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“Hotspots” in trauma memories in the treatment of post-traumatic stress disorder: A replication

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Hotspots refer to memories of detailed moments of peak emotional distress during a traumatic event. This study investigates hotspot frequency, and the emotions and cognitions contained in “hotspots” of memory for trauma, to replicate a previous study in this area (Holmes, Grey, & Young, 2005). Participants were patients receiving treatment for post-traumatic stress disorder (PTSD) at a specialist outpatient clinic after experiencing a range of traumatic events. The main finding was that, after fear, the most common emotions reported were anger and sadness. Cognitions related to psychological threat to the self were more common than those related to physical threat.

Keywords: PRSD; Trauma; Hotspots; Cognition; Emotion.

Several authors in the clinical literature have identified the importance of “hotspots” in the memory of traumatic events (Ehlers & Clark, 2000; Foa & Rothbaum, 1998; Grey, Holmes, & Brewin, 2001; Grey, Young, & Holmes, 2002; Holmes, Grey, & Young, 2005; Richards & Lovell, 1999). The term hotspot is used to refer to the specific parts of the trauma memory that cause highest levels of emotional distress, and that are associated with intense re-experiencing of aspects of the trauma. These are readily identified during the course of cognitive behaviour therapy for post-traumatic stress disorder (PTSD) where the trauma is discussed in great

detail, encouraging high affect. PTSD is a psychological response to traumatic events in which the person meets set diagnostic criteria that include symptoms of re-experiencing, avoidance/numbing, and hyperarousal (American Psychiatric Association, 1994). Many people experience intrusive memories after trauma, although their symptoms may not warrant a clinical diagnosis of PTSD. Thus it is not claimed that hotspots are unique to trauma memories, and they may have wider applicability. Our research began investigating PTSD memories within a clinical setting. Recent clinical guidelines for the UK National Health Service

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30 recommend trauma-focused (i.e., memory-focused) cognitive behaviour therapy as the treatment of choice for PTSD (National Institute of Health and Clinical Excellence, 2005).

35 A core feature of PTSD is the presence of intrusive memories of the event(s). Typically these intrusions are in the form of visual mental images but they can also occur in other sensory modalities (Hackmann, Ehlers, Speckens, & Clark, 2004). One feature that distinguishes these traumatic memories from other autobiographical memories is that they are experienced as happening “now” rather than as a memory in the past (Ehlers & Clark, 2000; Hackmann et al., 2004). Degree of “nowness” of intrusive memories is a good predictor of chronic post-traumatic stress disorder after assault (Michael, Ehlers, Halligan, & Clark, 2005). In such “flashback” memories, the emotions felt at the time of the trauma are re-experienced and usually among the most distressing symptoms for which patients request help. It is this experience of “nowness” that contributes to the “current sense of threat” that a recent cognitive clinical model posits is at the heart of PTSD (Ehlers & Clark, 2000). This model further suggests that the current sense of threat may be to one’s physical integrity or to one’s sense of self (see also Brewin & Holmes, 2003; Conway & Pleydell-Pearce, 2000; Conway, Meares, & Standart, 2004).

40 In order to meet diagnostic criteria for PTSD, the person must experience extreme fear, helplessness, or horror during the trauma (American Psychiatric Association, 1994). However, clinical observation has long suggested that patients report a broader range of peritraumatic emotions, such as anger, sadness, shame, guilt, and disgust (e.g., Lee, Scragg, & Turner, 2001). In the first empirical study of these emotions in trauma memories, Grey et al. (2001) used an illustrative sample consisting of only eight selected cases, which could bias the prevalence of “non-diagnostic” emotions. Grey et al. (2002) illustrated four individual case examples with hotspots as part of a treatment description. Later, Holmes et al. (2005) reported on a study using an unselected sample of 32 people with PTSD receiving cognitive behaviour therapy at an outpatient clinic. This provided the first systematic investigation of emotional and cognitive themes within trauma memory hotspots. They found that patients identified several hotspots in their trauma memories (mean 6.1, *SD* 2.6). While the most common emotion experienced was fear, the diagnostic emotions of PTSD of fear, helplessness,

and horror only accounted for 42% of the emotions in the hotspots. Dissociation, anger, and sadness all appeared more frequently than helplessness and horror. The most common of the seven cognitive themes identified were “control and reasoning” (e.g., “I have to try to remain calm”), “general threat of injury and death” (e.g., “I’m going to die”), and “uncertain threat” (e.g., “what’s going to happen now?”). Two of the seven themes related to direct threat to physical integrity and accounted for 36% of the cognitions in the hotspots. The remaining five cognitive themes related more to psychological threat to the self (e.g., abandonment, “I’m all alone”; esteem, “I’m to blame”) and accounted for 64% of the cognitions in hotspots. The study also found that 78% of intrusions matched a hotspot, providing evidence for the common assumption that the most distressing moments during a trauma are reflected in people’s intrusions.

Hence, in people seeking treatment for PTSD following traumatic experiences there are a number of worst moments of the memory (hotspots), and these moments contain a range of emotional and cognitive responses, not limited to fear and physical threat. However the study by Holmes et al. (2005) was at a single clinic and the generalisability and replicability of these results remains uncertain. In this study we used the same methodology as Holmes et al. (2005) to attempt to replicate these results with a larger sample at a different treatment centre. Thus, following Holmes et al. (2005) we hypothesised that PTSD memories would contain a number of hotspots, rather than a single worst moment; that only about half of the emotions experienced will be the diagnostic emotions of PTSD (fear, helplessness, and horror); that the majority of the cognitions will be related to psychological rather than physical threat; and that most of the intrusions reported will also be a hotspot.

METHOD

Participants

The participants comprised 42 patients from the Centre for Anxiety Disorders and Trauma, South London and Maudsley NHS Trust, London, a specialist outpatient clinic in the UK National Health Service. All participants met diagnostic criteria for chronic PTSD using the Clinician Administered PTSD Scale (CAPS; Blake et al.,

1996) or Structured Interview for DSM-IV (SCID; First, Spitzer, Gibbon, & Williams, 1995). Patients were taken through imaginal reliving (Foa & Rothbaum, 1998) as part of a trauma-focused cognitive behavioural treatment for PTSD (Ehlers, Clark, Hackmann, McManus, & Fennell, 2005) and were fluent English speakers. Exclusion criteria for the clinical service are current alcohol or drug dependence, current psychosis, or severe depression needing immediate treatment in its own right. Data were collected by each participant's clinician since this included discussing the index trauma and assessing patients' memory during treatment. Three clinicians contributed 24, 10, and 8 patients respectively.

There were 26 female and 16 male patients. Their mean age was 41.2 years ($SD = 11.2$; range 24–62 years). The majority of patients were Caucasian ($n = 29$, 69%), 11 (26%) were Afro-Caribbean, and two (5%) were Asian. A total of 22 (52%) were married or cohabiting, 2 (5%) were divorced/separated, and 18 (43%) were single. About half of the patients were working ($n = 20$, 48%), eight (19%) were unemployed, eight (19%) were on disability allowance, three (7%) were students, and three (7%) were retired. The index traumatic events experienced were physical assault ($n = 15$), road traffic accident ($n = 8$), other accident ($n = 8$), witness death ($n = 7$), armed robbery ($n = 2$), sexual assault ($n = 1$), and medical trauma ($n = 1$). The mean time since the trauma was 2 years 8 months ($SD = 34$ months; range 4–176 months). All participants were assessed with the SCID for comorbid disorders. Only 21% ($n = 9$) had no comorbid diagnosis, and the following comorbidities were reported: depression (52%), personality disorder (29%), panic disorder with agoraphobia (26%), social phobia (10%), specific phobia (10%), and chronic pain (7%). PTSD was the primary diagnosis in all cases.

Clinical measures

The Structured Clinical Interview for DSM-IV (SCID; First et al., 1995) is a well-validated structured interview designed to ascertain diagnostic status. A specific segment of the interview assesses the criteria for PTSD. The Clinician Administered PTSD Scale (CAPS; Blake et al., 1996) is a well-validated structured interview

designed to assess the 17 symptoms of PTSD contained in the DSM-IV diagnostic criteria (Cronbach's alpha of .94 and test-retest reliability from .90 to .98; Weathers & Litz, 1994). The Post-traumatic Diagnostic Scale (PDS; Foa, Cashman, Jaycox, & Perry, 1997) is a widely used self-report measure of severity of response to traumatic events. It asks how often the patient is "bothered" by each of the 17 DSM-IV PTSD symptoms ranging from 0 "never" to 3 "5 times per week or more/almost always". It is well standardised with high validity and reliability (Cronbach's alpha of 0.92 and test-retest reliability of 0.83). Levels of depressive and anxious symptoms were measured using the well-established and validated Beck Depression Inventory (BDI; Beck & Steer, 1987) and Beck Anxiety Inventory (BAI; Beck & Steer, 1993). Both measures consist of 21 questions answered on a 0 to 3 scale providing a single sum score.

Procedure

The diagnoses of PTSD and comorbid disorders were made in a separate initial assessment session (Ehlers et al., 2005). In the first treatment session patients were asked to briefly describe their "main intrusion" from their index traumatic event, i.e., the one occurring most frequently. If they experienced many intrusions with similar frequency the most distressing of these was identified as the main intrusion. The nature of "intrusions" was defined, as in Holmes et al. (2005), as intrusive memories of trauma with sensory qualities, that come to mind spontaneously, without a conscious intention to retrieve a memory, and with a strong sense of "nowness". Hotspots in trauma memories were identified during the first reliving treatment session, following Holmes et al. (2005). A standard PTSD reliving (exposure) cognitive behaviour therapy technique was followed (e.g., Foa & Rothbaum, 1998; NICE, 2005). The patient was asked to recount their traumatic event, with their eyes closed, in the first-person present tense, giving as much detail as possible, including their emotional and cognitive states. Immediately after the reliving, patients were asked to identify the "worst moments" (hotspots) in their account. These data were written into a table as they were described,

which recorded for each hotspot separate columns for the situation, the emotions, and associated thoughts or meanings. The exact words used by the patient were recorded.

The patients were then asked if their previously identified “main intrusion” matched any of their hotspots, and if so which one. The overall procedure was designed to systematise good clinical practice and not to interfere with the process of therapy. The first reliving procedure occurred in treatment session 2 for 26 people (62%), session 3 for 12 people (29%), and in sessions 4, 5, 6, and 11 for a single person in each case. This was decided by the treating clinician on clinical grounds. In order to standardise data collection, therapists received training using a clinical manual (Holmes & Grey, 2002). Regular supervision sessions were held to monitor data collection and to address any difficulties that arose.

RESULTS

Patient symptom levels

The mean PDS score was 29.51 ($SD = 9.50$, range 11–46), with mean scores on intrusion, avoidance, and hyperarousal subscales being 9.81 ($SD = 2.90$), 14.0 ($SD = 3.56$) and 11.28 ($SD = 2.91$)

respectively. This indicates a moderate to severe level of PTSD symptoms (Foa et al., 1997). The mean BDI score was 27.0 ($SD = 10.15$, range 8–54), indicating a moderate to severe level of depressive symptomatology (Beck & Steer, 1987.) The mean BAI score was 28.00 ($SD = 13.63$, range 2–63), indicating moderate to severe levels of anxiety symptoms (Beck & Steer, 1993).

Hotspot frequency and match to main intrusion

Overall, participants reported that they had several “worst moments” (hotspots) in their memory of the traumatic event. The mean number of hotspots was 3.74 ($SD = 1.48$, range = 1–7). Only one participant reported just one hotspot. Examples of all hotspots for two participants are shown in Table 1.

Examples of main intrusions as described by participants include: “feeling like I’m thrown around in the car”; “being rushed down the corridor”; “seeing the gun”; “seeing men in balaclavas”; “the impact and pain”; “sound of glass shattering and screaming”; “seeing and smelling smoke”. Participants designated 35/42 of their main intrusions (83%) as matching a particular hotspot.

TABLE 1
Two participants’ hotspots

<i>Hotspot situation</i>	<i>Cognition</i>	<i>Coded cognitive theme</i>	<i>Emotion</i>	<i>Coded emotion category</i>
A1. Pulled onto bed	They’re going to rape me.	General threat of injury and death	Fear	Fear
A2. Getting an erection*	It’s not normal. I must want this to happen.	Esteem	Shame	Shame
A3. [few moments later]	They shouldn’t be doing this. I want to kill them.	Control and reasoning	Anger	Anger
A4. End of rape	I’ll be killed.	General threat of injury and death	Fear	Fear
B1. Near impact of other car	She’s not slowed down.	Uncertain threat	Surprise	Surprise
B2. Mount pavement	There’s a load of shit coming up.	General threat of injury and death	Panic	Fear
B3. Scaffold smashes windscreen*	I’ll be decapitated.	General threat of injury and death	Scared	Fear
B4. Hearing things hit the car	I’ll be killed. How can I make this as painless as possible? I’ve nothing to leave behind.	General threat of injury and death. Control and reasoning. Esteem.	Scared Demoralised	Fear Sadness
B5. Woman screaming at me	You should be shouting at her not me.	Control and reasoning.	Angry	Anger

Example of two participants’ hotspots illustrating a range of cognitive themes and emotions, following a sexual assault and a road traffic accident. * indicates that this hotspot matched the main intrusive memory.

Emotions associated with hotspots

There were approximately 1.56 ($SD = 0.48$) emotions reported per hotspot. The mean number of emotions reported per participant in all their hotspots combined was 5.86 ($SD = 2.75$).

Coding of emotions. Each individual emotion word used was coded to a particular emotion category, e.g., the emotion description given as “terrified” was coded as *fear*; “trapped” was coded as *helpless*.¹ The coding scheme used followed Holmes et al. (2005), with 11 categories: the basic emotions from Ekman (1994): *anger*, *fear*, *disgust*, *sadness*, and *happiness*. *Shame*, *guilt*, and *surprise* were added (Ekman & Davidson, 1994) due to their perceived clinical importance in PTSD (Lee et al., 2001). The PTSD diagnostic emotions of *helplessness* and *horror* were used (APA, 1994) as well as *dissociation* (e.g., for “numb” or “unreal”). The authors rated the emotion words independently. The inter-rater reliability was found to be high, Cohen’s kappa = 0.84 (Barker, Pistrang, & Elliott, 1996). Any disagreements were jointly allocated.

Frequency of emotion themes. The mean frequency of each emotional category reported per participant is shown in Figure 1. With respect to the diagnostic emotions for PTSD, 52% of emotions were of fear, helplessness, or horror. The most common emotion theme was fear, and dissociation, anger, sadness, and surprise all appeared more frequently than both helplessness and horror.

Cognitive themes in hotspots

Participants reported approximately 1.50 cognitions per hotspot. The mean number of cognitions reported per participant in all their hotspots combined was 5.59 ($SD = 2.08$). For examples and their coding see Table 1.

Coding of cognitions. The coding scheme described in Holmes et al. (2005) was employed. A single unit of coding corresponded to a phrase, which corresponded to each time the meaning

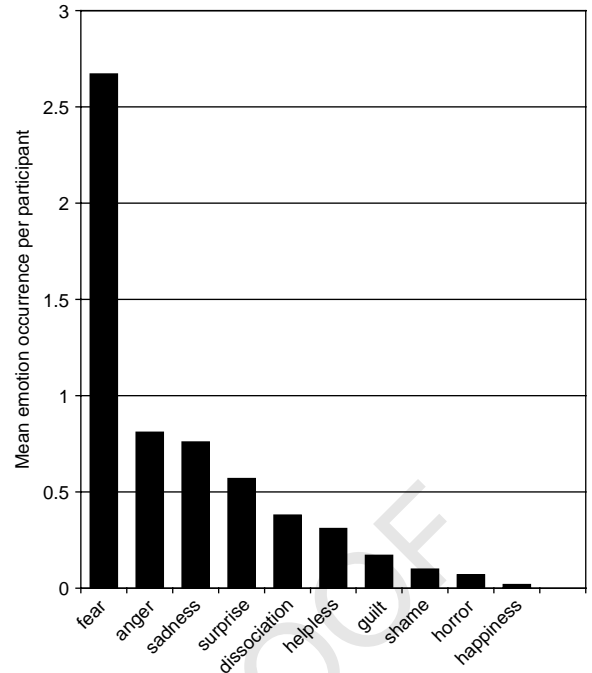


Figure 1. Mean frequency per participant for each emotion theme in trauma hotspots.

changes (following Joffe & Yardley, 2004). For the 42 patients, a total of 235 cognitions that occurred during hotspots were identified. The seven coding categories were: *uncertain threat* (unease, confusion, realisation of a non-specific threat, ongoing threat); *general threat of injury and death* (self dying, self will die, self injured, self will be injured, other death, other injury); *control and reasoning* (interpersonal reasoning, planning, revenge/injustice); *consequences* (consequences, relief, realisation after); *abandonment* (let down by others, outrage); *esteem* (self-blame/criticism); and *cognitive avoidance* (disbelief, dissociation). The inter-rater reliability was high, Cohen’s kappa = 0.82 (Barker et al., 1996). The authors agreed final groupings jointly.

The relative frequency of each the seven cognitive themes in all hotspots is shown in Figure 2. The three most common themes experienced were general threat of injury and death, control and reasoning, and uncertain threat. Two themes related to direct threat to physical integrity (general threat and uncertain threat) and the remaining five more to psychological threat to one’s sense of self (control and reasoning, consequences, abandonment, esteem, and cognitive avoidance). Themes related to threat to physical integrity were less commonly reported (44%) than the

¹ Further details of the emotion and cognitive coding schemes are available from the authors, including which categories and themes that all words or phrases were placed in.

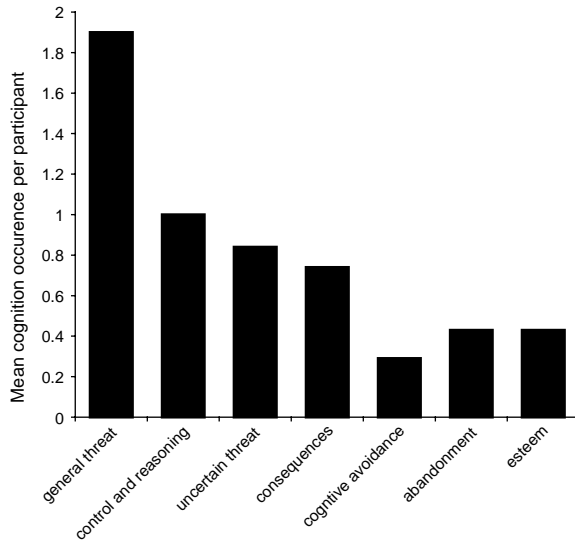


Figure 2. Mean frequency per participant for each cognitive theme in trauma hotspots.

other themes apparently associated with psychological threat to one's sense of self (56%).

DISCUSSION

The main findings of this paper replicate the results of Holmes et al. (2005) with a larger sample at a different clinic. We found that people seeking treatment for PTSD typically have a number of very distressing moments—hotspots—in the trauma memory rather than a single moment; only about half of the emotions in these worst moments are the “standard” PTSD emotions of fear, helplessness, and horror; over half the cognitions/appraisals in these hotspots are related to psychological threat to the self rather than to physical threat; and the vast majority of main intrusions are also a hotspot.

Compared to Holmes et al. (2005) the present sample was very similar in terms of levels of post-traumatic stress and depressive symptomatology, the percentage match of intrusions to hotspots, the number of emotions and cognitions per hotspot, and the pattern of emotions, with fear as the most common, followed by anger and sadness, and the pattern of cognitions, with the most common themes general threat of physical injury and death, control and reasoning, and uncertain threat. This high level of emotions other than fear is also consistent with a recent study by Speckens, Ehlers, Hackmann, Ruths, & Clark (2007). In their sample of 31 people receiving cognitive

therapy for PTSD the emotion most commonly associated with the most prominent intrusive memory was anger. The next most common emotions were “anxiety”, “helplessness” and “sadness”.

However, there are some differences in the present results compared to Holmes et al. (2005). There were fewer hotspots reported in the current sample (3.7 vs 6.1) and a higher proportion of the emotion of fear and the cognitive theme of general threat of injury and death. One methodological difference is that Holmes et al. (2005) conducted a more detailed assessment of all intrusions at assessment, whereas the current study only identified the main intrusion. Additionally the time since trauma was lower in the present sample with a larger number of more recent traumas. Marshall and Schell (2002) found recollections of peritraumatic dissociation changed over a 12-month interval, from shortly after exposure, to 3- and 12-month time points. Thus, an individual's report of hotspots may vary depending on the retention interval since trauma. It may be that soon after trauma patients recall and report fear more, and that over time, during which there is further cognitive elaboration of the intrusions, other emotions emerge and become associated with specific moments. Consistent with this Speckens et al. (2007) reported that the emotions of anger and sadness were reported by patients to be stronger during their intrusive experiences as compared to during the trauma itself. The opposite pattern was observed for anxiety and helplessness.

As in any clinical study of trauma memories the retrospective assessment of their nature should be considered. It may be argued that hotspots do not reflect processing occurring during the trauma, i.e., peritraumatic processing. It is not suggested that hotspots or the main intrusion need be a veridical replay of the actual events. They will also include worse-case scenarios, peritraumatically imagining a worse outcome than in fact occurred (e.g., Conway et al., 2004; Merckelbach, Muris, Horselenberg, & Rassin, 1998). Hotspot B3 in Table 1 gives such an example, in which the person thought that he was about to be decapitated, and in fact had an image of this happening at the time of the trauma. In treatment his main intrusion was of the scaffolding smashing his windscreen but a further intrusion was of seeing himself decapitated. The emotions and cognitions that emerge during reliving may or may not be exactly those that consciously occurred peritraumatically. However,

clinically, patients report little difficulty in distinguishing between feelings they attribute to occurring at the time of the event and later feelings. No measure of patients' degree of conviction of this distinction was included in this study, and this would be a welcome addition to future research. Memory in general can be influenced by later appraisals and by the way in which questions about the memory are posed (e.g., Loftus, 2001). In addition, in combat veterans, as PTSD symptoms increased so did inconsistencies in recall of traumatic events when assessed in a test-retest procedure, 2 years apart (Southwick, Morgan, Nicolaou, & Charney, 1997).

This is a clinical study rather than an experimental one, and as such its strengths are its clinical depth and detail, which aim to provide a springboard for future research studies. Clinicians were seeking to identify hotspots as part of normal treatment of PTSD (Ehlers et al., 2005), and this was done in a consistent fashion following the first reliving (usually session two or three). This should reduce the likelihood that treatment had already affected the nature of the traumatic memory reported, but clearly there are demand effects of being asked about such "worst moments" (cf. Jones et al., 2003, who found little mention of flashbacks in war pension records of ex-servicemen prior to recent conflicts). Further research could include asymptomatic control groups, both trauma-exposed and not, in order to examine the nature of any memory hotspots that they may have. Hotspots may occur in memories more generally, especially as highly emotive intrusions are not limited to people with PTSD (Day, Holmes, & Hackmann, 2004; Holmes, Arntz, & Smucker, 2007; Holmes, Crane, Fennel, & Williams, 2007; Pillemer, 1998; Reynolds & Brewin, 1999), and there is some evidence that there may not be special memory mechanisms unique to experiencing traumatic events (e.g., Geraerts et al., 2007). However, a recent review concluded that trauma and non-trauma memories do differ in clinical populations (Brewin, 2007), and we defined hotspots as those parts of a trauma memory that cause high levels of distress and are associated with intense re-experiencing. Future research should seek to determine whether there are hotspot characteristics that distinguish symptomatic and non-symptomatic individuals.

The presence of hotspots in descriptions of traumatic memories is also consistent with the theory that traumatic memories may act a

"landmark", by which they form dysfunctional reference points for the organisation of autobiographical memory of people with PTSD symptoms (Berntsen, Willert, & Rubin, 2003). One or more hotspots may themselves be the aspects of the traumatic memory that become the landmark, rather than the complete traumatic memory.

A further limitation to this study is that formal symptom validity tests in addition to the SCID were not given to patients. However, there were convergent measures of PTSD, including both self-report questionnaires and structured interviews. This is the same level of information typically provided by leading clinical research groups in the field (Ehlers et al., 2005).

In conclusion, there is converging evidence from this and previous studies that indicate there are several worst moments or hotspots in trauma memories, which are associated with high distress. It is not simply fear that is experienced at these times but a range of emotions. The sense of current threat in re-experiencing trauma memories is not limited solely to the threat to one's physical integrity but also to one's sense of self—"psychological threat" (Conway et al., 2004; Conway & Pleydell-Pearce, 2000; Ehlers & Clark, 2000). This suggests clinically that additional cognitive restructuring techniques used within reliving/exposure treatment may increase the effectiveness of treatments (e.g., Ehlers et al., 2005; Grey et al., 2002), especially since high levels of emotional engagement do not always lead to habituation or good outcome for all individuals in even well-controlled prolonged exposure trials (Jaycox, Foa, & Morral, 1998). This might be particularly so for appraisals linked to psychological threat that themselves may be associated with a diverse range of emotions such as anger, sadness, guilt, and shame. Some preliminary evidence supporting this has been provided by Arnzt, Tiesma, and Kindt (2007) who found that the addition of rescripting to imaginal imagery leads to better effects on non-fear emotions such as anger and guilt.

It is hoped that these clinical data may stimulate much-needed future research studies in this complex area, including controlled experimental studies. One challenge will be to better link clinical conceptualisations of PTSD with contemporary autobiographical memory theory. For example, taken together, certain features of hotspots such as being short-time slices of the wider trauma experience, recalled with high affect, distinctive meaning for self, and being

relived with a sense of recollective experience, seem highly related to the characteristics of episodic memory identified by Conway (2001, 2005). Hotspots may then be highly vivid episodic memories. It will be an exciting challenge to bridge insights from episodic memory research to the clinical trauma arena. Indeed, the theoretical and clinical significance of this may indeed reach beyond PTSD to other psychological disorders in which intrusive imagery is a pathological feature, such as agoraphobia, social phobia, and obsessive compulsive disorder (Hackmann & Holmes, 2004; Holmes & Hackmann, 2004).

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