The role of peri-traumatic visuo-spatial and verbal interference on the development of intrusions.

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Abstract

Intrusions are regarded as a ‘hallmark’ symptom of Post-Traumatic Stress Disorder, yet relatively little is known about their formation and development. This thesis was an experimental examination of potential information processing factors implicated in intrusion development. The thesis begins with an examination of PTSD in the context of intrusions, followed by a review of the main theories of PTSD symptom development and the place of intrusion development within these. Recent theories of PTSD are examined, specifically Dual Representation Theory (Brewin, Dalgleish, & Joseph, 1996), which regards PTSD as a ‘hybrid’ disorder that involves two distinct yet parallel types of memory encoding one based in part on sensory, visual processing, the other on verbal/narrative based processes, the interaction of which can lead to intrusion development under certain conditions. This thesis attempted to replicate and extend research (Holmes, Brewin, Hennessy, 2004) founded on dual-representation theory, that explored the role of peri-traumatic visuo-spatial and verbal processing in the formation of intrusions based on a trauma analogue film.

40 non-clinical participants were involved either a control condition, or one of two dual-task interference conditions: a visuo-spatial interference
condition (involving tapping out a key pattern of a hidden keyboard); and a verbal interference condition (involving counting backwards in threes). Participants were instructed to watch a trauma-analogue film designed to generate intrusions, whilst performing the task they were allocated. Diary measures were taken of subsequent intrusions experienced in the week following exposure to the analogue trauma film.

Visuo-spatial interference appeared to significantly disrupt the formation of intrusions, while there was a trend for verbal processing to increase intrusions. The visuo-spatial interference task did not impact on attention to the film, or features of either recall or recognition of film material. For the verbal interference condition, there was also significantly more visual imagery type intrusions, more data driven processes reported, and a reduction in recall memory and attention to film. Increases in state dissociation were also implicated in higher reported intrusions.

These findings were discussed in the context of current theories of intrusion formation, and in terms of clinical implications for the assessment and treatment of intrusions in PTSD.
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Introduction

Post Traumatic Stress Disorder (PTSD) was first formally recognised in 1985 by DSM III (APA, 1985), and had been identified primarily by symptoms of vivid intrusive imagery following a traumatic event. Despite the fact that inherent to the concept of PTSD is exposure to a 'traumatic' event, not all individuals exposed to such an event subsequently develop the same level of intrusive images. This suggests that exposure in itself, whilst necessary to the concept of PTSD, is not sufficient for developing the features of the clinical syndrome. More recently, concepts from cognitive and experimental psychology have provided innovative frameworks for creating methodologies to explore the development of the key intrusive features of PTSD.

One central model in the developmental of this research, and a theoretical basis of the experiments this thesis attempts to replicate and extend (Holmes, 2000; Holmes, Brewin & Hennessy, 2004), is Dual Representation Theory (Brewin, Dalgleish, & Joseph, 1996). This theory focuses on the ways traumatic information may be represented in memory, hypothesising that such information may be represented in two distinct formats, one influenced by visual encoding and the other by narrative processing. The extent to which different symptom types, i.e. intrusive and
avoidant symptoms, are expressed depends on how information has been encoded by the individual.

This theory fits particularly well with the more recent exploration of so-called peri-traumatic factors in the formation of PTSD symptoms, i.e. factors present in or around the moment of traumatic exposure that may distort or predispose processing of traumatic material in particular modes potentially leading to developing different symptoms of PTSD. Key in this approach is that PTSD is a hybrid disorder with two distinct pathways leading to the different symptoms defined in its classification (Brewin & Holmes, 2003), both the hallmark intrusive images and elements of avoidance and disruption in meaning also associated with the clinical syndrome.

1.1. Aim of the Thesis

This thesis adopts a cognitive-experimental methodology developed by Holmes and colleagues (Holmes, 2000; Holmes et al., 2004) to explore the factors that promote or inhibit the development of a key symptom of PTSD, the phenomenon of intrusive imagery. The thesis initially explores the development of models concerning the processes involved in the formation of symptoms in PTSD, followed by a closer examination of Dual Representation Theory. It then sets out the basis for the empirical
investigation of intrusive imagery based on the theory that traumatic events can be laid down in memory in a primarily non-verbal form, rich in sensory, situational, and visual information. When encoded in such a fashion, traumatic information present at the time of trauma is prone to automatic and non-conscious activation in the form of imagery based intrusions, triggered via sensory and situational cues.

Holmes et al. (2004) used peri-traumatic tasks designed to selectively interfere with either verbal or visual encoding, thereby investigating such interference on the two routes by which memories are hypothesised to be encoded during trauma. The extent that task interference impacts on the production of traumatic related intrusions is taken as a measure of the involvement of the process targeted by the interference task. This thesis attempts to replicate the findings of these studies and extend the empirical data using additional measures of processing, traumatic pathology, and extensions of the intrusion recording methodology.

1.2. Layout of Thesis

Chapter one begins with an examination of the literature investigating the clinical features of PTSD, with a focus on the phenomenon of intrusive cognitions. Processing theories of PTSD are examined, with particular attention to Dual Processing Theory and more recent information
processesing approaches incorporating theory-practice links. The current research on peri-traumatic interference will be examined with reference to Holmes et al.'s (2004) work. The specific extensions that this study employs in relation to this research are then defined in relation to the current hypotheses of this study. Chapter Two details the specific methodology of this study, while Chapter Three presents the empirical outcomes and data analysis, which is discussed in detail in Chapter Four in the context of current research and practice in the treatment of PTSD.

1.3. Clinical and Epidemiological Features of PTSD

The phenomenology of PTSD involves marked intrusive features regarding the experience of the traumatic event or events. Alongside these hallmark symptoms, other domains of symptomatology are often present in behavioural, and affective domains. Some individuals also experience longer term disruption of prior relationships and assumptions regarding the world, self-efficacy, and others, with these constructs being coloured by threat, danger, and avoidance.

There are currently two recognised diagnostic classifications of PTSD, as defined by the ICD 10 (WHO, 1992) and DSM IV (APA, 1994) diagnostic systems. Both systems acknowledge the importance of a traumatic event as a precursor in the development of PTSD. The definition of 'a traumatic
event' is similar in both systems, emphasising the importance of severity, although DSM IV is more specific in what constitutes such an event. DSM IV defines traumatic events by content and associated emotional reaction; primarily they involve 'actual or threatened death or serious injury, or a threat to the physical integrity of self or others', accompanied with fear, helplessness or horror.

ICD 10 is less specific on the definition of a traumatic event, but focuses rather on the degree of distress aroused, defining such events as of 'exceptionally threatening or catastrophic nature, which would be likely to cause pervasive distress in anyone' (ICD 10, 1992, p.168).

Both diagnostic systems offer a relatively wide breadth of definition regarding the specific types of event necessary to generate a traumatic response, but identify necessary features of extreme threat and distress involving the recollection of a particular event. This therefore allows a wide range of events and situations to act as traumatic antecedents, ranging from military action and torture, to road traffic accidents, natural disasters and assault.

With regards specific symptom types within the domain of PTSD, DSM IV requires the presence of symptoms in each of three domains: persistent re-
experiencing; persistent avoidance of stimuli associated with the traumatic event or numbing of general responses; and symptoms of hyper-arousal. These symptoms need to be present for at least one month, and cause significant distress or impairment in various areas of functioning.

In contrast, ICD 10 focuses primarily on the re-experiencing and intrusive symptoms identifying key features of PTSD as the ‘...repetitive, intrusive recollection or re-enactment of the event in memories, daytime imagery, or dreams.' It recognises that while features of emotional detachment, numbing or avoidance of traumatic stimuli are commonly present, they are not necessarily required for a diagnosis of PTSD, and similarly neither is the presence of autonomic arousal, mood disorder or behavioural disturbances.

Both diagnostic systems therefore identify re-experiencing, of which intrusive phenomena are representative symptoms, as a core feature of PTSD, however, they differ in the relative diagnostic necessity for which emotional numbing and other factors are key to a classification of PTSD (e.g. Yule, Williams, & Joseph, 1999).

1.3.1 The development of PTSD

A key issue in PTSD research that has been locked into the debate over the
development of PTSD symptoms since it was first formally defined in 1980, is that not all individuals who are exposed to traumatic events go on to develop problematic symptoms. An often quoted study of Australian fire-fighters (McFarlane & Papay, 1992), found that of 300 people involved in a serious bush fire where colleagues died, only 18% developed PTSD and 10% depression at 42 months post event. In a recent review of the literature by Lee and Young (2001), around 93% of the population are reported as having been exposed to traumatic events, but only 5-12% go on to develop PTSD. Lee and Young did find evidence of elevated rates of PTSD occurring in survivors of severe types of events such as torture/kidnapping (53.8%), rape (49%), followed by serious assault (31.9%) and sexual assault not involving rape (23.7).

The lack of a direct correspondence between traumatic events and subsequent PTSD has led research to explore what factors may contribute to symptom development, beyond event type and severity. Brewin, Andrews, and Valentine’s (2000) meta-analysis of risk factors for developing PTSD found 14 risk factors, the most consistent and strongest were trauma severity, lack of social support post-trauma, and life stress post-trauma; followed by smaller effects due to: prior psychiatric history; childhood abuse; familial psychiatric history; lower socio-economic status; lack of education; low intelligence; prior non-abuse trauma; and adverse
childhood environment. As summarised by Lee and Young, peri-traumatic and post-trauma factors act as the strongest reliable factors in developing PTSD.

A full theory of the development of PTSD would involve consideration of the complex bio-psycho-social features incorporated in the ethnography of PTSD. However, a core area of research in PTSD has focused on formulating models of PTSD development in terms of the psychological mechanisms and processes potentially implicated in traumatic symptom development. This research attempts to make sense of the contingent presentation of PTSD in terms of current frameworks of psychological functioning. Such approaches are amenable to developing experimental manipulations, and hence allow some degree of isolation regarding potential components implicated in reactions to trauma. Crucially, they may also allow the development of a clinical focus on treatment development and evaluation, which is a central interest in this thesis.

1.3.2. The Phenomena of Intrusions in Post Traumatic Stress Disorder
As already noted, the hallmark aspect of PTSD is its intrusive imagery, at times also referred to as ‘flashbacks’. The striking feature of these intrusions has been their vivid and highly emotionally charged re-experiencing of the original trauma which differs in quality from other
forms of memory recall. Survivors of trauma often describe losing touch with their current environment and being placed back in the midst of the traumatic situation, re-experiencing the emotions they originally had without a loss of the original intensity.

A core feature of these flashbacks is the high levels of sensory and visual detail, which appear often in a disjointed or fragmented fashion rather than as a direct playback of the original event. Relatively little research has investigated this common feature of PTSD, and only recently has it been explored in relation to psychological processes involved in the processing of trauma related information. Any theory of PTSD is required to account for these phenomena and how they may arise out of exposure to traumatic event and present longer term difficulties for some individuals and not others.

1.4. Theoretical Models of PTSD

A wide range of theories now exist to account for how people develop PTSD following traumatic experiences. While certain factors indicate a pre-disposition to develop PTSD following particular events, the key interest of this thesis is examining how cognitive factors such as information processing may lead to the development of PTSD symptoms experienced, as these factors have a significant bearing in modern psycho-
therapeutic approaches to PTSD. A number of these early theories emerged around the early to mid 1980's; at the time the APA formally recognised the classification of PTSD in DSM III (APA, 1980). Some of the general theoretical models are reviewed here, before exploring more contemporary theories including Dual Representation Theory and its influence on the empirical work in this thesis. This review is based upon extensive reviews by Thrasher and Dalgleish (1999) and Brewin and Holmes (2003).

This section aims to focus on some of the key issues in the development of theories of PTSD, particularly the evolution of understanding regarding trauma related aetiology and how current theories develop from inconsistencies and gaps in these early approaches. These early theories therefore provide a basic conceptual canvas for locating the later theories upon which this thesis is based.

The starting point for this section is the seminal work of Rachman (1980), whose concept of ‘emotional processing’ laid down some of the foundations for future processing theories, and is a concept of considerable importance in the therapeutic literature. It is a vital concept, as it distinguished from material that can or has been worked through and is no longer causing high levels of distress, versus material that still creates distress and has become ‘stuck’ in the process of being worked through. A
distinction that may be made between people who experience longer term problems after trauma and those that tend not to based on this concept. Single level or unitary process models of PTSD will then be examined, before exploring the multi-process models which attempt to resolve some of the difficulties single level models have in accounting for the breadth of PTSD symptoms. The first type of single level approaches will be socio-cognitive theories, which attempt to understand the longer-term impact of traumatic experiences and symptoms on a person's relationship with themselves, others, and the world in general.

1.4.2. The Concept of Emotional Processing
Rachman (1980) developed the concept of 'emotional processing' to capture the features in the individual and the environment that promote or reduce ones recovery from stressful events. Following experience of a stressful or threatening event, individuals may for a time experience heightened anxiety reactions as a natural feature of mammalian threat responses. Over time the individual begins to locate the threat in the past and their anxiety reactions diminish as they process the initial event as no longer threatening to them.

Emotional processing is regarded as a normative process through which initial reactions to threat are worked through, leading to an abeyance in
anxiety over time. However, in certain situations and individuals, the initial threat is so overwhelming that normal habituation does not occur and the anxiety reactions become prolonged and accentuated, indicating a failure to emotionally process the threatening material. PTSD is a prime example of incomplete emotional processing, and contemporary therapeutic perspectives, especially cognitive behavioural approaches, tend to be aimed at promoting adaptive processing of emotional content.

1.4.3. Socio-Cognitive Theories of PTSD: The processing of meaning.
Socio-cognitive approaches share a common framework in their attempts to understand how trauma impacts on individuals’ relationships with the world, or more accurately, their relationships with prior understanding about the way the world is. These models are not necessarily unique to PTSD and have applicability to a number of clinical difficulties, but they do begin to demarcate where differences between PTSD and other disorders would fit, an issue picked up in the following section when examining information processing theories.

Horowitz’s Stress Response Theory
Horowitz’s (1986a; 1986b) theory hypothesises that two opposing processes operate following people’s experiences of traumatic events; integration and inhibition. Integration of any new material into prior
knowledge is seen by Horowitz as a general feature of human experience called the ‘completion tendency’; a desire to match new information to information already contained in one's inner world. However, information based on traumatic experiences may have particular qualities that initially overwhelm the completion tendency and prevent integration of the information. These qualities include a marked incongruity with past knowledge, substantially reducing the means by which traumatic information may fit in with prior knowledge, and a high level of distress associated with the event itself promoting defence mechanisms further suppressing awareness of the traumatic material.

After traumatic exposure an individual may therefore experience fluctuations between initially inhibitory defensive responses on the one hand, and subsequent attempts at integration of the traumatic material over time into prior knowledge on the other hand. Each attempt at completion should reduce associated distress. Distress reduction occurs either by habituation or through modifying prior knowledge to accommodate the traumatic material. Intrusions are seen as a key feature of activation/integration processes linked to the completion tendency. In some individuals, however, the avoidance/integration cycle becomes stuck and the traumatic material is not processed, the individual thus remaining locked in the intrusion and avoidance cycle.
Horowitz's approach has at its core a fundamental realisation of the importance of peoples’ pre-existing representations of the world with regards traumatic symptoms. The model holds an explanatory and intuitive appeal of how traumatic events lead to cyclical re-experiencing of intrusive traumatic material, and how this may be a part of a functional attempt at emotional processing of such material. However, the theory does not directly address the potential mechanisms involved in the integration of traumatic content and does not examine in detail the issue of individual differences regarding the capacity to integrate traumatic experiences, and how some individuals get stuck in the process.

Janoff-Bulman – The Model of Shattered Assumptions.

Another similar socio-cognitive approach that has enjoyed considerable interest has been Janoff-Bulmans’ Shattered Assumptions Model (Janoff-Bulman, 1992). This approach focuses on the way traumatic symptoms may emerge from violations of the basic beliefs a person has about the world and themselves. This model revolves around the concept that people have internal models of the world as just and benevolent which allows them to function with some degree of confidence, safety, and a sense of agency. Traumatic experiences act as exemplars of events that are incongruent with these pre-existing beliefs about a just world, and for some people this incongruence becomes catastrophic as they can no longer trust
in the belief that the world is safe or just, or that they are invulnerable. In this model the ‘shattering of assumptions’ is what leads to PTSD symptoms by preventing an individual assimilating these experiences, and hence developing ongoing anxiety regarding the world and their relationships between it and themselves.

An intuitive and appealing approach, however, certain predictions from this model do not match empirical findings. For example, the model predicts that people with high levels of pre-existing ‘just world’ beliefs will be more affected by trauma than those who have already had their assumptions shattered, the ‘fall’ is greater for them. As noted earlier, the opposite tends to be true in that previous trauma is a key risk factor for the development of future traumatic symptoms. An additional difficulty with this model, shared with the Stress Response model, is that it lacks detail regarding the short-term mechanisms operating following trauma, and the processes involved in these.

1.4.4. Information Processing Accounts of PTSD

Socio-cognitive accounts provide an understanding of the potential long-term impact of trauma, but they do not explain the specific mechanisms involved in intrusive symptoms. They remain vague on the mechanisms implicated in the immediate impact of trauma on an individual and how
these mechanisms mediate and moderate processes involved in the reception of information. In contrast, information processing models attempt to map out the factors influencing the encoding of traumatic memories and how these may contribute to developing trauma-related symptoms, particularly intrusive content. These models focus more on the immediate reactions to trauma and recruit core concepts from the areas of behavioural psychology, cognitive psychology, and more recently cognitive neuro-psychology to expand understanding of traumatic experience. The central focus of these approaches is that traumatic symptoms emerge from the way trauma memories are encoded, and that there is something about this encoding that inhibits emotional processing of the event.

Information processing models have a persuasive appeal for exploring PTSD as the hallmark symptoms suggest distortions of underlying cognitive processes in memory and attention, such as the retrieval of memories of a certain event, interpretations of threat, and hyper vigilance (Thrasher & Dalgleish, 1999). This is further supported by experimental evidence suggesting the presence of memory and attention biases for trauma related information (for review see Thrasher & Dalgleish 1999; Brewin and Holmes, 2003).
Dissociation

In terms of PTSD research, dissociation is seen as a pathological disruption in the usual integrated processing of information, which leads to traumatic information being separated off or dis-integrated from other forms of memory and memory related processes involved in perception of the self and the world. The original theory of dissociation, developed by Janet in the late 1880’s to explain principally hysterical phenomena, suggested that after traumatic experiences parts of the self may become split off from the main structures of knowledge, memory, and self. These separate ‘complexes’, as Janet called them, are segregated along with affective and behavioural patterns that can be activated and maintained automatically outside of the awareness of the main personality, but still impinging upon consciousness by their consequences.

A number of prospective studies have indicated that peri-traumatic dissociative-type distortions, such as alterations in the perception of self and reality based on pervasive feelings of detachment, de-personalisation, de-realisation, and at times amnesia, are strong predictors of the development of subsequent intrusive pathology (e.g., Murray, Ehlers, & Mayou, 2002; Engelhard, van den Hout, Kindt, Arntz, & Schouten, 2003; Ozer, Best, Lipsey, & Weiss, 2003). These peri-traumatic distortions are often seen as a key defence mechanism against the immediate
overwhelming experience of a traumatic event (Cardena, 1994). More recently researchers have suggested that dissociation reflects a ‘freeze’ type defensive response similar to that seen in animals (e.g. Nijenhuis, Vanderlinden, & Spinhoven, 1998).

From a more experimental approach, Murray (1997) and later Holmes (2000) used a non-clinical sample to investigate how instructions to dissociate while watching an analogue traumatic stimulus, a stressful film of road traffic accidents, influenced formation of intrusions in a two week period following exposure. These findings did not support a direct link between number of intrusions and instructions to dissociate, but did find significantly more intrusions for those with higher trait dissociation.

While a promising avenue of investigation, theories based on dissociative processes face an inherent semantic difficulty in identifying a precise definition for the term itself and the symptoms it encompasses. Researchers (e.g. Cardena, 1994) have argued that without an agreement on its basic operational features, the definition of any process as ‘dissociative’ risks vague over-inclusion at best, a clear problem when looking for mechanisms of action regarding the development of traumatic symptoms.
The issue is complicated further as some authors view dissociative phenomena as occurring on a continuum (Waller, Putnam, & Carlson, 1996) encompassing experiences ranging from pathological (Dissociative Identity Disorder) to the mundane, such as daydreaming or absorption. However, the current psychometric literature using the Dissociative Experiences Scale II (DES II: Carlson & Putnam, 1993), the ‘gold standard’ measure of dissociation, has begun to identify a qualitative distinction between mundane dissociative phenomenon which are continuum based revolving around imagination and absorption, and more pathological experiences potentially identifying a taxonomic element predisposing individuals to dissociative pathology (Waller, et al. 1996; Waller & Ross, 1997). The concept of dissociation along these terms has begun to broaden our understanding of how dissociative processes may represent a constitutional bias expressed during traumatic events that may subsequently maintain trauma related pathology in some individuals. However, the nature of these processes still requires extensive research and in many ways is at a relatively early stage of investigation.

**Conditioning Theory**

Conditioning theory, as a purely behaviourist approach, is not necessarily about the way information is processed on a cognitive level. However, the basic theories of learnt associations between environmental stimuli and
PTSD related responses forms the foundation of a number of information processing approaches to the anxiety disorders and PTSD specifically and is therefore worth discussing here. Conditioning approaches to anxiety disorders suggest that an initially neutral stimulus acquires fear related responses when this stimulus occurs within a fear provoking situation, thereby becoming associated with fear elicitation.

Another influential model is Mowrer's (1960) two-factor learning theory which suggests that while the initial fear response is acquired by classic associative conditioning to a conditioned stimulus, it is subsequently maintained through operant conditioning based on functional avoidance of the fear conditioned stimulus. Such operant responses negatively reinforce the original fear conditioning and prevent its extinction by reducing habituation of the conditioned stimulus in non-threatening contexts.

These models provide an excellent rationale for exposure work especially regarding the role of behavioural avoidance in maintaining symptoms, but they lack explanatory power regarding more cognitive features of PTSD such as re-experiencing symptoms, or cognitive factors potentially involved in PTSD.
Network Theories

A number of theories have emerged around the concept of information networks within which a trauma memory is situated, forming specific types of connections to behavioural, affective, and cognitive systems that give trauma memories their affective tone and behavioural/cognitive response features (Chemtob, Roitblat, Hamada, Carlson, & Twentyman, 1988; Foa, Steketee, & Rothbaum, 1989; Litz & Keane, 1989; Creamer, Burgess, & Pattison, 1992). Such approaches see these encoding features as preventing emotional processing.

One of the most prominent early network type theories was developed by Foa et al. (1989) in relation to anxiety disorders and PSTD, based on behaviourist principles of conditioned learning of associations, but also examining the role of cognitive mechanisms in anxiety disorders, and was later developed as a more specific theory of PTSD. Their initial theory was based on Lang’s Bio-informational theory (e.g. Lang, 1979) and the concept of fear structures, which was an approach integrating behaviourist principles into wider cognitive perspectives regarding phobic disorders.

Central to Foa et al. (1989) work was Lang’s hypothesis that fearful events are encoded in memory as interconnected patterns of stimuli ‘nodes’ within an associative network. Each node could represent features of three main
domains of information about an event: stimulus information about sensory features of a situation; affective information including physiological flight/fight responses; and interpretations about an event especially in terms of its potential threat. As each network node was associated to differing degrees with other stimuli nodes, activation of one node could lead to activation of others in the network, hence providing an explanation for how certain environmental triggers can elicit particular feared responses and intrusive cognitions based on the original event.

Foa et al. (1989) adapted Lang’s concepts to a more specific model of PTSD by suggesting that in addition to the presence of a fear network surrounding the traumatic event, these events are represented in memory in a much stronger fashion than previous associations or memories. Traumatic events significantly overshadow past associations, especially those involving individual interpretations regarding the world, such as associations about the meaning of personal safety. This model indicates that traumatic events are encoded in memory in a different way from other memories. These memories replace previous associations of safety such that their impact is substantial and catastrophic as the patterns of fear response generalise to a wide range of potentially safety related situations. This network was also seen to have a low activation threshold, leading to
more generalised activation of a learnt trauma response pattern when faced with a broad pattern of cues.

The impact of overturning prior assumptions, as encoded in previous non-fear related networks, is that very general cues may lead to a sense of threat and hence activate associated feelings and behaviours related to potential vulnerability. Foa et al. emphasised that to understand traumatic symptoms and responses more was required than basic conditioning theory, the concept of the meaning of events has to be intrinsically involved in clinical models, and hence advances on both conditioned theory and aspects of the socio-cognitive models detailed above.

A basis of this model is that the emotional processing of trauma memories is reduced due to their very strong and potentially generalised roots. Exposure to the feared stimulus may allow habituation to fear and incorporation of non-feared information regarding the traumatic stimulus (e.g. Foa and Kozak 1986). However, Foa et al. (1989) suggest that despite prolonged exposure, traumatic associations may continue, unless key maintenance features of the network are targeted, such as high levels of arousal or selective attention preventing attending to disconfirmatory evidence.
These network theories clarify and formalise some of the key features of the socio-cognitive accounts of trauma within current mechanisms from learning and cognitive theory, focusing primarily on the fear responses associated with a traumatic event and their development post-trauma. They repeat and clarify the importance of reduced integration of traumatic information, interpreting this lack of integration as a blocking or overshadowing by traumatic memories, strongly superseding previous held associations regarding safety. Such clarification allows an understanding of how traumatic events are encoded to produce the hallmark symptoms, such as intrusive re-experiencing.

Information processing approaches, however, do not specifically address the issue of flashbacks or necessarily allow a differentiation of these from other cognitive responses in trauma. They also have difficulty in accounting for how a single traumatic memory can produce vivid flashbacks, while also being fragmentary and containing gaps (Brewin & Holmes, 2003). In this sense, the same memory structures are attempting to account for phenomena of vivid and at times detailed features, associated with heightened physiological activity, but then need to explain how such a memory can appear considerably incomplete when consciously recalled. These models also struggle to account for a number of other emotional and cognitive risk factors that may contribute to developing trauma (Brewin &

1.5 Multi Level Theories of PTSD

The theories reviewed thus far have assumed that traumatic events are represented in memory as a single memory trace and focus on how this memory develops into either short or longer term psychopathology as emotional processing breaks down. The socio-cognitive approaches focus mainly on the development of longer term avoidance as a result of severe incongruence between the occurrence of a traumatic event and prior information/beliefs. These theories, however, do not account well for cognitive biases present in traumatised individuals, or for the more overt symptoms such as flashbacks and heightened fear response. Information processing accounts focus on the encapsulation of traumatic memories within structures of information related to strong stimulus links, especially associated with extreme threat/fear responses, leading to intrusive and hyper-arousal symptoms, but conversely do not account for longer term memory disruption.
Each theory examined thus far only focuses on a specific feature of PTSD, and does not mark out traumatic memories as differing in nature from other memories. None of the theories so far provide an overarching model of all the symptoms associated with PTSD. A synergy of the basic principles of these theories is required to make sense of the different symptoms within the domain of PTSD.

Brewin et al. (1996) argue that in order to achieve such a synergy and explain the whole symptom domain of PTSD within one theory, a fundamental requirement is to perceive trauma related information as represented in two distinct, but parallel formats. A single level of representation, by which is meant the way that information is encoded within memory, cannot account for both the powerful intrusive experiences underlying flashbacks, and the general disruptions in identity, self and world appraisals that may also form part of PTSD symptoms, or how prior beliefs may act as risk factors for developing PTSD. Dissociation approaches do traditionally assume trauma memories are processed differently from autobiographical information. However, approaches to dissociative theory at this time lack the depth of definition to hold much explanatory power as they stand.
The two principal theories reviewed in this next section, Dual Representation Theory (DRT: Brewin et al. 1996), Ehlers and Clarks’ cognitive model (Ehlers & Clark, 2000), examine complex processing features potentially involved in developing the varied symptoms of PTSD and form the basis for the research this thesis attempts to replicate and extend. They are detailed below along with empirical evidence supporting them and finally examined in relationship to the formation of the key paradigms and hypotheses for this thesis.

Dual Representation Theory

Dual Representation Theory (DRT) provides an overarching framework for understanding the hallmark symptom of PTSD, intrusions/flashbacks, while also explaining how longer-term appraisal based problems can develop post trauma, and how these can be related to pre-traumatic beliefs. The theory proposes that traumatic memories are encoded by two distinct, but parallel types of memory system, one involving a verbal or narrative type of representation called Verbally Accessible Memories (VAM), the other using primarily non-verbal and mostly sensory or imagery based coding and called Situationally Accessible Memories (SAM). These distinct types of representations have certain specific properties that are predisposed towards certain symptom profiles, with SAMs being the basis of intrusive imagery such as flashbacks, and VAMs being based on appraisal of
meaning related to longer term disruptions in evaluating identity and the world. The development of certain types of symptoms indicates the precedence of one system over the other at a certain time.

VAMs represent memories that are verbally or orthographically retrievable and are the outcome of information processing based on sufficient conscious attending during and after the traumatic event. The narrative code underlying VAM and the nature of the memory system responsible for their production, not only makes them accessible at will, but also allows them to be integrated within autobiographical information. This allows them both to be located within a personal temporal context, and to become updated after the trauma through appraisals involving the meaning of the traumatic event and its impact on a person’s view of self, the world, and others. VAMs represent the basic cognitive products involved in socio-cognitive type approaches, and are based on more normative memory systems. It is also important to note that prior beliefs may act as risk factors for developing maladaptive appraisals of the traumatic event. Encoding a situation as VAM does not necessarily reduce symptomatic impact, but may lead to different symptom types. What VAM encoding cannot account for easily is the occurrence of flashbacks and other imagery related intrusive content.
As the memory system responsible for encoding VAMs is restricted in the amount of information that it can process, based on the maximum information held in active or working memory, such memories may be relatively incomplete. In addition to this, heightened physiological arousal, while initially conducive for such processing, over time may lead to increasingly narrowed attention and further restrict information attended to. Consequently, there is a considerable amount of information, especially a large amount of low level perceptual/sensory inputs, that may not be encoded via the VAM system.

The remainder of incoming information not encoded by VAMS, a majority of which is low level sensory and perceptual features of a traumatic event, are coded as SAMs. In contrast to VAMs, SAMs are produced by a non-verbal and primarily associative memory system which encodes stimuli rapidly but with too little attentional processing. SAMs are separate from autobiographical information, are not communicable verbally or orthographically to others, due to being represented in a non-verbal code, and hence they cannot be updated by current or prior information stored in long term memory, and also are not deliberately retrievable. They are, however, prone specifically to non-conscious activation by virtue of their associative encoding, mostly triggered by basic perceptual and sensory cues similar to those occurring at the time of the traumatic event. These
memories only contain sensory and perceptual information occurring at the
time of trauma, and remain contextless with regards to personal experience.
They are encoded in a non-verbal format because they receive too little
attention during traumatic exposure to be subsequently represented as
VAMs.

It is the automatic and involuntary activation of SAM encoded traumatic
material that subsumes the key features of flashbacks, as individuals are
open to uncontrolled activation of intense unprocessed intrusive imagery.
The occurrence of flashbacks is therefore perpetuated by the lack of
integration of SAMs into a narrative form which would allow deliberate
conscious control or updating of SAM information within personal
meaning and temporal contexts.

The lack of verbal encoding in SAMs also predisposes an individual to
contextual distortions often associated with flashbacks, such as re-living
the trauma as if it was happening in the present, rather than having
occurred in the past lacking the temporal ordering of personal experience
coded in autobiographical memory. As SAMs do not distinguish temporal
contexts, being encoded outside of a temporal narrative, current cues or
reminders of the traumatic events lack a temporal context to place them in
the past, and so are experienced as occurring in the present activating fear
system responses with all the potential strength of the original trauma. A diagrammatic representation of this approach, based on Brewin et al. (1996; Brewin, 2001) is presented in figure 1.1.

The concepts of SAM and VAM representations provides a key rationale for how specific processes occurring at the time of trauma may bias production of non-verbal imagery based representations, and how these may be different and separate from appraisals made during or after the event. A key aspect of DRT is that SAM and VAM systems operate in parallel at the time of a traumatic event, laying down different memories with different properties. SAM allow an understanding of how certain traumatic phenomena, specifically intrusive imagery related symptoms such as flashbacks, are more automatically activated, have stronger links to fear/threat responses, and are unregulated by conscious processing and updating such as emotional processing. DRT provides a framework for distinguishing processes that are recruited at the time of trauma versus those that may operate following the trauma, in terms of ongoing appraisal mechanisms (Brewin & Holmes, 2003).
Figure 1.1. Detailing the process of laying down VAM and SAM representations and their involvement in triggering intrusive phenomena following exposure to subsequent traumatic cues. Strong VAM representations act as competing representations for access to the associative system and can inhibit activation of this system and hence prevent automatic activation of associated fear responses. Weak VAM representations cannot compete with stronger SAM representations, often promoted by high distress during the traumatic event. In such cases SAM representations are activated and subsequently lead to activation of associated fear responses. (Based on Brewin et al. 1996; Brewin 2001; Mannu et al. 1999).
DRT is open for empirical testing of peri-traumatic factors that may influence the SAM system and hence moderate the development of intrusive phenomena. Before exploring this literature, upon which the empirical aspect of the thesis is based, the development of imagery based intrusions, a similar theory also needs examining, Ehlers and Clarks (2000) model of threat apprehension which contributes further to the concept of intrusion development, but primarily within a treatment context.

**Ehlers and Clarks Cognitive Model**

A further theory that extends understanding of the formation of traumatic symptoms, including intrusions, has been more recently developed by Ehlers and Clarks (2000). The cognitive model, as it will be referred to here demonstrates considerable convergence with DRT in that it also adopts a multi-level multi-process view of PTSD symptoms.

At the core of Ehlers and Clarks model is an assumption that PTSD symptoms are maintained by an ongoing severe sense of current threat. This is based upon ‘excessively negative appraisals of the trauma and/or its sequelae’ (Ehlers and Clark 2000), and secondly by autobiographical disturbances where trauma memories are poorly elaborated into prior knowledge, lacking appropriate contextualization, while having strong links to associative memory and perceptual priming (Ehlers and Clark,
These core features are maintained by cognitive and behavioural coping strategies, such as avoidance.

The model hypothesizes that intrusive pathology is characterized by strong data-driven processing (Roediger & McDermott, 1993), which lacks subsequent conceptual based processing from higher level systems responsible for addressing meaning and incorporating information into representations of the self and the world. These intrusive memories therefore remain frozen in time and isolated from emotional processing, hence when activated appear to be direct re-experiences of the original traumatic situation without inhibition from higher level processes. These memories may also be encapsulated within a framework of poorly elaborated appraisal systems that prevent emotional processing by recruiting more conceptual related processing that inhibits working through of negative coping strategies.

Summary of Multi-Level Processing Models

The theories such as DRT, and Ehlers and Clark's model, indicate a general convergence towards recognising intrusive imagery in PSTD as subsumed by a processing differing from that responsible for autobiographical memory. A strong theoretical link can be established between the data-driven sensory focused processing suggest by Ehlers and Clark's model,
and SAM formation in DRT. Also the activation of conceptual processing routes matches well with the concept of VAM representations, which can be elaborated and contextualized in relation to prior meaning and subsequent appraisal processes.

These theories also imply that factors occurring at the time of trauma may bias intrusion development if they interfere with specific aspects of memory processing at the time of encoding, and this is crucial for the domain of investigation of this thesis, which will be detailed in the next section. Manipulating processing preferences at the time of a traumatic event may therefore influence the systems underlying the production of intrusive imagery.


A number of studies have provided indirect support for links between visuo-spatial processes and the production of traumatic or emotive imagery. Andrade, Kavanagh, and Baddeley (1997), in a set of four experiments, asked non-clinical participants to perform a number of separate tasks based on either forming images of recently presented neutral or negative slides, or to recollect personal neutral and negative images. Participants were required to perform concurrent visuo-spatial tasks during
the imagery recollection and to rate vividness and emotiveness of the images, either involving eye-movements, or tapping out simple or complex key patterns. In the second experiment they also performed a verbal distracter task (saying '1' out loud as fast as possible) to examine if any concurrent task impacted on imagery, vividness or emotiveness.

They found that with recently presented slides, imagery vividness was clearly reduced by a concurrent eye-movement and by complex pattern tapping tasks, but reduction in imagery emotiveness was small and inconsistent for eye-movements and non-significant for the tapping tasks. When participants were asked to recall personal neutral and negative events (Experiment 4), there was a significant trend for reduced imagery vividness, with the eye-movement task demonstrating the largest reduction, followed by the complex tapping task, both significantly less vivid than the control condition. Emotiveness of the images was only significantly less in the eye-movement condition, with a non-significant trend for less emotive images under complex tapping conditions compared with controls. These findings taken as a whole support some elements of visuo-spatial encoding involved in the vividness of recalled images, with some indications of reduction in emotive content.

In a study with patients, Hellawell and Brewin (2002) asked their
participants to write narrative accounts of their trauma, and then stopped to perform visuo-spatial or verbal tasks. Their findings indicated that visuo-spatial tasks were impaired when the patients were previously reporting spontaneous intrusive content, while no interference was found when patients reported non-intrusive features of their trauma. The narrative task was unhindered by prior reports of intrusive imagery or non-intrusive standard autobiographical accounts of the trauma.

This set of studies implicates the operation of visuo-spatial processes associated with particular emotional or intrusive traumatic memories. This fits in well with DRT approaches that predict the involvement of visuo-spatial processes in the SAM system that is postulated to underlie primarily intrusive imagery, in contrast to verbal mechanisms that are not directly implicated in the production of such intrusive imagery.

**Intrusion Research and Working Memory**

In order to place the above findings solidly within the context of current cognitive models of information processing, it is worth at this point being explicit about the underlying assumptions of this study. A good starting point is again Andrade et al.’s (1997) study of concurrent visuo-spatial and narrative tasks in the formation of images. While this study did not assess the impact of visuo-spatial and narrative processing on intrusive
images, it provides a specific model to interpret the findings of studies by Holmes at al. (2004) detailed below and fits in well with the assumptions of DRT.

The basic model adopted by Andrade et al. was the Working Memory model of Baddeley (1986; Baddeley & Hitch, 1974). In this model, memory processing comprises a central executive and two slave systems: the phonological loop based on auditory processing, and the visuo-spatial scratchpad used for processing incoming spatial and visual information. These slave systems closely resemble Brewin et al.'s (1996) VAM (phonological loop) and SAM (visuo-spatial scratch pad). A key assumption of the working memory model is that concurrent tasks of a visuo-spatial or narrative nature will selectively interfere with resources available to process incoming information in short term memory.

As demonstrated by Andrade et al., not all visuo-spatial tasks in their study had the same impact on vividness or on emotiveness associated with recalled images. However, their paradigm did not directly address analogues of traumatic material, or the processing of material under specific encoding conditions, rather only at recall. A different paradigm is required to assess features of peri-traumatic encoding of central interest to this thesis.
The Stressful Film Analogue Paradigm

In order to further understanding of peri-traumatic factors involved in traumatic exposure, experimental paradigms have been developed to manipulate specific encoding processes during exposure to traumatic stimuli. A key paradigm used in the research has been exposure to a stressful film (e.g. Lazarus, Opton, Nomikos, & Ramkin, 1965) to create conditions analogous with traumatic exposure, but without actually placing participants in danger or causing extreme levels of distress. Subsequent phenomena of interest, such as number of intrusions, may then be recorded by participants using diary methodology.

Murray (1997) was the first to use this methodology in the context of trauma to examine the impact of promoting dissociative processing during exposure to a stressful film, in this case a film of scenes of car crash aftermaths, containing severe wounds, dead bodies, and individuals in pain and distress. As indicated in section 1.4.4. Murray’s original hypotheses were not supported, but high trait dissociation did predict more intrusions in the subsequent two weeks.

Brewin and Saunders (2001) used the same analogue film paradigm, but this time using a concurrent task designed to distract attention away from the film and therefore promote dissociative processing and reduce
conscious attentional processing of the film material. Based on both
dissociation theories and DRT, a concurrent distracter task should limit
integration of the film material within explicit memory and hence lead to
more intrusive imagery, in effect promoting a more SAM based processing
route. However, they found that the concurrent task, a visuo-spatial task
based on Moar (1978) consisting of tapping a pattern of keys on an unseen
keypad, significantly reduced subsequent intrusions in a two week period
compared to a neutral control. While counter to the original hypotheses, the
marked reduction in intrusive imagery suggested that the visuo-spatial task
was perhaps interfering with the development of intrusive symptoms.

Holmes (2000) re-interpreted Brewin and Saunders (2001) results further in
terms of DRT, suggesting that the visuo-spatial task used potentially
interferes with the image-based systems underlining SAM representations
implicated with intrusive imagery. An implication of DRT, suggested by
Brewin (2001), is that the larger the discrepancy between information
encoded primarily as SAMs and that coded as VAMs the more frequent the
SAM system should be activated by relevant cues. A clear hypothesis
emerging from DRT is that the extent to which factors promote or inhibit
either VAM or SAM processing can therefore predict alterations in the
frequency of subsequent imagery related intrusions.
Factors that decrease SAM production, such as occupying specific types of processing needed by the SAM system, and/or increase VAM production, such as promoting enhanced encoding of trauma material at the time of the event, may reduce flashbacks or intrusive imagery. This appears to clearly implicate the influence of peri-traumatic factors on the setting up of SAM and VAM representations. Brewin and Saunders key tapping concurrent task, rather than acting as an attention distracting task, may have crucially interfered with a central process in laying down SAM representations, specifically being the operation of visuo-spatial systems. This clearly links into Andrade et al.'s (1997) research on the role of the visuo-spatial scratch pad in the recall of negative images.

The use of a dual task interference tasks within a trauma analogue context therefore allowed a direct testing of assumptions underlying DRT by selectively interfering with processes either promoting or inhibiting the operation of SAM and conversely VAM systems. The direct manipulation of peri-traumatic processing, and subsequent recording of intrusive content, side-steps a reliance on standard yet indirect measures of recall and recognition of traumatic information that may be open to self-report biases.
Empirical investigation of intrusion development: Peri-Traumatic dual task influences on intrusion formation.

Holmes and colleagues (Holmes et al., 2004) conducted a detailed set of three studies investigating the role of dual task interference in the production of intrusions, based closely on DRT. Each explored a different aspect of peri-traumatic processing as it related to DRT by using concurrent tasks targeting either visuo-spatial or narrative encoding systems during exposure to the same stressful video as used by Brewin and Saunders (2001).

The first experiment consisted of three between-subjects conditions, relating to two concurrent tasks, a dissociation task, the same visuo-spatial task as used by Brewin and Saunders (2001), and a non-task control. The number and type of intrusions was measured using diary sheets over a period of one week. The dissociation task did not lead to any significant differences in number or type of intrusions compared to controls, but participants in the visuo-spatial task condition had significantly less intrusions compared to non-task controls. This was not related to level of attention paid to the film as measures of explicit memory did not differ across conditions. In addition to replicating the findings of Brewin and Saunders (2001), this study also found that changes in state dissociation, specifically increases from pre- to post-video levels, predicted increases in
dissociation across all conditions. Level of distress was the same across all conditions, and the film effectively reduced ratings of happiness, but increased ratings of depression, with no change in anxiety.

In the second study, Holmes et al. examined the same visuo-spatial task in more detail, exploring the extent that attentional features of the task could be related to its impact on intrusion development. Level of prior practice and task complexity were used to manipulate the attentional load of the visuo-spatial tapping task in four conditions, single key tapping (low complexity), well practiced 5 key sequence tapping, and a minimal practice version of the 5 key sequence.

The results supported previous findings that visuo-spatial tasks appear to contribute to reducing intrusions, compared to control conditions, with a linear trend for fewer intrusions as task complexity increased. Attentional factors did not appear to be involved as even under over-practiced conditions, where attentional demands are reduced, the intrusion limiting effect of the tapping task was significant. Also, there were no differences across all conditions in film recall or recognition measures, or in self-report measures of attention to task, or in distress during film, removing these as likely alternative explanations to the reduced intrusions in the tapping conditions. However, spontaneous change in state dissociation did still
predict intrusions, although at a weak level. The film again demonstrated a main effect on mood reducing impact on happiness, with increasing depressed mood, and anger.

The third and final study focused on the processes potentially involved in the VAM encoding system. This study explored the role of verbal interference in disrupting VAM representations and in increasing intrusive imagery. Brewin et al. (1996; Brewin & Holmes, 2004) noted that regardless of the strength of SAM encoding, an adequate VAM representation of the trauma should be sufficient to compete for activation of intrusive content and hence reduce intrusions. Disruption of VAM encoding may therefore increase intrusions. Conversely, factors that accentuate verbal enhancement of narrative encoding were hypothesized by Brewin et al. (1996) to reduce intrusions by prompting VAM encoding that can compete with SAM based activation.

The results of this third study indicated that when a concurrent verbal task was used during exposure to the traumatic film, counting back in threes out loud, intrusions were significantly increased compared to controls. The use of a verbal enhancement task, an attempt to promote verbal narration by asking participants to vocalize their mental contents, did not reduce intrusions, obtaining similar levels as control participants. The film caused
equivalent amounts of distress for participants in all conditions and also
significant deterioration in mood across all conditions in terms of
depression and happiness, with a trend for increasing anger. There was a
reduced rating of attention paid to film for the verbal interference task.

Recall of film at one week follow up was equivalent for all conditions.
However, a significant increase in recognition, and implicit memory
measures, was found for participants in the verbal enhancement compared
to the verbal interference condition. Non-significant trends (p<0.10) were
found for decreased recognition scores in verbal interference participants
and increased recognition in verbal enhancement participants compared to
controls. Memory measures were not related to number of intrusions.

As with the previous studies in this set, state dissociation increased overall
in all conditions, but this was not related to quantity of intrusions. Trait
dissociation was also not related to number of intrusions. A hierarchical
regression demonstrated that neither trait dissociation nor changes in state
dissociation predicted intrusions over and above condition.

The findings of this final study, while not supporting the role of verbal
enhancement in limiting intrusions, did provide further crucial data on the
role of a concurrent task, specifically verbal interference, in promoting
intrusions. These findings go against alternative explanations of intrusion reduction which state that any concurrent task would reduce intrusions by virtue of disrupting encoding. The role of state changes in dissociation was not replicated, but this may have been in part due to the potential differences in mechanisms promoted in this study compared to the previous two. A central feature of this study, along with the development of the peri-traumatic mechanisms paradigm, was the use of memory measures. The findings of the memory measure used in this study tend to indicate that the experimental manipulations and number of intrusions found were unrelated, and hence extend the research paradigm beyond studies looking at explicit and implicit factors relevant to intrusive images (Holmes, et al. 2004).

In summary, these three studies provide the background for this thesis, which attempts to replicate findings using visuo-spatial and verbal interference tasks on the development of intrusions following exposure to an analogue trauma related film within the same study. This thesis also extends some of the design features of these studies. These are described in the next section.
1.7 Visuo-spatial and narrative processing links to therapy: Exposure and EMDR techniques.

Before addressing the methodological extensions and specific hypotheses made in this thesis in relation to Holmes et al.'s (2004) studies, it is important to note that these theoretical approaches have considerable value for the treatment of PTSD. This is a core interest for this thesis.

Although Rachman’s concept of emotional processing is a key cornerstone of much therapeutic work in PTSD, unlike other anxiety disorders the fairly unique presence of extreme intrusive imagery in PTSD requires specific attention to be paid regarding the processes involved in their development. These intrusive images distinguish PTSD from other diagnostic syndromes, and may require specific attention in treatment that can be driven by theoretical models of the disorder. As discussed in earlier sections, the processes underlying these intrusive features may differ from mechanisms responsible for longer term disruptions of meaning, behaviour, and affect. Therefore promoting emotional processing in therapeutic contexts can be extended by better understanding of the mechanisms underlying both intrusive and meaning/appraisal related features of PTSD.

Brewin et al. (Brewin, et al. 1996; Brewin 2001) indicated that emotional
processing in PTSD needs to address both systems of representations postulated to underlie encoding of traumatic information. Both the SAM and VAM systems need to be focused on in therapy. The production of more complete VAM representations, in addition to addressing clinical features of negative appraisals, can help prevent automatic activation of SAM related information by competing for activation, as illustrated in fig 1.1 above. This competing therapeutic process can be augmented by interleaving the sensory information found in SAMs with VAM representations, in effect laying down new associations between SAM information and narrative context, reducing a sense of immediate threat by contextualizing SAM material in autobiographical memory.

Ehlers and Clark's theory has considerable overlap with DRT, and presents the most detailed therapy model to date regarding PTSD. The different processes they suggest as responsible for alternate intrusive and appraisal aspects of PTSD closely match the concept of VAMs and SAMs. Intrusive imagery features supported by primarily data-driven poorly elaborated memories (very similar to SAM representations); and a more appraisal based maintenance route (VAM related in DRT). However, DRT implies that adequate VAM processing regarding the trauma is sufficient to prevent SAM activation, while the link between narrative processing at the time of trauma is not made explicit in Ehlers and Clark's model.
Exposure therapy and information processing approaches support the laying down of new stimulus response associations within a SAM type system, relating prior cues associated with traumatic responses to more para-sympathetic physiological and behavioural reactions such as relaxation and self-soothing. The eliciting of cue related traumatic reactions in session, using controlled flashback triggering approaches such as the ‘flashback ladder’ or in vitro exposure, can be used in conjunction with relaxation training or self-soothing to promote different associations between trauma cues and physiological processes. While these new links may not over-write prior SAM representations, they may promote new SAM representations based around non-anxiety physiological features. These controlled exposure procedures also promote new VAM representations of degrees of control over the previously automatic triggering of fear response.

**EMDR**

A relatively new therapeutic approach emerging in the last ten years has been Eye Movement De-sensitization and Re-Processing (EMDR: Shapiro, 1995). This treatment modality has attracted considerable attention, both positive and negative in the therapy literature. One of the key difficulties with EMDR is its lack of empirical or theoretical foundation in current psychological theory. The ostensible elements of EMDR focus on
recollection of the traumatic event whilst attention is focused on moving visual imagery. The concept behind this procedure is that the focus on visual stimulus promotes processing of 'blocked' traumatic information that has not been integrated into higher level meaning structures. One of the main criticisms of this approach, in addition to some of the early claims of EMDR as a 'Power Therapy', is the general lack of theoretical underpinnings supporting the therapy. Current studies suggest EMDR is of equivalent efficacy as other formal therapies, although there have been difficulties regarding the methodologies in a number of these studies. However, the lack of a clear substantive theoretical model underpinning EMDR processes creates difficulties for the therapeutic approach. At best, this prevents development of further theory driven research tackling the issues of the critical ingredients involved in EMDR.

1.8 The Current study: Extensions of previous research and study hypotheses.

The main aim of this study is to replicate in a single study the findings of Holmes et al. (2004) on the influence of peri-traumatic visuo-spatial and verbal interference tasks on subsequent intrusion development. This study adopted the same methodological procedures developed by Holmes et al., with some extensions. The changes made are outlined below.
Diary Methodology

In the original Holmes et al. studies, participants were asked to use an A4 diary sheet to fill in and record their intrusions, recording whether these were a thought, feeling, or both. Participants were also to record the content of such intrusions. The diary methodology used in this study was the same, but an attempt was made to make it a more portable and accessible recording device that participants could keep on them throughout the day and use at the time of the intrusion. The amount of information participants were asked to record was also reduced in an attempt to limit the amount of time participants needed to spend using the diary and promote compliance.

The size of the diary was reduced, with a cover sheet divided into a seven day tick sheet, where participants could note the occurrence of an intrusion, and then subsequently fill in an attached intrusion record of the type of intrusion experienced (e.g. verbal thought, visual image, or felt sense). They were also asked to record any associated mood or feelings accompanying the intrusion, and rate these in strength. The main part of the intrusion sheets was the intrusion record where participants were asked to detail the content of the intrusions, if possible what they were doing at the time, and any accompanying feelings they had.
Visuo-Spatial task

The visuo-spatial task used in the original study involved tapping keys on a hidden keyboard. While the tapping task dimensions were varied in the original study, there was a trend for increasing pattern complexity to produce more intrusions, based on a more complex 5 key pattern. The complex key tapping task involved tapping a five letter sequence (JYPVA) on a 5 by 5 alphabet pad, each key representing a letter starting with A and preceding along the alphabet to Y.

A brief pre-pilot was therefore conducted with ten participants from the experimenter’s course colleagues, who were asked to verbalize any strategies they were using whilst tapping the key pattern out using the alphabet grid. Out of these ten, nine reported verbally rehearsing the pattern J-Y-P-V-A as they tapped the pattern out. A brief literature search on the use of visuo-spatial interference task methodology in a variety of settings indicated that a number of studies that detailed their visuo-spatial methodology did not adopt the standard Moar based alphabet pad, rather they utilized block tapping varying from two to four blocks (e.g. Andrade, Kemps, Werniers, May, & Szmalec, 2002; Smyth, & Pelky, 1992), or a figure eight pattern (e.g. Sietz & Schuman-Hengsteler, 2000; Pearson, Logie, & Gilhooly 1999), or more complex block tapping patterns (Andrade et al. 1997).
To reduce potential overlap with verbal tasks, and follow precedents in other areas of visuo-spatial task use, the alphabet markers were removed from the tapping task, and participants were shown the key pattern and then followed it during the pattern learning phase.

**Use of clinical measure of trauma pathology**

In order to potentially generalize any findings in the current study to more clinical literature a brief standard assessment of traumatic symptoms based on intrusion and avoidance was included, the Impact of Events Scale (IES: Horowitz, Wilner, & Alzarez, 1979).

**Measure of Data Driven and Self-referential processing**

Based on the work of Ehlers and Clark, and the potential involvement of data driven processing in the development of intrusive images, which is also hypothetically linked to SAM processing, a measure of data driven processing was included (Ehlers & Clark, 2000).

**Empirical Investigation and Study Hypotheses**

The key hypotheses of this study emerge from multi-level processing accounts of PTSD, such as DRT and Ehlers and Clark's model, and processing accounts of peri-traumatic visuo-spatial and verbal interference tasks developed by Holmes et al. (2004).
1.9 Detailed Study Hypotheses

**Intrusion Quantity**

From a DRT perceptive, the formation of SAM representations is seen to underlie the development of intrusive imagery. SAM processing is predicted to be supported by visuo-spatial encoding systems in memory, which may be disrupted by a concurrent visuo-spatial task that reduces visuo-spatial resources available for SAM encoding.

The extent to which a traumatic event is represented by VAMs prevents the activation of SAM triggered by trauma related cues. Disruption of VAM encoding, subsumed by narrative processing in memory, particularly the phonological component of working memory, should therefore lead to less competition with SAM related activation and hence lead to more intrusions following initial exposure.

The incorporation of the IES, and its Intrusion sub-scale provides a more indirect assessment of the hypotheses below.

- **Hypothesis 1:** Participants conducting a concurrent visuo-spatial task while watching a trauma analogue film will have significantly less intrusions relating to the film over the week following exposure.
compared to control participants who watch the film without a visuo-spatial interference task. The IES intrusion sub-scale scores are predicted to mirror this with increased intrusive features.

• Hypothesis 2: Participants conducting a concurrent verbal task while watching a trauma analogue film will have significantly more intrusions relating to the film over the week following exposure compared to control participants who watch the film without a verbal interference. The IES intrusion sub-scale scores are predicted to mirror this with decreased intrusive features.

As this study does not deal directly with avoidance type symptoms no direct hypotheses are made regarding the IES avoidance sub-scale, rather this is used as an explorative measure.

Intrusion Type

Based on the hypothesized intrusion limiting influence of a concurrent visuo-spatial task, it is hypothesized this will also be expressed by reducing the number of different content features of the video footage encoded by the SAM system, leading to less variation in intrusions experienced compared to no-task control participants.
Hypothesis 3: Participants conducting a concurrent visuo-spatial task will have less variation in the intrusive content they report compared to controls.

Conversely, verbal interference will reduce narrative VAM encoding of the video footage, allowing more features of the video to be encoded via a SAM route leading to increased probability of more video footage acting as a stimulus for intrusive content.

Hypothesis 4: Participants conducting a concurrent verbal task will have more variation in the intrusive content they report compared to controls.

Imagery, Verbal, and Felt Sense Type Intrusions

Based on a Working Memory Model of information processing (Baddeley, 1986; Baddeley & Hitch, 1974), the consequence of performing a concurrent visuo-spatial task is a reduction in visual/imagery resources. DRT predicts that such a concurrent visuo-spatial task limits the visual processing of the traumatic film footage that drives intrusion formation and hence should impact on intrusion quality by producing less imagery based intrusions compared to participants not performing a concurrent visuo-
spatial task. This should also lead to less sensation based intrusions if the sensory encoding of traumatic type events is also supported by visuo-spatial processing. Any intrusions experienced after encoding under visuo-spatial interference conditions should rely more on narrative rather than visual processing, and hence this increases the probability of verbal content being a key feature of such intrusive experiences.

- **Hypothesis 5:** Participants conducting a con-current visuo-spatial task will have a) less imagery based intrusions, b) less sensation based, and c) more verbal intrusive content compared to controls.

In contrast, verbal interference is hypothesised to reduce verbal resources capable of encoding film material in a narrative VAM format. Under verbal interference conditions, SAM type encoding routes would be accentuated, subsumed by imagery-based processes, leading therefore to increased visual-imagery and sensation type intrusions, but less verbal intrusions.

- **Hypothesis 6:** Participants conducting a con-current verbal interference task will have a) more imagery based intrusions, b) more sensation-based intrusive content compared to controls, and c) less verbal thought intrusions.
The extent to which intrusive thoughts can be moderated by SAMs and VAMs has been implicated in discussion above, however, it is difficult to hypothesize the outcome of these manipulations in this context, unless the proportion of imagery versus verbal intrusions is examined. In this case, while expecting lower levels of intrusions in general in the visuo-spatial interference condition, there should be proportionally more verbal intrusions in this condition that the control or verbal interference conditions as this route should lead to more verbal based encoding represented by verbal intrusive content. Again, the contrasting possibility is that verbal interference leads to proportionately more imagery based intrusions relative to verbal intrusions by virtue of inhibiting verbal processing. This remains an explorative hypothesis.

**Processing Biases**

Based on both DRT and Ehlers and Clark's approach, data driven processing is closely associated with potential intrusion formation. The visuo-spatial condition is hypothesized to block visual based input so should act to reduce experiences of data driven processing. The impact of visuo-spatial interference on concept based processing is less clear. While reducing data driven or SAM type processing could increase conceptual processing, it is plausible that such visual interference acts only to prevent disruptions in concept driven processes and not accentuate such processing
which may require a more prolonged meaning or interpretive based task.

- **Hypothesis 7:** For participants in the visuo-spatial condition, data driven processing will be reduced, as will disruptions in conceptual processing.

Considering the influence of verbal interference on promoting SAM type encoding, this task should also accentuate data-driven processing which appears associated with bottom-up sensory information. It would also be expected that conceptual encoding is supported by narrative processes which would be impaired by a verbal interference task, hence leading to reported impairments in conceptual or self-referential processes following verbal interference.

- **Hypothesis 8:** Participants conducting a concurrent verbal task will experience more data-driven experiences and more disruptions to conceptually driven encoding compared to controls.

**Distress and Mood**

Findings by Holmes et al. (2004) suggest that overall the trauma film impact on dimensions of mood, regardless of condition, specifically increases in key emotions related to traumatic events such as depression,
anger, and reductions in happiness. Anxiety did not appear affected by this trauma video. Distress was equivalent for all groups in the three studies conducted. In addition to this, other measures of mood may also show reductions based on fear, hopelessness, horror, helplessness, disgust, shame, and guilt. These have also been proposed as potential mood based ‘hot-spots’ (e.g. Grey, Young, & Holmes, 2001) that can occur at the time of trauma, and so are included in the design.

*Hypothesis 9: Based on the findings of Holmes et al., the trauma film will have a mood reducing effect for participants, and that all conditions would have equivalent levels of distress.*

**Attention and Memory**

Holmes et al. also measured attention and memory related to each of their experimental manipulations. Both these are indicators of potential confounding effects accounting for a reduction in intrusions in the visuo-spatial conditions, in that intrusion reducing effects of the visuo-spatial task may be attention based rather than content based. If this is correct, then any concurrent task may reduce intrusions by virtue of its capacity to distract individuals from the video content. However, Holmes et al. found that both implicit and explicit memory were unaffected by the visuo-spatial task when using a complex key pattern task used in the current study. Attention
also did not change across conditions comparing control to visuo-spatial
tasks.

In relation to verbal interference, there did not appear to be an impact on
memory scores for participants performing this concurrent task in Holmes
et al.'s 3rd study, but it did have a suppressing effect on attention. Despite
this reduction in attention, significantly more intrusions were noted for this
condition.

• **Hypothesis 10:** Replicating Holmes et al.'s findings with verbal
interference, attention to film will be reduced in the verbal interference
condition compared to no task controls, but this will not impact on
memory ratings of the film.

**State and Trait Dissociation**

As a final hypothesis, Holmes et al. found that in two of their experiments,
state dissociation was increased as a result of the film and related to
intrusion development, but not to condition in terms of visuo-spatial and
control tasks. This finding was not replicated in a further experiment (exp
3) where verbal tasks were used to selectively promote or suppress
intrusion development. Part of this framework also requires an exploration
of the potential impact of trait dissociation on the number of intrusions
formed. These hypotheses require replication as a potential route to how intrusions may develop.

- **Hypothesis 11:** Increased state dissociation will lead to an increase in intrusions regardless of condition. The role of trait dissociation in predisposing individuals to developing intrusive content needs to be assessed in the context of changes in state dissociation.
Method

2.0 Overview of study

The study consisted of two between subjects experimental manipulations based around verbal and visuo-spatial concurrent tasks performed whilst watching trauma related video footage, with a no-task control for comparison. A follow-up stage is involved one week later where participants return a diary they have kept of any intrusions they experienced in relation to the film. The key dependent variable being number of intrusions, and variables derived from this (e.g. content of intrusions, type of intrusion).

In order to assess hypotheses associated with intrusion development outlined in the introduction, a number of additional measures were taken. Measures of trait dissociation, state dissociation, trauma history and variables relevant to the trauma film (e.g. number of car crashes, personal relevance of car crashes) and mood were taken prior to watching the film. Post-film measures were taken on mood change, attention to film, general distress, and task performance, data driven and conceptual processing taken after the film. At follow-up measures of recall and recognition memory were taken, along with a measure of trauma related symptoms.
The study was submitted to the University College London Graduate School Ethical Committee for human participants for approval, which was granted. The Information and consent forms are included in Appendix B of this thesis.

2.1. Participants

Data from 40 participants were used in the study. Recruitment was through adverts placed around University College London and by face-to-face contact in and round around the University campus. The inclusion criteria were for healthy non-clinical volunteers over 18-years-old who consented to take part in the study after reading the study information sheet. Participants were excluded if they had a previous mental health problem or had received either psychological or medication treatment for a mental health problem. They were also excluded if they had participated in a similar experiment in the past, or had a college exam in the intervening week of the experiment. This last exclusion criterion was to ensure that the experiment did not adversely affect college exam performance and was requested by the ethics committee.

56 participants initially agreed to participate in the study. Of these, three had previous mental health difficulties and did not participate in the main experiment, two exercised their right to withdraw participation before
taking part in the main experimental session, and five did not attend the experimental session and did not reply to further attempts to contact them. An additional five participants were excluded from the study due to lack of follow up data and/or lack of data regarding task performance (two had inaudible counting in the verbal task, one lacked correct sequence data in the tapping ask and did not complete all the follow up measures, two did not complete the follow up measures or send in their diaries despite repeated attempts at contacting them). One participant completed the experimental session, but experienced a traumatic real life event two days after exposure to the film and subsequently experienced intrusive images of this event unrelated to the study. They did not subsequently complete the follow up.

Assignment to experimental condition was randomly generated prior to participants arrival, using a pre-generated chart with conditions determined in advance using a dice roll (six sided dice: 1-2 = control condition; 3-4 = tapping condition; and 5-6 = counting condition). When a participant attended the experimental session they had therefore been pre-assigned to an experimental condition according to this chart. Of the final 40 participants who completed participation, 23 were male and 17 female. Of these 14 were in the control condition, 11 in the tapping condition, and 15
in the counting condition. Participants ages ranged from 19 to 66, with a mean age of 29 (SD 7.64).

2.2 Experimental Tasks

**Visuo-Spatial Task**

Participants were told that they had been given the task to tap a specific key sequence continuously on a hidden keyboard whilst watching a video. This task was based on a keypad tapping task that developed by Brewin and Saunders (2001) and used by Holmes et al. (2004) in their studies as a visuo-spatial interference procedure. The original task consisted of repeatedly tapping a pattern of five keys on a lettered 5x5 keypad using the dominant hand. In the current study the keys were blank, but the same specific pattern sequence was used. Measures taken from this task, recorded by computer, were: number of keys pressed and the correct number of sequences.

**Verbal Interference Task**

This task was based on that used by Holmes et al. (2004). It consisted of participants counting backwards out-loud in 3s from 958. Participants were audio-taped during this task and measures were taken of counting errors overall, total number of numbers counted, and total number of pauses of
one second and above. Errors were defined by inaccuracies in counting
down in threes or as repetitions/returning to an earlier number. Errors per
10 seconds were calculated by dividing the total errors by overall duration
of video in seconds and multiplying by 10.

2.3 Materials

2.3.1. Trauma Film

This consisted of 13 minute and three second video of real police footage
following the aftermath of five road traffic accidents, originally complied
by Steil (1996) and used in similar studies (e.g. Holmes et al., 2004;
Brewin & Saunders, 2001; Murray, 1997) to prompt intrusive imagery. The
footage consisted of five scenes from the aftermaths of separate road traffic
incidents where emergency crews have arrived at the scene. Examples of
content included body parts; dead bodies in cars or being moved and placed
in coffins; injured individuals screaming and in distress; and emergency
services attending to injured individuals. Each scene was preceded by a
brief audio pre-amble presenting the context of events. The emergency
workers spoke in German, and the video included full audio of the events
occurring on the screen.
The film attempted to capture elements defined as 'traumatic' by diagnostic systems such as DSM IV (APA, 1994), containing scenes of death, distress, and serious physical injury to others. While the content was chosen to represent distressing and traumatic type content, it is noted here that to the knowledge of the investigators no lasting effects adverse effects have been noted in previous participants.

2.3.2. Self Report Measures

A number of self-report measures were used in the study. These are detailed below in the order they were presented. The item content of each measure is included in Appendix C. With the exception of the data and concept driven processing questions, and the modified diary format, all the measures listed below were used by Holmes et al. (2004) in some or all of their experiments.

Trait Dissociation: The Dissociative Experiences Scale II (DES II: Carlson & Putnam, 1993) was used as a pen and paper measure of trait dissociation. It was developed to assess levels of life time experiences of dissociative type phenomena such as de-personalisation, de-realisation and amnesia. The DES II is one of the mostly widely used instruments for measuring dissociation. The overall format of the measure consists of 28 statements.
reflecting dissociative type experiences to which participants respond by rating the frequency of each experience on a scale of 0-100% in steps of 10%. The DES II scores are represented as averaged ratings over all 28 items and hence range from 0-100%. Higher scores are indicative of higher dissociative experiences. The reliability of the scale is well documented in standard population samples as high (Cronbachs α varies from 0.90 to 0.97; Carlson & Putnam, 1993).

**State Dissociation:** 19 computer administered items were used to assess state dissociation, taken from the subjective patient rated sub-scale of the Clinician Administered Dissociative States Scale (CADSS: Bremner, Krystal, Putnam, Southwick, Marmar, Charney, & Mazur, 1998). These items were originally developed to measure changes in dissociative experiences based on symptoms of de-personalisation, de-realisation, and amnesia in clinical populations. Participants rate each of the items using a 5-point Likert-type scale according to the subjective strength of their experience at the time, with the scale anchored at 0 (not at all) and 4 (extremely). Ratings are summed and averaged to obtain an overall score, with higher ratings indicating more state dissociation. Examples of scale items include, 'Do you feel as if you are looking at things outside your body' (de-personalisation), and 'Do things appear to be moving in slow
motion’ (de-realisation). This sub-scale has demonstrated good internal reliability (Cronbach $\alpha = 0.94$, Bremner et al., 1998).

**Trauma History**: A brief computer administrated trauma history questionnaire based on the Foa Post-traumatic Diagnostic Scale (PDS: Foa, 1995) assessed prior trauma history. The PDS was designed as a self-report measure of PTSD based on DSM IV criteria. In the form utilised in this study 12 computer administrated items where taken from the PDS regarding the occurrence of potential traumatic events.

**Mood and Distress Ratings**: Computer administrated 11 point Likert-type scales were used to rate levels of current mood pre- and post-exposure to the trauma film. One rating scale was used specifically to rate distress associated with the film post-exposure. The rating scale was anchored at 0 (not at all) to 10 (Extremely). Mood ratings were based on specific affective types including anger, depression, happiness, and anxiety (based on Davies & Clark, 1998) representing core emotions relevant to traumatic experience. In addition, measures of fear, horror, helplessness, disgust, shame, and guilt were also representing other potential emotional reactions people may experience during traumatic events (e.g. Grey, et al. 2001).
Number and relevance of car crashes: A computer administered item asked participants to indicate how many car crashes they had been involved in. They were also asked to rate the personal relevance of car crashes on an 11 point computer administered rating scale anchored at 0 (not at all relevant) to 10 (extremely relevant).

Data driven and disrupted conceptual processing: A 16 item pen and paper questionnaire was used to measure the presence of either data-driven (bottom-up) or concept-driven (top-down) processing in relation to the trauma film, adapted from Davies and Clark (1998). 8 items measured data driven processing and 8 items measured disruptions in concept driven processing, in part represented by disruptions in self-referential processing. Each item was rated on a 5 point Likert-type scale in relation to the participants’ levels of endorsement for each statement. The scales were anchored at 0 (not at all) to 4 (Very Strongly). Scores were summed up and averaged over respective sub-scale items. Examples of a data-driven item was ‘It was just like a stream of unconnected impressions following each other’, higher total scores indicating more data-driven processing. Concept-driven items included ‘It felt as if someone else was watching the video’, higher scores indicating more disruptions in self processing and hence lower levels of conceptual processing. One item from the concept-driven sub-scale (item 3) was re-worded as previously it stated ‘I was aware of
what was going on, but not that it was happening to me’, which is by implication true for video watching, and changed to ‘I was aware that I was watching the video, but not so much that it was me watching it.’

_Film and Task Attention:_ Attention to film was measured using a single computer administrated 11-point Likert-type rating scale anchored at 0 (not at all) to 10 (total attention) in response to the question ‘Please indicate how much attention you paid to the film you have just seen’. In the concurrent task conditions, attention to task was measured using the same computer administrated rating scale regarding the statement. ‘Please indicate how much attention you paid to the task. Please rate 0 if you did not undertake a task during the film’.

_Recall and Recognition Memory:_ Two pen-and-paper memory questionnaires were used to assess memory for the video footage at 7 days post exposure, based on implicit recognition of events during the footage, and explicit recall. The questionnaires were specifically developed by Holmes et al. (2004) for their study, based on the same video footage. The implicit/recognition measure consisted of 20 items in total each item describing a potential event from the video with participants required to identify if that event occurred or not in the footage they saw. The explicit
recall questionnaire consisted of 15 questions asking participants to recall details of the video footage from all 5 scenes.

Clinical intrusions and avoidance: The Impact of Events Scale (Horowitz, Wilner, & Alzare, 1979) was used as a brief pen-and-paper measure of PTSD type symptoms. It consists of a 15 item scale of questions regarding potential experiences associated with exposure to a traumatic event. The scale can be broken down into items indicative of avoidance and intrusion-type symptoms. Participants are requested to rate the frequency of each item on a 4-point scale anchored at 'not at all' and 'often'. For each item, rating scores are given in ascending order beginning with 0, 1, 3 and 5. Item 9 was excluded from the summation process as it measured the extent participants tried to not talk about the trauma (film), which participants were explicitly requested not to do while they kept the diary. Reliability has been shown as relatively high (Intrusion Cronbachs α = 0.78; Avoidance Cronbachs α = 0.82).

The IES is widely used to assess changes in PTSD symptoms in a clinical context, but has had difficulty in assessing situations with more than one primary trauma. In this experimental context participants were asked to rate their experience of participating in the study using this scale, and this was used as a back-up measure to determine if any participant had been unduly
traumatised by participation, and also as a related standardised clinical measure of the impact of the experiment.

*Intrusion Diary:* This diary was based on that developed by Holmes et al. (2004) to record the occurrence and details of intrusions in a 7 day period following exposure to the trauma film. The diary consisted of one ‘tick-box’ front sheet, which participants were instructed to tick when they had an intrusion, attached to 16 Intrusion Record Sheets. Both the front tick sheet and the Intrusion Record Sheets were small sized A7 format, held together by treasury tags and contained in an A6 plastic wallet with instructions on how to fill in the diary fixed to the outside of this wallet. The front tick-box sheet consisted of a 7 day format array, each day divided into morning, afternoon, and evening sections, with each section containing a number of boxes participants could tick as soon as they had an intrusion. This was designed as a means to attract attention to filling in the second part of the diary, which was the more specific Intrusion Record Sheets attached.

The Intrusion Record sheets contained space for participants to fill in the type of intrusion they had, the day they experienced it, any accompanying primary feelings or emotions they had when they experienced the intrusion, and to rate the level of this feeling using an 11-point rating scale, anchored
at 0 (not at all) to 10 (very strongly). This mood measure was designed to pick up any principal emotions accompanying the intrusions, including any feelings of distress. The final part of the each Intrusion Record Sheet was a larger box labelled ‘Content of Intrusion’ where participants were requested to detail their intrusions, in terms of what they involved, what they were doing at the time, and also any accompanying physical reactions. These record sheets would then be used as cues for more detailed discussion at one-week follow-up. In order to cut down on participant task demands, measures from the original diary of fragmentation, ‘being in the intrusion’, and spontaneity of intrusion were removed. Spontaneity was assessed at follow up by asking the question ‘Was this intrusion spontaneous, rather than being part of a conscious attempt to think about some aspect the experiment or the video’.

**Diary Compliance**: This was measured using an 11-point pen-and-paper Likert-type scale, in response to the question used in the previous Holmes et al. (2004) studies: ‘To what extent is the following true of you: I have been unable (or forgotten) to record my unpleasant thoughts and images in the tick diary’. The rating scale was anchored at 0 (not at all true of me) to 10 (completely true of me). Lower scores indicate more compliance.
2.4. Apparatus

- A 15 inch generic colour portable colour television (SONY) was used to present the video footage.

- A video tape recorder was used to play back the video footage, with playback controlled by a computer.

- A standard PC console and PC monitor were used to regulate administration of task instructions, computer administrated self-report measures, mood measures, video playback, and key tapping responses. A standard 'qwerty' type keyboard was used to record participants' responses to self-report measures.

- A 5-by-5 keypad matrix keypad array was used to record pattern tapping in the visuo-spatial interference condition. The response keys were blank, but consisted of standard keyboard keys.

- The computer software used to operate the video recorder was based on that developed by Holmes et al. (2004). It controlled the presentation of task instructions, presented self-report measures,
logged participants’ responses to self-report measures and tapping
tasks and produced data files of the results.

- A standard Sony TCM (model 939) audio tape recorder was used to
  record participants’ counting. Standard C90 audio tapes functioned
  as recording media.

- Diary materials consisted of 17 A6 sized paper sheets, held together
  by a treasury tag, and placed within an A6 transparent plastic
  sealable wallet.

- Bell: Used to inform the experimenter when the participant has
  finished the computer administered procedures, or when they wished
  to end their participation during these procedures. Although the
  experimental room was soundproofed from street noise, the bell
  could still be heard through the main door.

2.5. Procedure

The author was the experimenter throughout the study. Participants who
initially showed interest in the study, either by responding to an advert or
through face-to-face contact, were booked in for the experimental session
and their contact details were taken. Efforts were made to contact
participants the day before the session to remind them, this was possible in most cases by phone, by leaving a message if they did not answer the phone, or by sending an email.

The experiment consisted of two sessions, the first based on computer administered measures and exposure to the trauma video. The second was a one-week follow-up to discuss the diary and debrief participants as to the purpose of the experiment.

2.5.1. First Session

*Stage 1: Introduction to the experiment.*

Participants who attended the first experimental session were seen in a sound proofed room, which had its windows blacked out to prevent distraction from daylight. The room contained a chair for the participant placed in front of a desk. Upon the desk was arrayed the video screen 50cms in front of the participant, with a computer monitor to their left side and the computer key board in front of them. A second chair was used by the experimenter.

All participants were given the Healthy Volunteer Information Sheet to read and those that agreed to take part completed and signed an ethical consent to participate form. Following this, participants who agreed to
continue were given the pen-and-paper DES II to complete while the experimenter was in the room, this was also a means of examining the participant’s ability to use Likert-type rating scales. Following completion of the DES II participants were then given the following pre-amble by the experimenter, regardless of condition they were placed in:

'After some questionnaires on the computer screen you will be shown a film depicting real police footage of road traffic accidents, and finally answer a few more questions. It is important that you pay attention to the film and do not look away from the screen or around the room. All questions you answer will be treated confidentially and anonymously’

Stage 2: Task instructions and Procedures.

For participants in the concurrent task orientated conditions (visuo-spatial tapping and verbal interference) task specific instructions and procedures were given as detailed below, before the computer administered questionnaires and video were presented. Control condition participants were introduced directly to the computer administered stage (stage 3) of the experiment.
Visuo-Spatial Task Procedures

'(Visuo-Spatial Task Instructions) You have been given the task of tapping a pattern of keys on a hidden box during the film. During each scene of the video you are required to press a sequence of keys on the square board continuously. The square board will be concealed from view. The computer is wired up to record every correct sequence, the time it takes for you to complete the sequence and the number of errors. You will have one minute to practice the task looking at the keypad. I will show you the whole sequence first, then you will be asked to follow my pen and touch each key after they touch them. Do you have any questions?'

Participants in this condition were then shown the key-pad they were to use, shown the sequence, and then given time to practice it (maximum 1 minute). They were asked to practice with their dominant hand. All participants were told to focus on the pattern of the sequence and managed to learn the sequence in under one minute. The keypad matrix was then placed out of sight on a stand under the table the participant sat at, on the side of their dominant hand. The participant checked the keypad could be accessed comfortably, but that it remained occluded by the table and were allowed to practice the key pattern again for 10 seconds with the key pad out of sight. Participants were again told that it was important for them to
keep the tapping going while maintaining their attention on the video, their key tapping would be recorded for accuracy and consistency.

**Verbal Interference Procedure**

'(Verbal Interference) You have been given the task today of watching the film while you count backwards, out-loud, in three's from 958. This is not a test of your mathematical ability. It is important that you perform the task continuously through each scene of the film. If you make a mistake, or lose track of what number you are up to, just carry on from where you think you left off. Please count out loud, clearly, because you will be recorded as part of the experiment. Do you have any questions?'

No further instructions where given apart from repeating that it was very important for the participants to complete the task as best they could and pay attention to the film. They were not asked to practice the task before hand, although a clarification was given of what counting back in threes meant.

**Stage 3: Computer administered questionnaires**

All participants were then directed to the computer screen and their code number was inputted into the computer and they were asked to follow the
instructions on the computer screen. After asking if there were any questions, the experimenter told participants they would be in the room alone for this stage, which included watching the video. They were then told the following instructions:

'AFTER FILLING IN SOME QUESTIONNAIRES ON THE COMPUTER YOU WILL BE SHOWN THE FILM FOOTAGE OF ROAD-TRAFFIC ACCIDENT SCENES, AND FINALLY ANSWER A FEW MORE QUESTIONS. THERE ARE MANY QUESTIONS TO ANSWER SO TRY TO GIVE THE FIRST RESPONSE THAT COMES TO MIND AND ANSWER AS SWIFTLY AS POSSIBLE WITHOUT RUSHING. PLEASE DO NOT CHANGE YOUR ANSWERS OR GO BACK, BUT TELL THE EXPERIMENTER AT THE END IF NECESSARY. YOU CAN STOP AT ANY POINT AND RING THIS BELL TO GET THE EXPERIMENTERS ATTENTION.'

A bell was shown to participants and they were also asked to ring a bell if the computer/video stops working. The lights were then turned off and the experimenter left the room. For participants in the verbal interference condition, the audiotape recorder was set to record and activated prior to the experimenter leaving the room.

The participants had a blue light from the TV AV status screen to help them see the computer keyboard and the rating keys were labelled in red to facilitate their use in these blue light conditions.
Participants then completed the following questionnaires that appeared on the computer screen:

Pre-Film computer administrated measures

- State Dissociation
- Age
- Gender
- Number of car crashes
- Personal relevance of car crashes
- Exposure to trauma history
- A key press filler task involving tapping the ‘Ins’ key (key labelled on keyboard 38 times (this replaced a previous questionnaire not used in this study)
- Mood ratings of how unhappy, anxious, depressed, angry, fearful, horrified, helpless, disgusted, ashamed, and guilty they felt at the time.

Stage four: Video Instructions

The computer then gave participants different instructions based on the condition they were assigned to. These instructions were presented prior to the video footage.
Control (No Task) Condition:

'You will next see a 12 minute film showing road traffic accidents. Imagine you are there, a bystander at the scene of the accident. Watch the film and do not look away or shut your eyes. PAY CLOSE ATTENTION TO THE FILM You'll be asked questions about the film later.'

Visuo-Spatial Task

'You will next see a 12 minute film showing road traffic accidents. Imagine you are there, a bystander at the scene of the accident. Watch the film and do not look away or shut your eyes. PAY CLOSE ATTENTION TO THE FILM You'll be asked questions about the film later. During the video try to CONTINUOUSLY do the tapping task, your responses are being recorded. THE SEQUENCE TO TAP IS THE SAME AS YOU PRACTISED EARLIER. Remember, use ONLY ONE HAND, your dominant hand to tap the sequence. Whenever you find yourself not doing the key tapping task, immediately start tapping again. Practise the sequence ONCE now, you may look now but then put the box OUT OF SIGHT UNDER THE TABLE. Start tapping the SEQUENCE as soon as the video starts. Remember, watch the film and DO NOT look at the key pad DO NOT look away from the film or shut your eyes'
Verbal Interference Task.

'You will next see a 12 minute film showing road traffic accidents. Imagine you are there, a bystander at the scene of the accident. Watch the film and do not look away or shut your eyes. PAY CLOSE ATTENTION TO THE FILM. You'll be asked questions about the film later. Please perform the counting task while watching the video. If you lose track of what number you are up to at any time, simply continue from your best guess of the number you reached. Do your best to count ACCURATELY and CONTINUOUSLY during the scenes of the video. You will be tape-recorded while performing this task. Please begin counting backwards in three's from 958 as soon as the first scene begins.'

Participants initiated the film using a key press after these instructions. When the film was finished the television screen went blank and the computer bleeped continuously, while the computer monitor indicated that the video had finished and asked the participant to press any key to continue. The bleeping continued until a key was pressed.
Stage 5: Post Film Measures

The computer displayed the following measures after participants pressed a key.

- State dissociation measure
- State mood ratings

A short pre-amble then followed indicating the last two measures would be next, and asked participants to press any key to continue. The following measures were then administered.

- Attention paid to film ratings
- Distress related to film
- Attention paid to task measure (if relevant)

Participants were then instructed to ring the bell, and the experimenter entered the room and administered paper versions of the data processing measures. Participants were then instructed on the use of the intrusion diary.
Stage 6: Intrusion Diary

All participants were then given the intrusion diary and guided in its use based on the instructions on the outside of the wallet. The front tick box sheet was identified and participants asked to tick every spontaneous intrusion they experienced, and this may be one or more of an image, a thought, or sometimes a mood or feeling that they believed was related to the video footage or the experiment. The individual Intrusion record sheets were then shown and each section indicated, 1) Intrusion type, 2) Day of Intrusion, 3) Accompanying mood or feeling, 4) Intrusion Content. They were asked to keep the diary on them at all times and recorded any intrusions they may have as soon as possible after the experience or at least within the same part of the day. All participants were told that the diary was the most important part of the study and the more accurate they were with this the better this information could help our understanding of intrusions. A follow up session was then booked and the participant walked to the lift. Discussion of the experiment was avoided.

2.5.2. Second session: One Week Follow-Up

Six days after the exposure to the video participants were phoned to remind them of the follow-up session. At follow-up participants were asked for their diaries and the total number of intrusions counted. They were then asked for a diary compliance rating, and for those in an experimental
condition then asked a hypothesis question, 'Do you think you would have had more, less, or the same number of intrusions if you had not performed the task?' Then each intrusion sheet was examined. If participants had recorded or indicated they had experienced more than one image or different thoughts for the same intrusion this was explored and counted as separate intrusive content. Each intrusion was checked for its spontaneity, with participants asked 'Was this intrusion spontaneous, rather than being part of a conscious attempt to remember parts of the film or experiment', If an intrusion was not spontaneous in this sense it was discounted, but noted down as a conscious attempt at recall. Participants were then given the pen-and-paper measure including the implicit recognition memory questionnaire, the explicit memory questionnaire, followed by the IES. The IES was checked for extreme scores and the participant then de-briefed as to the purpose of the study.

All participants were asked if they had any concerns about taking part in the experiment or if they felt disturbed by taking part. Participants were told they could contact the experimenter if they felt or became concerned about the experiment. None of the participants indicated that they felt distressed at the follow up stage, but some did indicate that they found the material disturbing at the start, others fed back that they were surprised that
the material was not very disturbing. The participant was then thanked and paid £5 for their participation.

2.6. Data Analysis

Data Analysis was conducted using SPSS 11.5, to perform data cleaning on the variables involved, searching for univariate and multivariate outliers, and generating descriptive statistics. Tests used to explore the study hypotheses were based on the same statistical procedures used by Holmes et al. (2004), including One-Way ANOVAs, with planned comparisons or post-hoc contrasts to assess between group differences, Mixed ANOVAs and Linear regression. Probability values for each test were set at $\alpha = 0.05$, and where specific hypotheses were not made tests were subjected to Bonferroni correction to adjust for multiple comparisons.
Results

3.1. Data Cleaning

Treatment of Outliers

Prior to analysis, 5 participants had been removed for not completing the follow-up tasks and/or not having data to support or examine their task performance. The remaining cases were screened for accuracy of data entry with all variables presenting appropriate means, minimum and maximum values. Investigation of outliers was undertaken using visual examination of box-plot followed by z-scores analysis based on recommendations from Tabachnick and Fidell (1996) looking for outliers within each condition. Outliers were first investigated on the whole sample, ungrouped, for demographic, state and trait variables potentially relevant to sampling issues and to influence intrusions i.e.: age, number of car crashes, personal relevance of car crashes, number of traumas, state dissociation pre-video, and trait dissociation.

Four cases were indicated as potential outliers in the overall sample with z-scores exceeding 3.29; one on age (case 9 – counting task, $z=4.78$), one on number of car crashes (case 28 – control task, $z=5.11$), and two on state dissociation (case 23 and 35, both counting task, both $z=3.66$). Of these,
case 28 appeared as the most relevant for exclusion regarding the content of trauma film, but examining this case on a group/condition basis indicated it was marginally within the bounds suggested by Tabachnick and Fidell (1996) (case 28, z score = 3.09), and hence was retained for analysis in order to preserve as many cases as reasonable.

Analysis by condition found no further outliers. The final data set consisted of 40 cases, 14 in the control condition, 11 in the visuo-spatial interference task condition, and 15 in the counting condition.

3.2. Randomisation Checks

There were no significant differences between groups in terms of age ($F(2,37)<1$, ns); number of traumas ($F(2,37)<1$, ns); number of car crashes ($F(2,37)=1.04$, $p>0.05$); personal relevance of car crashes ($F(2,37)<1$, ns); trait dissociation ($F(2,37)<1$, ns); or pre-film state dissociation ($F(2,37)=1.43$, ns). There was no significant difference in gender across conditions ($\chi^2(2) = 4.73, p >0.05$).

3.3. Task Performance Checks

Participant’s performance on the individual experimental tasks was analysed to determine the level of adherence to the tasks. The descriptive statistics for these task checks are displayed below in table 1.
Table 1: Experimental tasks performance.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Visuo-Spatial tapping</td>
</tr>
<tr>
<td></td>
<td>$M$</td>
</tr>
<tr>
<td>Total key presses</td>
<td>848.09</td>
</tr>
<tr>
<td>Number of correct key sequences</td>
<td>137.18</td>
</tr>
<tr>
<td>Total numbers counted</td>
<td></td>
</tr>
<tr>
<td>Total number of errors</td>
<td></td>
</tr>
<tr>
<td>Total number of pauses above one 1 second</td>
<td>0.25</td>
</tr>
<tr>
<td>Pauses per 10 seconds</td>
<td></td>
</tr>
<tr>
<td>Attention to task</td>
<td></td>
</tr>
</tbody>
</table>

For the tapping task, the means and standard deviations match those of previous studies (Holmes et al., 2004: exp 1 mean total key presses = 807.12, $SD$ 254.35; mean correct sequences = 132.88, $SD$ 56.99). There were no outlying cases in this distribution, suggesting all participants performed well in the tapping task. There was no significant correlation between visuo-spatial errors and intrusions ($r(11) = 0.05, p>0.05$).

For the verbal interference task, it is noted that the mean number of errors was particularly high compared to previous findings (Holmes et al., 2003: exp 3, mean errors = 6.94 $SD$ 9.77 in the verbal interference task). As counting errors are predicted to indicate reduced task performance, the potential association between counting errors on number of intrusions was examined. Statistically significant moderate-to-strong negative correlations
were found for total number of intrusions in relation to both number of counting errors ($r(15) = -0.54, p=0.019$ 1-tailed) and the proportion of counting errors to the total numbers counted ($r(15) = -0.49, p = 0.032$ 1-tailed). No other index of task performance demonstrated significant associations with number of intrusions. No outliers were noted on these counting task variables. Performance on the counting task that comprised the verbal interference manipulation appears substantially less than in previous studies, and may have had a suppressing influence on number of intrusions experienced.

Self-rated ‘attention paid to task’ was not significantly different between the counting task compared to the visuo-spatial tapping task ($t(25) = 1.52, p > 0.05$ 2-tailed; Levene’s $F = 5.46, p < 0.05$; equal variances not assumed)

When participants were asked the impact of not performing a concurrent task on the number of intrusions experienced, 88% of participants across all conditions declared that doing a concurrent task would decrease the number of intrusions (22/25), as both the tasks were seen as distractions from the film content. Nine participants in the visuo-spatial interference condition (81%), and 13 in the verbal condition (92.8%) reported that not doing the task would lead to more intrusions. Few participants believed that performing their respective tasks would lead to fewer intrusions, 1 in the
tapping condition and 1 in the counting condition. Only one participant overall believed that performing a task made no difference to the number of intrusions, and they were from the counting condition. It is clear that a majority of participants believed that any task would lead to fewer intrusions because of the distraction from watching the film.

Talking about the study: Participants in all conditions had been asked not to talk to anyone about the experiment in the week following the first session. None of the participants reported talking to anyone about the experiment, but two had indicated that they had wanted to do so. Item 9 from the IES, which asks participants the extent to which they tried not to talk about the film, was used as a further assessment of adherence to this request. It appeared there were significant differences between groups on how much participants tried not to talk about the film ($F(2,37)= 4.17, p<0.05$; Levene $F<1$, ns). Post-hoc analyses indicated that participants in the verbal task condition had significantly higher rated frequency of trying not to talk about the film (mean = 3.35, SD 2.03: mean difference from control = 2.25, $p<0.05$), compared to controls (mean = 1.29, SD 1.16). The visuo-spatial interference participants did not differ significantly from control participants in the mean frequency of attempts not to talk about the film (mean = 2.07, SD 2.14: mean difference from control= 1.44, $p>0.05$).
3.4. Distress and Mood

Table 2 contains means and standard deviations of mood ratings, pre- and post-video, per group based on mood measures used by Holmes et al. (2004). A one-way ANOVA for general self-rated distress to film indicated a significant main effect of condition ($F(2,37)= 3.96, p<0.05$, Levene $F = 0.42, p>0.05$), with post-hoc analyses indicating, as suggested by the mean distress ratings, that the visuo-spatial interference condition presented significantly lower distress ratings than controls (Bonferroni comparisons mean difference = -2.29, $p<0.05$). No post-hoc differences were found between visuo-spatial interference and verbal interference, (Bonferroni comparisons mean difference = 0.60, $p>0.05$) or between the verbal interference and control conditions (Bonferroni comparisons mean difference = -1.69, $p<0.05$) on distress.
Mixed ANOVAS were conducted on the data with condition as the between groups factor and time (pre/post video) as the within subjects factor, to explore potential decreases in mood over time and possible main effects/interactions of condition (hypothesis 9). In terms of happiness, there was a significant main effect of time ($F(1, 37)= 33.66, p<0.001$), but not condition ($F(2, 37)<1, \text{ ns}$), with no significant interaction ($F(2, 37)= 2.85, p>0.05$). Post-hoc comparisons indicated there was a significant decreases in happiness after watching the film ($t(39)=5.87, p<0.001$ 2-tailed), collapsing over conditions.
For anxiety, there was a significant main effect for both time ($F(1, 37) = 4.80, p<0.05$) and condition ($F(2, 37) = 3.64, p<0.05$), but no interaction ($F(2, 37) = 1.54, p>0.05$). The means for anxiety suggest a reduction over time for all conditions, and this was supported by a paired sample t-test on pre- and post-film anxiety scores, collapsing over conditions, indicating significantly lower anxiety over-time ($t(39) = 1.96, p <0.05$ 1-tailed).

Exploring this further by condition, a series of paired-sample t-tests were conducted within each group of participants. These revealed a significant reduction in anxiety within the visuo-spatial interference condition ($t(10) = 2.61, p = 0.025$), but not for the verbal or control conditions (verbal interference: $t(14) = 0.56, p > 0.05$; control: $t(13) = 0.58, p > 0.05$).

Post-hoc tests on the main effect of anxiety across conditions indicated significantly lower anxiety in the visuo-spatial interference condition compared to the control condition (Bonferroni comparisons, mean difference $= -1.73, p<0.05$), but no other differences (verbal vs control: Bonferroni comparisons, mean difference $= -1.22, p>0.05$; verbal vs visuo-spatial: Bonferroni comparisons, mean difference $= 0.51, p>0.05$).

Given the potential importance of anxiety in interfering or accentuating encoding of film information, and the differences in anxiety level across conditions, a mixed one-way ANCOVA on post-film anxiety was
performed with one between-subjects factor, based on condition, and pre-film anxiety as a covariate. The ANCOVA indicated that after accounting for pre-film anxiety, post-film anxiety remained significantly different between conditions ($F(2, 36) = 4.29, p < 0.05$). Post-hoc comparisons indicated that post-film anxiety was significantly reduced in the visuo-spatial interference condition compared to controls (marginal mean contrasts, mean difference $= -2.06, p < 0.01$), with no difference between the control condition and verbal task condition (marginal mean contrasts, mean difference $= 0.13, p > 0.05$).

For depression, there was a significant main effect for time ($F(1, 37) = 4.33, p < 0.05$), but no main effect of condition ($F(2, 37) = 2.45, p > 0.05$) or interaction ($F(2, 37) < 1, \text{ns}$). Post-hoc comparisons found no significant differences between conditions, but revealed a significant increase in depression over time ($t(39) = -2.10, p < 0.05$ 2-tailed).

In terms of anger, there were no significant main effects (time: $F(1, 37) = 2.37, p > 0.05$; condition: $F(2, 37) = 1.10, p > 0.05$) or interactions ($F(2, 37) < 1, \text{ns}$).

Additional measures of mood were also included in this study, extending the examination of mood changes into other potential affective features of
traumatic situations based around fear, horror, hopelessness, helplessness, disgust, shame, and guilt. The means and standard deviations of these are presented in Table 3.

Table 3. Manipulation of additional mood outcome measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>No-task Control (N=14)</th>
<th>Visuo-Spatial Interference (N=11)</th>
<th>Verbal Interference (N=15)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Fear</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-per</td>
<td>2.00</td>
<td>1.66</td>
<td>1.27</td>
</tr>
<tr>
<td>-post</td>
<td>3.00</td>
<td>1.92</td>
<td>0.36</td>
</tr>
<tr>
<td>Horror</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-pre</td>
<td>0.07</td>
<td>0.26</td>
<td>0.18</td>
</tr>
<tr>
<td>-post</td>
<td>3.71</td>
<td>2.78</td>
<td>1.82</td>
</tr>
<tr>
<td>Helplessness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-pre</td>
<td>0.38</td>
<td>0.65</td>
<td>1.15</td>
</tr>
<tr>
<td>-post</td>
<td>1.92</td>
<td>1.84</td>
<td>1.38</td>
</tr>
<tr>
<td>Disgust</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-pre</td>
<td>0.01</td>
<td>0.01</td>
<td>0.08</td>
</tr>
<tr>
<td>-post</td>
<td>3.15</td>
<td>2.96</td>
<td>1.00</td>
</tr>
<tr>
<td>Shame</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-pre</td>
<td>0.31</td>
<td>0.63</td>
<td>0.38</td>
</tr>
<tr>
<td>-post</td>
<td>0.62</td>
<td>0.87</td>
<td>0.38</td>
</tr>
<tr>
<td>Guilt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-pre</td>
<td>0.69</td>
<td>1.10</td>
<td>0.00</td>
</tr>
<tr>
<td>-post</td>
<td>0.62</td>
<td>0.96</td>
<td>0.62</td>
</tr>
</tbody>
</table>

As with the previous mood means, Mixed Factorial ANOVAs were conducted to explore differences between condition and over time.

For Fear, there was a significant main effect of condition \((F(2, 37)=6.12, p<0.01)\), but not time \((F(1, 37)<1, ns)\), and no significant interaction \((F(2, 37)=2.48, p>0.05)\). Post-hoc comparisons indicated significant differences
between conditions on rated levels of fear with participants in the control condition rating more fear than in the visuo-spatial interference condition (Bonferroni comparison: mean difference -1.68, p<0.01) and the verbal interference condition (Bonferroni comparison: mean difference -1.30, p<0.05).

For horror, there was a significant main effect for time only (time: F(1, 37)= 40.05, p<0.001; Condition F(2, 37)= 2.33, p>0.05), with horror significantly increasing over time (paired samples t(39) = -6.17, p<0.001). In relation to helplessness, there was a main effect of time (F(1, 37)= 4.23, p<0.05) with increased helplessness (t(39) = -2.09, p<0.05 2-tailed), but no significant effects for condition (F(2, 37)<1, ns) or interaction (F(2, 37)<1, ns). For disgust there was a significant main effect of time (F(1, 37)= 37.00, p<0.001), again indicating a general increase in disgust over time (t(39)= -4.37, p<0.001), but no main effect for condition (F(2, 37)= 2.32, p>0.05) and no significant interaction (F(2, 37)= 1.82, p>0.05).

Regarding shame and guilt, there were no significant main effects of time (shame: F(1, 37)<1, ns; guilt: F(1, 37)<1, ns), or condition (shame F(2, 37)<1, ns; guilt F(2, 37)= 1.29, p>0.05), and no significant interactions (shame: F(2, 37)= 1.25, p>0.05; guilt: F(2, 37)<1, ns).
3.5. Attention and Memory

Attention and memory measures are displayed in table 4 by condition to explore potential differences in recall and recognition memory (Hypothesis 10), and attention (hypothesis 11) between conditions. Examining the descriptive statistics, it appears the verbal interference condition has lower levels of attention to film, and both memory measures, providing initial support for predicted patterns.

Table 4: Measures of processing types related to watching the film

<table>
<thead>
<tr>
<th>Condition</th>
<th>Measure</th>
<th>No-task Control (n=14)</th>
<th>Visuo-Spatial Interference (n=11)</th>
<th>Verbal Interference (n=15)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Attention to film</td>
<td>9.21</td>
<td>.57</td>
<td>8.27</td>
<td>1.84</td>
</tr>
<tr>
<td>Recall Measure</td>
<td>9.07</td>
<td>2.81</td>
<td>9.81</td>
<td>2.22</td>
</tr>
<tr>
<td>Recognition measure</td>
<td>10.28</td>
<td>2.23</td>
<td>11.00</td>
<td>3.89</td>
</tr>
</tbody>
</table>

As mentioned previously, attention to the experimental tasks was significantly different between conditions, with the verbal interference task being less well attended to than the visuo-spatial interference task.

In terms of attention to film, a One-Way ANOVA indicated a significant main effect of condition ($F(2, 37)= 16.25$, $p<0.001$). Post-hoc tests of attention to film indicated significantly less attention paid in the verbal task compared to both control (Post-hoc Bonferroni comparisons: mean
difference -3.55, \( p<0.001 \) and visuo-spatial interference conditions (Post-Hoc Bonferroni comparison: mean difference -2.61, \( p<0.01 \)). Control and visuo-spatial interference conditions did not differ significantly on attention paid to film (Post-Hoc Bonferroni comparison: mean difference .094, \( p>0.05 \)).

Analysis of the memory scores for both cued recall and recognition scores was conducted based on the procedures outlined in Holmes et al. (2004), where individual items were examined for invariance (either percent correct or incorrect being <15%), with these items dropped from analysis. On the basis of this approach, item 4 was dropped from the recall questionnaire, while 5 items were dropped from the recognition measures. ANOVAs on the remaining memory scores indicated no main effects for condition regarding the recognition scores (\( F(2, 37) = 2.11, p>0.05 \), Levene \( F<1, \text{ns} \)), but did show a significant main effect of condition on recall scores (\( F(2, 37) = 8.25, p=0.001 \), Levene \( F<1, \text{ns} \)).

Planned comparisons on the recall memory scores indicated significant reduction in recall for the verbal task compared to controls only (\( t(37)=3.14, p<0.01 \), equal variances assumed).
3.6. Impact of Experimental Manipulations

The impact of the experimental manipulations is examined below, following the specific hypotheses set out in the introduction. For each hypothesis one-way between subjects ANOVAs are used to explore significant differences between condition means, followed up with orthogonal planned comparisons contrasting the no-task condition with either the visuo-spatial interference or verbal interference conditions. Where appropriate, analyses of covariance are used to statistically remove the impact of memory and mood variables, such as anxiety, and that may account for the results. Tests of specific hypotheses are conducted using un-adjusted pairwise 1-tailed comparisons, based on Least Significant Difference (LSD) to identify significant differences falling in line with predictions.

3.6.1. Diary Related measures

The group means for diary related measures of intrusions are illustrated in table 5 below.
Table 5. Diary related intrusion measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No-task Control (n=14)</td>
</tr>
<tr>
<td></td>
<td>M  SD</td>
</tr>
<tr>
<td>Diary Compliance ratings:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Examing the group means suggests that diary compliance was equivalent over groups, no significant difference between means was present ($F(2, 37)&lt;1$, ns; Levene $F = 3.39, p=0.01$).</td>
</tr>
<tr>
<td>Intrusion related measures:</td>
<td></td>
</tr>
<tr>
<td>Total number of intrusions</td>
<td>5.36 3.31</td>
</tr>
<tr>
<td></td>
<td>- Number of different</td>
</tr>
<tr>
<td></td>
<td>intrusions</td>
</tr>
<tr>
<td></td>
<td>- Number of Visual images</td>
</tr>
<tr>
<td></td>
<td>- Number of Verbal</td>
</tr>
<tr>
<td></td>
<td>Thoughts</td>
</tr>
<tr>
<td></td>
<td>- Number of Felt sense</td>
</tr>
</tbody>
</table>

**Total number of Intrusions**: Eyeballing the group means for diary recorded intrusions appears to support the predicted differences between conditions with lower intrusions in the visuo-spatial interference condition and higher numbers of intrusion in the verbal interference condition compared to no-task controls (Hypotheses 1 and 2 respectively). Examining the significance of these differences confirmed a significant main effect of group ($F(2, 37)= 7.15, p<0.05$; Levine $= 7.24, p<0.05$). Planned comparisons supported the prediction of lower intrusions in the visuo-spatial interference condition compared to controls (Hypothesis 1: $t(21) = -$
3.46, \( p = 0.01 \) 1-tailed: equal variances not assumed), however, planned comparisons only indicated a trend for the higher intrusions predicted in the verbal interference condition compared to controls (Hypothesis 2: \( t(23.9) = 1.13, p = 0.094 \) 1-tailed: equal variances not assumed).

Using ANCOVA, with recall memory scores, pre- and post-film anxiety as covariates, total intrusions was again examined between groups. The overall ANOVA remained significant, demonstrating a main effect of condition on total intrusions (\( F(3,34) = 10.35, p < 0.001 \)). Pair-wise comparisons, unadjusted for multiple comparisons in order to examine a priori comparisons, indicated significantly lower intrusions for participants in the visuo-spatial interference condition compared to controls (estimated control mean = 5.03, SE 1.07, estimated visuo-spatial mean = 0.43, SE 1.29. LSD: mean difference = -4.50, \( p = 0.01 \)) as indicated in the ANOVA above. Unadjusted pair-wise comparisons also indicated significantly higher intrusions for the verbal interference condition compared to controls when covarying recall memory and the anxiety ratings (estimated control mean = 5.03, SE 1.07, estimated verbal interference mean = 8.70, SE 1.09. LSD: mean difference = 3.74, \( p = 0.026 \)), which differs from the findings prior to the covariance analysis.
**Differing intrusion content:** The number of specific different intrusions, as defined by differences in the content of reported intrusions described by participants, was examined between groups. The means in table 2 provide initial support for the predictions that participants in the visuo-spatial interference condition will have less differing intrusions compared to controls (Hypothesis 3). However, there was little difference between the verbal interference and control condition means to suggest a predicted higher number of different intrusion scenes for the verbal interference condition compared to the no-task control (Hypothesis 4). ANOVA supported a significant main effect of condition \( F(2, 37) = 5.71, p < 0.01; \text{Levine} < 1, \text{ns} \) in terms of number of different intrusion scenes reported.

Planned comparisons indicated significantly less differing intrusions in the visuo-spatial interference conditions compared to controls (Hypothesis 3: \( t(37) = -2.95, p < 0.01 \) 1-tailed, equal variances assumed), but no significant differences between the verbal interference condition and controls (Hypothesis 4: \( t(37) = 0.04, p > 0.05 \), equal variances assumed).

An ANCOVA analysing differing intrusion content was conducted, again covarying for recall memory, and anxiety ratings. The main effect of condition remained significant \( F(2, 34) = 8.09, p = 0.001 \). Unadjusted pairwise comparisons supported the initial findings of the ANOVA, with
visuo-spatial interference participants having significantly lower differing content compared to controls (estimated control mean = 3.31, SE 0.51, estimated visuo-spatial interference mean = 0.79, SE 0.62. LSD: mean difference = -2.51, \( p < 0.01 \) 1-tailed), but no significant difference between verbal interference and control means (estimated control mean = 3.31, SE 0.51, estimated verbal interference mean = 4.25, SE 0.52. LSD: mean difference = -2.51, \( p > 0.05 \), 1-tailed).

**Intrusion Formats:** The extent to which intrusion formats, i.e. visual imagery, verbal thoughts, or felt sense, varied between conditions was examined. The descriptive statistics in table 2 indicate that for the visuo-spatial interference condition, compared to controls, there appears to be predicted decreases in both intrusive visual imagery (Hypothesis 5a) and felt sense intrusions (Hypothesis 5b) although to a lesser degree, but less verbal thought intrusions contrary to predictions (hypothesis 5c). In the verbal interference condition, compared to controls, there were slightly more imagery type intrusions (Hypothesis 6a), and to a lesser extent, more felt sense intrusions (Hypothesis 6b) compared to controls. Contrary to prediction (hypothesis 6c) there were slightly more verbal intrusions in the verbal condition compared to controls.
Inferential statistics on these group means did reveal a significant main
effect for visual imagery (imagery: $F(2, 37) = 5.77, p<0.01$; Levene = 7.22,
$p<0.05$), but not for verbal thoughts ($F(2, 37) <1$, ns; Levene = $F(2, 37) <1$, ns), or felt sense ($F_{2,37} = 1.99, p>0.05$; Levine $F_{2,37} = 3.06$, ns).

Planned comparison on the visual imagery main effect indicated
significantly less imagery type intrusions in the visuo-spatial interference
condition compared to controls (Hypothesis 5a: $t(22.2)= -2.42, p<0.01$ 1-
tailed, equal variances not assumed), with a marginally non-significant
trend for increased visual imagery intrusions in the verbal interference
condition compared to controls (Hypothesis 6a: $t(22.8) = 1.69, p = 0.051$ 1-
tailed, equal variances not assumed). As none of the other omnibus
ANOVA$s were significant, no further comparisons were made for felt
sense or verbal thoughts.

Again, an ANCOVA was conducted to statistically remove the effect of
anxiety and recall memory on the above results. A main effects was found
only for visual imagery (visual imagery: $F(2, 34) = 8.17, p =0.01$; verbal
thoughts: $F(2, 34) = 1.31, p >0.05$; felt sense: $F(2, 34) = 2.14, p >0.05$).
More specific tests, using pair-wise a priori comparisons indicated that
visual imagery means were significantly less for in the visuo-spatial
condition, and significantly higher in the verbal interference condition,
compared to controls (estimated control mean = 3.52, SE 1.44; estimated visuo-spatial mean = 0.36, SE 1.23; estimated verbal interference mean = 7.37, SE 1.04; LSD visuo-spatial vs control, mean difference -3.15, \( p < 0.05 \) 1-tailed; LSD verbal interference vs control, mean difference 3.84, \( p < 0.01 \) 1-tailed). No significant differences were found when examining mean differences between conditions in terms of verbal thoughts (LSD visuo-spatial vs control, mean difference = -0.59, \( p > 0.05 \) 1-tailed; LSD verbal interference vs control, mean difference = 1.13, \( p > 0.01 \) 1-tailed). For felt sense, there was only one significant difference, and this was for lower felt-sense type intrusions in the visuo-spatial condition compared to controls using unadjusted pair-wise comparisons (estimated control mean = 1.47, SE 0.41; estimated visuo-spatial mean = 0.28, SE 0.49; estimated verbal interference mean = 1.61, SE 0.42; LSD visuo-spatial vs control, mean difference -1.19, \( p < 0.05 \) 1-tailed; LSD verbal interference vs control, mean difference 0.14, \( p > 0.01 \) 1-tailed).

3.6.2. Intrusive and Avoidant Symptoms

The sub-scales of the IES gave measures for intrusion and avoidance symptoms reported over the preceding week in relation to the trauma video, these measures were used in addition to diary rated intrusions to explore the impact of experimental condition on potential trauma related symptoms. The means of these sub-scales per-condition are displayed in table 6 below.
Between group One-Way ANOVAs based on the IES intrusion and IES Avoidance sub-scale ratings failed to uncover any significant group differences for the intrusion sub-scale (Hypothesis 1 and 2: $F(2, 37) = 1.23, p>0.05$, Levene $F<1$, ns), but found a trend for the Avoidance sub-scale ($F(2, 37) = 2.46, p=0.09$, Levene $F = 2.34, p>0.05$). Exploring this trend in Avoidance further, using planned comparisons found significantly more avoidance symptoms for individuals in the verbal interference condition compared to controls ($t(26.7)= 2.58, p = 0.015$ 2-tailed, equal variances not assumed), but no significant differences between controls and the visuo-spatial interference condition ($t(16.5)= 0.9, p >0.05$ 1-tailed, equal variances not assumed).

As with the Diary based intrusion measures, an ANCOVA was conducted on the data from the IES sub-scales, covarying the anxiety measures and recall memory. There were no significant main effects for either the

<table>
<thead>
<tr>
<th>Measure</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No-task Control (n=14)</td>
</tr>
<tr>
<td></td>
<td>$M$</td>
</tr>
<tr>
<td>IES intrusion measure</td>
<td>5.85</td>
</tr>
<tr>
<td>IES avoidance measure</td>
<td>3.50</td>
</tr>
</tbody>
</table>
intrusion or avoidance IES measures between groups (intrusion sub-scale: 
\[ F(2, 34) = 1.56, p > 0.05; \] avoidance sub-scale \[ F(2, 34) = 2.17, p > 0.05. \]
Looking at more specific group differences, however, did reveal a 
marginally significant pair-wise difference with intrusive items rated higher 
by verbal interference task participants compared to controls using non-
adjusted a priori comparisons (estimated control mean = 5.31, SE 1.36; 
estimated verbal interference means = 8.80, SE 5.97; LSD: mean difference 
= 2.93, \( p < 0.05 \) 1-tailed), but no difference between visuo-spatial 
interference and controls (LSD mean difference = 0.57, \( p > 0.05 \)).
Participants in the verbal interference condition also rated avoidance items 
as significantly higher after covarying anxiety and recall memory scores, 
compared to controls when examining direct unadjusted pairwise 
comparisons (estimated control mean = 3.65, SE 1.76; estimated verbal 
interference means = 9.06, SE 1.80; LSD: mean difference = 5.40, \( p < 0.05 \) 
1-tailed).

Correlations indicate that the intrusion sub-scale of the IES was moderately 
correlated with diary based intrusions \( r(40) = 0.42, p < 0.01 \), while 
avoidance was not correlated with diary intrusions \( r(40) = 0.07, p > 0.05 \).
Reliability analyses were conducted on the IES subscales, using Cronbach's $\alpha$, the Intrusions subscale resulted in a low reliability ($\alpha = 0.65$), with the Avoidance scale producing similarly low reliability ($\alpha = 0.69$).

3.6.3. Data Driven and Conceptually Driven Processing

From table 7 below, there appear to be small differences in data driven processing between groups, with lower scores in the visuo-spatial condition compared to control and verbal conditions. Preliminary analysis of the questionnaires used to measure these processes indicated low reliability for the data driven (Cronbach's $\alpha = 0.66$) and disruptions in conceptual processing (Cronbach's $\alpha = 0.65$), so the following results need to be treated with caution.

The verbal condition had the highest level of reported data driven processing. A significant main effect of condition was found for data-driven processing (Hypothesis 7 & 8: $F(2,37) = 4.82, p = 0.014$, Levene's $F = 1.64, p > 0.05$), but not for disruptions in concept driven processing ($F(2,37) < 1$, ns).
Table 7: Measures of processing types related to watching the film

<table>
<thead>
<tr>
<th>Measure</th>
<th>Condition</th>
<th>No-task Control</th>
<th>Visuo-Spatial Interference</th>
<th>Verbal Interference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(n=14)</td>
<td>(n=11)</td>
<td>(n=15)</td>
</tr>
<tr>
<td>Data Driven processing</td>
<td>M  SD</td>
<td>8.57 4.03</td>
<td>6.63 3.10</td>
<td>11.93 5.47</td>
</tr>
<tr>
<td>Disruptions in conceptually driven processing</td>
<td>M  SD</td>
<td>2.35 3.47</td>
<td>2.4 2.20</td>
<td>3.66 4.45</td>
</tr>
</tbody>
</table>

Planned comparisons of between group differences in reported data driven processing indicated the predicted statistically significant increase in data driven processing in the verbal interference condition compared to controls (hypothesis 8: \( t(37)= 2.04, p = 0.024 \) 1-tailed, equal variances assumed).

There was no predicted reduction in data driven processing in the visuo-spatial interference condition compared to controls (hypothesis 7: \( t(37)= -1.08, p >0.05 \) 1-tailed, equal variances assumed).

Using ANOCVA to control for recall memory and anxiety levels pre- and post-film indicated a trend for significant a main effect of data-driven processing (\( F(2, 34)= 2.76, p = 0.07 \)), but no significant main effect of conceptually-driven based disruptions (\( F(2, 34)= 1.5, p > 0.05 \)).

More specific follow-up analyses from the ANCOVA using pair-wise group differences based on unadjusted a priori comparisons indicated
significantly higher levels of data-driven and disruptions in concept-driven processing for the verbal interference group compared to controls (data-driven estimated mean for controls = 7.56, SE 1.21; data-driven estimated mean for verbal interference = 11.68, SE 1.23; LSD verbal interference vs control mean difference for data-driven processing = 4.11, \( p = 0.014 \) 1-tailed; estimated mean for disruptions in concept-driven processing in controls = 1.49, SE 1.02; estimated mean for disruptions in concept-driven processing in verbal interference = 4.17, SE 1.04; LSD verbal interference vs control mean difference for disruptions in concept-driven processing = 2.67, \( p < 0.05 \) 1-tailed). There were no significant differences between the visuo-spatial conditions and controls in terms of either data-driven processing or disruptions in concept-driven processing (LSD visuo-spatial vs control mean difference data-driven processing = 0.69, \( p > 0.05 \) 1-tailed; LSD visuo-spatial vs control mean difference for disruptions in concept-driven processing = 1.37, \( p > 0.05 \) 1-tailed).

3.7. State and Trait Dissociation

A mixed ANOVA was conducted to investigate the role of state dissociation with state dissociation as a dependent variable, time as the within subjects variable (pre- and post-film) and condition as between group variable. There was a significant main effect of time \( (F(1, 37) = 19.65, p < 0.001) \), but not for condition \( (F(1, 37) < 1, \text{ ns}) \) nor was there a
significant interaction ($F(1, 37) = 1.82, p>0.05$). However, the assumptions of equality of covariance were not met (Box's $M = 21.57, F = 3.30, p<0.01$). For this reason t-tests were conducted for pre- and post-film measures of state dissociation within each condition. There were significant increases in state dissociation in the control ($t(13) = -3.01, p = 0.01$) and verbal conditions ($t(14) = -4.01, p = 0.001$), but not for the visuo-spatial interference task ($t(10) = -1.43, p>0.05$), these remain significant after Bonferroni correction (alpha set to 0.016, 3 tests).

Correlational analysis on number of intrusions and change in dissociation produced a significant moderate positive correlation between change in dissociation and number of intrusions ($r(40) = 0.35, p=0.024$ 2-tailed).

Trait dissociation was also examined in relation to number of intrusions, with the DES II used as an overall measure of dissociation finding no significant correlation ($r(40) = 0.11, p>0.05$), and in relation to the DES II taxon ($r(40) =0.06, p>0.05$) and imagination sub-scales ($r(40) =0.10, p>0.05$). When broken down by group there were no significant associations present.
Discussion

This study set out to replicate findings from previous studies (e.g. Brewin & Saunders, 2001; Holmes et al., 2004) regarding the role of peri-traumatic visuo-spatial and verbal interference tasks in the development of intrusions in the context of watching an analogue trauma film. The main results replicate previous findings that performing a concurrent visuo-spatial task during film exposure significant decreases the amount of intrusions recorded in a one week period (Hypothesis 1). The predicted role of a verbal interference task in the development of increased intrusions (hypothesis 2) came close to replication, with a non-significant trend supporting a potential increase in reported intrusions compared to controls. However, this trend became significant when controlling for level of recall memory and pre-/post-film anxiety.

These two principal hypotheses are discussed in detail below, along with associated hypotheses regarding the content of intrusions, their representational format, and their relation to core cognitive processes occurring during the encoding of trauma-like material, such as attention, memory, and arousal. The potentially key roles of memory recall and anxiety in developing intrusions are discussed as related, yet alternative explanations of the studies main findings. These findings are also discussed
in relation to the corroboration of clinical models of PTSD and subsequent therapeutic implications. The use of a film analogue to approximate trauma-like processes is also discussed, along with potential weaknesses in the study and further developments for future research.

4.1. The development of intrusions: A visuo-spatial perspective?

In formulating the study hypotheses relating to the development of intrusions, two processes were focused on, heavily based on multi-level theories of PTSD symptoms such as DRT (Brewin et al., 1996; Brewin, 2001) and Ehlers & Clarks cognitive model (2000). The visuo-spatial tapping task has been adopted in previous studies (Holmes et al., 2004) to explore the impact of interfering with visuo-spatial processing during the encoding of trauma related material. Performance measures for the visuo-spatial task indicated good performance on the tapping task demands equivalent to previous usage (e.g. Holmes et al., 2004).

Not only were reported intrusions significantly lower for people performing the visuo-spatial tapping task, compared to controls, but also there were significantly less differing scenes forming these intrusions, and significantly less intrusive imagery. There was no reduction in self-reported data-driven processing for participants who performed the visuo-spatial
task, compared to controls, and no significant differences in disruptions of conceptual processing.

When using an alternative measure of intrusive symptoms, the IES, no significant differences were found between conditions in terms of the influence of visuo-spatial interference compared to the no-task control, although the means suggested an increase in intrusive symptoms for the verbal interference condition. It is possible that the questions used by the IES to capture elements of intrusive symptoms are difficult to rate when using the specific anchor system (Not at all, Rarely, Sometimes, and Often), which may lead to overestimation, especially when interpreting anchors such as 'sometimes'. It is also possible that having the IES at the end of the follow up session, having gone through the intrusion diary immediately prior, may have artificially elevated estimates of symptoms over the week. This may have occurred through priming these in active memory and maybe leading to expectations of more intrusions than actually recorded, similar to an availability heuristic. There was also low inter-item reliability for the IES intrusion subscale, suggesting it may not be an adequate tool to be used in this context.

With the exception of the IES intrusion sub-scale, which may prove of questionable reliability in this context, the diary related findings provide
support for the role of a concurrent visuo-spatial task in reducing intrusions post-exposure, at least in the following week. These findings did not change when level of recall memory or anxiety pre- and post-film was statistically controlled for across conditions. The data also appears to suggest important evidence implicating the key function of visuo-spatial processes, but not necessarily data-driven processing in the development of intrusions (Brewin et al. 1996; Brewin, 2001). The significantly fewer visual imagery intrusions provided additional support that the effective mechanism for this task is the disruption of imagery related processes at encoding, and how this may be supported via a sensory type code. The questionnaire used to measure data-driven processing had low reliability in this context, potentially because it is measures a number of apparently disparate features of data-driven processing, including disruptions in clarity of thinking in addition to more pure measure sensory impression items.

Alternative explanations of the intrusion suppressing effect of the visuo-spatial task need to be addressed; some of these have already been detailed by Holmes et al. (2004) in their discussion of similar findings. One key alternative explanation to the visuo-spatial interference hypothesis is that any concurrent task, regardless of content, would reduce reported intrusions. This alternate hypothesis is based on the potentially distracting role of a concurrent task in limiting encoding of the traumatic stimulus,
hence reducing the amount of material possibly expressed as intrusions. An implication of this ‘distraction’ hypothesis is that deficits in memory and attention should be present if the concurrent task does in fact reduce encoding capacity.

As in Holmes et al.'s study, the ‘distraction explanation’ was not supported by the findings of the current study, based on both attention and memory scores. Attention to the film in the visuo-spatial condition was not rated as significantly less compared to controls, neither did the visuo-spatial task have any apparent impact either on film recall or recognition. It can be argued that attention was not objectively measured. The memory results are more difficult to discount, unless it is claimed they lack sensitivity. If this was the case, then it would be difficult to account for the impact of the second key task, the verbal interference task, which did produce reductions in attention to film and recall memory, but actually indicated a trend for increasing intrusions, rather than fewer. The active features of the visuo-spatial intrusion suppressing effect appear to be located elsewhere, and not based on a generic distraction account, rather it may be the quality and type of encoding promoted rather than the quantity that is key.

It is interesting that there was less variation in the types of intrusions recorded, in terms of different intrusive ‘scenes’ reported. While one
possibility is that less of the film material could have been encoded, and therefore less material would be activated as intrusive content, the memory data did not support this as no impairment was found for film recall and recognition. Rather it is possible that memory of the film remained intact, but the quality of the memories encoded in the visuo-spatial condition may have prevented development of these traces into more automatically activated intrusions.

Another alternative explanation for the reduction of intrusions in the visuo-spatial condition is related to the role of arousal and emotion in accentuating explicit memory processing (e.g. Brown & Kulik, 1977; Cahill, 1997). This second alternative explanation suggests that explicit memory tends to be accentuated under conditions of moderate arousal and stress, based on the classic Yerkes-Dobson inverted ‘U’ curve relating performance to arousal/anxiety. Based on this hypothesis, the role of a concurrent task is to divert attention away from ongoing arousing or emotional events, thereby interfering with memory accentuating arousal.

As with the alternative ‘distraction’ hypothesis, the consequence of this ‘reduced arousal’ approach is that less information should be encoded compared to conditions were arousal/emotional valence is more salient, hence less information being available to be developed into intrusions. The
current study did indicate that visuo-spatial participants experienced significantly less reported distress compared to participants in other conditions. Distress in this case was measured by a global distress rating and individual mood fluctuation ratings, and was seen to increase between pre- to post-film. The possibility remains plausible that those participants in the visuo-spatial condition experienced less distress and hence arousal.

When examining more specific mood ratings, there were increases in negative mood across all conditions, involving increases in unhappiness, depression, helplessness, disgust, and horror, some of the key emotions involved in what are called ‘hot spots’ or hot cognitions experienced at the time of trauma (Grey et al., 2001). These mood related features suggest the film used had a negative impact on participants’ mood, regardless of condition, replicating prior findings using this video stimulus (e.g. Holmes, et al., 2004).

The alternative ‘arousal reduction’ explanation cannot be completely discounted regarding the mechanisms by which a visuo-spatial task may lead to fewer intrusions. When explored in detail, there was a statistically significant reduction in self-reported anxiety within the visuo-spatial condition compared to other conditions, which remained after controlling for initially lower levels of anxiety pre-film. To our knowledge, this was
not found in prior studies using similar methodology (e.g. Holmes et al., 2004).

A reduction in anxiety appears to match an alternative explanation of the role of the visuo-spatial task in reducing arousal and hence encoding efficacy, this is still not borne out by the memory or general mood data. Also, covarying out anxiety both pre- and post-film did not have a substantial impact on the findings regarding the visuo-spatial interference task, unlike the findings for the verbal task. However, applying these covariates did reveal a significant reduction of felt-sense type intrusions in the visuo-spatial condition, suggesting that when level of anxiety and potentially recall effects are controlled for, the tapping task may be able to also suppress sensory or mood related type intrusions. There may be something specific about anxiety reduction, in relation to the visuo-spatial task and intrusion formation that does not impact necessarily on memory related processes, but may be related to preventing intrusions, especially those of a visual and sensory format.

As suggested by Holmes et al. (2004), the use of traditional memory measures, in this and their study, is a novel approach, one that suggests, based on the findings from both studies, that the impact of traumatic-type stimuli on memory may be a separate issue to the actual expression of
intrusions. The active mechanisms responsible for the reduction of intrusions in the visuo-spatial task do appear to be related more to a disruption in visuo-spatial processing, than to reductions in attention or generally memory related encoding.

4.2. Verbal Encoding and Intrusions: Verbal Interference as a disrupting effect on intrusion suppression?

Another important feature of this study is that it adopted a verbal task that was hypothesised to lead to increased intrusion frequency. The verbal task was hypothesised to disrupt narrative processing that can aid in the inhibition of intrusions. Adopting the verbal task within the same experimental design aimed to reduce variation due to task and situational demands, thus providing appropriate use of baseline and control measures. This combination of experimental tasks was lacking in previous studies that did not adopt verbal and visuo-spatial tasks within the same experiment (e.g. Holmes et al, 2004). The verbal task therefore provides a vital feature of for this experiment, and brings together a series of studies outlined by Holmes et al. (2004).

The initial findings involving the verbal interference task provide partial support for the impact of verbal interference in increasing intrusion frequency. The data came close to replicating previous findings that the
role of a verbal interference task during encoding may increase intrusions. However, when covarying the potential effects of recall memory and anxiety (both pre- and post-film) the results appear more in line with predictions, with significantly higher total intrusions compared to controls; significantly more imagery format intrusions, and significantly higher frequency of symptoms on both the IES intrusion and avoidance symptoms.

The use of a verbal task designed specifically to increase intrusions, poses a direct challenge to theories that suggest ‘distraction/attention’ produced by any concurrent task may lead to reduced intrusions. Therefore, as in the visuo-spatial condition, it is not necessarily the attentional features of the task that explain its influence. The content of the task seems crucial to understanding its impact on increasing visual intrusions, data-driven processing, and to a certain extent, increasing intrusions in general.

Also of key interest, was a significant increase in reported data-driven type processing for participants in the verbal condition compared to controls. The predicted effect was found for disruptions in conceptual processes after covarying the effects of anxiety pre-film, anxiety post-film, and recall memory, as would have been expected if the verbal task interfered with the processing of meaning at a narrative level. Caution must be taken over findings involving the data-driven and conceptual processing scales, as the
measure of data-driven processing had limited reliability. However, a potential alternative explanation of the higher levels of data-driven processing in the verbal condition is that the measure of data-driven processing may have been contaminated by difficulty with performing the counting task itself, rather than the experience of watching the film. This is a possibility because some of the item content was related to difficulties in thinking clearly, which may be due more to the difficulty in maintaining the counting task for over 12-13 minutes. This confounds potential task demands, and the low level of sub-scale reliability signals the need for caution when interpreting the data-driven and conceptual processing measures.

It is important to consider why the counting/verbal interference task did not achieve clear significance, without covarying the impact of anxiety and recall memory related features. One possibility is the lack of power in the design, which required 42 participants per cell as suggested by previous studies, based on an effect size of 0.90. Another possibility was that the level of task performance in the verbal counting task was limited compared to previous studies (exp 3: Holmes et al., 2004,) with a high rate of errors overall.
The error rate was also significantly associated with fewer intrusions, as was the proportion of errors to the total numbers counted. This suggests a clear relationship between task performance and the impact of the verbal task on its capacity to increase subsequent intrusions. It may have been that errors represent lack of task performance, and hence reduction in the impact of verbal interference on intrusion development, however, they may also represent lower working memory capacity. This is especially salient as lower working memory capacity, and related concepts such as fluid intelligence, have been implicated in difficulties suppressing thoughts (Brewin & Beaton, 2002), and are factors in the experience of intrusions. It remains uncertain how to interpret error rate in relation to theoretical basis for intrusion formation and subsequent suppression processes. These relationships are difficult to untangle from the data in this study. A parsimonious understanding of the error rate suggests it primarily represents lack of attention/performance on task, which subsequently impacted on both attention to film, reducing encoding of film material, and limiting verbal interference. The issue of verbal task performance would have been clearer if other performance indexes, such as number of pauses, or amount of numbers counted, were also associated with decreased intrusions.
Unlike the visuo-spatial task, the verbal task did appear to reduce attention and recall of the film, but not recognition memory. This suggests that less explicit information regarding the film was encoded, which would suggest possibly less intrusive content. Combining this with a lack of sufficient disruption in narrative processing may provide one explanation for the less than a significant increase in intrusions compared to controls. However, if attention reduction, limitations in memory encoding, and reduced verbal interference through reduced task performance, were primary factors in the verbal condition, there would have potentially been significantly less intrusions reported than controls, on a par perhaps with the level found in the visuo-spatial task. This was not the case. The presence of increases in visual imagery intrusions and higher reported levels of data-driven processing in the verbal interference condition suggest the verbal nature of the task is pre-disposing participants to experience elevated rather than decreased intrusive content.

The possibility remains that as a result of verbal interference memories of the trauma film were encoded in a less narrative fashion and hence more difficult to access in a recall situation, but nonetheless encoded in a more implicit format amenable to recognition tests and elevated intrusion frequency. This fits the data on recognition and recall memory found in this
study, and sits well with the significantly higher imagery-based intrusions found under the verbal interference condition compared to controls.

Participants in the verbal interference condition also had significantly higher frequency of avoidance symptoms on the IES sub-scale compared to controls, and intrusive symptoms after covarying the impact of recall memory and anxiety. As the IES sub-scales both presented with low inter-item reliability caution is required in its interpretation. Participants in the verbal interference condition also experienced higher frequencies of not wanting to talk about the study in relation to controls, based on item 9 of the IES. It is a possibility these participants experienced higher levels of avoidance and more potential attempts to suppress thinking about the film. Avoidance may have been indicative of repeated attempts to suppress intrusions, but this was not borne out by non-significant correlation with number of reported intrusions.

Overall, these findings offer some support for the potential role of verbal interference in preventing the inhibition of sensory information by more narrative driven processing. This opens the possibility that verbal processes can regulate the presence of data-driven processing, at least as measured by the questionnaires used in this study. The efficacy of the counting task in producing intrusive content may be in part related to it’s disruption of
verbal encoding, but may also be moderated by participants cognitive capacities such as working memory capacity and fluid intelligence. These key ability factors may confound the efficacy of the verbal task in the development of intrusions, while also indicating that a number of cognitive factors may be involved in the concept of verbal/narrative encoding in the development of less VAM type memories.

4.3. State and Trait Dissociation

Peri-traumatic dissociation has been considered a factor implicated in the development of intrusions, potentially through a disruption in the encoding and integration of information during exposure. There was a significant increase in state dissociation over all conditions, with no main effect of condition or interaction. When examining the relationship between this change in state dissociation and overall number of diary reported intrusions, there was a moderate correlation present, supporting the role of state dissociation in the development of intrusions. There were no indications in this study that trait dissociation, as measured by the DES II and its taxon and non-taxon sub-scales, was related to number of intrusions reported. The relatively low number of participants in this study precluded more detailed regression analysis of the predictive value of state dissociation after accounting for condition. The possibility remains that an active mechanism of tasks such as the verbal interference in elevating
intrusions may be due in part to some increase in state dissociation, while
tasks such as the visuo-spatial task may reduce intrusions by reducing state
dissociation. However, it is important to note that state dissociation
increased in all conditions, except the visuo-spatial condition. This
potentially reflects a grounding type effect of this task in reducing
dissociative experiences (e.g. Kennerly, 1996)

4.4. Implications of visuo-spatial and verbal interference for models of
trauma symptom development.

Some of the findings have already been discussed in relation to their
theoretical implications, but the key emphasis of these findings is on the
role of a peri-traumatic task in the development of intrusive imagery. This
paradigm has allowed an examination of the potentially crucial role of
factors occurring at encoding in relation to intrusion development, and has
supported the involvement of both visuo-spatial and verbal processes in the
encoding of trauma related memories.

The key theories used to generate the study hypotheses, namely DRT and
Ehlers and Clark’s cognitive approach, support the involvement of sensory
processing in the development of traumatic memories pre-disposed to
generate intrusive images. The study data supported the theoretical
underpinnings of these models.
From the DRT perspective, the theoretical model driving this study and the studies it is based upon (e.g. Holmes, et al., 2004), the involvement of visuo-spatial processes is tied into the development of SAM type representations responsible in part for the automatic and potent sensory images related to flashback type intrusions. The disruption of these visuo-spatial processes, using the visuo-spatial tapping task, supports the supposition that weakening sensory input impacts on SAM formation and therefore leads to fewer intrusions.

The use of a verbal interference task was predicted to weaken VAM type representations by impairing narrative processes supporting VAM formation. This was partially replicated, along with evidence that visual imagery intrusions were accentuated following the verbal interference task. The data supports the possibility that narrative processes are involved in the formation of VAMs, and disrupting these processes therefore increases intrusions by a process of preventing adequate inhibitory VAM representations. This is further supported by a reduction in explicit memory recall, a means of tapping into narrative based declarative knowledge associated with VAM formation.

It is still unclear from this study what other mechanisms may disrupt formation of VAMs and therefore accentuate intrusions, in addition to the
involvement of potentially narrative encoding routes. Based on previous research (Holmes et al., 2004), the verbal task implicates the involvement of phonological processing, and, as suggested by the task performance data, attention and recall memory. The level of task load may also be an important factor in combination with the verbal nature of the task. An attention based explanation, in terms of disrupted memory encoding and increased distraction, is not sufficient to account for the increase of intrusions. A process of disrupted verbal encoding, with a potential accentuation of representations based on visuo-spatial and data-driven code, fits well with the data on intrusions and the potential saliency of data-driven processes.

More recent theoretical developments exploring the neuro-psychological substrates of PTSD have implicated a number of different neurological pathways in processing information regarding traumatic events. It is these different routes, and the variation in level and type of processing they imply, that provides a physiological basis supporting the different modes of representation responsible for PTSD symptoms, especially the formation of SAM and VAM representations. Interpretation of the study data needs to take account of these developments in theory.
Based on these theories, Brewin (2001; Brewin & Holmes, 2003) identifies two specific neural routes that correspond well with the distinction in DRT between VAM and SAM processing. VAM type processing appears closely associated with the encoding of information in a more coherent way, including processing of context and conscious experiences, mediated by cortical structures involving interactions with the hippocampus. This route involves more sophisticated and refined processing of sensory data, which can become incorporated with longer term memory. A possibility here is that at some level this information uses verbal code for processing, or is stored in a fashion transferable into coherent verbally accessible forms.

Under conditions of heightened threat, sensory details may be transmitted rapidly via another route, avoiding prolonged hippocampal processing, but feeding more directly into the amygdala, a limbic structure in part responsible for activating hard-wired fear responses. The consequence of processing via this amygdala based route is that situational information is not encoded via a more coherent and consciously accessible cortical routes, but remains as raw sensory traces associated with signals of potential threat that represent associative links to fear and activation not initially inhibited by cortical processing. This sensory information is therefore readily activated in response to potential trauma related environmental cues. It is
this route that is hypothesised to support the more automatic, sensory-imagery based SAM type processes linked to intrusive imagery.

The role of stress and arousal in these models focuses specifically on the contrasting psycho-biological impact of stress regulating hormones on hippocampal and amygdala processing routes. Increased arousal influences hippocampal processing by initially accentuating encoding performance followed by a decline in performance as arousal increases, based on the classic Yerkes-Dobson inverted ‘U’ performance curve. The amygdala, serving its evolutionary function as a threat response system, performs progressively better as arousal increases, hence at higher levels of arousal or stress the more rapid amygdala route may be dominant, with an implication that limited hippocampal activity is involved, reducing VAM coherency and leaving SAM type processing unaffected. Therefore, the more threatened or aroused an individual, the more one would expect SAM related encoding to occur as the amygdala route is accentuated, and less VAM representations as the hippocampus capacity to encode complex information is affected.

Considering these theories with regards this study, the visuo-spatial tapping condition appeared to produce less anxiety, and therefore may have facilitated less direct amygdala type processing, promoting less SAM
encoding, and hence less potential intrusions. At the same time hippocampal processing is left somewhat unimpaired, enabling adequate encoding of film material in memory, as was found in this study. The visuo-spatial task may act to reduce or block sensory processing of the film material, by competing for visual-spatial resources, hence reducing the sensory material available to activate hard-wired fear responses from the amygdala, but not impacting on narrative related encoding in the hippocampus. This would account for the intact explicit memory findings in the visuo-spatial condition. However, this explanation needs to take into account at what stage of processing the visuo-spatial task interferes with encoding of sensory material, the hypothesis suggested here is that processing is interfered with early on, preventing rapid activation of amygdala routes.

It is also noted that while level of distress were relatively equivalent between the control and visuo-spatial conditions in terms of mood indices, but with less global rated distress and anxiety in the visuo-spatial condition. The dimensional ratings of mood in this study suggested that core features of decreased mood were based on depression, helplessness, horror, disgust, and unhappiness, tentatively suggested as evaluative mood responses, rather than immediate responses based around threat/negative arousal features. As a speculative hypothesis, these evaluative features of mood
may be more related to some degree of processing at a later stage in relation to previous experience, rather than more immediate fear responses. A means forward in exploring these processing stage issues is to use functional imaging studies to examine the locus of brain activity triggered due to visuo-spatial interference tasks, and any evidence of decreased activity in limbic systems as a result of such tasks compared to control conditions.

Overall, the findings support to a large extent the multi-process distinctions made by recent theories of PTSD, and fit well with the models from which this study was derived. This helps corroborate such models, which in turn feeds into an understanding of the aetiological factors involved in developing intrusion prone representations, and hence into the targeting of these factors via therapeutic interventions.

4.5. Clinical Implications

Studies such as the current one feed into clinical processes in a number of ways including informing models of syndrome formation and development, which identifies some key features of assessment and formulation, intervention and technique. In the clinical context these models have implications at different phases of therapy, including initial data gathering, psycho-education, treatment selection, and treatment development.
In the previous section, the corroborating role of findings from studies like these was considered in terms of encoding processes, from a peri-traumatic perspective. This is important for targeting central features of processes involved in symptom formation and localising potential obstacles in adaptive emotional processing. Part of this process in the clinical setting is the detailed assessment of predisposing and precipitating factors, which may include peri-traumatic features, including the presence of state dissociative experiences. Appropriate measurement of these features may contribute to monitoring the efficacy of an intervention, and focus on what features contribute to symptom maintenance.

For therapy, the issue of retrieval process and retrieval context is important, as these factors may be linked into the promotion of emotional processing after the traumatic event. This is again informed by a validation of potentially critical processing features that prevent therapeutic processing, such as the development of memory representations that are difficult to access consciously in therapy due to their encoding related features.

The parallel nature of visuo-spatial and narrative processing representations or codes implies the need, as discussed by Brewin et al. (1996), to address these features of PTSD in conjunction. The evidence that both these processing routes are implicated in a ‘hybrid’ disorder support the use of
techniques that target both these features. Traditional approaches to therapy address these features by using both exposure and appraisal/challenge related techniques, to help develop emotional processing of traumatic events at two distinct yet inter-related levels. In relation to exposure techniques, this study, along with Holmes et al. (2004), suggest a strong focus on utilising visuo-spatial dimensions to interact with the appropriate format underlying SAM/data-driven based representations. At the same time, verbal based process may be used to develop VAM type representations that attempt to fully integrate the associated sensory details stored in a primarily SAM type sensory based code.

At an early stage of therapy, psycho-education regarding the processes involved in intrusions may be informed by such research. In a well developed treatment context, promoting a normative view of intrusions and the processes involved in the formation of intrusions may help reduce potential therapy sabotaging factors such as stigma and avoidance. Following this, the question is open as to what role sensory focused techniques can be used at a retrieval stage regarding traumatic symptoms, as distinct from peri-traumatic processes examined in this study. A number of techniques have been developed to help regulate the emotional impact of flashbacks or detailed re-living/re-visiting used in session (e.g. Richards & Lovell, 1999). Relaxation and grounding procedures (e.g. Kennerly, 1996)
have also formed a basis for these techniques. It should be noted that it is possible that overuse of such strategies for simple symptom reduction can lead to the formation of safety behaviours, which are implicated in the maintenance of a number of anxiety disorders by becoming avoidant strategies preventing emotional processing of trauma content. However, using some of these techniques can help reduce extreme level of arousal that may act to reduce narrative processing implied in re-living, while blocking sensory loaded intrusions from activating SAM type processes.

A key factor in techniques such as grounding, in addition to their capacity to give clients a sense of control over their symptoms, is their focus on sensory input. Incorporation of visuo-spatial grounding tasks can help manage flashback symptoms in everyday life and in combination with in session practice of re-scripting techniques can facilitate the generalisation of the therapeutic elements of these approaches in everyday life or in vivo exposure. Grounding may also incorporate images or phrases that allow the person to re-focus on the here-and-now, and combat overwhelming flashbacks or dissociative experiences, whilst targeting both SAM based sensory-imagery processing and recruit the counteracting focus of VAM systems. An interesting issue arising here is the extent to which self-generated and internal visuo-spatial tasks may act as techniques to reduce
intrusions, in contrast to external paced tasks such as the tapping procedure used in this study.

The current study suggests that, although focused on encoding, the impact of sensory information during re-living may be moderated using a task that interferes with visuo-spatial processing, also allowing an alternative narrative to be constructed surrounding the traumatic event. Potentially structured decreasing levels of visuo-spatial interference, similar in fashion to a graduated hierarchy, may reduce overwhelming sensory re-living similar to the use of sensory grounding during high levels of dissociative experiences and reduce the potential formation of safety behaviours. Another possibility, given a potential difficulty in precise regulation of visuo-spatial interference, is to switch between using re-living under visuo-spatial interference conditions to using re-living without visuo-spatial interference. Again, this may allow a sense of control over sensory intrusive symptoms, while facilitating interleaving of key sensory representations into narrative formats (Brewin, 2001), but prevent the formation of safety behaviours. These features, to the author's knowledge, remain to be explored in an experimental context, focusing on the retrieval phase of the trauma related materials.
EMDR

As a technique, this already incorporates many features of sensory focus and detailed imaging of the traumatic event. As mentioned in the introduction, while EMDR has some demonstrated efficacy, despite flaws in the methodology of a sub-set of studies, one of the critical issues with this approach is its lack of supporting theoretical foundation. From a DRT perspectives, much of the focus of EMDR activity is on sensory coding similar to SAM representations, while also promoting focus on interweaving both internal and external narratives around the traumatic scene. Studies such as the current one, which supports the mediating impact of visuo-spatial resources regarding intrusion development, provide support for approaches such as EMDR, and may help develop models regarding its underlying efficacy. A critical element of these approaches is that purely attention based explanations of the role of concurrent tasks/process at encoding or retrieval may be insufficient to explain intrusion reducing effects, and that the content of the task may be of clear importance. Some research supports the contention that eye-movements are not central to EMDR, and that manipulations of the role of visual fixation can still prove effective even when visual attention is focused on a static stimulus (e.g. Renfery & Spates, 1994), although this result has not been consistent (Montgomery & Allyon, 1994) as noted by Holmes (2000).
4.6. Potential Improvements to the design and the role of analogue trauma stimuli.

A key feature of this study was the use of an analogue ‘trauma film’. A potential criticism of this study is that such the paradigm adopted is flawed, an underlying assumption being that the trauma film does not recruit processes similar to the extreme events encountered in real-life events. This criticism can implicate both quantitative and qualitative issues, either that the trauma film is not sufficiently extreme or of the same type of stress that experienced in real life event. To address the qualitative issues first, in terms of the elements present in the trauma film a number of these match components of trauma as listed in DSM IV (APA, 1994) such as death, pain, and suffering, critical threat or actual severe compromise of physical integrity. Therefore the analogue appears to contain the elements commonly found when people are exposed to a ‘traumatic event’.

It can still be argued from a quantitative approach that the level of stress produced by the film does not compare to actual trauma. It can also be argued that watching a video creates a distance from events that reduces the impact of the event. Clearly, these issues are tied into the ethics of research, as participants should not be severely traumatised under experimental conditions. In response to this continuum type criticism, the issue here is
the extent that an analogue activates relevant processes involved in actual trauma. As indicated in the results and previous discussion, there were clear affective changes shown in response to the film, in line with the type found under real-life traumatic experiences, but not necessarily the extent. It is also important to note that the film did appear to lead to reported intrusive content, validating its role as a stimulus for producing intrusions content. The level of these responses may not have been sufficient to fully recruit psycho-physiological features implicated in the experience of trauma (e.g. disrupted hippocampal processing, increased activation of direct amygdala encoding). However, the focus of this study was to establish the potential involvement of visuo-spatial and narrative processes implied in encoding stressful and trauma related materials. The paradigm and methodology appeared appropriate and sufficiently valid to have achieved this. The intrusions were also assessed to examine if they contained elements commonly found in traumatic experiences, such as spontaneity.

The use of the diary methodology was a crucial feature of this study. The aim of using a portable diary system was to increase the accuracy of recording intrusions. However, this diary system could be further enhanced using technological features, such as audio-recording of intrusions as they happen, or the use of mobile phone technology to tag time of intrusion and content on-line. There may always be limitations to recording intrusions,
but attempting to facilitate diary usage and adopting usage measures can be
means of reducing these restrictions. This study did not use a measure of
the temporal proximity of intrusive experience to diary use, which may in
future provide a further index of diary effectiveness.

The tasks used to interfere with processing at encoding appeared generally
effective in their roles, however, it is a possibility that they can be refined
further. For example, the verbal interference task can be assessed for the
impact of attention load on working memory, and a measure of working
memory distinct from the counting task can help address issues of
attentional load in relation to verbal task efficacy for intrusion increase.
Perhaps modifying the verbal content may also indicate to what extent the
verbal component is reliant on arithmetic/working memory capacity based
experimental interventions, and further examine the role of a purer verbal
task without the confounding effect of factors such as mathematical ability.

As a final note, the role of interference tasks at retrieval can be examined in
future studies, perhaps the role of a combination of visuo-spatial and verbal
tasks in potentially reducing intrusive content, fitting closer to re-scripting,
exposure contexts and EMDR related approaches.
4.7. Summary

This thesis began with a review of the literature concerning PTSD and the development of the rationale behind this study. The frameworks used to develop this study focused on the 'hybrid' nature of PTSD, and the need to understand the different types of processing involved in the development and maintenance of PTSD symptoms. The experimental stage of the thesis, based on prior studies (e.g. Holmes et al. 2004), implicated the role of visuo-spatial and verbal processes in the development of intrusions using a direct recording of intrusive content, in the context of a trauma-film analogue. These findings have implications for the models underlining the development of intrusive symptomatology, and have key relevance for the practice of therapy. Potential extensions of the study were also examined. The recognition of peri-traumatic factors has allowed the elaboration of existing models of PTSD and is proving a fertile domain for investigating the development and treatment of PTSD symptoms. Analogue paradigms have also provided a good foundation for providing converging elements of theory and experimental manipulation that can be developed in more clinical contexts.
References


Appendix A: Summary of Study Hypotheses.

Appendix B: Participant Information and Consent Form.

Appendix C: Questionnaire measures

Appendix D: Diary Sheets

Appendix E: One Week follow up questionnaires (with memory measures and IES)
Appendix A: Summary of Study Hypotheses.

- **Hypothesis 1**: Participants conducting a concurrent visuo-spatial task while watching a trauma analogue film will have significantly less intrusions relating to the film over the week following exposure compared to control participants who watch the film without a visuo-spatial interference task. The IES intrusion sub-scale scores are predicted to mirror this with increased intrusive features.

- **Hypothesis 2**: Participants conducting a concurrent verbal task while watching a trauma analogue film will have significantly more intrusions relating to the film over the week following exposure compared to control participants who watch the film without a verbal interference. The IES intrusion sub-scale scores are predicted to mirror this with decreased intrusive features.

- **Hypothesis 3**: Participants conducting a concurrent visuo-spatial task will have less variation in the intrusive content they report compared to controls.
• **Hypothesis 4:** Participants conducting a con-current verbal task will have more variation in the intrusive content they report compared to controls.

• **Hypothesis 5:** Participants conducting a con-current visuo-spatial task will have a) less imagery based intrusions, b) less sensation based, and c) more verbal intrusive content compared to controls.

• **Hypothesis 6:** Participants conducting a con-current verbal interference task will have a) more imagery based intrusions, b) more sensation-based intrusive content compared to controls, and c) less verbal thought intrusions.

• **Hypothesis 7:** For participants in the visuo-spatial condition, data driven processing will be reduced, as will disruptions in conceptual processing.

• **Hypothesis 8:** Participants conducting a concurrent verbal task will experience more data driven experiences and more disruptions to conceptually driven encoding compared to controls.

• **Hypothesis 9:** Based on the findings of Holmes et al., the trauma film will have a mood reducing effect for participants, and that all conditions would have equivalent levels of distress.
• **Hypothesis 10**: Replicating Holmes et al.'s findings with verbal interference, attention to film will be reduced in the verbal interference condition compared to no task controls, but this will not impact on memory ratings of the film.

• **Hypothesis 11**: Increased state dissociation will lead to an increase in intrusions regardless of condition. The role of trait dissociation in predisposing individuals to developing intrusive content needs to be assessed in the context of changes in state dissociation.
Sub-Department of Clinical Health Psychology

Investigators: Dr. Emily Holmes (Clinical Psychologist), Dr Tony Roth (Clinical Psychologist), Dr Francisco Frasquilho (Trainee Clinical Psychologist).

* You are invited to participate in this psychology experiment studying effects of trauma. You do not have to take part in this study if you do not want to. If you decide to take part you may withdraw at any time without having to give a reason.

* The purpose of this experiment is to study the role of imagery and language in the development of intrusive memories of traumatic information. Specifically, this experiment aims to use a brief distressing video to explore links between the development of intrusive memories and the following: (1) Visual-Spatial processing while watching a video scene, based on tapping a key pattern on an unseen key-pad, (2) Verbal processing involving counting numbers out loud; and (3) Emotional responses and previous experience of participants (measured via questionnaires and self-rating scale).

* The experiment involves watching a distressing video, containing graphic scenes of the aftermath of road traffic accidents, including seriously injured and dead victims. You may spontaneously think about this after the film and may be distressed by it. Intrusive recollections may take the form of visual images, thoughts or mood changes. In previous research with this film involving over 200 participants no long-standing emotional problems have been reported, but this does not mean there is zero risk to you.

* In the first session, which will take about 1 hour, you will watch the video and complete short questionnaires about your emotional state, previous experience of various events and your mood. For the week afterwards you will keep a simple “diary” of any spontaneous intrusions/memories about the video you watched. You will return one week later for a follow-up session to give back the diary and answer some questions about the film and any effects it had on you. You will be debriefed as to the experiment and given the opportunity to discuss any aspects of the study you wish to. All your responses will be kept confidential.

* You can contact the experimenter at any point during or after the study if you experience difficulties. The experimenter may contact you to remind you of the follow-up session. If for any reason you do not attend the follow-up session then experimenter may contact you.

**IMPORTANT: Please do NOT take part in this study if any of the following are the case:**
- you have received treatment for a mental health problem, including medication, psychological therapy, or counselling
- you are planning to undertake a college examination in the next week
- you have participated in a similar study

**Data Protection:** Your name will not appear on any record of data gathered for this study. We keep a record on paper and computer disk of all participants’ ages, occupations, and gender along with their responses to questionnaires and diary materials. Information collected for this study is for research purposes only and will not contain any participants’ names. Data will be held by Dr Francisco Frasquilho until the experiment is completed, and then will remain with Dr Emily Holmes.

All proposals for research using human subjects are reviewed by an ethics committee before they can proceed. This proposal was reviewed by the joint UCL/UCLH Committees on the Ethics of Human Research.

**Investigators’ Contact Address:**
CONFIDENTIAL

Volunteer Consent Form

Study Title: Visuo-Spatial and Verbal Encoding of Traumatic Scenes

Investigators: Dr. Emily Holmes (Clinical Psychologist), Dr Tony Roth (Clinical Psychologist), Dr Francisco Frasquilho (Trainee Clinical Psychologist - Experimenter).

* Have you read the information sheet about the study? YES / NO

* Have you had an opportunity to ask questions and discuss the study? YES / NO

* Have you received satisfactory answers to all your questions? YES / NO

* Have you received enough information about this study? YES / NO

* Who have you spoken to about this study?

* Do you understand that you are free to withdraw from this study:
  - at any time? YES / NO
  - without giving a reason for withdrawing? YES / NO

* Do you agree to take part in this study? YES / NO

Volunteer's Name: ............................................................................

Volunteer's Tel. No.: ............................................................................

Signed: ............................................................................

Date: ............................................................................

Investigator's Name: ............................................................................

Signed: ............................................................................

Date of Follow-up: ............................................................................
Dear Dr Holmes

Re: Notification of Ethical Approval


Following the meeting of the UCL Committee for the Ethics of Non-NHS Human Research on 1 May 2003, I am pleased to inform you that the above research has been granted ethics approval for the duration of the project (11 June 2003 – 11 June 2004) subject to the following conditions:

1. You must seek Chair’s approval for proposed amendments to the research for which this approval has been given. Ethical approval is specific to this project and must not be treated as applicable to research of a similar nature. Each research project is reviewed separately and if there are significant changes to the research protocol you should seek confirmation of continued ethical approval by completing the ‘Amendment Approval Request Form’.

The form identified above can be accessed by logging on to the ethics website homepage: http://zzz.grad.ucl.ac.uk/ethics/ and clicking on the button marked ‘Key Responsibilities of the Researcher Following Approval’.

2. It is your responsibility to report to the Committee any unanticipated problems or adverse events involving risks to participants or others. Both non-serious and serious adverse events must be reported.

Reporting Non-Serious Adverse Events.
For non-serious adverse events you will need to inform Ms Helen Dougal, Ethics Committee Administrator (h.dougal@ucl.ac.uk), within ten days of an adverse incident occurring and provide a full written report that should include any amendments to the participant information sheet and study protocol. The Chair or Vice-Chair of the Ethics
Committee will confirm that the incident is non-serious and report to the Committee at the next meeting. The final view of the Committee will be communicated to you.

**Reporting Serious Adverse Events**

The Ethics Committee should be notified of all serious adverse events via the Ethics Committee Administrator immediately the incident occurs. Where the adverse incident is unexpected and serious, the Chair or Vice-Chair will decide whether the study should be terminated pending the opinion of an independent expert. The adverse event will be considered at the next Committee meeting and a decision will be made on the need to change the information leaflet and/or study protocol.

3. On completion of the research you must submit a brief report (maximum of two sides of A4) of your findings to the Committee. Please comment in particular on any ethical issues you might wish to draw to the attention of the Committee. We are particularly interested in comments that may help to inform the ethics of future similar research.

Yours sincerely

Sir John Birch  
Chair of the UCL Committee for the Ethics of Non-NHS Human Research

Cc: Dr Frank Frasquilho, Clinical Health Psychology, UCL  
Dr Tony Roth, Clinical Health Psychology, UCL
Appendix C: Questionnaire measures

Items for State Dissociation Questionnaire: Computer administered

Please answer the following questions as you feel AT THIS MOMENT IN TIME, in this room. The following questions concern dissociation and how you feel at the moment.

1. At this moment in time: Do things seem to be moving in slow motion?
   not at all, slightly, moderately, considerably, extremely
   0  1  2  3  4

2. At this moment in time: Do things seem to be unreal to you, as if you are in a dream?
   not at all, slightly, moderately, considerably, extremely
   0  1  2  3  4

3. At this moment in time: Do you have some experience that separates you from what is happening; for instance, do you feel as if you are in a movie or a play, or as if you are a robot?
   not at all, slightly, moderately, considerably, extremely
   0  1  2  3  4

4. At this moment in time: Do you feel as if you are looking at things from outside of your body?
   not at all, slightly, moderately, considerably, extremely
   0  1  2  3  4

5. At this moment in time: Do you feel as if you are watching the situation as an observer or spectator?
   not at all, slightly, moderately, considerably, extremely
   0  1  2  3  4

6. At this moment in time: Do you feel disconnected from your own body?
   not at all, slightly, moderately, considerably, extremely
   0  1  2  3  4

7. At this moment in time: Does your sense of your own body feel changed: for instance, does your own body feel unusually large or unusually small?
   not at all, slightly, moderately, considerably, extremely
   0  1  2  3  4
8. At this moment in time: Would people seem motionless, dead, or mechanical?
   not at all, slightly, moderately, considerably, extremely
   0 1 2 3 4

9. At this moment in time: Do objects look different than you would expect?
   not at all, slightly, moderately, considerably, extremely
   0 1 2 3 4

10. At this moment in time: Do colours seem to be diminished in intensity?
    not at all, slightly, moderately, considerably, extremely
    0 1 2 3 4

11. At this moment in time: Do you see things as if you were in a tunnel, or looking through a wide angle photographic lens?
    not at all, slightly, moderately, considerably, extremely
    0 1 2 3 4

12. At this moment in time: Does this experience seem to take much longer than you would have expected?
    not at all, slightly, moderately, considerably, extremely
    0 1 2 3 4

13. At this moment in time: Do things seem to be happening very quickly, as if there is a lifetime in a moment?
    not at all, slightly, moderately, considerably, extremely
    0 1 2 3 4

14. At this moment in time: Do things happen that you later cannot account for?
    not at all, slightly, moderately, considerably, extremely
    0 1 2 3 4

15. At this moment in time: Do you space out, or in some other way lose track of what is going on?
    not at all, slightly, moderately, considerably, extremely
    0 1 2 3 4

16. At this moment in time: Do sounds almost disappear or become much stronger than you would have expected?
    not at all, slightly, moderately, considerably, extremely
    0 1 2 3 4

17. At this moment in time: Do things seem to be very real, as if there is a special sense of clarity?
    not at all, slightly, moderately, considerably, extremely
    0 1 2 3 4
18. At this moment in time: Does it seem as if you are looking at the world through a fog, so that people or objects seem far away or unclear?

not at all, slightly, moderately, considerably, extremely

0 1 2 3 4

19. At this moment in time: Do colours seem much brighter than you would have expected?

not at all, slightly, moderately, considerably, extremely

0 1 2 3 4
Traumatic Experiences Questionnaire

Many people have lived through or witnessed a very stressful and traumatic event at some point in their lives. Coming next is a sequence of descriptions of traumatic events.

When you read an event that has happened to you, or you have witnessed please circle Yes. Otherwise, please circle No if that event is not relevant to you.

1. Have you experienced or witnessed: Serious accident, fire, or explosion? (for example, an industrial, farm, car, plane, or boating accident). Yes / No

2. Have you experienced or witnessed: Natural disaster? (for example, tornado, hurricane, flood, or major earthquake. Yes / No

3. Have you experienced or witnessed: Non-sexual assault by a family member or someone you know? (for example, being mugged, physically attacked, shot, stabbed, or held at gunpoint. Yes / No

4. Have you experienced or witnessed: Non-sexual assault by a stranger? (for example, being mugged, physically attacked, shot, stabbed, or held at gunpoint). Yes / No

5. Have you experienced or witnessed: Sexual assault by a family member or someone you know? (for example, rape or attempted rape). Yes / No

6. Have you experienced or witnessed: Sexual assault by a stranger? (for example, rape or attempted rape. Yes / No

7. Have you experienced or witnessed: Military combat or a war zone? Yes / No

8. Have you experienced or witnessed: Sexual contact when you were younger than 18 with someone who was 5 or more years older than you? (for example, contact with genitals, breasts). Yes / No

9. Have you experienced or witnessed: Imprisonment? (for example, prison inmate, prisoner of war, hostage. Yes / No

10. Have you experienced or witnessed: Torture? Yes / No

11. Have you experienced or witnessed: Life-threatening illness? Yes / No

12. Have you experienced or witnessed: Any other traumatic event? Yes / No

Please specify the traumatic event (Enter brief description in the box below).

If you responded "Yes" to any of the above questions, then please answer the following questions:

How long ago did the traumatic event happen? (please circle one)

(1) Less than 1 month
(2) 1 to 3 months
(3) 3 to 6 months
(4) 6 months to 3 years
(5) 3 to 5 years
(6) More than 5 years
The following questions are about the traumatic event

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Were you physically injured?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was someone else physically injured?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you think that your life was in danger?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you think that someone else's life was in danger?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you feel helpless?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you feel terrified?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Data-Driven and Disruptions in Conceptual Processing Questionnaire (pen and paper)

In this questionnaire, we are interested in WHAT WENT THROUGH YOUR MIND during the video footage. Please indicate the extent to which the following statements applied to you DURING THE VIDEO FOOTAGE.

DURING THE VIDEO FOOTAGE...

<table>
<thead>
<tr>
<th>Statement</th>
<th>Not at all</th>
<th>A little bit</th>
<th>Moderately</th>
<th>Strongly</th>
<th>Very Strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I couldn’t really take it all in.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2. I did not fully understand what was going on.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3. It was just like a stream of unconnected impressions following each other.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. I could not think clearly.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5. I was overwhelmed by sensations and couldn’t put everything together.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6. I was confused and could not fully make sense of what was happening.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7. My mind was fully occupied with what I saw, heard, smelled, and felt.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8. My mind was full of impressions and my reactions to them.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9. It felt as if someone else was watching the video</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10. It felt like I was a different person from the person I used to be.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>11. I was aware that I was watching the video, but not so much that it was me watching it.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>12. I felt cut off from my past.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>13. I felt cut off from my future.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>14. I couldn't imagine anything beyond this experience.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>15. Things that had been important to me before did not matter any longer.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>16. I felt there was no way back to my normal life after this.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Mood Ratings pre-post film (computer administered)

The next four questions concern your mood. Please answer them according to how you feel NOW at this moment in time. Try to answer quickly without thinking for too long.

1. Please indicate how happy you currently feel
   
<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

   (0 = not at all happy)  (10 = extremely happy)

3. Please indicate how depressed you currently feel
   
<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

   (0 = not at all depressed)  (10 = extremely depressed)

4. Please indicate how angry you currently feel
   
<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

   (0 = not at all angry)  (10 = extremely angry)

5. Please indicate how fearful you currently feel
   
<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

   (0 = not at all helpless)  (10 = extremely helpless)

6. Please indicate how horrified you currently feel
   
<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

   (0 = not at all horrified)  (10 = extremely horrified)

6. Please indicate how helpless you currently feel
   
<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

   (0 = not at all helpless)  (10 = extremely helpless)
6. Please indicate how **disgusted** you currently feel

   0  1  2  3  4  5  6  7  8  9  10

   (0 = not at all disgusted)  (10 = extremely disgusted)

7. Please indicate how **ashamed** you currently feel

   0  1  2  3  4  5  6  7  8  9  10

   (0 = not at all ashamed)  (10 = extremely ashamed)

8. Please indicate how **guilty** you currently feel

   0  1  2  3  4  5  6  7  8  9  10

   (0 = not at all guilty)  (10 = extremely guilty)

---

**Attention and film questions (computer administered at end of post film moon questionnaires).**

The next two questions are about the film you have just seen.

Please indicate how much **attention** you paid to the film you have just seen.

   0  1  2  3  4  5  6  7  8  9  10

   None at all  Total Attention

Please indicate how much **distress** the film caused you

   0  1  2  3  4  5  6  7  8  9  10

   None at all  Extreme Distress
Appendix D: Diary sheets.

Instructions for recording intrusions in the Weekly Diary:

Front Sheet
If over the next week you experience any *spontaneously* occurring intrusions/memories about the film you have just watched, I would be very grateful if you could note them down in the diary provided. It would be very helpful if you note the occurrence of any intrusion as soon as you experience it by placing a tick in one of the boxes provided on the front page of the diary, as indicated in the example below. *Only* tick a box if you experience an intrusion. If you experience no intrusions for that time of day then write 'Zero' in the box. In the example below the person experienced no intrusions in the Monday morning or evening, but had two intrusions in the afternoon.

<table>
<thead>
<tr>
<th>Monday</th>
<th>Morning</th>
<th>Afternoon</th>
<th>Evening</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Zero</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Zero</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Intrusion Sheets
On the following pages you will see a number of diary sheets. Please fill in a diary sheet as soon as you can after the intrusion. It may not always be possible to fill in a sheet immediately after an intrusion, so please try and fill one out on the day you had an intrusion, one sheet for each intrusion that day. Try to fill in the sheets within the same period of the day as the intrusion occurred (morning, afternoon, evening).

Please note all you can about the content of the intrusion, such as its subject matter. Also note if you had any accompanying physical sensations (for example increased heart rate).

IT IS VITAL FOR THIS EXPERIMENT THAT YOU AT LEAST MAKE SURE YOU NOTE THAT AN INTRUSION OCCURRED AND ON WHAT DATE/TIME OF DAY USING THE FRONT SHEET.

Diary tick sheet:

<table>
<thead>
<tr>
<th>Morning</th>
<th>Morning</th>
<th>Morning</th>
<th>Morning</th>
<th>Morning</th>
<th>Morning</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Afternoon</th>
<th>Afternoon</th>
<th>Afternoon</th>
<th>Afternoon</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Evening</th>
<th>Evening</th>
<th>Evening</th>
<th>Evening</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Images Diary
Please number one box every time you experience a film image or memory of the film. Then fill in the details one of the pages overleaf. Please fill this in everyday and put a 0 if you had no images.
Diary Intrusion Record.

One intrusion only per sheet.

<table>
<thead>
<tr>
<th>A) Type of Intrusion</th>
<th>B) Day</th>
<th>C) Please indicate or describe your principle mood or feeling at the time of the intrusion and rate its intensity using the rating scale below.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>I felt:</td>
</tr>
<tr>
<td>Visual Image</td>
<td></td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>Verbal Thought</td>
<td></td>
<td>Not at Somewhat Extremely all</td>
</tr>
<tr>
<td>Felt sense</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>D) Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Briefly describe what the intrusion was. Even if you are in a rush please just note a couple of words.</td>
</tr>
</tbody>
</table>
Appendix E: One week follow-up Measures

Follow up:

Participants Code:
Date:
Condition:

1) Ask for diary and check if completed: Complete any missing information.

2) Ask to chose a most significant/important/frequent intrusion:

3) Read out the following: To what extent is the following true of you: I have been unable (or forgotten) to record my unpleasant thoughts and images in the tick diary

0 1 2 3 4 5 6 7 8 9 10
(0 = not at all true of me) (10 = Completely true of me)

4) Hypothesis question: More/Same/Less intrusions if hadn't done counting / tapping
Recognition test

What follows are a series of statements for each scene. Please circle YES if you think a statement describes something that happened in that scene, or NO if you think the statement describes something that did NOT happen in the scene.

Scene 1. In scene 1 did any of the following occur:

<table>
<thead>
<tr>
<th></th>
<th>Statement</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A baby in a blanket is passed and placed to a paramedic and placed in an ambulance.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>An upside down car is focused on and a paramedic manipulates a naked leg which is sticking out.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>A team of firemen race to a car that is on fire and spray foam on it in order to quench the flames.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>A distraught teenager is led away from the scene by a member of the public.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Three members of the public help the emergency personnel carry a body to the side of the road.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Scene 2: In scene 2 did any of the following occur:

<table>
<thead>
<tr>
<th></th>
<th>Statement</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A woman being cut out of a crashed vehicle cries out, and appears to lose consciousness.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>When the man with the injured leg is on the stretcher the paramedics shine a light into his eyes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>A team of firemen attach metal equipment to the front of the minibus to pull the wreckage away from the woman’s legs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>A policeman stands watching the wreckage whilst making notes on a clipboard.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>When the man with the injured leg is on the stretcher, the paramedics cut his trousers and reveal a bloody wound.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Scene 3: In scene 3 did any of the following occur:

<table>
<thead>
<tr>
<th></th>
<th>Statement</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A body which has been covered by a blanket in a wreaked car is removed and laid on the ground, two blankets are laid over him.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Rescue workers put up a yellow and blue police incident tape in order to keep the crowd back from the scene.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Before covering the man’s body with a blanket, the fireman closes the man’s eyes.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Scene 4: In scene 4, did any of the following occur?

<table>
<thead>
<tr>
<th></th>
<th>Statement</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Emergency personnel use cutting equipment to remove the body of a man from a beige car who has been crushed in the driver’s seat.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>A fireman struggles to release a trapped woman’s seat belt.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>A bent car number plate lies on the ground close to the coffin the man is placed in.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Two men lift up two bodies and bundle them into metal coffins.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Scene 5: In scene 5, did any of the following occur?

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A female student is moaning as she is treated in an ambulance. She is naked and electrodes are attached to her chest.</td>
<td>yes</td>
</tr>
<tr>
<td>B</td>
<td>A paramedic injects the female student in her right arm, whilst others attend to her injuries.</td>
<td>yes</td>
</tr>
<tr>
<td>C</td>
<td>As her head is bandaged, a relative arrives at the ambulance and is kept to one side by paramedics.</td>
<td>yes</td>
</tr>
</tbody>
</table>

Please DO NOT turn over
The Explicit Memory Questionnaire: *Experimenter Administered*"

'I would like to ask you some questions about the video you saw.'

1. What colour was the car that was seen on fire, by a tree, at the beginning of the first scene?

2. What part of a body did you see sticking out of the upside down car in the first scene?

3. What was in the blanket that the man wearing the cap and long coat was carrying at the end of the first scene?

4. What colour was the t-shirt worn by the middle-age woman tapped in the mini-bus in scene two?

5. When the woman was finally cut out of the mini-bus and placed on a stretcher, where on her body was cut and bleeding?

6. In scene two, once they got the man out of the car onto the stretcher, what did they do to him?

7. What part of the injured man’s body was zoomed in on, in scene two?

8. In scene three, a body was still in a car covered by a stripy blanket, what body part did you see hanging out from under the blanket?

9. What kind of vehicle had the mangled car from the above scene crashed into?

10. In scene four, what colour was the car that had its roof cut off in order to remove the dead?

11. How many doctors in white coats were shown at the scene of the accident in scene four?

12. How many people were put in coffins in scene four?

13. In the final scene, what was the female student receiving medical attention wearing?

14. In the final scene, what part of the female student’s body was bandaged by the paramedics.

15. Can you remember any other medical procedures that were performed on the injured girl?
Below is a list of comments made by people after stressful life events. Please check each item, indicating how frequently these comments were true for you during the past seven days in relation to you watching the video. If they did not occur during that time, please mark the "not at all" column.

<table>
<thead>
<tr>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I thought about it when I didn't mean to</td>
</tr>
<tr>
<td>2. I avoided letting myself get upset when I thought about it or was reminded of it.</td>
</tr>
<tr>
<td>3. I tried to remove it from memory</td>
</tr>
<tr>
<td>4. I had trouble falling asleep or staying asleep, because of the pictures or thoughts about it that came into my mind</td>
</tr>
<tr>
<td>5. I had waves of strong feelings about it</td>
</tr>
<tr>
<td>6. I had dreams about it</td>
</tr>
<tr>
<td>7. I stayed away from reminders of it</td>
</tr>
<tr>
<td>8. I felt as if it hadn't happened or it wasn't real</td>
</tr>
<tr>
<td>9. I tried not to talk about it</td>
</tr>
<tr>
<td>10. Pictures about it popped into my mind</td>
</tr>
<tr>
<td>11. Other things kept making me think about it</td>
</tr>
<tr>
<td>12. I was aware that I still had a lot of feelings about it, but I didn't deal with them</td>
</tr>
<tr>
<td>13. I tried not to think about it</td>
</tr>
<tr>
<td>14. Any reminder brought back feelings about it</td>
</tr>
<tr>
<td>15. My feelings about it were kind of numb</td>
</tr>
</tbody>
</table>