The Effect of Visual versus Verbal Tasks on the Uncued Spontaneous Recall of Traumatic Film Images

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ABSTRACT

A hallmark symptom of Post-traumatic Stress Disorder (PTSD) is spontaneous intrusive memories (*flashbacks*). Cognitive science has proposed a foundation for testing much needed interventions to reduce or prevent flashbacks. Studies suggest that a visuospatial task, performed concurrently with a trauma film, reduces later flashbacks, whereas a concurrent verbal task may increase flashbacks (Holmes, Brewin & Hennessy, 2004). This year, Holmes, James, Coode-Bate, and Deeprose (2009) tested the effect of a visuospatial task applied *after* viewing a trauma film. They found that the visuospatial task reduced subsequent flashbacks of the film, compared to a control condition. The present study aimed to replicate and extend Holmes et al.'s (2009) study by testing the effect of a visuospatial task and a verbal task after exposure to a trauma film. It was predicted that the visuospatial task would reduce later flashbacks of the film, whereas the verbal task would increase later flashbacks. Following exposure to a trauma film, 45 participants completed either a visuospatial task, a verbal task, or no task. Flashbacks were self-reported for one week. Despite not finding a statistically significant difference for flashbacks between the groups, subsidiary factors point to the possible effectiveness of the visuospatial task as an intervention in the prevention of these flashbacks.

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CHAPTER 1. INTRODUCTION

The purpose of the experiments reported in this thesis was to attempt to replicate and extend the results of a paper with important implications for the prevention of the clinical problem known as Post-traumatic Stress Disorder (PTSD). The paper published earlier this year by Holmes, James, Coode-Bate, and Deeprose (2009) found that having people play 'Tetris' after viewing a trauma film led to them having fewer spontaneous intrusive memories (*flashbacks*) than were experienced in the absence of any intervention.

The remainder of this introduction will present seven main areas. Firstly, an overview of PTSD is provided. This is followed by a description of the nature of trauma memory. A psychological theory of PTSD and how it can be tested is then discussed. Finally, the concepts of working memory and memory consolidation in relation to interventions for PTSD and predictions for what the present study expects to find are presented.

1.1 OVERVIEW OF POST-TRAUMATIC STRESS DISORDER

PTSD is a psychiatric disorder that can develop in response to a traumatic experience and is characterised by the core features of reexperiencing the trauma, avoidance behaviours, emotional numbing, and symptoms of excessive arousal (Vasterling & Brewin, 2005). People of any age, sex, or ethnicity have the potential to experience, or be exposed to, a traumatic event at some time in their life. Exposure to trauma can result in feelings of intense fear, helplessness, or horror as described in the Diagnostic and Statistical Manual of Mental Disorders, 4th ed. (DSM-IV) (American Psychiatric Association, 1994). In the immediate aftermath of trauma, symptoms of PTSD may be experienced. While these symptoms tend to fade for most survivors of trauma, between 5% and 30% go on to develop the debilitating, chronic condition of PTSD (Ozer, Best, Lipsey & Weiss, 2003).

A traumatic event is an event which involves actual or threatened death, serious injury, or threat to the physical integrity of self or others (American Psychiatric Association [APA], 1994). Traumatic events experienced directly can include violent personal assault (including sexual assault and physical attack), severe motor vehicle accidents, terrorist attacks, and natural or man-made disasters. It is not necessary to experience a traumatic event directly for it to cause psychological distress. Witnessing serious injury or death, or learning about unexpected or violent death can also be a traumatic stressor (Vasterling & Brewin, 2005).

Sufferers of PTSD may experience symptoms including recurrent distressing dreams of the event, acting or feeling as if the traumatic event were recurring, intense psychological distress when exposed to cues that symbolise an aspect of the traumatic event, or physiological reactivity when exposed to cues that symbolise an aspect of the traumatic event (APA, 2004). The relentless and sustained nature of such symptoms can have a considerable negative impact on a person's engagement in their social environment, relationships, work, and overall day to day activities. For a diagnosis of PTSD to be made, the duration of the disturbances described in the

DSM-IV criteria must be greater than one month (APA, 2004). PTSD sufferers often receive additional diagnoses due to a number of shared clinical characteristics. Epidemiological surveys have reported that rates of somatisation disorder, psychosis, anxiety disorder, and depression are substantially elevated in PTSD sufferers (Brewin, Dalgleish, & Joseph, 1996).

Two core elements of PTSD are avoiding reminders of the trauma, and experiencing physiological hyperarousal. The hallmark symptom of PTSD is the re-experiencing of the trauma in the form of intrusive, image-based memories, also known as 'intrusions' or 'flashbacks' (Holmes, Brewin, & Hennessy, 2004). These memories appear rapidly and spontaneously. In many cases the intrusive memories consist of images accompanied by high levels of physiological arousal that appear to lack a time perspective and a context (Brewin et al., 1996; Ehlers, Hackman, & Michael, 2004). Although there are a number of efficacious treatments for PTSD including exposure therapy, stress inoculation training, and cognitive therapy (Hembree & Foa, 2003), the domain of preventing symptoms of PTSD appears underdeveloped. Specifically, there is a lack of interventions that can be delivered either immediately, or as soon as practicable after the traumatic event, to reduce the likelihood of developing flashbacks (Holmes et al., 2004). This poses an interesting question: Is it possible to reduce the likelihood or even prevent intrusions from occurring by applying an intervention closer to the time of trauma? Tenets of cognitive science have been employed in order to investigate such a notion.

1.2 THE NATURE OF INTRUSIVE MEMORIES OF TRAUMATIC EVENTS

Intrusive memories (or *flashbacks*) are involuntary recollections of events that appear, apparently without provocation, in a person's consciousness (Brewin & Saunders, 2001; Davies & Clark, 1998; Holmes et al., 2004). Studies have found that intrusive memories occur often in everyday life, with non-clinical populations reporting 1–5 a day (Mace, 2005). Several theorists have argued that trauma memories are different from other autobiographical memories (Brewin et al., 1996; Ehlers & Clark, 2000). Flashbacks can take the form of sensory mental images or narrative thoughts. Ehlers and Clark suggest that emotional memories such as those formed after exposure to a traumatic event, typically take the form of mental images regardless of whether they are intrusive or deliberately recalled. It is argued that involuntary intrusions reported by sufferers of PTSD can be conceptualised as a distinct form of memory (Brewin, 2001; Brewin et al., 1996). Specifically, intrusive memories have been described as brief sensory fragments of ordinary autobiographical memory (Conway & Pleydell-Pearce, 2000).

Research investigating the distinction between voluntary and involuntary memory suggests that involuntary trauma memories are greatly associated with sensory and spatial processes (Brewin, 2007). Hellawell and Brewin (2004) compared PTSD sufferers' voluntary memories of the traumatic event with their involuntary memories of the same event and found that reports of involuntary memories contained significantly more sensory features than did reports of voluntary memories. Therefore, it appears that stimuli that are encountered in the environment which

corresponds to stimuli stored at the time of trauma, triggers involuntary recall of the trauma memory (Brewin et al., 1996; Brewin, 2001; Conway & Pleydell-Pearce, 2000; Ehlers & Clark, 2000). Steel, Fowler and Holmes (2005) suggested that other disorders, for which intrusive memories are apparent, may maintain similar cognitive information-processing mechanisms. Therefore, investigating the way in which trauma-related information is encoded, stored, and subsequently recalled is vital in extending our understanding of spontaneous intrusive memories (Steel et al., 2005).

1.3 THE DUAL-REPRESENTATION THEORY OF PTSD

Cognitive theories of PTSD can be separated into two categories: social-cognitive theories, and information-processing theories (Brewin et al., 1996). For the purpose of this thesis, the focus will be on information-processing theories. Information-processing theories propose how trauma-related information is represented in cognition, and how it is subsequently processed.

The dual-representation theory of PTSD emphasises the processing or encoding of the trauma, and the retrieval of the trauma memories. Brewin et al. (1996) proposed the existence of a dual-memory system in which trauma memories are processed, and that this dual-processing creates two separate representations. One memorial representation is of the person's conscious experience of the trauma. Representations of this kind are processed in the verbally accessible memory (VAM) system. The amount of information contained in memories in the VAM system is restricted to what has been consciously attended to. VAM representations form part of the store of autobiographical experiences and can be intentionally retrieved (Brewin et al., 1996). However, VAM memories are restricted, in that they only contain information that the individual has consciously attended to before, during, and after the traumatic event (Brewin & Holmes, 2003). The dual-representation theory proposes that disruption in attention to the traumatic event greatly restricts the information that can be recorded in the VAM system during the event itself (Brewin & Holmes, 2003).

Non-conscious processing of a traumatic event forms the second type of representation, which is processed in the situationally accessible memory (SAM) system. This representation cannot be intentionally accessed (Brewin et al., 1996). The SAM system contains information that has been encoded from a lower level of perceptual processing of the traumatic event. This includes sights and sounds that did not receive sufficient conscious attention to be recorded in the VAM system. According to the dual-representation theory, the SAM system reflects the idea that intrusions are only ever triggered involuntarily by situational reminders of the trauma. Situational reminders can be external environmental factors or in the internal environment of a person's mental processes (Brewin & Holmes, 2003). The two representations share similar features, however they differ in a number of significant ways. For example, encoding into the VAM system requires verbal capacity while the SAM system does not use a verbal encoding, but relies upon a visuospatial encoding process (Brewin et al., 1996).

The dual-representation theory predicts that concurrent verbal interference tasks increase intrusive memories. The underlying argument for this effect is that unlike image-based

memories in the SAM system, verbally accessible memories of a traumatic event include information about the context of the event (for example, specific time and place). Intrusions are more likely to be triggered when there is little contextual information in the memory to assist in distinguishing retrieval cues in the current environment from similar features of the traumatic event or experience (Holmes et al., 2004). Therefore, it is predicted that tasks that compete for resources involved in verbal encoding will lead to less contextual information being encoded and result in an increase in the likelihood of intrusions occurring.

Cognitive theories of PTSD such as the dual-representation theory, have led to studies investigating the effect of cognitive tasks on spontaneous intrusive memories of traumatic events. The use of visuospatial tasks has revealed some positive results in terms of reducing intrusive memories. Brewin and Saunders (2001) found that participants who performed a visuospatial tapping task during exposure to a trauma film reported significantly fewer spontaneous memories compared to a no-task control condition, despite no difference between the groups for explicit memory for the film. The dual-representation theory provides an explanation for these findings. Specifically, the dual-representation theory predicts that a verbal task will directly compete for verbal resources and increase intrusion frequency, whereas a visuospatial task would compete for visuospatial resources, decreasing intrusion frequency (Brewin, 2001).

Based on Brewin and Saunders' (2001) study and the dual-representation theory, Holmes et al. (2004) investigated the role of various cognitive tasks on spontaneous intrusive memories of a trauma film. Holmes et al. hypothesised that tasks which primarily disrupt VAM encoding (conscious, verbal accounts of the trauma) through competing for verbal resources during the observation of the trauma, will lead to increased intrusions. While in contrast, disrupting encoding in the SAM system (sensory information) through competing for visuospatial resources, will decrease intrusions.

1.4 THE TRAUMA FILM PARADIGM

How can the dual-representation theory be tested? A limitation found in many studies investigating the processes involved in trauma memory is the reliance on retrospective reports of responses to trauma. Prospective designs are therefore warranted, however it is clear that deliberately exposing participants to real trauma exceeds ethical boundaries (Holmes & Bourne, 2008). One method of investigating responses to trauma, which has been employed in many studies, is the trauma film paradigm (Brewin & Saunders, 2001; Halligan, Clark, & Ehlers, 2002; Stuart, Holmes & Brewin, 2006).

The trauma film paradigm involves non-clinical research participants viewing short films containing scenes depicting stressful or traumatic events. Films attempt to comply with the DSM-IV criteria for PTSD as scenes of actual or threatened death or serious injury to the body are included. Butler, Wells, and Dewick (1995) extended the paradigm by monitoring film-related intrusions for a week after film viewing. This technique has been employed in conjunction with a trauma film in a number of studies, including the current study (Holmes et al.,

2004; Stuart et al., 2006; Holmes et al., 2009). As the trauma film paradigm is a controlled analogue of clinical trauma, it can be employed to test specific theory-driven predictions (Holmes & Bourne, 2008).

1.5 THE EFFECT OF VISUOSPATIAL TASKS VERSUS VERBAL TASKS

Holmes et al. (2004) conducted three experiments to investigate the effect of a visuospatial task and a verbal task performed concurrently with exposure to a trauma film, on the frequency of flashbacks. In the first experiment, participants either performed a visuospatial tapping task, a dissociation task, or no task (control condition) while viewing a trauma film. In the second experiment, participants either performed a single key tapping task, an over-practiced visuospatial tapping task, or no task (Holmes et al., 2004). A tapping task is assumed to constitute a potentially attention-demanding secondary task, but one that does not involve the phonological loop, hence offering the potential to separate out the general effects of a concurrent load from modality-specific effects (McGaugh, 2000). For the following seven days participants recorded any intrusions of the film in a diary.

The results of both experiments indicated that participants who performed a visuospatial task during the film reported experiencing significantly fewer intrusions than those in the control condition. Therefore, the visuospatial tapping task appeared to protect against the potential development of intrusive memories. This supports the hypothesis that a visuospatial task competes for resources in the same memory system as that responsible for intrusive visual images, resulting in a reduction of intrusions (Holmes et al., 2004).

The third experiment conducted by Holmes et al. (2004) tested the hypothesis that a concurrent task which competed for verbal processing resources would result in an increase in the number of intrusions. This is based on the dual-representation theory as the interference with the formation of contextual memory in the VAM system is held responsible for the expected increase in intrusion frequency. Participants were exposed to the same traumatic film stimulus as used in the first two experiments. Participants either performed a verbal interference task, a verbal enhancement task, or no task (control condition) while viewing the film. The verbal interference task involved counting backwards in threes. This verbal task was chosen due to the notion that counting backwards in threes is thought to selectively impair verbal processing as carried out by the articulatory loop of working memory, while not interfering with the other subsystem, the visuospatial sketchpad (Holmes et al., 2004). The verbal enhancement task involved participants describing the details of the film aloud. The latter task was predicted to reduce subsequent intrusions due to a detailed verbal representation.

The results indicated that the verbal enhancement condition did not lead to the predicted reduction in the number of intrusions, however, as predicted, participants in the verbal interference task condition reported significantly more intrusions of the film compared to the control condition. This supports the hypothesis that a task that competes for resources with the

VAM system will lead to more intrusions (Holmes et al., 2004). These experiments contributed to the understanding of the mechanisms underlying spontaneous intrusive memories of traumatic material. A visuospatial task appears to significantly reduce the likelihood of experiencing later intrusions, yet a competing verbal task appears to increase intrusions.

Using a within-subjects design, Stuart et al. (2006) employed the trauma film paradigm to investigate the effect of a visuospatial task (modelling clay) on subsequent intrusions of the film. During part of the film participants constructed shapes out of clay, while for the rest of the film no-task was performed. The results correspond to previous findings (Brewin & Saunders, 2001; Holmes et al., 2004) indicating that a concurrent visuospatial task interferes with the development of later intrusive memories of the film. Studies employing the trauma film paradigm have indicated that intrusive memories of traumatic material can be reduced by concurrent interventions. Given the support for this finding in addition to the unpredictable nature of trauma, it is important to test the effectiveness of a visuospatial intervention in the aftermath of traumatic events (Holmes & Bourne, 2008).

1.6 THE EFFECT OF AN EARLY COGNITIVE INTERVENTION APPLIED POST-TRAUMA

Studies reported so far have dealt with the effect of cognitive tasks interfering with trauma memory at the time of exposure to the trauma film exclusively (Brewin & Saunders, 2001; Holmes et al., 2004; Stuart et al., 2006). While these studies have provided valuable insight into the processes involved in memory for traumatic events, the application of their proposed interventions in real-life is problematic due to the fact that the occurrence of real-life trauma is unpredictable.

A recent study by Holmes et al. (2009) acknowledged the need for investigating the effect of cognitive tasks on intrusions *following* exposure to a traumatic event, rather than during encoding. As visuospatial tasks have been demonstrated to reduce intrusive memories when performed concurrently with trauma material (Brewin & Saunders, 2001; Holmes et al., 2004; Stuart et al., 2006), Holmes et al. (2009) aimed to test whether the effect could be extended to the post-trauma time period. The researchers thought it essential to test a visuospatial task that is widely-available in the real-world, therefore the popular computer game 'Tetris' was employed. 'Tetris' is a visuospatial task which draws on the ability of mental rotation and processes used to form mental images. The theoretical basis for investigating the effect of visuospatial tasks in the post-trauma time period on the frequency of intrusions is supported by the working memory model and the concept of consolidation.

1.7 WORKING MEMORY

Cognitive science introduced the concept of working memory which proposes a system that underlies human thought processes. Working memory assumes a limited capacity system, where information is maintained and stored temporarily. Baddeley and Hitch proposed a three-

component model of working memory comprising of a control system of limited capacity (the central executive), and two subsidiary storage systems: the phonological loop and the visuospatial sketchpad (Baddeley, 2003).

The phonological loop is based on sound and language. Retrieval and re-articulation allow memory traces to be refreshed. Immediate memory has a limited span because articulation takes place in real time, therefore, as the number of items rehearsed increases, a capacity is filled and the first item will have faded before it can be rehearsed. Similarly, a limited capacity can also be observed in the corresponding subsystem, the visuospatial sketchpad. Features of objects including colour, and location and shape compete for storage capacity within a given dimension, whereas features from different dimensions do not (Baddeley, 2003). Baddeley suggests that given the role of the phonological loop in language acquisition, it is reasonable to assume that the visuospatial sketchpad plays a role in acquiring semantic knowledge from the appearance of objects. This proposal emphasises the capacity of working memory to manipulate and create new representations (Baddeley, 2003). Therefore, virtually any concurrent task has the potential to interfere with performance through its demands on limited attentional capacity in working memory (McGaugh, 2000).

1.8 MEMORY CONSOLIDATION

Complimenting the assumptions of working memory, the neurobiology of memory consolidation also provides a foundation for predicting the role of visuospatial tasks in the reduction of intrusive memories of trauma material. The consolidation theory suggests that the physiological representation of newly acquired information was labile and that over a period of time post-acquisition, the information was slowly "consolidated" into a more a stable form (Weingartner & Parker, 1984). A key assumption of consolidation is that recently formed memories still being consolidated are especially vulnerable to interference. Predictions based on the consolidation theory are derived from the central notion: "New memories are clear but fragile and old ones are faded but robust" (Wixted, 2004, p. 265).

Once the information enters in to long-term memory it becomes insensitive to disruptive factors (Nader, Schafe, & LeDoux, 2000). Evidence has been found to support the idea that information is subject to a period of vulnerability to disruption immediately following acquisition, after which the memory trace is consolidated into long-term memory (Glickman, 1961; McGaugh, 1966; McGaugh, 2000). The most common example of consolidation is retroactive amnesia being attributed to interference with the consolidation process (Weingartner & Parker, 1984).

The neurobiology of memory suggests there is a six hour time period (post-event) within which memories are vulnerable to disruption (Nader, 2003; Walker, Brakefield, Hobson & Stickgold, 2003). Combining this notion with (1) evidence suggesting that the likelihood of intrusive memories is reduced when visuospatial tasks are performed concurrently while viewing a trauma film (Brewin & Saunders, 2001; Holmes et al., 2004; Stuart et al., 2006), and (2) the limited capacity within the working memory system (Baddeley, 2003), Holmes et al. (2009) predicted that visuospatial cognitive tasks applied within a six hour window (post-trauma) would reduce

subsequent intrusive memories. The proposed facets of working memory and memory consolidation suggest that an intervention applied within a six hour time period post trauma may be able to disrupt memory processes associated with trauma.

In the study that Holmes et al. (2009) conducted, 40 participants watched a trauma film and then performed simple filler tasks for 30 minutes. This time frame was chosen due to statistics indicating that the average waiting time in an emergency department in the United States of America is 30 minutes. Following the filler tasks, participants were then randomly assigned to one of two task conditions— either playing 'Tetris' or sitting quietly in a room for 10 minutes. Participants then kept a diary for one week and recorded any spontaneous memories they had about film. Results of the study indicated that those who played 'Tetris' reported significantly fewer spontaneous memories of the trauma film, compared to those who sat quietly. Therefore suggesting interference *after* exposure to a trauma film may also reduce the number of spontaneous intrusive memories.

In addition to the participants in the visuospatial task condition reporting fewer spontaneous memories, they also reported significantly lower scores on the measure of clinical symptomatology of trauma- the Impact of Event Scale (Horowitz, Wilner & Alvarez, 1979) a week after exposure to the trauma film. A recognition memory test was also completed and indicated that voluntary recall for the film remained stable regardless of whether 'Tetris' was played. This suggests that the effect of the visuospatial task 'Tetris' is isolated to the frequency of spontaneous intrusive memories, and does not appear to affect explicit memory.

1.9 AIMS AND HYPOTHESES

The effect of a visuospatial interference in the post-trauma period has been examined (Holmes et al. 2009), with evidence indicating a reduction in flashbacks. However, the effect of post-trauma verbal interference has not yet been examined. Therefore, the aim of the present study was to replicate and extend the work of Holmes et al. in search for early interventions that can be applied to people exposed to real-life trauma. In particular, the present study aimed to assess the relative effects of a visuospatial task, a verbal task, and no task on uncued spontaneous memories of a trauma film.

Firstly, it was hypothesised that participants in the visuospatial task condition would report significantly fewer uncued spontaneous memories of the film compared to participants in the verbal task and no-task conditions. In addition, it was hypothesised that participants in the verbal task condition would report significantly more uncued spontaneous memories of the film compared to participants in the no-task condition. Following the results of Holmes et al. (2009) which revealed that explicit memory remained intact despite exposure to a visuospatial task, it was also predicted that there would be no significant difference between the three condition groups in a recognition memory test one week after exposure to the film. Finally, it was hypothesised that participants in the visuospatial task condition would have significantly lower scores on the Impact of Events Scale (Horowitz et al., 1979) compared to participants in the

verbal task and no-task conditions, and that participants in the verbal task condition would have significantly higher scores than the control condition.

CHAPTER 2. METHOD

2.1 PARTICIPANTS

The sample comprised 45 undergraduate students from the University of Tasmania. The number of participants was decided on the basis of the desired power of the experiment. Specifically, a power calculation was performed to determine the number of participants that would be needed in each group assuming that the effect size for the number of flashbacks would be identical with that found by Holmes et al. (2009), (effect size, 0·95), and with a desired power of 0·8. The required number of participants per group was found to be 15.

Next, an estimate was made of the power of the experiment with regard to the hypotheses concerning the Impact of Event Scale. Under the assumption that the true effect size was identical to that found by Holmes et al. (2009) (effect size, 0·79), and with 15 participants per group (as per the previous calculation), the estimated power was found to be 0·68.

There were 14 males and 31 females with a sample age range of 18 to 56 years old. The mean age was 24·9 years. Participants were recruited through advertisements placed on the Psychology webpage on the University website and posters placed around the School of Psychology. In addition to advertisements, students were contacted by email if they met standards of a voluntary screening test. The recruitment instruments stated that participants were required to be 18 years or over and to suffer from no anxiety problems. All participants were first year Psychology students who received 1·5 hours of course credit upon completion of their participation in the study. All participants were previously unknown to the researcher. Prior to recruitment, ethics approval had been obtained from the University of Tasmania Human Research Ethics Committee.

The participants who were included in the study all scored below the exclusion threshold (7 or above), on the General Health Questionnaire (mean = 0·96; standard deviation = 1·6; minimum = 0; maximum = 6).

2.2 DESIGN

The present study was a 3 group design. The independent variable was Intervention with three conditions, namely a visuospatial intervention ('Tetris'), a verbal intervention (counting task), and no-intervention (sitting quietly). The central dependent variable was the number of uncued spontaneous memories of a film stimulus over the course of one week. Subsidary dependent variables included a recognition memory test, and an Impact of Event scale (Horowitz et al., 1979).

2.3 MATERIALS

2.3.1 Recruitment materials

A4 posters, an advertisement on the University of Tasmania's Psychology website, and email to potential participants—stated that the study involved filling out some questionnaires, watching a film that might be disturbing or upsetting, completing one other simple task (the nature of which was unstated), and keeping a diary for a week. Potential participants were provided with a detailed information sheet and consent form prior to the commencement of the study.

2.3.2 Screening tests

The screening test used in the present study was the General Health Questionnaire-12 (GHQ-12) which consists of 12 items assessing general mental health over the past few weeks (Goldberg, 1992). The GHQ-12 is widely used as a screening measure, and its psychometric properties are well understood (Hardy, Shapiro, Haynes, & Rick, 1999; Tait, French, & Hulse, 2003; Bell, Watson, Sharp, Lyons, & Lewis, 2005).

2.3.3 Inventories

The State-Trait Anxiety Inventory- Trait version (STAI-T) (Spielberger, Gorusch, Lushere, Vagg, & Jacobs, 1977) was also used in the study. The STAI-T comprised 20 items measuring trait anxiety on a four-point scale.

Materials also included two mood inventories, Pre-film and Post-film. Both mood inventories comprised seven visual analogue scales which asked how participants were feeling at that moment. Moods included, in order of appearance, Sad, Happy, Depressed, Angry, Fearful, Hopeless, and Calm, and were measured on a 10cm long visual analogue scale. The Post-film inventory included three additional measures for attention to the film, distress caused by the film, and personal relevance. The mood inventories (see Holmes et al., 2009) were provided to the experimenter by C. Deeprose (personal communication, March 28, 2009).

2.3.4 Film stimulus

Materials also included a 13·5 minute film consisting of 5 scenes of the aftermath of real-life motor vehicle accidents, death and injury (Steil, 1996). The film was presented on a full screen (39 cm) Dell Studio 15 laptop computer with the volume at 62% (Figure 1). Permission to use the film, compiled by Steil (see Holmes et al., 2004) was obtained from Prof A. Ehlers, one of the copyright holders (personal communication, March 23, 2009).

Figure 1: An example scene from the trauma film stimulus

2.3.5 Intervention materials

Materials for the delivery of the interventions included the computer game 'Tetris' (version 1.6) presented on a laptop computer (Figure 2), and a list of random numbers counting backwards in 3s and 7s alternatively, for the researcher's use only.

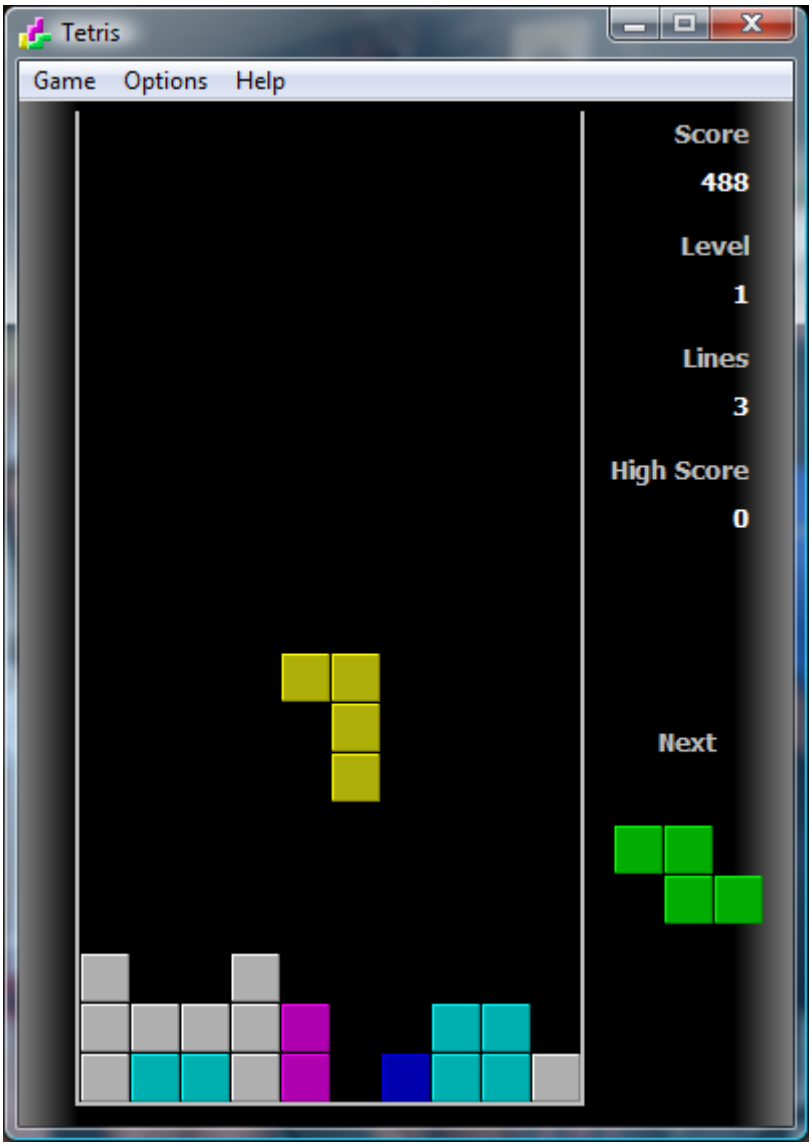

Figure 2. Tetris version 1.6.

2.3.6 Dependent variable materials

The standardised diary included sections for participants to record any spontaneous memories they had about the film. Permission was obtained from Deeprose to use the same diary as used in Holmes et al. (2009). Dependent variable materials also included an Impact of Event scale (IES) (Horowitz et al., 1979). The IES comprised an intrusion sub-scale and an avoidance sub-scale, with 15 items in total (Appendix A). A diary compliance rating was used. Participants rated the extent to which the statement, "I have often been unable (or forgotten) to record my intrusions in the diary" was true of them (0 being 'not at all true' to 10 being 'completely true').

A recognition memory test consisting of 20 written statements about the film, with 'true' or 'false' responses (Appendix B) was also used. There were four statements corresponding to each of the five scenes, with two 'true' statements and two 'false' statements. All false statements

were false for the entire film. A debriefing sheet outlining the aims of the study was also prepared for presentation to participants at the end of the study.

2.4 PROCEDURE

2.4.1 Phase 1

Participants were tested individually in a quiet room. In the initial session, participants were provided with an information sheet outlining the aims of the study, the risks and benefits associated with participating in the study, and what the participant would be asked to do. After reading the information sheet, each participant signed a consent form, acknowledging that they understood what the study involved.

Participants then completed the GHQ-12 if they had not previously done so. Participants then played the computer game 'Tetris' for eight minutes. Verbal instructions were given to each participant informing them of the aim of the game and the correct keys to use. The researcher also demonstrated how to play. Participants were instructed to play until the researcher told them to stop. Participants were shown how to start a new game and were instructed to do so if they had finished the game before they were told to stop playing. Participants started playing 'Tetris' on level 1 if they had not had experience playing the game, or on level 3 if they had played the game prior to the study. All participants completed this period of playing 'Tetris' regardless of the intervention they would be given following the film. Participants then completed the STAI-T and the pre-film visual analogue mood inventory.

Participants were then reminded that the film contained scenes from real-life motor vehicle accidents, and were asked if they were still able to watch the film. Participants were asked to concentrate on the film while it was playing. They were told that the researcher would not be in the room while they watched the film but would return when it finished. Each participant viewed the film in a darkened room. Upon completion of the film participants completed the post-film visual analogue mood inventory. Participants then completed one of three intervention tasks.

Intervention tasks

In the 'Tetris' intervention participants played 'Tetris', starting at level 1, and were instructed to start a new game if they had finished the game before the researcher told them to stop.

In the 'Verbal' intervention participants were instructed to count backwards out loud from random numbers read out by the researcher. Participants were instructed to count backwards in 3s from the first random number, and then in 7s from the second random number and to continue alternating from 3s and 7s until the researcher instructed them to stop. For example, if the researcher instructed the participant to count backwards in three's from '151' then the participant would respond, '148 … 145 … 142 …' until they reached '0', and if the researcher instructed the participant to count backwards in seven's from '184' then the participant would respond, '177 … 170 … 163 …'. The participants were given this example during instructions.

In the 'Sitting' intervention participants were instructed to sit quietly in the room and not do anything. Participants were instructed to not use their mobile phone or get their books out. The researcher informed the participants that they would be left alone and that the researcher would return in 10 minutes. All interventions were completed in 10 minutes and all participants were told of the duration prior to commencing the intervention.

Diary instructions

Following the completion of the intervention task, participants were provided with the diary and the following instructions were given:

> Please take this diary and keep it for the next seven days to record any spontaneous memories you have about the film. Only record the memories that are spontaneous. This is when you do not deliberately think about the film, rather it just pops into your mind suddenly. There will be a few different types of memories you might have. You might have an image pop into your mind, for example the car on fire, or you might have a thought about the film, for example you might think to yourself, 'I'm glad I wasn't that person', or you might have a combination, a thought and image together. There are seven boxes, one for each day, and these are divided into morning, afternoon, and evening. When you have a spontaneous memory about the film please write in the corresponding time, an 'I' if it is an image, a 'T' if it is a thought, or an 'IT' if it is a thought and an image combined. After you have done that, if you could write in this content page the day, if it was an image, thought, or image and thought combination, the content of the memory, if anything triggered the memory, and how distressed you were at the time of the memory. This ranges from 0 being not at all to 10 being extremely. Please try and record in the diary as soon as the memory occurs and bring it with you to next week's follow-up appointment.

During instructions the researcher filled in examples with red pen.

2.4.2 Phase 2

Follow-up session

Participants returned the diary and completed the Impact of Event scale and a recognition memory test. Participants were then debriefed on the aims of the study and what the researchers were hoping to find. A debriefing sheet was provided at the end of the study. Participants were asked to not divulge any information to other potential participants.

The data was analysed using Microsoft Excel and the Statistical Package for Social Sciences version 17.0. An alpha level of ·05 was used for all statistical tests.

CHAPTER 3. RESULTS

3.1 PHASE 1

3.1.1 Did the groups differ in terms of anxiety prior to watching the film?

To ensure that the random allocation of subjects to groups had resulted in groups that were essentially equal, a one-way analysis of variance was conducted to compare the intervention groups on the STAI-T. The results indicated that the groups were not significantly different (Visuospatial $M = 38{\cdot}9$, $SD = 7{\cdot}3$, Verbal $M = 39{\cdot}2$, $SD = 5{\cdot}4$; Sitting $M = 37{\cdot}6$, $SD = 4{\cdot}2$; $F(2, 44) = 0{\cdot}33$, $p = 0{\cdot}72$).

3.1.2 Did the film affect mood as expected? Did the groups differ in terms of mood?

To ensure the groups were essentially the same prior to the intervention, the effect of the film stimulus on the groups was examined using a series of 3 (between—Group) × 2 (within—Pre-Post) mixed design ANOVAs for each of the mood measures. For test of effects that involve the within-subjects factor (i.e., The pre-post main effect and the group × pre-post interaction), Keppel's (1991) advice regarding sphericity has been followed. Specifically, sphericity has been assumed not to hold. No correction has been applied to the degrees of freedom rather, α for these tests has been reduced from ·05 to ·025. The main effect for time of test was significant on all mood measures (Sad, Happy, Depressed, Angry, Fearful, Hopeless, and Calm) together with an examination of the direction of change, indicated that overall mood altered significantly in the expected direction, maximum $F(1, 42) = 13{\cdot}56$, $p < {\cdot}002$. Figure 3–Figure 9 illustrate the direction the moods change for each condition group, after watching the film. As expected, for each condition group, the negative moods including sad, depressed, angry, fearful, and hopeless increase after watching the film, while the positive moods happy and calm decrease.

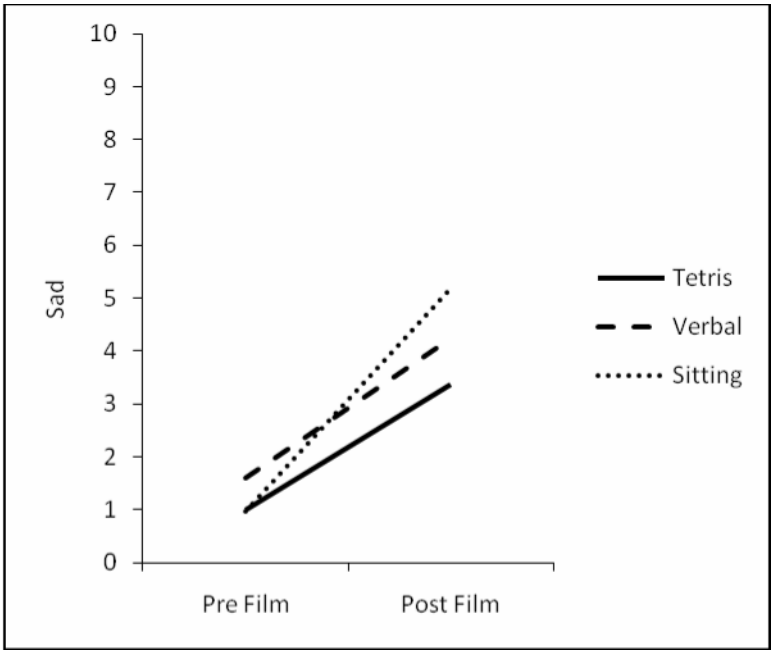

Figure 3. Sad mood: pre-film and post-film scores for sad mood by group.

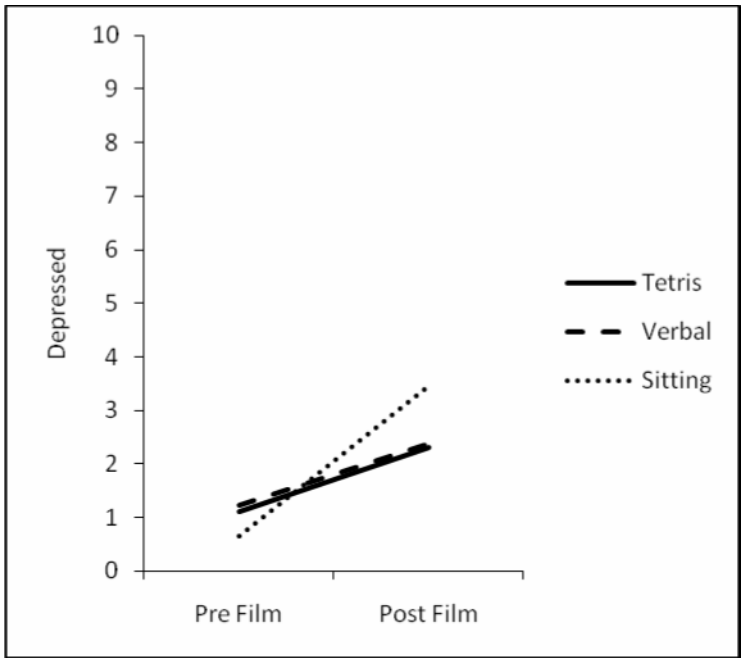

Figure 4. Depressed mood: pre-film and post-film scores for depressed mood by group.

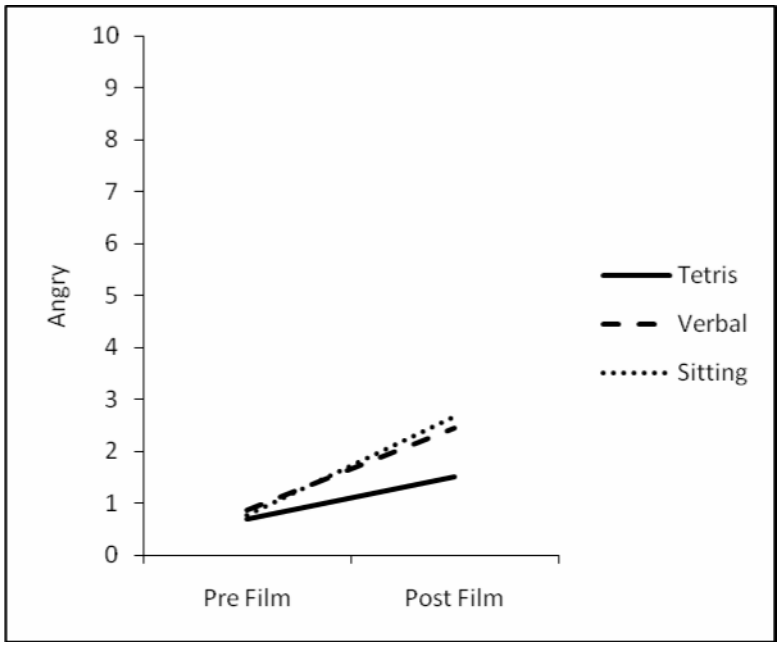

Figure 5. Angry mood: pre-film and post-film scores for angry mood by group.

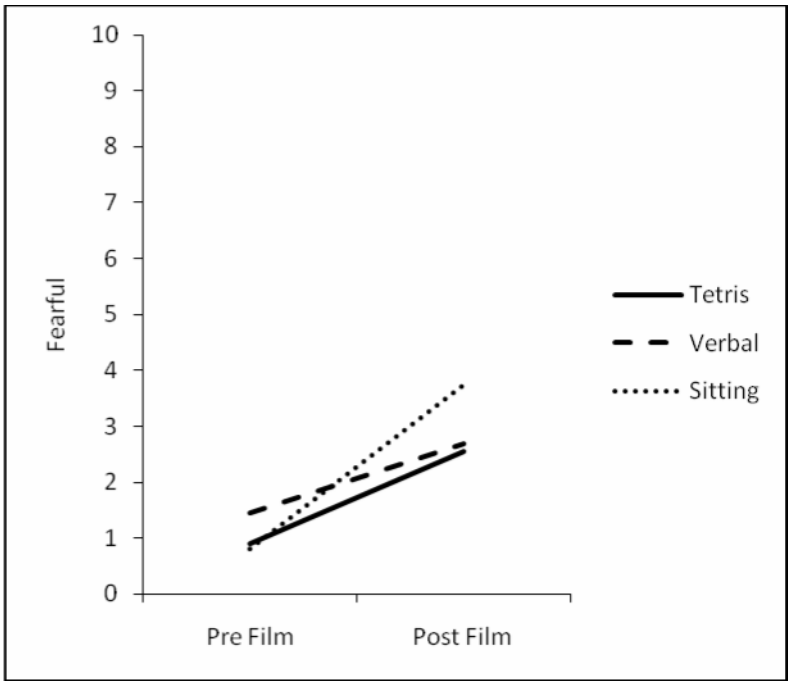

Figure 6. Fearful mood: pre-film and post-film scores for fearful mood by group.

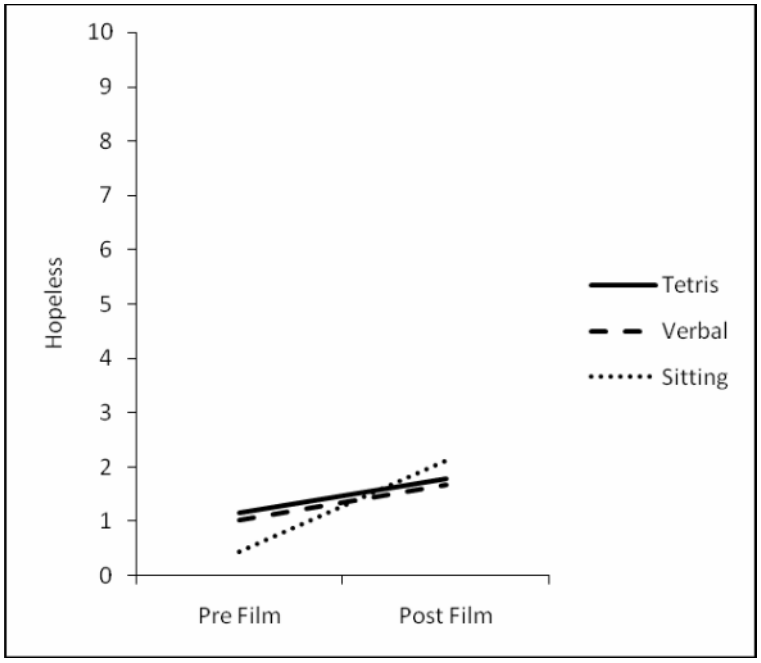

Figure 7. Hopeless mood: pre-film and post-film scores for hopeless mood by group.

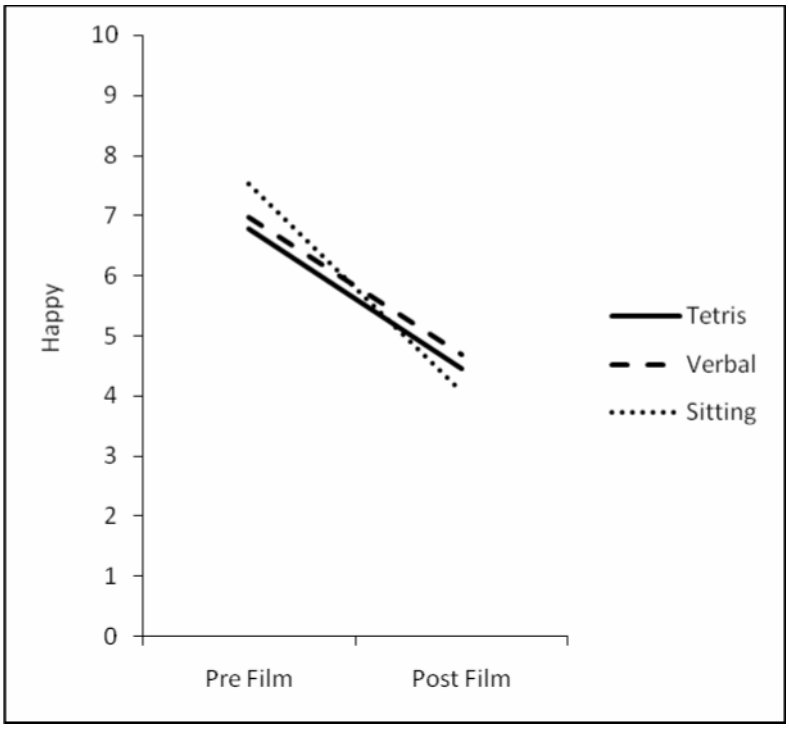

Figure 8. Happy mood: pre-film and post-film scores for happy mood by group.

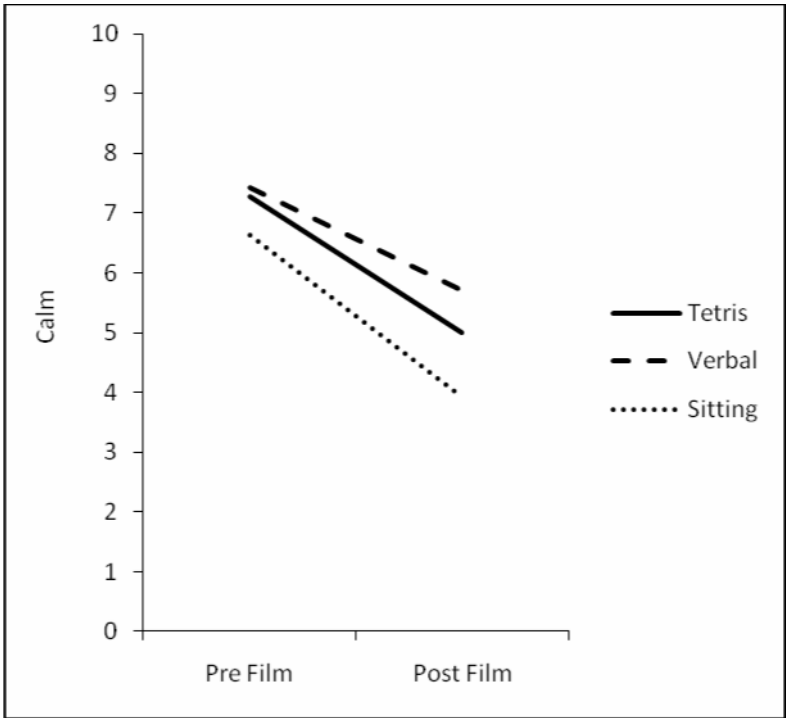

Figure 9. Calm mood: pre-film and post-film scores for calm mood by group.

The results also indicated that the main effect of group was not significant in all these ANOVAs, maximum $F(2, 42) = 2{\cdot}88$, $p = {\cdot}67$.

A non-significant interaction for group × pre-post occurred for all but two measures, being Sad, $F(2, 42) = 3{\cdot}43$, $p = {\cdot}042$, and Depressed, $F(2, 42) = 3{\cdot}98$, $p = {\cdot}026$. The means and standard deviations are reported in Table 1.

		Visuospatial		Verbal		Sitting	
		Pre	Post	Pre	Post	Pre	Post
Sad	*M*	·99	3·37	1·59	4·23	·98	5·18
	SD	·91	1·88	2·01	2·62	·76	1·59
Depressed	*M*	1·11	2·32	1·23	2·37	·65	3·47
	SD	1·22	2·02	1·90	1·78	·74	2·12

Table 1. Pre and Post Mean Scores for Moods Sad and Depressed (and Standard Deviations) for Intervention Group

To exclude the possibility that group differences might provide an explanation for later results, the groups were further examined pre and post exposure to the film stimulus. An ANOVA revealed that prior to watching the film, there was no significant difference between groups for all mood measures, therefore groups were essentially equal in terms of mood before watching the film, maximum $F(2, 42) = 1{\cdot}74$, $p = {\cdot}189$. The ANOVA also indicated that for all but one mood

measure there was no significant difference between groups after watching the film, maximum $F(2, 42) = 2{\cdot}86$, $p = {\cdot}068$. The significant difference was found for the mood Calm, $F(2, 42) = 4{\cdot}07$, $p = {\cdot}024$. A Post-hoc analysis was conducted to investigate the significant difference. Scheffe's test indicated a significant difference between the Verbal group ($M = 5{\cdot}7$, $SD = 1{\cdot}56$) and the Sitting group ($M = 3{\cdot}93$, $SD = 1{\cdot}72$), $p = {\cdot}025$.

3.1.3 Did the groups differ in: paying attention to the film, feeling distressed by the film, and finding the film personally relevant?

One-way ANOVAs were conducted to examine attention, distress, and personal relevance. The groups did not differ significantly on attention, $F(2, 44) = {\cdot}622$, $p = {\cdot}542$, or on personal relevance, $F(2, 44) = 1{\cdot}36$, $p = {\cdot}268$. However the result for distress was significant, $F(2, 44) = 4{\cdot}06$, $p = {\cdot}024$. A Post-hoc test was conducted to compare differences between the intervention groups on distress. The Visual group ($M = 5{\cdot}01$, $SD = 2{\cdot}28$) reported significantly lower distress scores compared to the Sitting group ($M = 6{\cdot}83$, $SD = 1{\cdot}08$), Scheffe's test, $p = {\cdot}025$.

3.1.4 Phase 1 Summary

The results of Phase 1 indicated the groups did not differ in terms of anxiety prior to watching the film, therefore, the results of Phase 2 would not be influenced by differential effects as the groups were essentially equal in terms of anxiety prior to watching the film. The results also indicated that in terms of mood overall, the groups did not differ. The results also indicated that the film had a significant effect on mood, in that all groups reported an increase for moods: Sad, Depressed, Angry, Fearful, and Hopelessness, and a decrease for moods: Happy and Calm after watching the film. In terms of mood, all groups were equal prior to the film stimulus, and for all but one mood measure groups were equal after the film stimulus. Finally, for five of the mood measures the groups did not differ between Pre-film and Post-film. Any unexpected significant differences may have been due to high type 1 error rate due to the number of ANOVAs conducted.

3.2 PHASE 2

It was hypothesised that participants in the visuospatial task condition (Tetris) would report significantly fewer uncued spontaneous memories of the film compared to participants in the Verbal condition and the Sitting condition. Following Keppel's (1991) advice, planned comparisons were used to examine the main hypotheses. Firstly, the Visuospatial group was compared with the Verbal and Sitting groups, in terms of the total diary scores, using contrast weights of 1, −0·5, −0·5 respectively (Table 2).

	Contrast	Value of Contrast	Std. Error	t	df	Sig. (1-tailed)
Total Diary	1	0·27	1·15	0·232	42	·40

Table 2. A Planned Comparison of the Visuospatial Group with the Verbal and Sitting Groups for Total Diary Scores.

The results of the planned comparisons indicated that contrary to the main hypothesis, the Visuospatial group did not differ significantly in total diary scores compared to the Verbal and Sitting groups.

It was also hypothesised that participants in the Verbal task condition would report significantly more uncued spontaneous memories of the film compared to participants in the Sitting condition. An inspection of the means (Table 3) revealed that it was unnecessary to perform this planned comparison the means indicated that the groups differed in a direction contrary to the hypothesis.

		Mean	Std. Deviation	Minimum	Maximum
Visuospatial	Diary	5·40	4·64	0	17
	IES	13·93	10·26	0	33
Verbal	Diary	5·47	2·83	1	11
	IES	15·47	7·35	2	30
Sitting	Diary	5·87	3·16	2	12
	IES	24·33	11·17	5	49

Table 3. Mean Diary and Impact of Event Scale Scores (and Standard Deviations) for Intervention Groups.

To test the hypothesis that participants in the Visuospatial condition would have significantly lower scores on the Impact of Event Scale (IES) compared to participants in the Verbal condition and Sitting condition, a planned comparison was conducted to compare the Tetris group with the Verbal and Sitting groups. The contrasts used were consistent with the initial planned comparisons. The results are shown in Table 4.

	Contrast	Value of Contrast	Std. Error	t	df	Sig. (1-tailed)
Total IES	1	5·97	3·08	1·94	42	·03

Table 4. A Planned Comparison of the Visuospatial Group with the Verbal and Sitting Groups for Impact of Event Scale Scores.

The results of the planned comparisons and visual inspection of the means for the IES indicated that, the mean score for the Visuospatial group was significantly lower than for either the Verbal group and the Sitting group. Means and Standard Deviations for each group are presented in Table 3.

It was also hypothesised that participants in the Verbal task condition would have significantly higher scores on the IES compared to the Sitting condition. However, it was unnecessary to perform the planned comparison regarding the Verbal and Sitting groups as an inspection of the means (Table 3) indicated that the groups differed in a direction contrary to the hypothesis.

An inspection of the mean scores for the IES (Table 3) revealed an unexpectedly large difference between the Verbal and Sitting groups. To examine the possibility that the different effects of the Verbal and Sitting interventions warranted further analysis, an independent samples *t*-test was conducted and indicated a significant difference, $t(28) = 2{\cdot}57$, $p = {\cdot}016$.

Finally, to test the hypothesis that there would be no significant difference between the three intervention groups in a recognition memory test one week after exposure to the film stimulus, a one-way ANOVA was conducted. The results showed no significant difference between the groups, $F(2, 43) = 0{\cdot}278$, $p = {\cdot}759$, indicating that differences in recall of the film does not provide an explanation for the observed effects of the interventions.

3.3 EXPLORATORY ANALYSES

There is a possibility that the number of flashbacks of the film that people experienced depended on how relevant the film was to them or distress experienced as a result of the film. This possibility was investigated by examining the correlation between total diary responses and personal relevance, and total diary responses and distress. Correlations between total diary responses and personal relevance, and total diary responses and distress were both weak, $r = {\cdot}27$ and ·21 respectively. Therefore, differences in the number of reported spontaneous memories of the film are not strongly related to personal relevance or how distressing the film was found to be.

It is also a possibility that differences in total diary responses for each condition group depended on how compliant participants were in reporting experienced flashbacks. To test whether groups differed in how compliant they were in reporting experienced flashbacks, a one-way ANOVA was conducted on compliancy ratings. The results indicated no significant difference —$F(2, 42) = 1{\cdot}77$, $p = {\cdot}18$ — and as a consequence, the results relating to the hypotheses regarding the number of spontaneous memories could not be accounted for by any differences between groups in reporting in the diary.

As reported in the Phase 2 results section, there was a significant difference between the visuospatial group and the verbal and sitting groups in total IES scores. The possibility that these results were attributable to only one of the subscales was investigated. Both the intrusion subscale and avoidance subscale scores for each group were significantly different, $F(2, 42) = 3{\cdot}65$, $p = {\cdot}035$, and $F(2, 42) = 4{\cdot}64$, $p = {\cdot}015$, respectively. A post-hoc test indicated that the visuospatial group had significantly lower intrusion scores compared to the sitting group, Tukey HSD = ·026. A post-hoc test also indicated that the visuospatial group had significantly lower avoidance scores compared to the sitting group Tukey HSD = ·048, and that the verbal group had significantly lower avoidance scores compared to the sitting group Tukey HSD = ·021.

CHAPTER 4. DISCUSSION

In an attempt to contribute to research into the prevention of symptoms typical of PTSD, particularly the intrusive reexperiencing of trauma, the present study aimed to replicate and extend the work of Holmes et al. (2009). The effect of a visuospatial task (the computer game 'Tetris'), was compared with the effect of a verbal task (a counting task) on later spontaneous memories of a trauma film. The present study failed to replicate the main findings by Holmes et al. Specifically, the prediction that the visuospatial task 'Tetris' would reduce spontaneous memories of a trauma film compared to the verbal task and no-task condition, was not supported. In addition, the hypothesis that a verbal task would increase spontaneous memories of a trauma film compared to the no-task condition was also not supported. More generally, the results did not indicate any significant differences between the three interventions in their effect on the number of flashbacks experienced over one week following exposure to a trauma film. As expected, the groups were found to be comparable on a recognition memory test, indicating that the intervention tasks did not interfere with voluntary memory for the film. A detailed discussion of the results is presented in the sections to follow.

4.1 THE EFFECT OF THE VISUOSPATIAL TASK

To recapitulate, the dual-representation theory of PTSD proposes that people process a traumatic event in two separate systems— the verbally accessible memory (VAM) system and the situationally accessible memory (SAM) system. Contextual information associated with the traumatic event, which is consciously attended to, is processed in the VAM system. In contrast, sensory information of the traumatic event such as sight and sound, which need not be consciously attended to, is processed in the SAM system (Brewin et al., 1996). According to this theory, the SAM system is responsible for intrusive flashbacks of a traumatic event, which are predominantly sensory mental images.

The dual-representation theory is explicit about the effect of concurrent tasks, in that a visuospatial task is argued to interfere with the processing of sensory information in the SAM system, resulting in fewer flashbacks, compared to a no-task condition. This is supported by Holmes et al.'s (2004) findings. However, the theory is not explicit about the effect of applying a cognitive task after a delay, in the post-trauma time period. Holmes et al. (2009) found that a visuospatial task applied after a delay could reduce later flashbacks of a trauma film. In the present study, the visuospatial intervention did not indicate a statistically significant reduction in flashbacks. However, overall the results of the present study are somewhat supportive of Holmes et al.'s (2009) findings in so far as the direction of the effect of the visuospatial task was in the expected direction, and further supported when considered in conjunction with the IES results. The IES results will be discussed below.

It might be argued that the present study did not replicate Holmes et al.'s (2009) finding because the 30 minute delay between viewing the film and the application of an intervention was not

replicated. However, this argument is implausible as Holmes et al. (2004) previously demonstrated a positive effect when a visuospatial task intervention was concurrently performed, and a positive effect when performed after 30 minutes (suggested to be the average waiting time in a United States emergency department). Therefore there was no reason to suppose that an intermediate time would not be successful.

Holmes et al. (2009) based their hypotheses not only on past studies but also on the concept of working memory. Holmes et al. predicted that due to the demonstrated limited capacity nature of working memory, playing the computer game 'Tetris' would compete for resources with the visuospatial images of the trauma film, and therefore reduce later intrusions. In addition, the concept of memory consolidation was also proposed as a basis for Holmes et al.'s hypotheses. Holmes et al. proposed that as 'Tetris' was played within six hours of viewing the trauma film, the memory of the film would be subject to disruption as it would not be stable or consolidated. The results of the present study suggest that the cognitive tasks did not interfere with information processing in the working memory, or during the time when memory is argued to be labile and sensitive to disruption. This suggests that a visuospatial task optimally interferes with the processes in the SAM system when performed concurrently during exposure to a trauma film, and not after.

As reported in the results section, the visuospatial group reported significantly lower scores on the IES compared to the verbal and no-task groups. Of particular interest is the finding that the visuospatial group reported lower scores on the intrusion subscale of the IES compared to the no-task condition. The intrusion subscale is characterised by unbidden thoughts and images, troubled dreams, and episodes of negative feelings, and repetitive behaviour (Horowitz et al., 1979). Overall, the IES is a broadly applicable measure used to assess current subjective distress for any life event. It reports sound empirical validity, adequate test-retest reliability and sensitivity, and persons of various educational, socio-economic, and cultural backgrounds have been able to be administered the scale (Horowitz et al., 1979). Given the discrepancy between the IES scores and diary responses, combined with the finding that the diary results (at least as far as 'Tetris' is concerned) are in the right direction, the visuospatial task may well have reduced the flashback frequency in the present study yet the tool employed to measure this was possibly unreliable or insufficient to demonstrate this. The limitations of using of a self-report diary measure will be returned to in a discussion of the limitations.

4.2 THE EFFECT OF THE VERBAL TASK

In 2004, Holmes et al. found that a verbal task performed concurrently with a trauma film increased the number of subsequent flashbacks compared to a no-task condition. The present study extended Holmes et al.'s (2009) study by testing the effect of a verbal task in the post-trauma time period. This appears to not have been tested previously. It was predicted that the verbal task would increase later flashbacks of a trauma film, however the results did not demonstrate this effect. An explanation for this outcome is that the application of the intervention was delayed in the present study, in contrast to Holmes et al.'s (2004) study, where

the intervention was concurrently administered. This delay in administration of the intervention may have led to the differing result.

An alternative possibility for why no significant difference was found in the number of flashbacks between the verbal task condition and the no-task condition is that the verbal task may not have been complex enough to compete for resources in the VAM system. In line with the dual-representation theory, it was hypothesised that a verbal task would increase flashbacks compared to no-task because less contextual information would be processed, leading to more sensory input in the SAM system (responsible for flashbacks). The verbal task employed in the present study was almost identical to the one used by Holmes et al. (2004), where it was found to increase the frequency of flashbacks when performed concurrently with a trauma film. Therefore, it appears that the nature of the verbal task was not complex enough to cause interference in the VAM system, when it was applied in the post-trauma time period.

Many people believe that it is better to discuss one's feelings than to internalise (McNally, Bryant, & Ehlers, 2003). Although talking therapy, as a treatment of psychological effects of trauma**,** is supported by many scholars (Everly, Flannery, & Eyler, 2002), the efficacy of this type of therapy has caused much controversy (McNally et al., 2003). The key elements of psychological debriefing are ventilating emotions about the trauma through discussion of thoughts, feelings, and reactions with a trained professional (McNally et al., 2003). While support exists for debriefing as a treatment for those with a high risk of developing PTSD, studies have revealed that debriefing does not help prevent PTSD, but also worsen later trauma symptoms (van Emmerick, Kamphuis, Hulsbosch, & Emmelkamp, 2002; Mayou, Ehlers, & Hobbs, 2000). Mayou et al. found that at a three-year follow-up, participants who had received psychological debriefing after experiencing a road traffic accident had a significantly worse outcome in terms of general psychiatric symptoms, compared to participants who did not receive debriefing.

The dual-representation theory explicitly states that verbally accessible memories depend on attention to encode contextual information of the traumatic event (Brewin et al., 1996). Holmes et al. (2004) supported the idea that a concurrent verbal task would lead to an increase in flashbacks. Those results support the findings that talking therapy, such as psychological debriefing, exacerbates the risk of developing clinical psychiatric problems such as those associated with PTSD (van Emmerick et al., 2002; Mayou et al., 2000). The present study appears to be the first to test the idea that a post-trauma cognitive verbal task would lead to increased flashbacks also. However, contrary to Holmes et al.'s results, the results of the present study did not support this hypothesis. The implications of this finding will be discussed below.

4.3 LIMITATIONS

There are a number of possible limitations in the present study. One of these was the use of diaries to record the main dependent variable (flashbacks). Similar to any self-report measure, the use of diaries is potentially unreliable. Diary methodology is difficult to evaluate in line with standard psychometric theory as there are no external criteria of validity and standard measures

of reliability are inappropriate (Holmes & Bourne, 2008). Despite the compliance data reported in the results section, the results of the present study should be interpreted with caution, particularly as the data solely consisted of participants' introspective reports.

The results of the present study show that the trauma film employed did induce negative mood, distress, and subsequent flashbacks of the film content. Controversy surrounds the trauma film paradigm in relation to its usefulness as an analogue to real life trauma (Holmes & Bourne, 2008). Although the paradigm has been employed in a number of studies investigating trauma memory (Brewin & Saunders, 2001; Stuart et al., 2006; Holmes et al., 2004; Holmes et al., 2009), debate continues as to whether PTSD can actually develop from viewing a traumatic event via the television (Pfefferbaum, Pfefferbaum, North, & Neas, 2002). Although the trauma film paradigm provides a useful analogue for investigating trauma in prospective studies, its impact is considerably lessened by being viewed within a controlled environment. Therefore, results of studies employing the trauma film paradigm should be interpreted with caution due to its apparent differing impact as compared to real-life trauma.

The use of a student sample poses some limitations to the study. Firstly, using a student sample may have produced unreliable results as it is a narrow sample of the general population. Secondly, cognitive ability has been found to be related to risk for PTSD among people exposed to trauma. For example, lower intelligence was found to be associated with greater severity of PTSD symptoms among Vietnam veterans (McNally & Shin, 1995). Other researchers have replicated this finding (Silva et al., 2000; Vasterling et al., 2002), for example, Silva et al. found that higher intelligence quotient (IQ) was a protective factor against PTSD among inner-city children and adolescents exposed to trauma. In this study, Silva et al. found that of those with above-avergae IQ, 67% had neither PTSD nor subthreshold PTSD, while those with below-average IQ, only 20% had no PTSD symptoms.

Holmes et al. (2009) did not state what type of sample they used, however assuming it was a broader population sample than a student sample used in this study, the results of the present study may not have replicated those found by Holmes et al. due to the sample in the present study consisting of university students who generally have average or above IQ scores. Therefore, the sample used in the present study may have had a protective factor (average or above-average cognitive ability) against PTSD, therefore the trauma film may not have had the same affect.

4.4 IMPLICATIONS

The results of the present study suggest that performing a visuospatial task after viewing a traumatic film, does not reduce subsequent flashbacks of the film compared to a no-task condition. It appears that the present study is only the second to test the effect of performing a visuospatial task in a post-trauma time period. The results of the present study conflict with those found by Holmes et al. (2009), suggesting that performing a visuospatial task such as 'Tetris' after being exposed to a traumatic event, would not reduce the likelihood of experiencing flashbacks of the event. However, there are two outcomes that suggest that playing 'Tetris' may

have had a positive impact on later flashbacks. These include the participants who played 'Tetris' after watching the trauma film reporting significantly lower scores on the intrusion subscale of the IES compared to those who did not perform a task, and that the total number of diary responses were reported to be in the expected direction.

Performing a verbal task after viewing a trauma film did not seem to increase the frequency of flashbacks of the film, as it was expected. This result conflicts with Holmes et al.'s (2004) finding that a concurrent verbal task did increase later flashbacks. It may be that the verbal task of counting backwards is weak and not powerful enough to cause disruption in the VAM system when applied in a post-trauma time period. The results of the present study cannot be generalised to every verbal task, such as talking therapy.

4.5 RECOMMENDATIONS FOR FUTURE RESEARCH

Given that the present study appears to be the first to compare the effect of performing a visuospatial task with a verbal task after viewing a trauma film, it is clear that further studies replicating the design of the present study, and Holmes et al. (2009), is necessary for reliable conclusions to be inferred. Of particular importance is the examination of the effect of applying these interventions during the post-trauma time period as this time period has the most relevance in terms of reducing or preventing flashbacks in real-life.

Due to limiting generalisability related to using a student sample, it is recommended that future studies use a wider sample of the population which would encompass varying ages, socio-economic status and IQ. Furthermore, alternative instruments to measure flashback frequency other than a diary, such as regular spaced interviews at set time intervals, could be employed as diaries rely solely on self-reporting.

An explanation proposed for why the expected effects of the cognitive tasks did not occur in the present study included the possibility that the tasks were not complex enough to replicate the results found in studies of concurrent tasks. Future studies could extend investigations to cognitive tasks with differing levels of complexity, to test whether higher levels of complexity could illicit interference with memory of a traumatic event.

In addition to investigating different levels of task complexity, future research could also investigate the effect of cognitive task interventions at varying time intervals. There is evidence to suggest within a six hour window, after exposure to trauma, where memories are vulnerable to disruption would be suitable (Nader, 2003; Walker et al., 2003). Therefore, studies could test the effect of interference from cognitive tasks along a six hour time line.

The limitations of employing the trauma film paradigm have been presented. In order to address these limitations, future research could employ an alternative paradigm such as testing trainee fire-fighters prior to their exposure to a real life fire (Bryant & Guthrie, 2005). Alternatively, another suggestion is to test this experimental visuospatial intervention with those at risk of battle trauma, for example soldiers in Afghanistan and Iraq, specifically as it has not been demonstrated to have a negative effect. More prospective studies would be helpful in developing

a wider understanding of PTSD symptoms following exposure to trauma and developing interventions to prevent these from occurring.

4.6 CONCLUSION

The present study failed to replicate the findings of Holmes et al. (2009), however limiting factors may have had an impact on these results. Despite the failure to replicate Holmes et al.'s findings, this study has contributed to research into early interventions to prevent spontaneous intrusive flashbacks of a traumatic event, that being a feature of PTSD. Considering the global scale of traumatic events, including war, terrorism, natural disasters, and interpersonal violence, there is a need for widely-available and easily accessible interventions which is not being extensively addressed. As there appears to be no documented research testing the effectiveness of a visuospatial task and a verbal task in the post-trauma time period, this study may contribute to the overall body of knowledge in the prevention of post-trauma flashbacks. The results of this study could stimulate future research into this area.

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APPENDIX A

On . . . . you watched a collection of film clips that showed scenes of traffic accidents.

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. If they did not occur during that time, please mark the "Not at all" column.

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

Please circle the number which corresponds to how true the following statement is:

I have often been unable (or forgotten) to record my intrusions in the diary	0 Not at all true	1	2	3	4	5	6	7	8	9	10 Completely true

APPENDIX B

These statements are related to the film that you watched last week. Please read the statements carefully, and circle 'True' or 'False' according to what you believe to have happened in the film.

Scene #1

- A woman was helped out of an upside-down car True/False
- A car had been smashed by a train True/False
- A baby was injured in the accident True/False
- A group of elderly people watched close by True/False

Scene #2

- A vehicle had to be cut open to free the victim True/False
- A man sustained a severe knee injury True/False
- An ambulance officer vomited at the scene True/False
- It was night time True/False

Scene #3

- A group of children were run into by a car True/False
- The accident involved a pile-up True/False
- You saw dead people True/False
- You could see a news team with cameras present True/False

Scene #4

- A man died before being removed from the car True/False
- Two men lifted a body into a box True/False
- A bike rider was hit by a car True/False
- A helicopter came to air-lift a victim to hospital True/False

Scene #5

- Police were taking statements from the victims True/False
- A woman had a bandage around her head True/False
- The accident took place in a busy city street True/False
- A woman had to have a tube put down her throat True/False