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Psychological theories of posttraumatic stress disorder

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Abstract

We summarize recent research on the psychological processes implicated in posttraumatic stress disorder (PTSD) as an aid to evaluating theoretical models of the disorder. After describing a number of early approaches, including social-cognitive, conditioning, information-processing, and anxious apprehension models of PTSD, the article provides a comparative analysis and evaluation of three recent theories: Foa and Rothbaum's [Foa, E. B. & Rothbaum, B. O. (1998). *Treating the trauma of rape: cognitive behavioral therapy for PTSD*. New York: Guilford Press] emotional processing theory; Brewin, Dalgleish, and Joseph's [*Psychological Review* 103 (1996) 670] dual representation theory; Ehlers and Clark's [*Behaviour Research and Therapy* 38 (2000) 319] cognitive theory. We review empirical evidence relevant to each model and identify promising areas for further research.

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1. Introduction

The official recognition of posttraumatic stress disorder (PTSD) in the DSM-III ([American Psychiatric Association, 1980](#)) has prompted what is now a very considerable body of

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research into the psychology, biology, epidemiology, and treatment of the condition. This growth in knowledge has been accompanied by the development of increasingly sophisticated theories that have attempted to keep pace with new findings while at the same time remaining anchored in basic psychological research. In this article, we first review briefly the current state of knowledge about PTSD, highlighting those areas that are regarded as of most theoretical significance. We then provide an overview of early theories of the disorder that have informed current thinking, including social-cognitive, conditioning, information-processing, and anxious apprehension theories. The main section of the article presents three more recent theories that are currently the focus of investigation: Emotional processing theory (Foa & Riggs, 1993; Foa & Rothbaum, 1998), dual representation theory (Brewin, 2001, *in press*; Brewin, Dalgleish, & Joseph, 1996); Ehlers and Clark (2000) cognitive theory. Each theory is described in detail and relevant empirical research summarized. The final section of the article concludes with a discussion of where the theories are in agreement or disagreement and what seem to be the areas most urgently in need of further research.

2. Psychological processes and PTSD

2.1. Memory and PTSD

In PTSD, a number of changes in memory functioning have been identified that are comparable with studies of depressed patients: There tends to be a bias toward enhanced recall of trauma-related material and difficulties in retrieving autobiographical memories of specific incidents (Buckley, Blanchard, & Neill, 2000). More specific to PTSD is a contradictory pattern of recall related to the traumatic material itself, similar to that found in studies of emotion and memory in nonclinical samples: In some studies, high levels of emotion are associated with more vivid and long-lasting memories (e.g., Brown & Kulik, 1977; Conway et al., 1994; Pillemer, 1998; Rubin & Kozin, 1984), while in others, they are associated with memories that are vague, lacking in detail, and error prone (e.g., Koss, Figueiredo, Bell, Tharan, & Tromp, 1996; Kuehn, 1974; Loftus & Burns, 1982).

The DSM-IV (American Psychiatric Association, 1994) describes PTSD as characterized both by high-frequency, distressing, intrusive memories and by amnesia for the details of the event. Consistent with this are clinical studies and observations reporting that confusion and forgetting are as typical of trauma memories as is vivid, lasting recall (Herman, 1992; Terr, 1990; van der Kolk & Fisler, 1995). More systematic studies of patients' memories of personally experienced traumatic events confirm that recall tends to improve over the first few weeks (Mechanic, Resick, & Griffin, 1998), that their content may change (Schwarz, Kowalski, & McNally, 1993; Southwick, Morgan, Nicolaou, & Charney, 1997), and that they tend to be disorganized and contain gaps (Foa, Molnar, & Cashman, 1995; Harvey & Bryant, 1999a,b).

The other notable feature of memory in PTSD is the reliving experiences or "flashbacks" to the trauma. Compared to normal autobiographical memory, flashbacks are dominated by sensory detail such as vivid visual images and may include sounds and other sensations.

However, these images and sensations are typically disjointed and fragmentary. “Reliving” of these memories is reflected in a distortion in the sense of time such that the traumatic events seem to be happening in the present rather than (as in the case of ordinary memories) belonging to the past. Reliving episodes also do not seem to occur as a result of a deliberate search of memory, but are triggered involuntarily by specific reminders that relate in some way to the circumstances of the trauma, such as the sound of a police siren or the smell of smoke, or particular thoughts or images relating to the event.

Although flashbacks are routinely described by clinicians and researchers working with traumatized victims (e.g., Bremner, Krystal, Southwick, & Charney, 1995; Ehlers & Clark, 2000; Janet, 1904), there has been relatively little research to back up the many informal observations about their nature. In one of the first systematic studies, Reynolds and Brewin (1998) interviewed matched groups of patients suffering from either PTSD or depression, as well as nonclinical controls, and asked them to describe the image or thought related to a stressful event that was most frequently coming to mind. Flashbacks, either on their own or in combination with other images and thoughts, were reported as the most frequent intrusive cognition by 43% of the PTSD patients, 9% of the depressed patients, and none of the nonpatients. This supports the claim that flashbacks are a distinctive feature of PTSD.

More recent research has started to look at other memory processes that are relevant to PTSD. For example, individual differences in working memory capacity (i.e., the ability to hold and manipulate material in focal attention) appear to be related to the ability to prevent unwanted material from intruding and negatively affecting task performance. Healthy individuals with greater working memory capacity are better at suppressing unwanted thoughts when instructed to do so under experimental conditions, whether these thoughts are neutral (Brewin & Beaton, 2002) or obsessional (Brewin & Smart, 2002) in nature. These findings may help to explain why low intelligence, which is strongly related to working memory capacity, is a risk factor for PTSD (Brewin, Andrews, & Valentine, 2000). Given the demands of psychological therapy, low levels of working memory capacity may also predict a less successful outcome in therapy.

2.2. Attention and PTSD

Studies of attention in PTSD have recently been reviewed by Buckley et al. (2000), who divided the literature into studies of automatic and strategic processing. Two studies have suggested that there is an attentional bias operating very early in processing, as shown by slowed color naming following subliminal presentation of trauma words on a Stroop test (Harvey, Bryant, & Rapee, 1996) and speeded reaction time to trauma words in a dot probe paradigm (Bryant & Harvey, 1997). However, comparable results were not obtained using an auditory recognition task with Vietnam veterans (Trandel & McNally, 1987). Thus, strong conclusions cannot be drawn, and further evidence is needed concerning automatic processing. In contrast, Buckley et al. argued that the evidence for attentional bias is clearer in studies targeting post-recognition processes, for example using Stroop tasks with supraliminal presentation times (Bryant & Harvey, 1995; Foa, Feske, Murdock, Kozak, & McCarthy, 1991; McNally, Kaspi, Riemann, & Zeitlin, 1996).

While attentional bias is clearly important in PTSD, the research does not provide evidence that the effects are unique to PTSD. Rather than using the above paradigms, tasks which look at sustained attention and repeated exposure to threat stimuli may be more relevant to cognitive and exposure treatments which require patients to attend and process their trauma memories for an extended period of time. They may also be more ecologically valid in terms of patients' daily experience of vigilance in environments rich in threat cues. However, the available evidence on whether PTSD is associated with deficits in sustained attention is inconsistent (Vasterling et al., 2002; Yehuda et al., 1995).

2.3. Dissociation and PTSD

"Dissociation" has sometimes been defined as any kind of temporary breakdown in what we think of as the relatively continuous, interrelated processes of perceiving the world around us, remembering the past, or having a single identity that links our past with our future (Spiegel & Cardeña, 1991). Mild dissociative reactions are common under stress, for example, being reported by 96% of soldiers undergoing survival training (Morgan et al., 2001). Dissociative symptoms most commonly encountered in trauma include emotional numbing, derealization, depersonalization, and 'out-of-body' experiences. They are related to the severity of the trauma, fear of death, and feeling helpless (Holman & Silver, 1998; Morris, Kaysen, & Resick, 2000; Reynolds & Brewin, 1999). It has been suggested that such reactions reflect a defensive response related to immobilization ("freezing") in animals (Nijenhuis, Vanderlinden, & Spinhoven, 1998). In contrast to fight–flight reactions, in which heart rate normally increases, dissociation has been linked to a decrease in heart rate (Griffin, Resick, & Mechanic, 1997).

When these symptoms occur in the course of a traumatic experience, they are referred to as 'peri-traumatic dissociation.' At least seven prospective studies have assessed peri-traumatic dissociation shortly after a trauma and found it to be a good predictor of later PTSD (Ehlers, Mayou, & Bryant, 1998; Engelhard, van den Hout, Kindt, Arntz, & Schouten, 2003; Holeva & Tarrier, 2001; Koopman, Classen, & Spiegel, 1994; Murray, Ehlers, & Mayou, 2002; Shalev, Peri, Canetti, & Schreiber, 1996; Ursano et al., 1999). Laboratory studies with healthy participants have confirmed that dissociation during exposure to a trauma film is associated with an increase in subsequent intrusive memories of the film (Holmes, Brewin, & Hennessy, 2002). In contrast, the presence of dissociative symptoms occurring after rather than during the trauma is not so consistently associated with risk for later PTSD (Brewin, Andrews, Rose, & Kirk, 1999; Harvey & Bryant, 1998, 1999b).

2.4. Cognitive–affective reactions and PTSD

A requirement of the PTSD diagnosis according to DSM-IV (American Psychiatric Association, 1994) is to experience intense fear, helplessness, or horror at the time of the trauma. Consistent with this, there is a strong relationship between each of these specific reactions in victims of violent crime and the risk of PTSD 6 months later (Brewin, Andrews, & Rose, 2000). Of those victims who did not go on to develop PTSD, 44% reported at least

one of these reactions at an intense level, compared to 89% of those who did go on to develop PTSD. However, consistent with other studies, a small number of victims who would have met previous diagnostic criteria for PTSD did not report experiencing any of these reactions intensely. Instead, they reported high levels of anger or shame. Other investigators have identified a variety of emotions including shame and anger as sometimes being present during the most intense moments of the traumatic event (Grey, Holmes, & Brewin, 2001; Holmes, Grey, & Young, 2003).

Closely related to helplessness is the idea of ‘mental defeat,’ defined as “the perceived loss of all autonomy, a state of giving up in one’s own mind all efforts to retain one’s identity as a human being with a will of one’s own” (Ehlers, Maercker, & Boos, 2000, p. 45). It is a profound state that, like helplessness, defies categorization as either an emotion or a belief, having some characteristics of both. Trauma victims who experience mental defeat may describe themselves as like an object or as being destroyed, or as ceasing to care whether they lived or died. Mental defeat, then, goes beyond mere helplessness in attacking the person’s very identity. Ehlers et al. (2000) studied former political prisoners in East Germany and found that even allowing for the degree of torture experienced, those who still had PTSD years after their imprisonment were characterized by having reacted during the trauma with mental defeat.

Whereas some emotions are the direct result of outcomes, others depend on an element of cognitive appraisal (e.g., Weiner, 1986). Traumatic events vary considerably in the time that is available to the victim to appraise what is happening and to generate corresponding emotions. Posttrauma, however, cognitive appraisal of the cause of, responsibility for, and future implications of the trauma will provide numerous opportunities to generate negative emotions (see also Beliefs and PTSD below). There is abundant evidence that feelings of guilt, shame, sadness, betrayal, humiliation, and anger frequently accompany PTSD (Freyd, 1996; Resick & Schnicke, 1992; Reynolds & Brewin, 1999).

Longitudinal studies show that high levels of anger (Ehlers et al., 1998), and more specifically anger with others (Andrews, Brewin, Rose, & Kirk, 2000), predict a slower recovery from PTSD. In victims of violent crime, shame is a powerful predictor of how PTSD symptoms develop over time (Andrews et al., 2000). This study provided the first evidence of a mechanism that linked a pre-trauma vulnerability factor, childhood abuse, with a failure to recover from adult traumas. Both the victims who had been abused as children and the victims who felt more shame after being assaulted as adults tended to recover more slowly. In addition, being abused as a child made victims more likely to report experiencing shame. The effect of childhood abuse on recovery was almost wholly mediated by the experience of shame. Recent innovations in the treatment of PTSD have also focused on modifying shame and guilt in addition to fear (Lee, Scragg, & Turner, 2001).

2.5. Beliefs and PTSD

The significance of beliefs is illustrated by the fact that although threat to life consistently emerges as a powerful predictor in studies of populations as diverse as combat veterans,

political prisoners, assault victims, and motor vehicle accident victims (e.g., Dunmore, Clark, & Ehlers, 2001; Kilpatrick & Resnick, 1993), the subjective perception of threat is often a more influential predictor of distress and even of failure to respond to treatment than more ‘objective’ indicators (Alvarez-Conrad, Zoellner, & Foa, 2001; Bernat, Ronfeldt, Calhoun, & Arias, 1998; Girelli, Resick, Marhoefer-Dvorak, & Hutter, 1986). However, in PTSD the beliefs that are believed to be important include much more than threat. A central idea is that traumatic events shatter people’s basic beliefs and assumptions (Bolton & Hill, 1996; Horowitz, 1976, 1986; Janoff-Bulman, 1992).

Consistent with this, a general increase in negative beliefs about the self, others, and the world has been found in trauma victims with PTSD compared to victims not suffering from PTSD (Dunmore, Clark, & Ehlers, 1999; Foa, Ehlers, Clark, Tolin, & Orsillo, 1999). A number of authors have emphasized the potential for trauma to destroy trust and lead to the belief in victims that they have been let down or betrayed, for example by caregivers (Freyd, 1996; Herman, 1992) or superior officers (Shay, 1995). High levels of anger with others reported by PTSD patients are also consistent with a loss of belief in the good intentions of other people (Andrews et al., 2000). Work on torture victims indicates that political activists are not as traumatized by the experience as are nonactivists, even though they may be more severely tortured (Başoğlu et al., 1997). Whereas torture is consonant with the expectations of activists, for nonactivists, it is a violation of implicit beliefs that torture is either not employed or is reserved for enemies of the state.

Other research has confirmed the importance of beliefs about the self. PTSD is associated with the belief that trauma has brought about a negative and permanent change in the self and in the likelihood of achieving life goals (Dunmore et al., 1999; Ehlers et al., 2000). In shipping disasters, passengers who attributed the bad things that happened during the sinking to themselves and their actions had more symptoms of PTSD (Joseph, Brewin, Yule, & Williams, 1991; Joseph, Brewin, Yule, & Williams, 1993). A series of studies has found that negative interpretations of the event itself and of why the victim is subsequently experiencing symptoms are more frequent in people who develop PTSD after an assault or a motor vehicle accident, and particularly in those whose symptoms persist (Dunmore et al., 1999; Ehlers et al., 2000; Steil & Ehlers, 2000). In prospective studies, Dunmore et al. (2001) and Ehlers et al. (1998) additionally showed that negative interpretations of symptoms predicted a slower recovery from PTSD. As noted above, negative beliefs do not have to occur during the trauma itself but may represent the outcome of a separate appraisal process that only begins after the danger is past. Were beliefs to have occurred peri-traumatically, however, they could form part of the reexperienced trauma memory and thus be triggered by reminders of the trauma (Grey, Young, & Holmes, 2002).

2.6. Cognitive coping strategies and PTSD

There is now extensive evidence that attempts to suppress unwanted thoughts are usually doomed to failure and that afterwards, the thoughts return even more strongly (Wenzlaff & Wegner, 2000), and it has been suggested that the deliberate avoidance of intrusive thoughts and memories will similarly be unhelpful for the majority of trauma victims. The theoretical

link between greater avoidance and higher symptom levels has been confirmed in a number of retrospective studies of assault and motor vehicle accident victims (Dunmore et al., 1999; Steil & Ehlers, 2000). Prospective studies have shown that avoidance and thought suppression are related to a slower recovery from PTSD (Dunmore et al., 2001; Ehlers et al., 1998). Other coping strategies that are associated with a greater risk of PTSD include rumination (Ehlers et al., 1998; Murray et al., 2002) and increased use of safety behaviors (Dunmore et al., 2001).

2.7. Social support and PTSD

Of 14 separate risk factors for PTSD investigated in a recent meta-analysis, including trauma severity and gender, social support was shown to have the strongest effect size (Brewin et al., 2000). Although most studies have only considered positive elements such as the perception of emotional and practical support, several recent investigations have also considered negative aspects of support such as indifference or criticism. When both positive and negative support elements are investigated, a negative social environment is a better indicator of PTSD symptomatology than lack of positive support (Ullman & Filipas, 2001; Zoellner, Foa, & Bartholomew, 1999). Moreover, negative appraisal of others' support attempts at initial assessment predicted PTSD symptoms 6 and 9 months later (Dunmore et al., 2001). Negative social support, at least in the case of violent crime, appears to be more prevalent for women than for men victims, and in addition, the relationship between negative social support and later PTSD symptoms is stronger for women than for men (Andrews, Brewin, & Rose, *in press*). Negative social support by partners has also been found to predict a poorer response to treatment for PTSD (Tarrier, Sommerfield, & Pilgrim, 1999).

2.8. Summary

PTSD is associated with disturbances in a wide range of psychological processes including memory, attention, cognitive-affective reactions, beliefs, coping strategies, and social support. At present, it appears that what is most likely unique to PTSD, compared to other psychological disorders, are the unusual and inconsistent memory phenomena centered on the event itself and the recruiting of a variety of dissociative responses. In contrast, the findings concerning other processes have much in common with the results of research on depression and other anxiety disorders, with which PTSD is frequently comorbid. It is clear that the emotions involved in PTSD are not by any means restricted to fear, helplessness, and horror, or to what was actually experienced at the time of the trauma. Beliefs, too, are not restricted to those concerning the event itself but may involve much more general aspects of the person, the social world, and the future. Theories of PTSD, therefore, need to incorporate explanations of processes that are both specific to PTSD and more general, as well as processes that are relatively automatic (such as helplessness and dissociation) or relatively strategic (such as individual appraisals and choice of coping strategy).

3. Early theories

3.1. Stress response theory

Horowitz (1976, 1986) is a pioneer in the PTSD field due to his long-standing interest in the processing of thoughts, images, and moods related to loss and trauma. His theory has roots in psychodynamically informed observations of normal and abnormal bereavement reactions, and in a long tradition emphasizing people's development of individual assumptive worlds. Horowitz argued that when faced with trauma, people's initial response is outcry at the realization of the trauma. A second response is to try to assimilate the new trauma information with prior knowledge. At this point, many individuals experience a period of information overload during which they are unable to match their thoughts and memories of the trauma with the way that they represented meaning before the trauma. In response to this tension, psychological defense mechanisms are brought into play to avoid memories of the trauma and pace the extent to which it is recalled. For example, the individual may be in denial about the trauma, feel numb, or avoid reminders of it. However, the fundamental psychological need to reconcile new and old information means that trauma memories will actively break into consciousness in the form of intrusions, flashbacks, and nightmares. These consciously experienced trauma memories provide the individual with an opportunity to try to reconcile them with pre-trauma representations.

It becomes apparent that, according to Horowitz, there are now two opposing processes at work: One to defend the individual by the suppression of trauma information and one to promote the working through of the traumatic material by bringing it to mind. Therefore, the individual oscillates between avoidance and intrusions of the trauma. This oscillation allows the traumatic information to be worked through, and as this happens, the intensity of each phase decreases. In particular, longer term structures in memory representing the self or future goals can be adjusted so that they are consistent with the new data, at which point, trauma processing is considered to be completed. Failure to process the trauma information is proposed to lead to persistent posttraumatic reactions as the information remains in active memory and continues to intrude and be avoided.

Horowitz's work contains numerous important observations and has rightly been very influential. In particular, he was one of the first theorists to emphasize the impact of trauma on wider beliefs about the self, the world, and the future and to consider how recovery might involve far-reaching cognitive change. Recognizing this broader perspective and its ability to explain the breadth of beliefs and emotions encountered in PTSD, his theory was described as "social-cognitive" by Brewin et al. (1996). Areas not treated in any depth by his theory include the difference between flashbacks and ordinary memories of trauma, individual variations in trauma response, peri-traumatic reactions, the role of environmental factors such as trauma cues and social support, and how to distinguish remission of symptoms due to successful recovery from remission due to successful avoidance (e.g., Brewin, in press; Litz, 1992).

3.2. Theory of shattered assumptions

The origins of this social-cognitive model also lie in the tradition of individual internal models or assumptive worlds that, though they may be illusory, help to sustain people in their everyday lives and motivate them to overcome difficulties and plan for the future. The three common assumptions Janoff-Bulman (1992) regarded as the most significant in influencing response to trauma are that the world is benevolent, the world is meaningful, and the self is worthy. That is, other people are in general well-disposed towards us, there are reliable rules and principles that enable us to predict which behaviors will produce which kinds of outcome, and we ourselves are personally good, moral, and well-meaning. Being attacked by a complete stranger without any provocation, being involved in a serious road traffic accident when we have been obeying the rules of the road, and putting our own survival ahead of anything else when our life is threatened are all situations that have the potential to be traumatic in that they may shatter deeply held and probably unexamined assumptions about how we believe the world and ourselves to be.

Updating of assumptions can take place spontaneously through the reexperiencing and avoidance cycle described by Horowitz (1986). In addition, updating can be made to occur deliberately by reflecting on the trauma. As in stress response theory, the strength of the approach lies more in its description of longer term adjustment after a trauma rather than the specification of how trauma impacts on the individual in the short term or how trauma is represented in memory. The theory of shattered assumptions is important, however, in identifying common themes in schema change, specifying the role of the person's social and interpersonal context in facilitating or blocking this process, and emphasizing the possibility of positive reframing of the trauma and of posttraumatic growth.

Although the research cited earlier has confirmed the importance of the basic assumptions described by Janoff-Bulman, other assumptions may be even more fundamental. Bolton and Hill (1996) proposed that for people to act in the world, they must have a set of beliefs that the self is sufficiently competent to act, that the world is sufficiently predictable, and that the world provides sufficient satisfaction of needs. Traumatic incidents are highly unpredictable and unpleasant and produce feelings of intense helplessness, thereby challenging these beliefs. Bolton and Hill suggest that in some cases, this produces intense conflict and feelings of unreality, since the experience of the trauma appears to contradict the person's core beliefs, but according to those beliefs the experience cannot really have happened.

According to the theory of shattered assumptions, people with the most positive experiences in life, who should therefore hold the most positive assumptions, should be the ones most affected by traumatic events. In fact, as several commentators have noted (e.g., Resick, 2001), the exact opposite is the case, with experience of previous trauma being a major risk factor for developing PTSD (Brewin et al., 2000). This is puzzling, because people who have already been traumatized should have lost at least some of their protective illusions about the world. In discussing this point, Janoff-Bulman (1992) suggested two possible resolutions. The first was that people with the most positive assumptions have the greatest initial distress but recover more easily. This has not been tested empirically. Her other suggestion was that previous trauma would be a risk factor to the extent that the victim had

not reestablished a stable and secure inner world. This introduces a quite new idea, namely, that trauma does not have to shatter illusions when they have been shattered already. Although the nature of this inner world that harbors psychological vulnerability has not been specified, it is clinically useful to place an emphasis on the role of prior beliefs on the processing of trauma and to focus on the deliberate updating of information in recovery (e.g., Grey et al., 2002). This will be discussed in more detail later.

3.3. Conditioning theory

This approach sought to apply conditioning theories developed for other anxiety disorders to PTSD. Following Mowrer's (1960) two-factor learning theory, an initial phase of fear acquisition through classical conditioning results in neutral stimuli present in the traumatic situation acquiring fear-eliciting properties through their association with the unconditioned stimulus (in this case, those elements of the traumatic situation that directly arouse fear). Keane, Zimering, and Caddell (1985) proposed that a wide variety of associated stimuli would acquire the ability to arouse fear through the processes of stimulus generalization and higher order conditioning. Although repeated exposure to spontaneous memories of the trauma would normally be sufficient to extinguish these associations, extinction would fail to occur if the person attempted to distract themselves or block out the memories, rendering the exposure incomplete. Avoidance of the conditioned stimuli, whether through distraction, blocking of memories, or other behaviors, would be reinforced by a reduction in fear, leading to the maintenance of PTSD.

In their application of conditioning theory to combat veterans, Keane et al. made further suggestions about the origin of specific symptoms. For example, they proposed that amnesia for aspects of the trauma could be due to avoidance of thinking or talking about it, as well as to being in a different mood state at recall than at the time of the trauma. Anger and irritability might reflect behaviors acquired during military training and reinforced during civilian life by the attainment of desired goals or a reduction in anxiety. More recently Orr et al. (2000) have shown that people with PTSD develop conditioned responses more readily to aversive events in general and that these responses are harder to extinguish. Although this could be a result of PTSD, it may also reflect genetic or acquired pre-trauma differences in conditionability.

Whereas the conditioning approach does not clearly distinguish the etiology of PTSD from that of other anxiety disorders, it does provide a powerful explanation of many prominent features of PTSD, particularly the wide range of potential trauma reminders, physiological and emotional arousal elicited by these reminders, and the central role of avoidance in the maintenance of PTSD. It is also compatible with observations of a general increase in conditionability. The theory is less useful when applied to questions concerning the nature of reexperiencing symptoms, effects on attention and declarative memory, the influence of emotions other than fear, and the role of appraisals and coping strategies. Although in a number of cases, a conditioning account could be constructed, the limitations of the underlying theory and the absence of cognitive constructs mean that such an account has a tendency to sound impoverished. For this reason, the conditioning approach now tends to be

supplemented by observation and theory drawn from a broader range of research on cognition and emotion (e.g., Pitman, Shalev, & Orr, 2000).

3.4. Information-processing theories

Cognitive theories that have focused mainly on the traumatic event itself rather than on its wider personal and social context have been termed “information-processing” theories (Chemtob, Roitblat, Hamada, Carlson, & Twentyman, 1988; Creamer, Burgess, & Pattison, 1992; Foa, Steketee, & Rothbaum, 1989; Litz & Keane, 1989). The central idea is that there is something special about the way the traumatic event is represented in memory and that if it is not processed in an appropriate way, psychopathology will result. Like social-cognitive theories, this approach emphasizes the need for information about the event to be integrated within the wider memory system. However, the difficulty in achieving this is attributed more to characteristics of the trauma memory itself than to conflict with preexisting beliefs and assumptions.

Most early theories had their origins in attempts to understand fear conditioning and phobic responding, and particularly in the work of Lang (1979). Lang reformulated behavioristic accounts of fear conditioning that depended on the learning of associations between stimuli and responses within a more comprehensive cognitive framework. He proposed that frightening events were represented within memory as interconnections between nodes in an associative network. A fear memory consisted of interconnections between different nodes representing three types of propositional information: Stimulus information about the traumatic event, such as sights and sounds, information about the person’s emotional and physiological response to the event, and meaning information, primarily about the degree of threat. Thus, cognition and affect were integrated within an overall response program designed to rapidly escape or avoid danger.

Lang suggested that patients with anxiety disorders have unusually coherent and stable fear memories that are easily activated by stimulus elements that may be ambiguous but bear some resemblance to the contents of the memory. When the fear network is activated, the person experiences the same physiological reactions and tends to make meaning judgments that accord with the original memory. Chemtob et al. (1988) proposed an evolutionary perspective on trauma reactions that took account of the persistent reexperiencing and high levels of arousal that distinguish PTSD from specific phobias. They suggested that in individuals with PTSD, the fear network is permanently activated, causing them to function in a “survival mode” that proved adaptive during the traumatic incident.

Foa et al. (1989) put forward an influential version of the fear network approach and suggested that what distinguishes PTSD from other anxiety disorders is that the traumatic event is of monumental significance and violates formerly held basic concepts of safety. In emphasizing individual perceptions, they explicitly endorsed the need for a theory that went beyond simple conditioning and was able to represent subjective meanings. A traumatic event, they suggested, leads to a kind of representation in memory that is different from one created by an everyday experience in several ways. For example, someone who was attacked in an alley would form associations between the alley node, the fear node, and nodes

representing behavioral and physiological responses that were much stronger than the connections between the alley node and other emotion and response nodes, formed when the person had previously walked down alleys in neutral or positive mood states. Now having to walk down an alley would selectively activate the fear network in memory, causing the person to become hypervigilant (the arousal symptoms of PTSD), to have information in the network enter consciousness (the intrusion symptoms of PTSD), and to attempt to avoid and suppress the intrusions (the avoidance symptoms of PTSD). Foa et al. further suggested that fear networks in PTSD, compared to other anxiety disorders, are characterized by particularly strong response elements, for example, high heart rate. In addition, the overturning of basic assumptions about safety means that there will be a large number of environmental cues that cause the network to be activated. Finally, the network will have a low threshold of activation.

For information in the fear network to be integrated with the rest of a person's memories, these overly strong associations would have to be weakened. Rather than being in an alley only activating the fear memory, the strength of the interconnections within the fear memory would have to be reduced so that other nonthreatening memories of being in an alley could also be activated in this situation and no one representation would dominate. In order to reduce the strong associations, the fear network needs to be activated, for example, by imaginal or *in vivo* exposure, and modified by incorporating information that is incompatible with it. The most potent corrective information is thought to derive from the experience of the habituation of fear, which in therapy may occur either within a clinical session or between sessions. In the modified network, therefore, the various stimulus and meaning elements are associated much more weakly with fear.

According to Foa et al. (1989), PTSD reactions tend to persist when achieving exposure of sufficient length to all the various elements in the fear network is difficult. Under these circumstances, only some associations are weakened, leaving other elements of the fear network to continue being strongly associated with fear. This might come about because excessive arousal or thinking errors might interfere with attention to and integration of disconfirmatory evidence, and because there might be a strong tendency to avoid reexposure to trauma cues.

The strength of the various fear network models has been that they provided much clearer proposals about how, and using what kind of cognitive architecture, information about a traumatic event is processed, both at the time and afterwards. They offered more adequate explanations of attention and memory processes and of the vulnerability produced by the overturning of assumptions. Most importantly, they led to the development of highly successful, theoretically grounded treatment interventions. Among the limitations of the early fear network models is their difficulty in explaining how a memory can, on the one hand, produce rapid responses such as flashbacks and physiological arousal, but at the same time be disorganized and contain gaps. They did not distinguish between flashbacks and ordinary trauma memories, or account for the wide range of other posttrauma emotions and beliefs that are implicated in risk for PTSD. In addition, the idea that memories can be activated and altered by the addition of contradictory information was inconsistent with a new understanding of fear conditioning arising from animal studies. Several lines of research suggested it was more plausible that old memories remain intact and that fear reactions are

inhibited by the creation of new memories (Bouton & Swartzentruber, 1991; Jacobs & Nadel, 1985; Ledoux, 1998).

3.5. Anxious apprehension model

Jones and Barlow (1990) argued that variables implicated in the etiology and maintenance of panic disorder are also involved in PTSD, and that there is a marked similarity between panic attacks and traumatic flashbacks. While recognizing the role of biological vulnerability, the trauma itself, and the experience of intense emotions at the time, their key point is the inclusion of cognitive factors that occur after the trauma and produce a feedback cycle of anxious apprehension. That is, patients with PTSD focus their attention upon and are hypervigilant for information about ‘emotional alarms’ and associated stimuli. Although in the face of actual trauma, the alarm is genuine, false alarms can occur subsequently in the absence of danger, as described in Barlow’s (1988) model of panic disorder.

In PTSD, the focus of people’s anxious apprehension is on cognitive and physiological cues from the time of the actual trauma as they wish to avoid the distress generated by alarms. The learned alarms generate hyperarousal symptoms, which through their association to cues present at the time of the original trauma (the real alarm) result in a negative feedback loop ensuring successive reexperiencing symptoms. To prevent the triggering of alarms, the person will tend to avoid emotional interoceptive information, for example, through emotional numbing, as well as avoid external trauma-related stimuli. Jones and Barlow argued that coping styles and social support can, as in other anxiety disorders, moderate the expression of PTSD.

This approach emphasizes the similarity of PTSD to other anxiety disorders and the importance of distorted information processing in PTSD. Consistent with the model, panic symptoms are often reported both during and after trauma and may be a risk factor for later PTSD symptoms (Bryant & Panasetis, 2001; Falsetti & Resnick, 1997; Nixon, Resick, & Griffin, *in press*). Relatedly, Ehlers, Hackman et al. (2002) have proposed that the content of intrusive memories corresponds to moments that act as warning signals for the traumatic event. While Jones and Barlow’s theory draws attention to a potentially important but neglected aspect of PTSD, it does not discuss in detail the role and variety of cognitions and emotions arising from the consequences of the event.

3.6. Summary

Early theories can be divided into three types. Social-cognitive theories primarily focus on the way trauma breaches existing mental structures and on innate mechanisms for reconciling incompatible information with previous beliefs. Conditioning theories deal with learned associations and avoidance behavior. Information-processing theories focus on the encoding, storage, and recall of fear-inducing events and their associated stimuli and responses. Within their frame of reference, all of them are consistent with much of the available evidence and have provided important insights into PTSD. Conditioning theory provides a good account of how trauma cues acquire the ability to elicit fear and of the critical role played by avoidance, but is

limited by the absence of cognitive elements in explaining many of the symptoms and data concerning PTSD, especially those dealing with beliefs and perceived threat. Social-cognitive theories provide good accounts of the range of emotions and beliefs occasioned by trauma and of the process of long-term adjustment, without clearly differentiating between PTSD and other types of reaction such as depression, nor do they account for the nature of responses to trauma reminders. Information-processing theories offer clearer descriptions of the cognitive architecture by which the traumatic event may be represented, of effects on attention, and of how the overturning of assumptions increases the number of potential trauma reminders, but are less able to account for the importance of emotions other than fear and of beliefs extending beyond issues of danger to the wider social context. All these early theories, however, were restricted by the small amount of published research on trauma, memory, and PTSD available at that time.

4. Recent theories

It is interesting that not all recent attempts to develop a theory of PTSD based on traditional assumptions about fear and memory have been successful. For example, Tryon (1999) proposed a theory of PTSD based on a connectionist neural network. This involved making several assumptions, for example, that there would be an association between enhanced memory for the trauma and greater PTSD and between enhanced peri-traumatic dissociation and reduced PTSD. As we have seen, both of these are inconsistent with current empirical evidence. In contrast, there are now several theories with a relatively broad scope developed by clinical researchers actively involved in the treatment of PTSD.

4.1. Emotional processing theory

The earlier network theory of Foa et al. (1989) has been elaborated by Foa and Riggs (1993) and Foa and Rothbaum (1998) in several ways in order to take account of accumulating knowledge, particularly with respect to assault and rape victims. One development was to elaborate the relationship between PTSD and knowledge available prior to the trauma, during the trauma, and after the trauma. They proposed that individuals with more rigid pre-trauma views would be more vulnerable to PTSD. These could be rigid positive views about the self as being extremely competent and the world as extremely safe, which would be contradicted by the event, or rigid negative views about the self as being extremely incompetent and the world as being extremely dangerous, which would be confirmed by the event (see also Dalgleish, 1999).

Another development was an increased emphasis on negative appraisals of responses and behaviors which could exacerbate perceptions of incompetence. Foa et al. outlined how these appraisals might relate to events that took place at the time of the trauma, to symptoms that developed afterwards, to disruption in daily activities, and to the responses of others. Beliefs that were present before, during, and after the trauma could interact to reinforce the critical negative schemas involving incompetence and danger that they hypothesized underlie chronic PTSD.

Foa & Rothbaum (1998) also elaborated a number of mechanisms thought to be involved in exposure treatment. First, repeated reliving should promote the habituation of fear, reducing the level of fear associated with other elements in the trauma memory as well as countering the belief that such anxiety is permanent. Second, it prevents avoidance of the trauma memory being negatively reinforced. Third, rehearsing the trauma memory in a therapeutic environment incorporates safety information into the trauma memory. Fourth, the trauma can be better discriminated from other potentially threatening events and seen as a specific case rather than as one among many examples of a dangerous world or an incompetent self. Fifth, exposure offers the possibility to experience the self as showing mastery and courage in the face of challenge. Sixth, by reflecting on events in detail, patients may reject previous negative evaluations as being inconsistent with the evidence. Seventh, the severity of the event frequently disrupts the cognitive processes of attention and memory at the time of the trauma and produces dissociative states such as out-of-body experiences. This disruption leads to the formation of a disjointed and fragmented fear structure that is resistant to modification and to trauma narratives that are relatively brief, simplistic, and poorly articulated. Repeated reliving generates a more organized memory record that is easier to integrate with the rest of the memory system. In summary, exposure is thought to have a number of separate effects, some relatively automatic such as reduction in anxiety and change in memory structures, and others more strategic such as positive reappraisals of actions and events.

4.1.1. Empirical evidence

The treatment method associated with emotional processing theory, prolonged exposure, is well established as a highly effective treatment for PTSD (Foa et al., 1991, 1999). Several studies have investigated whether, as the theory predicts, the successful outcome of exposure treatment is related to the initial activation of fear and to within-session and between-session habituation. Two studies have supported the predicted relationship with initial activation of fear, as measured either by facial expressions (Foa, Riggs, Massie, & Yarczower, 1995) or increased heart rate (Pitman et al., 1996). Jaycox, Foa, and Morral (1998) reported that initial fear activation was only associated with improvement when it was followed by sustained habituation, and Van Minnen & Hagaars (2002) did not find a significant association between fear activation and improvement once initial symptom severity was controlled for. Improvement has been shown to be related to reductions in levels of fear between treatment sessions but not to reductions in fear within sessions (Jaycox et al., 1998; Van Minnen & Hagaars, 2002). It is not clear, however, that between-session reductions in fear are actually produced by habituation rather than by some other mechanism such as reappraisal.

Other important predictions from the theory concern the content of trauma narratives. One strategy has been to assess the complexity or level of articulation of a narrative by measuring reading ease. Computer programs are available that measure reading ease or the grade level of reading reflected in a text by calculating the average number of syllables per word and words per sentence. Using this method, Amir, Stafford, Freshman, & Foa (1998) found that assault victims whose narratives reflected a lower reading level and a greater reading ease had more

severe PTSD symptoms 3 months later. However, opposite results were obtained by Zoellner, Alvarez-Conrad, and Foa (2002). Gray and Lombardo (2001) replicated Amir et al.'s findings that PTSD was associated with lower reading levels in a trauma narrative, but found that the effect disappeared when writing skill and cognitive ability were controlled for. Contrary to prediction, they found that trauma and non-trauma narratives did not differ in reading level. Among the problems with the use of computer programs to measure reading level is that there is as yet no evidence that these measures are related to other indices of articulation, organization, or fragmentation of a trauma memory.

The prediction that higher levels of fragmentation and disorganization in the trauma narrative are related to the occurrence of dissociative responses has received relatively consistent support. Harvey and Bryant (1999a) found that current dissociative symptoms were related to an independent rating of greater narrative disorganization. Murray et al. (2002) reported that dissociation at the time the event occurred was associated with self-reported memory fragmentation, but not with an expert rating of narrative fragmentation. Engelhard et al. (2003) also found a relationship between self-reports of dissociation and fragmented memory. More recently, however, Halligan, Michael, Ehlers, and Clark (in press) showed that dissociation at the time the event occurred was related to both expert-rated and self-report measures of narrative disorganization in each of two studies of trauma survivors.

In contrast, there is little evidence that dissociation leads to trauma narratives that are shorter and more simplistic. Harvey and Bryant (1999a) found that the trauma narratives of patients with acute stress disorder, which is characterized by high levels of dissociative symptoms, were longer than those of trauma-exposed controls. In Gray and Lombardo's (2001) study, trauma narratives of participants meeting full or partial criteria for PTSD were longer than the same participants' non-trauma narratives. Using a computer-generated measure of reading ease, high dissociation has been found to relate to more complex, rather than more simplistic, narratives (Zoellner et al., 2002).

Foa et al. (1995) rated various aspects of the content of trauma narratives produced by rape victims at the beginning and end of exposure therapy for their PTSD. They found that along with an overall increase in narrative length, the percentage of thoughts and feelings increased over the period of therapy, particularly thoughts attempting to organize the trauma memory. However, a measure of the fragmentation of the narrative did not change over this period in the sample as a whole. Individuals whose narratives did show a reduction in fragmentation reported greater reductions in trauma-related anxiety, but not depression, whereas individuals whose narratives showed an increase in "organized" thoughts reported a reduction in depression, but not in trauma-related anxiety.

In an attempt to replicate this study, Van Minnen, Wessel, Dijkstra, and Roelofs (2002) reported that improvement in PTSD symptoms posttreatment was associated with a decrease in disorganized thoughts, but not with changes in organized thoughts or narrative fragmentation. Other data inconsistent with the theory were provided by Halligan et al. (in press), who investigated the relationship between change in several measures of memory disorganization and change in level of PTSD symptoms in a naturalistic follow-up study of assault survivors. Over the 6 months following initial assessment, they observed no significant associations between changes in memory disorganization and changes in symptoms.

4.1.2. Summary

Emotional processing theory has a great deal of explanatory power and is extremely comprehensive. It draws attention to many of the important aspects of PTSD that are likely to be encountered within therapy and offers many valuable suggestions to clinicians about how to conceptualize these. For example, the observation that the rigidity of beliefs may be problematic, regardless of whether the content of the beliefs is positive or negative, is potentially very important and helps to resolve some difficulties with the theory of shattered assumptions. The theory is associated with a highly effective treatment and also offers an extremely sophisticated account of the various mechanisms that may underlie the success of treatment using prolonged exposure.

The increased emphasis on pre-trauma risk factors and on appraisal processes has been strongly supported by recent research reviewed earlier. The status of other aspects of the theory is less well established, particularly the hypothesized mechanisms of change. Although problems in recalling the trauma are consistently related to peri-traumatic dissociation, as the theory predicts, there is as yet no consistent evidence that improvement in therapy is related to changes in the structure of trauma memories, to the initial activation of fear, or to habituation. Interesting questions remain about the relative importance of the automatic changes in trauma memories brought about by exposure and changes resulting from conscious reappraisal of beliefs and about whether these reflect the operation of different kinds of mechanism. As previously noted, trauma memories may not in fact be altered by the incorporation of new information, but may remain unchanged and be blocked or inhibited by new memories created through therapy.

It also remains unclear that an associative network model provides a sufficiently flexible architecture to account for the sometimes contradictory phenomena. The idea of a fear network as described by Foa and her colleagues involves different aspects of information about the event being strongly associated. By implication, in response to reminders, the entire fear memory (stimulus information, response information, and meaning) will be retrieved. This is difficult to reconcile with observations that for many patients, their trauma memory might contain gaps, parts might be clear and parts vague, and initial amnesia might begin to diminish posttrauma ([Mechanic et al., 1998](#)).

Associative network models have also been criticised for being too simple to capture complex clinical phenomena ([Johnson & Multhaup, 1992](#); [Power & Champion, 1986](#); [Teasdale & Barnard, 1993](#)). Teasdale and Barnard pointed out that in the original form of the associative network model, there was only one node for each emotion, so that simply talking about fear, say, would necessarily have the effect of arousing fearful feelings to some varying degree. The single level of representation also prevents associative network models from distinguishing between remembering an event in an emotion-laden, “hot” way and remembering it on another occasion in a more detached, “cool” fashion. A more general problem with the associative network approach is that it cannot represent knowledge at levels of meaning beyond that of the word or sentence, whereas there is every reason for thinking that the meaning of emotional events tends to be complex, multilayered, and often impossible to fully capture in words.

4.2. Dual representation theory

In contrast to the proposal of fear network theories that a traumatic memory is an ordinary memory that has a particular structure (more response elements, stronger inter-element associations, etc.) is the idea that trauma memories are represented in a fundamentally distinct way (Janet, 1904; Terr, 1990; van der Hart & Horst, 1989; van der Kolk & van der Hart, 1991). These authors suggested that pathological responses (for example, vivid and uncontrollable reexperiencing in the present) arise when trauma memories become dissociated from the ordinary memory system and that recovery involves transforming them into ordinary or narrative memories. However, they have not made clear whether ordinary memories of the traumatic event can exist alongside dissociated memories, and exactly how one form of memory is transformed into another.

One way of understanding this notion of a dissociated memory is to posit that there are two (or more) memory systems and that trauma information is better represented in one system than in the other. Several cognitive psychologists have proposed that there is a separate perceptual memory system that records information that has received little, if any, conscious attention. For example, even under ordinary conditions of attentional diversion, people frequently fail to see highly visible but unexpected objects before their eyes, a phenomenon known as “inattentional blindness” (Mack & Rock, 1998). These unattended objects or items that are not consciously seen in their experiments are nevertheless encoded and analyzed in considerable detail and can unconsciously affect participants’ responses on tests of indirect memory. The findings appear to be very relevant to trauma victims, whose attention tends to be captured by the immediate source of threat and who may report that they simply failed to hear words that were shouted or shots that were fired in close proximity to them. Whereas in some models, the perceptual memory system is unable to support conscious experience (e.g., Tulving & Schacter, 1990), in others, it supports sensory images such as visual scenes (e.g., Brown & Kulik, 1977; Johnson & Multhaup, 1992; Pillemer, 1998). Although perceptual representations are usually thought to be transient or only detectable by indirect probes, it has been suggested that experiencing events with high levels of emotion or importance results in the storage of long-lasting, vivid traces.

According to Brewin et al.’s (1996) version of dual representation theory, two memory systems continue to operate in parallel, but one may take precedence over the other at different times. Oral or written narrative memories of a trauma reflect the operation of a “verbally accessible memory” (VAM) system, so called to reflect the fact that the trauma memory is integrated with other autobiographical memories and the fact that it can be deliberately retrieved as and when required. VAM memories of trauma are therefore represented within a complete personal context comprising past, present, and future. They contain information that the individual has attended to before, during, and after the traumatic event, and that received sufficient conscious processing to be transferred to a long-term memory store in a form that can later be deliberately retrieved. These memories are available for verbal communication with others, but the amount of information they contain is restricted because they only record what has been consciously attended to. Diversion of attention to the immediate source of threat and the effects of high levels of arousal greatly restrict the volume

of information that can be registered during the event itself. VAM memories register conscious evaluations of the trauma both at the time it is happening and afterwards, as the person considers the consequences and implications of the event, and asks themselves how it could have been prevented. Thus, the emotions that accompany VAM memories include both “primary emotions” that happened at the time and “secondary emotions” generated by retrospective cognitive appraisals of those events.

In contrast, flashbacks are thought to reflect the operation of a “situationally accessible memory” (SAM) system, so called to reflect the fact that flashbacks are only ever triggered involuntarily by situational reminders of the trauma (encountered either in the external environment or in the internal environment of a person’s mental processes). The SAM system contains information that has been obtained from more extensive, lower level perceptual processing of the traumatic scene, such as sights and sounds that were too briefly apprehended to receive much conscious attention and hence did not become recorded in the VAM system. The SAM system also stores information about the person’s bodily response to the trauma, such as changes in heart rate, flushing, temperature changes, and pain. This results in flashbacks being more detailed and emotion-laden than ordinary memories.

Because the SAM system does not use a verbal code, these memories are difficult to communicate to others, and they do not necessarily interact with and get updated by other autobiographical knowledge. SAM memories can be difficult to control because people cannot always regulate their exposure to sights, sounds, or smells that act as reminders of the trauma. The emotions that accompany SAM memories are restricted to “primary emotions” that were experienced during the trauma. During some traumatic events, there may be time for more complex evaluations to take place. A person may experience a range of emotions such as anger and shame, and these would be coded into a SAM memory along with fear, helplessness, and horror (Grey et al., 2001; Holmes et al., 2003).

One implication of dual representation theory is that PTSD is a hybrid disorder that potentially incorporates two separate pathological processes, one involving the resolution of negative beliefs and their accompanying emotions and one involving the management of flashbacks. Recovery depends on the outcome of both these processes. One requirement is to reduce negative emotions generated by cognitive appraisal of the trauma, by consciously reasserting perceived control, reattributing responsibility, and achieving an integration of the new information with preexisting concepts and beliefs. The second requirement is to prevent the continued automatic reactivation of situationally accessible knowledge about the trauma. Following Brewin (1989), it was suggested that this is brought about by creating new SAMs that block access to the original ones. The new SAMs would consist of the original trauma images paired with states of reduced arousal and reduced negative affect brought about by habituation or by cognitive restructuring of the meaning and significance of the event.

This approach is consistent with the idea that two systems underpin human thought (Sloman, 1996). One is associative and automatic, making use of basic principles such as the similarity between elements or the closeness of two elements in time. It searches for and bases conclusions on patterns and regularities between elements such as images and stereotypes.

The second system is rule-based and deliberate, and tries to describe the world in more conceptual terms by capturing a structure that is logical or causal. Exposure treatments appear to draw on associative reasoning in that they attempt to produce new patterns and regularities involving the same elements that were part of the traumatic experience. Although the steps demanded by the treatment are deliberate, the processes by which change occurs are automatic. In contrast, cognitive methods involve the derivation of explicit rules that are then deliberately evaluated and modified verbally within therapy sessions.

4.2.1. Neuropsychology and dual representation theory

Relating the theory to findings in cognitive neuroscience, [Brewin \(2001, in press\)](#) highlighted the importance of the amygdala in activating fear responses and the different pathways that could convey trauma information to the amygdala. Pathways involving processing by the hippocampus would result in the laying down of integrated, coherent representations of conscious experience, located in the appropriate temporal and spatial context. Like VAM memories, these representations would be available for deliberate recall. However, information can reach the amygdala via a number of different routes, independently of the hippocampus. Memories formed as a result of activity in these alternative pathways would not be open to deliberate recall, or locatable in a broader temporal or spatial context, but could be accessed automatically by reminders, particularly perceptual features, similar to those recorded in the trauma memory.

Stress has very different effects on the hippocampus and the amygdala. Declarative memory is initially enhanced by release of the adrenal hormones adrenaline and corticosterone, and the sympathetic nervous system and amygdaloid complex together constitute a powerful mechanism for ensuring that emotional events are preferentially retained in memory ([Cahill & McGaugh, 1998](#)). Equally, there is evidence that prolonged, intense stress associated with high levels of corticosterone (cortisol in humans) tends to impair the functioning of the hippocampus. This then tends to reverse the improvement in declarative memory ([Bremner et al., 1995; Metcalfe & Jacobs, 1998](#)). In contrast, the functioning of the amygdala appears generally to be enhanced as stress increases.

These anatomically distinct memory systems, and the effects of stress upon them, provide a plausible neural basis for verbally accessible and situationally accessible memories, and for the symptoms of PTSD. Verbally accessible memories, which are flexible, subject to modification and change, but often vague, disorganized, and full of gaps, strongly suggest a form of representation that is dependent on the hippocampus. Because temporal context is encoded, they are experienced as in the past. Conversely, situationally accessible memories, which are highly perceptual, elicited automatically, and experienced as happening in the present, suggest an image-based, non-hippocampally dependent form of memory that is unable to encode information about past versus present. This lack of temporal context has two consequences (also suggested by [Ehlers & Clark, 2000](#)): first, that when the memories are retrieved, they are reexperienced in the present, and second, that the representation of ongoing threat leads to attentional and memory biases.

[Brewin \(2001, in press\)](#) also provided a revised account of how flashbacks are abolished. When the trauma survivor deliberately focuses and maintains attention on the content of the

flashbacks rather than trying to suppress them, information that is only present in the SAM system becomes reencoded into the VAM system, at which point the memories are assigned a spatial and temporal context. The process has to be repeated numerous times because there may be a lot of extra information about the trauma in the SAM system that has to be transferred to the VAM system. Eventually, providing the person is now safe, detailed memories in the SAM system that signaled the continuing presence of danger are matched by detailed memories in the VAM system that locate the danger in the past. When the person encounters trauma reminders, there is retrieval competition between these VAM memories and the original SAM memories. If the new VAM memories are accessed, inhibitory pathways from the prefrontal cortex prevent inappropriate amygdala activation and the accompanying return of fear.

Unlike most other contemporary explanations of PTSD, dual representation theory maintains that the original trauma memories are not altered in any way but remain intact and may be vividly reexperienced again in the future if the person unexpectedly comes across very detailed and specific reminders of the trauma. Rather, recovery is seen in terms of introducing retrieval competition between old and new trauma memories. So long as SAM memories contain information that is poorly represented in the VAM system, they will continue to enjoy a retrieval advantage when that information is encountered in the environment. The new VAM memories will enjoy a retrieval advantage to the extent that information that could act as a retrieval cue for them is well represented, that these memories have been well rehearsed, and that these memories are distinctive.

The principle of retrieval competition is also used by Brewin (in press) to explain how, within the VAM system, negative beliefs about self, world, and future are overcome. Consistent with social psychological theories, people are thought to have in memory multiple self-representations or identities that compete to be retrieved. These identities provide a series of high-level frameworks that summarize experiences with the world and with close relationships, and within which specific thoughts, images, or impulses are organized. For example, common negative identities evoked by trauma include the self as powerless, the self as inferior, the self as nonexistent, the self as futureless, the other as abandoning, the other as betraying, and the other as hostile.

Negative cognitions related to the trauma often arise because the event has made it difficult to retrieve positive self-identities or has reactivated negative self-identities created by previous adversity. Modifying these negative cognitions may therefore involve exploring the existence of alternative identities that have been experienced by the person with PTSD and tracing the links between these identities and the experience of trauma. In this way, the theory attempts to explain why trauma and its treatment sometimes has such a profound impact on views of the self and the world, and so often leaves trauma victims feeling changed in some fundamental way. According to this approach, cognitive therapy enhances the retrievability of positive identities by making them more distinctive and by creating new associative links that enable them to be retrieved following the activation of negative thoughts or images. As with SAM memories, however, old representations remain unchanged and retain their potential to be retrieved by the right combination of cues.

4.2.2. Empirical evidence

Essentially, whereas associative network theories imply that there is a single type of trauma memory that gradually changes over time, dual representation theory claimed that two types of trauma memory can be detected in the same individual at the same time. In a series of experiments designed to test the theory Holmes et al. (2002) had participants watch a trauma film under different conditions. In one condition, they had to carry out a concurrent visuospatial task, tapping a pattern on a concealed keyboard. In another condition, they had to carry out a concurrent verbal task, counting backwards in threes. The dependent variable was the number of intrusive memories of the film over the next week, as recorded in a diary. The prediction was that the visuospatial task would compete for the resources of the SAM system, leading to perceptual information being less well encoded and resulting in fewer intrusions than a no-task control condition. In contrast, the verbal task was expected to compete for the resources of the VAM system, leading to a less-detailed conscious representation and resulting in more intrusions than a no-task control condition. As in an earlier study (Brewin & Saunders, 2001), the concurrent visuospatial task reduced intrusive memories, but Holmes et al. also showed that the verbal task increased the number of intrusions relative to a control condition. These results support the claim of dual representation theory that intrusive trauma images are supported by a different memory system, one that is predominantly visuospatial rather than verbal in nature.

Hellawell and Brewin (2002, *in press*) conducted the first study specifically with people currently suffering from PTSD to test single versus dual representation theories. They first described the difference between flashbacks and ordinary memories to participants and then had them write a detailed narrative of their traumatic event. At the completion of the narrative, participants were asked to retrospectively identify sections they had written during which they experienced the two types of memory. Consistent with predictions concerning the perceptually based SAM system, during flashback sections, participants used more words describing seeing, hearing, smelling, tasting, and bodily sensations, as well as more present tense verbs and references to motion. These sections also contained more words referring to death and to the primary emotions fear, helplessness, horror, whereas ordinary memory sections contained more words referring to secondary emotions such as sadness. While writing sections that participants would later label as flashbacks, they exhibited significantly more frequent bodily movements, breathing changes, vocalizations, and facial changes such as flushing.

Hellawell and Brewin (2002) reasoned that if flashbacks were based on a perceptual memory system, then they should interfere with performance on other tasks that also made demands on this system, but not interfere with unrelated tasks. Participants writing their narrative were therefore stopped on two occasions, once when they were in a flashback phase and once when they were in an ordinary memory phase, and carried out a visuospatial task (trail-making) and a verbal task (counting backwards in threes). Consistent with predictions, trail-making performance was much worse when participants had been halted during a flashback section of their narrative than when they had been halted during an ordinary memory section. One possible explanation is that they were more upset during the flashback sections, which would have a negative impact on all test performance. However, the results

indicated that counting backwards in threes was adversely affected to an equal extent when participants were halted in the flashback and ordinary memory sections.

4.2.3. Summary

Dual representation theory addresses a number of specific observations about PTSD that are hard to explain under the assumption of a single memory system. It attempts to include observations made by both social-cognitive and information-processing perspectives within an overarching framework that explicitly differentiates cognitive processes happening during the trauma from the more extensive appraisals that occur afterwards. Among the implications are that images, appraisals, and emotions occurring peri-traumatically are processed in a way that is more automatic, more influenced by previous associations, and less consciously accessible than when these same mental contents occur posttrauma. These changes in processing are in turn reflected in the differential recruitment of image-based and verbal memory systems. The image-based system initially supports flashbacks but can be suppressed by involving the VAM system in creating detailed representations of the trauma that are preferentially retrieved.

Although unlike emotional processing theory or Ehlers and Clark's cognitive model, the theory is not linked to a detailed outline of therapeutic procedures, it does have several implications for therapy. One is that there is a fundamental distinction between those aspects of therapy aimed at abolishing flashbacks, which rely on relatively automatic processes arising from the increased hippocampal processing of retrieval cues, and those aimed at correcting negative appraisals, which rely on explicit verbal reasoning. Another implication arises from the idea that recovery involves the creation of alternative and more benign representations in memory that are preferentially retrieved. According to this approach, the new representations do not have to be more accurate or contain corrective information; they only have to be more memorable. In this way, the theory is able to account for the effectiveness of imagery rescripting and other procedures that are not concerned with veridicality but aim to block intrusive images by creating more benign alternatives.

The focus of the theory is mainly on memory, emotion, and appraisal, and there is little discussion of other important features of PTSD such as increased conditionability or emotional numbing. Dissociative responses do not receive any detailed treatment and are only discussed in terms of their potential to interfere with encoding into the VAM system during the trauma, thus increasing the risk of later PTSD. One useful aspect of the theory has been to facilitate links with recent advances in cognitive psychology and cognitive neuroscience and to generate a number of unique predictions. There is some preliminary support for the model derived from clinical and analogue studies that tends to support the role of image-based or visuospatial processes in representing trauma and to suggest that these are dissociable from verbal trauma memories. A great deal more research is necessary, however, before the basic tenets of the theory can be regarded as supported.

4.3. Ehlers and Clark's cognitive model

Ehlers and Clark (2000) drew attention to the paradox in PTSD whereby patients feel anxious about the future, even though the trauma lies in the past. They proposed that

pathological responses to trauma arise when individuals process the traumatic information in a way that produces a sense of current threat, either an external threat to safety or an internal threat to the self and the future. The two major mechanisms that produce this effect involve negative appraisals of the trauma or its sequelae and the nature of the trauma memory itself.

Expanding on the work of Foa and Rothbaum (1998) and Jones and Barlow (1990), Ehlers and Clark identified a wide range of relevant negative appraisals. Some of these are focused on the traumatic event and signal overgeneralization of danger (e.g., "Others can see I am a victim") or negative appraisal of own actions (e.g., "I deserve that bad things happen to me"). Other appraisals focus on sequelae, such as the PTSD symptom of numbing ("I'll never be able to relate to people again"), other people's reactions ("They think I am too weak to cope on my own"), and life prospects ("My body is ruined"). The different types of appraisal, variously involving danger, violation of standards by self or others, or loss, explain the variety of emotions reported by patients with PTSD.

Among the factors that increase the likelihood of negative appraisals are thought processes during the trauma and prior beliefs and experiences. Ehlers and Clark identified a specific frame of mind they termed 'mental defeat,' discussed previously in Cognitive-affective reactions and PTSD. This reaction, emphasizing the inability of the person to influence their fate, is a risk factor for such self-appraisals as being weak, ineffective, or unable to protect oneself. Prior experiences of traumatization, weakness, or helplessness also increase the risk of appraising oneself as unable to act effectively, as being extremely vulnerable to danger, as being the target of others' hostility, and so on.

Ehlers and Clark's approach to explaining research findings on traumatic memory was to suggest that the memory of the event is poorly elaborated, not given a complete context in time and place, and inadequately integrated into the general database of autobiographical knowledge. This accounts for the difficulty in intentional recall (absence of clearly specified retrieval routes), reexperiencing in the present (absence of a temporal context), the lack of connection with other relevant information, and the easy triggering by physically similar cues. At the same time, consistent with conditioning accounts, they suggested that strong S-S and S-R associations for traumatic material are formed which help the person to make (sometimes preconscious) predictions about future sources of danger. They also noted that retrieval from associative memory is cue-driven and unintentional, so that the person may be unaware of the triggers for reexperiencing. The strong associations result in perceptual priming, which they define as a reduced perceptual threshold for trauma-related stimuli.

Ehlers and Clark proposed a number of peri-traumatic influences that operate at encoding and affect the nature of the trauma memory. One of these involved an important distinction made by cognitive psychologists (e.g., Roediger & McDermott, 1993) between data-driven processing (focused on sensory impressions) and conceptual processing (focused on the meaning of the situation, organizing the information, and placing it in context). Conceptual processing, Ehlers and Clark argued, facilitates integration of the trauma memory with the autobiographical database, whereas data-driven processing leads to strong perceptual priming and a memory that is hard to retrieve intentionally. Other peri-traumatic factors were an inability to establish a self-referential perspective while experiencing the trauma, dissociation, emotional numbing, and lack of cognitive capacity to evaluate aspects of the event accurately.

As well as discussing various ways in which appraisals can interact with the nature of the trauma memory, Ehlers and Clark developed a detailed account of the importance of maladaptive behavioral strategies and cognitive processing styles in maintaining the disorder. Among the behavioral strategies likely to cause PTSD to persist are active attempts at thought suppression, distraction, avoidance of trauma reminders, use of alcohol or medication to control anxiety, abandonment of normal activities, and adoption of safety behaviors to prevent or minimize trauma-related negative outcomes. For example, a person injured in a car crash might adopt the safety behavior of continually clinging on to the seat or the hand brake, or looking in the rear-view mirror, during subsequent journeys. Maladaptive cognitive styles include selective attention to threat cues and persistent use of rumination or dissociative responses.

4.3.1. Empirical evidence

As outlined at the beginning of this article, there is now good evidence in support of various aspects of the model. In particular, there is evidence about the relationship of the following variables with persistent PTSD symptoms months later: mental defeat (Ehlers et al., 2000; but not replicated by Dunmore et al., 1999, after controlling for previous history and assault severity); peri-traumatic dissociation (Halligan et al., *in press*; Murray et al., 2002); a self-report measure of data-driven versus conceptual processing (Halligan et al., *in press*; Murray et al., 2002); negative interpretations of the trauma (Dunmore, Clark, & Ehlers, 1997; Dunmore et al., 1999); negative interpretations of initial PTSD symptoms (Clohessy & Ehlers, 1999; Dunmore et al., 1997, 1999; Halligan et al., *in press*; Ehlers et al., 1998; Ehlers & Steil, 1995; Mayou, Bryant, & Ehlers, 2001; Steil & Ehlers, 2000); negative interpretations of other people's responses (Dunmore et al., 1997, 1999); perception of permanent change in self or life goals (Dunmore et al., 1999; Ehlers et al., 2000); thought suppression (Clohessy & Ehlers, 1999; Ehlers et al., 1998; Mayou et al., 2001; Steil & Ehlers, 2000); rumination (Clohessy & Ehlers, 1999; Ehlers et al., 1998; Mayou et al., 2001; Murray et al., 2002; Steil & Ehlers, 2000); safety behaviors and avoidance (Dunmore et al., 1999).

A limitation of studies that follow-up trauma survivors is that the nature of any association between predictor variables (even those assessed shortly after the trauma) and later PTSD symptoms is not unambiguous. Initial event or symptom factors could be causally influencing both these psychological variables and later severity of the disorder. A number of studies have, however, controlled for the level of initial symptoms and thereby made a stronger case that the following variables are causally implicated in the way the disorder unfolds after the initial symptomatic period: mental defeat (Dunmore et al., 2001); negative interpretations of initial PTSD symptoms (Dunmore et al., 2001; Ehlers et al., 1998; Halligan et al., *in press*; Mayou et al., 2001); safety behaviors and avoidance (Dunmore et al., 2001). In addition, consistent with the Ehlers and Clark model, negative interpretations of initial PTSD symptoms have been found to be related to increased distress and to increased use of strategies such as rumination and thought suppression (Clohessy & Ehlers, 1999; Ehlers et al., 1998; Steil & Ehlers, 2000).

There is as yet less evidence to support Ehlers and Clark's proposals about cognitive processing during trauma. Halligan, Clark, and Ehlers (2002) attempted to manipulate data-driven versus conceptual processing during analogue trauma, using a nonclinical sample

watching a trauma film. They instructed one group to immerse themselves in the images and sounds and the other group to concentrate on what was happening in the scene, why it was happening, and what might happen next. The data-driven group recalled a smaller proportion of events from the video in the correct order and a smaller number of events overall, but did not differ on any of the analogue symptom measures including reexperiencing over the next week. There were several significant correlations between degree of data-driven processing and later distress and avoidance, but neither data-driven processing nor memory coherence was related to intrusive memories.

In a second study, Halligan et al. (2002) selected groups with a more general tendency to respond to stressful events with a data-driven versus conceptual style of processing and had them both watch the trauma film. The groups did not differ in the actual quantity or coherence of their recall of the video, but the data-driven group reported more memory intrusions, subjectively more disorganized memories, and a greater number of analogue PTSD symptoms.

Cognitive processing in two samples of assault survivors was investigated by Halligan et al. (in press). In both samples, high levels of memory disorganization were related to peri-traumatic dissociation, data-driven processing, and lack of self-referent processing. All these aspects of processing were highly related to each other, with none being a unique predictor of memory disorganization. Cognitive processing and memory disorganization variables all predicted levels of PTSD 3 and 6 months later. Importantly, although these variables were also related to depressive symptoms, their ability to predict PTSD was independent of levels of depression, strengthening the case that the variables identified by Ehlers and Clark are at least in part specific to PTSD.

4.3.2. Summary

Ehlers and Clark's cognitive model provides what is currently the most detailed account of the maintenance and treatment of PTSD. They have significantly expanded understanding of the wide range of relevant negative appraisals and have identified both appraisals and a variety of cognitive coping factors that influence the course of the disorder. These aspects of the model have been strongly and consistently supported by empirical research. In addition, they have identified a new aspect of peri-traumatic processing, mental defeat, that appears to be an important risk factor for later disorder. Importantly, as with emotional processing theory, these ideas are closely tied to an approach for treating PTSD. In early trials, the therapy appears to be very effective, both as a form of early intervention and as a community-based intervention for established PTSD (Ehlers, Clark et al., in press; Gillespie, Duffy, Hackmann, & Clark, 2002).

The study by Halligan et al. (in press) also confirms Ehlers and Clark's theory that cognitive processing at the time of the trauma is related to the development of PTSD symptoms after the objective and subjective impact of the event has been controlled for. Taken as a whole, however, the research illustrates two potential problems that have been encountered by a number of investigators (Holmes et al., 2002; Murray, 1997; Murray et al., 2002). First, measures of trait or spontaneous trauma processing are consistently related to the experience of intrusive memories, whereas attempts to instruct participants to process material in a particular

way tend to be ineffective. One implication is that deliberate attempts to dissociate or engage in data-driven processing are only weakly related to spontaneous reactions to trauma, in which there may be alterations in perceptual thresholds or other changes that are hard to model in the laboratory. As noted by Halligan et al., however, it is very difficult to infer causal effects without being able to bring variables under experimental control.

The second problem is that the assessment of cognitive processing or memory disorganization is inherently complex, and measures are not always consistently related either to each other or to other variables. It is difficult to assess the extent of data-driven versus conceptual processing at the time the trauma is actually occurring on the basis of retrospective self-report items such as “Were you overwhelmed by different sensations and impressions?” and “Did you realize you were in a dangerous situation?” (Murray et al., 2002), in part because responses may be influenced by the extent of subsequent processing or reexperiencing. Processes such as dissociation, data-driven and conceptual processing may also tend to be interrelated, so that self-report measures have difficulty in distinguishing between them.

Research on data-driven versus conceptual processing within cognitive psychology is largely restricted to giving participants instructions on how to deliberately process relatively simple verbal or pictorial material (e.g., Roediger & McDermott, 1993). Little is known about how different styles of processing could be applied to complex and emotional material such as trauma films and the extent to which, for example, conceptual processing depends on prior data-driven processing. Moreover, the conceptual processing of a potentially threatening event may have a number of aspects. One more abstract aspect could be to classify and contextualize the event or organize its constituent elements, regardless of level of threat. Another more specific aspect could be to evaluate threat in relation to oneself or others. Ehlers and Clark (2000) suggested additionally that what might be critical is to process the event in relation to oneself, relating it to other autobiographical information. This integration with the autobiographical knowledge base should, Conway & Pleydell-Pearce (2000) have proposed, inhibit automatic retrieval in response to perceptual cues.

In the cognitive psychology laboratory, conceptual processing has rarely been concerned with aspects of organization and context. Manipulations of data-driven versus conceptual processing of neutral stimuli do not tend to affect measures of perceptual implicit memory such as priming, and there is as yet little evidence that data-driven processing would impair intentional retrieval (Roediger & McDermott, 1993). However, this may not be true of traumatic situations. Michael, Ehlers, & Halligan (2002) found that soon after their trauma, PTSD patients showed enhanced priming specifically to trauma-related words and that stronger priming effects were related to later symptom severity. More research is required to discover how the distinction between data-driven and conceptual processing transfers from the cognitive psychology laboratory to the real world of complex emotional events.

5. Conclusions

There is a high degree of overlap between the three recent models of PTSD reviewed in this article. All of them are able to incorporate a wide range of findings on the importance of

factors affecting encoding, alterations in memory functioning, appraisals, coping strategies and cognitive styles, importance of prior beliefs and trauma exposure, and so on. The most important areas where they differ is their accounts of how trauma impacts on memory, the processes whereby changes are brought about in memory, and how these changes are related to recovery. In addition, memory disturbance and appraisal are treated to a greater extent as distinct aspects of PTSD in the two more recent theories than in emotional processing theory.

Whereas Foa et al.'s emotional processing theory relies on the idea of a single associative network in memory, in which all information is represented in the form of propositions (i.e., logical relationships between concepts), both the others have explicitly considered that different types of memory may be involved. In the most recent version of dual representation theory (Brewin, 2001, *in press*), trauma stimuli receiving insufficient processing to form ordinary autobiographical memories are stored in a separate image-based SAM system where, in the context of trauma reminders, they give rise to intrusive images and physiological responses until their activation is blocked or inhibited by the creation of corresponding VAM representations. The intrusive images produced by the SAM system consist of reperceived, sensory representations, whereas intrusive images produced by the VAM system, like those of emotional processing theory, are based on propositional knowledge. In Ehlers and Clark's cognitive theory, there is an autobiographical memory system consisting of higher order themes and personal time periods as well as more specific event-related information. Poor incorporation of the event into the more general part of the autobiographical database is thought to result in a memory that is hard to retrieve intentionally, that is experienced as being without a context, and that is easily triggered by physically similar cues. There is also an associative memory system that can process information preconsciously, prime the individual to respond to trauma reminders, and initiate reexperiencing directly in response to relevant cues.

At present, Ehlers and Clark's cognitive model places more emphasis on the way in which stimuli are processed during trauma (i.e., the data-driven versus conceptual distinction) rather than on the specific way in which the output of these processes is represented in memory. The model of autobiographical memory they employ (Conway & Pleydell-Pearce, 2000) distinguishes more general autobiographical knowledge from more specific sensory information, called event-specific knowledge (ESK). To the extent that ESK involves imagery, it may behave in ways similar to Brewin's SAM system. Ehlers and Clark have not yet specified whether all reexperiencing is a product of this autobiographical memory system, of a separate associative memory system, or of both. One possibility that would align their approach more closely with dual representation theory is if ESK was represented in a form of analogue memory system that was specifically concerned with recording images.

Although the dual representation and Ehlers and Clark models are in many ways similar, there are some areas in which they make different predictions. In the latter, data-driven processing during a trauma is a risk factor for developing PTSD. For dual representation theory, the detailed processing of sensory information is only regarded as harmful if the information is overrepresented in the SAM system relative to the VAM system. Provided the processing is done with full attention and the information is being adequately encoded in the VAM system, no ill effects should ensue. Hippocampal processing in VAM will automatically

assign a context, rather than this needing to be brought about by deliberate conceptual processing. The dual representation approach would suggest that some self-reports of high levels of data-driven processing may reflect a state of mind in which attentional resources are overstretched, leading to disproportionate encoding in the SAM rather than the VAM system. Under these conditions, VAM representations would be inadequate to prevent reexperiencing of the SAM representations in the form of vivid images.

Dual representation theory also differs from the emotional processing and Ehlers and Clark models in that it does not assume disorganization or fragmentation in the trauma memory are in themselves risk factors for PTSD. Instead, it proposes that what is critical is to have stimuli that are associated with very high levels of arousal during the trauma represented within the VAM system where they are assigned a context. Memory disorganization may be related to difficulty in deliberately retrieving clear and detailed images of these critical moments in time, but according to dual representation theory, it is the contents of the memory rather than the degree of organization that is the risk factor.

All three theories agree that one of the benefits of reliving is the elaboration and contextualization of the trauma memory, but offer somewhat different explanations for why this process is helpful. Foa and Rothbaum proposed that it enables the trauma memory to be reintegrated with the rest of the memory network, so that the elements of the trauma memory are equally strongly associated with external elements as with each other. Ehlers and Clark suggested that contextualization sites trauma-related information within periods and themes in a preexisting autobiographical database, and that this inhibits retrieval of sensory details and physiological responses in response to reminders of the trauma. According to Brewin, contextualization, particularly in time, results in the creation of new VAM memories that are able to prevent the amygdala from responding to trauma reminders.

The three theories also differ in their account of how psychological treatment works. Emotional processing theory emphasizes the importance of incorporating specific types of disconfirmatory information into the trauma memory, but does not differentiate at a theoretical level between automatic changes in the trauma memory brought about, for example, by exposure and between-session habituation, and deliberate changes brought about by cognitive reappraisal. In contrast, the dual representation and Ehlers and Clark models address separately the bringing about of modifications to the trauma memory and changes in problematic appraisals, for example, discussing the circumstances under which it might be helpful for cognitive restructuring to precede exposure work. Ehlers and Clark's focus on memory processes led them additionally to propose that it might be insufficient to carry out cognitive restructuring on its own and that the agreed reappraisals might have to be incorporated into reliving sessions.

Dual representation theory contains the additional notion that that treatment creates new trauma memories that compete with the original representations to be retrieved by trauma cues. Which particular representation is retrieved depends on their accessibility, influenced by the match between those cues and information in the memory, by the amount retrieval of the representations has been practised, and by the distinctiveness of the representations. Grey et al. (2002) applied the theory to explaining why patients might benefit from carrying out cognitive restructuring within reliving sessions. They suggested that this process led to the

creation of particularly rich and detailed VAM memories in which positive reappraisals relevant to a variety of negative emotions were associated with a large number of sensory and physiological cues present during the trauma. In the presence of trauma reminders, these more detailed memories would have a retrieval advantage over VAM memories just containing information about the positive appraisals and would be better able to inhibit the activation of corresponding SAM memories.

Outcome research suggests that exposure treatment for PTSD which does not explicitly address cognition is as effective as cognitive treatment containing no explicit element of exposure (Marks, Lovell, Noshirvani, & Livanou, 1998; Tarrier et al., 1999). Emotional processing theory does not distinguish at a theoretical level between different methods of incorporating corrective information into trauma memories, and Foa and Rothbaum (1998) drew attention to the potential of prolonged exposure to lead to cognitive change. However, the theory has greater difficulty in explaining how change is brought about in the absence of memory activation and habituation. The two other theories would agree that exposure may lead to cognitive change, for example, by providing evidence that the patient can now tolerate their intrusions. For both theories, the process of achieving cognitive change may involve selective reliving of some trauma moments (particularly hot spots), or may reduce the aversiveness of reliving and do away with need to suppress or avoid flashbacks. Cognitive change, in this view, removes the blocks to trauma processing and puts the patient back on a path of natural recovery.

Two areas which are agreed to be important and in which theoretical progress would be most valuable in increasing our understanding of PTSD involve the way in which trauma is encoded, and the connections between appraisals, emotions, and identity. One way of understanding encoding would be to specify in greater detail the processes that impede or facilitate it. This requires more theoretical elaboration of the different aspects of dissociation, data-driven processing, and conceptual processing. As well as using self-report measures, analogue studies will be useful in determining which types of concurrent tasks affect the development of intrusive memories after traumatic stimuli. Conclusions from such studies depend on the assumption that the tasks compete for limited resources and that these are the same resources that are deployed during trauma.

If memory organization turns out to be an important risk factor, it will be important to develop more reliable ways of measuring it. There is an assumption, for example, that disorganization in a narrative reflects disorganization in an underlying memory representation, whereas it may have more to do with problems in retrieving or in expressing the contents of the memory. Fragmentation in a memory representation may take place at the level of the individual image, of a sequence of images, or of a complete narrative. Good agreement between different measures of memory is obtainable (Halligan et al., in press) but there is considerable scope for improving our understanding of what is being assessed with self-report and objective measures.

More consideration needs also to be given to other types of memory representation that may be relevant. For example, knowledge abstracted from past experience may help to determine reactions to trauma. This knowledge may also not be verbally accessible and may be represented as a schematic model or within an associative network (Dalgleish, 1999), or as

another type of situationally accessible memory (Brewin, 1989). Dalgleish (1999) has proposed that in a traumatic situation, information is recorded within three memory systems, one schematic (involving higher levels of meaning), one propositional (involving facts and ideas that can be fully expressed in words), and one analogical (involving images and other sensory impressions). Reexperiencing, he suggested, can be based on information stored in any of these systems.

The relationship between preexisting models of the self and the world, aspects of identity, and beliefs and emotions concerning the trauma is also ripe for further study. According to most theorists, information about the trauma fails to be processed when it conflicts with the dominant goal structure of the self and thus cannot be readily incorporated within the autobiographical knowledge base. Under these conditions, Conway and Pleydell-Pearce (2000) proposed that trauma ESK becomes associated by default with any goal that was currently active when the event took place. Subsequent activation of these goals leads to the intrusion of the trauma ESK, a process that will not be halted until the current goal structure changes. This model provides a good explanation of cognitive treatments for PTSD that attempt to reconcile the trauma with previous beliefs, but is less able to account for the success of brief, symptom-focused treatments, such as eye movement desensitization and reprocessing (Shapiro, 1995) or prolonged exposure counter-conditioning (Paunović, *in press*), that do not address current goals.

In addition to this idea that trauma cannot be assimilated to any preexisting knowledge structures, other theorists have suggested that it may be assimilated to negative schematic models of the self (Dalgleish, 1999; Foa & Rothbaum, 1998), negative beliefs (Ehlers & Clark, 2000), or negative identities (Brewin, *in press*). Little is known about the nature and variety of these knowledge structures, which are most common, whether there are important interactions between certain types of knowledge structure and certain types of trauma, nor has there been confirmation of the strong clinical impression that these knowledge structures predate the trauma rather than being a response to it. Finally, research is needed on the relation of structures involving self and identity to emotional responses. Given the findings that emotions such as anger are as common as fear in PTSD, and that shame mediates the relation between childhood adversity and later PTSD symptoms in trauma victims, it is likely that they are centrally involved in understanding how trauma impacts on the self.

While emotional processing theory has generated a highly effective treatment program for PTSD, its primary focus has been on the habituation of fear. Other emotions involved in PTSD may not respond to exposure and may contribute to treatment failures using these techniques. The implications of dual representation theory have been extended by Grey et al. (2002) and Brewin (*in press*) to suggest PTSD treatment approaches that are inclusive of a wider range of emotional experiences than fear and that draw on alternative principles of memory functioning, such as retrieval competition and distinctiveness. Treatment trials have not been conducted from a dual representation theory perspective, however, and in its present form, it remains clinically informative rather than offering specific guidelines for therapy. Presently, the theoretical model with the most comprehensive implications for cognitive-behavioral treatment is that of Ehlers and Clark. As is the case with existing cognitive treatments for PTSD such as cognitive processing therapy (Resick, Nishith, Weaver, Astin, &

(Feuer, 2002; Resick & Schnicke, 1992), early results suggest that therapy based on the model appears to be highly effective. Further increments in effectiveness are likely to follow from an improved theoretical understanding of trauma, memory, and PTSD.

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