

# THE EFFECT OF DISTRESS ON SUSCEPTIBILITY TO FALSE MEMORIES



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## ABSTRACT

False memories are of concern in situations involving eyewitness testimony, as inaccurate recollections of events may lead to false convictions. It is especially important to investigate the role of distress in the formation of false memories, due to many eyewitness testimony circumstances involving an event of a negative and traumatic nature. It was the aim of this thesis to investigate several key factors that may contribute to false memories for distressing events, namely Post-Traumatic Stress Disorder (PTSD) symptoms such as avoidance, intrusions, and dissociation, and also the biological marker of cortisol response. In order to investigate these aims, two main techniques were chosen: the Deese-Roediger-McDermott (DRM) word list procedure and the Trauma Film Paradigm (TFP) using narratives to introduce misinformation following the viewing of a film.

In Experiment One participants completed the DRM using neutral and trauma-related words along with measures of dissociation and biases related to threat. Analyses indicated that dissociation was related to false recall for traumatic stimuli; findings related to the biases were less straightforward. In Experiment Two misinformation was introduced following viewing of a neutral or stressful film. Findings indicated dissociation was related to higher distress ratings following the film, but unrelated to acceptance of misinformation. Avoidance scores were related to increased reporting and recognition of misinformation items and reported experiences of intrusions related to greater accuracy.

Experiment Three was designed to address discrepant findings between that of the previous two experiments: namely that dissociation was significantly related to falsely remembering trauma words in the DRM task but did not predict false memories for the films. Participants completed both the DRM task and the film task. Results suggested that neither

dissociation nor trauma history was significantly related to DRM false recall. While the distress and state dissociation results of Experiment Two were replicated (specifically that all were higher in response to the trauma film in comparison to the neutral film), the memory results were not. Accuracy on the DRM task predicted accuracy for the film task; however susceptibility to the DRM illusion was unrelated to susceptibility to the misinformation effect. This unexpected finding raised questions regarding whether all false memory tasks are equivalent.

Experiment Four builds on the previous experiments by including a biological, objective measure of distress in response to film viewing: cortisol release. Cortisol responders were found to be more susceptible to the misinformation effect than non-responders, depending on sample timing. Dissociation was found to be related to cortisol response, and also confabulations for the film.

Chapter Eight ties all four experiments together in the General Discussion. While several limitations were identified, it was concluded that the findings of how distress experiences following the film affected memory were particularly novel. These findings have important practical implications regarding eyewitness testimony, as well as identifying people at risk of maladaptive distress reactions.

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## LIST OF ABBREVIATIONS

AAI	Affect-as-Information
ABC	Arousal-Based Competition
AMT	Activation-Monitoring Theory
ANP	Apparently Normal Personality
ASD	Acute Stress Disorder
BAI	Beck Anxiety Inventory
BAS	Backwards Associative Strength
BDI-II	Beck Depression Inventory - II
BFNE	Brief Fear of Negative Evaluation
BTQ	Brief Trauma Questionnaire
CL	Critical Lure
CEQ	Creative Experiences Questionnaire
CFQ	Cognitive Failures Questionnaire
CPT	Cold Pressor Test
DES	Dissociative Experiences Scale
DES-C	Dissociative Experiences Scale - Comparative
DID	Dissociative Identity Disorder
DRM	Deese-Roediger-McDermott Paradigm
DRT	Dual-Representation Theory
EIA	Enzyme Immunoassay
EP	Emotional part of the Personality
FAS	Forwards Associative Strength
FM	Fantasy Model of Dissociation
FR	Free Recall
FTT	Fuzzy Trace Theory
GC	Glucocorticoid
GSS	Gudjonsson Suggestibility Scale
HPA	Hypothalamic Pituitary Adrenal
IES	Impact of Event Scale
IES-A	Avoidance subscale of the IES
IES-I	Intrusions subscale of the IES
LCS	Looming Cognitive Style
LMSQ-R	Looming Maladaptive Style Questionnaire - Revised
MEM	Multiple-Entry Modular
PEI	Post-Event Information
PF1	Post-Film 1 (cortisol sample 20 minutes post-film)
PF2	Post-Film 2 (cortisol sample 35 minutes post-film)

PNE	Paradoxical Negative Emotion
PTCI	Post-Traumatic Cognitions Inventory
PTSD	Post-Traumatic Stress Disorder
SAM	Situationally Accessible Memory
SD	Social Desirability
SDQ	State Dissociation Questionnaire
T1	Time One (immediately post-film)
T2	Time Two (one week post-film)
TAS	Tellegen Absorption Scale
TFP	Trauma Film Paradigm
TIPI	Ten Item Personality Inventory
TM	Trauma Model of Dissociation
TSST	Trier Social Stress Test
VAM	Verbally Accessible Memory

## OVERVIEW OF THESIS

In the legal system, it has been found that a significant number of cases involving false convictions are due to eyewitnesses misremembering details (Wells et al., 1998). As such, many researchers have focused on investigating the conditions under which eyewitnesses are likely to make mistakes, or develop false memories. Loftus and colleagues were able to demonstrate with the classic ‘misinformation effect’ experiments that memory is reconstructive in nature (see Loftus, 2005, for a review). The misinformation effect is defined as the impairment in memory for past events due to exposure to misleading post-event information (Loftus, 2005).

Up until recently, most false memory research has involved exposing participants to relatively harmless, neutral events. This is problematic as witnesses and victims are often required to relay their memories for an event that was distressing in nature. There is considerable debate in the literature regarding whether negative emotional events make false memories more likely (e.g., Dehon, Bastin, & Larøi, 2008; Gallo, Foster, & Johnson, 2009; Kensinger, O'Brien, Swanberg, Garoff-Eaton, & Schacter, 2007). Additionally it is apparent that some people may be particularly susceptible to developing false memories compared to others (Cann & Katz, 2005), and this may also depend on their response to the traumatic event (Zoellner, Foa, Brigidi, & Przeworski, 2000). It is therefore important to further investigate the likelihood of false memory development following a distressing, compared to a neutral event.

The overall aim of the research in this thesis was to investigate how psychological and biological factors affect susceptibility to false memories. To achieve the above aim, four studies were conducted, with each study building on the last. The first three chapters examine the background literature related to false memories and stressful events.

The aim of Chapter One is to detail the history and current state of the literature regarding false memory methods and theories. In particular, two key methods are highlighted: that of the DRM procedure and the Misinformation Effect procedure. Several theories that have been posited to explain false memory phenomena are detailed; however following an evaluation of the theories two in particular are chosen based on their relevance to the subsequent experimental methods: Fuzzy Trace Theory and Source-Monitoring Theory (later combined with Activation-Monitoring Theory).

The aim of Chapter Two is to explain the research related to psychological and biological distress responses. In particular, this chapter focuses on psychological symptoms related to Post-Traumatic Stress Disorder (PTSD), such as intrusions, avoidance and dissociation. Two key theories are detailed in order to explain why PTSD symptoms develop and persist: The Dual Representation Theory of PTSD, and the Cognitive Model of PTSD. A key psychological variable of interest in the experiments of this thesis is that of dissociation. Subsequently, several theories employed to explain dissociative symptoms are compared and contrasted. Particular attention is paid to the Trauma Model of dissociation, based on its' explanatory power and relevance to the experiments of this thesis. As it is also important to compare subjective correlates of distress to more objective measures, the literature on cortisol as a biological correlate of distress is reviewed.

Chapter Three attempts to relate these concepts back to the false memory research detailed in Chapter One. The research on whether emotional stimuli enhances or degrades memory is considered. Following this, key theories of false memory for emotional stimuli are discussed. The Paradoxical Negative Emotion Theory is emphasised based on its relevance to the subsequent experiments conducted in this thesis. Next the research on distress responses



(both psychological and biological) as predictors of false memories is evaluated, and several gaps in the literature are identified. These gaps in the literature have thus informed the design of the experiments conducted in the subsequent chapters.

Based on the arguments presented in the background chapters, Chapter Four details the rationale and findings of the first experiment conducted, in which several psychological factors were investigated regarding their relationship to increased false memories on a word list task. Chapter Five details the next experiment, in which a different approach was adopted involving the trauma film paradigm, where participants completed several psychological measures and watched either a neutral or distressing film. Based on conflicting findings observed in the first two experiments, the experiment in Chapter Six was designed in an attempt to bridge the gap in these findings by combining both the word list task and the trauma film paradigm.

Due to the subjective nature of the psychological constructs investigated in the first three experiments, Chapter Seven details the last experiment which also included an objective biological measure: that of salivary cortisol levels following viewing the neutral or distressing film. It was expected that the psychological and biological measures would relate to each other, and thus a more comprehensive picture of how responses to stressful events can lead to false memory development was expected to emerge. Chapter Eight evaluates whether the aims and expectations for the thesis were met, with reference to some limitations. Chapter Eight also concludes the thesis by highlighting some potential implications, applications and future directions.

## CHAPTER ONE

### Background to False Memory Research and Theory

Autobiographical memory is the term given to the recall of events personally experienced. This information is somewhat malleable, subject to a person's cognitive abilities, beliefs, and social and identity goals (Conway, 2005). In addition to these internal processes that can alter memory, memory can also be influenced by an external source, such as another person. This concept received much attention in the 1980s and 1990s, as several controversial lawsuits emerged in the United States where psychologists and psychiatrists were sued for implanting false memories of childhood abuse in the context of therapy. Initially, those adults in therapy thought that due to the highly traumatic and emotional nature of their memories, the memories must be accurate; however many came to retract their allegations of abuse. It was argued that in at least some of these cases, the use of highly suggestive questioning and hypnosis techniques may have led to the creation of false memories (see Dalenberg, 2006, for a review).

Foundational studies by Elizabeth Loftus and colleagues (e.g., Loftus & Palmer, 1974) demonstrated that participants can be led via suggestive interview techniques to believe that they witnessed aspects of an event that did not actually occur. This could be for a small detail, such as the appearance of glass on the road following a traffic incident (Loftus & Palmer, 1974), or a much larger detail, such as seeing a building that was not present (Loftus, 1975). This finding was termed the misinformation effect, which refers to the impairment in memory for past events due to exposure to misleading information (see Loftus, 2005, for a review). Particularly concerning are the findings that people can report high levels of confidence for these influenced memories (Loftus, 2005), which has real-world implications: eyewitnesses

with impaired memories could influence the focus of an investigation, as well as future criminal proceedings (Wells et al., 2000). Consequently, a variety of techniques arose to investigate ‘false memory’ phenomena, such as word list tasks, exposing participants to false information following an event, and suggestive interviewing. Additionally a variety of theories emerged attempting to explain these effects. Both false memory methodology and theory are discussed in turn in the following sections.

### Methods for Investigating False Memories

#### *The Deese-Roediger-McDermott Paradigm*

In early memory research it was suggested that memory can be both reproductive and reconstructive (Bartlett, 1932; cited in Roediger & McDermott, 1995). Reproductive memory refers to accurately reproducing material from memory in a rote fashion. Reconstructive memory on the other hand involves a more active process of filling in missing elements, and this is when errors are likely to occur. It was assumed that reproductive memory is employed for remembering simple materials such as word lists, whereas more complex meaningful information (such as stories and real events) give rise to reconstructive memory (Roediger & McDermott, 1995). Upon re-examining list learning research conducted in the mid 20<sup>th</sup> century (such as that of Deese, 1959), Roediger and McDermott (1995) were able to argue this reproductive-reconstructive distinction may not be accurate.

Deese (1959) developed semantically related word lists (e.g., bed, rest, pillow...) with each list being associated with a particular un-presented word (e.g., sleep). Participants in Deese’s experiment were often found upon free recall to produce this crucial non-presented word (defined in this thesis as the ‘critical lure’; CL) as an intrusion. However, some lists

produced this intrusion effect while others did not; this led Deese to conclude that the lists in which the associations went in both backward and forward directions were more likely to elicit the intrusions. Backwards Associative Strength (BAS) refers to the probability that the CL will be produced when an associated word from the list is presented, for example the likelihood that the word 'bed' will produce the CL 'sleep' (see Knott, Dewhurst, & Howe, 2012, for a recent study on backward associative strength). Forwards Associative Strength (FAS) refers to the reverse: the probability that when the CL is presented the list word will be produced.

Roediger & McDermott (1995) then used the word lists that produced the strongest intrusions of the CL to investigate false memory phenomena. They developed what is now known as the Deese-Roediger-McDermott (DRM) paradigm to demonstrate that memory can be reconstructive even for stimuli as simplistic as a word list. The common DRM procedure involves either a free recall component or a recognition component, or both. Free recall involves participants writing/typing all the words they remember being presented in the list, usually directly after the list is presented. The recognition task usually occurs after a delay, where studied words are presented alongside the CLs and unstudied words, and participants rate whether each word is old or new.

Although the question does arise as to whether the CLs produced and recognised by participants are actually false memories (as opposed to say, a liberal response bias; Miller & Wolford, 1999), Roediger & McDermott (1995) included a remember-know procedure to investigate participants' phenomenological experience during the procedure. A 'remember' response was to be given when participants were able to mentally relive the experience of being presented with the word, whereas a 'know' judgment was to be based on a feeling of familiarity, without any re-experiencing. In their initial experiment, it was expected that

participants would respond to recognising CL words as old with a 'know' judgment. However, it was actually found that over 70% of those CLs falsely recognised were judged with 'remember' responses. This finding indicated that participants did experience false memories in this task, which led Roediger and McDermott (1995) to conclude that "any contrast between reproductive and reconstructive memory is ill-founded: indeed, all remembering is reconstructive in nature" (p.g. 812). Since then, this paradigm has been used numerous times and has been found to elicit robust effects, with participants often confidently recalling and recognising words never presented (see Gallo, 2010, for a review).

Critics of this method have questioned whether word lists studied in a laboratory setting have much relevance to real-life situations involving false memories (e.g., Freyd & Gleaves, 1996; Pezdek & Lam, 2007). In their original paper, Roediger and McDermott (1995) contended that as there was a focus on intentional remembering, with short retention intervals, using student populations - "professional memorizers", and that a dramatic effect was still found, this effect should be stronger outside the laboratory with less ideal situations. In response to Freyd & Gleaves (1996), it was acknowledged that there are several main ways in which the DRM procedure differs from recovered memories in a therapy context: retention intervals (stimuli in the DRM is retrieved usually within seconds/minutes, whereas memories retrieved in therapy usually involve events years prior); social context of recollection (private remembering versus therapist/others prompting recall); personal relevance of material being tested; and the complexity of the material (Roediger & McDermott, 1996). In a recent review of DRM research, it was stated that most DRM researchers do not address the issue of generalisability, but rather assume it is possible, or simply leave it for others to figure out (Gallo, 2010). This concern will be discussed further in a later section.

### *Misinformation Techniques*

Post-Event Information (PEI) refers to details about an event that a person receives following that event. This can be information the person can already recall themselves, or it may be additional to their recollection of that event. Based on findings that correct PEI can help participants report more accurate information compared to controls (Paterson & Kemp, 2006b), PEI can be considered helpful to eyewitness memory; however it is helpful only as long as this information is truthful. Unfortunately this is not always the case.

The general misinformation effect procedure involves participants witnessing an event (a series of pictures, a film, or in person) and then being misled afterwards about some details of the event (through false PEI). This information can be transmitted through a variety of methods, for example by having participants read a summary of the event, or through suggestive questioning. Another method of misleading participants involves co-witness information: information that one eyewitness of the event passes on to another (Luus & Wells, 1994). This co-witness information can be conveyed directly through conversation, or indirectly through a third party (such as a police officer mentioning what another witness said; Luus & Wells, 1994). These different methods will be discussed in more detail below. After being exposed to the misinformation, participants are then tested for their memory of the event in the hope that some of that false information is reported. It has consistently been found that a substantial proportion of participants in these experiments do in fact go on to report misinformation in their accounts of the witnessed event (Loftus, 2005).

#### *Narrative Methods of Introducing Misinformation*

This method involves having participants view an event, and afterwards they are presented with a narrative. The narrative may contain a number of misleading details alongside

accurate information. Participants are later asked to report their memory for the event, either through a free or cued recall task, a recognition task, or some combination of those. This narrative can be a fabricated newspaper article, an eyewitness statement seemingly from another participant, or simply a story about the event. In one early study of the misinformation effect using written narratives (Loftus, Miller, & Burns, 1978), participants viewed a series of slides, and then read a narrative with misleading information or a narrative without misleading information (control). On a forced-choice recognition test, correct choices were made 55% of the time when participants had received misleading information in the narrative, compared to 71% of the time for control participants. A similar effect can also be observed using an audio narrative instead of a written narrative (Chan, Thomas, & Bulevich, 2009).

#### *Co-Witness Discussion Methods of Introducing Misinformation*

Another way in which a witness might encounter PEI is through discussion with others. This has been studied in three main ways: the social contagion of memory paradigm, whereby misinformation is introduced via a group discussion with a confederate (Harris, Paterson, & Kemp, 2008); memory conformity effects, whereby a witness of an event unwittingly introduces false information that is picked up by a fellow witness (e.g., Memon & Wright, 1999), or experimentally participants discuss information that unbeknownst to them is slightly different (however this too could involve a confederate); or a collaborative recall paradigm, where a group collaborates to recall information and misinformation may be spontaneously introduced (Harris et al., 2008).

Co-witness discussion procedures typically demonstrate robust effects: for example, one study found that 71% of witnesses who had discussed an event went on to mistakenly recall items acquired during the discussion (Gabbert, Memon, & Allan, 2003). This type of research

is also forensically significant, as it has been found in a survey that the majority of people who witnessed a serious event discussed it with fellow witnesses (Paterson & Kemp, 2006a; see also Skagerberg & Wright, 2008b).

### *Research Combining the DRM and Misinformation Effect*

Currently it appears little research has been conducted to consider whether false memory findings for the abovementioned DRM word list task are equivalent to the false memories that arise from exposure to misinformation. One study involved participants viewing a film and then completing a questionnaire with misinformation items embedded in it, and compared this to their responses on the DRM task (Bock, 2009). It was found that false memories for misinformation were not significantly related to false memories on the DRM task, however ratings of source confusion between the film and the misinformation items (meaning participants were unsure whether the information they reported was from the film or the questionnaire) were related to DRM responses. As the DRM task has not been compared specifically with a post-event narrative (which is more complex than a questionnaire with misinformation embedded), this is worth considering further.

### *Rich False Memories*

As mentioned above, some early research focused on changing slight details of a witnessed event, such as the appearance of glass on the road following a traffic incident. Rich false memory experiments on the other hand involve planting an entire event in memory. This procedure is often also known as the ‘lost in the mall’ technique, based on an experiment finding that through repeated questioning and elaboration, participants were led to believe that



on one occasion they went missing while shopping with their family (Loftus & Pickrell, 1995). In this study, 25% of participants claimed they either fully or partially remembered being lost. Moreover, many of these participants went on to describe these memories in substantial detail, such as the physical characteristics of the person who found them.

In subsequent research it has also investigated whether it is possible to create false memories for more emotional events (e.g., Porter, Birt, Yuille, & Lehman, 2000), a theme that will be returned to in Chapter Three. However, as there are reportedly few studies that involve implanting entire events, apparently due to being “extremely time consuming and laborious compared to other false memory techniques” (Wade et al., 2007, pg. 19), this thesis will not be focusing on this method.

#### *Debate Over the Term ‘False Memory’*

Before moving on to discuss the theories of the mechanisms behind false memory development, it is first important to examine the meaning of the term ‘false memory’. It has been argued that it should be defined strictly as referring only to those situations (and experiments) where an entirely new event has been planted in memory (Pezdek & Lam, 2007). In contrast, situations where words are mistaken to have been presented in an earlier list (e.g., the DRM procedure) should be termed ‘intrusion errors’, and situations where only a detail of an event has been changed in memory (e.g., misinformation effect studies) should be referred to as ‘flawed memories’ (Pezdek & Lam, 2007). If the underlying mechanisms of these different experiments are not equivalent, then using different terminology to describe them is a logical suggestion.

Attempts to determine whether the DRM is relevant to false memory phenomena include studies that have compared the DRM illusion to autobiographic memories that may be false. It was found, for example, that participants who reported recovered memories of alien abduction (which most skeptics would consider a false memory) were significantly more likely to exhibit false recall and recognition on the DRM than people never claiming to have been abducted (Clancy, McNally, Schacter, Lenzenweger, & Pitman, 2002). Additionally, in research on brain-damaged patients it was found that damage to the medial temporal lobes appeared to cause autobiographical amnesia and also decreased the DRM illusion; however prefrontal cortex damage appeared to increase autobiographical confabulations and also elevate the DRM illusion (see Gallo, 2010, for a review). These findings led to the suggestion that the DRM can be related to autobiographical memories; however the study that did not find the DRM to be related to the misinformation effect (Bock, 2009) requires further examination. As such, the DRM may still be an important procedure to use, perhaps in conjunction with more ecologically valid methods.

Regarding misinformation research, Pezdek & Lam (2007) stated that only experiments where an entirely new event has been implanted in memory can be generalised to real-world situations, such as recovered memories of childhood abuse. However, this argument seems to ignore the fact that details of an event can be quite important for solving a crime: for example the driving speed estimates manipulated in Loftus & Palmer (1974) would be important in a negligent driving case. Further, a review was conducted where the method of altering some aspects of an event was compared to implanting an entire event, and found similar rates of acceptance by participants for both types of information (Wade et al., 2007). Wade et al. (2007) concluded the underlying memory changes must therefore be at least similar, and as many

cognitive psychology researchers do in fact use the term ‘false memory’ to refer to a range of procedures, it is reasonable to apply this term more broadly than Pezdek & Lam (2007) suggest.

Therefore, for the purpose of this thesis, ‘false memory’ experiments can refer to the three aforementioned methods of influencing memory. It is still of course prudent to be cautious when suggesting findings of experiments using word lists or only changing small details of an event relate to real cases of memories of traumatic events. However this thesis will operate under the assumption that the underlying mechanisms are similar enough to allow speculation of how the following laboratory simulations may have real-world applications.

### False Memory Theories

Several different explanations have been suggested to account for false memory findings. One simple rationale is the ‘vacant slot’ explanation: that witnesses fail to encode the original event, and therefore assume the misinformation is the same as what would have been witnessed and report it as such (e.g., Skagerberg & Wright, 2008a). It is likely this does occur for some people. However, in the situations where the original memory has been encoded and then subsequent misinformation is reported, three main categories of explanations of false memory findings have been identified (Ainsworth, 1998; Ayers & Reder, 1998):

- 1) Alteration hypotheses: those that implicate memory impairment by changing the original information.
- 2) Strategic effects and task demands: this involves the suggestion that it is not memory impairment that drives false memory results; rather, it is due to demand characteristics of the experiment leading the participant to respond in the desired way.

- 3) Co-existence hypotheses: it is argued that both the original memory and the new memory still exist, but due to competition and confusion among multiple memory traces the false memory is the one usually recovered.

Each will be discussed in turn, referring to the most prominent theories in each category, followed by an attempt to evaluate the most effective and relevant theory for the aims of this thesis.

### *Alteration Hypotheses*

#### *Overwriting Account*

Based on the early misinformation effect research of Loftus, it was proposed that exposure to new information would lead to an update in memory from the original representation (Loftus, 1979). If the new information was contradictory to the original memory, the conflict would be resolved with one version being rejected and a single representation remaining. A suggestion arising from this account was that the conflict created by the competing memories could be observed by increased reaction time at test in participants who received misinformation, relative to those who had not (Loftus, 1979). On the other hand, if the original memory had in fact been replaced by the misinformation there would not be a difference in response time. Research found that participants did not take longer at test when they had received misinformation compared to those who received no misinformation (Cole & Loftus, 1979), supporting the overwriting account.

#### *Blend Hypothesis*

The original misinformation experiments involved participants having to make a choice between whether they observed a 'stop' sign or a 'yield' sign. As there is not a continuum of

options between these two signs, it is not possible to have a compromise between the two – which forces participants to choose one even if their actual memory is some mixture of both. In another study, Loftus (1977) showed participants a scene which involved a green car, but gave misinformation suggesting the car was blue. Participants were given a colour wheel on test and instructed to pick the colour they thought most approximated the colour of the car they saw. Many misled participants chose a blueish-green colour, suggesting a blend had occurred between the two memories (see also Skagerberg & Wright, 2008a, for a recent study investigating this effect). A similar blend effect has also been observed with numbers (Loftus, 1975).

#### *Strategic Effects and Task Demands*

Challenging the assumption that the misinformation effect results were from memory alteration, McCloskey & Zaragoza (1985) argued that mistakes at test were due to the way the task had been designed. If participants did not recognise the original information but did remember the information presented in the narrative, they may simply have chosen the item from the narrative. Alternatively, participants may have remembered the original information, but assumed the experimenter wanted them to report the misinformation and so reported that instead.

Similar to Loftus et al., (1978), McCloskey & Zaragoza (1985) in their experiment had half the participants read a narrative with misleading information about the slides they had viewed, while the other half were control participants who read a narrative with no misleading information. The procedure was modified so that only the originally seen items and new items (and not the incorrect items in the narrative) were options in the recognition test. The

hypothesis was that if misleading information did impair participant's original memory, they would perform poorly at test in comparison to control participants. It was found that performance in the misled condition did not differ from performance in the control condition. The authors took this to mean that exposure to misinformation does not necessarily impair memory for the originally seen material.

### *Co-Existence Hypotheses*

#### *Fuzzy Trace Theory*

Fuzzy Trace Theory (FTT) originated as a model of cognitive reasoning, however was eventually extended to also account for false memory phenomena (Brainerd & Reyna, 2002; Reyna & Brainerd, 1995). FTT describes two ways in which the brain represents information: verbatim and gist traces. Verbatim traces involve the surface aspects of the information – these traces are quite specific and contain details of the actual experience of the rememberer (e.g., the font in which a word is displayed, and the fact that the word was displayed as text and not a picture; Brainerd & Reyna, 2004). Gist traces are more elaborate, involving semantic and relational information about the memory – they are thought to be less specific, but related to the understanding and interpretation the rememberer draws from the experience (e.g., the meaning of the word; Brainerd & Reyna, 2004). It is argued that these two traces are encoded at the same time, but stored in parallel (Brainerd & Reyna, 2002).

On retrieval of information, verbatim traces are supposed to induce a realistic reinstatement of the experience similar to that at encoding, whereas gist traces are episodic interpretations of concepts (meanings, relations, and patterns) that subjects access in memory (Brainerd & Reyna, 2002, 2004). Which trace is retrieved on a memory test depends on the cue

used: for example, non-experienced stimuli with similar meaning to what was experienced are more likely to retrieve the gist trace from memory. Relating this to false memory research, in cases where the verbatim trace of an event is not retrieved, but the less exact gist trace is, the overall meaning of the event will still come across, but some specific details may be lost (Reyna & Brainerd, 1995). Verbatim traces are also not thought to be preserved in memory as well as gist traces, and may be much more susceptible to interference (Brainerd & Reyna, 2004). False information may generate a feeling of familiarity if the overall meaning is similar enough to activate the gist trace (as opposed to the verbatim trace). This leads to the acceptance of the false information as true.

A number of predictions have been made based on FTT with regard to false memory experiments. Firstly, as younger children are thought to have less ability to extract meaning (gist) from events due to having less developed links between concepts, this means younger children should be *less* susceptible to false memories than older children and adults (Brainerd, Forrest, Karibian, & Reyna, 2006; Brainerd & Reyna, 2002, 2004). For example a DRM list that contains the semantic associates of the word ‘doctor’ (nurse, sick, etc.) will easily lead to the extraction of the overall theme in older people. Younger children however are thought to be less likely to spontaneously extract this meaning, and therefore be less likely to produce the CL ‘doctor’ at free recall test, or falsely recognise it as having been previously seen. In research by FTT advocates it was found that both false recall and recognition rates in the DRM increase with age (see Brainerd & Reyna, 2004, which pools data from several experiments to observe overall trends).

Another prediction based on FTT is that false reports may be more stable in memory than true reports, and these get stronger while the true memory decays (Brainerd & Reyna,

2004). This is due to false memories relying on gist traces which are argued to be more stable over time, whereas true memories rely on verbatim traces which decay more rapidly. This too appears to have received empirical support: for example adults were found to have made 50% more false alarms after a week delay compared to an immediate test (Forrest, 2002, cited in Brainerd & Reyna, 2004).

#### *Activation-Monitoring Theory*

Another prominent theory invoked to explain the processes involved in developing false memories involves the Source Monitoring Framework (Johnson, Hashtroudi, & Lindsay, 1993). Thoughts, images and feelings that are experienced as memories are attributed to particular sources by the rememberer (Lindsay & Johnson, 2000). There are three types of source monitoring judgements: reality monitoring, involving the discrimination of memories of internally versus externally generated information; external source monitoring, involving discrimination of two external memory sources such as two different people; and internal source monitoring, involving the discrimination of two internal memory sources. Information from different sources may overlap for some features, leading to source confusions (Johnson et al., 1993). Most source attributions are thought to be made very quickly and without much reflection, making it easy for false memories to arise when thoughts, images and feelings from one source are attributed to another (Lindsay & Johnson, 2000). As recollected features can differ regarding quality and vividness, these perceptual differences may be used to determine whether to accept or reject a memory as true (Johnson et al., 1993). In support of the source-monitoring framework, research has found that the misinformation effect is decreased if participants are asked to monitor the source of their recollections: for example being asked to



state whether information was from the original witnessed event or whether it was first seen in a narrative presented (Johnson et al., 1993).

The source monitoring framework was eventually combined with a spreading-activation approach to create the Activation-Monitoring Theory (AMT). The two processes of activation and monitoring are thought to influence the probability that false memories will be induced (McDermott & Watson, 2001). Accessing one concept in memory spreads activation through linked pathways to prime related concepts, making them more easily accessible (McDermott & Watson, 2001). Using the DRM task as an example, word lists that have strong associations with the CL are therefore likely to prime the lure for recall. The finding by Deese (1959; see also Roediger, Watson, McDermott, & Gallo, 2001) that associative strength is a strong predictor of false memory in DRM lists has been taken as evidence in favour of the involvement of associative processes (Gallo, 2010).

It is thought that after a concept has been activated, source monitoring is needed to be able to determine whether that concept was presented, or simply primed (McDermott & Watson, 2001). As source-monitoring accounts suggest the main way false memories occur is due to similarity in information (although it is acknowledged that it can occur in other ways; Lindsay & Johnson, 2000), the main advantage of this combined theory is the explanation of how incorrect concepts that may not be overly similar to the original information may lead to false memories (due to strong associative links).

A related theory is that of Associative-Activation Theory (AAT; e.g., Howe, Wimmer, Gagnon, & Plumpton, 2009). This theory suggests that one concept (e.g., a word on the DRM) activates another (the CL) in our knowledge base, and although activated concepts were not originally presented they are incorrectly activated due to their connection with other items. The

likelihood of falsely remembering activated items is related to how closely they are associated in that knowledge base (Howe et al., 2009). This theory is mostly applied in relation to DRM findings, and does not appear to offer a particular explanation as to how this activation actually leads to false remembering. This is where AMT has an advantage, as it explains not only how this occurs (the activation is then attributed to an incorrect source), but also explains a broader range of findings including the misinformation effect and social contagion of memory (e.g., Meade & Roediger, 2002).

### *An Evaluation of the Theories*

#### *Concerns with Alteration Accounts of False Memories*

Both the overwriting account and blend explanation make the suggestion that once someone is exposed to false information their memory is permanently changed. However, it is argued that an overwriting hypothesis cannot account for findings from a reversed-design misinformation procedure (Ayers & Reder, 1998). In this design, participants are given misinformation first, are then exposed to the event, and finally are given a memory test on the event. An overwriting account would suggest the misinformation effect would be eliminated due to the correct information being presented second (Ayers & Reder, 1998), however participants are still found to be misled by the misinformation (Lindsay & Johnson, 1989). While the blend explanation may still account for this finding to some extent, it cannot explain the research suggesting original memories can be recovered if the source of the information is correctly monitored (Johnson et al., 1993). Another issue with the blend hypothesis is that it is only able to explain results for details that exist along a continuum. For example, it is unlikely a

blend will occur for an item in a scene such as a building that was either present or not present: it cannot be half present.

#### *Concerns with the Strategic Effects Account*

Although the structure of the task may in some cases bias participants towards responding a certain way, in other situations memory distortion does appear to occur. For example, in one experiment using the misinformation procedure it was found that those participants who did not receive misinformation responded faster on a forced choice recognition test when they were correct than incorrect; interestingly however, misled participants responded faster when picking the misinformation item than the original correct item (Loftus, Donders, Hoffman, & Schooler, 1989). Loftus et al. (1989) used these results to argue that the strategic effects account cannot adequately explain this finding: if participants still held both memories it should take longer to deliberate when choosing their response. As this did not occur, it implies misled participants only had access to one memory. In another example of a study where false memories were argued not to be due to demand characteristics alone (Lindsay, 1990), participants were told that the narrative they had read contained incorrect information, and therefore to only report what they originally saw. As participants still reported the misinformation, this prompts the suggestion that some memory distortion had occurred.

#### *Comparison and Evaluation of the FTT and AMT*

Based on the concerns raised for both alteration hypotheses and the strategic effects account, it appears that a co-existence account of false memories is the most appropriate. While it may be possible to retrieve the original memory in some circumstances, in other cases it appears to be extremely difficult, and therefore only the false information will be activated.

This could explain the results of Loftus et al., (1989) where participants were faster to choose misinformation compared to the original item: if only the false information was activated the same effect could be observed. As such, it is important to evaluate which of the two prominent co-existence theories is most suitable for explaining the majority of research findings.

There are some similarities between FTT and AMT. Firstly, the original source-monitoring theory was based on Johnson's (1983) multiple-entry modular (MEM) model of memory which classifies two processing subsystems: perceptual processes and reflective processes (Lindsay & Johnson, 2000). Which particular cues are presented at test can determine which subsystem is activated. Further, these subsystems are thought to operate in parallel. This perceptual-reflective distinction is quite similar to the verbatim-trace distinction of FTT (although it has been argued that MEM was conceptualised first; Lindsay & Johnson, 2000). Both theories suggest that reflective/gist processes can contribute to false memory development due to a failure to correctly identify the familiarity-invoking information (due to similarities in meaning) as false. However in FTT, verbatim traces, if activated, can be used to reject false memories (called recollection rejection, which appears to be a monitoring process). In comparison, in AMT the surface/perceptual features can be used along with reflective processes to decide the source of the information and this can lead to either a rejection of false information, or a misattribution that can lead to false remembering.

Lindsay & Johnson (2000) argue that FTT does not adequately explain false memory phenomena: "the challenge for any theoretical approach to false-memory phenomena is to explain why thoughts, images, and feelings are sometimes erroneously experienced as evidence of past episodes that never really occurred" (p.g. 157). In particular it is argued that FTT fails to account for those circumstances where surface information is not used to reject false

information, but actually contributes to its acceptance. Further, a finding in favour of AMT is that DRM lists elicit higher levels of false memories when associative strength is manipulated relative to gist structure (e.g., Howe et al., 2009; Pierce, Gallo, Weiss, & Schacter, 2005).

It is predicted using FTT that young children, being limited in their gist-processing abilities, will be less susceptible to false memories compared to older children and adults. However, it has been suggested that children can extract gist, but less automatically and at a slower pace than adults (Howe, 2005). Due to this process being more effortful in children, it is predicted instead that while children do produce false memories, they may be better able to inhibit their responses due to the false items being more conscious. This hypothesis was tested by adding a directed-forgetting procedure (where certain items carry the instruction to purposefully not remember them) to the DRM paradigm. In this study younger and older children were found to produce fewer false memories when instructed to forget the false items (Howe, 2005). This then suggests that it is the automatic processing in older children and adults that prevents inhibition of the false items, and not that younger children fail to produce false memories due to limited gist-extraction; a finding attributed to associative-activation processes (Howe et al., 2009).

Regarding the FTT prediction that as gist traces are more stable over time false memories may outlast true memories, it has been argued this effect can also be accounted for using source-monitoring. Shortly after experiencing an event, perceptual details can be used to distinguish sources of information. However as the perceptual details fade over time, the false information presented becomes more similar in memory to the original event based on the quantity of details associated with it, which could contribute to greater source confusions (Frost, Ingraham, & Wilson, 2002). This was found in a misinformation effect experiment by

Frost et al., (2002) whereby a higher number of source monitoring errors occurred alongside a higher acceptance of false information after one week, compared to immediate test.

To summarise, AMT and FTT have some overlapping features and are both able to explain a variety of false memory findings. However, AMT appears to have additional explanatory power regarding how surface/verbatim features of memory may still be used to create a false recollection of events. Moreover, there appear to be some findings that are not as easily accounted for by FTT as by AMT, for example that a greater number of false memories occur when associative strength is manipulated as opposed to gist strength. Therefore, further discussions of false memory theory in this thesis will focus particularly on AMT.

## CHAPTER TWO

### Review of the Distress Literature

Many situations in which eyewitnesses are called upon to report their memories involve distressing events. Chapter Three will detail the research involving false memories for emotional events, as well as specific aspects which may make certain people particularly vulnerable to such false memories. First however, it is important to examine the research on psychological and biological responses that people may experience following a trauma.

### Psychological Responses to Distressing Events

#### *Post Traumatic Stress Disorder*

The way in which memories for stressful events are processed may not only influence eyewitness testimony, but also potential recovery from that event. Individuals can differ with regard to how severely they are affected by a trauma (Foa & Riggs, 1995). While initial extreme reactions to a distressing event are somewhat expected, this distress tends to fade with time in most people (Foa & Riggs, 1995). It has been suggested, however, that those who fail to properly process the trauma are more likely to develop psychological symptoms (Ehlers & Clark, 2000); with Acute Stress Disorder (ASD) and Post Traumatic Stress Disorder (PTSD) being two possible outcomes to experiencing a trauma.

According to the most recent Australian National Survey of Mental Health and Wellbeing, PTSD was the most common anxiety-related disorder in the population (6.4%) based on 12-month prevalence rates in 2007 (Australian Bureau of Statistics, 2007). PTSD is a diagnosis given to an individual who, following an extreme (i.e., life threatening) traumatic stressor, develops a severe and intense response involving fear, helplessness and horror. These

responses are manifested in symptoms such as: persistent re-experiencing of the event (intrusive memories, recurrent dreams, flashbacks); persistent avoidance of stimuli related to the event and numbing of general responsiveness (also includes amnesia and detachment); and increased arousal (exaggerated startle, increased hypervigilance to danger). All symptoms need to be present for more than a month to receive a PTSD diagnosis (American Psychiatric Association; APA, 2000). A diagnosis of ASD may be given if the symptoms have been present for less than a month, and then may be upgraded to PTSD if the symptoms continue for a month.

On the surface, PTSD appears to involve seemingly contradictory symptoms: being unable to recall certain aspects of a traumatic event, while at other times memories of the event intrude into consciousness without intentionally retrieving that memory. The Dual-Representation Theory of PTSD (DRT; Brewin, Dalgleish, & Joseph, 1996) details two types of encoding that can occur during a trauma leading to two separate representations in memory: information receiving a high level of conscious processing leads to a memory trace that can be retrieved deliberately (considered the verbally accessible memory system; VAM); the other system stores sensory information (producing the situationally accessible memory system; SAM) which may be accessed later from triggers in the environment (Holmes, Brewin, & Hennessy, 2004). This automatic triggering may produce intrusive images and flashbacks due to a failure to distinguish retrieval cues in the environment from related stimuli experienced during the trauma (Holmes et al., 2004).

Support for the DRT comes from research where participants watched a trauma film and simultaneously completed a visuospatial distracter task (typing letters in a sequence throughout the film). As the SAM is thought to primarily store sensory information, especially



in the form of images, it was hypothesised that the distracter would compete for resources involved in sensory encoding in the SAM and therefore decrease the likelihood of intrusions. This was found to be the case, with fewer intrusions in the distracter group compared to a group watching the film without the task (Holmes et al., 2004). Likewise, a subsequent experiment included a verbal distracter task which increased intrusions (in comparison to a non-distracter group) through disruption of the conceptual encoding supposed to occur in the VAM (Holmes et al., 2004). It was argued that the mode of encoding disrupted (sensory or verbal) specifically enhanced the other type of processing, thereby decreasing or increasing intrusions respectively. More recent research has also supported this assertion, with the visuospatial computer game “Tetris” being used to interfere with intrusive memory development following trauma film viewing (Deepröse, Zhang, DeJong, Dalgleish, & Holmes, 2012).

A related theory is the cognitive model of PTSD put forward by Ehlers & Clark (2000). The authors of this model explain that there are two routes of retrieving autobiographical information: the first involves higher-order meaning-based retrieval, whereas the second is through direct triggering by stimuli associated with the event. Which type of information is accessed may depend on the type of processing that occurred during the event, for example more data-driven processing (focusing on sights, smells, sounds etc.) may prevent conceptual meaning-based encoding. According to this model, in PTSD the trauma memory is poorly elaborated and inadequately integrated – as such, intentional, meaning based memories are hard to access, whilst easily triggered surface aspects intrude (sights, smells etc.) unintentionally (Ehlers & Clark, 2000). Avoidance strategies and thought suppression may be attempted by the sufferer in order to reduce these intrusive memories; however these behaviours are considered maladaptive, and may actually increase the likelihood of intrusive memories (Ehlers & Clark,

2000). These processes, along with problematic appraisals of the event contribute to a perception of continuing, current threat in people with PTSD (Ehlers & Clark, 2000; Ehling, Ehlers, & Glucksman, 2008).

Support for Ehlers & Clark's theory come from prospective and longitudinal studies where theory-derived cognitive variables (such as data-driven processing, memory disorganisation, negative appraisals, etc.) were related to PTSD symptoms up to six months after motor vehicle accidents (e.g., Ehling, Ehlers, & Glucksman, 2008; Murray, Ehlers, & Mayou, 2002). The DRT of PTSD is consistent with the data-driven processing aspect of Ehlers & Clark (2000), as both suggest less conceptual processing during the event may increase the likelihood of intrusions later. In sum, both of these theories contribute to greater understanding of the mechanisms behind PTSD development and point to clinical implications regarding prediction of those most at risk following a traumatic event, alongside symptom prevention.

### *Dissociation and Trauma*

Dissociation is also recognised as a common response to trauma (Breh & Seidler, 2007). It is described by the DSM-IV as a disruption in integrating functions of consciousness, memory, identity, or perception (American Psychiatric Association, 2000). This disturbance can be sudden and transient (referred to as state, or peri-traumatic dissociation), or can be gradual and chronic (trait dissociation; APA, 2000). Dissociation can involve depersonalisation and derealisation (a separation from the self or reality), amnesia, and absorption (total immersion in an event to the exclusion of other stimuli). Experiencing at least three dissociative symptoms is a key criteria for a diagnosis of Acute Stress Disorder (ASD) and is also frequently present in the context of PTSD (American Psychiatric Association, 2000). For

example, in one study road traffic accident survivors were tested for state and trait dissociation, and it was found that both were significant predictors of PTSD symptom severity (Murray et al., 2002). This finding has been replicated across numerous studies (e.g., Koopman, Classen, & Spiegel, 1994; Ozer, Best, Lipsey, & Weiss, 2008), however other studies have not found this to be the case (e.g., van der Velden et al., 2006).

A potential limitation with the abovementioned studies is that there may be demand characteristics and reporting biases in assessing dissociation levels after a traumatic incident (Candel & Merckelbach, 2004). Specifically, people who did not develop PTSD may underestimate their dissociation levels during the trauma, whereas people who did develop PTSD or have recently experienced dissociation may overestimate their levels of past dissociation (Candel & Merckelbach, 2004). As such, prospective studies are also needed to investigate this relationship. One prospective study assessed police officers in training and found that past trauma and trait dissociation were significant predictors of peri-traumatic dissociation and PTSD symptoms for critical incidents experienced in the subsequent year (McCaslin et al., 2008).

Debate in the literature exists surrounding how dissociation relates to PTSD. Some suggest dissociation is central to posttraumatic psychopathology (Dalenberg et al., 2012), and as such PTSD should in fact be classed as a dissociative disorder. Ehlers & Clark (2000) suggest that derealisation, depersonalisation and emotional numbing experienced during dissociation may impede recovery from PTSD by preventing the elaboration and integration of the trauma memory into the autobiographical memory knowledge base. Similarly, the DRT of PTSD suggests that dissociation during a trauma may disrupt VAM encoding which would consequently increase unwanted intrusions due to SAM encoding (Holmes et al., 2004).

However, not all cases of PTSD involve dissociation. It has been argued that only people with pre-existing dissociative tendencies respond to trauma with dissociation, suggesting dissociation may not be a significant factor in PTSD development or maintenance (Kihlstrom, Glisky, & Angiulo, 1994). Another argument uses the same information to form a different conclusion: since many people develop PTSD without dissociative symptoms, the diagnosis of PTSD should include a subtype with clinically significant dissociation (Steuwe, Lanius, & Frewen, 2012; Waelde, Silvern, Carlson, Fairbank, & Kletter, 2009). Although the DSM-IV identifies the avoidance and numbing symptoms in ASD as dissociative, interestingly for PTSD it does not; an inconsistency which adds to the confusion of how dissociation and PTSD relate (van der Hart, Nijenhuis, & Steele, 2005).

Dissociation is argued to occur in non-clinical populations as well, although what is experienced is mild and unlikely to cause concern to the person experiencing it (Bernstein & Putnam, 1986). However, higher levels of dissociation in healthy populations may still affect responses to an event (Soraci et al., 2007). The findings of one study where psychologically healthy soldiers were exposed to a stressful survival training task suggested that dissociative responses occurred in the majority of participants (Morgan et al., 2001). Additionally, those participants who had reported previous life-threatening experiences were found to report more symptoms of dissociation (Morgan et al., 2001). This finding supports the assertion that healthy people can also dissociate in response to a threatening event. However, it could also be the case that dissociation becomes a learned strategy for dealing with threat, and may be especially pronounced in clinical dissociators (Dorahy, 2006).

In several laboratory studies researchers have attempted to elicit state dissociation, using such procedures as dot-staring, mirror staring, pulsed light and audio stimulation, and also

pharmacological methods (Zoellner, Sacks, & Foa, 2007). For example, in the intrusions study by Holmes et al., (2004) mentioned above, non-clinical participants were shown a traumatic film, and during the film state dissociation was induced through dot staring. Although participants in the dissociation condition did report significantly more state dissociation compared to the control condition, participants who spontaneously dissociated (regardless of which experimental condition they were in) reported a subsequent increase in intrusive memories about the film. This suggests a potential mechanism by which dissociative responses to distress prompt intrusive phenomena, a key symptom for ASD and PTSD diagnosis (Holmes et al., 2004).

### *Theories and Explanations of Dissociation*

Additional to the debate on the relationship between dissociation and PTSD is disagreement on what the concept of dissociation actually entails, alongside debate about the underlying mechanisms of dissociation. Originally dissociation referred to divisions in personality and was used by 19<sup>th</sup> century clinicians to explain concepts such as conversion disorders from hysteria (e.g., paralysis due to a psychological trauma). When the DSM-III came out in 1980 the dissociative type of hysterical neurosis was reconceptualised as a somatoform disorder (see van der Hart & Dorahy, 2009, for a review).

### *Continuum Model of Dissociation*

By the mid-20<sup>th</sup> century dissociation had taken on a different meaning: dissociative experiences began to be explained as alterations in consciousness such as depersonalisation and derealisation. This account had less focus on divisions of personality, and more focus on a breakdown in integrated functioning (as in the DSM-IV definition). Instead of being only

related to clinical disorders, dissociation was considered to exist on a continuum with relatively mild and non-pathological phenomena such as daydreaming on one end, and extreme disturbances in mental processes like those experienced in Dissociative Identity Disorder (DID) on the other end (Bernstein & Putnam, 1986). This view suggests all dissociative phenomena are qualitatively similar and differ only by degree (Holmes et al., 2005).

Support for the continuum view comes from studies employing a factor analysis on the most commonly used instrument assessing dissociation: the Dissociative Experiences Scale (DES; Bernstein & Putnam, 1986). The DES asks people to rate the number of times they experience certain dissociative phenomena, such as realising in the middle of travelling that they do not remember the earlier parts of the journey, or looking in the mirror and not recognising their own face. Research using non-clinical populations has found only one factor to emerge, suggesting a unidimensional construct (e.g., Wright & Loftus, 1999).

#### *Detachment/Compartmentalisation*

Another conceptualisation suggests that dissociation actually refers to two distinct phenomena: detachment and compartmentalisation (Holmes et al., 2005). Detachment is used to describe an altered state of consciousness involving a separation from the self (depersonalisation) or the world (derealisation). “Subjects experiencing detachment often report feeling ‘spaced out’, ‘unreal’ or that they are ‘in a dream’” (Holmes et al., 2005, p.g. 6). Compartmentalisation on the other hand involves a failure to control mental processes that are usually amenable to such control; this refers to dissociative amnesia (failure to retrieve usually accessible memories), fugue states, DID, and conversion disorders (such as paralysis with no medical cause). This preservation of disrupted functions in compartmentalisation comprises the key difference between it and detachment phenomena (Holmes et al., 2005). Like the

unidimensional conceptualisation of dissociation above, this explanation invokes alterations of consciousness as a key aspect of dissociation. However as two distinct phenomena are described, dissociation is not considered here to exist on a continuum.

Support for this distinction is based on research finding compartmentalisation phenomena in absence of detachment phenomena and vice versa (see Holmes et al., 2005, for a review); as well as factor analytical studies suggesting three factors emerging from the DES measure instead of one (Ross, Ellason, & Anderson, 1995; Ross, Joshi, & Currie, 1991; Stockdale, Gridley, Balogh, & Holtgraves, 2002). The factors are: depersonalisation/derealisation (detachment), absorption, and amnesia (or activities of dissociated states, as specified by Ross et al., 1991). Absorption is considered as a tendency to become overly immersed in experiences such as movies, nature, daydreaming and past events (Tellegen & Atkinson, 1974). While absorption is assessed in many dissociation scales, many consider absorption non-pathological and therefore less related to dissociative aspects of disorders such as PTSD (Bremner, 2009; Holmes et al., 2005). Thus absorption would not fit into the detachment/compartmentalisation distinction. One potential implication of this distinction is that using the DES measure as a whole may miss particular aspects of dissociation, compared to investigating subtypes that may be more relevant for particular populations (Brown, 2006).

A related conceptualisation involves the suggestion that features of PTSD/trauma response involving hyperarousal symptoms (including intrusions) are actually a form of 'primary dissociation', whereas the avoidance/numbing symptoms are more indicative of 'secondary dissociation' (Pain, Bluhm, & Lanius, 2009). Primary dissociation is due to an under-modulation of affect, whereby a failure to inhibit brain areas involved in controlling

arousal occurs, which therefore increases hyperarousal and intrusion symptoms (Lanius et al., 2010). Secondary dissociation on the other hand involves an over-modulation of affect, to disengage from the emotional content of the trauma (Lanius et al., 2010). It is thought that people with chronic PTSD may exhibit both subtypes of dissociation simultaneously or separately (Lanius et al., 2010).

Support for this primary/secondary distinction comes primarily from neuroimaging studies involving participants with PTSD reliving their traumatic event through experiencing stimuli related to their event (e.g., combat scenes and noises in combat-related PTSD) or script-driven imagery (hearing the details of their trauma being read out to them). It has been found that hyperarousal and hypoarousal responses show opposite patterns of brain activation in regions implicated in emotion regulation and affect modulation (specifically, the medial prefrontal cortex, the anterior cingulate cortex and the limbic system; Lanius et al., 2010; Pain et al., 2009). As Pain et al., (2009) refer specifically to dissociation in relation to PTSD, an explanation involving phenomena such as DID is not included.

This distinction of primary and secondary dissociation may therefore fit to some extent with the more general detachment/compartmentalisation distinction, in that the detachment phenomena could be further distinguished into primary and secondary subtypes (Pain et al., 2009). For example, another avoidance symptom – the inability to recall important aspects of the trauma – is argued to occur due to detachment at the time of the trauma leading to inadequate encoding and fragmented recall (although it could occur due to compartmentalisation preventing retrieval of the event; Holmes et al., 2005). Phenomena such as flashbacks and other re-experiencing symptoms in PTSD have been suggested by Holmes et al., (2005) to be dissociative since they involve features of detachment (such as being separated



from reality during the reliving of the event) consistent with the primary dissociation aspect (see also the DSM-IV which considers flashbacks to be dissociative, American Psychiatric Association, 2000; and Ehlers, Hackmann, & Michael, 2004).

#### *Dissociation as an Avoidance Method*

The function of pronounced dissociation is considered by some to be an avoidance method for disengaging from threatening information (DePrince & Freyd, 2004). This dissociation may have positive effects at first, by allowing the person to ward off physical or mental pain until the individual feels it is safe to resolve the situation, but persistent dissociation can then place the individual at risk of disorder (Dalenberg & Paulson, 2009). To successfully avoid the threat, the person with a dissociative processing style may first direct awareness towards the threat, so as to then successfully direct attention towards non-emotional stimuli (Dorahy, 2006). This could be during the traumatic event to prevent encoding, or afterwards as a method to avoid retrieving the particularly distressing aspects (Dorahy, 2006).

Support for this view comes from directed-forgetting research that found high scorers on the DES were significantly better at forgetting trauma-related words (when instructed to forget them) compared to neutral words, in comparison to low dissociators (DePrince & Freyd, 2004). Superior forgetting of trauma related words in dissociators was thought to reflect increased suppression and avoidance of the threatening information so as to prevent distress (DePrince & Freyd, 2004). Similarly, research comparing directed forgetting in people with ASD and traumatised controls found that the people with ASD exhibited superior forgetting of trauma-related words (Moulds & Bryant, 2002). As dissociation is considered a key component of the ASD diagnosis, it is possible these results were at least partially due to dissociative processes in the ASD population (Moulds & Bryant, 2002).

This method of suppression in dissociators has been theorised to stem from an abusive childhood, whereby dissociation becomes a learned response to avoid memories of the abuse (DePrince & Freyd, 2004). Importantly however, an attempt to replicate the directed forgetting findings of DePrince & Freyd (2004) was unsuccessful (Deville, Ciorciari, et al., 2007). Using the exact same materials and method, high dissociators in this sample were not significantly more likely to forget trauma words in comparison to low dissociators. This unsuccessful replication casts this theory into doubt. Further, the finding of increased forgetting in the ASD group of the Moulds & Bryant (2002) study does not appear to be related to child abuse history, as participants were recently traumatised, and the distressing events involved either nonsexual assault or a motor vehicle accident.

It has been argued that this paradigm is unlikely to be able to adequately assess the type of memory processes involved in dissociators with an abuse history, as forgetting may occur over a long period of time, not immediately following a word presentation (Bremner, 2010). However, as mentioned above, the DSM-IV identifies the avoidance and numbing symptoms in ASD as dissociative (which also fits with the hypoarousal aspect of dissociation put forward by Pain et al., 2009), and some research has found peri-traumatic dissociation to be related to avoidance symptoms (e.g., Zoellner, Alvarez-Conrad, & Foa, 2002). Therefore while the directed-forgetting evidence regarding dissociation and avoidance is mixed, it does appear that the two concepts are strongly related to each other.

#### *Dissociative Parts of the Personality*

Another account of dissociation following a trauma involves a lack of structural integration of the personality, which manifests as two or more personalities with each subsystem having its own first person perspective (Nijenhuis & den Boer, 2009; Nijenhuis &

van der Hart, 2011; Steele, van der Hart, & Nijenhuis, 2009). This conceptualisation is based on the argument that alterations in consciousness are not considered aspects of dissociation, and that the definition of dissociation should revert to the original understanding involving a division of personality (Nijenhuis & van der Hart, 2011; Steele et al., 2009; van der Hart & Dorahy, 2009). While alterations in consciousness may occur during a dissociative episode, it is thought they are still distinct phenomena (van der Hart & Dorahy, 2009). This version of dissociation does not consider the symptoms usually ascribed to ‘peri-traumatic dissociation’ (e.g., alterations in perception such as size and time distortion) as dissociative, as the personality is argued to divide after a traumatic event (van der Hart & Dorahy, 2009).

According to this theory of dissociation there are two major types of dissociative parts of the personality that emerge following a trauma: the Apparently Normal Personality (ANP) and the Emotional Personality (EP). The ANP is focused on functioning in daily life, and may strive to avoid reminders of trauma, whereas the EP is thought to be stuck focusing on the trauma (e.g., in the form of intrusions; Steele et al., 2009). These parts can have overlapping abilities and traits, and can operate in sequence or parallel. The creators of this theory further suggest that in PTSD there is one ANP and one EP; however in cases involving DID there may be multiple EPs. If these divisions in personality are able to be overcome, then this will resolve the person’s traumatisation (Nijenhuis & van der Hart, 2011).

The advocates of this theory mostly accept the compartmentalisation aspect of dissociation put forward by Holmes et al. (2005) and Brown (2006), but argue that it is overly general (Nijenhuis & van der Hart, 2011). However, the authors do not consider detachment to be relevant to their theory due to the inclusion of alterations of consciousness and a lack of division of personality (see also Dorahy, 2006). They also reject the continuum model for a

similar reason (van der Hart & Dorahy, 2009). As the majority of current research includes alterations of consciousness as being (at least part of) dissociation and involves instruments that assess them as such, it is difficult to see how this redefinition would work from an empirical standpoint.

Further, it is unclear what the utility of this distinction of separate personalities is, when this can also be explained as different symptoms that occur at different times. For example, it may be the case that a person is successfully able to avoid reminders of their traumatic event, but other times they are unable to prevent intrusions, and prompt detachment. It also seems difficult to determine whether or not this switching from hypoarousal to hyperarousal symptoms is due to different parts of the personality. As it has been suggested that incorporating this theory may not influence treatment practices considerably, it is still unclear whether this additional conceptualisation is necessary (Brown, 2011).

#### *Fantasy Model of Dissociation*

In a recent review, Dalenberg et al., (2012) contrasted the Trauma Model (TM) of dissociation (that dissociation is inherently related to trauma, as characterised by most of the explanations above) with what they termed the Fantasy Model (FM). The FM is based on the rejection of the view that dissociation is related to trauma, but instead that highly dissociative people may be more likely to fabricate trauma reports (see Dalenberg et al., 2012, for a review). It is also suggested in the FM that dissociation is part of a more general deficit in information processing, due to heightened distractibility (Giesbrecht, Lynn, Lilienfeld, & Merckelbach, 2008), cognitive failures, suggestibility and fantasy proneness (Merckelbach, Muris, Rassin, & Horselenberg, 2000).

Cognitive failures can be described as a cognitive propensity towards making everyday mistakes, and can be measured via the self-report Cognitive Failures Questionnaire (CFQ; Broadbent, Cooper, FitzGerald, & Parkes, 1982). Studies investigating the relationship between dissociation and the CFQ have found significant correlations of .42 (Merckelbach et al., 2000) and .61 (Wright & Osborne, 2005), adding some support to this definition of dissociation. However, some items on both the CFQ and DES are considered similar (Bremner, 2010), and research testing cognitive failures on a number of constructs still found significant associations once the shared variance with dissociation was removed (Wright & Osborne, 2005). This suggests that while these constructs may be overlapping to some extent, cognitive failures as a concept is not able to completely explain or subsume dissociation (Bremner, 2010; however see Giesbrecht, Lynn, Lilienfeld, & Merckelbach, 2010, for a response to this argument).

The primary measure of suggestibility is the Gudjonsson Suggestibility Scale (GSS; Gudjonsson, 1984) which tests the likelihood of participants yielding to leading questioning and shifting answers following bogus feedback that their response was incorrect. Research testing the relationship between suggestibility and dissociation however, has not found a significant relationship (Polczyk, 2005). A measure assessing fantasy proneness (the propensity to engage regularly in intensively vivid fantasising), the Creative Experiences Questionnaire (CEQ; Merckelbach, Horselenberg, & Muris, 2001) has also demonstrated high correlations with dissociation (ranging from .47 – .63; Merckelbach et al., 2001); though it has also been argued this association is due to significant overlap between some items of the CEQ with the DES (Bremner, 2010).

### *Analysis of the Explanations of Dissociation*

Overall, many accounts of dissociation suggest that for a subset of people during a distressing event, an alteration in mental processes occurs that prevents proper encoding of the event. This may be due to extreme arousal, detachment in the form of depersonalisation and derealisation (Brown, 2006; Holmes et al., 2005), and/or a reduction in the awareness of one's surroundings (as in ASD; American Psychiatric Association, 2000). After the event this dissociation may continue in the form of intrusions and flashbacks (as primary dissociation; Pain et al., 2009), detachment symptoms, and also numbing and inability to recall some important aspects of the event (American Psychiatric Association, 2000). Further, although some information from the event may have been encoded, compartmentalisation processes may prevent deliberate access to certain memories (Holmes et al., 2005; see also Dorahy, 2006, for a similar depiction of dissociation as a failure to integrate encoded information), or this failure to access memories may be due to the ANP purposefully avoiding reminders of the event (Steele et al., 2009).

All dissociative symptoms have been argued to lie on a continuum, based on studies that found the primary measure of trait dissociation (the DES) to only produce one factor (Bernstein & Putnam, 1986; Wright & Loftus, 1999). Other studies however have found several factors to emerge (Holmes et al., 2005), highlighting three key categories: depersonalisation and derealisation, amnesia, and absorption. Based on arguments that absorption phenomena are primarily non-pathological it is often not included in explanations of dissociation relating to clinical disorders such as PTSD (Holmes et al., 2005). For the purposes of this thesis, while perhaps the overarching term of 'dissociation' may be useful in some circumstances, in others it may be more pragmatic to refer specifically to the type of

dissociative symptom or phenomena relevant to the results observed (e.g., depersonalisation) as opposed to identifying some aspects as dissociative and others not (see Brown, 2011, for a similar suggestion).

One exception may be ‘primary dissociation’ (hyperarousal and intrusions in PTSD). Although this can be a helpful term theoretically, operationally it may not be useful to consider this a form of dissociation. Specifically, the DES as the primary trait measure of dissociation used in the false memory literature, only has one question (out of 28) that resembles intrusive/re-experiencing phenomena: “some people have the experience of sometimes remembering a past event so vividly that they feel as if they were reliving that event”. This question does not specifically refer to reliving a traumatic event, nor does it mention whether this reliving occurred automatically without intention to retrieve that memory as in posttraumatic intrusions. As such it is considered an aspect of absorption. Some state measures of dissociation do not include questions related to intrusions either – for example the State Dissociation Questionnaire (SDQ; Murray et al., 2002) contains no ‘primary dissociation’ questions. Therefore for this thesis although primary dissociation involving intrusions, flashbacks etc. is not considered an incorrect conceptualisation, it will be considered as a phenomenon separate from that of dissociation in general.

Most accounts of dissociation do involve avoidance in some way. It may be the case that the dissociation is a maladaptive way to deal with threatening circumstances (McCaslin et al., 2008), through avoidance (Lanius et al., 2010; Steele et al., 2009). Exactly how the two concepts relate requires additional consideration. Importantly, it is unclear whether (secondary) dissociation *is the same as* avoidance, a form of more general avoidance, or whether avoidance is just the purpose of dissociation. It could also be that avoidance and dissociation are different

processes that lead to similar outcomes regarding fragmentation of a trauma memory. This confusion is worth exploring further.

One explanation of dissociation however does not as easily fit in with the rest: that of general distractibility, fantasy proneness and cognitive failures (Giesbrecht et al., 2008). While the latter depiction has not received wide support (Bremner, 2010; Dalenberg et al., 2012), these different conceptualisations may lead to differing predictions regarding false memory development, which will be discussed further in the next chapter.

### Biological Response to Distressing Events

One of the primary methods of assessing both PTSD symptomatology and dissociative phenomena is that of self report (or the report of an observer). A key concern of using these questionnaires is that they are subjective in nature. Where possible it is important to compare these reports with objective, biological correlates to determine whether the subjective ratings correspond to the objective observations of what is actually occurring in the brain and body. Activation of the hypothalamic pituitary adrenal (HPA) axis is one such biological marker of stress. This axis coordinates reactions to distress through interactions between the hypothalamus and pituitary in the brain, and the adrenal glands above the kidneys. Cortisol secretion is a major aspect of HPA axis activation in response to distress (Khalili-Mahani, Dedovic, Engert, Pruessner, & Pruessner, 2010). Cortisol is very easy to assess through saliva, plasma, or urine samples. High correlations have been observed between cortisol levels in the three sampling methods (e.g., Neary, Malbon, & McKenzie, 2002), suggesting these methods can be used interchangeably. This makes cortisol a prime candidate as an objective measure to compare with subjective reports of distress. In this section a discussion of how cortisol is



involved in the stress response is included, followed by a synthesis of research on how cortisol relates to PTSD and dissociation.

### *Cortisol and Stress*

Cortisol is a glucocorticoid (GC) hormone released from the adrenal glands, following prompts from the higher-order areas of the hypothalamus and the pituitary. In the short term cortisol aids fight-or-flight survival responses to threat by increasing energy and cardiovascular tone, while suppressing non-essential bodily functions (Sapolsky, 2000). The HPA axis has a negative feedback loop where circulating cortisol acts on GC receptors to dampen subsequent HPA activity when cortisol levels are too high. If the feedback loop is impaired, this could lead to damaging effects such as a super-suppression of cortisol (Weiss, 2007). Chronically excessive cortisol levels however can also have harmful consequences such as immune suppression and hypotension (Sapolsky, 2000).

Another potential harmful consequence of dysregulation of cortisol levels involves a disruption of brain regions which have a high density of GC receptors, such as the hippocampus, a key brain area involved in learning and memory (Sapolsky, 2000). It is thought a possible mechanism by which GCs induce hippocampal atrophy is by increasing glutamate (an amino acid that is excitotoxic in high concentrations) in hippocampal synapses, which may inhibit neurogenesis in this area (Reagan & McEwen, 1997). However, it is also the case that abnormally low levels of GCs can cause cell death in the hippocampus (Reagan & McEwen, 1997). The implications of cortisol-related hippocampal damage (and subsequent memory problems) will be discussed further in relation to the false memory research in the next chapter.

Methods to investigate cortisol release in the laboratory include the administration of synthetic cortisol or related compounds (e.g., Kirschbaum, Wolf, May, Wippich, & Hellhammer, 1996), or by physical or psychological stressors. As would be expected, administering synthetic cortisol does produce increases in systemic cortisol (Kirschbaum et al., 1996). Another related method to investigate HPA axis function is cortisol suppression in response to dexamethasone (a synthetic GC). A low dose of dexamethasone suppresses cortisol levels in people without pathology related to HPA axis dysregulation, making it a useful measure for assessing cortisol dysfunction in clinical groups such as those with PTSD (McFarlane, Barton, Yehuda, & Wittert, 2011).

The main physical stress method to prompt cortisol release experimentally is the Cold Pressor Test (CPT). This task involves participants submerging their arm in cold water (0-4°C) for 1-2 minutes, which is considered painful (but not permanently damaging in nature). Research has found this method to be very reliable in elevating cortisol levels (Bullinger et al., 1984), alongside subjective reports of distress (McRae et al., 2006).

In clinical populations, psychological methods of inducing cortisol release typically involve symptom provocation (e.g., playing battle sounds to war veterans with PTSD; Geraciotti et al., 2008). In non-clinical populations, the main method of elevating cortisol levels through psychological distress is the Trier Social Stress Test (TSST; Kirschbaum, Pirke, & Hellhammer, 1993). The TSST involves participants unexpectedly being asked to perform a public speaking task and mental arithmetic in front of an audience, with little time to prepare. This too has been found to increase cortisol levels significantly (Kirschbaum et al., 1993; Kirschbaum et al., 1996). Recently, studies have also combined both the CPT and TSST to

increase cortisol responses beyond what either method is able to accomplish alone (Schwabe, Haddad, & Schachinger, 2008; Smeets et al., 2012).

Another relevant psychological method of assessing cortisol response involves exposing participants to violent films. In a sample of healthy women, cortisol levels were found to increase during film viewing (Gerra et al., 1996). In a study with a male sample, it was found that only those with low trait anxiety (compared to high) responded to a violent film with a cortisol increase (Hubert & de Jong-Meyer, 1992). In another study with both male and female participants, significantly higher cortisol levels were found in response to an emotional film compared to a neutral film (Nejtek, 2002). Interestingly, subjective reports of distress for the film were found to be unrelated to cortisol levels (Nejtek, 2002).

There are also considerable individual differences in cortisol responses to stressful events (Kudielka, Hellhammer, & Wüst, 2009), as well as differences in the rate of post-stress recovery (Roy, Kirschbaum, & Steptoe, 2001). For example, differences in cortisol levels following a stressor have been found for age, gender and prior stress experiences (see Kudielka et al., 2009, for a review). Some studies also separate cortisol ‘responders’ from ‘non-responders’ (e.g., Buchanan, Tranel, & Adolphs, 2006; Kirschbaum et al., 1996). It appears that people who respond to a stressful event with elevated cortisol also rate the event as significantly more distressing compared to those designated as ‘non-responders’ (Kunz-Ebrecht, Mohamed-Ali, Feldman, Kirschbaum, & Steptoe, 2003), which may serve to explain why previous studies have not found a relationship with subjective reports of distress and cortisol levels overall (e.g., Nejtek, 2002). Additionally, it has also been found that excessive suppression of cortisol in the dexamethasone test was related to higher anxiety scores and more

frequent use of avoidant coping strategies (Hori et al., 2010). These findings reiterate that both high and low cortisol levels can be related to psychological dysfunction (Hori et al., 2010).

### *Cortisol and PTSD*

Assessing neuroendocrine markers such as cortisol may be useful for prospectively differentiating between trauma victims who will go on to meet criteria for PTSD and those who will not (Delahanty, Raimonde, & Spoonster, 2000; Neylan et al., 2005). Further, investigating the neurobiological mechanisms underlying the trauma response may inform prevention and treatment procedures (Bremner, 2005). However there have been mixed findings in the literature regarding cortisol: while some research has revealed low levels of cortisol following a trauma predict subsequent PTSD symptoms, others studies have found the reverse. For example, victims of motor vehicle accidents admitted to a trauma centre gave urine samples which were assessed for cortisol levels. Those victims who met criteria for acute PTSD had lower cortisol levels in the first 15 hours after their accident, compared to those who did not receive a PTSD diagnosis. Lower cortisol levels also predicted higher intrusion and avoidance symptoms at 1-month follow up (Delahanty et al., 2000; Marshall & Garakani, 2002). A similar result was observed with salivary cortisol levels assessed within nine hours of an accident: lower cortisol levels were related to PTSD at six months, and these low cortisol levels were also related to reports of past trauma (Ehring, Ehlers, Cleare, & Glucksman, 2008).

Interestingly, the reverse was found in children assessed 12 hours following admission to a trauma centre: elevated cortisol levels were found to predict acute PTSD diagnosis at a 6-week follow up (Delahanty, Nugent, Christopher, & Walsh, 2005). In another study salivary cortisol levels were measured in accident victims within two days of admission to hospital. Cortisol levels measured at 8am were found to negatively correlate with PTSD symptoms six

months later, however cortisol at 4pm was positively related to PTSD (McFarlane et al., 2011). Other studies have not found cortisol response to predict subsequent PTSD symptoms (Bonne et al., 2003; Shalev et al., 2008); though cortisol was assessed a week or more post-trauma in these studies. These variable findings highlight the potential importance of timing for testing cortisol, as well as potential differences between adults and children following stress exposure.

Some researchers investigating chronic, long-term PTSD have found elevated cortisol levels in people with PTSD compared to traumatised people without PTSD (e.g., Inslicht et al., 2006; Maes et al., 1998; Rasmusson et al., 2002). Conversely, lower cortisol levels have also been observed in people with PTSD, which led the researchers to suggest this reflects a disengagement style of coping with trauma (e.g., Mason et al., 2001). A limitation in these chronic PTSD studies is that participants often differ with regard to the time since the onset of the PTSD (for example in the Rasmusson et al., 2002 study participants ranged from 1 – 40 years since initial trauma), as well as the type of trauma experienced. An additional difficulty with many of the long-term studies is the inability to determine whether there were pre-existing neurobiological deficits which may have contributed to the subsequent PTSD symptoms following the trauma (Weiss, 2007). Therefore it would be useful to investigate the association between cortisol levels and PTSD symptomatology where the timing of the measurement since the event is held constant, and the event experienced is also equivalent.

In an attempt to account for this, cortisol and PTSD symptoms were investigated in New Yorkers exposed to the 9/11 World Trade Center attacks nine months on (Simeon, Yehuda, Knutelska, & Schmeidler, 2008). Compared to a non-exposed control group, those participants exposed (including some with PTSD) did not have significantly different baseline cortisol levels, or different cortisol levels in response to challenge (using dexamethasone

suppression and the TSST). The conclusions that can be drawn from this study are somewhat limited though, due to small sample sizes and the fact that the exposed group contained both people with and without PTSD. Additionally, these participants were assessed at least nine months after the exposure, making it difficult to determine the role of any pre-existing vulnerabilities to poor psychological response.

Due to the uncertainty regarding whether pre-existing HPA axis dysfunction is present in people with PTSD prior to their trauma, it is important to use laboratory studies where baseline cortisol differences can be assessed to determine any pre-existing vulnerabilities to distress response prior to the stressor. Further, each participant is able to be exposed to the exact same stressor and be followed up at the exact same time post-stressor. This experimental control allows the abovementioned problem of assessing people with PTSD with varied onset time and trauma backgrounds to be addressed.

Further, at present it appears that in experimental paradigms where distress has been measured, cortisol has not been investigated with regards to specifically predicting intrusion and avoidance symptoms. This may be due to the nature of the tasks used. Although transiently distressing, it is unlikely that the CPT or the TSST create intrusion symptoms or make it necessary to avoid reminders of the task. Of interest to this thesis then is how cortisol (both prior to stressor and afterwards) may relate to intrusions and avoidance for more complex stimuli. As such a different experimental task is required: the trauma film paradigm (TFP) is proposed as a potential candidate. Using such a task also allows investigation of cortisol as a predictor of false memory development; a possibility to be addressed in the next chapter.

### *Cortisol and Dissociation*

Evidence for biological abnormalities in dissociative disorders would increase confidence in diagnoses (Bremner, 2009); as such recent research has examined the biological correlates of dissociation in response to distress (see Dalenberg et al., 2012, for a review). It is thought that the HPA-axis response to stress may be involved in dissociative responses (Koopman et al., 2003; Weiss, 2007). Additionally brain regions sensitive to stress such as the hippocampus have been proposed to mediate symptoms of dissociation (Bremner, 2009). One mechanism by which this may occur is that excessive suppression of cortisol may eventually produce dissociative or numbing experiences which prevent stressful events from entering into consciousness; another possibility is that avoidance and numbing as a protective mechanism may lead to suppression of cortisol responses over time (Weiss, 2007).

As mentioned earlier, both excessive GC levels, and chronically low GC levels may damage the hippocampus. Research has found negative correlations between dissociative symptom level (as measured by the DES) and hippocampal volume from MRI in early-childhood sexual-abuse-related PTSD victims (see Bremner, 2009, for a review), which may give indirect evidence for a link between dissociation and cortisol. It has also been suggested that some mixed findings regarding PTSD and biological measures could be potentially accounted for by dissociation, which is not always measured in PTSD studies (Simeon et al., 2008). Attempts to directly assess dissociation and basal cortisol levels (in the absence of a stressor) have yielded mixed results: higher cortisol levels (Simeon, Knutelska, Yehuda, et al., 2007), lower cortisol levels (Schechter et al., 2004; Simeon et al., 2008), and null results for high dissociation have all been observed (Dalenberg et al., 2012).

Prospective studies have investigated the relationship between cortisol and dissociation typically by assessing cortisol levels before and after a stressor, and then relating this to state dissociation. In one study performance on a stressful military task was assessed and it was found that post-task cortisol levels were positively associated with dissociative symptoms, and these were both associated with poorer task performance (Morgan, Rasmusson, Pietrzak, Coric, & Southwick, 2009). In a sample of women with PTSD from childhood abuse, acute dissociation in response to an interview about their trauma was found to be related to an increase in salivary cortisol when assessed one day later (Koopman et al., 2003). The authors of this study suggested that dissociation may dampen HPA axis reactivity during a stressor, but cause rebound HPA activation within the next day (Koopman et al., 2003).

Although basal cortisol levels have been related to trait dissociation (with mixed results) and cortisol response to a stressor has been related to state dissociation, only one study to date has investigated whether trait dissociation will predict the cortisol response in the face of a stressful event. It was found that depersonalisation and derealisation were positively related to cortisol levels, whereas absorption was negatively related (Giesbrecht, Smeets, Merckelbach, & Jelicic, 2007). However this study used the TSST to prompt cortisol release, which, as argued earlier, does not allow exploration of intrusions and avoidance alongside dissociation and cortisol responses. Further, it may be the case that some aspects of dissociation (depersonalisation, absorption, etc.) are differentially related to cortisol response and memory. This possibility will be returned to in Chapter Three following a discussion of the literature on the abovementioned predictors and how they relate to false memory vulnerability.



## CHAPTER THREE

### Review of Research on False Memories for Distressing Events.

Victims and witnesses involved in a traumatic event may experience significant distress as a consequence. Although much of the research detailed in Chapter One has advanced understanding of the mechanisms of false memory development, a major criticism is that most of that research only investigated eyewitness memory for innocuous events unlikely to distress any participants. This limits the applicability of these findings to real world cases where traumatised individuals are expected to accurately recall that traumatic event in court.

The relationship between stress and memory is a complex one. Emotional events are suggested to be remembered differently than neutral, ordinary events (see Christianson, 1992; for a review). Conventional wisdom suggests people remember distressing events particularly well (e.g., in the case of 'flashbulb' memories; Davidson & Glisky, 2002); however this may not always be the case. This relationship becomes even more complicated when investigating false memories for a traumatic event.

Opinion is mixed in the literature concerning whether emotional stimuli enhances or impedes recall (e.g., Dehon, Laroi, & Van der Linden, 2010; Gallo et al., 2009; Kensinger et al., 2007). Emotional stimuli (particularly negative) may evoke more memories of personal experiences, leading to greater encoding. This could increase the distinctiveness of the stimuli and therefore more accurate remembering occurs alongside easier rejection of false information (Doerksen & Shimamura, 2001; Kensinger et al., 2007). Others propose that negative stimuli are more semantically linked in memory to other negative concepts, and an inability to suppress these other concepts once activated may increase false memories (e.g. Brainerd, Stein, Silveira, Rohenkohl, & Reyna, 2008; Joormann, Teachman, & Gotlib, 2009; Otgaar, Candel, &

Merckelbach, 2008). It is important to note that experiments have led to mixed findings: traumatic memories have been found to be more accurate than positive memories (Porter & Peace, 2007); others have found false memories were greater for neutral compared to emotionally-negative stimuli (Pesta, Murphy, & Sanders, 2001); while others have found that false memories for negative stimuli can substantially exceed false memories for neutral information (Devilly, Ciorciari, et al., 2007; Gallo et al., 2009; Howe, 2007; Otgaar et al., 2008). As a consequence, several theories have been developed to attempt to account for these findings. These will be reviewed briefly below.

### Theories of False Memory for Emotional Stimuli

#### *Affect-As-Information Hypothesis*

One account of emotional valence influencing false memory development involves the affect-as-information (AAI) hypothesis. The advocates of this approach suggest that emotional reactions to tasks serve as a cue regarding predicted outcomes. This information then can influence how a person approaches the task (Storbeck & Clore, 2011). Two processing or learning styles are differentiated: item-specific processing and relational processing. Item-specific processing involves encoding the unique, distinctive qualities of incoming information (Brainerd & Reyna, 1998). This style of processing appears to be similar to the verbatim concept of Fuzzy Trace Theory (FTT) or the perceptual features in the MEM model (both discussed in Chapter One). Relational processing involves encoding stimuli in relation to other stimuli in the environment and/or memory (Brainerd & Reyna, 1998). Relational processing resembles gist traces in FTT or reflective features in the MEM model.

Of relevance to this thesis, positive affect is thought to lead to a relational processing style, whereas the experience of negative affect promotes an item-specific processing style (Storbeck & Clore, 2005, 2011). Item-specific processing in this model is expected to lower susceptibility to false memories in comparison to the more general relational processing, due to the focus on distinctive features of the task allowing rejection of false information. Therefore, if negative affect promotes item-specific processing, lower susceptibility to false memories should occur in participants when a negative, as opposed to positive, emotion has been induced (Storbeck & Clore, 2011).

Testing this theory, a positive, neutral or negative mood was induced in participants who were then given the DRM task. Participants who were in the negative mood condition appeared to recall significantly fewer critical lures, compared to those in the other groups (Storbeck & Clore, 2005). The authors suggested that their results were at odds with Activation-Monitoring Theory (AMT; as mentioned in Chapter One) as this theory would predict that a similar number of critical lures (CLs) would be activated regardless of mood. Instead, they advocated FTT, with negative moods impairing gist processing and thus leading to fewer false memories in the negative mood group (Storbeck & Clore, 2005). Building on this finding, in a subsequent experiment happy or sad moods were induced either prior to DRM list learning or afterwards. As sad mood prior to, but not after, learning reduced false recognition, this was taken to suggest that mood specifically affects encoding of information while retrieval processes remain unaffected (Storbeck & Clore, 2011; see also Forgas, Laham, & Vargas, 2005, for a related study using leading questions).

### *Arousal-Biased Competition Theory*

Affect is thought to be made up of at least two dimensions: valence and arousal (Corson & Verrier, 2007). Whereas valence concerns the direction of the emotion (i.e., positive, neutral, negative; Baron & Byrne, 2003), arousal can be considered the level of activation of an emotion and can range from drowsiness to highly alert (Corson & Verrier, 2007). This means that two stimuli could be equal in valence but differ in arousal. For example, sadness would be considered a negative emotion with a low arousal state, whereas anger would be a negative emotion high in arousal (Corson & Verrier, 2007). This is an important distinction as there may be different memory outcomes based on equally valenced stimuli with different states of arousal.

As such, Arousal-Biased Competition (ABC) theory has also been used to explain findings in the emotional memory literature. In particular, arousal is thought to modulate the strength of competing mental representations, biasing competition towards goal-oriented, conspicuous stimuli (Mather & Sutherland, 2011). The aspects of the stimuli that are then consolidated in memory are those that were the highest in priority, irrespective of arousal. This theory incorporates earlier research on cue-utilisation (where emotional arousal reduces the number of cues able to be utilised in a task; Easterbrook, 1959) suggesting narrowing of memory in situations of high arousal. Additionally, items that are arousing and central in detail (i.e., temporally relevant, key aspects of the event) are said to be remembered better than more peripheral cues (i.e., temporally irrelevant, background details of an event; Christianson, 1992; Mather & Sutherland, 2011).

Regarding emotional valence, it is argued in ABC theory that arousal is more critical in terms of biasing competition than valence (Mather & Sutherland, 2011). In studies where a pair

of equally valenced stimuli are presented that differ in arousal levels, the arousing stimulus generally attracts more attention (see Mather & Sutherland, 2011, for a review). Further, although emotional stimuli are suggested to receive processing priority over neutral stimuli, arousal should enhance this competitive advantage. The reasoning behind this assertion is based on findings that regardless of the valence of stimuli, the amygdala (a brain area thought to be involved in memory and emotion) is activated by arousal (e.g., Cunningham, Raye, & Johnson, 2004). This means that positive and negative stimuli can similarly influence how the amygdala biases attention. The authors of ABC theory do state that positive and negative affect may have differential effects on processing of stimuli, however they predict that memory differences will not be observed between neutral and emotional events when arousal levels are held constant (Mather & Sutherland, 2011).

In one study where the role of arousal in false memory susceptibility was tested, five mood groups were compared: happy, serene, angry, sad, and control. High arousal conditions were the happy and angry groups, while low arousal conditions were the serene and sad groups. If arousal was more related to false memories than valence, it was expected that higher false memories would be observed in both high arousal groups (Corson & Verrier, 2007). Results were in the expected direction: regardless of valence, participants in the high arousal groups falsely recalled and recognised more critical lures. The authors suggested that activation processes (like those thought to contribute to false memories in AMT) are dependent on arousal, whereby high levels of arousal favour more elaborative encoding (Corson & Verrier, 2007; however, see Van Damme, 2012, for the opposite result).

### *Paradoxical Negative Emotion Hypothesis*

Another way to explain the abovementioned mixed findings involves the Paradoxical Negative Emotion (PNE) hypothesis of memory (Porter, Taylor, & ten Brinke, 2008). In this theory, negative events not only facilitate accurate recall, but also paradoxically increase the likelihood of false memories related to that event (compared to neutral or positive events). It is reasoned that from an evolutionary perspective, it is advantageous to have superior recall of negative or dangerous events so as to better deal with them in the future (Porter & Peace, 2007). At the same time, it is also adaptive to incorporate into memory negative information provided by trusted others, which potentially allows for greater distortion of negative information in memory (Porter, Bellhouse, McDougall, ten Brinke, & Wilson, 2010).

Testing the PNE theory, Porter et al., (2008) had participants recall 20 events, half of which were fictitious. Events also varied regarding whether they were positive or negative. Results were in the direction hypothesised by the theory: memories for negative events were more detailed and accurate and yet participants also reported more false memories for these events, compared to positive stimuli (Porter et al., 2008). A subsequent study using emotional pictures also found increased susceptibility to false memories for the negative pictures, an effect that persisted at one-week and one-month follow ups (Porter et al., 2010); however the hypothesised simultaneous increase in accuracy for the negative stimuli was not observed.

In attempting to account for these different findings across studies from the same research group, the authors suggested that arousal may have been a factor in the failure to replicate the accuracy results. As arousal ratings were equivalent for both the positive and negative scenes in the Porter et al., (2010) study, memory intensity for both types of stimuli may have been the same. As such, it appears negative valence of a stimulus alone may not be

sufficient to influence memory accuracy; however it may still influence false memory development.

### *Evaluation of Theory and Research on False Memories for Emotional Stimuli*

While the authors of both the ABC and PNE approaches suggest that arousal may account for differing findings regarding emotional memory, in the AAI approach valence is considered to be more important. Considering the possible role of arousal, Storbeck & Clore (2011) in their DRM study added a second part where different participants rated the arousal levels of the word lists used. It was found that arousal levels were significantly higher for the negative mood condition compared to the positive and neutral conditions. As fewer false memories were observed in the negative condition, this appears to directly contradict the suggestion that arousal, not valence, is the main contributor to false memory development (Storbeck & Clore, 2011). However, Storbeck & Clore (2011) were unable to explain the different findings observed in Corson & Verrier (2007; mentioned above). Additionally, Van Damme (2012) attempted to account for these conflicting results by investigating both arousal and valence in the DRM, but instead found different results: low arousal states (as opposed to high in Corson & Verrier, 2007) were related to false recognition, regardless of valence. It appears further research is required to work out these conflicting results.

While it is hypothesised using the AAI theory that false memories will be lower for negative emotions, the opposite hypothesis is suggested using the PNE theory, with study findings to support this assertion (Porter et al., 2010; Porter et al., 2008). Importantly, the AAI discusses negative emotion in relation to sadness, but not distress. Distressing stimuli might be expected to produce different arousal levels than sad stimuli. In the ABC theory attention is

biased in favour of high priority (goal-related) information (Mather & Sutherland, 2011), and using the PNE hypothesis it is suggested that dangerous events are remembered especially well to enhance survival (Porter et al., 2008). At this point it appears these accounts are in accordance, as survival is clearly of high priority.

Further, it is suggested by the advocates of the PNE hypothesis that accuracy will be higher for negative compared to neutral events; but when arousal was equal for both stimuli in Porter et al's (2010) study, memory accuracy did not differ, which supports ABC. Even so, false memories were still found to be higher for the negative stimuli (Porter et al., 2010), a finding not easily accounted for by the ABC theory. A tentative conclusion at this point may be that arousal is particularly relevant for memory accuracy, however valence may still be an important contributing factor in relation to false memory development.

When comparing neutral and emotional stimuli it is important to consider that there may be individual differences in the way that people respond to these stimuli. For example, it may be the case that some people are less able to remember negative information well because it does not distress them. Others may be so distressed they fail to encode the event, thus enhancing the likelihood that they will develop false memories. The ability to identify which people may be particularly susceptible to false information is of great consequence in the legal system, as within this setting the aggregate response is not as important as whether the particular witness or victim testifying has a good memory for the event in question.

Thus of particular concern in this chapter is the suggestion that people with a known propensity towards false memories may be less credible eyewitnesses, necessitating research investigating individual susceptibility to false recall (e.g., Zhu et al., 2010). The individual differences highlighted in this chapter have been chosen based on the fact that they may be



related not only to false memory development, but also to differential outcomes in response to a distressing event. The characteristics highlighted are intrusions, avoidance, dissociation and cortisol reactivity. Directly below is a synthesis of the research on how these variables can be used to predict susceptibility to false memories, particularly for distressing events.

### Distress Responses as Predictors of False Memories

#### *Post Traumatic Stress Disorder*

Many of the symptoms of PTSD are considered to be related to memory, either directly or indirectly (Golier & Yehuda, 2002). The fact that intrusions can occur as well as psychogenic amnesia and other avoidance symptoms suggests that PTSD is not about over-remembering or under-remembering, but a distortion of memory, and the distress associated with it (Golier & Yehuda, 2002). People with PTSD often have fragmented and poorly integrated memories for the traumatic event, which not only leads to diminished capacity for accessing complete memories for the event, but also to increased intrusions of other aspects into consciousness (Brewin et al., 1996; Ehlers & Clark, 2000). Poor discrimination due to failure to properly place the event in context has also been hypothesised to increase source-monitoring errors, potentially making people with PTSD more susceptible to false memories (Brennen, Dybdahl, & Kapidzic, 2007).

According to the PNE hypothesis of memory, negative concepts may create source-monitoring errors due to the activation of related concepts and the inability to suppress them (Porter et al., 2008; see also Joormann et al., 2009). Exploring this possibility using the DRM, it was found that traumatised participants with PTSD falsely recalled more CLs compared to non-traumatised controls (Zoellner et al., 2000). Although traumatised participants without

PTSD also recalled significantly more CLs than controls, the authors suggested that this could have been due to residual PTSD symptoms. As the above study only used neutral word lists, it is possible that this study did not account for the fact that people with PTSD may have functional memory processes for aspects unrelated to trauma.

Another DRM study was designed to address this limitation by comparing participants with war-related PTSD and trauma-exposed people without PTSD using neutral word lists and trauma-related lists (Brennen et al., 2007). While both groups were equally susceptible to recalling CLs from the neutral lists, it was found that those participants with PTSD mistakenly recalled more trauma CLs. Overall these results imply that there may be a general source monitoring deficit in trauma-exposed individuals, perhaps particularly those with PTSD-related symptomatology (Zoellner et al., 2000), and especially for trauma material.

However, the DRM method precludes assessment of whether people with PTSD have false memories for the traumatic event they actually experienced. Accordingly, in a recent study flashback experiences in PTSD patients were manipulated by getting participants to write a narrative of their trauma and report which aspects of the trauma prompted flashbacks for them (Brewin, Huntley, & Whalley, 2012). Words relating to the narratives were compiled and were presented to participants a week later. Foil items (words relating to other participants' trauma narratives but not their own) were sometimes found to prompt flashbacks and subsequently be misidentified as being part of the original event (Brewin et al., 2012).

While the findings of the abovementioned studies suggest that people with PTSD may in some cases be susceptible to false memories, further research is required to determine whether there are particular vulnerabilities prior to the trauma that make false memory development more likely. Assessing pre-existing vulnerabilities to poor recovery and false

memory development following a distressing event presents difficulties relating to the fact that retrospective reports are gathered post-trauma, and self-reports may be influenced by the event and current symptom severity (Ehring, Kleim, & Ehlers, 2011; Holmes & Bourne, 2008). It is therefore necessary for research to turn to predicting distress reactions in non-clinical participants and relating that distress to false memory development. Therefore a useful (and more ethical) laboratory analogue to exposing participants to a trauma is the Trauma Film Paradigm (TFP). Participants are able to be assessed on individual difference measures prior to viewing the distressing film, and these can be used to predict actual responses following the event (see Holmes & Bourne, 2008, for a review).

The TFP has also been used to investigate the effects of co-witness discussion on susceptibility to misinformation and distress for a film. In one such study participants were shown a film of victims of a car accident and then some participants received misinformation from a confederate during a group discussion (Devilly, Varker, Hansen, & Gist, 2007). It was found that those in the misinformation condition were significantly more likely to falsely recall this information as fact, compared to those in conditions without a confederate. Although the TFP has primarily been used to investigate intrusions, it is also potentially useful for assessing pre-existing vulnerabilities to both distress responses and false memory development.

Two key symptom clusters involved in the diagnosis of PTSD are proposed in this thesis to be related to differential memory effects: re-experiencing in the form of intrusions and avoidance of reminders of the event. Intrusions may increase accurate recall of perceptual details due to constant re-experiencing of the event; however intrusions of some details more than others could have an inhibiting effect on other information from that event (e.g., Wessel & Hauer, 2006). Another possibility is that intrusions may relate to over-inclusive responding and

fear stimulus generalisation, which could also enhance acceptance of false information into memory (Dalenberg et al., 2012).

In one TFP study by Holmes et al., (2004), intrusions for the film were assessed via a diary and memory for the film was tested using cued recall and recognition; however memory accuracy was not significantly related to level of intrusions (Holmes et al., 2004). While the intrusions diary is useful for assessing the frequency and nature of intrusions experienced, this method has been argued to be somewhat difficult to evaluate psychometrically. Further, a key method of memory testing, free-recall (as opposed to cued recall or recognition) was not assessed in this study. It still may be the case that intrusions are unrelated to memory accuracy; however it is worth assessing whether they are related to false memory development. As flashbacks are considered part of intrusive phenomena, the recent study by Brewin et al., (2012) mentioned above may serve as a preliminary indication that intrusions are related to false memory development. However the issue remains regarding heterogeneity in trauma history, which can be addressed in a laboratory study keeping the trauma event consistent across participants.

Purposeful avoidance of reminders of trauma (and also unintentional inability to access some trauma memories) may lead to improper processing of the event. This avoidance subsequently prevents the traumatic memories from being properly integrated in the autobiographical memory knowledge base (Ehlers & Clark, 2000). As such it is possible that strongly avoiding reminders of an event could increase the likelihood that false information will not be easily discriminated from true information, or that people who avoid reminders may be more likely to accept misinformation from others to fill in any gaps in memory. At present avoidance symptoms have not been studied in relation to false memory development.

### *Dissociation*

Dissociation may also be a vulnerability factor for developing false memories (Merckelbach, Zeles, Van Bergen, & Giesbrecht, 2007; Soraci et al., 2007). During a distressing event detachment may prevent encoding of that event in the first place. Thus any misinformation presented may be considered true due to not being able to detect discrepancies between it and the original information. This situation is similar to that suggested by Skagerberg & Wright (2008a) whereby it is not that the original memory is distorted, but rather the false information is the only information encoded. Another possibility is that compartmentalisation processes prevent the information that was encoded from being accessed at test, and only the misinformation is able to be reported. This could lead to increased confabulations (spontaneously produced false information as remembered without prompting from an external source).

If compartmentalisation/lack of integration does not prevent retrieval of the memory of the event, it may be the case that those people who frequently dissociate may have reduced confidence in their own ability to retrieve accurate memories (Merckelbach et al., 2000), making them more likely to accept others' versions of events (Eisen, Winograd, & Qin, 2002). This could lead to source monitoring errors due to an inability to determine whether false information was introduced externally or actually experienced. The Fantasy Model of dissociation suggests the dissociative individual is prone to construction of fantasies and then mistake these for real memories, therefore suggesting it is more fantasy proneness than dissociation that is the relevant factor (Candel, Merckelbach, & Kuijpers, 2003; Giesbrecht et al., 2008). Additionally, instead of dissociation, cognitive failures related to poor memory are also suggested to relate to increased susceptibility to false memories (Giesbrecht et al., 2008).

A variety of methods have been employed to assess the role of dissociation in false memory vulnerability, with mixed results. For example, in some studies of dissociation and the DRM task significant results have been observed, suggesting higher scores on dissociation scales are associated with increased generation of CLs (e.g., Clancy, Schacter, McNally, & Pitman, 2000; Winograd, Peluso, & Glover, 1998); however in other studies no significant association was found (e.g., Geraerts, Smeets, Jelicic, van Heerden, & Merckelbach, 2005; Jelinek, Hottenrott, Randjbar, Peters, & Moritz, 2009). In another study a ‘scenic’ DRM was used in which short film clips were shown to participants with and without PTSD. The film clips shown were trauma-related (displaying interpersonal violence), negative, neutral and positive. The DES as a whole was not significantly related to false memories, however the derealisation/depersonalisation subscale was (Hauschildt, Peters, Jelinek, & Moritz, 2012). Additionally the authors of this study argued that previous studies failing to find a link between PTSD, dissociation and false memories could be due to the use of the trait measure, instead of a state measure; as such in this study state dissociation was also assessed and found to be related to increased false memories (Hauschildt et al., 2012).

However, based on suggestions by some that the dissociation and DRM findings may have low ecological validity with regards to autobiographical memory (e.g., Candel et al., 2003), other false memory tasks have also been employed to investigate the role of dissociation. For example, in one study participants completed a series of tasks, and then one week later they were unexpectedly asked about their memory for the tasks using a questionnaire with misleading items. Trait dissociation was significantly related to higher misinformation reporting (Eisen, Morgan, & Mickes, 2002). Dissociation has also been found to be related to increased susceptibility to misleading questions following a film of a crime

(Wright & Livingston-Raper, 2002); however in a similar study dissociation was not related to false memories of a crime film (Drivdahl & Zaragoza, 2001). Two main differences between these studies may potentially explain the different results. Firstly, different versions of the dissociation questionnaire were used. Further, in the Drivdahl & Zaragoza (2001) study, participants were exposed to misinformation via a narrative, whereas participants in the Wright & Livingston-Raper (2002) study were exposed to misleading questions.

Investigating the role of emotion in the dissociation-false memory link, participants in one study were selected based on being high or low scorers on the DES. These participants were exposed to an emotional story and then asked to free recall this story. Confabulations (termed commission errors by the authors) were found to be significantly higher for people scoring high on the DES – a result that remained significant even when accounting for differences in fantasy proneness (Candel et al., 2003). Confabulations have also been found to be related to high dissociation scores for a distressing film (Giesbrecht, Geraerts, & Merckelbach, 2007), or an emotional staged event (Merckelbach et al., 2007). In another study in which participants were led by an interviewer to create rich false memories for an emotional childhood event (e.g., a serious animal attack), it was also found that higher trait dissociation was related to increased memory distortion (Porter et al., 2000). Despite these findings, a review of studies examining the role of dissociation in false autobiographical memories noted that many null results have also been observed (Dalenberg et al., 2012).

An important concern with much of the above research is that non-clinical populations were used (besides the DRM and PTSD study of Hauschildt et al., 2012), and it is unclear whether these participants were exposed to stimuli distressing enough to prompt dissociative responses such as those mentioned in relation to disorders such as ASD and PTSD (DePrince &

Freyd, 2004). As highlighted earlier, dissociation has been argued to occur in psychologically healthy populations, both in response to distress (Morgan et al., 2001) and also to relatively common neutral situations (Bernstein & Putnam, 1986). It is difficult to determine in clinical populations how pre-existing trait dissociation may have affected responses to the event. Further, due to ethical concerns in inducing trauma experimentally, dissociation in healthy populations is still a useful factor to consider with relation to false memories.

Although the DES has been used in non-clinical populations, floor effects have often been observed which may limit the applicability of the findings. Responding to these criticisms an alternative form of the DES was developed, the DES-C (comparative; Wright & Loftus, 1999). In this version participants rate how often they experience certain dissociative phenomena *in comparison to other people*. The DES-C was found to be significantly related to participants' susceptibility to misinformation introduced following a crime video (Wright & Livingston-Raper, 2002). Using the DRM paradigm, one study found a positive relationship between the DES-C and false recall (Dehon et al., 2008), while another did not (Wright, Startup, & Mathews, 2005); however, both used neutral word lists only. Given these mixed findings, combined with many studies only investigating neutral stimuli in the DRM, it is necessary to investigate the DRM for neutral and trauma-related words, with the DES-C.

Additionally of interest is the finding by Porter and colleagues (2008) when testing their PNE hypothesis, that dissociation (using the DES) was significantly related to false recall of the negative events in particular. It is worth extending this finding using the narrative method (as leading questions were used) and to investigate dissociation using the DES-C. Further, although negative events were used, participants were not assessed for distress. Overall, the research investigating the relationship between dissociation and susceptibility to false information has



mixed findings. Therefore, it is important to research the effect of dissociation in response to a distressing event by using a film (as it can be argued that although related to trauma, DRM words may not induce stress) which may produce more ecologically valid results.

### *Cortisol*

The possibility that cortisol levels may impact memory relates to the findings (reviewed in the previous chapter) that both hypersecretion and hyposcretion of cortisol may damage the hippocampus, a brain structure known to play a crucial role in learning and memory (Sapolsky, 2000). Damage to the hippocampus is usually attributed to *chronic*, long-term conditions of abnormal cortisol levels. Unless those tested for false memories already have such deficits, it is important to consider how cortisol levels immediately following a stressor may contribute to memory problems for the event in healthy participants.

It has been suggested that an abnormal biological response to a trauma may impair information processing (Ehring, Ehlers, Cleare, et al., 2008), which could then make memory errors more likely. In a study assessing memory of emotionally arousing and neutral words, non-clinical participants either underwent the CPT or a control task. Stressed participants were split based on those who exhibited a cortisol response, and those who did not. It was found that the cortisol responders recalled significantly fewer words than non-responders or controls, with the effect being particularly pronounced for the emotionally arousing words (Buchanan et al., 2006).

Further, imaging studies have found that participants who were cortisol responders for a psychosocial stressor experienced a deactivation of the hippocampus during the stress response. Additionally, this hippocampal deactivation appeared to occur on a continuum, with greater

deactivation being associated with higher cortisol levels (Pruessner et al., 2008). Extending this finding, cortisol responders with deactivation of the hippocampus also performed worse on a recognition memory test (Khalili-Mahani et al., 2010). As the hippocampus is thought to be involved in the consolidation of short-term memory into long-term explicit memory (see Sapolsky, 2000, for a review), these findings indicate an underlying neural mechanism for acute memory deficits in cortisol responders. In another study however, high levels of cortisol were found to improve recall of emotionally relevant information and consolidate long term memory (Abercrombie, Kalin, Thurow, Rosenkranz, & Davidson, 2003). These mixed findings parallel those in the literature regarding subjective distress and whether it enhances or decreases accuracy for that event.

With regards to the effects of cortisol on false memory development, minimal research has been conducted and the findings are somewhat mixed. In one study participants received synthetic cortisol (through intravenous infusion) seven hours following learning of a DRM-like task (using shapes instead of words). Participants were then tested for false memory retrieval while the infusion was continuing. It was found that cortisol reduced susceptibility to false recognition of shapes, but also reduced accuracy (Diekelmann, Wilhelm, Wagner, & Born, 2011). In another study participants underwent the TSST and then completed the DRM task. Correct recall was impaired in the stress group, however cortisol response was not significantly related to false recall or recognition (Smeets, Jelicic, & Merckelbach, 2006). In another study it was investigated whether cortisol release at different time points would affect memory on the DRM. Participants were exposed to the CPT before encoding, during consolidation, before retrieval, or were not stressed and then completed the DRM with neutral and emotional word lists. Recall was assessed 24 hours later: cortisol enhanced true memory in the consolidation

group but led to worse accuracy in the retrieval group. Cortisol did not appear to be related to false recall for either neutral or emotional words (Smeets, Otgaar, Candel, & Wolf, 2008).

Although the above findings have been useful in elucidating the role of cortisol in different aspects of false memory such as encoding, consolidation and retrieval, there are some methodological issues with these studies. The stress-inducing task in Smeets et al., (2008) was a physical stressor only (the CPT), Smeets et al., (2006) used a social stressor (the TSST) and in Diekelmann et al. (2011) synthetic cortisol was administered to participants. Additionally the timing of the cortisol manipulation was not at the time of the to-be-remembered event, which poses some problems with ecological validity. Specifically, false memories were not tested for the stressful task, but rather for a different task administered at a different time. The abovementioned methods of inducing cortisol release do not adequately emulate the real life situation where people are tested on their memory for the traumatising event they experienced. Although having the to-be-remembered event occur at the same time as the stressor complicates the picture, as investigators may not be able to easily determine at which point (encoding, consolidation, retrieval) cortisol influences memory, especially as the distress may continue beyond the event. However such a method is necessary to be able to make predictions about false memories for real events.

To date, only one study fulfils this criterion: children aged 3-16 who were involved in investigations of abuse and neglect underwent an anogenital exam and venopuncture, both of which were thought to increase stress. Cortisol and dissociation were measured. Children then completed a questionnaire about the event, with some questions being misleading in nature. Findings suggested children who produced stronger cortisol responses and exhibited greater dissociative were more likely to produce false memories regarding the event (Eisen, Goodman,

Qin, Davis, & Crayton, 2007). Older age was also a significant predictor of increased accuracy (Eisen et al., 2007). Some important questions remain unanswered, however. Previous research has demonstrated differential cortisol response to stress in children versus adults (Delahanty et al., 2005; Delahanty et al., 2000). It is still uncertain, then, whether similar results to the Eisen et al., (2007) study would be observed in adults. Additionally, the highly dissociative children in the Eisen et al., (2007) study were traumatised prior to the study, meaning prospective predictions are difficult regarding trait dissociation prior to distress.

Few studies have looked at the role of cortisol in contributing to dissociative symptoms and in turn contributing to poor memories for a stressful event in a non-clinical population, as they have usually been for people with disorders such as depression or PTSD, or using military populations that are choosing to participate in a stressful task such as survival training. Furthermore, research on how these variables in combination contribute to *false* memories in adults is even rarer (no study is known at the time of writing). Therefore, one of the aims of this thesis is to investigate whether increased cortisol levels following a stressful event affect the likelihood of accepting misinformation for that event.

### Summary of Background Chapters

These first three chapters have reviewed the current state of knowledge concerning false memories and distress. Several methods and theories in the literature were identified; however it was argued that so far little research has considered individual susceptibility to false memories for stimuli of different emotional valence. Further, research into false memories in traumatised populations has been limited by the difficulty in assessing pre-existing vulnerabilities, necessitating the use of trauma film studies. The current chapter highlighted that

different psychological responses to distress should be investigated, as they may differentially affect false memory susceptibility. These different psychological responses may be in line with, or incongruent with, how the biological stress response impacts memory. These gaps in the literature have thus informed the design of the experiments conducted in the following chapters.

It is the overall aim of the experiments in this thesis to investigate several key factors that may contribute to false memories for distressing events, namely psychological distress symptoms such as avoidance, intrusions, and dissociation, and also the biological measure of cortisol release. However, within this overarching aim are several secondary aims exploring methodological and theoretical debates in the literature. The first aim is to investigate accurate and false memories for neutral and distressing stimuli. This will aim be examined in all four experiments. The second aim is to compare the DRM task to the misinformation effect procedure. The DRM task will be employed in Experiment One, the misinformation task in Experiment Two, and then both will be directly compared in Experiment Three. The third aim of this thesis is to compare subjective and objective distress levels. Thus in Experiment Four, cortisol samples will be taken alongside psychological measures of distress. Across all experiments the overarching aim will be investigated alongside the relevant secondary aims.

## CHAPTER FOUR

### Experiment One: Individual Differences in Susceptibility to False Memories for Neutral and Trauma-Related Words.

An article based on the results presented in this chapter has been published in a peer-reviewed journal (Monds, Paterson, Kemp, & Bryant, 2012). As discussed in Chapter One, the Deese-Roediger-McDermott (DRM) paradigm is a robust method of inducing false recall and recognition. Additionally, in Chapter Three it was demonstrated that there are mixed findings and competing theories regarding false memory susceptibility for stimuli of different emotional valence. Concerns have been raised regarding the fact that few studies have investigated individual susceptibility to false memories on the DRM task in relation to distressing stimuli (Dalenberg et al., 2012). Thus, as the first experiment of this thesis, this study was designed with an exploratory purpose: to investigate which individual differences would impact false memory susceptibility for trauma (in comparison to neutral) stimuli.

As highlighted in Chapter Three, dissociation is an individual difference predictor that may influence false memory susceptibility for the DRM procedure. People who dissociate may be less confident about their recollections (Eisen, Morgan, et al., 2002) and more prone to making source-monitoring errors. Further, although research has previously investigated the role of dissociation in response to the DRM task, findings have ranged from a positive association, no significant association, and even to a negative association with false memories (see Dalenberg et al., 2012, for a review). The primary trait measure of dissociation (the DES) has been employed in both clinical and non-clinical populations. However the use of the DES in non-clinical populations has been critiqued due to the likelihood of producing floor effects (Wright & Loftus, 1999). Therefore, it is important to determine how an alternative version

designed to counteract these effects (the DES-C) would impact results in relation to the DRM task. Further, based on DES factor analysis results suggesting three subtypes of dissociation, amnesia, depersonalisation/derealisation, and absorption (Stockdale et al., 2002), it is worth considering whether these aspects impact memory in different ways.

Another individual difference factor was also investigated based on its potential to predict false recall and recognition: cognitive biases. It was anticipated that cognitive biases may be related to both dissociation and false memory development. As such a brief description of this factor follows.

### *Schemas and Biases*

Schemas are mental frameworks regarding specific concepts, and are considered to help organise information (Baron & Byrne, 2003). They influence attention, encoding, and retrieval, but can create a tendency to distort information leading to persistent biases and stereotypes (Baron & Byrne, 2003). People may be more likely to take on false memories related to their biases (e.g., Wiseman, Greening, & Smith, 2003), due to an increased accessibility of these concepts and an inability to suppress them. This could lead to difficulties determining whether stimuli were imagined or viewed (i.e., problems in source-monitoring; e.g., Joormann et al., 2009).

Of relevance to this study is a cognitive bias towards threat known as the Looming Cognitive Style (LCS). The LCS involves perceptions of rapidly evolving threat and escalating urgency (Riskind, Williams, Gessner, Chrosniak, & Cortina, 2000). People with LCS tend to exaggerate the extent to which feared stimuli are advancing, changing, or moving towards them. This framework emphasises the dynamic nature of psychologically threatening situations,

and led to the development of the Looming Maladaptive Style Questionnaire (LMSQ; Riskind et al.); which assesses to main threatening themes: physical danger (such as the possibility of being injured in a car accident) and social danger (such as being rejected by a group of peers).

People with this bias often employ avoidance as a coping method (Elwood, Hahn, Olatunji, & Williams, 2009), which could prevent extensive processing of threatening material and produce source-monitoring errors. This may lead to an increase in false recall for threat stimuli. The only study so far using the DRM to look at the LCS found that while high type I worry (avoidant form of worry which transforms anxiety provoking mental images to words) was associated with vulnerability to false memories overall; participants with high LCS had a lower rate of false memories for threat, specifically for people who were high in metaworry (worry about worry; Consolla, 2006). The author explained their unexpected findings by suggesting that participants may have had more of an external focus looking for threat, and hence noticed the presence or absence of particular words. As the study had some unexpected results, it would be interesting to explore this area further. This research has interesting applications for the study of threat-related biases and a predisposition to negative outcomes following trauma, but especially also with regard to the generation of false memories surrounding such an event.

Cognitive schemas surrounding traumatic events potentially serve to enhance or inhibit recovery from a trauma (Regehr, Hill, & Glancy, 2000), as well as increase susceptibility to false memories for such stimuli. Potentially problematic cognitive schemas include: the self as incompetent to cope with threat, self-blame, and viewing the world as dangerous (Ehlers & Clark, 2000; Foa, Ehlers, Clark, Tolin, & Orsillo, 1999). Using a short version of the Post Traumatic Cognitions Inventory (PTCI; Foa et al., 1999) which assesses these three schemas,



one study identified participants as either being at high risk or low risk for negative evaluations of intrusions (Wilksch & Nixon, 2010). These participants were then exposed to a distressing film. It was found that those participants who were in the high risk category experienced a greater frequency of intrusions following the film (Wilksch & Nixon, 2010). Therefore these schemas may be useful for predicting poorer outcomes following trauma exposure.

### *Cognitive Biases and Dissociation*

Cognitive bias accounts and dissociative accounts of memory for traumatic events are somewhat contradictory. According to dissociative theories people are paying *less* attention (either through heightened distraction or purposeful avoidance) to stressful stimuli and therefore cannot properly process the event. Uncertainty over whether events were imagined or experienced (a source monitoring error) in people who dissociate may lead to a susceptibility to false memories. According to cognitive bias research however, people with particular schemas may pay *more* attention to threatening parts of the event and interpret it in a more threatening way. This could invoke false memories due to source monitoring errors from difficulty suppressing related concepts. Or, as based on the results of Consolla (2006), paying more attention to a stimulus may decrease false memory susceptibility. It is also possible that people who dissociate have an initial subconscious hypervigilance to threat based on cognitive biases, and employ dissociation as a coping strategy (e.g., Dorahy, 2006; Ehlers & Clark, 2000).

### *The Current Study*

In this study neutral and trauma word lists were compared on the DRM task, and dissociation and cognitive biases scales were included as predictors of false memory

susceptibility. It is thought this study adds to the current literature in several ways. Firstly, it contributes to the debate on how emotion affects both accurate and false memories by using the DRM with trauma words and neutral words in a non-clinical population. Further, dissociation has mostly been studied in relation to the DRM for neutral words only. However, based on suggestions that dissociation is an avoidance response to distressing information, the trauma lists may help demonstrate this and explain previous null findings with neutral lists. The DES-C was designed to counteract floor effects in non-clinical populations, and therefore may be a more appropriate measure for the student population employed in this study. Using the DES-C may also serve to explain previous null findings with the skewed DES in student populations.

Additionally, only considering the DES as a whole scale may lead to missing separate relationships between the different factors of the scale with the memory measures. Lastly, this study is only the second that uses the LCS measure in relation to the DRM, and the first study to investigate the three abovementioned schemas in relation to false memories. The results of this study will therefore contribute to others emphasising the importance of assessing individual differences to predict false memories, particularly for distressing stimuli.

### *Study Aims and Hypotheses*

Based on the mixed findings in the DRM literature regarding the role of neutral and negative stimuli in producing false memories, it was of interest in this study to investigate this further. According to the ABC hypothesis (detailed in the previous chapter) memory for stimuli of different valence will not differ when arousal levels are held constant (Mather & Sutherland, 2011), however others have suggested that valence effects may still emerge (Storbeck & Clore, 2011). Therefore in this experiment trauma-related and neutral word lists are compared with

equal arousal ratings; however due to conflicting findings in the literature, no specific hypotheses were generated.

Another aim of this study was to investigate the relationship between the individual difference areas (dissociation and cognitive biases) and false memories for neutral and trauma-related word lists. It was expected that dissociation, post-traumatic cognitions, and the Looming Cognitive Style (LCS), would predict susceptibility to false recall and recognition of critical lures (CL) – words not presented but strongly related to those in the list. It was also thought that since both dissociation and cognitive biases may have some particular involvement in response to traumatic situations, they may be particularly effective in eliciting false memories for more traumatic stimuli (over neutral). However, again based on conflicting findings in the literature for dissociation, and the lack of research into threat-related biases, it is also possible that different or non-significant relationships may emerge. Further, based on the overlap the cognitive biases may share with anxiety (e.g., Riskind, Rector, & Cassin, 2011) and depression (e.g., Foa et al., 1999), both concepts were also included for exploratory purposes.

It is possible that the three abovementioned post-traumatic cognitions may affect memory differently: for example, viewing the self as incompetent to deal with threat may lead to disengagement from threatening information and reduced encoding of stimuli. This negative view of the self concept and self blame on the other hand may induce a sad mood similar to that felt in depression; as depression has been found to enhance susceptibility to false recall of negative DRM lures (Joormann et al., 2009), these schemas could produce similar results. Finally, viewing the world as dangerous could prompt external focus similar to those people

who employ the LCS. As such participants who employ this schema could exhibit enhanced memory accuracy, or could experience avoidance and fail to encode the stimuli.

## Method

### *Participants*

Undergraduate Psychology students (N = 109, 34 male) from the University of Sydney participated for credit. The mean age was 19.42 years ( $SD = 1.67$ ; Range 18 – 28). Participants were tested in groups of 2 – 12. Participation was voluntary and conducted following informed consent.

### *Materials*

#### *Dissociation.*

The Dissociative Experiences Scale - Comparative (DES-C; Cronbach's  $\alpha = .95$ ) consists of 28 statements each with an 11-point response scale, with ranging from 0 (*much less than others*) to 10 (*much more than others*). Higher scores indicate more self-reported dissociative experiences. Based on the factor analysis of Stockdale et al., (2002) the DES can also be split into three subscales: depersonalisation/derealisation (six items; Cronbach's  $\alpha = .86$ ), absorption (16 items; Cronbach's  $\alpha = .91$ ), and amnesia (six items; Cronbach's  $\alpha = .81$ ).

#### *Cognitive Biases.*

The Posttraumatic Cognitions Inventory (PTCI; Foa et al., 1999) consists of 36 items responded to on a 7-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*), with higher scores indicating stronger endorsement of negative cognitions surrounding a personal event perceived as traumatic. The subscales in the PTCI are the self-as-incompetent subscale

(Cronbach's  $\alpha = .95$ ); the world is dangerous subscale (Cronbach's  $\alpha = .91$ ); and the self-blame subscale (Cronbach's  $\alpha = .81$ ). The following instructions were given to participants to clarify what can be considered a trauma for the PTCI: "We are interested in the kind of thoughts which you may have had after one particular traumatic experience. What counts as a traumatic experience can be different for each person (examples include an accident or injury, the end of a relationship, witnessing or being a victim of a crime, a large scale disaster, etc). Below are a number of statements that may or may not be representative of your thinking. Please read each statement carefully and tell us how much you AGREE or DISAGREE with each statement by clicking the appropriate option. People react to traumatic events in many different ways. There are no right or wrong answers to these statements."

The Looming Maladaptive Style Questionnaire – Revised (LMSQ-R; Riskind, 1997, Cronbach's  $\alpha = .91$ ) consists of six scenarios (three physical threat and three social), with four questions per scenario. Responses were on a 5-point Likert scale (that changed depending on the question), with higher scores indicating a higher tendency to employ the LCS.

#### *Depression and anxiety.*

The Beck Depression Inventory – II (BDI-II; Beck, Steer, Ball, & Ranieri, 1996, Cronbach's  $\alpha = .93$ ) and Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988; Cronbach's  $\alpha = .90$ ) were also employed. Both are 21 items long. The BDI-II has a 4-point scale (that changes depending on the question). The BAI is responded to on a 4-point scale (ranging from 0 = *not bothered at all* by particular anxiety symptoms to 4 = *bothered severely*). Higher scores reflect higher levels of depression/dysphoria, and anxiety, respectively.

#### *Other.*

Demographics such as age and gender were recorded. Several other questionnaires

unrelated to the hypotheses were added to the battery, to help disguise the purpose of the study. These questionnaires included the Ten-Item Personality Measure (TIPI; Gosling, Rentfrow, & Swann, 2003), the Brief Fear of Negative Evaluation Scale (BFNE; Watson & Friend, 1969), and the Social Desirability Scale (SD; Crowne & Marlowe, 1960). Additionally, the Tellegen Absorption Scale (TAS; Tellegen & Atkinson, 1974) was included with the expectation that absorption would be related to dissociation and memory; due to non-significant correlations with the dependent variables of interest however, the scores on this scale was not considered further.

#### *DRM.*

Twelve lists of ten words were generated (see Appendix A), with six lists of trauma-related words (e.g., cut, assault, beaten; adapted from Brennen et al., 2007, English translation; and Moulds, 2002), and six neutral word lists (e.g., shoe, hill, postman from Brennen et al., 2007, and Stadler, Roediger, & McDermott, 1999). Each word was projected individually onto a screen for two seconds. Display of lists was alternated. Based on the standardised Affective Norms for English Words database (Bradley & Lang, 1999), and a pilot study for two words not present in the database, the trauma CLs were significantly more negatively valenced than the neutral CLs,  $t(10) = 6.28, p < .001$ , but just missed significance regarding arousal ratings,  $t(10) = 2.14, p = .06$ .

As mentioned in Chapter One, since backwards associative strength (BAS) has been suggested to be a key factor in CL recall and recognition (e.g., Knott et al., 2012; Roediger et al., 2001), a pilot study was conducted using a separate sample to calculate the mean BAS of the lures to determine whether this may influence results (see Appendix B). Results of the pilot suggested that the word list types did not significantly differ with regard to mean BAS,  $t(10) =$

0.01,  $p > .99$ . This means any observed differences in the predictors will not be due to differences in BAS, and may not be related to arousal, but rather the valence of the word list types. As such BAS and arousal will not be included in further analyses. Participants completed the free recall (FR) questionnaire via computer. Each FR list was scored for accuracy, CLs (target word not shown) and confabulations (words not shown, not the target word but spontaneously produced by participants).

### *Procedure*

The participants in this study were informed that they were participating in “A study of life experiences, personality, and recall”, and were unaware of the real purpose. Participants were asked to pay close attention to the words presented to them since after each list they would be asked to recall the words. After the first list had been shown participants had one minute to type as many of the list words as they could remember on the computer. They were instructed to only type items that they were reasonably sure they saw.

Following the one minute, the next list was shown, and so on, until all 12 word lists had been displayed. Participants then completed the questionnaires on their computer in the following order: Demographics, TIPI, DES-C, BFNE, PTCI, BAI, LMSQ, BDI-II, TAS, and SD, with a manipulation check at the end of the experiment asking what participants thought the purpose of the study was. The total time to complete the experiment was approximately 60 minutes, and participants were debriefed at the end.

## Results

Analyses were based around three questions: Firstly, were accurate and false memories related to the valence of the word lists? Secondly, how do dissociation and cognitive biases relate? Thirdly, how do they influence memory or valence effects? Three participants were excluded from analyses by scoring over three standard deviations above the mean on several measures (Osborne & Overbay, 2004); and one participant provided incomplete data, however their results were included for completed sections.

### *Memory*

Three measures of recall were calculated:

- 1) Accuracy (total score of words recalled that were present in the lists)
- 2) Critical Lures (total score of target words recalled not present in the lists)
- 3) Confabulations (total score of words recalled not present in the list and not the target word)

Participants correctly recalled an average of 82.79 (out of 120;  $SD = 9.61$ ) of the words studied. Participants recalled significantly fewer neutral ( $M = 40.07$ , out of 60;  $SD = 5.58$ ) than trauma words ( $M = 42.72$ ,  $SD = 5.54$ ),  $t(108) = 4.97$ ,  $p < .001$ . Participants reported on average 1.05 CLs (out of 12,  $SD = 1.12$ ), with 63.3% of participants reporting at least one CL overall. Participants reported significantly more neutral ( $M = 0.66$ ,  $SD = 0.85$ ) than trauma CLs ( $M = 0.39$ ,  $SD = 0.58$ ),  $t(108) = 3.11$ ,  $p = .002$ . The main contributor towards this difference was high reporting of one neutral CL. Excluding 'letter', led to non-significant differences between neutral and trauma CL recall,  $t(108) = 0.93$ ,  $p = .43$ . However excluding this word list did not



considerably change the results of further CL analyses, so results are reported with ‘letter’ still included.

Participants on average made 1.42 confabulations overall ( $SD = 1.42$ ), with 73.4% of participants making at least one confabulatory response. Participants made an average of 0.65 confabulations for neutral word lists ( $SD = 0.87$ ), and 0.77 confabulations for trauma word lists ( $SD = 1.00$ ), with no differences in confabulations for the two list types,  $t(108) = 0.97, p = .33$ .

### *Scales*

See Table 1 for mean answer scores on the PTCI subscales and the LMSQ-R, and mean total scores on the BAI, BDI-II, and DES-C.

*Table 1. Descriptive statistics for PTCI subscales, LMSQ-R, BAI, BDI-II and DES-C*

	Mean	SD	N
PTCI – Self	2.21	1.15	109
PTCI – World	3.41	1.56	109
PTCI – Blame	2.86	1.40	109
LMSQ-R	3.17	0.65	107
BAI	12.18	9.53	108
BDI-II	14.99	9.81	109
DES-C – total	36.93	14.20	109

Pearson correlation analyses indicated that all PTCI subscales were highly correlated with each other; the PTCI self-subscale was also highly correlated with all other scales, the

world-subscale correlated positively with the BAI, BDI-II and the DES-C but not the LMSQ. The blame-subscale correlated with the BDI-II and the DES-C only. The LMSQ correlated with the DES-C negatively. The BAI and BDI-II positively correlated with each other, however only the BDI-II correlated positively with the DES-C. Due to non-significant correlations with the dependent variables, and extremely high correlations with some independent variables (causing issues with multicollinearity), the BDI-II and BAI were excluded from subsequent analyses and will not be discussed further in the results (see Table 2).

*Table 2. Correlations between the PTCI, LMSQ-R, BAI, BDI-II and DES-C*

	PTCI-Self	PTCI-World	PTCI-Blame	LMSQ-R	BAI	BDI-II	DES-C
PTCI-Self	1	<b>.64**</b>	<b>.54**</b>	<b>.28**</b>	<b>.53**</b>	<b>.80**</b>	<b>.27**</b>
PTCI-World		1	<b>.41**</b>	.18	<b>.45**</b>	<b>.62**</b>	<b>.27**</b>
PTCI-Blame			1	.14	.16	<b>.28**</b>	<b>.25*</b>
LMSQ-R				1	<b>.36**</b>	<b>.32**</b>	<b>-.20*</b>
BAI					1	<b>.55**</b>	.15
BDI-II						1	<b>.19*</b>
DES-C							1

\* $p < .05$ ; \*\* $p < .01$

### *Memory and Individual Differences*

Accuracy for neutral words and accuracy for trauma words were regressed on the DES-C, the PTCI subscales, and the LMSQ-R respectively, using simultaneous multiple regression

analysis. Neither model was found to be significant. A regression was conducted for neutral CL recall, however was not significant. The regression model for trauma lures was significant; the only significant predictor in the model was the DES-C. To determine whether splitting the DES-C into the subscales would better explain the results, a further regression was conducted for trauma lures (with the PTCI subscales, LMSQ-R and DES-C subscales), and this model was found to be significant, with the absorption subscale emerging as a significant positive predictor.

Confabulation scores for neutral and trauma lists were simultaneously regressed on the DES-C, the PTCI subscales, and the LMSQ-R. The neutral confabulation regression was not significant, with no variable emerging as a significant predictor. For trauma list confabulations, although the model was not significant, the LMSQ-R emerged as a significant predictor, suggesting a positive relationship with confabulations, the PTCI-Self scale just missed significance, suggesting a negative association with confabulations, and the DES-C also just missed significance, with a positive relationship with confabulations. To determine whether splitting the DES-C into the subscales would better explain the results, a further regression was conducted for trauma confabulations, but this model was not significant and no DES-C subscale was a significant predictor. See Table 3 for regression results and Appendix C for the analyses with the DES-C subscales.

Table 3. Predictors of Free Recall Accuracy, Critical Lure Recall, and Confabulations

Variable	Neutral	Trauma	Neutral	Trauma	Neutral	Trauma
	Accuracy	Accuracy	Lure	Lure	Confabulation	Confabulation
	$\beta$	$\beta$	$\beta$	$\beta$	$\beta$	$\beta$
DES-C	.06	.10	.13	<b>.24*</b>	-.03	<b>.20†</b>
PTCI - Self	.15	.05	-.06	-.03	.06	<b>-.27†</b>
PTCI - World	-.14	-.18	.16	.08	.10	.14
PTCI - Blame	.01	-.08	.07	.13	.11	-.01
LMSQ	-.13	-.19	.06	.07	.00	<b>.21*</b>
R <sup>2</sup>	.04	.09	.05	.10	.05	.08
F(5,101)	0.74	2.05	1.18	<b>2.34*</b>	.95	1.68

\* $p < .05$ ; \*\* $p < .01$ ; † $p < .061$

## Discussion

As the first experiment of this thesis, this was an exploratory study with the aim to assess recall memory for stimuli of different valence, particularly neutral and trauma-related word lists on the DRM. Of particular interest was the investigation of which individual differences would impact false memory susceptibility for neutral and distressing stimuli. The results highlight the importance of using stimuli of differing emotional valence, as the individual factors studied were found to influence memory differently depending on whether the stimuli were negative (trauma-related) or neutral.

## *Memory*

More trauma words were accurately recalled overall in comparison to neutral words. The recall finding is in accordance with other studies, where greater accuracy was observed for negative over neutral stimuli (Budson et al., 2006; Porter & Peace, 2007). It was found that the valence of the word lists did not appear to be significantly related to increases *or* decreases in false memories, which is in line with the findings of Budson et al., (2006), but not others (e.g., Dehon et al., 2010). Additionally, as arousal levels were not significantly different when comparing the neutral and trauma-related word lists, this supports the argument of the ABC theory that suggests that when arousal levels are the same, emotional valence will not differentially affect memory (Mather & Sutherland, 2011); however, as the arousal differences between the two list types just missed significance ( $p=.06$ ) arousal may have still impacted results.

However, Dehon et al., (2010) in their study controlled for arousal levels and still found increased false memories for the emotional lists (both positive and negative; see also Storbeck & Clore, 2011). Differences in word lists used across studies may potentially account for the discrepant findings, as well as display times of each word. For example, in the present study each word was displayed for 2000ms, Budson et al., (2006) had words displayed for 2600ms, whereas Dehon et al., (2010) only showed each word for 1500ms. It has been found previously that false recall declines with increasing stimulus presentation (McDermott & Watson, 2001). It may therefore be the case that a shorter presentation time allows for differential effects between list-types to emerge. As this is a very tentative suggestion, further research is required to determine whether this is the case.

### *Individual Difference Measures*

In this study it was also of interest to examine how the variables of interest, dissociation and cognitive biases, would correlate. As both dissociation and cognitive biases may be related to threat, it was hypothesised that they would also be strongly related to each other. While dissociation was found to be significantly positively correlated with the post-traumatic cognitions measures, the LCS was significantly negatively correlated with dissociation. According to the trauma theory of dissociation, dissociative symptoms are a response to traumatic distress (Bremner, 2010), therefore it is perhaps not surprising that there is an association with post-traumatic cognitions. Expecting the world to be a dangerous place, along with a bias towards having insufficient resources to cope with a distressing event may lead to an initial hypervigilance for threat in the environment (Foa et al., 1999). In the face of an actual (or perceived) threat people may initially direct attention towards the distressing stimulus, so as to then mount a dissociative response as a mechanism of coping (Dorahy, 2006).

Less comprehensible though, is why there might be a negative relationship between dissociation and the LCS. People with a propensity to employ the LCS are thought to have a highly active threat schema, searching the environment for potentially harmful situations; in contrast, dissociation involves a detachment from reality, with less attention paid to surroundings. It seems possible then that highly dissociative people are unlikely to be paying close attention to the external environment, and therefore unlikely to score highly on measures referring to cognitive appraisals of threat for external situations (Riskind et al., 2000).

People with a bias towards viewing threatening objects as looming may experience more extensive and severe reactions to trauma (Elwood et al., 2009). As the PTCI investigates reactions to an event perceived as traumatic, it was expected that high scorers would also score

highly on the LCS measure. However, only the self-subscale of the PTCI was correlated with the LMSQ-R, and not the blame- or world-subcales. The PTCI items largely relate to cognitions surrounding a previous traumatic event. The LMSQ-R however, primarily investigates perceptions of potential future threat. The LMSQ-R also includes questions involving social rejection, which may explain the correlation with the self-subscale. Therefore, while it is clear the variables tested in this study do relate to each other, exactly how this relationship plays out in the face of a distressing event is still unclear.

### *Memory and Individual Differences*

The relationship between the two individual difference areas of interest (dissociation and cognitive biases) and false memories for neutral and traumatic word lists was also assessed. It was predicted that both dissociation and cognitive biases would be associated with higher false recall, especially for traumatic stimuli. Dissociation was related to increased false recall of traumatic, but not neutral lures. This finding is in contrast to another study where non-significant correlations between the DES and neutral and trauma lures were observed (Geraerts et al., 2005). These differences may be accounted for by study differences, including the fact that Geraerts et al., (2005) tested only female participants, some of whom were assault victims, and used the DES instead of the non-clinical version DES-C. According to the fantasy model of dissociation, dissociation primarily involves a tendency towards distraction (Giesbrecht et al., 2008), or a lack of cognitive efficiency (Merckelbach et al., 2000). If dissociation is primarily a characteristic of distractibility then we might predict that measures of dissociation should be correlated with measures of false recall of neutral *and* traumatic lures. This was not found to be the case in the present study.

Upon further analysis it was found that the absorption subscale of the DES-C in particular was related to trauma lure recall. Absorption has been described as being fully engaged in and paying total attention to the internal environment (such as thoughts and imagery), to the point where the individual has disconnected from their surroundings (Tellegen & Atkinson, 1974; Waller, Putnam, & Carlson, 1996). This result is surprising considering the Tellegen Absorption Scale (Tellegen & Atkinson, 1974) was also initially included in the study and found to be unrelated to any variable of interest. Dissociative absorption has been suggested to be a form of cognitive avoidance as a way of creating distance between the individual and their (past or current) experiences (Carlson, 1997; as cited in Eisen & Carlson, 1998). Therefore one possible explanation regarding why dissociation was only related to false recall of trauma lures (and not neutral) invokes the concept of dissociation as an avoidance strategy employed to disengage from threatening concepts (Bremner, 2010). Further, as absorption is often considered a non-pathological form of dissociation (Holmes et al., 2005), it is understandable that this feature of dissociation would be most prominently related to false memory in a non-clinical sample.

The activation-monitoring account (see McDermott & Watson, 2001) would suggest strong associations between the list items and the CL result in the word being triggered, but then due to inadequate source monitoring (perhaps due to absorption as an attempt to avoid thinking about the negative stimuli) the participant is unable to realise the lure was not part of the original list and subsequently reports the CL during the recall task. This finding may have important practical implications regarding the possibility that highly dissociative people may be more susceptible to false memories for threatening information; however, being a word list task it is important to demonstrate similar results with a more complex and distressing task.



The LCS measure (the LMSQ-R) was not significantly related to false recall of the CLs. This finding is not consistent with Consolla (2006), where participants who scored high on the LMSQ-R had fewer false memories for negative CLs than other participants. These findings would suggest that the LCS is not a vulnerability factor for false recall for threatening stimuli; however, in the current study the LCS was significantly positively associated with confabulatory responding for trauma word lists. Confabulations (or commission errors) can also be considered false memories. A possible explanation for this finding is that people who employed the LCS failed to encode the trauma stimuli (due to external focus on threat) and as a consequence did not make the associations between the word lists and the CLs. However, this failure to encode then led to increased confabulation errors for the recall task. As only two studies have considered the LCS in relation to the DRM, and different results were observed, it is important that future studies extend these findings.

The expectation that post-traumatic cognitions would be significantly related to an increase in false recall was not supported. Interestingly however, the self-subscale of the PTCI was negatively associated with confabulations for the trauma-lists (although just missed significance). Perhaps the self-subscale produces closer focus on trauma material (and therefore fewer confabulations). As very little research has been conducted on trauma cognitions and memory, it would be useful to further assess this relationship with more upsetting stimuli. As the current study did not have a clinical population, it is assumed most participants did not have PTSD. However the PTCI does include questions regarding an event the participant found traumatic. Therefore while biases towards threat may to some extent prevent false memory development for trauma material, this over-focus on negative concepts may still prevent adequate recovery from a traumatic event (Regehr et al., 2000).

### *Limitations, Future Directions and Conclusion*

The variances explained in the regressions were quite modest – it is therefore important to conduct further studies including other variables to gain a fuller picture of what makes an individual more or less susceptible to false memories. One possibility includes cognitive failures, as this has been previously implicated (Giesbrecht et al., 2008). Further, CL reporting appeared quite low, with an average of one out of 12 lures being recalled; however over 60% of participants recalled at least one CL. Furthermore, the means observed are quite similar to those reported elsewhere using non-clinical populations (e.g., Dehon et al., 2008), so the task appears to have been successful in producing at least one false memory in a majority of participants.

An additional limitation of the present study relates to the fact that ratings were not taken to assess whether participants actually found the trauma word lists threatening. Nonetheless there did appear to be differential effects depending on word list type. This could be addressed in future studies by employing more ecologically valid procedures more similar to a traumatic event, such as showing a stressful film and providing detailed misinformation (e.g., Devilly, Varker, et al., 2007).

In conclusion, the results revealed that differential valence effects were observed with regard to accuracy; however no valence effects were observed for false recall. Dissociation was significantly related to false recall for trauma-related words but not neutral words. The LCS was related to an increase in confabulations. The results of this study have highlighted the importance of assessing individual differences for susceptibility to false memories for stimuli of different valence. These findings have also built on previous research suggesting that susceptibility to false memories may be related to dissociative tendencies.

## CHAPTER FIVE

### Experiment Two: False Memories in the Trauma Film Paradigm: Distress, Dissociation, and Cognitive Failures as Vulnerability Factors.

An article based on the experiment in this chapter is published in the *Journal of Trauma and Dissociation* (Monds, Paterson, Kemp, & Bryant, 2013). In the previous chapter it was found that dissociation was significantly related to false recall for trauma-related, but not neutral word lists in the DRM task. However, as previous researchers have raised concerns regarding the use of the DRM word list task to investigate false memory susceptibility (Freyd & Gleaves, 1996; Pezdek & Lam, 2007), it is important to consider more ecologically valid methods in relation to false memories for a distressing event.

In the present study, dissociation was explored further by employing a method expected to produce higher distress levels than the DRM: the Trauma Film Paradigm (TFP). As detailed in Chapter Two, the TFP has been used to assess outcomes such as intrusions, memory accuracy and false memories following film viewing. In one study, viewing a trauma film was found to increase intrusions as assessed in a diary, however the intrusions were not found to be related to memory accuracy (Holmes et al., 2004). In another study it was found that false memories for a trauma film could be induced by a confederate (Deville, Varker, et al., 2007); however whether this was related to any pre-existing vulnerabilities was not assessed.

In a study by Giesbrecht, Geraerts, et al., (2007) dissociation was assessed in response to a violent video fragment. Dissociation (as measured by the DES) was found to be related to an increase in confabulations - details not in the film that were mentioned spontaneously by participants, termed by the authors as commission errors (Giesbrecht, Geraerts, et al., 2007). As an undergraduate population was used, it is also important to consider whether the non-clinical

version of the DES (the DES-C) would be a more appropriate measure of dissociation. Further, although in this study skin conductance was used to objectively assess distress, participants were not asked whether they experienced intrusions or avoidance in response to the film. Another concern is that the video fragment used was from a fictional movie (American History X). This method may have issues with ecological validity, as participants may have seen the film previously (and therefore may have been desensitised to the violence depicted) and they may also have experienced less distress due to being aware the people involved were actors (although it should be noted that in other studies fictional movies have been used to successfully induce negative emotions).

### *The Current Study*

In an attempt to extend the findings of Giesbrecht, Geraerts, et al., (2007), the current study includes a film that involves a real event. Additionally, while confabulations are an ecologically valid way to index false memory development, these spontaneous errors are often quite varied and low in number. It was therefore decided that the method to be used for the current study was a written summary with misinformation included. Further, while experiments have been conducted using a trauma film to assess intrusions and memory accuracy, at present it appears no neutral film has been included for a comparison. This addition in the current study allows for the TFP literature to be linked with the emotional memory literature and the debate on whether distress enhances or worsens memory for that event.

Intrusive symptoms have been investigated extensively in relation to the TFP, however, avoidance symptoms have been somewhat neglected. As avoidance of reminders of the trauma film is proposed to differentially affect memory in comparison to intrusions, including an

avoidance assessment is an important addition in this experiment. The suggestion that dissociation is a form of avoidance (e.g., Foa & Riggs, 1995) can also be directly tested, by correlating avoidance reports to state and trait dissociation measures. Lastly, while dissociation has been investigated previously in relation to false memory susceptibility, using intrusions and avoidance responses as potential predictors as well can allow a more comprehensive picture to emerge regarding individual responses to distressing events.

### *Study Aims and Hypotheses*

Memory and correlates of distress responses for a traumatic (car accident) compared to a neutral (fire-fighter training) film were investigated, and the role of individual differences in influencing these responses was examined. It was hypothesised that those participants viewing the trauma film would experience higher levels of distress compared to those viewing the neutral film. Previously, it has been found that distress levels in response to a trauma film can persist for up to one month following viewing (Deville & Annab, 2008); therefore in the current study reports of intrusions and avoidance were collected both immediately following the film and one week later. Additionally, narratives containing misinformation about the films were created, with the expectation that these narratives would be successful in introducing false information into participant's memories of the film. Another aim was to test the Paradoxical Negative Emotion (PNE) theory of memory (Porter et al., 2008), highlighted in Chapter Three, that negative information should increase both accurate and false recall relative to neutral information. Accordingly, it was hypothesised that participants who viewed the trauma film would be both more accurate and more susceptible to the misinformation from the narrative.

A further aim was to investigate the role of both distress and dissociation in influencing memories. As mentioned in Chapter Three, one interpretation of dissociation suggests that cognitive failures may underlie dissociative responses (Giesbrecht et al., 2008). To account for this, the Cognitive Failures Questionnaire (CFQ) was included also. Those who avoid thinking about the film were expected to be less accurate, and more likely to accept false information in the form of a written eyewitness statement. If dissociation is a method of avoidance (e.g., Bremner, 2010), a similar result was expected with regards to memory. In particular it was expected more avoidance/dissociation would occur in response to the distressing, compared to neutral film (in line with the findings of Porter et al., 2008).

If instead dissociation is primarily a form of faulty information processing (e.g., Giesbrecht et al., 2008; Giesbrecht et al., 2010), it could be expected that it would be equally related to memories for both films, and that it would be very similar to results for the cognitive failures measure. It was hypothesised that higher levels of intrusions could relate to greater accuracy, or be related to higher false memories if high intrusions for some aspects inhibit memory for other parts of the event. However as Holmes et al., (2004) did not find any association between intrusions and memory using the trauma film it was also thought possible that no significant effect would be observed.

## Method

### *Participants and group allocation*

There were 109 (27 male) undergraduate Psychology students from the University of Sydney who participated for course credit. The mean age was 19.46 years ( $SD = 2.92$ ). No participants reported having received a diagnosis of PTSD. Inclusion criteria included

proficiency in written and spoken English. There were two groups, those who viewed the neutral film ( $N = 54$ ), and those who viewed the trauma film ( $N = 55$ ). Each group was further split into two conditions, those who received misinformation (neutral  $N = 27$ ; trauma  $N = 26$ ), and no-misinformation control (neutral  $N = 27$ ; trauma  $N = 29$ ). Participants were randomly allocated to each group and condition, and were not significantly different in terms of age or gender (all  $p > .423$ ). Participants were tested in groups of 2–10 but seated at individual computers. Participation was voluntary and conducted following informed consent.

### *Materials*

Participants completed the measures via the internet survey program LimeSurvey (v1.87), and viewed one of the two films on their computer.

#### *Neutral film.*

The film was live footage of a fire-fighter recruit training exercise, filmed in 2007. It involves the rescue of dummy victims, and fire-fighters entering a smoking building to put out a fire. There was a voice-over added at the beginning of the film, which contained some items also mentioned in the voice over of the trauma film (e.g. the date, the name of the officer in charge, etc.; see Appendix D). It is clear from the film and voice over that this was a training exercise, and that nobody was in danger. The film lasts approximately 10 minutes.

#### *Trauma film.*

The film was the same as that shown in another study (Deville, Varker, et al., 2007), however there was also a voice over added at the beginning so there was some overlap of information with the neutral film (see Appendix D). The film follows US emergency service personnel attending the scene of a motor vehicle accident. Most of the film focuses on the

workers assisting four of the victims. It is clear that the victims are in pain and are upset, however their injuries are not overtly apparent (i.e., no blood present). The last minute of the film focuses on the removal of a fatality from the car, including a close up of the deceased's disfigured face. The film lasts approximately 10 minutes.

#### *Narratives.*

After returning a week later, participants were given an 'eyewitness statement' of the film they viewed, under the pretext of reminding them of the event. For each film type, there were two versions of the narratives: one that contained misinformation (details that were different or absent from the film; see Table 4), and one that only had factual details of the film (the same but with the misinformation items removed). Participants only read one narrative (see Appendix D for complete narratives). Narratives were constructed based on the results of a pilot study, where participants viewed the films and wrote everything they remembered from each film. Common aspects of different responses were combined to provide overall statements. Misinformation items were chosen based on common confabulation errors in accounts (e.g., several people confabulated about the injuries sustained in the trauma film), and some misinformation items were taken from Devilly, Varker, et al., (2007; further information on the pilot study available upon request).



*Table 4. Misinformation Items included in the Narratives*

Film Condition	Misinformation Items	Correct Information
Trauma and Neutral	Event occurred on Thursday	Tuesday
Trauma and Neutral	Event occurred in May	March
Trauma and Neutral	Officer in Charge: Chief James Edwards	Chief James Edmonson
Trauma and Neutral	Colour of helmets of emergency services: many white and red	Only one or none of this colour
Trauma and Neutral	A helicopter was seen flying overhead during the event	No helicopter was seen
Trauma only	Un-uniformed man helping wore a brown shirt	Purple shirt
Trauma only	Victim pointed to arm when asked where in pain	Pointed to hip
Trauma only	Deceased victim wore black trousers	Blue jeans
Neutral only	Building on fire was an automotive parts factory	Air conditioner factory
Neutral only	One role of fire-fighters was to check building walls for stability	Columns were checked
Neutral only	Dummy victim rescued was cream/yellow in colour	Dummy was blue/green

## *Measures*

### *Dissociation.*

As in Chapter Four, trait dissociation was measured using the Dissociative Experiences Scale – Comparative (DES-C; Wright & Loftus, 1999; Cronbach's  $\alpha = .94$ ), along with the three subscales, depersonalisation/derealisation (Cronbach's  $\alpha = .86$ ), absorption (Cronbach's  $\alpha = .89$ ) and amnesia (Cronbach's  $\alpha = .79$ ). State dissociation (dissociation during the viewing of the film) was measured using an adapted version of the State Dissociation Questionnaire (SDQ; Murray et al., 2002; Cronbach's  $\alpha = .79$ ), consisting of seven items, with scores ranging from 0 (*Not at all*) and 4 (*Very strongly*). As the original questionnaire asks questions concerning a trauma, and the current study uses the SDQ to assess responses to a film, two items from the original questionnaire were removed: "I felt as if I was separated from my body and was watching it [the event] from outside" and "I felt as if I was living in a dream or film, rather than in real life". Higher scores indicate more self-reported dissociative experiences.

### *Cognitive Failures.*

Cognitive failures were measured using the CFQ (Broadbent et al., 1982; Cronbach's  $\alpha = .91$ ). The CFQ consists of 25 questions responded to on a five-point scale, with scores ranging from 0 (*Never*) and 4 (*Very Often*), with questions concerning minor memory mistakes that have happened in the past six months. Higher scores indicate higher self reports of failures in perception, memory, and motor function.

### *Distress prior to, and following the film.*

Prior to viewing the film, participants were asked whether they had ever been diagnosed with PTSD, to rule out the effect of existing conditions on the viewing of the film. After participants viewed the film they were asked to complete measures that assessed the impact the

film had on them. An adapted version of the Impact of Event Scale (IES; Horowitz, Wilner, & Alvarez, 1979) was used to assess reports of intrusions (Cronbach's  $\alpha = .89$ ) and avoidance (Cronbach's  $\alpha = .85$ ) following a stressful event; both taken to be correlates of distress responses. The 15 item scale was shortened to 11 items (4 intrusion items, 7 avoidance items) to remove questions participants would be unable to answer directly after the film (e.g., I had dreams about it). Participants responded on a 6-point scale with ratings from 0 (*Not at all*) to 5 (*Often*). The original scale also asks about the impact of the event over a seven day period; for the purposes of this experiment the instructions were altered at the first time point to say "after the film".

*Other.*

Demographics such as age and gender were recorded. Additionally, a shortened version of the Gudjonsson Suggestibility Scale (GSS; Gudjonsson, 1984) was originally included as it was expected to be related to the variables of interest (e.g., Merckelbach et al., 2000). Surprisingly however, it was not found to be related to either the dependent or independent variables. As it was at the end of the experiment (after the memory tasks) it was not expected to influence other results and as such was excluded from analyses.

*Memory: Free Recall and Recognition.*

In session two, participants were instructed to type on their computer as much as they remembered about the film as possible. It was structured using two guided questions in order to stimulate participant's memories. The first question involved asking participants to recall as much as they could remember about the information provided to them on the voice over. The second question required participants to recall as much as they could remember about the rest of the film. Participants were asked to be as specific as possible. Accuracy, reporting of

misinformation, and confabulations (items not in the film or narrative, spontaneously made up by participants) were assessed.

For the recognition section, a true-false forced choice questionnaire was given that was adapted from Devilly, Varker, et al., (2007), to assess participants' recollections from the film and narrative. There were two versions of the questionnaire, one for the neutral film and the other for the trauma film. Where possible, there were overlapping statements relevant to both films (e.g., the presence of coloured hardhats, items from the voiceovers, etc.). A series of 32 statements were displayed pertaining to events of the film. There were four types of statements: true statements that were both in the film and the narrative; true statements that were only in the film; false statements that were neither in the film nor the narrative; and false statements from the narrative (misinformation). There were eight items for each statement type. After indicating true or false for each item, participants then had to indicate how confident they were that this answer was correct (1 = *not at all*, through to 5 = *extremely*; see Appendix E).

### *Procedure*

This procedure was adapted from Devilly, Varker, et al., (2007). The participants in this study were informed that they were participating in "A Forensic Psychology Study of Memory", with the true purpose being concealed. Participants were informed that they would be shown a film on their computer screen and that they should pay close attention to the film since they were going to be asked to recall the details later. All participants, regardless of the film to which they were assigned, were warned about the content of the trauma film, and told that if they had recently been in a road traffic accident, or had lost friends/family members from a traffic accident, it would be better for them to withdraw from the study. Following

informed consent, participants were administered the demographics questionnaire, the DES-C, and the CFQ. They were then reminded that the film may distress some participants, and they were free to leave at any time without completing the experiment. After the warning, participants were shown either the trauma film or the neutral film (depending on the condition to which they had been randomly allocated). After the film was completed, the participants filled out the post-film distress measures, and were informed that this was the end of part one. Participants were instructed to return exactly one week later.

For part two, participants were given the ‘eyewitness statement’ to remind them of the events of the film, and instructed to complete the IES again, along with the memory questionnaires. There was a manipulation check at the end of the experiment asking what participants thought the purpose of the study was, and participants were then debriefed. The time to complete the experiment was approximately 90 minutes for both parts combined.

## Results

Analyses were based around the following questions: Would participants who saw the traumatic film experience more distress than those viewing the neutral film? Would those people who received misinformation report it? Would the amount of misinformation reported differ depending on the film watched; and would distress, dissociation and cognitive failures influence these findings?

Two participants were excluded from analyses for scoring over three standard deviations above the mean on the dissociation and distress measures (Osborne & Overbay, 2004). Ten participants did not complete the follow up one week later. However their results

were still included for analyses of the measures they did complete, as follow up status was not significantly related to any of the dependent variables tested in session one ( $ps>.299$ ).

*Distress*

Table 5 presents the descriptive statistics of the distress measures and the state dissociation scale for the two film conditions.

*Table 5. Descriptive statistics by film condition (neutral and trauma) for state dissociation (SDQ), the Impact of Event Subscales (Intrusions and Avoidance), post film (T1) and at one week follow up (T2).*

	Neutral			Trauma		
	Mean	SD	N	Mean	SD	N
SDQ	12.80	4.89	54	15.04	5.25	55
Intrusions T1	1.98	3.17	50	6.40	3.84	52
Intrusions T2	1.49	2.71	48	4.06	3.23	54
Avoidance T1	3.65	5.28	45	9.78	5.73	50
Avoidance T2	3.04	5.29	45	7.27	5.38	51

Reports of dissociation during the film (SDQ) were assessed for group differences with a 2 (film type, neutral and trauma) by 2 (misinformation type, control and misinformation) ANOVA. As expected, there was a significant effect of film type,  $F(1,105) = 5.22, p=.02, \eta^2 = .05$ , with those participants who viewed the trauma film reporting significantly more

dissociation than those in the neutral film condition. There was no statistically significant effect of misinformation condition,  $p=.61$ , nor was the interaction significant,  $p=.27$ .

Reports of intrusions of the film (using the intrusions subscale of the IES (IES-I)) directly following the film (T1), and at one-week follow up (T2) were analysed using a 2 (film type, neutral and trauma) by 2 (misinformation type, control and misinformation) by (2) (time, T1 and T2) mixed ANOVA. There was a significant effect of time,  $F(1,86) = 17.15$ ,  $p<.001$ ,  $\eta^2 = .17$ , with significantly fewer reports of intrusions overall at T2 compared to T1. In line with hypotheses, there was also a significant effect of film type, with significantly more reports of intrusions for those who viewed the trauma film than the neutral film,  $F(1,86) = 31.40$ ,  $p<.001$ ,  $\eta^2 = .27$ . There was no significant effect of misinformation condition ( $p=.46$ ). There was a significant time\*film type interaction,  $F(1,86) = 6.28$ ,  $p=.01$ ,  $\eta^2 = .07$ , whereby participants experienced a greater decline in intrusions from T1 to T2 for participants in the trauma condition. The other interactions were not significant,  $ps>.09$ .

Reports of avoidance (using the avoidance subscale of the IES (IES-A)) of the film directly following the film (T1), and at one-week follow up (T2) were assessed with a 2x2x(2) mixed ANOVA. There was a significant effect of time,  $F(1,88) = 5.40$ ,  $p=.02$ ,  $\eta^2 = .06$ , with significantly more reports of avoidance overall at T1 compared to T2. As expected, there was a significant effect of film type, with participants who viewed the trauma film reporting significantly more avoidance overall compared to the neutral film,  $F(1,88) = 24.91$ ,  $p<.001$ ,  $\eta^2 = .22$ . There was no significant effect of misinformation condition, nor were any interactions significant,  $ps>.34$ .

## *Memory*

### *Free Recall*

Three measures of recall were calculated:

- 1) Accuracy (total score of the count of correct items present in the film)
- 2) Misinformation (total score of the count of misinformation items introduced in the narrative)
- 3) Confabulations (total score of the count of items spontaneously fabricated by participants, these were items not in the film or narrative)

As the scorer of the recall responses was the experimenter, a second scorer blind to the experimental condition allocations and hypotheses scored a random subset of the responses to assess inter-rater reliability of the scoring, and the intra-class correlations were adequate for accuracy ( $r = .81, p=.001$ ) and misinformation ( $r = .98, p<.001$ ). However, there were inconsistencies with the confabulation scoring that were unable to be resolved ( $r = .19, p=.29$ ); as a consequence confabulations were not analysed further.

A series of 2 (film type, neutral and trauma) by 2 (misinformation type, control and misinformation) ANOVAs were conducted to investigate differences between film types and misinformation conditions for the following:

For accuracy, there was a significant effect of film type, with those participants in the trauma film conditions recalling significantly more true information ( $M = 24.75, SD = 7.40$ ) than those in the neutral film conditions ( $M = 13.60, SD = 4.95$ ),  $F(1,95) = 74.67, p < .001, \eta^2 = .44$ , supporting the hypotheses generated by the PNE theory. There was no significant effect



of misinformation condition,  $F(1,95) = 0.60$ ,  $p = .44$ ,  $\eta^2 = .01$ . The interaction term was not significant,  $F(1,95) = 0.00$ ,  $p = .97$ .

For misinformation, as hypothesised, there was a significant effect of misinformation condition, with those participants who received misinformation in the narrative recalling significantly more misinformation ( $M = 0.82$ ,  $SD = 1.01$ ), than those in the control conditions ( $M = 0.06$ ,  $SD = 0.23$ ),  $F(1,95) = 31.44$ ,  $p < .001$ ,  $\eta^2 = .25$ . There was also an almost significant effect of film type, with those participants in the trauma film conditions recalling less misinformation ( $M = 0.29$ ,  $SD = 0.70$ ) than those in the neutral film conditions ( $M = 0.52$ ,  $SD = 0.87$ ),  $F(1,95) = 3.19$ ,  $p = .077$ ,  $\eta^2 = .03$ , which does not support the PNE theory that more memory errors should be observed for negative stimuli. The interaction was significant,  $F(1,95) = 4.10$ ,  $p = .046$ ,  $\eta^2 = .04$ , with the difference between misinformation and no misinformation control conditions being greater in the neutral film than the trauma film condition.

### *Recognition*

Three measures relating to recognition were calculated:

- 1) Accuracy (scores out of 24 for correctly responding 'true' to seeing eight items viewed in the film, correctly responding 'true' to eight items mentioned in the narrative summary that were also in the film, and correctly responding 'false' to eight non-misinformation items not viewed in the film).
- 2) Misinformation (score out of eight for number of misinformation items reported as true).
- 3) Confidence for accurate and misinformation items (score out of five of how confident for each item).

A 2x2 ANOVA was conducted to investigate differences in accuracy between film types, and misinformation conditions. There was a significant effect of film type, with those participants in the trauma film conditions recognising significantly more true information ( $M = 18.18$ ,  $SD = 2.15$ ) than those in the neutral film conditions ( $M = 16.83$ ,  $SD = 2.01$ ),  $F(1,95) = 10.06$ ,  $p = .002$ ,  $\eta^2 = .10$ , again in line with the PNE hypothesis. There was no significant effect of misinformation condition,  $p = .54$ , and the interaction was not significant,  $p = .74$ . A 2x2 ANOVA was conducted to investigate differences in accuracy confidence between film types, and misinformation conditions. There was no significant effect of film type,  $p = .52$ , misinformation condition,  $p = .30$ , nor was the interaction significant,  $p = .29$ .

The misinformation effect was observed when participants reported recognising false items introduced in the narrative, as true. A 2x2 ANOVA was conducted to compare groups on false recognition of misinformation items. There was a significant effect of misinformation condition, with those participants in the misinformation conditions (regardless of film type) recognising significantly more misinformation items as true ( $M = 5.08$ ,  $SD = 1.66$ ) than those in the control conditions ( $M = 4.28$ ,  $SD = 1.58$ ),  $F(1,95) = 6.09$ ,  $p = .015$ ,  $\eta^2 = .06$ . There was no significant effect of film type,  $p = .22$ , which does not support the PNE hypothesis. The interaction was not significant,  $p = .70$ . A 2x2 ANOVA was conducted to investigate differences in confidence for misinformation items between film types, and misinformation conditions. There was no significant effect of film type,  $p = .29$ , misinformation condition,  $p = .24$ , nor was the interaction significant,  $p = .75$ .

Pearson correlations were conducted to assess the relationship between recognition memory and confidence. Recognition accuracy and confidence for accuracy were not

significantly correlated,  $r = .08$ ,  $p=.42$ , nor were misinformation and confidence for misinformation items correlated,  $r = .00$ ,  $p=.98$ .

#### *Individual differences, Distress and Memory*

Trait dissociation (as measured by the DES-C) was not found to be significantly different across conditions ( $M = 35.91$ ,  $SD = 13.20$ ),  $F(3,105) = .63$ ,  $p =.63$ . Similarly, cognitive failures (as measured by the CFQ) was also not significantly different across conditions ( $M = 83.73$ ,  $SD = 14.98$ ),  $F(3,105) = .765$ ,  $p=.77$ . These findings suggest that allocation to groups was successful as there were no differences between the groups on trait measures assessed prior to experimental manipulation.

Table 6 presents correlations between the scales and the distress measures. Both IES subscales were significantly correlated with each other, and at both T1 and T2. It was found that, in line with expectations trait dissociation (as measured by the DES-C) was significantly positively correlated with the CFQ, SDQ and IES Avoidance scale at T2. Similarly as expected, the SDQ was significantly positively correlated with the CFQ, and the IES-A at both T1 and T2. The CFQ was not found to correlate to the IES subscales. Additionally, the correlation analyses were re-run to include the DES-C subscales. Of particular note, the depersonalisation/derealisation subscale was significantly positively correlated with both the IES subscales at both time points, and the amnesia subscale was significantly positively correlated with the IES avoidance subscale at T2 (see Appendix F).

Table 6. Correlations between the IES subscales (IES-A and IES-I) post film (T1) and at one week follow up (T2), state (SDQ) and trait (DES-C) dissociation scales, and the cognitive failures (CFQ) scale.

	IES-I T1	IES-I T2	IES-A T1	IES-A T2	SDQ	DES-C	CFQ
IES-I T1	1	<b>.64**</b>	<b>.75**</b>	<b>.55**</b>	.14	.09	.03
IES-I T2		1	<b>.55**</b>	<b>.64**</b>	.14	.11	.06
IES-A T1			1	<b>.58**</b>	<b>.20*</b>	.13	.09
IES-A T2				1	<b>.22*</b>	<b>.21*</b>	.03
SDQ					1	<b>.36**</b>	<b>.26**</b>
DES-C						1	<b>.47**</b>
CFQ							1

\* $p < .05$ ; \*\* $p < .01$

Due to high correlations, all variables were checked for multicollinearity, however no exclusions were required for the regressions (lowest Tolerance = .37; decision based on Keith, 2005). Recall accuracy scores were analysed using simultaneous multiple linear regression, with the variables IES-I (T1 and T2), IES-A (T1 and T2), SDQ, CFQ, and DES-C as predictor variables. The model was significant. The IES-I (T1) was a significant positive predictor, suggesting higher scores on this scale were related to higher recall accuracy. The SDQ was also a significant positive predictor.

This regression analysis was repeated with recall of misinformation as the dependent variable. The model just missed statistical significance. The IES-A at T1 and T2 were significant predictors, however in opposing directions: the IES-A at T1 had a negative

relationship with misinformation reporting, but as expected, the IES-A at T2 had a positive relationship with misinformation recall. Contrary to hypotheses, dissociation was not found to be related to misinformation recall. See Table 7 for regression results. The above regressions were repeated using the DES-C subscales as predictors instead of the DES-C as a whole, however generally the results did not change. See Appendix F for the regressions with the subscales.

*Table 7. Predictors of Free Recall Accuracy and Misinformation Reporting*

Variable	Accuracy	Misinformation
	$\beta$	$\beta$
Intrusions T1	<b>.41**</b>	.10
Intrusions T2	.04	-.19
Avoidance T1	.02	<b>-.46**</b>
Avoidance T2	-.09	<b>.39*</b>
State Dissociation	<b>.23*</b>	.04
Trait Dissociation	-.04	.06
Cognitive Failures	-.16	-.16
R <sup>2</sup>	.22	.16
F(7,78)	<b>3.13**</b>	<b>2.08†</b>

\* $p < .05$ ; \*\* $p < .01$ ; † $p = .056$

Recognition accuracy scores were analysed using multiple linear regression, with the variables IES-I (T1 and T2), IES-A (T1 and T2), SDQ, DES-C, and CFQ. The model was not

significant, with no predictors found to be significant. A regression was conducted for recognition of misinformation items with the above predictors. The model was not significant, however the IES-A at T1 did emerge to be a significant negative predictor. The above regressions were repeated using the DES-C subscales as predictors instead of the DES-C as a whole. Again, the results mostly did not change, however the absorption subscale was positively related to recognition accuracy.

A regression was conducted for confidence in accurate responses; the CFQ emerged as the only significant predictor with a negative relationship between reports of cognitive failures and confidence ratings. A regression for confidence in responses for misinformation items was significant, and both the CFQ and IES-A T2 were significant predictors, with the CFQ having a negative association, and the IES-A having a positive association with confidence ratings. The confidence regressions were repeated using the DES-C subscales as predictors instead of the DES-C as a whole. For confidence in accurate responses, the CFQ was still a negative predictor, and the absorption scale of the DES-C was a positive predictor,  $\beta = .54, p=.001$ . For confidence in misinformation responses, only the IES-A at T2 was still a significant predictor. See Table 8 for regression results and Appendix F for the results of the regressions with the DES-C subscales included.

Table 8. Predictors of Recognition Accuracy, Misinformation Reporting, and Confidence

Variable	Accuracy	Misinformation	Accuracy	Misinformation
	Recognition	Recognition	Confidence	Confidence
	$\beta$	$\beta$	$\beta$	$\beta$
Intrusions T1	.21	.22	-.17	-.24
Intrusions T2	.12	.07	.03	-.19
Avoidance T1	-.19	<b>-.38*</b>	.10	-.08
Avoidance T2	-.05	-.05	.17	<b>.30*</b>
State Dissociation	-.04	-.01	.06	-.01
Trait Dissociation	<b>.25†</b>	.17	.07	.01
Cognitive Failures	-.11	.13	<b>-.43*</b>	<b>-.23*</b>
R <sup>2</sup>	.09	.11	.20	.17
F(7,78)	1.12	1.34	<b>2.80*</b>	<b>2.23*</b>

\* $p < .05$ ; † $p = .054$

## Discussion

The aim of this study was to examine distress and memory using the Trauma Film Paradigm, with a neutral film for comparison. It was expected that more distress and dissociation would occur in response to the trauma (accident) film compared to the neutral (fire-fighter training) film. A further aim was to test whether the newly created narratives based on the films would be successful in producing the misinformation effect. Finally, the distress, dissociation and cognitive failures measures were investigated to determine whether individual differences on these variables would influence susceptibility for false memory development.

## *Distress*

As hypothesised, in comparison to the neutral film, higher levels of distress (in the form of intrusions and avoidance) were reported following viewing the trauma film, both immediately following the film and at the one week follow up. This supports suggestions the trauma film paradigm is a useful analogue for distressing events (Ehring et al., 2011; Holmes & Bourne, 2008; Holmes et al., 2004; Zetsche, Ehring, & Ehlers, 2009). Additionally, the distressing nature of the trauma film appeared to prompt dissociative responses, as significantly greater reports of state dissociation were observed in response to the trauma film compared to the neutral film. This finding appears to support the Trauma Model of dissociation, whose proponents suggest that dissociation is a regulatory response to extreme distress (Dalenberg et al., 2012). Accordingly, the Fantasy Model of dissociation, whose advocates suggest the link between trauma and dissociation is inconsistent and weak (Giesbrecht et al., 2008), is not supported by these results.

In Holmes et al., (2004) state dissociation was found to be significantly related to reports of intrusions in the following week after viewing the trauma film; this finding was not replicated here in that state dissociation was not found to be correlated to intrusions. However, a different state dissociation questionnaire was used in Holmes et al., (2004), along with the different measurement method for intrusions, which may potentially explain the incongruent results.

Based on the literature defining dissociation as a form of avoidance (Bremner, 2010; McCaslin et al., 2008), it was hypothesised that dissociation would be related to the avoidance subscale of the IES. In line with expectations, state dissociation was significantly correlated with reports of avoidance at both time points, and trait dissociation as a whole with avoidance



at the week follow up. These results also support the findings of a study where state dissociation during an assault was significantly correlated with avoidance on the IES, but not intrusions (Cooper, Yuille, & Kennedy, 2002). A relationship between a pre-existing (trait) tendency to dissociate and dissociation in response to the film was also observed, which is in line with findings in the trauma literature (e.g., Cooper et al., 2002; Murray et al., 2002).

When dividing the trait dissociation measure into the three subscales based on previous factor analysis results (e.g., Ross et al., 1991; Stockdale et al., 2002), it was found that the depersonalisation/derealisation (or 'detachment', using the terminology of Holmes et al., 2005) subtype was related to avoidance and intrusions at both time points. However, absorption was not significantly related to either and amnesia was only related to avoidance at the week follow up. It has been suggested that absorption phenomena reflect “normative” types of dissociation that are transient in nature, whereas both depersonalisation and derealisation may have a trauma-based aetiology (Barlow & Freyd, 2009). It may therefore be the case that people who regularly experience detachment are more likely to experience intrusions and use avoidance strategies following a distressing event. As these are correlational results, further research is required before a more conclusive statement can be made on this relationship; however, at this point these results would also appear to support the Trauma Model of dissociation.

### *Memory*

In line with other research on the misinformation effect (Drivdahl, Zaragoza, & Learned, 2009; Gabbert, Memon, Allan, & Wright, 2004; Paterson & Kemp, 2006b), participants reported misinformation that they encountered in the written ‘eyewitness statement’. This was found to be the case for both the neutral and trauma films, as assessed via

both the recall and recognition tasks. The PNE hypothesis (Porter et al., 2008) that negative stimuli should enhance memory, as well as paradoxically increase susceptibility to false memories for that event was assessed. Although those participants who viewed the trauma film were significantly more accurate (for both the recall and recognition task) than those in the neutral film conditions, they also reported *less* misinformation overall. While confabulations did occur in response to both films, it was unfortunate that differences in coding were unable to be resolved. One possible explanation for this coding inconsistency is due to the fact that the number of confabulations that did occur was so low.

Along with higher accuracy found in the trauma film conditions, it was found that reports of intrusions were related to higher accuracy for the recall (but not recognition) task. The failure to find an effect with recognition accuracy is in line with the findings of Holmes et al., (2004) where intrusions were not found to be related to memory accuracy. While Holmes et al., (2004) found that both recognition and cued-recall were not related to intrusions, free recall was not assessed. Therefore this current finding may be more indicative of how intrusions relate to recall memory (as opposed to all methods of memory assessment) following a trauma.

It is also possible that the differences observed between the present study and Holmes et al., (2004) are due to other differences in the methods used. Although both trauma films were of car accidents, they were not the same film. One film may have been more distressing than the other and prompted more intrusions. This is not able to be directly assessed, however, as the present study employed the IES to measure intrusions, whereas the Holmes et al., (2004) study had an intrusions diary where participants recorded intrusions throughout the week. A diary method to measure intrusions may be more accurate in terms of gauging the frequency and quality of the intrusions throughout the week compared to a retrospective questionnaire at the

end of the week. At the same time, diaries are difficult to quantify psychometrically (Holmes et al., 2004), which is a disadvantage of this approach in comparison to the IES. A useful suggestion for future research would be to combine an intrusions questionnaire and an intrusions diary to compare results (e.g., Zetsche et al., 2009).

Intrusions were not significantly related to false recall or false recognition. According to the cognitive model of PTSD, intentional, meaning based memories of the trauma are hard to access, whilst easily triggered surface aspects (sights, smells etc.) intrude unintentionally (Ehlers & Clark, 2000). In the present study, it is possible that the effect of intrusions on accurate remembering was related specifically to perceptual details of the film. This suggests a beneficial effect of intrusions in accurate remembering; however, as intrusive memories of a distressing event are usually unwanted, and are considered a key criterion for a PTSD diagnosis (American Psychiatric Association, 2000), it is unlikely that intrusions would be considered a positive aspect of a trauma.

Avoidance of reminders of the film led to a complicated effect; although immediately after the film avoidance seemed to predict lower acceptance of misinformation, persistent avoidance at one week follow up had the opposite effect. It should also be noted that the intrusions and avoidance subscales of the IES were very highly correlated in this study. This means that many people who experienced intrusions also endorsed items relating to avoidance. This could suggest that at least a subset of participants were both more accurate and more susceptible to false memories (which would support the PNE hypothesis). Another possibility is that experiences of intrusions facilitated accurate remembering of some aspects of the event, while other aspects were avoided and more susceptible to influence. Further research is required to probe the specifics of this association.

Following on from the findings of Experiment One, it was expected that dissociation would be related to a greater number of false memories in this experiment. This was not found to be the case. The absorption subtype was found to be positively related to recognition accuracy, which was an unexpected finding. However, this result can be explained based on further examination of the definition of absorption. Although some describe absorption as being immersed in internal events (e.g., imagination), a person can also become absorbed in a specific external event, such as a film (Tellegen & Atkinson, 1974). Perhaps total immersion in the film allowed for greater attention to be paid, which then allowed for superior performance on the recognition task. This also appeared to result in greater confidence of recognition accuracy. As mentioned above, avoidance was related to false memories, and dissociation (particularly detachment) was positively correlated with avoidance. This result supports suggestions that dissociation is related to avoidance of distressing memories (Bremner, 2010; McCaslin et al., 2008); but it appears it is more avoidance in general, as opposed to dissociation, that is related to false memory development.

Cognitive failures were also assessed in this study based on previous research finding high correlations with dissociation (Merckelbach et al., 2000; Wright & Osborne, 2005). Although the cognitive failures measure (CFQ) was significantly correlated with both trait dissociation and state dissociation, it was not related to avoidance. As such it can be argued that although similar constructs, dissociation and cognitive failures are distinct in relation to their response to stressful events. Further, although unrelated to memory accuracy or false memories, high scorers on the cognitive failures measure exhibited lower confidence ratings for both memory accuracy and misinformation items. One interpretation of the CFQ suggests it is not an objective measure of mistakes, but more a subjective measure of confidence in cognitive

ability (van Doorn, Lang, & Weijters, 2010; Wilhelm, Witthoft, & Schipolowski, 2010). The current results support this suggestion, as the CFQ was not related objective memory errors in this study.

One possible implication of this CFQ finding is that while in some circumstances eyewitnesses reporting high confidence for false memories are believed (Simons & Chabris, 2011); in others testimonies may be unduly ignored due to low confidence levels reported by witnesses with low estimations of their abilities. Further, accuracy was not significantly correlated with confidence. Therefore this finding demonstrates that caution should be taken when using confidence measures to gauge the likelihood of accuracy for memory.

#### *Limitations, Future Directions and Conclusion*

This chapter has highlighted the importance of assessing the type of distress people experience following a stressful event, in order to determine whether they are more likely to be vulnerable to false memory development. People who avoid thinking about a distressing event may be more likely to accept false information introduced by others. Conversely, experiencing intrusions may promote greater accuracy. As an analogue study however, it is difficult to predict whether these findings would be the same following a real life trauma. It is also possible that some differences observed between the two film conditions may not have been due to the different valence, but rather due to the fact that they were different films. However, every attempt was made to make the films comparable by having both be of emergency services, adding voiceovers with matching information, and including similar or identical misinformation items in both narratives.

Future studies could also include diagnostic measures, including a trauma history, so a more accurate picture of the relationship between vulnerability to dissociation, PTSD symptoms and false memory reporting can be determined. Nevertheless, this result clearly has important implications regarding witnesses or victims of a traumatic event avoiding reminders and then being later exposed to misinformation. These relationships, along with the unexpected non-significant findings regarding dissociation and false memory susceptibility require further exploration, and thus informed the study design of the next chapter.

## CHAPTER SIX

### Experiment Three: Susceptibility to False Memories: Comparing the DRM and the Trauma Film Paradigm

Based on the findings in Chapter Four of this thesis suggesting dissociation is a predictor of false memory development in the DRM (see also Dehon et al., 2008), as well as for more ecologically valid procedures (such as a crime film; Wright & Livingston-Raper, 2002), it was expected that dissociation would also be related to false memories for a stressful film. However, in Chapter Five it was revealed that dissociation was not significantly related to false recall or recognition, for either the neutral or trauma film. The contradictory findings of Chapter Four and Chapter Five may potentially be explained due to the methodological differences in the two studies: in the first experiment the DRM word list task was employed, whereas the second experiment involved film viewing and misinformation from a narrative. As the interest of this thesis is to investigate those people susceptible to false memory development, it is important to explore under which conditions certain people are likely to produce these effects. Therefore it is worth combining the DRM and film task to determine whether people will be equally susceptible to false memories using both methods, and whether dissociation is involved in these effects.

As false memories for both the DRM and misinformation tasks have previously been explained by errors in source monitoring (see Chapter One), there could be underlying similarities in the way people respond to both tasks. At present, it appears that only one study has compared responses on the DRM to a misinformation task. In that study, participants completed five DRM lists for neutral words. They were also exposed to five film clips of different crimes, all lasting 90 seconds each. Following each film, participants were asked a

series of questions concerning the details, with some questions containing misinformation. It was found that responses to the DRM task were not related to susceptibility to reporting the misinformation from the questions (Bock, 2009). However, people who reported source confusion in response to the misinformation procedure were also more likely to falsely recognise lures in the DRM procedure (Bock, 2009). Additionally, as the DRM lists used in Bock (2009) were neutral, and the films did not appear to be rated in terms of distress, it is uncertain whether the same results would be observed when considering stimuli of different emotional valence.

One limitation of the study in Chapter Five was that trauma history was not considered. Although a non-clinical student population was employed and participants were asked about PTSD diagnosis, it is still possible that trauma history may have been present. Trauma history alone has been related to increased distress for subsequent stressors (e.g., Spertus, Yehuda, Wong, Halligan, & Seremetis, 2003). Based on research findings that trait dissociation is related to state dissociation during an event (e.g., Chapter Five; Murray et al., 2002) it has been theorised that dissociative responses may be a learned coping mechanism in the face of previous trauma that increases the likelihood of dissociating during future threatening events (Dalenberg et al., 2012). Additionally in a study of psychologically healthy soldiers it was found that past trauma was related to increased dissociation in response to a stressor (Morgan et al., 2001). It has also been suggested that the relationship of previous trauma to subsequent PTSD development for a new event could be due in part to dissociation (McCaslin et al., 2008).

Several researchers have investigated trauma history in relation to susceptibility to false memories on the DRM task. In populations with a homogeneous trauma history, childhood abuse, it has been found that those participants who report a continuous memory of their abuse



were less susceptible to recalling or recognising lures on the DRM than those who reported that they recovered or repressed such a memory (Clancy et al., 2000; Geraerts et al., 2005). It has also been found that women reporting abuse who also had PTSD were more susceptible to the DRM illusion than those reporting abuse without a PTSD diagnosis (Bremner, Shobe, & Kihlstrom, 2000). Similarly in a population with a more mixed trauma history, traumatised participants with and without PTSD were more like to falsely recall un-presented words on the DRM compared to non-traumatised controls (Zoellner et al., 2000). People with PTSD have also found to be more likely to develop false memories for trauma words than neutral words (Brennen et al., 2007).

Trauma history in studies of susceptibility to false memories following a trauma film has not been as extensively studied. It has either not been considered (e.g., Giesbrecht, Geraerts, et al., 2007), or assessed, but not used as a predictor for false memory susceptibility (e.g., Devilly, Varker, et al., 2007). It is therefore worth considering this individual difference factor further.

### *The Current Study*

This study appears to be the first in which responses on the DRM task are compared to susceptibility to post-event misinformation in the form of a narrative. If the two tasks are found to be unrelated, this is an important demonstration that not all false memory tasks have the exact same underlying memory mechanisms. Such a finding would potentially add credence to suggestions that the term “false memory” should only be applied in situations referring to rich false memories for an entirely fabricated event (Freyd & Gleaves, 1996). Further, in the only similar study to this one (Bock, 2009) crime films were used; however it is uncertain whether

these films were distressing in nature. This study therefore allows comparison of the neutral and trauma films, as used in the previous chapter, to further investigate the differences in memory for stimuli of different valence. Individual differences in trauma history and dissociation are also able to be investigated as predictors of false memory susceptibility on both the DRM and misinformation tasks.

### *Study Aims and Hypotheses*

Overall, the aim of the present study was to compare responses on both the DRM task and the film task. Additionally, dissociation questionnaires, along with a trauma history assessment were administered to understand their relationship with each task. It was expected that dissociation would be related to increased susceptibility to false memories for the trauma lists of the DRM. Further, based on previous research on trauma history, it was expected that this may also be related to false recall on the DRM task. Regarding the film part of the study, it was expected that the results of the previous experiment would be replicated; but it was also expected that if the DRM and film tasks are not equivocal with regards to false memory development, the scores on one task would not strongly predict performance on the other. Lastly, as trauma history has not been extensively studied in relation to false memories for a film, no directional hypotheses were made for this variable.

## Method

### *Participants and Group Allocation*

There were 89 (23 male) undergraduate Psychology students from the University of Sydney who participated for course credit. The mean age was 20.10 years ( $SD = 4.16$ ). No

participants reported having received a diagnosis of PTSD. Inclusion criteria included proficiency in written and spoken English. Of the 89 participants who completed Part One, only 70 returned for Part Two. In Part Two participants were randomly allocated to one of two groups, those who viewed the neutral film ( $N= 34$ ), and those who viewed the trauma film ( $N= 36$ ). In Chapter Five it was established that participants who received misinformation in the narrative reported significantly more misinformation than control participants. This was taken to mean the procedure was successful; thus the control conditions were not included in the present experiment. Participants were randomly allocated to each group, and were not significantly different in terms of age or gender (all  $ps > .24$ ).

### *Materials*

Participants completed the measures via the internet survey program LimeSurvey (v1.87), and viewed one of the two films on their computer.

#### *Films.*

The films shown were the same neutral (live footage of a fire-fighter recruit training exercise) and trauma (US emergency service personnel attending the scene of a motor vehicle accident) films with voiceovers used in Chapter Five. Participants only saw one film.

#### *Narratives.*

After a short delay, participants were given an ‘eyewitness statement’ of the film they viewed, under the pretext of reminding them of the event. The narratives contained both true information and misinformation (details that were different or absent from the film) and were the same as those in the experiment of Chapter Five. Participants only read one narrative.

## *Measures*

### *DRM.*

The same six trauma (e.g., blood, spider, hurt) and six neutral (e.g., foot, mountain, letter) related word lists were displayed in the same manner as in the experiment from Chapter Four. Participants were tested for free recall (FR) of the words in the lists. Each FR list was scored for accuracy (count of correct words recalled), CLs (target word not shown) and confabulations (words not shown, not the target word).

### *Dissociation.*

As in Chapters Four and Five, trait dissociation was measured using the Dissociative Experiences Scale – Comparative (DES-C; Wright & Loftus, 1999; Cronbach's  $\alpha = .93$ ), and also divided into the three subscales: depersonalisation/derealisation (Cronbach's  $\alpha = .88$ ), absorption (Cronbach's  $\alpha = .88$ ), and amnesia (Cronbach's  $\alpha = .79$ ). State dissociation (dissociation during the viewing of the film) was measured using the adapted version of the State Dissociation Questionnaire (SDQ; Murray et al., 2002; Cronbach's  $\alpha = .81$ ).

### *Trauma History.*

The Brief Trauma Questionnaire (BTQ; Schnurr, Spiro, Vielhauer, Findler, & Hamblen, 2002) consists of 10 items which ask whether participants have experienced particular traumatic events that meet DSM-IV criteria for PTSD: A.1, exposure to a potentially life-threatening event, and A.2, a subjective reaction of fear, helplessness, or horror. (e.g., “Have you ever served in a war-zone or in a non combat job that exposed you to war-related casualties (e.g., as a medic or on graves registration duty)?”), for which participants are required to answer “Yes” or “No”. If participants answer “Yes” to the question they are then asked two follow up questions about that event: “Did you fear for your life?” and “Were you seriously

injured physically?’. Although it was initially designed to be a clinician-administered scale, in this study the BTQ was computerised and included as part of the online component of Part One.

*Distress prior to, and following the film.*

As in Chapter Five, participants were asked prior to film viewing a question regarding prior PTSD diagnosis, to rule out the effect of existing conditions on response to the film. After participants viewed the film they completed an adapted version of the Impact of Event Scale-Revised (IES-R; Horowitz et al., 1979) which assessed reports of intrusions (Cronbach’s  $\alpha = .87$ ) and avoidance (Cronbach’s  $\alpha = .91$ ) following a stressful event.

*Other.*

Demographics such as age and gender were recorded.

*Film Free Recall and Recognition.*

As in Chapter Five, participants were instructed to type on their computer as much as they remembered about the film as possible. FR accuracy, reporting of misinformation, and confabulations (items not in the film or narrative, spontaneously made up by participants) were assessed. For the recognition section, the same true-false forced choice questionnaire from Chapter Five was used to assess participant’s recollections from the film and narrative. The confidence ratings questionnaire used in Chapter Five was not examined in the current experiment, based on the lack of meaningful findings in the former experiment with any of the current variables of interest.

## *Procedure*

Participants were informed that they were participating in a study entitled “What Makes a Good Eyewitness?” with the true purpose being concealed. Participation for both parts was voluntary and conducted following informed consent. The experiment was divided into two parts. Part One was conducted online in the participants’ own time. In Part One, participants completed the demographics questions, the DES-C and then saw the DRM lists and completed the DRM FR task after each list. Participants then completed the BTQ.

Participants then came into the lab approximately seven days later for Part Two. Participants were tested either singly or in groups of 2–10 but seated at individual computers. Participants watched either the neutral or trauma film, completed the SDQ and a filler task (‘e’ counting), and then read the ‘eyewitness statement’ containing misinformation. Participants were then tested for their memory of the film (both FR and recognition) and completed the IES-R. They were then informed that this was the end of the experiment and asked about their perceptions of the purpose of the study. The total time to complete the experiment was approximately 90 minutes for both parts combined, and participants were debriefed at the end.

## Results

Analyses were based around the following questions: Would the DRM results observed in Experiment One be replicated, and would trauma history also impact susceptibility to the DRM illusion? Would the distress results observed in Experiment Two (that participants reported more state dissociation and distress in response to the trauma film than the neutral film) be replicated? Would the amount of misinformation reported differ depending on the film watched; and would trauma history, distress and dissociation influence these findings? Finally,

would susceptibility to the DRM illusion be equivalent to susceptibility to the misinformation effect?

### *DRM Memory*

Three measures of recall were calculated:

- 1) Accuracy (total score of words recalled that were present in the lists)
- 2) Critical Lures (total score of target words recalled not present in the lists)
- 3) Confabulations (total score of words recalled not present in the list and not the target word)

Participants correctly recalled an average of 81.93 (out of 120;  $SD = 11.90$ ) of the words studied. Participants recalled significantly fewer trauma ( $M = 39.54$ , out of 60;  $SD = 6.30$ ) than neutral words ( $M = 42.38$ ,  $SD = 6.56$ ),  $t(74) = 5.02$ ,  $p < .001$ , which is the opposite finding of Chapter Four. Participants reported on average 1.41 CLs (out of 12,  $SD = 1.49$ ), with 73.6% of participants reporting at least one CL overall, which is over 10% more than Chapter Four. When comparing neutral ( $M = 0.78$ ,  $SD = 0.91$ ) and trauma CLs ( $M = 0.62$ ,  $SD = 0.90$ ), there were no significant differences,  $p = .18$ . Participants on average made 1.66 confabulations overall ( $SD = 2.09$ ), with 75.9% of participants making at least one confabulatory response. When comparing neutral ( $M = 0.71$ ,  $SD = 1.09$ ) and trauma ( $M = 0.95$ ,  $SD = 1.40$ ) confabulations, there were no significant differences,  $p = .14$ .

### *Trait Dissociation and Trauma History*

The mean score of the DES-C was 35.63 ( $SD = 13.50$ ), which is similar to the mean of the previous experiments of this thesis. Of the 89 people who responded on the BTQ, only 18

did not report any previous trauma (20%). Of those reporting previous trauma, 46 (52%) had experienced more than one traumatic event (see Appendix G for further information).

### *DRM and Scales*

A simultaneous multiple linear regression was conducted for FR accuracy for neutral words with the DES-C and BTQ (as a continuous variable indexing number of traumas experienced). The model was not significant,  $p = .89$ , and neither variable was a significant predictor. The regression for trauma word accuracy was also not significant,  $p = .09$ , however the BTQ was a significant negative predictor,  $\beta = -.25$ ,  $p = .03$ , suggesting a greater number of traumas experienced was related to lower recall accuracy. Additionally a regression was conducted for neutral CL recall, and the model was not significant,  $p = .95$ . A regression for trauma CL recall was not significant,  $p = .82$ , with neither the BTQ nor the DES-C emerging as significant predictors. The failure to find a significant relationship between the DES-C and trauma CL recall is a conflicting finding to that of Chapter Four. The regression for neutral confabulations was not significant, nor was the regression for trauma word list confabulations,  $ps > .30$ , with neither the BTQ nor the DES-C emerging as significant predictors. The above regressions were repeated with the DES-C subscales as predictors alongside the BTQ. The regression model for free recall accuracy for neutral words was significant, with the depersonalisation subscale emerging as a negative predictor and the absorption subscale as a positive predictor. Although no further regression models were significant, the BTQ was still a negative predictor for trauma accuracy, and the amnesia subscale was a negative predictor of trauma CL recall (see Table 9).



Table 9. Predictors of Accuracy, False Recall and Confabulations on the DRM

Variable	Neutral	Trauma	Neutral	Trauma	Neutral	Trauma
	Accuracy	Accuracy	Lure	Lure	Confabulation	Confabulation
	$\beta$	$\beta$	$\beta$	$\beta$	$\beta$	$\beta$
BTQ	.07	<b>-.25*</b>	-.05	.08	.03	.14
DES - Depersonalisation	<b>-.35*</b>	.08	.16	.03	.13	-.02
DES - Absorption	<b>.43**</b>	.03	-.13	.19	-.04	.01
DES - Amnesia	-.24	-.02	.01	<b>-.31*</b>	.10	.15
R <sup>2</sup>	.13	.06	.02	.07	.03	.04
F(4,73)	<b>2.61*</b>	1.26	0.30	1.28	0.60	0.79

\* $p < .05$ ; \*\* $p < .01$

### Distress

Table 10 presents the descriptive statistics of the distress measures and the state dissociation scale for the two film conditions, assessed following film viewing.

Table 10. Descriptive statistics by film condition (neutral and trauma) for state dissociation (SDQ) and the Impact of Event Subscales (Intrusions and Avoidance).

	Neutral			Trauma		
	Mean	SD	N	Mean	SD	N
SDQ	11.41	3.61	34	14.14	6.29	36
Intrusions	8.12	4.04	34	16.83	5.79	36
Avoidance	9.71	5.00	34	19.47	9.02	36

Trait dissociation (as measured by the DES-C) was not found to be significantly different across the film conditions,  $F(1,60) = .72, p = .40$ , suggesting that random allocation to groups for Part Two was successful. Reports of dissociation during the film (SDQ) were compared for group differences of film type (neutral and trauma). As expected, the one-way ANOVA demonstrated statistically significant differences,  $F(1,68) = 4.87, p = .03, \eta^2 = .07$ , with those participants who viewed the trauma film reporting significantly more dissociation than those in the neutral film condition. In line with hypotheses and the results of Experiment Two, significant differences were also observed when analysing reports of intrusions of the film,  $F(1,68) = 52.80, p < .001, \eta^2 = .44$ , with more reports of intrusions from those participants who viewed the trauma film, in comparison to the neutral film. Similarly, significant differences were also observed when analysing reports of avoidance of the film,  $F(1,68) = 30.89, p < .001, \eta^2 = .31$ , with more reports of avoidance from those participants who viewed the trauma film, in comparison to the neutral film.

### *Free Recall Memory*

Three measures of recall were calculated:

- 1) Accuracy (total score of the count of correct items present in the film)
- 2) Misinformation (total score of the count of misinformation items introduced in the narrative)
- 3) Confabulations (total score of the count of items spontaneously fabricated by participants, these were items not in the film or narrative)

Two scorers blind to the experimental hypotheses scored half the responses each, plus a random subset of overlapping responses to assess inter-rater reliability of the scoring. The intra-class correlations were adequate (accuracy  $r = .99$ ,  $p < .001$ ; misinformation  $r = .95$ ,  $p < .001$ ; confabulations  $r = .89$ ,  $p < .001$ ). To ensure compliance of scorers to experimenter instructions, the experimenter also scored a random subset of responses, and again all intra-class correlations were adequate (accuracy  $r = .94$ ,  $p < .001$ ; misinformation  $r = .93$ ,  $p < .001$ ; confabulations  $r = .90$ ,  $p < .001$ ). As a consequence any overlapping scores were averaged for the final analyses.

A series of one-way ANOVAs were conducted to investigate differences between film types for the following:

For accuracy ( $M = 46.04$ ,  $SD = 30.34$ ), there were significant differences between film types,  $F(1,68) = 31.16$ ,  $p < .001$ , with those participants in the trauma film condition recalling significantly more true information ( $M = 62.45$ ,  $SD = 32.90$ ) than those in the neutral condition ( $M = 28.66$ ,  $SD = 13.12$ ). For misinformation ( $M = 1.04$ ,  $SD = 1.25$ ), there were no significant differences,  $F(1,68) = 1.80$ ,  $p = .18$ . These findings support those of Experiment Two. There were significant differences for confabulations ( $M = 2.29$ ,  $SD = 2.05$ ),  $F(1,68) = 5.21$ ,  $p = .03$ ,

with those participants in the trauma film condition ( $M = 2.81$ ,  $SD = 2.33$ ) confabulating more than those in the neutral condition ( $M = 1.72$ ,  $SD = 1.54$ ).

### *Recognition Memory*

Two measures relating to recognition were calculated:

- 1) Accuracy (scores out of 24 for correctly responding 'true' to seeing eight items viewed in the film, correctly responding 'true' to eight items mentioned in the narrative summary that were also in the film, and correctly responding 'false' to eight non-misinformation items not viewed in the film).
- 2) Misinformation (score out of eight for misinformation items falsely reported as true).

A one-way ANOVA was conducted to investigate differences in accuracy between film types. Significant differences were observed,  $F(1,68) = 16.51$ ,  $p < .001$ ,  $\eta^2 = .20$ , with those participants in the trauma film condition reporting significantly more accurate information ( $M = 19.56$ ,  $SD = 1.80$ ) than those in the neutral film condition ( $M = 17.68$ ,  $SD = 2.07$ ). There were also significant differences between the conditions for recognition of misinformation items,  $F(1,68) = 4.65$ ,  $p = .035$ ,  $\eta^2 = .06$ , with those participants in the trauma film condition recognising significantly more misinformation items as true ( $M = 5.31$ ,  $SD = 1.67$ ) than those in the neutral film condition ( $M = 4.47$ ,  $SD = 1.56$ ). This is in contrast with the findings of Experiment Two, however is in line with the PNE hypothesis.

*Individual Differences, Distress and Memory*

Table 11 presents correlations between the scales and the distress measures. In contrast to hypotheses and the results of Experiment Two, the DES-C was not significantly correlated with any other scale. The BTQ was positively correlated with state dissociation however, suggesting that a greater number of past traumatic events experienced were related to higher reports of dissociation during the film. The SDQ was correlated positively with the intrusions subscale of the IES, and in line with Experiment Two it was also correlated with the avoidance subscale. The two IES subscales correlated positively with each other. Repeating the correlation analysis with the DES-C subscales, the only notable difference was that the amnesia subscale of the DES-C was significantly positively correlated with the BTQ,  $r = .31, p = .01$ .

*Table 11. Correlations between trait (DES-C) dissociation scale, trauma history (BTQ), the IES subscales (IES-A and IES-I) and the state dissociation (SDQ) scale.*

	DES-C	BTQ	SDQ	IES-I	IES-A
DES-C	1	.15	.11	-.03	.03
BTQ		1	<b>.26*</b>	.11	.18
SDQ			1	<b>.54**</b>	<b>.74**</b>
IES-I				1	<b>.69**</b>
IES-A					1

\* $p < .05$ ; \*\* $p < .01$

Due to high correlations, all variables were checked for multicollinearity, however no exclusions were required for the regressions (lowest Tolerance = .33; decision based on Keith,

2005). Recall accuracy scores were analysed using multiple linear regression, with the variables DES-C, BTQ, SDQ, IES-I, IES-A, and overall accuracy (both neutral and trauma lists combined) on the DRM task in Part One as predictor variables. The model was significant. The IES-I was a significant positive predictor, suggesting higher scores on this scale were related to higher recall accuracy. Accuracy on the DRM task was also a significant positive predictor, suggesting greater accuracy on the DRM was related to greater recall accuracy on the narrative task.

This regression analysis was repeated with recall of misinformation as the dependent variable, except that overall CL recall (neutral and trauma lists combined) on the DRM was added as a predictor instead of DRM accuracy. The model was not significant. This regression analysis was repeated for confabulation responses (with DRM confabulations instead of CLs), but the model was not significant. The SDQ emerged as a significant negative predictor however, suggesting greater dissociation during the film was related to fewer confabulations. See Table 12 for regression results. The above regressions were repeated using the DES-C subscales as predictors instead of the DES-C as a whole, however generally the results did not change. See Appendix G for the regressions with the subscales.

Table 12. Predictors of Free Recall Accuracy, Misinformation Reporting, and Confabulations

Variable	Accuracy	Misinformation	Confabulations
	$\beta$	$\beta$	$\beta$
DES-C	-.17	-.04	.02
BTQ	.20	.24	-.01
SDQ	-.017	-.28	<b>-.46*</b>
Intrusions	<b>.29*</b>	.05	.16
Avoidance	.18	.04	.22
DRM Score	<b>.45*</b>	.17	.17
R <sup>2</sup>	.39	.12	.09
F(6,54)	<b>5.79**</b>	1.20	0.92

\* $p < .05$ ; \*\* $p < .01$

Recognition accuracy scores were analysed using multiple linear regression, with the variables DES-C, BTQ, SDQ, IES-I, IES-A as predictor variables. The model was not significant. A regression of recognition of misinformation items with the same predictor variables was also not found to be significant. The above regressions were repeated using the DES-C subscales as predictors instead of the DES-C as a whole. The recognition accuracy regression became significant,  $R^2 = .24$ ,  $F(7,54) = 2.47$ ,  $p = .03$ . The amnesia subscale of the DES-C was a significant positive predictor  $\beta = .34$ ,  $p = .04$ , whereas the depersonalisation subscale was a significant negative predictor,  $\beta = -.33$ ,  $p = .04$ . The misinformation regression results did not change.

## Discussion

Memory for both the DRM task and misinformation effect procedure was investigated in this study, so as to directly compare participant responses on both tasks. Besides attempting to replicate the results of both Experiments One and Two, it was expected that those participants particularly susceptible to the DRM illusion would also be susceptible to accepting misinformation about the film viewed. Additionally an inventory of past traumatic experiences was included to investigate alongside the variables of dissociation and distress.

### *DRM Results*

In Experiment One, it was found that more trauma words were recalled in comparison to neutral words, however in the present study the opposite was found: fewer trauma words were recalled. This unsuccessful replication of Experiment One is concerning as the same methods were employed; this will be considered further in Chapter Eight. It was found that the valence of the word lists did not appear to be significantly related to increases *or* decreases in critical lure recall or confabulations, a finding which is in line with those of Experiment One (see also Budson et al., 2006).

Trauma history and trait dissociation were assessed in relation to the DRM task. In contrast to hypotheses, trauma history was not related to false recall of trauma words. This result is also in contrast to previous research on trauma history and the DRM (Brennen et al., 2007; Clancy et al., 2000; Geraerts et al., 2005; Zoellner et al., 2000). However, several of these studies included participants with PTSD. The traumas experienced may have also been more severe, and in some cases the trauma lists were tailored to the particular trauma that population had experienced (e.g., war-themed words; Brennen et al., 2007). Therefore it is



possible that the lack of association in the present study is due to the non-clinical population used. However, it was found that an increase in number of trauma experiences was related to worse accuracy for trauma words. Perhaps less encoding of the trauma words occurred, which would decrease accuracy and also decrease generation of associated words such as the critical lures.

The absorption subscale of the trait dissociation measure (the DES-C) was related to higher accuracy scores for neutral words on the DRM, whereas the depersonalisation/derealisation subscale was associated with worse accuracy. This result was not observed in Experiment One, however in Experiment Two the absorption subscale was found to be related to higher recognition accuracy for the film. It is unclear however as to why in the present experiment this result was only observed for the neutral word lists and not the trauma lists. In the Trauma Model of dissociation, the dissociative individual attempts to avoid thinking about trauma (Dalenberg et al., 2012), which would suggest dissociation would be related to worse trauma memory and would not affect accuracy for neutral stimuli. If dissociation is related to general distractibility as the advocates of the Fantasy Model of dissociation would suggest (Giesbrecht et al., 2008), then either neutral or trauma memory could be effected. Therefore in this case the finding that neutral and not trauma accuracy was related to dissociation may support the Fantasy Model.

In Experiment One dissociation predicted false recall of trauma lures, however this result was not observed in the present study. Instead it was found that high scorers on the amnesia subscale of the DES-C were *less* likely to recall any of the trauma lures. One possible explanation for this result relates to the directed-forgetting finding that high scorers on the dissociation scale were significantly better at forgetting trauma-related words compared to

neutral words, in comparison to low dissociators (DePrince & Freyd, 2004). Superior forgetting of trauma related words in dissociators was thought to reflect increased suppression and avoidance of the threatening information so as to prevent distress (DePrince & Freyd, 2004). Therefore it is possible that in the present study the overarching concepts that the words in the trauma lists were associated with (the critical un-presented lures) may have been suppressed by those scoring high in dissociative amnesia due to the wish to avoid those distressing concepts. However, concerns have been raised about the dissociation and directed forgetting findings due to a failure to replicate the results (Deville, Ciorciari, et al., 2007). Additionally this explanation is unable to account for why it was found originally in Experiment One that dissociation was related positively to false recall (see also Dehon et al., 2008).

Overall, it is difficult to discern the reason for these contrasting results, as the same word lists and timing were used as the previous experiment. These inconsistent findings will be returned to in greater depth in the General Discussion (Chapter Eight). At present the conclusion is that the valence and dissociation effects of the DRM are not robust.

### *Film Distress, Recall and Recognition*

It was expected, in line with the results of Experiment Two, that higher distress scores would be experienced for participants viewing the trauma film over the neutral film, and this occurred. Both intrusion and avoidance scores were significantly higher in the trauma film condition, and state dissociation was also higher. However, participants who viewed the trauma film were less susceptible to the misinformation in the narrative in Experiment Two, whereas no significant differences in misinformation recall were observed in the current study.

A potential reason for why the results of the film portion of the experiment differ greatly from those observed in Experiment Two may stem from changes to the timing of tasks. Due to the DRM being included in Part One of the present experiment, the film viewing, narrative and memory testing all occurred within the same session in Part Two. This decision to not include the film in Part One was made so that the words on the DRM would not affect responses to the film (e.g., priming effects). It has been found in previous research that the passage of time leads to a decrease in memory accuracy (e.g., Porter et al., 2010). Further, research suggests the misinformation effect is particularly strong when the information has been introduced after time has passed and the original event memory has faded (see Loftus, 2005, for a review). However, when inspecting the misinformation recall means of Experiment Two and the present experiment, the mean is higher in the present experiment. This suggests the misinformation effect did still occur; therefore perhaps the effect of valence on recall memory emerges after some time has passed. This possibility will be returned to in the next experiment.

In Experiment Two participants who viewed the trauma film were more accurate for recognition items than those in the neutral film condition; however no film differences were observed for recognition of misinformation items. Similarly in the present study people who viewed the trauma (as opposed to neutral) film were more accurate, but these participants also falsely recognised misinformation items as true. This finding supports the PNE hypothesis that negatively valenced stimuli (compared to neutral or positive) will lead to remembering more accurate details but also greater likelihood of memory distortion (Porter et al., 2008). Again, it may be the case that these different results relate to the timing of the misinformation exposure.

### *Individual Differences and Memory*

An unanticipated finding was the lack of correlation observed between DES-C and SDQ. In Experiment Two, trait and state dissociation were both tested within the same session and were positively correlated; however in this experiment they were tested a week apart. It is possible that having both questionnaires in the same session created demand characteristics, where responding to the trait dissociation questionnaire primed participants to endorse the state dissociation items following the film. However, when the questionnaires were a week apart as in this experiment, this effect disappeared.

A counterargument to this point relates to the findings of one study where trait dissociation in police recruits predicted both state dissociation and PTSD symptoms at a 12 month follow up (McCaslin et al., 2008). While it is unlikely the trait dissociation questionnaire created demand characteristics for the state version administered a year later, the findings do demonstrate that trait and state dissociation were related even after a considerable period of time had passed. Besides the time differences from this study, other key differences in the McCaslin et al., (2008) study also include the fact that a different state dissociation questionnaire was used, as well as the fact that the trauma events experienced were real.

According to the Trauma Model of dissociation, dissociation is a learned response to past trauma (e.g., Dalenberg et al., 2012), therefore it was expected that the DES-C and trauma history (assessed using the BTQ) would be positively correlated. This was not found to be the case in this experiment for the scale overall, however, the amnesia subscale of the DES-C was positively correlated with the BTQ. Trauma history also correlated with state dissociation during the film, which suggests that a greater number of past traumatic experiences related to dissociation in response to the film. This finding does therefore support the Trauma Model.

Higher reports of intrusions following the film were found to relate to greater FR accuracy, which supports the findings of Experiment Two. Reports of avoidance following the film were found in Experiment Two to be related to misinformation recall; this association was negative when avoidance was tested immediately following the film, but at the week follow-up higher avoidance scores were related to greater acceptance of misinformation. Avoidance in the present experiment was unrelated to misinformation in either direction. Further, an unexpected finding was that greater state dissociation in response to the film was related to fewer confabulations. The depersonalisation subscale was a significant negative predictor of recognition accuracy, which is a similar finding to the DRM results. Higher scores on the amnesia subscale of the DES-C were related to greater recognition accuracy, which was an unexpected finding.

Again these findings may be due to timing issues, however it may also hint at the possibility that the subjective reports of dissociation and distress are unstable. A further possibility regarding the trait dissociation results is that even though the DES-C was used in an attempt to combat floor effects of dissociation in a non-clinical population, higher levels of dissociative symptoms may not have been captured. It may be beneficial for future studies to screen for high and low dissociators to determine whether the two groups respond differently (e.g., Michael & Ehlers, 2007).

Recall accuracy on the DRM task was found to be a significant predictor of recall accuracy for the film task. However, susceptibility to false recall on the DRM was unrelated to false recall of misinformation for the film. It therefore appears that while accurately recalling words presented and accurately recalling film information may involve similar memory mechanisms, producing critical lures on the DRM and accepting misinformation may not. This

finding is in line with those of Bock (2009), where the DRM illusion and misinformation from leading questions were not significantly related. This finding calls into question whether these tasks are both “false memory” tasks with similar underlying mechanisms (see also Freyd & Gleaves, 1996; Pezdek & Lam, 2007). This problem will be returned to in greater depth in the General Discussion chapter.

### *Conclusion*

In conclusion, while several elements of Experiments One and Two were replicated, other key findings were not. Overall this may indicate the lack of robustness of both methods, as well as the instability of the trait measure of dissociation. Differences in timing of the misinformation exposure and memory testing may also have impacted the results. Further, the inconsistency of the distress and state dissociation measures with the memory results may relate to issues with subjective reporting of distress. It is therefore suggested that future research include objective measures of distress.

## CHAPTER SEVEN

### Experiment Four: Biological and Psychological Predictors of False memories in the Trauma Film Paradigm: An Investigation of Cortisol Levels and Dissociation.

While Experiments Two and Three have been informative regarding the role of distress responses in development of false memories, the methods of assessing this distress were subjective. Many assessments of distress for an event are self report and are used commonly in research; however these reports may be incongruous with objective ratings of distress (Denson, Spanovic, & Miller, 2009; Dickerson & Kemeny, 2004). This could be problematic when attempting to relate levels of distress experienced to objective memory errors. As highlighted in Chapter Two, cortisol, a hormone released during a stressful event (e.g., Morgan et al., 2001), has been implicated in differential effects of memory (Abercrombie et al., 2003; Buchanan et al., 2006). As such, cortisol is proposed to be a useful objective distress marker to compare with subjective reports.

Additionally, excessive cortisol levels may cause cognitive impairment, as evidenced by findings that chronic cortisol release can damage hippocampal cells (Vermetten & Bremner, 2002). Imaging studies have also revealed that acute cortisol response to a stressor is associated with a deactivation of the hippocampus (Khalili-Mahani et al., 2010; Pruessner et al., 2008). As the hippocampus is a brain area known to play a critical role in learning and memory, this further highlights the importance of assessing acute cortisol levels in response to a distressing event.

In Chapter Three the literature regarding cortisol as predictor for false memory susceptibility was discussed. Not only is the research in this area presently quite sparse, but most studies conducted have lacked ecological validity due to the methods employed to induce

cortisol response. While synthetic cortisol, the Cold Pressor Test (CPT) and the Trier Social Stress Test (TSST) methods (reviewed in Chapter Two) are known to produce high cortisol responses (e.g., Bullinger et al., 1984; Diekelmann et al., 2011; Kirschbaum et al., 1993), alone they are not appropriate analogue tasks to investigate reactions to a trauma. Psychological responses to these tasks are likely to be transient in nature, and unlikely to produce strong intrusions or avoidance. Further, these tasks are not long enough or detailed enough to produce a coherent narrative that could be manipulated to investigate false memory susceptibility. Because of this, in these studies the to-be-remembered stimuli used have been separate from the stressor, at a different time point. In reality however, when people are asked to report their memory of a trauma, the to-be-remembered stimulus and the stressor generally concern the same event.

As emphasised in Chapter Three, most cortisol and false memory research so far has involved the DRM task. Cortisol has been found to be related to accuracy; with reduced accuracy when cortisol was elevated at retrieval time (Diekelmann et al., 2011; Smeets, Jelicic, & Merckelbach, 2006), but increased accuracy when elevated during consolidation (Smeets et al., 2008). Further, cortisol was found to either reduce susceptibility for false memories (Diekelmann et al., 2011), or to have no effect on false memories (Smeets, Jelicic, & Merckelbach, 2006; Smeets et al., 2008). To date in only one study has cortisol been tested in relation to false memories for a more complex distressing event, and it was found that cortisol was related to increased susceptibility to misleading questions (Eisen et al., 2007). However this was in a sample of already traumatised children. Prospective studies are therefore required to assess the role of cortisol response in susceptibility to false memories in a non-traumatised adult sample.



It has been argued that a key aspect of a distressing event likely to produce a cortisol elevation is that the event is uncontrollable in nature (Dickerson & Kemeny, 2004), as well as challenging, threatening and intense (Denson et al., 2009). This means that any experiment attempting to increase cortisol levels should involve the abovementioned elements. According to Holmes et al., (2004): “Witnessing a trauma film is a situation where an active defense reaction is not appropriate and the participant cannot “escape” without terminating the experiment” (Holmes et al., 2004; p.g. 19). Therefore while the methods reviewed above (the TSST and CPT) both have uncontrollable elements, another option involves employing the trauma-film paradigm (TFP) to elevate cortisol levels. Cortisol levels have previously been found to increase in response to a distressing film relative to a neutral film (e.g., Nejtek, 2002; Takai et al., 2004). Thus the TFP is proposed as an alternative method of investigating how cortisol levels interact with distress to impact false memory susceptibility.

An additional concern with the abovementioned studies on cortisol and false memories is that participants were not separated into cortisol responders and non-responders. There are individual differences in cortisol response (e.g., Kudielka et al., 2009) and that these differences may lead to differences in memory following a stressor (Buchanan et al., 2006; Elzinga & Roelofs, 2005; Khalili-Mahani et al., 2010). This could mean that the cortisol and false memory effects (or lack thereof) reported could be influenced by variability in the cortisol response by participants (however, see Smeets, Jelicic, Merckelbach, et al., 2006, where cortisol responders and non-responders did not differ on a source-monitoring test). Therefore it is prudent to compare responders and non-responders for false memory susceptibility.

### *The Current Study*

In the current study the TFP is utilised as a psychological stressor in order to induce cortisol release as well as for testing false memory susceptibility. This method has clear benefits over the previous methods of the TSST and CPT, which involve inducing cortisol release and then assessing memory for a different stimulus. Further, while some studies have separated participants into cortisol responders and non-responders to determine differences in memory accuracy, it appears this study is the first to employ this technique in the context of false memories. Similarly, while previous studies have used violent films to increase cortisol levels, the assessment of cortisol responders and non-responders has not occurred.

One limitation of the previous two film experiments, however, is the fact that the neutral film used for comparison is an entirely different film to the trauma film. The differential findings when comparing the films may have been due to other differences between the films (as opposed to simply being different in valence). In previous research it has been demonstrated that providing instructions on how to appraise a distressing film (e.g., distancing responses compared to focus on the upsetting content) can influence subsequent reports of distress (Koriat, Melkman, Averill, & Lazarus, 1972). Therefore, to counteract the possibility that the neutral and trauma films were too different, in the present experiment an additional film condition was included where participants viewed the trauma film but were told that the people in the film were actors. In addition, it has been found that people who use reappraisal processes to deal with stress tend to experience and express more positive, relative to negative, emotion (Gross & John, 2003; see also Richards & Gross, 2000). Therefore it was expected that those participants in the reappraisal condition would experience lower levels of subjective and objective distress.

Lastly, the results of Experiments Two and Three differed with regard to timing of misinformation exposure, distress and memory testing, which may explain the contrasting results observed. In the present experiment the misinformation was administered during the first experimental session as in Experiment Three. The inclusion of the misinformation manipulation and memory testing in the first session (as opposed to a week later as in Experiment Two) was based on the decision to assess participants while cortisol levels were still affected by the film. However, memory and subjective distress were also tested a week after the film to determine the role of time in affecting both.

### *Study Aims and Hypotheses*

It was the aim of this study to compare biological and psychological distress responses regarding false memory susceptibility. In particular, cortisol responder status, dissociation, intrusions, and avoidance as vulnerability factors were examined using the TFP. It was expected that cortisol levels would be higher in response to the trauma film, in comparison to the neutral film (as found in Nejtek, 2002). Further, the third condition with the reappraisal manipulation for the trauma film was expected to produce cortisol levels resembling those of the neutral film condition. This reappraisal condition was also expected to produce less subjective distress in participants compared to those viewing the trauma film knowing the people are really hurt. Although overall cortisol levels may not relate to subjective distress ratings, it was expected in this study that distress ratings would also relate to cortisol responder status, in line with previous research (Kunz-Ebrecht et al., 2003).

Based on suggestions that cortisol may be related to dissociative responses (e.g., Giesbrecht, Smeets, et al., 2007; Koopman et al., 2003; Morgan et al., 2009; Weiss, 2007), it

was also expected that both state and trait dissociation would be positively correlated with cortisol levels in this study. While it was expected that cortisol responses would be related to false memories, due to conflicting research findings no directional predictions were made regarding whether cortisol would be related to an increase or a decrease in accuracy and false memories. Lastly, as some research has previously found high and low dissociators to differ in memory recall (e.g., DePrince & Freyd, 2004) and stress reactivity (Simeon, Knutelska, Smith, Baker, & Hollander, 2007), participants were screened for high and low dissociation levels to determine whether these results would be observed in the present study.

## Method

### *Participants*

Participants were 105 (44 male) undergraduate Psychology students with mean age 19.58 ( $SD = 3.04$ ) who participated for course credit. Inclusion criteria included proficiency in written and spoken English. There were three groups, those who viewed the neutral film ( $N=35$ ), those who viewed the trauma film ( $N=35$ ) and those who viewed the trauma film but were told the people were actors (the ‘reappraisal’ group;  $N=35$ ). Participants were randomly allocated to each group, and were not significantly different in terms of age,  $F(2,101) = .32, p = .73$ , or gender,  $F(2,101) = .13, p = .88$ . Participants were tested alone or in small groups of 2–4 but seated at individual computers. Participation was voluntary and conducted following informed consent.

### *Materials*

Participants completed the measures via the internet survey program LimeSurvey (v1.87), and viewed one of the two films on their computer.

#### *Films.*

The films shown were the same neutral (live footage of a fire-fighter recruit training exercise) and trauma (US emergency service personnel attending the scene of a motor vehicle accident) films with voiceovers used in Experiment Two and Three. Participants only saw one film. A further condition (termed the 'reappraisal condition') was added where participants viewed the trauma film, however they were told the following: "This is a training film used by emergency services, and is not real. The film was produced using actors, and no one was actually killed or injured. Please remind yourself of this as you watch the film."

#### *Narratives.*

Participants were given an 'eyewitness statement' of the film they viewed, under the pretext of reminding them of the event. The narratives contained both true information and misinformation (details that were different or absent from the film) and were the same as those in Experiment Three.

### *Questionnaires*

#### *Pre-screen.*

A screening questionnaire on the participant subject pool database was used to exclude participants from signing up if they were on hormonal contraceptive medication (as some research suggests hormonal contraceptive use interferes with cortisol levels in females; Kudielka et al., 2009). Participants taking medications known to affect cortisol levels such as

antidepressants (Kirschbaum et al., 1996), participants with previous or current psychiatric or neurological illness (Robinson, Sunram-Lea, Leach, & Owen-Lynch, 2008) and smokers (due to elevated basal cortisol levels in this population, according to Khalili-Mahani et al., 2010) were also excluded. Further, six questions from the DES-C (see Appendix H) were included in the pre-screen to recruit high (total score from 45-60) and low (0-15) dissociators. However, experimenters are unable to see the original scores on the pre-screen, as the pre-screen is only used to limit who can sign up for the experiment. As such participants were administered the full DES-C in the experiment.

#### *Cortisol Exclusion Questionnaire.*

On the day of the experiment those participants who reported waking prior to 6.30am or after 8am were excluded from the study or asked to return another day (in line with Robinson et al., 2008). Further exclusion criteria involved the following: food or drink consumption (except water) within one hour before testing (Robinson et al., 2008); alcohol or caffeine consumption 12 hours prior to the experiment; heavy exercise within one hour before testing; as all of these are known to affect cortisol levels. Additionally those participants who reported brushing their teeth within 45 minutes of testing were excluded due to interference with saliva collection (Salimetrics, 2011b).

#### *Demographic and pre-film questionnaires.*

Gender, age, trait dissociation (DES-C), and trauma history (brief trauma questionnaire – BTQ) were assessed, as used in previous experiments of this thesis.

#### *Post-film questionnaires.*

As with Experiment Three, after the state dissociation questionnaire (SDQ), filler task and narrative with misinformation, free recall (FR) and recognition memory were assessed.

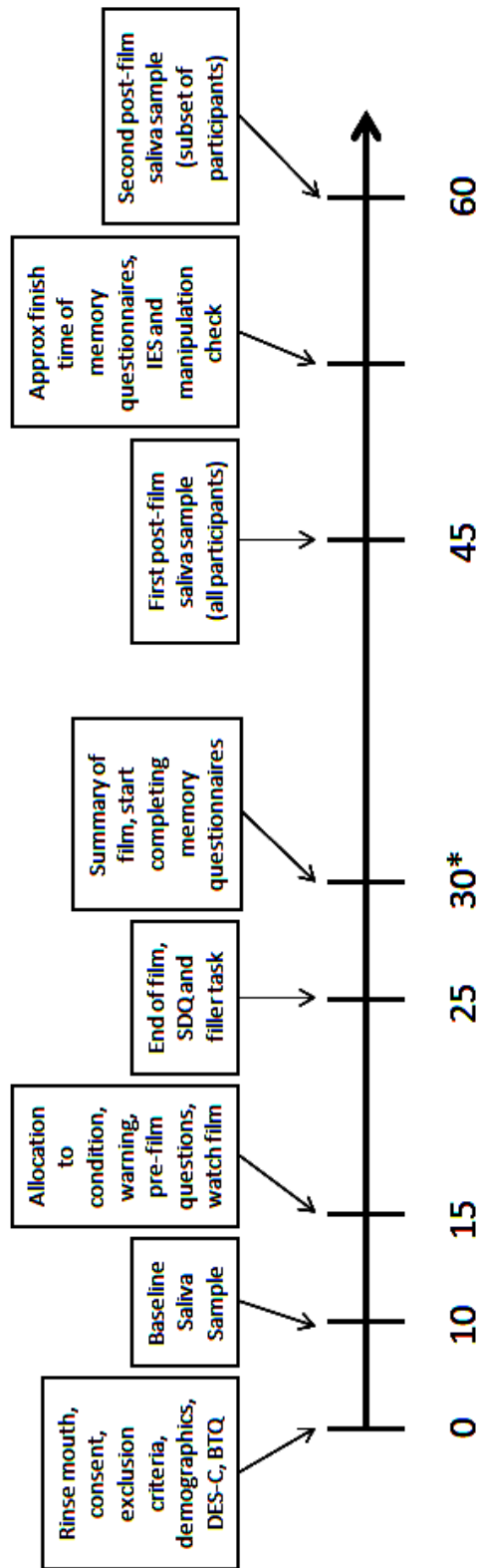
Participants completed the Impact of Event Scale - Revised (IES-R) to assess subjective distress, and lastly completed a manipulation check regarding whether participants guessed the purpose of the study. Participants completed the IES-R, the FR and recognition questionnaires and another manipulation check again a week later online. Those participants in the reappraisal condition also received a further manipulation check regarding whether they believed the people in the film were actors.

### *Procedure*

All experimentation was conducted between 2pm and 6pm to account for circadian rhythm effects on cortisol (in line with Beckner, Tucker, Delville, & Mohr, 2006; Giesbrecht, Smeets, et al., 2007). The participants in this study were informed that they were participating in “A Forensic Psychology Study of Memory Two”, with the true purpose being concealed. Firstly participants rinsed their mouths with water to prepare for the saliva sample. Participants then completed the exclusion criteria questions, demographics, the DES-C, and the BTQ. Basal cortisol levels in saliva were collected in storage tubes (Salimetrics, via Stratech Scientific; Sydney, Australia) at least 10 minutes after participants had rinsed their mouths. Participants were not informed of the exact nature of the trauma film until after the baseline measure had been taken so as to not increase cortisol levels through anticipatory stress. However, to ensure informed consent for ethical purposes all participants were told in the study advertisement that they would view a film that was “graphic” in nature. Following the baseline saliva sample, participants were informed which film they were to view (with participants in the reappraisal condition also told the people in the trauma film were acting and did not actually get hurt), and then watched the film.

Following the film, participants completed the SDQ and a filler task. They were then given the summary of the film to read (corresponding to which film they viewed) and then asked to complete the FR and recognition memory questionnaires. The post-film cortisol measure was taken at 20 minutes following the end of the film, as many studies report that it takes approximately 20-25 minutes for cortisol levels to peak peripherally (Giesbrecht, Smeets, et al., 2007; Robinson et al., 2008). A subset of participants (N = 46) provided another saliva sample for a third time point, 35 minutes post film (15 minutes following the previous sample). This was to ensure cortisol levels had peaked, as other studies also have tested participants around 30-40 minutes post stressor (e.g., Koessler, Engler, Riether, & Kissler, 2009; McRae et al., 2006). Participants completed the IES-R and manipulation check and were reminded that they would receive an online follow up in a week. See Figure 1 for a timeline of Part One of the experiment.





*\*Participants could go at their own pace for the questionnaires, so completion times are approximate. All participants gave saliva samples at timed intervals.*

Figure 1. Sequence of questionnaires, saliva sampling and film.

One week later, participants were sent a follow-up survey online which contained the IES-R, the FR and recognition memory questionnaires, and the manipulation check. Participants were then debriefed as to the true purpose of the experiment.

### *Saliva Storage and Cortisol Analysis*

Saliva samples were stored in a 4°C refrigerator for the length of the first experimental session and then promptly transferred to a -20°C freezer until ready for analysis (in accordance with instructions from Salimetrics, 2011b). On the analysis day, saliva was thawed and centrifuged at 3000 rpm for 15 minutes. Cortisol levels were determined using a commercially available salivary cortisol Enzyme Immunoassay (EIA) kit (Salimetrics, PA, USA), with each sample being processed in duplicate. Mean intra- and inter- assay variation coefficients have been reported of 3.5% and 5.1%, respectively (Salimetrics, 2011a).

## Results

Analyses were based around the following questions: Would participants who saw the traumatic film experience more distress compared to those viewing the film with the reappraisal manipulation or the neutral film? Would cortisol levels be higher in response to the trauma film compared to the other two conditions? Would cortisol levels relate to trauma history, dissociation and subjective distress? Would the amount of misinformation reported differ depending on the film condition; and would cortisol, trauma history, dissociation and distress influence these findings?

One participant was excluded from analyses for scoring over three standard deviations above the mean on the dissociation and distress measures (Osborne & Overbay, 2004). One

participant reported having previously received a diagnosis of PTSD; however as the traumatic event experienced by this participant was not a car accident their results were not excluded from analyses. In Part One, five participants guessed the purpose of the experiment, and in Part Two three participants guessed; however those participants who guessed were not significantly different from the other participants on any of the dissociation or distress measures, nor were they significantly different regarding misinformation reporting ( $ps > .131$ ). As such these participants were still included in all analyses. Of the participants in the reappraisal condition, 13 (46%) indicated they did not believe the people in the film were actors. Twenty one participants failed to return for part two; however follow up status was not significantly related to distress or dissociation in Part One ( $ps > .10$ ). Therefore where applicable these participants' answers were still included. This yielded 104 participants for part one, and 83 for part two.

### *Success of Pre-Screen*

Using the same six DES-C questions used in the subject pool pre-screen, it was expected that a binomial distribution would be observed where participants scored either in the range of 0-15 (low) or 45-60 (high). However many participants (49%) scored from 16-44. Therefore the screen was unsuccessful in only allowing high and low dissociators to participate in the experiment. Further, only six participants were classified as scoring high on the DES-C. This skew towards lower scores led to a slightly lower mean score (using all the DES-C questions;  $M = 31.45$ ,  $SD = 16.29$ ) than the previous chapters and other research, however the mean was still within the same range.

### *Trauma History*

Of the 87 people who responded on the BTQ (it was not compulsory due to the personal nature of the questions) only 25 did not report any previous trauma (23%). Of those reporting previous trauma, 29 (33%) had experienced more than one traumatic event (see Appendix I for further information).

### *State Dissociation and Distress.*

Table 13 presents the descriptive statistics for the distress measures and the state dissociation scale for the three film conditions (trauma, reappraisal and neutral film).

*Table 13. State dissociation (SDQ) and distress (IES subscales) across the three film conditions.*

	Trauma			Reappraisal			Neutral		
	Mean	SD	N	Mean	SD	N	Mean	SD	N
SDQ	1.80	0.64	34	1.85	0.73	35	1.56	0.51	35
Intrusions T1	2.76	1.10	31	2.58	1.37	32	1.67	0.89	33
Intrusions T2	2.36	1.11	27	1.99	1.17	28	1.38	0.49	28
Avoidance T1	2.18	0.73	31	2.10	0.91	32	1.48	0.74	33
Avoidance T2	2.15	0.95	27	1.79	0.85	28	1.32	0.54	28

Reports of dissociation during the film (SDQ) were assessed for group differences for the three film types using a one-way ANOVA. The group differences were not significant

overall,  $F(2,103) = 2.11, p=.13$ , however planned contrasts revealed that both the trauma and reappraisal film conditions prompted significantly more state dissociation in participants during film watching in comparison to the neutral film,  $t(101) = 2.02, p=.046$ . The trauma and reappraisal conditions were not significantly different from each other,  $p=.72$ .

Reports of intrusions of the film (using the intrusions subscale of the IES (IES-I)) directly following the film (T1), and at one-week follow up (T2) were analysed using a 3 (film type, trauma, reappraisal and neutral) x (2) (time, T1 and T2) repeated measures ANOVA. There was a significant effect of time  $F(1,80) = 16.55, p<.001, \eta^2=.17$ , with significantly fewer reports of intrusions overall at T2 compared to T1. There was also a significant effect of film type,  $F(2,80) = 9.55, p<.001, \eta^2=.19$ , with significantly higher reports of intrusions for the trauma and reappraisal film conditions than the neutral film at both T1,  $t(93) = 4.12, p<.001$ , and T2,  $t(80) = 3.53, p=.001$ . Contrary to hypotheses the trauma and reappraisal conditions were not significantly different from each other at either time point,  $ps>.17$ , nor was the time\*condition interaction significant,  $p=.49$ .

Reports of avoidance for the film (using the avoidance subscale of the IES (IES-A)) directly following the film (T1), and at one-week follow up (T2) were analysed using a 3 (film type, trauma, reappraisal and neutral) x (2) (time, T1 and T2) repeated measures ANOVA. There was a significant effect of time,  $F(1,80) = 5.44, p=.02, \eta^2=.07$ , with significantly fewer reports of avoidance overall at T2 compared to T1. There was also a significant effect of film type,  $F(2,80) = 8.50, p<.001, \eta^2=.18$ , with significantly higher reports of avoidance for the trauma and reappraisal film conditions than the neutral film at both T1,  $t(93) = 3.85, p<.001$ , and T2,  $t(80) = 3.50, p=.001$ . Contrary to hypotheses the trauma and reappraisal conditions

were not significantly different from each other at either time point,  $p > .10$ , nor was the time\*condition interaction significant,  $p = .54$ .

Table 14 presents correlations between trauma history (number of traumatic events experienced as assessed by the BTQ), the dissociation scales and the distress measures (for the conditions combined as similar patterns of results emerged when split by film type). It was found that the DES-C correlated positively with the SDQ, in line with the results of Experiment Two. The correlation between the DES-C and avoidance at T1 just missed significance. Trauma history (BTQ) was correlated positively with intrusions and avoidance at both time points. The SDQ was correlated positively with all scales except the BTQ. The IES subscales were highly correlated with the other subscales at both time points and subscales correlated with their equivalent subscale a week later. The correlation analyses were repeated using the DES-C subscales. All three subscales correlated positively with the SDQ,  $r_s > .22$ ,  $p_s < .03$ , and the depersonalisation/derealisation subscale positively correlated with avoidance at T1,  $r = .22$ ,  $p = .03$ . The subscales did not correlate with any other measure.

Table 14. Correlations between trauma history, dissociation (trait and state) and the distress measures.

	DES-C	BTQ	SDQ	IES-I T1	IES-A T1	IES-I T2	IES-A T2
DES-C	1	-.09	<b>.29**</b>	.05	<b>.20†</b>	.19	.17
BTQ		1	.10	<b>.24*</b>	<b>.28**</b>	<b>.24*</b>	<b>.31**</b>
SDQ			1	<b>.44**</b>	<b>.47**</b>	<b>.33**</b>	<b>.33**</b>
IES-I T1				1	<b>.72**</b>	<b>.60**</b>	<b>.51**</b>
IES-A T1					1	<b>.68**</b>	<b>.65**</b>
IES-I T2						1	<b>.82**</b>
IES-A T2							1

\* $p < .05$ ; \*\* $p < .01$ ; † $p = .05$

### Cortisol

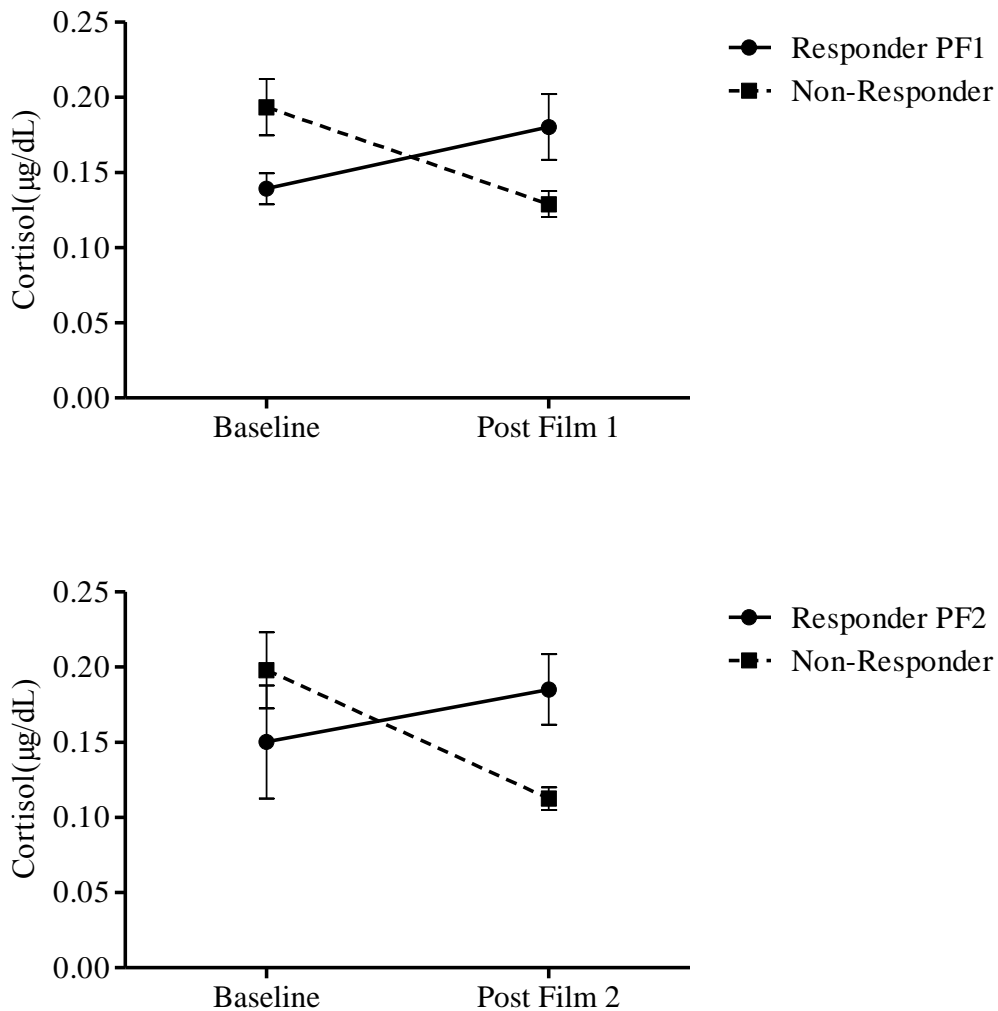
Differences in cortisol levels (mean  $\mu\text{g/dL}$ ) at baseline, post-film 1 (20 minutes; PF1) and post-film 2 (35 minutes; PF2) were assessed using a 3 (film type, trauma, reappraisal and neutral) x (3) (cortisol sample, baseline, PF1, PF2) repeated measures ANOVA. There were significant differences across sample time,  $F(2,42) = 4.73$ ,  $p = .01$ ,  $\eta^2 = .18$ , with an overall decline in cortisol levels from baseline to PF1 and PF2. Contrary to hypotheses there was no significant effect of film type, nor was the interaction significant  $ps > .16$ .

A post-hoc split was performed to separate participants into responders (those who responded to the film with any increase in cortisol from baseline either at PF1 or PF2) and non-responders (those who had no change or a decrease in cortisol levels from baseline to PF1 or PF2); this split was performed based on the methods of previous research (e.g., Buchanan et al.,

2006). Of the 103 participants who provided a sample at PF1, 45 (43%) were classed as responders and 58 (55%) were non-responders. Only 46 participants provided a sample at PF2, but of those, 16 (35%) were responders and 30 were non-responders (65%); see Figure 2. Nine (20% of 46) participants were responders at both time points.



Figure 2. Mean and SEM of cortisol values ( $\mu\text{g/dL}$ ) for responders and non-responders at the post film 1 and post film 2 time points.



Absolute percentage changes in cortisol from baseline to PF1 were then analysed using a one-way ANOVA with six groups (cortisol responders and non-responders for each film condition). While overall the means were not significantly different,  $F(5,97) = 1.54, p=.18$ , a planned contrast comparing trauma responders to reappraisal responders plus neutral responders was significant,  $t(97) = 2.59 p=.01$ ; suggesting a significantly greater change

(increase) in cortisol levels in responders in the trauma condition, as hypothesised. See Figure 3 for mean cortisol values across the six conditions (see also Appendix I for a table with means and SDs). Due to very small sample sizes when splitting into the six groups for PF2, the ANOVA and contrast were not conducted.

Figure 3. Mean and SEM of cortisol values ( $\mu\text{g/dL}$ ) for cortisol responders and non responders for each film condition.

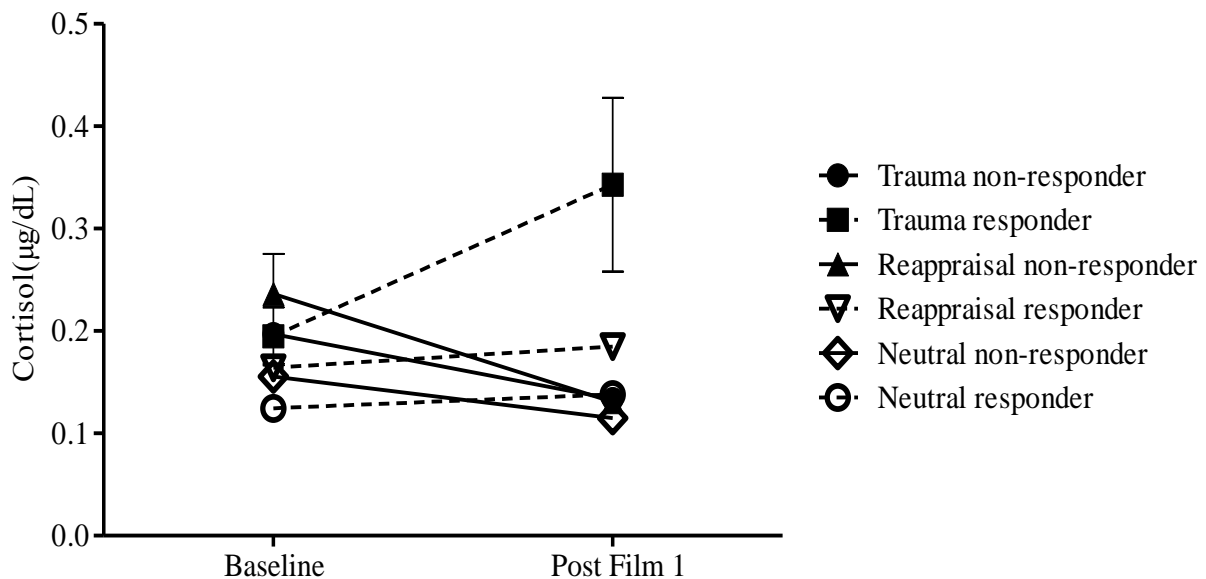


Table 15 presents the correlations between the baseline cortisol levels, percent change in cortisol from baseline to PF1, and from baseline to PF2, trauma history, dissociation (state and trait), and responses to the film (intrusions and avoidance). While there were no significant correlations between the variables at baseline or the first time point (baseline to PF1) significantly higher changes in cortisol levels from baseline to PF2 were observed for high scorers on both the SDQ and the avoidance subscale of the IES (T1). The correlation between

the DES-C and cortisol at PF2 just missed significance. Both cortisol time points were also highly correlated. Repeating the correlation analyses with the DES-C subscales, as expected it was found that the depersonalisation/derealisation subscale was positively correlated with cortisol change at PF2 but just missed significance,  $r = .28, p=.057$ , and the amnesia subscale was also positively correlated with cortisol change at PF2,  $r = .38, p=.01$ . A series of one-way ANOVAs were conducted to investigate whether cortisol responder status (at PF1 and PF2) affected reports of intrusions and avoidance (at T1 and T2), however contrary to hypotheses no significant differences were observed,  $ps >.192$ .

*Table 15. Correlations between trauma history, state and trait dissociation and the IES subscales for percent cortisol change.*

	BTQ	DES-C	SDQ	IES-I T1	IES-A T1
Baseline Cortisol	0.1	0.05	0.03	-0.03	0.04
Cortisol Change Baseline to PF1	0.03	-0	0.08	0.04	0.16
Cortisol Change Baseline to PF2	-0.01	<b>.29<sup>†</sup></b>	<b>.31<sup>*</sup></b>	0.11	<b>.29<sup>*</sup></b>

*\* $p < .05$ ; \*\* $p < .01$ ; † $p = .051$*

### *Memory*

#### *Free Recall*

The following measures of recall calculated at both time points:

- 1) Accuracy (total score of the count of correct items present in the film)

- 2) Misinformation (total score of the count of misinformation items introduced in the narrative)
- 3) Confabulations (total score of the count of items not in the film or narrative, spontaneously fabricated by participants)

The scorer of the recall responses was the experimenter; so to check for bias a second coder blind to conditions and hypotheses scored a random subset of the responses to assess inter-rater reliability of the scoring. There were significant intra-class correlations between the coders on all three recall measures (accuracy = .77, misinformation = .94, confabulations = .86; all  $p < .01$ ).

FR accuracy directly following the film (T1), and at one-week follow up (T2) was analysed using a 3 (film type, trauma, reappraisal and neutral) x 2 (time, T1 and T2) repeated measures ANOVA. There was a significant effect of time,  $F(1,80) = 6.68, p = .01$ . There was a significant effect of film type,  $F(2,80) = 24.13, p < .001, \eta^2 = .38$ , with significantly more true information reported in the trauma and reappraisal film conditions than the neutral film at T1,  $t(101) = 5.91, p < .001$  and T2,  $t(80) = 4.93, p < .001$ . The trauma and reappraisal conditions were not significantly different from each other at T1,  $t(101) = 0.43, p = .67$ , however were different at T2,  $t(80) = 2.48, p = .02$ , with participants in the trauma condition reporting significantly more true information than those in the reappraisal condition. The time\*condition interaction was not significant,  $p = .10$ .

Reporting of misinformation directly following the film (T1), and at one-week follow up (T2) was analysed using a 3 (film type, trauma, reappraisal and neutral) x 2 (time, T1 and T2) repeated measures ANOVA. There was no significant effect of time  $F(1,80) = 2.48, p = .12$ .

There was no significant effect of film type,  $F(2,80) = 0.86$ ,  $p=.42$ . The time\*condition interaction was not significant,  $p=.09$ .

Confabulations were assessed directly following the film (T1), and at one-week follow up (T2) using a 3 (film type, trauma, reappraisal and neutral) x 2 (time, T1 and T2) repeated measures ANOVA. There was no significant effect of time, nor was there a significant effect of film type, nor was the time\*condition interaction significant,  $ps>.06$ .

### *Recognition*

Two measures relating to recognition were calculated at both time points (T1 and T2):

- 1) Accuracy (scores out of 24 correctly responding 'true' to seeing eight items viewed in the film, and correctly responding 'false' to eight non-misinformation items not viewed in the film, and correctly responding 'true' to items mentioned in the narrative summary that were also in the film).
- 2) Misinformation (score out of eight for number of misinformation items falsely reported as true).

Recognition accuracy directly following the film (T1), and at one-week follow up (T2) was analysed using a 3 (film type, trauma, reappraisal and neutral) x (2) (time, T1 and T2) repeated measures ANOVA. There was a significant effect of time,  $F(1,79) = 9.42$ ,  $p<.01$ ,  $\eta^2=.11$ , with greater accuracy at T1 than T2. There was also a significant effect of film type,  $F(2,79) = 7.89$ ,  $p=.001$ ,  $\eta^2=.17$ . Planned contrasts revealed that participants in the trauma and reappraisal conditions were more accurate in comparison to the neutral condition at T1,  $t(101) = 3.87$ ,  $p<.001$ , however the trauma and reappraisal conditions were not significantly different,  $p=.90$ . The same pattern was observed at T2, with greater accuracy in the trauma and reappraisal conditions,  $t(80) = 3.13$ ,  $p=.002$ , however the trauma and reappraisal conditions

were not significantly different,  $p=.39$ . The time\*condition interaction was not significant,  $p=.94$ .

Recognition of misinformation items following the film (T1), and at one-week follow up (T2) was analysed using a 3 x (2) repeated measures ANOVA. There was no significant effect of time,  $F(1,80) = 0.08$ ,  $p=.78$ , nor condition,  $F(2,80) = 1.98$ ,  $p=.14$ , nor was the time\*condition interaction significant  $F(2,80) = 1.63$ ,  $p=.20$ .

### *Distress, Dissociation, Cortisol and Memory*

#### *Free Recall*

Recall accuracy scores at T1 were analysed using multiple linear regression, with the variables, DES-C, BTQ, SDQ, IES-I (T1), IES-A (T1) and cortisol responder status (PF1) as predictor variables. The model was not significant, neither were any of the predictors. This regression analysis was repeated with recall of misinformation at T1 as the dependent variable. Although the model was not significant, cortisol responder status was a significant positive predictor, suggesting cortisol responders reported more misinformation. No other predictor was significant. A regression for confabulation responses at T1 was also not significant, with no predictors significant; see Table 16 for regression output. The above regressions were repeated using the DES-C subscales as predictors instead of the DES-C as a whole. The depersonalisation/derealisation subscale was a significant predictor of accuracy,  $\beta = .45$ ,  $p=.049$ , however the rest of the models and predictors did not change; see Appendix I.

Table 16. Predictors of Free Recall Accuracy, Misinformation Reporting, and Confabulations at Time 1

Variable	Accuracy T1	Misinformation T1	Confabulation T1
	$\beta$	$\beta$	$\beta$
DES-C	-.18	-.11	-.06
BTQ	.02	-.04	.02
SDQ	.04	.08	-.21
Intrusions T1	.00	.15	.08
Avoidance T1	.19	-.14	.08
Cortisol Responder PF1	.09	<b>.24*</b>	.04
R <sup>2</sup>	.08	.08	.04
F(6,86)	1.12	1.18	0.63

\* $p < .05$

Recall accuracy scores at T2 were analysed using multiple linear regression, with the variables IES-I (T2), IES-A (T2), DES-C, SDQ, BTQ, and cortisol responder status (PF1 and PF2) as predictor variables. The model was not significant and no predictors were significant. A regression for misinformation at T2 was also not significant; however the BTQ emerged as a significant positive predictor, suggesting higher numbers of reported trauma events was related to increased reporting of misinformation items. A regression for confabulations at T2 was also not significant. Both the DES-C and the avoidance subscale of the IES at T2 were significant positive predictors, suggesting higher reports of dissociation and avoidance were related to increased confabulations. As can be seen from the regression output (Table 17), the percentage

of variance explained in each model is considerably higher than those at T1. Therefore it is possible with a higher sample size some of these models would have been significant. The above regressions were repeated using the DES-C subscales as predictors instead of the DES-C as a whole. No changes were observed for accuracy, however the absorption subscale just missed significance as a positive predictor of misinformation recall,  $\beta = .54, p=.058$ , and was a significant predictor of confabulations,  $\beta = .80, p=.004$ ; see Appendix I.

*Table 17. Predictors of Free Recall Accuracy, Misinformation Reporting, and Confabulations at Time 2*

Variable	Accuracy T2	Misinformation T2	Confabulation T2
	$\beta$	$\beta$	$\beta$
DES-C	-.24	.11	<b>.49*</b>
BTQ	.18	<b>.41*</b>	.09
SDQ	.16	-.17	-.01
Intrusions T2	-.14	.39	-.41
Avoidance T2	.34	-.31	<b>.69*</b>
Cortisol Responder PF1	-.11	.11	-.05
Cortisol Responder PF2	.22	-.32	-.30
R <sup>2</sup>	.28	.29	.36
F(7,36)	1.61	1.67	<b>2.30†</b>

\* $p < .05$ ; † $p = .054$



### *Recognition*

Recognition accuracy at T1 was analysed using multiple linear regression, with the variables IES-I (T1), IES-A (T1), DES-C, SDQ, BTQ, and cortisol responder status (PF1) as predictor variables. The model was significant,  $R^2 = .20$ ,  $F(6,86) = 3.42$ ,  $p=.005$ , with intrusions being a significant positive predictor,  $\beta = .33$ ,  $p=.02$ . The regression model for recognition of misinformation items at T1 was not significant,  $F(6,86) = 0.48$ ,  $p=.82$ , nor were any predictors significant,  $ps>.44$ . Recognition accuracy at T2 was analysed using multiple linear regression, with the variables IES-I (T2), IES-A (T2), DES-C, SDQ, BTQ, and cortisol responder status (PF1 and PF2) as predictor variables. Although  $R^2 = .27$ , the model was not significant,  $F(7,36) = 1.55$ ,  $p=.19$ ; however the DES-C was a significant negative predictor,  $\beta = -.46$ ,  $p=.02$ , suggesting higher scores on the DES-C were related to lower recognition accuracy.

The regression model for recognition of misinformation items at T2 was not significant,  $F(7,36) = 0.80$ ,  $p=.59$ , nor were any predictors significant  $ps>.20$ . The above regressions were repeated using the DES-C subscales as predictors instead of the DES-C as a whole. The main changes of note are that for recognition of misinformation items at T1 the depersonalisation/derealisation subscale was a significant positive predictor,  $\beta = .61$ ,  $p=.007$  and the absorption subscale was a significant negative predictor,  $\beta = -.55$ ,  $p=.01$ . Absorption was also a significant negative predictor of recognition accuracy at T2,  $\beta = -.78$ ,  $p=.01$ ; see Appendix I.

### Discussion

One aim of this study was to test whether the use of a trauma film would produce comparable subjective and objective distress responses. It was expected in line with

Experiments Two and Three, that greater subjective distress would be experienced in response to the trauma film, in comparison to the neutral film. Similarly, cortisol response was expected to be higher for the trauma film compared to the neutral film. A further aim was to test whether a reappraisal condition (where people viewed the trauma film but were told those hurt in the film were actors) would be comparable to the neutral film for distress and memory. Based on research suggesting dissociation and cortisol may be related, state and trait measures of dissociation were also included. The above aspects were then all tested with relation to greater susceptibility to false memories for the films.

### *Distress*

Similar to Experiments Two and Three, the trauma film produced higher levels of subjective distress than the neutral film, as assessed by the avoidance and intrusions subscales of the IES. Contrary to expectations however, the reappraisal condition was not successful overall in producing lower subjective distress ratings, as the intrusions and avoidance ratings were not significantly different to those in the trauma condition. This result may be due to the high number of reappraisal condition participants who responded in the manipulation check that they did not believe the people in the film were actors. Believing the film to be real would produce the same response in the reappraisal participants as in the other trauma condition. In other studies fictional films have been found to successfully prompt distress reactions (e.g., Wilksch & Nixon, 2010); so another possibility is that the film was still sufficiently traumatic to increase distress for the people who did believe the manipulation. Therefore, it appears that the reappraisal condition for this accident film is not an appropriate control to assess lower subjective distress.

Once participants were split into cortisol responders and non-responders, it could be seen that cortisol responders started with a lower baseline cortisol mean, whereas non-responders on average experienced a decline in cortisol levels from baseline to post film. This finding is in accordance with other research (Buchanan et al., 2006). As hypothesised, the greatest cortisol response was observed in those participants who viewed the trauma film. Cortisol responders had on average a 40% increase in cortisol levels from baseline to 20 minutes after viewing the trauma film; cortisol responders in the reappraisal and neutral film conditions had a significantly smaller response (both less than 22%). While the subjective distress findings suggest that the trauma and reappraisal film conditions prompted significantly higher reports of distress than the neutral film, the reappraisal condition manipulation appears to have been more successful here with regard to lower objective distress.

This incongruence in subjective and objective distress measures supports previous research (Nejtek, 2002), along with the meta-analysis findings that suggested that emotional valence alone may not appear to affect cortisol response, but rather the emotion along with a detrimental appraisal of the event (Denson et al., 2009). This result highlights the importance of assessing both subjective and objective distress when using the TFP, as well as investigating appraisals of the event.

It is worth noting the fact that some participants in the neutral film condition still exhibited a cortisol response. Ethically it was important to ensure informed consent so all participants in the experiment were informed that they may view the trauma film. It is therefore possible some participants experienced anticipatory distress (e.g., Colzato, Van der Does, Kouwenhoven, Elzinga, & Hommel, 2011; Mason et al., 1973) at the thought of viewing the trauma film, which led to an elevation in cortisol levels still present following the film. It would

be expected this would be equally likely in all three conditions; therefore the ~20% increase in cortisol for cortisol responders in the reappraisal and neutral condition could be due to anticipatory stress, and the ~40% cortisol response in the trauma film could be attributed to ~20% anticipatory stress plus a further 20% for the upsetting nature of the film.

A greater increase in cortisol from baseline to the second post film sample was positively correlated with reports of avoidance at the week follow up. This suggests a linear relationship where lower cortisol levels in response to the film prompted less avoidance of the film throughout the week, whereas higher cortisol levels had the opposite effect. Further, in previous research it was found that people who responded to a stressful event with elevated cortisol also rated the event as significantly more distressing compared to those designated as 'non-responders' (Kunz-Ebrecht et al., 2003). This finding was not replicated in the current study though, with responders and non-responders not differing significantly in ratings of avoidance or intrusions.

Previously cortisol samples taken shortly after a trauma have been found negatively relate to intrusion and avoidance symptoms at follow up (Delahanty et al., 2000; Marshall & Garakani, 2002); these findings are in contrast with the results of the current analogue study. However, in another acute trauma population study it was found that while cortisol samples taken at 8am were negatively correlated with subsequent PTSD symptoms, cortisol levels at 4pm were positively related to PTSD (McFarlane et al., 2011). In the present study all testing was conducted in the afternoon (2pm – 6pm), and the positive correlation of cortisol (at the second post film time point but not the first) with avoidance also resembles the 4pm findings of McFarlane et al., (2011). Cortisol levels are known to be diurnal – this means that the minimal

and maximal levels of cortisol differ depending on the time of day. These variable findings highlight the importance of timing for testing cortisol in both analogue studies and field studies.

However, cortisol levels in the present study did not appear to be related to intrusion symptoms. Cortisol (as assessed at the second post-film time point) was, however, related to state dissociation during the film. The correlation between trait dissociation scores and cortisol just missed significance, however the amnesia subscale was positively correlated with cortisol (and the depersonalisation scale just missed significance). This finding supports others relating state dissociation and cortisol response to stress (Giesbrecht, Smeets, et al., 2007; Morgan et al., 2009). State dissociation was correlated with avoidance scores (and again the correlation with trait dissociation just missed significance but the depersonalisation subscale was significantly correlated).

As many conceptualisations of dissociation propose it is a form of avoidance (e.g., Steele et al., 2009), and cortisol levels were related to avoidance and dissociation, one possibility is that cortisol levels reflect an attempt to mentally avoid an aversive situation when physical escape is not possible; a suggestion that has been made elsewhere (e.g., Mason et al., 2001; Nijenhuis & den Boer, 2009; however their suggestion is that lower cortisol levels long-term reflect avoidance/disengagement symptoms). As basal cortisol levels and dissociation were not significantly related it is not possible to state at this time that this result reflects an ongoing pattern of responding at the trait level. However, as a non-clinical population was tested and this relationship has been theorised in relation to disordered processing of a trauma it is worth investigating these variables further.

## *Memory*

As with the previous studies in this thesis, greater accuracy was observed in participants who viewed the trauma film in comparison to the neutral film. This effect was present for both the FR and recognition tasks. Participants were equally susceptible to the misinformation effect in all three groups, as evidenced by the non-significant differences in misinformation recall and recognition. Similarly, no differences were observed regarding confabulation reporting across the three groups.

The intrusions subscale of the IES was related to recognition accuracy immediately following the film. Interestingly, this is the opposite finding to that of Experiment Two, where intrusions were related to increased FR accuracy but not recognition. Avoidance scores were found to be significantly related to confabulations, replicating the results of Experiment Two. However the positive relationship with false memories observed in experiment two was not found here. An interpretation of these conflicting results will be offered in the next chapter (the General Discussion).

Trait dissociation as a whole was found to be related to an increase in confabulations. The confabulation finding supports that of Giesbrecht, Geraerts et al., (2007) where dissociation (as measured by the DES) was related to an increase in confabulations for a violent film clip. In the present study an alternate version of the dissociation measure was employed (the DES-C); therefore the corresponding findings suggest that both may be appropriate measures for a non-clinical population using this method.

The absorption subscale of the DES-C was almost a significant predictor of misinformation FR, and was significantly related to confabulations. Interestingly however, the absorption scale was negatively related to recognition of misinformation items. The

depersonalisation/derealisation subscale was found to be positively related to FR accuracy, as well as recognition of misinformation items. These results suggest that the different aspects of dissociation may differ depending on the type of memory task (recall or recognition). A comparison of these results with the previous experiments of this thesis, along with a synthesis of the meaning of these results will be covered in the next chapter.

Trauma history (as assessed by the BTQ) was found to predict increased FR reporting of misinformation at the one week follow up. This result is in line with findings using the DRM task, where traumatised participants (with and without PTSD) exhibited greater false recall (Zoellner et al., 2000). It was hypothesised in that study that a general source-monitoring deficit may be present in traumatised participants. However, in another DRM study self-reported trauma history was not significantly related to false recall or recognition, but rather fantasy proneness (Geraerts et al., 2005). It appears that this thesis is the first to assess trauma history as a predictor of false memory susceptibility using the TFP; therefore it is important that further research is conducted to replicate this result, perhaps with the inclusion of the fantasy proneness measure.

Interestingly, cortisol responder status at the first post-film time point was related to more misinformation recall immediately following the film. In previous research negative (e.g., Smeets et al., 2006) or null (e.g., Smeets et al., 2008) relationships between cortisol and false memories have been observed. However, these studies involved a stressor that was administered at a different time to the to-be-remembered event (which was the DRM task). Further, participants were not split into cortisol responders and non-responders for analyses, even though responder status has been found previously to impact memory accuracy results (e.g., Buchanan et al., 2006). These methodological differences may explain the discrepant

findings. However, the positive relationship observed here between cortisol responder status and false memories does support the finding of Eisen et al., (2007) where cortisol levels in traumatised children were related to an increase in false memory reporting. The present study adds to the literature as trauma history was accounted for in analyses and therefore demonstrates a unique relationship between cortisol and memory in the absence of a Criterion A trauma.

#### *Limitations, Future Directions, and Conclusion*

An achievement of the current experimental approach was the use of the TFP to investigate both cortisol response and false memory for the same event. This method is an improvement over others where the stressor (e.g., the CPT) is administered to induce a cortisol response, and then a different stimulus is investigated for false memory development. The current procedure can be considered more ecologically valid; however this advantage can also serve as a limitation. Specifically, as cortisol has been thought to typically peak peripherally 20 minutes from the onset of the stressor, it is difficult to determine how much encoding and consolidation of the information in the film was affected by cortisol prior to the 20 minute post film assessment.

An additional limitation of the current experimental design relates to the fact that while participants gave their saliva samples at exactly the same times following the film, they were allowed to complete the post-film questionnaires and memory tasks at their own pace. For the most part, participants took roughly the same amount of time to complete the tasks (e.g., generally everyone was finished by the cortisol sample at 35 minutes post film viewing). However, some participants had not started the recognition task by the first sample and some



may have been in the middle of the task. This means that while it is expected cortisol levels would have been high around retrieval time, exactly which part of the task was most affected may be slightly different for each participant.

However, the results of this study demonstrate that cortisol responders differ anyway with respect to exactly when their cortisol response is highest. Some participants were classed as ‘non-responders’ at the first post film sample, but by the second sample time they experienced an increase in cortisol and were then ‘responders’. Similarly, some responders at the first time point experienced a decline in cortisol levels from then onward, and by the second time point their cortisol levels were not significantly different from baseline. Only a small subset of participants had high cortisol levels at both post film sample times. Therefore even if memory tasks are controlled so that everyone starts them at the same time post-stress, the variation in amount of circulating cortisol may still affect people differently. Considerable research is still required to properly tease out the specifics of these timing effects.

A further limitation of this study involves the failure of the pre-screen questionnaire to only recruit high and low dissociators. Based on responses to a subset of questions from the DES-C, it was expected that only participants who scored in the top and bottom 25% would be recruited into the study. However, nearly 50% of participants fell in between these values. Further, only a small number of participants were classed as ‘high’ in dissociation leading to a slightly lower mean score on the DES-C than has been observed in other studies (e.g., Wright & Loftus, 1999), though the mean was still within the same range as the other experiments of this thesis. Therefore the sample employed in this study is likely to be as representative of the population as the other studies of this thesis, but if this is not the case this potentially colours

interpretation of the results. However, as the DES-C was included in all regression analyses, this was able to be accounted for to some extent.

It may be the case that the subset of DES-C questions chosen did not accurately represent the questionnaire as a whole. Unfortunately, due to limited space on the pre-screen, the entire questionnaire was not allowed to be included; future research including the entire questionnaire in the screen may prove more successful. Another possibility is related to the common statistical finding of regression to the mean (e.g., Brand, Classen, McNary, & Zaveri, 2009), where over time extreme scorers on scales tend towards the average. This could suggest that the DES-C is not assessing a stable trait after all, and responses may change with time (see Maaranen et al., 2008, for a longitudinal study where high and low dissociation classifications changed over three years).

The small sample sizes for the second post film cortisol sample may have limited power, meaning some non-significant results may have been significant with a larger sample. Additionally, the failure of the reappraisal manipulation where many participants did not believe those in the film were actors, and the decision to still include these participants in analyses, means the results from the reappraisal condition should be interpreted with caution until further research can be conducted. Regardless, the relationships observed still highlight a need for further investigation of these variables; a replication of the current study may be required first though. Therefore it can be tentatively concluded that following a stressor, the individual responder may differ with regard to their response during the event (intrusions, avoidance/dissociation), and also whether they experience a stress-induced cortisol increase. This may in turn affect whether they are more distressed later on, and also whether they remember the event accurately. As an analogue study, it is important to investigate these

mechanisms in a clinical population. To be able to pinpoint which people experience these phenomena may be helpful in determining which people make credible eyewitnesses, and which people to monitor for development of a more severe trauma response, such as PTSD.

## CHAPTER EIGHT

### General Discussion

This chapter ties together the findings of the four experiments of this thesis. The aims of the thesis are revisited, and whether the experiments were able to address these aims is considered. Results are compared across the four experiments in order to determine the root of any inconsistencies. The results are also examined in light of the current research and theory on this topic, and implications are discussed. Lastly, limitations of the methodological approach implemented are discussed, along with future research directions.

#### Overview of Research Findings

It was the overall aim of this thesis to investigate several key factors that may contribute to false memories for distressing events, namely psychological distress symptoms such as avoidance, intrusions, and dissociation, and also the biological measure of cortisol release. However, within this overarching aim were several secondary aims investigating methodological and theoretical debates in the literature. Each aim and the relevant findings are discussed below.

*Aim 1: To investigate accurate and false memories for neutral and distressing stimuli.*

In Experiment One participants completed the DRM using neutral and trauma-related words. In Experiment Two misinformation was introduced in a narrative following viewing of a neutral or trauma film. In Experiment Three both the DRM and the misinformation procedure were utilised, and in Experiment Four besides adding the objective cortisol measure, a further change was the addition of a reappraisal condition (where people viewed the trauma film but

were told all people in the film were actors) condition to test whether this would be comparable to the neutral film for distress and memory. Some conflicting findings were observed across the experiments relating to the comparison of neutral and distressing stimuli, possibly due to these methodological changes. A comparison and explanation of these results follows.

Whereas in Experiment One greater accuracy was observed for the trauma word lists in comparison to the neutral lists, in Experiment Three the opposite was observed: fewer trauma words were accurately recalled. It is difficult to discern the reason for these contrasting results, as the same word lists and timing were used in both experiments. The only methodological difference was how participants viewed the words. In Experiment One participants came into the lab and viewed the words on a projector screen. In Experiment Three participants accessed the DRM task online at a time and location of their choosing. This change may have resulted in participants paying less attention during the task due to the experimenter not being present; however it is unclear why this would have only affected memory for trauma words and not neutral words. As the disagreement still stands in the literature regarding whether emotional valence enhances or degrades memory (e.g., Dehon et al., 2010; Gallo et al., 2009; Kensinger et al., 2007), at present the conclusion is that the accuracy valence effects of the DRM are not robust.

In both Experiment One and Three using the DRM task, the valence of the word lists (trauma and neutral) did not appear to be significantly related to critical lure recall or confabulations. These consistent findings suggest no significant valence effects for susceptibility to the DRM illusion or to making spontaneous errors; as least using these specific word lists and this exact method.

In Experiments Two, Three and Four both FR and recognition memory for the neutral or trauma film was assessed. In Experiments Two and Four it was found that participants were more accurate for the trauma film in comparison to the neutral film, as evidenced by higher FR and recognition accuracy scores. In Experiment Three, while higher recognition accuracy for the trauma film was also observed, no significant differences were observed for FR accuracy. Additionally, in Experiments Two and Four participants who viewed the trauma film recalled less misinformation than those in the neutral film conditions, however no differences were observed in Experiment Three. Another unexpected difference in Experiment Three was that participants in the trauma condition falsely recognised more misinformation than their neutral condition counterparts.

The reason for these inconsistent valence and memory findings for the film studies may be due to the different timings of the misinformation and memory assessments. In Experiment Two, the misinformation and memory assessments were a week after film viewing; in Experiment Three the misinformation and assessment took place in the same session as the film; and in Experiment Four the misinformation was administered in the same session, and the memory assessments were conducted at this time and at a week follow up. These different timing decisions were made based on the other variables involved in each study. For example, the inclusion of the DRM in Experiment Three meant that to avoid any confounding effect of viewing the trauma words prior to watching the trauma film (e.g., priming) the film and misinformation task occurred the week following the DRM. For Experiment Four, in order to investigate the role of cortisol levels on memory, the misinformation and memory assessments were administered while cortisol was expected to be elevated. In an attempt to investigate the

role of timing in Experiment Four, the memory assessments were also administered for the week follow up.

The memory consolidation process has been argued to take from 10 minutes to six hours (Walker, Brakefield, Hobson, & Stickgold, 2003). This means in both Experiments Three and Four the misinformation was given during the consolidation period, whereas in Experiment Two the misinformation was given well after this time frame. However, it has also been argued that the reactivation of a memory can return it to a sensitive state where a reconsolidation process can occur (Walker et al., 2003). Therefore while it appears that participants in all experiments were susceptible to some memory interference from the misinformation, the valence effects on memory may have been more sensitive to the timing of the assessments.

*Aim 2: To compare the DRM task to the Misinformation Procedure*

In Chapter One three main methods of indexing false memories were detailed: the DRM, the misinformation procedure, and the rich false memory procedure. It was argued that the underlying memory processes involved in each task are similar, and as many cognitive psychology researchers use the term ‘false memory’ to refer to a range of procedures, it is appropriate to apply this term for all three methods (Wade et al., 2007). Accordingly this thesis studied both the DRM task and the misinformation task, with the assumption that both would produce equivalent results. However, this did not occur: specifically, dissociation was significantly related to falsely remembering trauma words in the DRM task in Experiment One but was not related to false memories for the film task in Experiment Two. Experiment Three was designed to address discrepant findings between the previous two experiments. Whilst accuracy on the DRM task predicted recall accuracy for the film, false recall on the DRM was

not significantly related to false recall for the misinformation items introduced in the narrative. This would suggest that the underlying memory mechanisms for susceptibility to the DRM illusion and susceptibility to misinformation may not be the same.

Several researchers argue that from an ecological validity standpoint, only experiments where an entire event has been implanted in memory should be considered a false memory procedure (Freyd & Gleaves, 1996; Pezdek & Lam, 2007). However, in previous research responses on the DRM were found to be related to autobiographical false memories (such as alien abduction; Clancy et al., 2002). Additionally Wade et al., (2007) suggested that misinformation experiments and rich false memory experiments may influence the same underlying memory mechanisms. Why the DRM and misinformation results (both of this thesis and also Bock, 2009) are unrelated then is unclear; however, one argument is that the DRM requires two processes for a false memory (generating the lure and mistaking the source), whereas other false memory procedures only require a source monitoring error (mistaking the suggested information as part of the original event; see Wright et al., 2005). Future research is required to clarify these findings; however, based on the inconsistent findings of this thesis, there appears to be some support for the argument that not all false memory tasks assess the exact same phenomena.

### *Aim 3: To compare subjective and objective distress levels*

The inconsistent findings of Experiments One, Two and Three raised questions regarding the robustness of the methods and the stability of the subjective measures. Therefore Experiment Four was designed to build on the other experiments by including a biological, objective measure of distress in response to film viewing: cortisol release. One limitation of



many previous cortisol studies relates to the failure to separate cortisol responders and non-responders, and this may potentially explain some previous null findings and incongruence with subjective distress measures (e.g., Nejtek, 2002). In one study it was found that following a stressor, cortisol responders also rated the event as subjectively more distressing, compared to their non-responder counterparts (Kunz-Ebrecht et al., 2003). However, this result was not replicated in Experiment Four of this thesis, with responders and non-responders not differing significantly in ratings of avoidance and intrusions following the film. Several methodological differences may explain the incongruent results: in Kunz-Ebrecht et al., (2003) the stressor was a time-pressured, competitive cognitive task, and the subjective distress measure involved one single question with a low and high stress rating scale.

Taking into account cortisol responders and non-responders in Experiment Four, the greatest cortisol response was observed in those participants who viewed the trauma film. While the subjective distress findings suggested that the trauma and reappraisal film conditions were equivalent (both prompted significantly higher reports of distress than the neutral film), the reappraisal condition demonstrated a lower objective distress (cortisol) response, than the trauma condition. Cortisol change was found to be correlated with dissociation and avoidance, which suggests some similar underlying aspects. However the reappraisal result suggests that the biological measure may be more sensitive to detecting subtle differences produced by the conditions than the subjective measures.

*Overall Aim: To investigate the role of psychological and biological factors in predicting false memory susceptibility*

In Experiment One dissociation was related to false recall for traumatic stimuli in particular, as hypothesised; however findings related to the biases were less straightforward. The self-as-incompetent schema from the Post-Traumatic Cognitions Inventory was significantly related to lower confabulations, and the Looming Cognitive Style was related to an increase in confabulations. Dissociation was thus considered further in the subsequent experiments.

In Experiment Two avoidance scores were related to increased reporting and recognition of misinformation items. Reported experiences of intrusions related to greater accuracy. As intrusions and avoidance had not previously been considered in relation to false memory susceptibility, this novel finding was considered worthy of further exploration in the subsequent experiments. Trait and state dissociation were related to higher avoidance ratings following the film, but were not found to be related to false memory susceptibility. The failure to find a relationship between dissociation and false memories (as was observed in Experiment One) in Experiment Two was initially attributed to the differences between the tasks used in Experiments One and Two.

In Experiment Three, participants completed both the DRM task and the misinformation task. While the distress and state dissociation results of Experiment Two were replicated (specifically that all were higher in response to the trauma film in comparison to the neutral film), the memory results were not. Additionally, accuracy on the DRM task predicted accuracy for the film task; however susceptibility to the DRM illusion was unrelated to susceptibility to the misinformation effect, a similar finding to a study where the DRM was not related to

susceptibility to misleading questions (Bock, 2009). An inventory of past traumatic experiences was included to determine whether this would predict distress and memory responses. Contrary to expectations and previous research (e.g., Brennen et al., 2007; Geraerts et al., 2005), neither trauma history nor dissociation was related to false recall. These findings led to the evaluation that perhaps the subjective measures relating to distress and dissociation were not robust, thus necessitating the addition of the cortisol measure for the next experiment.

In Experiment Four cortisol responders appeared to be more susceptible to the misinformation effect than non-responders. Other researchers did not find a relationship between cortisol and false memory susceptibility (Smeets, Jelicic, & Merckelbach, 2006; Smeets et al., 2008); although these studies did not split participants into cortisol responders and non-responders, and the stimuli used was the much simpler DRM task. In this thesis cortisol levels were found to be related to dissociation and avoidance symptoms, depending on sample timing. Additionally, avoidance and trait dissociation were found to be related to increased confabulations and trauma history was related to an increase in acceptance of misinformation. The absorption subscale of the DES-C was almost a significant predictor of misinformation, and was significantly related to confabulations, but negatively related to recognition of misinformation items. The depersonalisation/derealisation subscale was found to be positively related to FR accuracy, as well as recognition of misinformation items. These results highlighted the need for assessing both psychological and biological responses to distress, as both appear to affect event memory.

A surprising finding in light of the results of Experiment Two (that intrusions were related to accuracy and avoidance to misinformation), is that in Experiments Three and Four reports of intrusions and avoidance were not as strongly related to the recall accuracy and

misinformation results. Research by Michael & Ehlers (2007; see also Ehlers, Mauchnik, & Handley, 2011; Zetsche et al., 2009) may potentially explain these discrepant findings. In this study a structured writing task following an analogue stressor allowed for memory elaboration and integration, which then led to fewer intrusive memories for participants in comparison to those in a distraction control condition (Michael & Ehlers, 2007). In Experiment Two of this thesis, participants saw the film, and came back a week later and then completed the memory tasks. However, in Experiments Three and Four the memory tasks were on the same day as the film viewing. This means that participants were able to elaborate and integrate the event quite soon after the trauma film, which therefore reduced any re-experiencing symptoms (in line with the PTSD theories of Brewin et al., 1996; Ehlers & Clark, 2000).

In summary, it appears that the overall aim of this thesis was achieved, as several variables were identified as being related to false memory susceptibility. While the dissociation results were unable to clarify the mixed results of the literature, other psychological variables not previously considered have now been identified that will require further investigation. These are cognitive biases, cognitive failures, avoidance and intrusions. The addition of the biological measure of cortisol in the fourth study also allowed additional insight relating to false memory susceptibility for cortisol responders and non-responders.

## Implications of Research

### *Theoretical Implications*

#### *Dissociation*

As highlighted in Chapter Two, dissociation is a complicated concept, with a lack of consensus in the literature over what exactly it encompasses. Two main arguments were

detailed: the Trauma Model, that dissociation involves an attempt to disengage from threatening information or events (Dalenberg et al., 2012); and the Fantasy Model, that dissociation is not related to trauma, but to increased false reporting of trauma due to fantasy proneness (Giesbrecht et al., 2008). Several different theories of dissociation implicate avoidance as a key aspect; however for the purposes of this thesis they were subsumed under the Trauma Model conceptualisation. Both the Trauma Model and Fantasy Model arguments were tested throughout this thesis with reference to differing predictions regarding stress response and susceptibility to false memories.

The Trauma Model predicts that dissociation will increase following a trauma: this was observed as state dissociation levels were significantly higher for participants who viewed the trauma film compared to those who viewed the neutral film. State dissociation was also found to be significantly related to subsequent distress reactions, both subjective (avoidance and intrusion reports) and objective (cortisol change at the second measurement following film viewing). The findings of this thesis therefore also provide support for the multiple Trauma Model theories of dissociation that implicate avoidance of trauma as a key aspect. Overall however, results regarding trait dissociation were mixed, with trait dissociation being correlated with the avoidance measure in some studies of this thesis but not others. Regardless, in line with previous research (e.g., Murray et al., 2002) trait dissociation was found to relate to state dissociation during a distressing event (except in Experiment Three), which in turn was a predictor of the other distress symptoms.

The advocates of the Fantasy Model propose that highly dissociative individuals are especially susceptible to false memories, due to the overlap of dissociation and fantasy proneness (Giesbrecht et al., 2008). As fantasy proneness was not assessed in this thesis it is

not possible to rule out that some of the dissociation results were mediated by fantasy proneness. The advocates of the Trauma Model on the other hand suggest that the relationship between dissociation and false memories would be weak and inconsistent, with several null findings observed in the literature (Dalenberg et al., 2012). The results of this thesis have not been able to present a clearer picture of this relationship, as mixed findings were also observed. In Experiment One it was found that trait dissociation was related to false recall of trauma-related words in the DRM procedure. In the subsequent three studies where the TFP was utilised dissociation was not significantly related to susceptibility to misinformation; however in Experiment Four trait dissociation was found to be related to confabulations and reduced recognition accuracy. The state dissociation and memory results were similarly unclear with no association with misinformation, but they were related to greater accuracy and reduced confabulations.

As discussed in Chapter Two, some theorists argue that trait dissociation is not a unidimensional construct, but rather can be split into three main aspects: absorption (considered non-pathological), depersonalisation and derealisation (combined to represent 'detachment'), and amnesia (Holmes et al., 2005). To account for these differing views, the trait dissociation measure was analysed as a whole and as split into the three relevant subscales (based on the factor analysis results of Stockdale et al., 2002). Over the four experiments of this thesis, where in many cases trait dissociation was unrelated to memory results, at least one of the subscales was. This suggests that future research should consider assessing the subscales alongside the scale as a whole. However, many of the results observed with the subscales were contrary to expectations and served to raise more questions. Based on the findings of this thesis it appears

the distress and memory results do support the Trauma Model of dissociation; however it is clear that additional research is required.

*Theories of Memory for Emotional Compared to Neutral Events*

The advocates of the ABC hypothesis (detailed in Chapter Three) suggest that memory for stimuli of different valence will not differ when arousal levels are held constant (Mather & Sutherland, 2011). In the DRM studies of this thesis lists of different valence with equivalent arousal levels were compared; therefore this hypothesis was able to be directly tested. In Experiment One it was found that there was greater recall accuracy for trauma words compared to neutral words, however the reverse was observed in Experiment Three. Although inconsistent, it is clear that even with arousal levels being equal valence effects emerged (see also Storbeck & Clore, 2011), which does not support the ABC theory.

The film studies also compared neutral and trauma stimuli; however arousal levels were not assessed. Therefore the ABC hypothesis was unable to be tested for the more complex stimuli in this thesis. However, another theory that was thought to be relevant for the purposes of this thesis was the Paradoxical Negative Emotion (PNE) hypothesis of memory (Porter et al., 2010). According to this theory, memory for emotional (compared to neutral) events is expected to be simultaneously more accurate (more true details will be recalled) and more susceptible to distortion (such as the misinformation effect). Both Experiments Two and Four found greater recall accuracy for the trauma film compared to the neutral film, and along with Experiment Three found greater recognition accuracy for the trauma film as well. Therefore this aspect of the PNE hypothesis was supported.

However, in Experiments Two and Four it was found that less misinformation was falsely recalled in the trauma film conditions relative to the neutral condition, and no

significant differences between films were observed for false recognition of misinformation items. These findings do not support the PNE hypothesis, and instead suggest an overall memory enhancement for the distressing film relative to the neutral film: greater accuracy and greater inoculation against the misinformation effect. In contrast, the results of Experiment Three suggest that while no recall differences were observed for the trauma and neutral film, those participants who viewed the trauma film were more likely to falsely recognise misinformation items than those who viewed the neutral film. This lone result does appear to support the PNE hypothesis.

Due to the mixed findings and the differences in timing of the memory manipulation and assessments across experiments, it may be the case that the PNE effect only operates in certain circumstances and not others. Future research is therefore required before more specific conclusions can be drawn. Additionally, assessment of arousal levels may further clarify these results and would also allow further tests of the ABC hypothesis.

### *Methodological Implications*

#### *Use of the DRM and Misinformation Procedure for Memory Research*

Based on the inconsistencies observed for the DRM task from Experiments One and Three, along with the failure to equate susceptibility to the DRM illusion to susceptibility to the misinformation effect, it is important to consider which method is worth implementing for further study. Researchers should be careful in assuming that any ‘false memory’ task is suitable for the purposes of their research question. Further, caution should be used when attempting to extrapolate the results of one method using individual differences to another



method. Instead, it may be worth utilising several tasks in the one experiment (as in Experiment Three of this thesis) so as to ensure that the key memory processes of interest are indexed.

#### *Recall and Recognition Memory*

This thesis examined both free recall and recognition memory for the narratives. It was found that most of the valence and individual difference results were related to recall – but not recognition – of accurate and false memory items. As recall memory is argued to involve more reflective processes than the familiarity-based judgements of recognition tasks (Lindsay & Johnson, 2000), it would appear that the distress and dissociation results observed relate particularly to elaborate memory processes rather than memory for surface features. However other studies have found similar recall and recognition results (e.g., the DRM results of Geraerts et al., 2005). These contrasting results demonstrate the importance of assessing both recall and recognition memory.

#### *Use of the Trauma Film Paradigm for Memory Research*

As the studies implementing the TFP were found to increase both subjective (state dissociation, intrusions and avoidance) and objective (cortisol) distress levels relative to the neutral film, this further strengthens the argument that the TFP is a good analogue to use for modelling PTSD symptoms (e.g., Holmes & Bourne, 2008). As other experimental methods of inducing cortisol levels through a stressor have been synthetic, physical or psychosocial, the TFP may be a closer approximation to what is experienced during a distressing event likely to produce PTSD symptoms. As argued in Chapter Three, while the other methods have been found to transiently increase stress and cortisol levels, it is unlikely any of those would produce symptoms such as intrusions or avoidance that are still observable one week later. The results of Experiment Two demonstrate that intrusion and avoidance levels were still significantly

higher for the trauma film compared to the neutral film a week later. Similarly, ratings of distress were found to persist for the same trauma film a month after testing in Devilly & Varker, (2008).

Importantly, when a film is long and elaborate, this also makes it suitable for investigating susceptibility for multiple misinformation items. This was demonstrated in Experiments Two, Three and Four, where many participants reported the misinformation that was included in the narrative. It is therefore proposed for future research involving susceptibility for misinformation for negative or distressing events that the TFP be utilised.

#### *Use of Salivary Cortisol Assessments for Memory Research*

The results of Experiment Four highlighted the importance of timing in testing cortisol and memory effects. Participants differed regarding whether they were cortisol responders or non-responders. Importantly, some non-responders at the first sample point were responders by the second post-film sample, whereas some responders at the first point experienced a decline in cortisol back to baseline levels by the second sample. Only a small number of participants were designated as responders for both samples.

The implication that arises from this finding is that designing an experiment where it is assumed that the peak in cortisol response is similar for everyone is problematic. In a study testing cortisol effects on memory, if memory tasks are administered at the same time for participants under the assumption that this testing point reflects the peak, differences may be observed that are artificial. For example, for a participant that is a cortisol responder only at a later time point, any memory test conducted prior to the cortisol peak may be unaffected by cortisol. It is therefore important for future research that experimenters be mindful of these differences when designing similar procedures.

### *Practical Implications*

The research of this thesis has highlighted the importance of prospectively assessing individual difference factors that may predispose certain people to adverse outcomes following a distressing event. Specifically, it appears that trait dissociation may make state (peri-traumatic) dissociation more likely during a distressing event. This state dissociation may then make avoidance and intrusion responses more likely in the aftermath of this event, both immediately and a week later. As ongoing avoidance and intrusions can be attributed to adverse outcomes such as ASD and PTSD, the analogue results of this thesis add to others in trauma-population studies suggesting that state dissociation may be an important predictor of poorer functioning following a trauma (e.g., Koopman et al., 1994; Murray et al., 2002; Ozer et al., 2008).

The pre-existing factors such as dissociation and cognitive biases may have some impact on memory; however the results are currently inconclusive and require further study. Such pre-existing factors may prove to be more (or less) relevant in response to a real traumatic event compared to the DRM or TFP. It is not possible to conduct prospective testing in trauma populations because access to trauma populations occurs after the event, due to difficulty in determining if an individual will experience a trauma. However, these assessments would potentially be useful in populations where future trauma events are expected, such as those undergoing training to be in the emergency services (e.g., Bryant & Guthrie, 2005). As members of the emergency services are often required to give testimony in court, this is an important population to monitor to ensure memory accuracy following an event. Additionally, trauma history was found in Experiment Four to relate to susceptibility to misinformation a week following the event. As trauma history in many cases can be directly verified, this is a

pre-existing variable that can be easily assessed following a traumatic event. While samples sizes in the current thesis prohibited the possibility of considering how the nature of past traumas experienced differentially impacted results (for example, considering participants with assault history separately to those who experienced a car accident), this would be of interest for future research due to findings suggesting different types of traumas can lead to differences in severity of psychological responses (e.g., Resnick, Kilpatrick, Dansky, Saunders, & Best, 1993).

The results of this thesis suggest that the distress reactions immediately after the stressor and the reactions in the following week may be more informative regarding memory outcomes than the pre-existing factors. Intrusion and state dissociation responses were found to relate to memory accuracy, whereas avoidance and cortisol response were found to impact false memory susceptibility. Although the current research involved reactions to a film, these factors could also be directly assessed in trauma populations in future research. While all witnesses and victims of traumatic events require careful questioning to ensure memory accuracy, people with highly avoidant responses and a strong cortisol response may be especially susceptible to memory distortion. Additionally, the different results depending on timing highlights the importance of considering when would be the best time to question victims and witnesses of traumatic events. It is the case that some people are interviewed very soon after the event, however in other cases substantial delays may occur before questioning. As stress, cortisol levels and memory can all change over time, it is important that those involved in questioning such people be aware of these potential issues.

## Limitations and Future Directions

### *The DRM Method*

A possible limitation regarding the DRM studies of Experiment One and Three is that the DRM lists were not presented in random order, but a fixed order alternating between neutral and trauma lists. This means any order effects were not controlled for. Although these word presentation decisions were made based on the constraints of the computer program used, future studies should randomise list presentation for encoding.

An additional limitation is that the words chosen for the lists may not have been ideal. Specifically, some of the neutral words could actually be considered by some to be positive (e.g., wedding and music). In research comparing neutral, positive and negative lists it has sometimes been found that emotional lists (both positive and negative) elicit different memory effects to neutral. However, the words chosen were primarily based on a previous study comparing neutral and trauma lists (Brennen et al., 2007). Regardless, the results observed suggested differences between the two list types. Additionally, some of the trauma lists may not have been particularly distressing for some participants. For example, for those without a spider phobia, the 'spider' list may not have been considered particularly upsetting.

A more suitable method for assessing memory processes related to a trauma may be to tailor trauma word lists using specific populations. For example, in one study car accident survivors viewed accident related words in a stem completion task (Ehring & Ehlers, 2011). The choice to include a variety of potentially distressing concepts for the trauma lists in this thesis was due to the non-clinical population used, with the expectation that any trauma that participants reported would involve heterogeneous events. This expectation was supported by the results of Experiments Three and Four where a variety of trauma events were reported by

participants. Ehring & Ehlers (2011) found that participants who demonstrated enhanced priming for trauma related words at two weeks post trauma were significantly more likely to develop PTSD symptoms at follow up. As their study found effects for implicit but not explicit memory, and did not assess false memory, it would be interesting for future research to include this manipulation. Specifically, recent accident survivors could be administered the DRM with accident related lists to determine whether their responses predict subsequent memory issues and distress.

### *The Trauma Film Paradigm and the Misinformation Effect*

The purpose of the trauma film was to elicit distress. However other emotions may have been elicited alongside the intended one. For example, stress and fear, while similar, have been argued to have different neurological profiles (Pruessner et al., 2008), and according to the ABC theory negative emotions such as sadness and anger can differ in arousal levels (Mather & Sutherland, 2011). While distress was observed in response to the trauma film (as indexed by avoidance and intrusions), it would be worthwhile in future studies to also assess a wider range of emotional responses to discern whether they affected memory differently. Additionally, it is important to note that while avoidance and intrusions were measured as indexes of distress, they could instead be considered correlates of distress, as opposed to directly measuring distress. Previously, researchers have included a simple one question scale regarding feelings of distress (Deville & Varker, 2008); this may be worth adding for future research.

It is also necessary to consider whether the neutral (fire-fighter) film that was used for a less distressing comparison to the trauma (accident) film was appropriate. Firstly, the assumption was made that the 'neutral' film was neutral in valence. It is possible that for some

participants the content of this film had negative connotations - for example, the smoke and firefighters may have reminded them of a traumatic fire they had experienced. While distress responses were significantly lower on average for the firefighter 'neutral' film than the car accident 'trauma' film, it may be necessary in future research to have participants rate the valence of the films to ensure the firefighter film is considered neutral.

Further, when comparing the neutral and trauma films, the films used did not have exactly the same content. Additionally the participants who viewed the trauma film seemed to produce more information overall when recalling the film than those who viewed the neutral film. It may be that there was less of a coherent narrative occurring in the neutral film, with fewer discrete details to remember. To attempt to address this however, voiceovers were added to the beginning of both films to make sure some information was identical across conditions, and similar misinformation items were also included in the post-event narratives (e.g., that a helicopter was seen, colours of clothing of key people in each film, etc).

An additional potential limitation involves the items chosen to introduce misinformation in the narratives. Previous research has compared central and peripheral items for the misinformation effect and it was found that participants recalled more central items correctly than peripheral items (Devilly, Varker, et al., 2007). While no specific ratings were collected in this thesis of whether items chosen were central or peripheral, for the most part, the items were likely peripheral to the primary content of the film (e.g., colours), compared to more central aspects (such as the accident victims). This means some of the accuracy and misinformation effects observed in this thesis could have been related to the nature items recalled. For future research it would be important to collect ratings of what participants considered central and peripheral aspects and tailor misinformation items accordingly.

Another limitation relates to the fact that arousal levels for the different films were not assessed; it is likely that the arousal levels were not equal. Further, it has been suggested that neutrally valenced stimuli are often not neutral in arousal, but actually boring and sleep inducing (e.g., Van Damme, 2012). Spontaneous comments regarding boredom were made by several participants who viewed the neutral film, which does attest to this suggestion. Low arousal levels and boredom may increase susceptibility to accepting misinformation, by producing an over-general retrieval style leading to a more liberal response bias (Van Damme, 2012). High arousal on the other hand may create a focus on distinctive properties of the event which could improve memory (Van Damme, 2012). This means that the finding of greater susceptibility to misinformation for participants who viewed the neutral film compared to the trauma film (in Experiments Two and Four) may have been due to differences in arousal and boredom. However, it would be difficult to create a neutrally valenced stimulus that is also highly arousing. Besides assessing distress levels to compare the films, future research could include questions regarding arousal and attention during the film to tease out the reasons for the differences observed.

Another method to address any potential discrepancies between the neutral and trauma films was to introduce a 'reappraisal' condition, whereby participants viewed the trauma film but were informed that it was a training film with actors who were not hurt. This way the content was able to be held constant, but it was expected that participants would experience less distress. The levels of intrusions and avoidance experienced in the trauma and reappraisal conditions were not significantly different though, which suggests this reappraisal manipulation was unsuccessful in reducing subjective distress. Further, many participants indicated they did not believe the people in the film were actors, which may also have impacted results.



Interestingly however, a significantly greater cortisol increase in responders was observed in the trauma condition relative to the reappraisal condition. This finding highlights the importance of assessing both subjective and objective distress measures, but suggests that the reappraisal manipulation may only be useful for observing differences in objective distress.

The film experiments in this thesis capitalised on already-created films; future research may require the creation of films that are identical except for one key aspect that makes one version distressing and the other not. Alternatively, in other research using the same trauma film, Devilly & Varker (2008) edited the ending to remove the most distressing aspect – the disfigured face of the deceased person. They compared responses on this edited version to those responses from viewing the entire film and found that subjective distress ratings were significantly lower than for the original version (Devilly & Varker, 2008). Therefore for future TFP studies comparing high and low subjective distress, it may be worth using the edited version of the film instead of a reappraisal manipulation. It would also be of interest to compare cortisol responses using this manipulation. The question of whether the neutral film is an appropriate comparison for the trauma film requires further investigation.

### *Individual Difference Variables*

Another potential explanation regarding the inconsistent and ambiguous findings regarding trait dissociation may be that the DES-C was not an appropriate measure for the purposes of this thesis. It has been argued that since the DES-C only correlates .25 with the original DES, the DES-C is not actually indexing dissociation (Dalenberg et al., 2012). Conversely, the creators of the DES-C argued that this low correlation was a strength of the measure as it allowed differences between healthy populations to emerge, instead of having a

floor effect (Wright & Loftus, 1999). The DES-C was not designed to determine who has a dissociative disorder, and participants answering the questionnaire are not expected to have pathological dissociation, so the results may not be the same. The correlation of .25 was significant however, and did include all the same experiences, except with slightly different wording and ratings (percentage of time this happens to you, versus how much this happens in comparison to others). Future research on false memories and distress could involve a comparison of multiple trait dissociation scales simultaneously to determine whether some measures are more appropriate than others.

Although the cortisol experiment in Chapter Seven contributed to the evidence that cortisol responses to distressing events are related to false memory susceptibility, the mechanisms behind this relationship still require further study. Firstly, however, it is important to thoroughly consider the effect of individual differences in timing of cortisol response. A proposed method to account for these cortisol response differences involves administering an initial stressor - such as the CPT - with many sample times (for example, every two minutes from the end of the stressor) so that each participant's cortisol peak time can be established. Then another day (to ensure cortisol levels are back to normal) the TFP is utilised, and the memory tasks can be administered during the expected peak of each person. Such a procedure would be useful for understanding the mechanisms behind cortisol effects on memory; however of course in studies of trauma populations directly after the event this would be difficult to control.

Besides dissociation and cortisol, several less-researched factors were included to consider their role in false memory susceptibility, namely cognitive biases and cognitive failures. A limitation of this thesis was that both cognitive biases and cognitive failures were

only investigated in one experiment each. Therefore while the memory findings related to these factors were novel, based on the lack of research in the literature it is difficult to come to specific conclusions without replication. The possibility remains that both variables are relevant for false memory development, and they therefore require further research.

### *General Limitations*

Overall, as this thesis progressed experimental procedures were refined and altered based on the findings and limitations of the preceding studies. As a consequence, some changes implemented may have limited the interpretability of results. For example, although similar memory results were observed regardless of the timing changes across each experiment (with the exception of Experiment Three) the results regarding distress and dissociation were more variable. A broader and more conclusive statement regarding the outcome of these procedures would have been possible if the methods had been reproduced for each experiment.

All experiments conducted for this thesis employed an undergraduate university population. This population was non-clinical, had a restricted age range and was predominantly female. Therefore caution should be used when attempting to generalise the results observed to other populations. However, as the aim of this thesis was to predict prospectively how the individual characteristics of a person prior to a trauma may differentially affect distress and false memory responses, a non-clinical population was suitable for this purpose. PTSD diagnosis was assessed, however instead of utilising an assessment instrument, only one question regarding previous or current diagnosis of PTSD was asked. It may therefore have been the case that some participants did have PTSD but chose not to disclose, or were never officially diagnosed, and this could have inadvertently confounded results.

Another potential limitation regarding the population employed involves the possibility that people with a vulnerability to developing adverse distress reactions opted not to sign up for the film experiments based on the advertisement descriptions of a “graphic film” (a description chosen based on ethics requirements). If this were the case, the results observed would only be relevant for people unlikely to exhibit a maladaptive response to distressing circumstances. Importantly however, the majority of participants (assessed in Experiments Three and Four) had previously experienced events that would be considered traumatic using the DSM-IV criteria; therefore it was still possible to determine whether prior emotional events would impact subsequent distress responses. Additionally, while the focus of this thesis was to study ASD and PTSD symptoms, these are not the only possible outcomes following a trauma: depression, substance abuse disorders, eating disorders, other anxiety disorders, and dissociative disorders can also be common responses (Bremner, 2005; Ehrling, Ehlers, & Glucksman, 2008). Therefore considering underlying vulnerabilities relating to other disorders may also be relevant for false memory susceptibility.

Further, to investigate reactions to trauma, analogues to a traumatic event were utilised. Reading the trauma words of the DRM and viewing a trauma film are both very different situations to those experienced by real trauma survivors. While the trauma words shown in the DRM may prompt participants to think of related autobiographical events, the false memories that arise are for the words, not for the events. Additionally, the viewing of an accident film is more likely to resemble the experiences of a witness of a traumatic event than those of a victim (Zetsche et al., 2009). However, witnessing a violent injury or death is still considered a trauma in the DSM-IV. Moreover, in both Experiments Three and Four witnessing a death or serious injury was the most common trauma experience reported by participants (see Appendices G

and I). Therefore the film results observed are still relevant at least for those people distressed by something they witnessed. While extensive research is required in populations of people with ASD and PTSD, analogue studies are able to inform these potential research avenues.

## Conclusion

This thesis has made a contribution to furthering understanding of the role of psychological and biological distress responses in influencing memory. Experiment One demonstrated that dissociation and cognitive biases differentially impact accuracy and false memory susceptibility for trauma words on the DRM task. The TFP has predominantly been used to predict and manipulate intrusion levels; the series of studies included in this thesis have also revealed it can be useful for assessing avoidance aspects of PTSD symptomatology as well. Experiment Two was the first study to compare a neutral and trauma film for false memory susceptibility. It was also the first study to highlight the role of both avoidance and intrusion responses in predicting false memory outcomes.

Experiment Three was the first experiment to compare the DRM to the more ecologically valid trauma film paradigm to determine whether these methods are equal in predicting false memory susceptibility. Experiment Three was also the first to use susceptibility to recall of critical lures for neutral and trauma DRM words as a predictor for misinformation for a neutral and trauma film. The findings of this study raised concerns as to whether all ‘false memory’ tasks involve the same underlying mechanisms.

One highlight of this thesis was that the TFP was able to be tested for objective, alongside subjective, distress. Experiment Four investigated a biological marker of stress, cortisol. This was the first study to consider the role of cortisol responders and non-responders

in predicting false memory susceptibility, where the stressor and the to-be-remembered event were the same. This is important as previous studies have employed stressors separate to what was supposed to be memorised (generally word lists in the DRM). It was found that cortisol responders were more susceptible to misinformation than non-responders. The findings are novel as previous studies have suggested that cortisol is unrelated to false memories, or perhaps just decreases false memories alongside true memories. Additionally, dissociation and avoidance were found to relate to cortisol response, and trauma history was also a predictor of susceptibility to misinformation.

Some limitations were raised regarding generalisability and ecological validity. Replication of the methods implemented is required, along with further research in trauma populations to answer the questions raised by the results observed. Despite these limitations and unanswered questions, the findings of how distress experiences following the films affected memory are noteworthy, and have important practical implications regarding eyewitness testimony.

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## DECLARATION

This thesis is submitted to the University of Sydney in partial fulfilment of the requirement for the Degree of Doctor of Philosophy. The work presented in this thesis is, to the best of my knowledge and belief, original except as acknowledged in the text. I hereby declare I have not submitted this material, either in full or in part, for a degree at this or any other institution. All research carried out in this thesis was approved by the Sydney University Human Ethics Committee.

This thesis work was conducted from March 2009 to November 2012 under the supervision of Dr Helen Paterson and Professor Iain McGregor at the University of Sydney.

Lauren Monds

January, 2013

## APPENDIX A

Neutral and Trauma-Related Word lists for the DRM Task.

Adapted from Brennen et al. (2007), Moulds (2002), and Stadeler, Roediger, and McDermott (1999).

*Neutral List*

Critical						
Lure	<b>Wedding</b>	<b>School</b>	<b>Foot*</b>	<b>Music</b>	<b>Letter</b>	<b>Mountain*</b>
Word List	<b>Cake</b>	<b>Students</b>	<b>Shoe</b>	<b>Song</b>	<b>Postman</b>	<b>Hill</b>
	Bride	Teacher	Hand	Singer	Mail	Valley
	Groom	Principal*	Toe	Melody	Envelope	Climb
	Best Man	Professor	Kick	Instruments	Send	Summit
	Bridesmaid	Class	Walk	Guitar	Write	Molehill
	Party	Classroom	Ankle	Opera	Mailbox	Peak
	Nuptial	Lesson	Arm	Sound*	Stamp	Glacier
	<b>Celebrant*</b>	<b>Bell</b>	<b>Boot</b>	<b>Pop</b>	<b>Card*</b>	<b>Goat</b>
	City Hall	Faculty	sock	Note	Telegram	Steep
	<b>Ring</b>	<b>Academic*</b>	<b>Knee</b>	<b>Orchestra</b>	<b>Post-office*</b>	<b>Ski</b>

---

\*words changed from Brennen et al (2007).

*Trauma List*

Critical						
Lure	<b>Blood</b>	<b>Tears</b>	<b>Funeral</b>	<b>Hurt*</b>	<b>Rape</b>	<b>Spider*</b>
Word List	<b>Red</b>	<b>Cry</b>	<b>Burial</b>	<b>Wounded</b>	<b>Humiliation</b>	<b>Web</b>
	Warm	Burn	Procession	Bruised*	Abuse	Insect
	Clot*	Salty	Grave	Bullet	Sexual	Bug
	Thorn	Flowing	Black*	Injured	Women	Fright
	Fresh	Sob	Cemetery	Injury	Girls	Fly
	Running	Sweat	Priest	Suffer	Dishonour	Arachnid
	Gushing*	Joy	Church*	Harmed*	Torture	Crawl
	<b>Cut</b>	<b>Eyes</b>	<b>Dead*</b>	<b>Weak</b>	<b>Force</b>	<b>Tarantula</b>
	Sticky	Sadness	Prayer	Damaged*	Violation	Poison
	<b>Knife</b>	<b>Bitter</b>	<b>Coffin</b>	<b>Beaten*</b>	<b>Assault*</b>	<b>Bite</b>

---

\*words changed from Brennen et al (2007).

## APPENDIX B

## Pilot Study: Backwards Associative Strength of DRM Words

One concern of the study conducted in Chapter Four was whether some of the null results observed may be due to not accounting for potential differences in backwards associative strength (BAS) of the lists. For example, the fact that the DES-C measure of dissociation was not significantly related to false recall for the neutral DRM list could be due to differences in BAS instead of valence effects. To address this, a second group of participants was asked to complete a word association task so the BAS of the CLs could be calculated. Although this experiment was conducted after the conclusion of Experiment One, it was possible to include the BAS results in the analyses, as in other studies (Roediger et al., 2001) separate groups of participants have been used to complete the word association task.

## Method

*Participants*

There were 175 (44 male) undergraduate Psychology students from the University of Sydney who participated for course credit. The mean age was 19.39 years ( $SD = 3.55$ ). Participants completed the task online in their own time. Participation was voluntary and conducted following informed consent.

*Materials**Demographics Questionnaire.*

Demographics questions concerning age, gender, country of origin and whether English was the participants' first language, were assessed.

## Stress and False Memories

### *Words in the Word Association Task*

Some of the words already have the BAS calculated from another database (Nelson, McEvoy, & Schreiber, 1998). Therefore the words used in Experiment One (see Appendix A) that were not in the database were included, dispersed amongst unrelated words<sup>1</sup>.

### *Procedure*

After providing consent and answering the demographics questions, participants were shown a series of words and instructed “Please type the first word that comes to mind after viewing each word shown. There are no right or wrong answers and your answers are anonymous, so please make sure to type the very first word that comes into your head, even if you think of a better word after that.” Participants were allowed as much time as they wished to complete the task, however it was expected the task would not take more than 15 minutes.

BAS was calculated according to the instructions provided by Roediger et al., (2001):

*“we took each study word and determined its connection strength to its corresponding critical item... we obtained for each study word (e.g., bed, rest, awake, tired, etc.) the probability that it elicited its critical item (e.g., sleep) as an associate... We then averaged these associations to obtain the mean BAS value for each list. For example, the mean BAS value for the sleep list is .431.”* (Roediger et al., 2001; p.g. 389)

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<sup>1</sup> Additional words used are available upon request.

Results<sup>2</sup>*Backwards Associative Strength*

Table 18 displays the mean BAS calculated for each critical lure. Overall means for each word list type (neutral mean = 0.15,  $SD = 0.04$ ; trauma mean = 0.14,  $SD = 0.14$ ) were then compared on a t-test. The word lists were not found to be significantly different,  $t(10) = 0.01$ ,  $p > .99$ .

*Table 18. Mean BAS for each Critical Lure used in the DRM task.*

Category	Word	Mean BAS
Neutral	Wedding	0.152
	School	0.089
	Foot	0.156
	Music	0.181
	Letter	0.204
	Mountain	0.107
Trauma	Blood	0.111
	Tears	0.414
	Funeral	0.027
	Hurt	0.168
	Rape	0.011
	Spider	0.155

## Discussion

This pilot study was conducted to rule out the possibility that the results observed in the first experiment (Chapter Four) were due to differences in the word lists used. Previous research has highlighted BAS as being an important predictor of false memory susceptibility

<sup>2</sup> Demographics results relating to country of origin and whether English was the participant's first language is available upon request.

(Knott et al., 2012; Roediger et al., 2001). If the mean BAS scores for the two different word lists types were different, this would have been concerning. Either the BAS results would have been then included for re-analyses of the data, or different word lists would have had to be created for subsequent research. As the differences are not significant, this suggests the word list types are equally as likely to produce false memories. Therefore, any differences observed based on the individual difference variables would be based on individual reactions to the different valences of the list only.

## APPENDIX C

## Additional Analyses for Experiment One

Table 19 presents the correlations between the PTCI subscales, LMSQ-R, BAI, BDI-II, and DES-C and subscales. Additional to the correlations already observed in Chapter Four, it can be seen that the depersonalisation/derealisation subscale correlated with the three PTCI subscales and the BAI. The absorption subscale correlated with the PTCI subscales and the BDI-II, and the amnesia subscale correlated negatively with the LMSQ-R. All DES-C subscales correlated with each other.

*Table 19. Correlations between the scales in Experiment One and the DES-C subscales, depersonalisation/derealisation, absorption, and amnesia*



	PTCI-Self	PTCI-World	PTCI-Blame	LMSQ-R	BAI	BDI-II	DES-CDep/Der	DES-CAbs	DES-C Amnesia
PTCI-Self	1	.64**	.54**	.28**	.53**	.80**	.28**	.27**	.10
PTCI-World		1	.41**	.18	.45**	.62**	.19*	.32**	.10
PTCI-Blame			1	.14	.16	.28**	.21*	.23*	.18
LMSQ-R				1	.36**	.32**	.17	-.14	-.31**
BAI					1	.55**	.20*	.14	-.01
BDI-II						1	.15	.21*	.08
DES-CDep/Der							1	.65**	.62**
DES-CAbs								1	.54**
DES-C Amnesia									1

\* $p < .05$ ; \*\* $p < .01$

Based on the regression results of Experiment One, in which dissociation was a significant predictor of trauma word critical lure free recall and was almost a significant predictor of trauma word list confabulations, two additional regressions were conducted to determine whether particular aspects of dissociation would better predict these memory results. The trauma lure regression (containing PTCI subscales, LMSQ-R and DES-C subscales as predictors) was not significant,  $R^2 = .11$ ,  $F(7,99) = 1.81$ ,  $p=.09$ , however the absorption subscale was a significant predictor,  $\beta = 0.27$ ,  $p=.04$ , with a positive relationship between it and trauma lure recall. The trauma confabulations regression was not significant,  $R^2 = .09$ ,  $F(7,99) = 1.32$ ,  $p=.25$ , and only the PTCI-self subscale was a significant negative predictor (as in Experiment One).

## APPENDIX D

Voiceovers and Eyewitness Statements for Neutral and Trauma Films.

Used in Experiments 2-4 (Chapter Five\*, Chapter Six, Chapter Seven). **Bold and underlined parts indicate shared information over the two films.**

*Script for Voiceover: Neutral*

**The event you are viewing took place on Tuesday, the 27<sup>th</sup> of March in the year 2007, at 2.20pm.** It is a firefighter training exercise for recruits of the Queensland fire brigade. This is the 2<sup>nd</sup> last training exercise for the recruits prior to graduating to become a professional fire fighter. The last exercise is tending to a controlled wildfire situation. The aim of the training exercise shown was to rescue and tend to any dummy victims, put out the fire, and make sure the building is safe. The building is an old air conditioner parts factory. It is important that the firefighters check the stability of the columns in the building to make sure the structure won't collapse. The **officer in charge** was **Chief James Edmonson**.

*Script for Voiceover: Trauma*

**The event you are viewing took place on Tuesday, the 27<sup>th</sup> of March in the year 2007, at 2.20pm.** It is following American Emergency Services Personnel as they respond to a motor vehicle accident. The victims of the incident were five friends, two of which are cousins, who were travelling home from a visit to the local shopping centre. A rabbit ran onto the road which the driver swerved to avoid, and the car ended up skidding and flipping over. Two of the passengers received whiplash, one received a fractured hip, and another received a head injury. There was one fatality. The response time for the emergency services was approximately 10 minutes. The job of the emergency services personnel is to first block off traffic in that lane to prevent any further accidents, and to simultaneously treat any injuries. The **officer in charge** of the incident was **Chief James Edmonson**.

*Eyewitness Statement for Firefighter Training Exercise.*

*Voice over section:*

The video was of a firefighter training exercise. It took place at 2.20pm, on **Thursday** the 27<sup>th</sup> **May**. They were supposed to put out fires, check for dummy victims, and check the building's **walls** for stability. The building was an old **automotive parts** factory. The officer in charge was Chief James **Edwards**.

*Sequence section:*

The video began with a number of firefighters standing around, and two fire trucks. There appeared to be a lot of bushes in the background. The firefighters were wearing yellow overalls, and some also had orange vests on. All had helmets on; some were yellow, **most were white, and a few red**. There were hoses on the ground, and they were dark red. There appeared to be smoke coming from the building. The sky was blue but cloudy, and seemed very windy. One of the firefighters with a vest went to look around the corner of the building and then came back. Then some firefighters started getting a hose out of the truck. Two dummy bodies were removed, they were **cream/yellow**. Some firefighters went into the building carrying hoses. A **helicopter** flew past in the distance at one point. The chief was then speaking to the camera crew, but it was a bit hard to hear it parts. He said he could 'teach a 10 year old to put out a fire', but that the hard part was identifying victims.

*Eyewitness Statement for the Car Accident.*

*Voice over section:*

The video was of a car accident. It took place at 2.20pm, on **Thursday** the 27<sup>th</sup> **May**. The crash took place when five friends, two of which were cousins had been driving home. A rabbit ran onto the road, and this caused the driver to swerve and the car flipped over. The officer in charge was Chief James **Edwards**.

*Sequence section:*

First the camera shows a lot of traffic backed up, and some officers standing around. All had helmets on; some were blue, **a few white, and some red**. Then you saw the car upside down, it was a grey/black colour. There was a person lying on the ground. Right next to her was another person, still half in the car. Around the other side of the car there was a man not in uniform helping another girl lying on the road. He was wearing a shirt that **was a brown colour with checks**. They tried to put one victim on stretcher but she started crying more. They asked her where it hurt and she pointed to her **arm**. The victims had yellow plastic covers put on them. A paramedic said he needed someone to go with him. At one point a helicopter goes past – probably **a news helicopter**. The camera went over to one of the victims sitting by the side of the road with people supporting her head. The woman on the stretcher got wheeled to the ambulance, and then a second victim was wheeled to another ambulance. Finally, a stretcher was brought out for the last victim. The person was dead, and his legs were very limp in his **black trousers** when the paramedics moved him. His face was all distorted. He was covered up in a black body bag.

*\*In Experiment Two some participants received a control version of the narrative with no misinformation. This version just has the bold and underlined pieces removed from the narrative.*

## APPENDIX E

## Recognition Questionnaires for Neutral and Trauma Films

Table 20. True-False Recognition Questionnaire, Neutral Film

Order	Category	Statement	Correct answer
3	FF1	It was raining on the day of training	F
5	FF2	There was a police officer present at the training exercise	F
8	FF3	The year the training took place was 2009	F
14	FF4	There were about 30 fire-fighters in the film	F
22	FF5	There was fire visibly coming out of one of the windows	F
24	FF6	In the film, one of the recruits stumbled and fell	F
27	FF7	The fire-fighter recruits have two more training exercises to do after this so they can graduate	F
32	FF8	One of the fire trucks drove away near the end of the film.	F
2	FT1	The training exercise was with the QLD fire brigade	T
6	FT2	There were two fire-fighters in orange vests	T
7	FT3	Some fire-fighters had white oxygen tanks on their backs	T
9	FT4	The last training exercise is to tend to a wildfire situation	T
13	FT5	There was a big pole in front of one of the fire trucks	T
19	FT6	One of the fire trucks had its lights flashing	T
21	FT7	Before entering the building from the balcony, one of the recruits sprays the door with the hose	T
28	FT8	Two fire-fighters were wearing blue overalls	T
11	NF1	The building was an old automotive parts factory	F
15	NF2	The officer in charge was Chief James Edwards	F
17	NF3	The day of the training was a Thursday	F
18	NF4	In the voiceover, it said to ensure the building was stable, the walls needed to be inspected	F
20	NF5	There were three fire-fighters wearing red hardhats	F
26	NF6	The date of the training was May 27th	F
29	NF7	A helicopter flew past in the background	F
30	NF8	The dummy victims were a cream/yellow colour	F
1	NT1	The training took place at 2.20pm	T
4	NT2	One of the aims of the training exercise was to rescue dummy victims	T
10	NT3	There were two fire trucks present	T
12	NT4	There were two dummy victims	T
16	NT5	The fire-fighters were mostly wearing yellow overalls	T
23	NT6	Most of the hardhats worn were white in colour	T
25	NT7	The hoses being used were a dark red colour	T
31	NT8	The chief said to the camera crew that he "could teach a 10 year old to put out fires"	T

Table 21. True-False Recognition Questionnaire, Trauma Film.

Order	Category	Statement	Correct answer
3	FF1	It was raining on the day of the accident	F
5	FF2	One victim had to receive CPR at the scene	F
8	FF3	The year the accident took place was 2009	F
14	FF4	There were about 30 fire-fighters in the film	F
22	FF5	There was smoke coming from the upturned car	F
24	FF6	In the film, one of the Emergency Services Personnel stumbled and fell	F
27	FF7	One of the victims had blonde hair	F
32	FF8	One of the wheels of the upturned car had come off and was on the road	F
2	FT1	The accident occurred in America	T
6	FT2	There was a police motorcycle present	T
7	FT3	In the voiceover, it said two of the victims received whiplash	T
9	FT4	The stretchers appeared to be made of wood	T
13	FT5	It took approx 10 minutes for Emergency Services Personnel to arrive	T
19	FT6	A second ambulance arrived part way through the film	T
21	FT7	The deceased had blood on his white shirt	T
28	FT8	The voiceover mentioned it was important to block traffic to avoid further accidents	T
11	NF1	There was an ununiformed man in a brown checked shirt helping near the beginning of the film	F
15	NF2	The officer in charge was Chief James Edwards	F
17	NF3	The day of the accident was a Thursday	F
18	NF4	When the victim crying was asked where it hurt, she pointed to her arm	F
20	NF5	There were three fire-fighters wearing white hardhats	F
26	NF6	The date of the accident was May 27th	F
29	NF7	A helicopter flew past in the background	F
30	NF8	The deceased was wearing black pants	F
1	NT1	The accident took place at 2.20pm	T
4	NT2	Two of the victims were cousins	T
10	NT3	The upturned car was a black/grey colour	T
12	NT4	There were five accident victims	T
16	NT5	One victim was sitting up away from the car	T
23	NT6	A rabbit ran onto the road, causing the driver to crash	T
25	NT7	Yellow plastic sheets were used to cover the victims	T
31	NT8	At one point you can hear a paramedic ask someone to accompany him and the victim in the ambulance	T

*Categories*

FF: Neither in the film nor in the narrative; FT: true in the film, not present in narrative;  
NT: true in the film and present in the narrative; NF: misinformation introduced in the  
narrative.



## APPENDIX F

## Additional Analyses for Experiment Two

Table 22 presents the correlations between the CFQ, SDQ, IES subscales, and DES-C and subscales. Additional to the correlations already observed in Chapter Five, it can be seen that the depersonalisation/derealisation subscale correlated positively with all other scales. The absorption subscale correlated positively with the CFQ and SDQ but not the IES subscales, and the amnesia subscale correlated with the CFQ and the avoidance subscale at T2 but not the other scales. All DES-C subscales correlated with each other.

*Table 22. Correlations between the variables in Experiment Two and the DES-C subscales*

	DES-C depder	DES-C abs	DES-C amnesia	CFQ	SDQ	Intrusions T1	Intrusions T2	Avoidance T1	Avoidance T2
DES-C depder	1	.72**	.70**	.41**	.37**	.23*	.21*	.25*	.25*
DES-C abs		1	.68**	.43**	.37**	.02	.05	.07	.140
DES-C amnesia			1	.42**	.16	.09	.13	.12	.27**
CFQ				1	.26**	.03	-.06	.01	.03
SDQ					1	.11	.14	.20*	.22*
Intrusions T1						1	.64**	.75**	.55**
Intrusions T2							1	.55**	.64**
Avoidance T1								1	.58**
Avoidance T2									1

Table 23 presents the regression results including the DES-C subscales. The main result of note which was different to the regressions with the DES-C as a whole is that the absorption subscale was positively related to recognition accuracy. No other subscales were significant predictors in any of the other regressions.

Table 23. Regression results including the DES-C subscales

Variable	Free Recall		Recognition	
	Accuracy	Misinformation	Accuracy	Misinformation
	$\beta$	$\beta$	$\beta$	$\beta$
DES - depersonalisation	-0.05	0.24	-0.25	-0.07
DES - absorption	0.26	-0.14	<b>.47**</b>	0.12
DES - amnesia	-0.29	-0.01	-0.01	0.14
CFQ	0.11	0.18	0.07	-0.13
SDQ	0.16	0.05	-0.04	0.01
Intrusions T1	<b>.40*</b>	0.08	0.23	0.23
Intrusions T2	0.04	-0.21	0.14	0.08
Avoidance T1	0.04	<b>-.49**</b>	-0.14	<b>-.36*</b>
Avoidance T2	-0.04	<b>.41**</b>	-0.06	-0.08
R <sup>2</sup>	0.27	0.18	0.14	0.11
F(9,76)	<b>3.076</b>	1.81	1.41	1.07

\* $p < .05$ ; \*\* $p < .01$ ; † $p = .06$

## APPENDIX G

## Additional Analyses for Experiment Three

Table 24 presents the trauma history of the participants who reported experiencing one or more of the events included in the Brief Trauma Questionnaire (BTQ). As can be seen in the table, the most reported traumatic event experienced was witnessing a death or serious injury.

*Table 24. Count and percentage of traumatic events experienced by participants in Experiment Three.*

Trauma Type	Count	Percent
Served in War Zone	1	1.2
Serious Accident	6	7.1
Major Disaster	5	5.9
Life threatening illness	4	4.7
Attacked/mugged	23	27.7
Beaten as a child	20	23.3
Unwanted sexual contact	21	25
Serious injury or fear of injury/death	15	17.4
Witness death or serious injury	39	45.3
Violent death of friend/ family member	17	20.0

\*Note: some participants experienced more than one type of trauma.

Table 25 presents the free recall regressions with the DES-C subscales included. The main result of note which was different to the regressions with the DES-C as a whole was that

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the BTQ just missed out on being a significant positive predictor of free recall accuracy. The DES-C subscales were not significant predictors in any of the regressions.

*Table 25. Free Recall Regression Results Including the DES-C Subscales*

Variable	Accuracy	Misinformation	Confabulations
	$\beta$	$\beta$	$\beta$
DES - Depersonalisation	.14	-.09	-.05
DES - Absorption	-.25	.00	.07
DES - Amnesia	-.04	.05	-.01
BTQ	<b>.22†</b>	.23	-.01
SDQ	-.17	-.27	<b>-.45*</b>
Intrusions	<b>.29*</b>	.06	.16
Avoidance	.20	.02	.22
DRM Score	<b>.51**</b>	.18	.18
R <sup>2</sup>	.41	.12	.10
F(8,52)	<b>4.49**</b>	0.90	0.68

\* $p < .05$ ; \*\* $p < .01$ ; † $p < .06$

## APPENDIX H

Short version of the DES-C used for the pre-screen in Chapter Seven

How often have you had these experiences *compared with other people*? We are interested in how often you have had these experiences. It is important, however, that your answers show how often these experiences have happened to you when you are NOT under the influences of alcohol or drugs.

Please indicate how much of this time the following happens to you in comparison to others. (This is a scale with 11 points, with 0 = Much less than others, 5 = About the same as others, and 10 = Much more than others).

1. Some people have the experience of feeling that other people, objects, and the world around them are not real. (Question 12 in whole DES-C)
2. Some people have the experience of feeling that their body does not seem to belong to them. (Question 13 in whole DES-C)
3. Some people have the experience of not being sure whether things that they remember happening really did happen or whether they just dreamed them. (Question 15 in whole DES-C)
4. Some people find that they become so involved in a fantasy or daydream that it feels as though it were really happening to them. (Question 18 in whole DES-C)
5. Some people sometimes find that they cannot remember whether they have done something or have just thought about doing that thing (for example, not knowing whether they mailed a letter or have just thought about mailing it). (Question 24 in whole DES-C)
6. Some people find evidence that they have done things that they do not remember doing. (Question 25 in whole DES-C)

## APPENDIX I

### Additional Analyses for Experiment Four

Table 26 presents the trauma history of the participants who reported experiencing one or more of the events included in the Brief Trauma Questionnaire (BTQ). As can be seen in the table, the most reported traumatic event experienced was witnessing a death or serious injury.

*Table 26. Count and percentage of traumatic events experienced by participants in Experiment Four.*

Trauma Type	Count	Percent
Served in War Zone	1	1.0
Serious Accident	7	7.2
Major Disaster	7	7.2
Life threatening illness	1	1.1
Attacked/mugged	20	21.1
Beaten as a child	18	19.0
Unwanted sexual contact	12	12.4
Serious injury or fear of injury/death	13	13.4
Witness death or serious injury	31	32.6
Violent death of friend/ family member	12	12.9

\*Note: some participants experienced more than one type of trauma.

Table 27 demonstrates the means and SDs for absolute percentage changes in cortisol from baseline to PF1 across the six groups (cortisol responders and non-responders for each film condition).



*Table 27. Absolute percent change in cortisol from baseline to PF1 in responders and non-responders for each film condition.*

Condition	Percent Change in Cortisol	Direction of Change	SD	N
Trauma non-responder	21.43	Decline	5.99	19
Trauma responder	40.51	Increase	6.53	16
Reappraisal non-responder	28.72	Decline	5.84	20
Reappraisal responder	17.42	Increase	7.24	13
Neutral non-responder	28.08	Decline	5.99	19
Neutral responder	21.46	Increase	6.53	16

Table 28 presents the free recall regressions for Time 1 with the DES-C subscales included. The main result of note which was different to the regressions with the DES-C as a whole was that the depersonalisation/derealisation subscale was a significant positive predictor of accuracy.

Table 28. Free Recall Time 1 Regression Results Including the DES-C Subscales

Variable	Accuracy	Misinformation	Confabulations
	$\beta$	$\beta$	$\beta$
DES - Depersonalisation	<b>.44*</b>	.30	.30
DES - Absorption	-.32	-.12	-.07
DES - Amnesia	-.29	-.30	-.29
BTQ	.06	-.01	.05
SDQ	.09	.11	-.18
Intrusions	.06	.19	.12
Avoidance	.11	-.20	.03
Cortisol Responder Status PF1	.07	<b>.23*</b>	.03
R <sup>2</sup>	.13	.12	.08
F(8,78)	1.50	1.27	0.81

\* $p < .05$ 

Table 29 presents the free recall regressions for Time 2 with the DES-C subscales included. Absorption and trauma history both just missed significance in predicting misinformation recall, whereas absorption and avoidance were positive predictors of confabulations and intrusions just missed significance as a negative predictor of confabulations.

Table 29. Free Recall Time 2 Regression Results Including the DES-C Subscales

Variable	Accuracy	Misinformation	Confabulations
	$\beta$	$\beta$	$\beta$
DES - Depersonalisation	-.10	-.14	-.32
DES - Absorption	-.46	<b>.54†</b>	<b>.80**</b>
DES - Amnesia	.34	-.38	-.06
BTQ	.21	<b>.36†</b>	.03
SDQ	.21	-.26	-.13
Intrusions	-.15	.30	<b>-.62†</b>
Avoidance	.30	-.14	<b>.97**</b>
Cortisol Responder Status PF1	-.09	.10	-.05
Cortisol Responder Status PF2	.18	-.25	-.22
R <sup>2</sup>	.34	.38	.45
F(9,27)	1.51	1.84	<b>2.48*</b>

\* $p < .05$ ; \*\* $p < .01$ ; † $p < .064$

Table 30 presents the recognition regressions for Time 1 with the DES-C subscales included. The main difference of note was that the depersonalisation and absorption scales were significant predictors of recognition of misinformation items, however in opposite directions.

Table 30. Recognition Time 1 Regression Results Including the DES-C Subscales

Variable	Accuracy	Misinformation
	$\beta$	$\beta$
DES - Depersonalisation	-.12	<b>.61**</b>
DES - Absorption	-.18	<b>-.55*</b>
DES - Amnesia	.17	-.08
BTQ	.04	.12
SDQ	-.09	.02
Intrusions	<b>.32*</b>	.12
Avoidance	.14	-.02
Cortisol Responder Status PF1	.09	.00
R <sup>2</sup>	.22	.14
F(8,78)	<b>2.69*</b>	1.56

\* $p < .05$ ; \*\* $p < .01$

Table 31 presents the recognition regressions for Time 2 with the DES-C subscales included. The main difference of note was that the absorption scale was a significant negative predictor of recognition accuracy.

Table 31. Recognition Time 2 Regression Results Including the DES-C Subscales

Variable	Accuracy	Misinformation
	$\beta$	$\beta$
DES - Depersonalisation	.08	.06
DES - Absorption	<b>-.78**</b>	-.04
DES - Amnesia	.29	-.15
BTQ	-.08	.05
SDQ	.10	.11
Intrusions	.46	.17
Avoidance	-.28	-.13
Cortisol Responder Status PF1	-.11	-.15
Cortisol Responder Status PF2	.21	-.26
R <sup>2</sup>	.36	.17
F(9,27)	1.70	0.61

\* $p < .05$ ; \*\* $p < .01$