewin, 2007).

Moreover, impaired voluntary trauma memory predicts the course of the disorder (Halligan, Michael, Clark, & Ehlers, 2003; Jones, Harvey, & Brewin, 2007). Perhaps not surprisingly, therefore, retrospective recall of traumatic events is not invariably stable but can be affected by symptom levels (Engelhard, van den Hout, & McNally, 2008; Giosan, Malta, Jayasinghe, Spielman, & Difede, 2009; Heir, Piatigorsky, & Weisaeth, 2009). Thus, the more severe the person's current PTSD symptoms, the more intense they will tend to describe their emotions and dissociative reactions at the time of trauma.

One of the puzzling aspects of recovered trauma memories is how the intense associated emotions were suppressed or went unnoticed, often for long periods of time. Were these emotions necessarily present at encoding? A common assumption, based on the typical definition of a trauma as an event that is overwhelming, is that emotional arousal, flashbacks, and other symptoms reflect the encoding of the event under extremely high arousal. These symptoms are immediate but essentially normal responses that usually disappear of their own accord. PTSD is typically understood as reflecting an inappropriate persistence of these responses (Yehuda & Ledoux, 2007). Must we assume therefore that people who recover trauma memories experienced intense emotions, high arousal, and reexperiencing around the time of the original events?

This standard view of how PTSD develops does not readily account for the fact that many onsets are delayed. Recent research using a variety of approaches including growth curve modeling (Bonanno et al., 2008; Bonanno, Rennicke, & Dekel, 2005) suggests that there are four common patterns to posttraumatic responses: symptom levels that are high initially and remain high (chronic pattern), symptoms that are high initially and then fall (recovery pattern), symptoms that are low initially and remain low (resilient pattern), and symptoms that are low initially and then rise (delayed onset pattern). Consistent with this, a recent systematic review found that delayed onset posttraumatic disorder accounted for approximately 15% of civilian and 38% of military PTSD cases (Andrews, Brewin, Philpott, & Stewart, 2007).

This assumption that disordered responding starts immediately post-trauma is also reflected in most biological research on PTSD, which models the disorder by exposing laboratory animals to fear-inducing situations and measuring their initial learning in terms of changes in hormones, neurotransmitters, gene transcription factors, and other processes. This conditioning model is relevant to normal fear responses but is unsuitable both for explaining why such responses to a traumatic event fail to subside in a minority of those exposed, and for explaining delayed onsets (Yehuda & Ledoux, 2007). Following the suggestions of Post and colleagues (Post, Weiss, & Smith, 1995), there is now considerable evidence for a gradually unfolding process of sensitization that occurs in the weeks and months post-trauma (Griffin, 2008; Shalev et al., 2000).

It has been argued that PTSD involves both associative fear memories, relevant to explaining the reexperiencing symptoms of PTSD, and nonassociative fear memories (e.g., sensitization), relevant to explaining hyperarousal (Siegmund & Wotjak, 2006). Animal experiments have provided evidence that the two processes are functionally distinct (Siegmund & Wotjak, 2007a, 2007b). Sensitization, which

Table 3 Dissociative and emotional trauma reactions in military veterans with immediate onset PTSD, delayed onset PTSD, and no PTSD (adapted from Andrews et al., 2009)

	Immediate onset PTSD (n=40)	Delayed onset PTSD (n=63)	No PTSD (n=39)	Sig
Fear, helplessness or horror (PTSD A2)	85% a	81% a	53% b	***
Peritraumatic dissociation	5.9 a	4.5 b	3.4 b	***
Anger at time of trauma	3.1 a	2.5 b	2.2 b	*
Shame at time of trauma	2.5 a	1.8 b	1.3 b	***
Anger about trauma now	3.3 a	2.6 b	1.7 c	***
Shame about trauma now	2.7 a	2.2 a	1.3 b	***

Means & % with different subscripts differ significantly

$*p<.05$; $***p<.001$

Table 4 Acquisition of PTSD symptoms over time in military veterans with immediate and delayed onset PTSD (adapted from Andrews et al., 2009). Values reflect mean number of cumulative symptoms

	Immediate onset PTSD (n=40)	Delayed onset PTSD (n=63)
Before any service trauma	.22	.33
Before main trauma in service	.40	.90
Within 6 months of main trauma	3.70	3.83
More than 6 months after main trauma	–	6.89
At PTSD onset	10.52	10.52

may involve structural remodelling in the amygdala, requires an extended time course and thus may provide a good account of the delayed onset of symptoms. Consistent with this position, hyperarousal appears to be important in predicting the way PTSD symptoms develop over time (Marshall, Schell, Glynn, & Shetty, 2006; Schell, Marshall, & Jaycox, 2004).

A recent study comparing immediate and delayed onset PTSD in war veterans (Andrews, Brewin, Stewart, Philpott, & Hejdenberg, 2009) found that they were similar in their amount of trauma exposure, and in the number and type of symptoms they reported at onset. At the time of the trauma, however, the immediate onset group reported significantly more peritraumatic dissociation, anger, and shame than those with delayed onsets, suggesting that they were overwhelmed by the intensity of the event in ways that went beyond fear, helplessness, and horror (see Table 3). The delayed-onset group, in contrast, differed in showing a gradual accumulation of symptoms that began earlier and continued to build up steadily throughout their military career. Table 4 shows that they already had significantly more symptoms than the immediate onset group prior to the main traumatic event they reported experiencing in service. They were more likely to report major depressive disorder and alcohol abuse prior to PTSD onset, which was generally triggered by a (non-military) severe life stressor. Table 5 shows that these stressors occurred significantly more often than in a control group of veterans with physical disabilities. As with the animal research reviewed above, Andrews and colleagues concluded

Table 5 Life stress in 12 months before onset in delayed-onset veterans and a comparable period in veterans with no PTSD (adapted from Andrews et al., 2009)

	Delayed onset PTSD (n=63) (%)	No PTSD (n=39) (%)	sig
Presence of a severe stressor	77	32	***
Presence of an 'independent' severe stressor	57	24	**
Presence of PTSD A1 trauma	11	18	ns
Presence of a minor stressor	45	58	ns

% with different subscripts differ significantly

$**p<.01; ***p<.001$

that the immediate and delayed onset presentations implicated different etiological mechanisms, one emphasizing the impact of the critical traumatic event on memory and one involving a more general and progressive sensitization.

Summary. Episodic trauma memories tend not to be distinctive in healthy populations, but have special features in people who either have PTSD or who have featured in clinical and case studies of recovered memory (see Fig. 2). These groups report vivid sensory imagery combined with poorly organized, fragmented narrative memories that may change over time. There is evidence that vivid reexperiencing does not always reflect being overwhelmed with emotion at encoding but may develop as a result of progressive sensitization. This is consistent with the observation that some memories recovered in adulthood can be experienced as vivid flashbacks even though this symptom was not previously recalled as having been present in childhood.

Trauma and Memory Appraisal

As we have seen in our discussion of semantic memory, judgments of forgetting often involve an inferential process. There have been a number of suggestions that faulty memory appraisal may be involved when people identify gaps in their memory for childhood experiences. It has been demonstrated (Belli, Winkielman, Read, Schwarz, & Lynn, 1998; Read & Lindsay, 2000) that when assessing the integrity of their memory for childhood, people rely partly on the ease or difficulty with which they can bring instances to mind. In the experiment by Belli et al., participants were asked to report four, eight, or twelve events from when they were 5–7 and 8–10 years old, after which they had to evaluate the adequacy of their childhood memory. Those who were instructed to retrieve more events paradoxically rated their childhood memory as worse than the groups who had to retrieve fewer events, at least in part because they attributed the difficulty of the task to deficiencies in their memory.

On the basis of these reports, it has been suggested (Belli et al., 1998; Winkielman, Schwarz, & Belli, 1998) that psychotherapy patients' reports of incomplete childhood memory might be a mistaken consequence of difficulty in trying to recall large numbers of events, rather than reflecting genuine problems with memory.

Despite this evidence that memory judgments may sometimes be mistaken, there is also reason to think that they are sometimes accurate. One study investigated whether ordinary individuals who judge themselves to have a bad memory for their childhood do in fact score more poorly on a standardized test of autobiographical memory (Brewin & Stokou, 2002). They found that a group who thought they had poor memory for childhood did score worse than a control group on tests of memory for both the facts and events of their own life. A more recent study has similarly reported that subjectively identified memory problems did not correlate with suggestibility or false recollections, and that participants were accurate in estimating their objective memory performance (Van Bergen, Jelicic, & Merckelbach, 2009).

A number of studies have tested whether trauma exposure or PTSD result in another type of appraisal problem, the mistaken belief that one has previously encountered a novel item. The Deese-Roediger-McDermott (DRM) paradigm measures the tendency to falsely recall that an associated item (e.g., 'sleep') was presented in a list of thematically related words (e.g., 'bed', 'pillow', 'dream'). The results so far with verbal and visual versions of this task have been inconsistent (Bremner, Shobe, & Kihlstrom, 2000; Brennen, Dybdahl, & Kapidzic, 2007; Jelinek, Hottenrott, Randjbar, Peters, & Moritz, 2009; Zoellner, Foa, Brigidi, & Przeworski, 2000).

The DRM paradigm was also used to explore memory recovery mechanisms by testing four groups of participants: women reporting recovered memories of childhood sexual abuse, women who believed that they were sexually abused as children but who could not recall this abuse (the "repressed" group), women who were sexually abused as children and always remembered the abuse, and women with no history of childhood sexual abuse (Clancy, Schacter, McNally, & Pitman, 2000; McNally, 2012, this volume). The results suggested that the recovered-memory group was more prone to false recognition than the other groups. More recently it has been shown that increased false recall and recognition are specific to people who recovered abuse memories in the context of suggestive therapy, and are not evident in people who recovered their memories spontaneously (Geraerts, 2012, this volume; Geraerts et al., 2009).

Based on the suggestions of Schooler (Schooler, 2001), the program of research conducted by Geraerts and colleagues (Geraerts, 2012, this volume; Geraerts et al., 2009) confirmed a different kind of appraisal problem that appears to typify those that recover memories spontaneously. Unlike participants who recalled abuse memories after suggestive therapy, or who had continuous memories of abuse, or who had not been abused at all, those with spontaneously recalled abuse were particularly likely to forget they had previously retrieved a word in another context (groups were similar in judging words retrieved in the same context). The authors suggested that having the experience of spontaneously recovering a memory reflects a more general deficit in the appraisal of previous recall attempts. In other words, the experience illustrates an illusion of forgetting rather than actual forgetting.

Summary. There is little evidence that trauma exposure or PTSD are in general reliably associated with memory appraisal problems. Recent research indicates that people who recover abuse memories spontaneously and those who recover them after suggestive therapy have distinct memory appraisal deficits.

Individual Differences in Memory Processes

In addition to evidence that trauma and PTSD differentially affect semantic and episodic forms of memory, it is important to recognize that there are great individual differences, not just in memory capacity but in memory process and memory appraisal. It is implausible, therefore, that trauma will have uniform effects on memory.

Repressive coping style. This style, despite its name, is only indirectly related to the concept of repression as used by psychotherapists. It is defined as a tendency to score simultaneously low on a measure of trait anxiety but high on a measure of social desirability (Weinberger, Schwartz, & Davidson, 1979). A large body of research has found that 'repressors' defined in this way have difficulty in recalling unhappy autobiographical memories. For example, given 60 s to recall as many childhood memories as possible, repressors recalled significantly fewer unhappy memories than non-repressors, and that their age at the time of the first unhappy memory they recalled was substantially greater. In contrast, there were no differences in recalling positive memories (Davis & Schwartz, 1987). This pattern has been replicated with memory for stories, and it has been shown that repressors are better able to deliberately forget negative, but not positive, material (Myers & Brewin, 1995; Myers, Brewin, & Power, 1998). Crucially, this does not seem to be because repressors have enjoyed happier, more problem-free lives: In fact, they reported significantly more hostility, more indifference and less closeness in their relationships with their fathers, making this possibility very unlikely (Myers & Brewin, 1994).

Attachment style. It has been proposed that individuals with an avoidant attachment style, who are fearful and dismissive of intimate relationships, defensively inhibit the processing of negative or attachment-related information. In one study, avoidant individuals recalled fewer emotional events and took longer to retrieve those they did recall, particularly events related to sadness and anxiety. They also rated their memories as less emotionally intense and the events as having occurred at an older age than those recalled by nonavoidant participants (Mikulincer & Orbach, 1995). In a recent study memory for documented instances of child abuse was assessed in victims approximately 13 years later. When the abuse was more severe, those with an avoidant attachment style were less likely to recall accurate details of their experiences (Edelstein et al., 2005). These memory deficits did not appear to result from a tendency to minimize what had happened. Non-avoidant individuals, in contrast, tended to recall more severe abuse better.

Summary. There is good evidence that some individuals are more adept than others at selectively forgetting negative material. At present it is unclear whether possession of these coping and attachment styles is related to an increased likelihood of having recovered memory experiences. The findings do, however, emphasize that generalizations about trauma and memory should be treated with great caution, and that early experiences may influence in unexpected ways the accessibility of negative information.

Explaining Recovered Memory

Contrary to the widespread myth that traumatic events are seldom if ever forgotten, much trauma is not remembered until something happens to bring it to mind. As is the case for non-traumatic events, availability for recall will depend on how well the events are represented within personal semantic memory (Williams, Stiles, & Shapiro, 1999). Particularly when it comes to childhood trauma, it is hazardous to impose adult assumptions about what should or should not be recalled. Over and above issues about the salience of the events, extensive trauma in childhood is associated with complexity and fragmentation in the self system, such that there are impoverished levels of semantic knowledge concerning the self and more scope for the existence of parallel self-representations in which specific trauma memories feature weakly if at all. The great variability in the amount and extent of amnesia reported in the context of recovered memory experiences is consistent with this multiplicity of representations.

What will determine if a trauma does become part of the person's overarching semantic knowledge about themselves? Family recognition, discussion, and explanation, and consequences that are explicitly linked to the trauma, such as changing schools or being taken into care, are all likely to generate associative links between the trauma and other aspects of the person's life, thus cementing the events within overarching semantic knowledge. Consistent with this, reported rates of forgetting child abuse are substantially lower when there have been legal proceedings nearer to the time at which the abuse occurred. Conversely, secrecy, lack of understanding, and the absence of any social interaction or obvious consequences, will produce representations with fewer associative links to other life experiences. To this must be added attempts to consciously forget frightening, hurtful, or embarrassing events (Anderson et al., 2004; Anderson & Huddleston, 2012, this volume; Levy & Anderson, 2008). Considering also that some individuals appear particularly adept at deliberately forgetting negative events, we can see that even highly arousing experiences may come to be represented in memory within limited contexts that are subsequently rarely accessed.

Figure 3 illustrates a possible set of processes underlying a genuine recovered memory experience that occurs spontaneously rather than as a result of suggestive therapy (Geraerts, 2012, this volume Geraerts et al., 2009). Let us assume that secrecy and fear of disclosure have led to the development of alternative identities, only one of which contains any knowledge about the abuse he or she experienced in childhood. The identity without this knowledge is in everyday use and generally dominant. Exposure to unexpected triggering events or thoughts leads to the involuntary retrieval of autobiographical abuse memories or specific images related to the abuse accompanied by high levels of emotion (see also Anderson & Huddleston, 2012, this volume). This in turn leads to the involuntary retrieval of the alternative identity with knowledge of the abuse. Many, if not most, recovered memory experiences may not elicit the shock that has been noted in case studies and clinical samples. When shock does occur, this is likely to be because of two linked reasons.
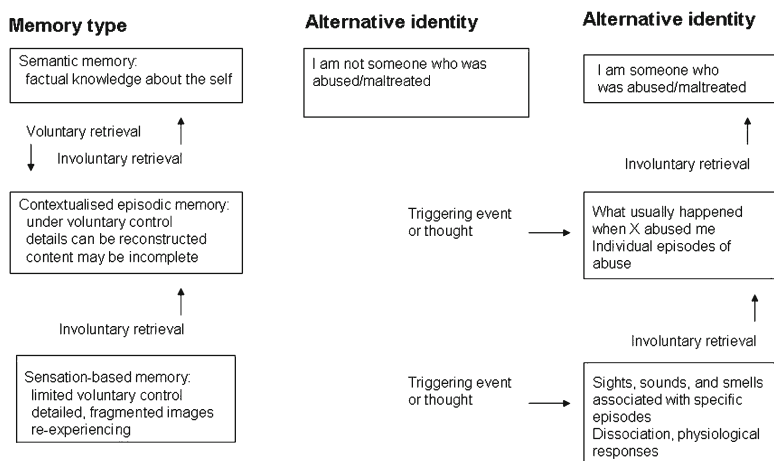
Memory type

```
┌─────────────────────────────────┐
│ Semantic memory:                │
│   factual knowledge about the self │
└─────────────────────────────────┘
```

Voluntary retrieval   ↑
    ↓   Involuntary retrieval

```
┌─────────────────────────────────┐
│ Contextualised episodic memory: │
│   under voluntary control       │
│   details can be reconstructed  │
│   content may be incomplete     │
└─────────────────────────────────┘
```

Involuntary retrieval   ↑

```
┌─────────────────────────────────┐
│ Sensation-based memory:         │
│   limited voluntary control     │
│   detailed, fragmented images   │
│   re-experiencing               │
└─────────────────────────────────┘
```

Alternative identity

```
┌─────────────────────────────────┐
│ I am not someone who was        │
│ abused/maltreated               │
└─────────────────────────────────┘
```

Triggering event
or thought   →

Triggering event
or thought   →

Alternative identity

```
┌─────────────────────────────────┐
│ I am someone who                │
│   was abused/maltreated         │
└─────────────────────────────────┘
```

Involuntary retrieval

```
┌─────────────────────────────────┐
│ What usually happened           │
│ when X abused me                │
│ Individual episodes of          │
│ abuse                           │
└─────────────────────────────────┘
```

Involuntary retrieval   ↑

```
┌─────────────────────────────────┐
│ Sights, sounds, and smells      │
│ associated with specific        │
│ episodes                        │
│ Dissociation, physiological     │
│ responses                       │
└─────────────────────────────────┘
```

Fig. 3 A possible set of processes underlying a recovered memory experience

First, sensation- and emotion-rich representations may be involuntarily accessed for the first time in many years, bringing with them intense feelings such as fear and shame. There are numerous instances of traumatic memories changing over time, and it is clear that experiencing a vivid recovered memory does not imply that the same emotions were necessarily experienced when the event was encoded. There are a number of mechanisms that may result in memories being re-encoded with much greater affect, leading to the generation of flashbacks when there may have been none before. First, the strength of a conditioned response may be greatly affected by subsequent information that alters the aversiveness of the original unconditioned stimulus. This is known as UCS revaluation (Davey, 1989). Thus learning that the original aversive experience was much more heinous, or involved much greater betrayal, than had hitherto been believed, would be expected to produce much stronger emotional and physiological reactions. Second, memories and their accompanying emotions may be amplified when they are revisited later in a very negative mood state (van Giezen, Arensman, Spinhoven, & Wolters, 2005). Third, a gradual build-up of arousal may produce the conditions for the formation and intrusion of highly emotional memories, usually following further severe stress (Andrews et al., 2009).

The second reason why there may be shock at memory recovery is the discovery that events regarded now as very significant were not represented in overarching semantic memory, thus contradicting basic assumptions about memory as well as a dominant self-narrative or self-theory (Harter, 1998). People who believed that trauma or abuse should always be remembered, yet cannot recall specifically thinking about it, will be more shocked, and also more likely to agree that they must have forgotten it. Even if the recovered memories are not initially accompanied by intense emotion, there will be unforeseen, and possibly profound, implications for the person's self-concept, and for their relationships with family and friends. This may

invest the memory recovery with the status of a turning point, generating further intense emotions that sustain high levels of arousal and increase the risk of PTSD.

The existence of the "forgot-it-all-along" effect (Schooler, 2001) is a useful reminder that memory recovery need not be a dramatic experience or personal turning point. Let us imagine that at some point a person has retrieved an identity containing semantic knowledge of their abuse or trauma, but that this identity has limited access to specific event memories of abusive episodes (illustrated by overlap bars b and c in Fig. 1). As a result, this person may only retrieve schematic representations of "what usually happened", characterized by suppression of negative emotions that were dangerous or unacceptable (DePrince et al., 2012, this volume; Freyd, 1996). This information may feature in a conversation without leading to the retrieval of more detailed, sensation- and affect-laden records. In the absence of these markers of significance, there may be no reason to identify the traumatic events as of such importance that they need to be represented at the level of overarching semantic knowledge concerning the self. Thus the information will remain linked to a specific, occasionally-retrieved 'self', and the conversation will soon be forgotten.

Another factor influencing the memorability of previous recall is whether events have come to mind as the result of a deliberate search or as the result of being cued (Padilla-Walker & Poole, 2002). In these experiments, participants first had to learn a series of sentences and then free recall them. Following a distraction task they were asked to generate the sentences again, and say whether or not they had remembered them on the previous occasion. Participants who were asked to free recall the sentences on the second occasion were more likely to remember their prior recalls than participants who performed a recognition task or were cued with a picture. These results suggest that when trauma memories have been recovered spontaneously, or cued by some reminder, memory for previous recollection will be less accurate, provided that in the previous recollection they did not produce feelings of shock or surprise and were not subsequently incorporated into overarching semantic knowledge.

In light of our accumulating empirical and theoretical understanding, genuine recovered memory experiences no longer appear as bizarre or counter-intuitive as they have been painted by those who are skeptical of their occurrence. The field has not been well-served by much of the existing literature, which has uncritically embraced a variety of myths, logical errors, and false assumptions, and adopted a simplistic approach to what are complex and fascinating memory phenomena. Understanding these experiences forces us to confront the complexity of memory and of the forces that shape it. The study of recovered memory has taught us about how limited our knowledge is of forgetting and of the representation of trauma, and about the danger of ignoring phenomena that are more clearly documented in the clinic than in the laboratory. But it has also taught us that some mental events are so compelling that reality and fantasy become confused, and that there are continuing dangers from ill-informed therapists employing suggestive procedures and failing to exercise a proper independence concerning the veracity of mental experiences. The only certain conclusion is that there is a great deal more to learn in the future.

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