Intrusive memory quality in posttraumatic stress disorder and depression: A multimethod comparison using self-report, narrative measures and psychophysiological responding

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A thesis submitted for the degree of Doctor of Psychology (Clinical) of The Australian National University
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STATEMENT OF ORIGINALITY

I hereby declare that this dissertation represents my original work and that, to the best of my knowledge, contains no material which has been previously published or written by another person, accepted or presented for the award of any degree or diploma from any university, except where due acknowledgement is given.

Lian V. Parry
17 December 2012
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ABSTRACT

Considerable empirical work has investigated theoretically-driven predictions about the distinctive nature of intrusive memory (IM) phenomena in PTSD. Recently, there has been increasing recognition that intrusive remembering may also play an important role in depression. The accompanying findings have been interpreted as indicating that IMs in depression and PTSD exhibit a large degree of overlap. However, much of the IM research in depression to date has been limited by a range of methodological issues (Brewin, Gregory, Lipton, & Burgess, 2010; Newby & Moulds, 2011). This dissertation attempted to address such limitations by applying a multimethod approach to the comparison of IM phenomenology across depressed, PTSD and non-clinical groups. Study 1 compared IM phenomenology using self-report and narrative data while Study 2 combined a script-driven imagery task and self-report measures to consider the role of psychophysiological arousal during trigger event recall.

Results confirmed that IMs in depression and PTSD share some degree of overlap but differ on other key features. Specifically, IMs in PTSD were found to be more sensory-perceptual in nature, accompanied by more physical sensations and rated as more distressing than the IMs in depression. The IMs in PTSD were also characterised by a lack of temporal context compared to ordinary memory segments, a difference which was not observed for the depressed group. Furthermore, compared to depressed and control participants, the PTSD group exhibited significantly greater physiological arousal, particularly heart rate responses, whilst recalling trigger events. Although group differences were not found for self-reports of IM-related “nowness”,

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ratings of nowness and physical sensations were strongly positively correlated with PTSD symptom severity. In contrast, no such relationship was found between nowness, physical sensations and severity of dysphoria in the depressed group.

Taken together, the results of Studies 1 and 2 present several theoretical and clinical implications. Firstly, the findings support the view that the processing and encoding disruptions thought to underlie IMs in PTSD differ in distinctive and conceptually important ways from those that occur with depression. Specifically, the characteristic sensory-perceptual quality of IMs in PTSD is consistent with a dominance for data-driven or sensory-perceptual processing over conceptual processing during PTSD trigger events, which does not appear to be the case for depression. This corresponds with models of PTSD (Brewin, Dalgleish, & Joseph, 1996; Brewin et al., 2010; Ehlers & Clark, 2000) which suggest that IMs in PTSD are due to information processing disruptions triggered by extreme levels of fear and arousal at the time of the event. This results in poorly contextualised, sensory-based representations which may be less available to conscious recall, yet prone to automatic triggering and accompanied by a re-experiencing of the emotions and physiological arousal from the original event. The heightened physiological responding in the PTSD compared to the depressed group also suggests important discrepancies in the remembering experiences of trigger events in PTSD and depression, and may encourage more avoidant coping mechanisms in PTSD. In contrast, the depressed and non-clinical control groups differed little on self-report and narrative-based IM phenomenology or in terms of physiological responsivity during the script-driven imagery task. However, depressed group memories contained a greater proportion of self-relevant devaluative content than those of the other two
groups, underscoring the role of schema-level processes in this disorder. Such findings complement previous studies which have distinguished between IMs as a common feature of several psychological disorders, and “flashbacks”, which may be a form of intrusive re-experiencing unique to PTSD (Bryant, O'Donnell, Creamer, McFarlane, & Silove, 2011) with possible PTSD-specific implications for treatment.

In light of these findings and the lack of theoretical models which account for the development of IMs in depression, caution is warranted over the direct application of traditionally trauma-focussed interventions to the treatment of depression. Indeed, further research is required both to clarify the mechanisms which give rise to and maintain IMs in PTSD and depression, and to elucidate the treatment rationale and potential contraindications for IM-focussed therapies for depression. In this regard, and as evidenced here, multimethod approaches provide a promising, yet so far neglected, avenue through which ongoing theoretical and clinical controversies in IM research may be addressed.
Intrusive autobiographical memories (IMs) are a type of intrusive cognition which relate to actual, experienced events and are distinct from deliberately retrieved memories or rumination (Holmes & Bourne, 2008). IMs have been defined in the literature as “involuntary recollections relating to events that appear, apparently spontaneously, in consciousness” (Holmes & Bourne, 2008, p. 553) and commonly include highly detailed or vivid, sensory recollections accompanied by strong physical sensations and emotional responding (Brewin et al., 2010). While IMs constitute a key symptom of posttraumatic stress disorder (PTSD, American Psychiatric Association, 2000), they have also been noted in non-clinical populations (Berntsen, 1996; Brewin, Christodoulides, & Hutchinson, 1996; Bywaters, Andrade, & Turpin, 2004; Salkovskis & Harrison, 1984) and other disorders including major depression (Brewin, Hunter, Carroll, & Tata, 1996; Kuyken & Brewin, 1995; Williams & Moulds, 2007a), agoraphobia (Day, Holmes, & Hackmann, 2004), bipolar disorder (Gregory, Brewin, Mansell, & Donaldson, 2010), and social phobia (Hackmann, Clark, & McManus, 2000; Hirsch, Clark, Mathews, & Williams, 2003)

IMs in PTSD have attracted the bulk of the research to date given that reexperiencing symptoms are a core diagnostic feature and have been implicated in the maintenance and severity of this disorder (Michael, Ehlers, Halligan, & Clark, 2005). Recent studies however, have claimed a considerable degree of overlap in the quality and nature of IMs across PTSD and major depression. For example, IMs in depression have been described as equally vivid and distressing, and accompanied by a similar
range of emotions and physical sensations as those that occur in PTSD (Birrer, Michael, & Munsch, 2007; Newby & Moulds, 2011; Reynolds & Brewin, 1998, 1999; Williams & Moulds, 2007b). Such findings have led researchers to question the emphasis on intrusive experiences as a distinguishing feature of PTSD (Reynolds & Brewin, 1999) and to examine the possibility of applying traditionally trauma-focussed interventions, such as exposure therapy, to the treatment of depression (Kandris & Moulds, 2008).

Much of the comparative IM research to date has relied heavily on retrospective, poorly validated self-report methods (Brewin et al., 2010), or has been conducted with non-clinical samples or clinical samples without an adequate control group (Newby & Moulds, 2011). Furthermore, as Brewin and colleagues (2010) point out, research on the qualitative nature of IMs has historically focussed “more on covering multiple dimensions... ...than on restricting the range of inquiry but using more reliable methods” (p. 212). Finally, few, if any theories have been developed to provide a conceptual framework for the aforementioned features and aetiology of IMs in depression, weakening the conclusions that may be drawn from the research to date.

In contrast, theoretical and aetiological distinctions informed by the PTSD literature support the possibility of key differences between the intrusions experienced in PTSD versus depression. Influential cognitive models of PTSD (e.g. Brewin, Dalgleish et al., 1996; Brewin et al., 2010; Ehlers, 2010; Ehlers & Clark, 2000) highlight the role of fear and heightened autonomic nervous system arousal which produces abnormalities in the encoding and retrieval of trauma memories and leads to IMs characterised by a high degree of nowness, sensory detail, intense physical sensations and emotions from the time of the trauma. Furthermore, it has been
theorised that at extremely high levels of arousal “coherent integration of sensory information breaks down” (Krystal, Bennett, Bremner, Southwick, & Charney, 1995, p. 245) giving rise to dissociative symptoms. Although the underlying cognitive processes are still poorly understood, peritraumatic dissociation is thought to be mediated by hyperarousal (Sterlini & Bryant, 2002), and both undermine encoding processes leading to trauma memories which are fragmented and poorly integrated within the autobiographical memory system (van der Kolk & Fisler, 1995). Interestingly, recent research suggests that post-trauma “flashbacks” (a dissociative phenomenon) represent a form of intrusive remembering unique to PTSD (Bryant et al., 2011). This corresponds with self-report studies which have found systematic, flashback-type differences (for example, more intense feelings of helplessness, “nowness” and out-of-body experiences) in the IMs of PTSD compared to depression (Birrer et al., 2007; Reynolds & Brewin, 1999). In addition, an increasing body of neuroscientific evidence suggests that experiences of prolonged and/or extreme stress, consistent with Criterion A traumas (American Psychiatric Association, 2000) may have particular impacts on brain structures, memory encoding and other cognitive processes (Cruwys & O’Kearney, 2008; Elbert et al., 2011; Lanius et al., 2001; Robinson & Shergill, 2011). Taken together, these factors provide reason to suspect some qualitative differences in the IM experiencing in PTSD versus depression, with possible disorder-specific implications for treatment.

Although past studies have advanced our understanding of IMs in psychopathology, further research is required to overcome methodological issues of past studies and to clarify the distinguishing features of these complex phenomena across
disorders. Moreover, whilst researchers have suggested that IMs are a prominent feature of depression, as mentioned above few, if any, theoretical models of IMs in depression have been devised or tested. Clarification of the experiential and physiological features of intrusive phenomena across disorders may therefore help to inform the development of such a model in the future.

**Objectives of the Current Research Program**

The current research seeks to strengthen the literature on the experiential features of IMs in PTSD and depression by adopting a multimethod approach, beyond that of the semi-structured interviews and other self-report measures which have historically dominated research in this field. Specifically, two studies have been designed to compare IM experiences and features across control, depressed and PTSD groups using traditional self-report methods, followed by the novel application of more objective, narrative measures adapted from Hellawell and Brewin (2004) and psychophysiological approaches which have been used in PTSD research (Pitman, Orr, Forgue, de Jong, & Claiborn, 1987). In a further extension to the literature, these studies index the qualitative features of IM experiences almost immediately after their occurrence, thereby reducing the limitations of retrospective reports.

**Structure of the Dissertation**

Chapter 2 provides an overview of the autobiographical memory system including the voluntary and involuntary remembering distinction, followed by a summary of the symptoms and diagnostic features of PTSD and depression. Influential cognitive models which account for the presence and/or role of IMs in psychopathology are considered followed by a review of the IM literature to date. The clinical and
theoretical implications, followed by the aims and hypotheses of the current research program will then be presented.

Study 1 is presented in Chapter 3, with a view to elucidating the similarities and differences in IM experiences across a depressed, PTSD and control group via traditional self-report ratings and more objective, narrative measures. The narrative approach is based on research by Hellawell and Brewin (2004) which tested a multiple memory systems theory within a traumatised sample. In adopting this method, the current study considers to what extent narrative differences in intrusive and ordinary memory segments of "trigger" events may be detected in depressed, PTSD and non-clinical groups, and in so doing, to what extent they support a common dual-route processing mechanism in memory.

Study 2 is presented in Chapter 4 and aims to further enhance understanding of negative event and intrusive remembering in depressed and PTSD populations via the novel application of a script-driven imagery task. Traditionally used in PTSD research, script-driven imagery serves as a symptom-provocation task which examines participants' physiological responding to audio-taped personal scripts of traumatic events. This study explores the extent to which physiological arousal may be a feature of event and intrusive remembering in depression compared with PTSD and controls, and considers how these findings fit within existing theoretical models.

Finally, Chapter 5 draws together the findings and conclusions of Study 1 and 2 and considers the theoretical and clinical implications in light of past research. The limitations of the current research are acknowledged and discussed, along with recommendations for future avenues of investigation.
Autobiographical Memory: The Involuntary and Voluntary Remembering Distinction

Autobiographical memory represents a highly complex, reconstructive system consisting of recollections which are of direct relevance to one's sense of self across time and space (Ball, 2010; McNally, 2005; Sutin & Robins, 2008). In addition to establishing a concept of self, autobiographical memories serve to guide current and future behaviours, actions and thoughts. As such, the way in which autobiographical memories are encoded, retrieved and appraised has been shown to influence mood and behaviour, which, in the context of psychopathology has important implications for prognosis and treatment.

Autobiographical memories enter consciousness through voluntary, "higher-order meaning-based" (Ehlers & Clark, 2000, p. 325) memory retrieval or via involuntary triggering by stimuli such as odours, sounds and images associated with the original event (Brewin, Dalgleish et al., 1996; Mace, 2010). Involuntary memory is therefore an automatic, associative process which contrasts with the deliberate and strategic retrieval strategies of voluntary remembering (Brewin et al., 2010). One of the dominant models of autobiographical memory, the Self-Memory System (SMS), proposed by Conway and Pleydell-Pearce (2000) conceptualises IMs as sensory-rich, "experience-near" episodic memories. Conway and Pleydell-Pearce (2000) suggest that when trauma-related episodic memories threaten self-coherence they remain isolated
from more abstract levels of autobiographical knowledge and continue to intrude when triggered by cues in the environment which resemble the memory. It is noteworthy that the SMS account of IMs “does not assume qualitatively different mechanisms for traumatic memories, but rather states that traumatic information may have more ‘difficulties’ along the way to become a ‘normal’ autobiographical memory” (Krans, Naring, Becker, & Holmes, 2009, p. 1079).

Other cognitive models proposed by Berntsen and Hall (2004) and Rubin and colleagues (2008) have also attempted to explain IM phenomena using general memory mechanisms. However, these models have been criticised for failing to adequately account for the full range of intrusive re-experiencing (such as dissociative flashbacks) observed in PTSD (Ehlers, 2010). Indeed, despite the apparent universality of IM phenomena, differences exist between the subjective intrusive experiences of healthy controls and those of clinical groups, with “normal” IMs tending to occur less frequently and to be less distressing than those experienced by clinical groups (Brewin et al., 2010; Bywaters et al., 2004). Furthermore, it is now widely accepted that IMs represent more than just an epiphenomenon of psychopathology with an increasing body of research highlighting the clinical significance of IMs, most notably in the area of PTSD. Prior to detailing the cognitive models and features of IMs in PTSD and depression, a brief review of the symptoms and diagnoses of both disorders is provided below.

**PTSD Symptoms and Diagnosis**

PTSD is unique within the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR, American Psychiatric Association, 2000) in that it requires an
aetiological event; namely, exposure to a traumatic event in which a person experienced, witnessed or was confronted with threat to life or serious injury, or a threat to the physical integrity of self or others (Criterion A1), combined with intense fear, helplessness or horror in response to the event (Criterion A2). Symptoms of PTSD are clustered into 1) re-experiencing of the event in various sensory forms, 2) avoidance of reminders of the event or emotional numbing and 3) hyperarousal of the autonomic nervous system (ANS). A PTSD diagnosis is considered if symptoms persist for more than one month and cause clinically significant distress or impairment in key areas of functioning (American Psychiatric Association, 2000; Rothschild, 2000).

While PTSD has long been considered a disorder involving a dysregulated fear system, characterised by a marked fear-anxiety response and hyperarousal, recent studies suggest that PTSD may be better conceptualised as a disorder of affect arousal regulation (Frewen & Lanius, 2006; Kemp et al., 2009) involving “a lack of control and inability to adaptively regulate levels of affective arousal and distress in the context of a stressor” (Kemp et al., 2009, p. 158). Indeed, individuals with PTSD commonly report a range of clinically-prominent affective states beyond fear-anxiety, including outbursts of irritability/anger, overwhelming guilt, loss and shame (Frewen & Lanius, 2006). Furthermore, while many PTSD patients do exhibit marked hyperarousal of the ANS in the presence of a stressor or reminder of the trauma, others exhibit inhibition of affective and autonomic arousal, consistent with a dissociative response (Frewen & Lanius, 2006; Griffin, Resick, & Mechanic, 1997; Lanius et al., 2002).

Dissociation is mentioned in the DSM-IV-TR criteria in the context of a “dissociative flashback”; a posttraumatic stress symptom which reflects a “splitting in
awareness” (Rothschild, 2000) or state of derealisation, depersonalisation and emotional numbing. Although dissociative reactions are generally associated with more severe traumas and have been linked to an increased risk of PTSD and IM development (Holmes, Brewin, & Hennessy, 2004; Shalev, Peri, Canetti, & Schreiber, 1996), peritraumatic dissociative states (which occur during or immediately after the trauma) and those that persist post-trauma have not always been sufficiently distinguished in the literature. For example, peritraumatic dissociation appears to be mediated by extreme levels of fear and arousal (Krystal et al., 1995; Sterlini & Bryant, 2002) while posttraumatic dissociation is often associated with emotional numbing and hypoarousal (but see Nixon, Bryant, Moulds, Felmingham, & Mastrodomenico, 2005). Furthermore, peritraumatic dissociation interferes with encoding of the memory, while persistent posttraumatic dissociation is likely to inhibit the retrieval and emotional processing of these memories. From a theoretical perspective, these failures of encoding and retrieval interfere with the emotional processing, elaboration and integration of the trauma memory in the autobiographical memory base, thereby impeding recovery from PTSD (Ehlers & Clark, 2000; Foa & Hearst-Ikeda, 1996).

While dissociation has been associated with subsequent memory deficits as reviewed above, little is known about the underlying neuronal circuitry or cognitive mechanisms which give rise to dissociative processes in the first place (Lanius et al., 2002). Similarly, while individuals with PTSD typically display a range of memory disturbances, controversies persist regarding the nature of some of these symptoms, their underlying causes and their role in perpetuating the disorder. For example, the extent to which integration of the trauma memory is required for recovery continues to
be the subject of debate within the PTSD literature (O'Kearney, Hunt, & Wallace, 2011). This reflects in part, the apparent contradiction between studies which have described trauma memories as confused and impoverished fragments in some instances, versus highly vivid and lasting impressions in others (Brewin & Holmes, 2003). Some theorists argue that the poor integration or isolation of trauma memories within the broader autobiographical memory base contributes to persistent, distressing IMs and the maintenance of PTSD symptoms (Ehlers & Clark, 2000; Kleim, Wallott, & Ehlers, 2008). A separate but connected issue is the extent to which the traumatic memories themselves are an integrated whole versus fragmented recollections with missing details and lacking in narrative coherence (Rubin, Feldman, & Beckham, 2004). The contrasting “landmark” view purports that memories for traumatic events in PTSD tend to be vivid, continuous and central to a person’s life story and that this “centrality” of the event in the autobiographical memory base influences PTSD severity (Berntsen & Rubin, 2007).

Whilst the memory fragmentation/landmark controversy remains unresolved, both approaches underscore memory disturbance as a hallmark, albeit complex, feature of PTSD. Indeed, much of the PTSD research to date acknowledges the role of encoding, processing and retrieval of trauma memories in the development and maintenance of posttraumatic stress symptoms (Brewin & Holmes, 2003). Moreover, while various social, biological and cognitive processes are certainly implicated in the development of these symptoms, consensus is growing that PTSD may be conceptualised primarily as a disorder of memory (McNally, 2005).
Depressive Symptoms and Diagnosis

According to DSM-IV-TR criteria (American Psychiatric Association, 2000), Major Depressive Disorder is determined by the presence of a clinically diagnosed Major Depressive Episode (MDE), without a history of mania. An MDE constitutes a persistent sad mood or loss of interest or pleasure in daily activities most days, for at least two weeks, in addition to at least four other symptoms which may include sleep or appetite disturbances, weight gain or loss, psychomotor agitation or retardation, fatigue or loss of energy, feelings of worthlessness or inappropriate guilt, difficulties concentrating or indecisiveness, recurrent thoughts of death or suicidal ideation. The onset of depression may occur rapidly or develop slowly over years. As with PTSD, depression has been found to impact many aspects of social, psychological and cognitive (including memory) functioning (Gotlib & Joorman, 2010). For example, one commonly reported symptom is the negative event bias where depressed individuals exhibit enhanced recall for negatively valenced material (see Mathews & MacLeod, 2005, for a review).

Unlike PTSD, major depression does not require a specific aetiological event for diagnosis however studies have consistently found that many (particularly first) depressive episodes are precipitated by a stressful life event (Kendler, Karkowski, & Prescott, 1999; Mazure, 1998; Monroe, Slavich, Torres, & Gotlib, 2007). Indeed, cognitive models (such as Beck, 1976, 1987), suggest that vulnerability to depression is linked to dysfunctional memory representations or self-relevant schemas (often involving themes of separation, loss, failure, worthlessness and rejection) which remain latent until activated by a negative life event. Once activated, these schemas trigger a
“vicious cycle of negative automatic thoughts, processing biases, and depressed mood” (Gotlib & Joorman, 2010, p. 4). Furthermore, these schemas are thought to persist beyond the current depressive episode, representing an ongoing vulnerability to relapse. However, the degree to which distortions in cognition and information processing represent mere symptoms or play a causal role in depression has been a matter of longstanding debate. Recently, Monroe and colleagues (2007) found that major life stressors predicted a distinctive pattern of cognitive change over the course of depression, strengthening evidence for an aetiological role of interacting cognition and stressful events in major depression.

**Overlapping Features of PTSD and Depression**

Despite their classification as separate anxiety/stress and mood disorders respectively (American Psychiatric Association, 2000; World Health Organization, 1992), PTSD and depression share several overlapping symptoms including loss of interest, detachment from others, restricted range of affect, insomnia, difficulty concentrating and guilt (Schillaci, Yanasak, Adams, Dunn, & Rehm, 2009) and risk factors, including female sex, neuroticism, history of childhood trauma, family history of major depression and pre-existing anxiety and depressive disorders (see Breslau, Davis, Peterson, & Schultz, 2000, for a review). Furthermore, pre-existing depression increases the risk of both trauma exposure and PTSD, while PTSD significantly increases the risk of first-onset depression (Breslau et al., 2000; Neria & Bromet, 2000). Not surprisingly, in clinical settings PTSD and depression exhibit high rates of comorbidity (Breslau et al., 2000; Brown & Barlow, 2009; Neria & Bromet, 2000; Schillaci et al., 2009) although it has been argued that co-occurring PTSD and
depression in trauma victims may reflect common underlying vulnerabilities or risk factors, rather than two truly “separate and distinct” comorbid disorders (Breslau et al., 2000).

More recently, calls for transdiagnostic approaches to conceptualising and diagnosing mood and anxiety disorders have arisen from studies which have identified overlaps in disturbances of cognitive processing and memory (Harvey, Watkins, Mansell, & Shafran, 2004). For example, rumination is a maladaptive cognitive processing style common to both depression and PTSD, characterised by a tendency to focus on negative emotional states which inhibits actions that might facilitate effective problem-solving or provide relief (Ehlers & Clark, 2000; Noelen-Hoeksema, 1991). Another common feature of depression and PTSD is a lack of autobiographical memory specificity (or overgeneral memory) whereby individuals produce “categoric” memories rather than recalling specific events. Other anxiety disorders do not exhibit this retrieval style (see Watkins & Teasdale, 2001, for a review) suggesting that overgeneral memory is specific to, and predicts both the onset and course of depression and trauma-related disorders (Bryant, Sutherland, & Guthrie, 2007; Hermans et al., 2008; Kleim & Ehlers, 2008; Van Minnen, Wessel, Verhaak, & Smeenk, 2005). Finally, depressed populations have been found to exhibit intrusive autobiographical memories as observed in PTSD, sparking renewed interest in the overlap between the disorders. As such, a review of IM phenomena and the cognitive models designed to account for the qualities and role of IM across both disorders is presented next.
Intrusive Memories in PTSD

According to current diagnostic criteria, intrusive re-experiencing of a traumatic event is a core feature of PTSD which may take any or all of the following forms (American Psychiatric Association, 2000):

- recurrent and intrusive distressing recollections of the event, including images, thoughts, or perceptions;
- recurrent distressing dreams of the event;
- acting or feeling as if the traumatic event were recurring (includes a sense of reliving the experience, illusions, hallucinations, and dissociative flashback episodes, including those that occur upon awakening or when intoxicated);
- intense psychological distress at exposure to internal or external cues that symbolise or resemble an aspect of the traumatic event; and
- physiological reactivity on exposure to internal or external cues that symbolise or resemble an aspect of the traumatic event.

These diagnostic criteria have spurred a wealth of research and led to the development of several theories designed to account for the aforementioned symptoms and commonly observed qualities of IM in PTSD. For example, Mace (2010) conceptualises IMs in PTSD as distinct from “direct” involuntary memories of everyday situations or “chained” involuntary memories which are triggered by other memories. What remains unclear is whether the IMs in depression (or other disorders) belong to the same category as traumatic involuntary memories, one of the other two categories (direct or chained), or a distinct category altogether. An alternative view is to consider psychopathological IMs as developing on a continuum of stressfulness from everyday
intrusions to the traumatic flashbacks witnessed in PTSD (Holmes & Bourne, 2008; Krans et al., 2009). Based on the findings of analogue studies, Holmes and Bourne (2008) suggest that “such a continuum may range from, say, viewing fictitious stressful films, through viewing films of real and self-related trauma, to the spectrum of “true” traumatic events” (p. 561). Although the objective “stressfulness” of an event is certainly implicated in the development of distressing IMs, a comprehensive account of PTSD intrusions is likely to demand a more complex consideration of interacting idiosyncratic (e.g. dissociative tendencies, coping styles, information processing traits; Halligan, Clark, & Ehlers, 2002; Lanius, Bluhm, Lanius, & Pain, 2006; Lanius et al., 2010; Lanius et al., 2002; Laposa & Alden, 2006) and situational (e.g. trauma type) factors (Briere & Scott, 2006).

Holmes and Bourne’s (2008) model draws from information processing theories of PTSD such as Ehlers and Clark’s (2000) cognitive model and Dual Representation Theory (DRT) (Brewin, Dalgleish et al., 1996; Brewin et al., 2010) which propose that IMs are produced following a shift from conceptual to perceptual information processing within (in the case of DRT) a multilevel memory system. In contrast to the general models of IMs reviewed earlier, Ehlers and Clark’s (2000) model and DRT were designed to account for the full range of PTSD symptoms (including dissociative flashbacks) and remain two of the more influential cognitive models of PTSD to date. While efforts to explain and predict IM phenomena are ongoing, these models are reviewed below for their relevance to the current research as they focus on the role of memory in the posttraumatic stress response, accounting for and predicting various re-experiencing phenomena and IM qualities.
Ehlers and Clark’s cognitive model of PTSD. Ehlers and Clark’s (2000) model provides a comprehensive account of the role of memory encoding processes and retrieval, arousal, appraisals and avoidance in the onset and maintenance of PTSD. In brief, PTSD is thought to develop when past traumatic experiences and their sequelae are processed, encoded and appraised in a way that produces an enduring sense of threat (Krans, Woud, Naring, Becker, & Holmes, 2010). Of particular interest to the current research is the emphasis that Ehlers and Clark (2000) place on the role of encoding processes and the subsequent nature of the trauma memory in the aetiology of PTSD symptoms.

Specifically, Ehlers and Clark (2000) distinguish between two forms of information processing, namely, conceptual versus data-driven processing. “Conceptual” processing involves processing the meaning of the situation, and the event itself, in an organised and contextualised way, and results in memories which are suitably integrated into the autobiographical memory knowledge base and can be deliberately retrieved. In contrast, “data-driven” processing involves the processing of immediate sensory impressions. During a traumatic event, a shift may occur from conceptual to data-driven processing, leading to memories which are rich in sensory detail but “poorly elaborated and inadequately integrated into its context in time, place, subsequent and previous information and other autobiographical memories” (Ehlers & Clark, 2000, p. 325). While such memories are difficult to retrieve intentionally, the strong perceptual priming for associated stimuli results in memories which are frequently and automatically triggered. This shift toward perceptual processing and the subsequent interference with memory encoding has been attributed in part to extreme
levels of fear, autonomic arousal and cortisol levels at the time of the trauma (Ehlers & Clark, 2000). Somewhat consistent with this view is the “narrowing of attention hypothesis” (Christianson, 1992) which suggests that high physiological arousal during a traumatic event results in focused attention on the “most salient aspects of the environment, consistent with the need to focus on the danger at hand… …while less critical, but important information about the context of the trauma may not receive much attention” (Krystal et al., 1995, p. 245). It should be noted however, that some PTSD patients have difficulties retrieving even central details of the trauma event (Halligan et al., 2002).

Ehlers and Clark (2000) argue that the resulting lack of memory elaboration and integration explains the difficulties with deliberate trauma memory recall, the high degree of nowness and sense of current threat (both of which are enhanced by the lack of temporal context), and the ease with which involuntary memories are triggered in the presence of physically similar cues (i.e. an “enhanced perceptual priming” effect). In addition, Ehlers and Clark (2000) emphasise the role of strong associative learning processes in PTSD, whereby memory fragments and other stimuli become conditioned to trigger fear and/or other emotions and high levels of autonomic arousal, as experienced during the original event. This associative learning and strong emotional and physical responding, together with the lack of temporal context and ease of triggering of IMs, exacerbates the sense of nowness and current threat inherent in the intrusive experiences in PTSD.

Ehlers and Clark (2000) also highlight the reciprocal relationship between the nature of the trauma memory and the negative appraisals of the trauma and its
consequences, as well as the role of maladaptive coping strategies, such as behavioural and cognitive avoidance, in the maintenance of PTSD symptoms. For example, interpretations of IMs as indicators of permanent damage or threat may maintain PTSD through the direct production of negative emotions and by encouraging thought suppression, a form of cognitive avoidance, whereby individuals actively try to push the IMs out of mind. Whilst avoidance may reduce the physiological arousal and distress caused by the intrusions over the short term, such strategies lead to a vicious cycle whereby the emotional processing and integration of the intrusive material is inhibited and the likelihood of future intrusions is enhanced (Ehlers & Clark, 2000).

**Dual Representation Theory.** A second influential cognitive model which addresses the occurrence of distressing IMs in PTSD is dual representation theory (DRT) (Brewin, Dalgleish et al., 1996; Brewin et al., 2010). DRT proposes two parallel memory systems; one which involves lower-level, perceptual processing and is predominantly image-based and another which involves more abstract processing and contextually-bound representations. Sensory input is processed via conscious (deliberate, limited and effortful) as well as non-conscious (rapid, yet less flexible and modifiable) memory processing systems (Brewin, Dalgleish et al., 1996). During a traumatic event, threat-related, sensory and emotionally-charged stimuli compete for attention, resulting in consciously and unconsciously encoded memories distinguished in DRT as “verbally accessible memories, VAMs”, now known as “contextual representations” (C-reps, Brewin et al., 2010), and “situationally accessible memories, SAMs” or “sensory representations” (S-reps). VAMs/C-reps are characterised by their ability to be deliberately retrieved and edited over time by the traumatised individual,
and are contextualised within the person's autobiographical memory database. In contrast, SAMs/S-reps typically consist of trauma-relevant representations such as briefly apprehended sights or sounds and bodily responses including changes in heart rate, temperature and pain. Since such stimuli receive limited conscious attention during the trauma, the SAMs/S-reps are poorly encoded in the contextual memory system and therefore cannot be deliberately retrieved or edited in the same way as VAMs/C-reps. As such, while normal event encoding generates closely connected contextual and sensory representations of the event, pathological encoding under conditions of extreme threat and arousal produces relatively stronger S-reps, weaker C-reps and impaired connections between the two, resulting in repetitive IMs or flashbacks. Recent extensions to the model suggest that while different forms of intrusive phenomena may occur in disorders other than PTSD, the conditions which give rise to flashbacks, namely, that memories are encoded under conditions of extreme threat or arousal and in the absence of corresponding contextual representations leading to a lack of present moment awareness, co-occur only with PTSD (Brewin et al., 2010; Bryant et al., 2011).

The DRT approach also distinguishes between two types of emotional reactions to memories of the event. "Primary" emotions refer to emotions (predominantly fear) which have been conditioned and are later re-experienced, along with relevant sensory and physiological information and IMs of the event. In contrast, "secondary" emotions (such as anger, guilt, shame, sadness and fear for the future) tend to arise from later appraisals of the implications or consequences of the trauma (Brewin, Dalgleish et al., 1996).
Like Ehlers and Clark’s (2000) model, DRT suggests that behavioural and cognitive avoidance of the intrusive material maintains and exacerbates symptoms, leading to secondary consequences such as depression and social withdrawal (Brewin, 2008). As such, recovery from trauma requires the conscious processing of information contained in the SAMs/S-reps which facilitates their transformation and encoding into the contextual memory system. In this way, DRT has been used to explain the effectiveness of exposure-based treatments for PTSD. Specifically, exposure therapy attempts to hold IMs in conscious awareness for long enough so that the perceptual representations may be “copied” into the VAM and provided with an autobiographical context (Brewin et al., 2010). Successful treatment results in memories of the event which may be consciously retrieved and reduces the degree of automatic triggering by perceptual cues. The model posits that the cognitive and emotional processing of the SAMs/S-reps into the contextual memory system attenuates the physiological and emotional intensity of the memories and in so doing, reduces hyperarousal and avoidance symptoms as well.

**Intrusive memory qualities.** As reviewed above, the DRT (Brewin, Dalgleish et al., 1996; Brewin et al., 2010) and Ehlers and Clark’s (2000) model provide an explanatory account of IM phenomena in PTSD. Despite their differences, both approaches highlight the effects of threat and arousal which leads to an imbalance in perceptual versus conceptual processing. As a result, representations of the trauma are poorly integrated into the autobiographical memory base and IMs are characterised by a high degree of sensory (mainly visual) content and a heightened sense of nowness, which includes a lack of temporal context, re-experiencing of the emotions, physical
sensations and autonomic arousal from the original event, as well as easy triggering by a wide range of internal and external stimuli.

Importantly, numerous analogue and clinical studies (Halligan, Michael, Clark, & Ehlers, 2003; e.g. Hellawell & Brewin, 2002; Hellawell & Brewin, 2004; Holmes et al., 2004) have provided evidence to support the role of conceptual versus data-driven processing and dual representations in memory in the development of post-trauma IMs, as well as the aforementioned IM qualities. For example, Halligan, Clark and Ehlers (2002) identified participants with a tendency to respond to stressful events with either a data-driven or conceptual style of processing. Both groups watched a trauma film and reported on subsequent intrusive memories and analogue PTSD symptoms. Consistent with the predictions of Ehlers and Clark (2000), the data-driven group reported subjectively more disorganised memories of the videotape content, as well as a greater number of analogue PTSD symptoms including more frequent, sensory, distressing and intrusive memory intrusions in the week following the experiment. In a later study, Halligan and colleagues (2003) compared cognitive processing styles in two groups of assault survivors and found that high levels of memory disorganisation were associated with peritraumatic dissociation, data-driven processing and lack of self-referent processing, and that cognitive processing and memory disorganisation variables predicted PTSD severity up to six months later. Importantly, although these variables also correlated with depressive symptoms “their ability to predict PTSD was independent of levels of depression, strengthening the case that the variables identified by Ehlers and Clark are at least in part specific to PTSD” (Brewin & Holmes, 2003, p. 364).
Empirical evidence has also been obtained for dual representations in memory. For example, in a study of 62 participants meeting diagnostic criteria for PTSD, Hellawell and Brewin (2002) found that performance on a visuospatial task was impaired during intrusive compared with ordinary memory segments of a trauma narrative, while performance on a verbal task was equally impaired in both phases. Based on the assumption of modality-specific competition for resources during dual-task activities (Brooks, 1968, cited in Hellawell & Brewin, 2002), such results add weight to the theory that flashbacks, unlike ordinary memories in PTSD, are associated with low-level perceptual processes and/or image-based representations in memory. Furthermore, consistent with DRT predictions, observations of behavioural changes revealed a significant increase in autonomic and motor responses during flashback segments. Hellawell and Brewin (2002) suggest that such movements may reflect automatic “mobilisation” responses during flashbacks which “may account for some instances of re-experiencing past trauma in which individuals with PTSD act ‘as if’ the event is occurring with concurrent physiological arousal” (Hellawell & Brewin, 2002, p. 1154). Taken together, these findings support the DRT perspective that flashback and ordinary memories are qualitatively distinct phenomena, supported by disparate underlying systems in memory (Hellawell & Brewin, 2002).

Numerous studies have also provided evidence for the key IM qualities in PTSD as predicted by these models. For example, PTSD intrusions have been found to consist predominantly of sensory, rather than verbal or thought-based, memories (e.g. Hackmann, Ehlers, Speckens, & Clark, 2004; Holmes et al., 2004; Holmes, Grey, & Young, 2005; van der Kolk & Fisler, 1995) consistent with a threat-induced shift.
toward pertitraumatic perceptual processing and/or IMs derived predominantly from a sensory memory system. These sensory impressions have been found to include a mix of auditory, kinetic or olfactory sensations, although the large majority of PTSD intrusions consist of detailed visual images or “snapshots” of the event (Ehlers et al., 2002; Ehlers & Steil, 1995; Hackmann et al., 2004; van der Kolk & Fisler, 1995). In a novel approach using narrative-based measures, Hellawell and Brewin (2004) examined the trauma narratives of participants with PTSD and also found that the intrusive segments contained significantly more sensory words than the ordinary memory segments. In addition, intrusive segments contained more references to fear, helplessness, horror and death than the ordinary memory segments, while emotions consistent with later appraisals and interpretations of the events (such as sadness and anger) occurred predominantly in ordinary memory sections. Furthermore, spontaneous switches to present tense occurred more frequently during intrusive compared to ordinary memory segments, suggestive of time distortion and hence a reliving quality unique to flashbacks. Taken together, these findings suggest “that reliving is not just a function of extreme emotion but of specific emotions such as fear that occur at the moment of trauma” (Brewin, 2008, p. 222).

Psychophysiological studies have also provided evidence for the distinction between ordinary memories and the reliving quality of flashbacks predicted by PTSD models. For example, using a script-driven imagery paradigm, Pitman and colleagues (1987) found that Vietnam combat veterans with PTSD exhibited exaggerated physiologic arousal during the recollection of traumatic experiences. Healthy controls were not very physiologically reactive to imagined scenes of highly stressful past
experiences despite this imagery being subjectively experienced as vivid. In contrast, PTSD subjects were physiologically hyperreactive, although this reaction was specific to imagery of their traumatic combat experiences, and did not extend to the other imagery studied. A later study by Pitman and colleagues (1990) also confirmed the presence of heightened physiological responsivity to combat imagery in a group of combat veterans with PTSD, but not in a group of trauma-exposed combat veterans with other (i.e. non-PTSD) anxiety disorders. Pitman and colleagues (1990; 1987) suggest that this is consistent with a specific reliving (not just recollection) of PTSD-related experiences; an important distinction in the conceptualisation of PTSD. In terms of the DRT perspective, heightened arousal of this kind is thought to have an ongoing inhibitory effect on the VAM/C-rep system and encourages cognitive and behavioural avoidance aimed at lowering levels of arousal and distress, thereby perpetuating the PTSD cycle (Cruwys & O'Kearney, 2008).

This reliving quality has also been described in the literature as a subjective sense of IM-related nowness, that is, “the feeling that the sensations are experienced in the present rather than as a memory from the past, and that the emotions (including physical reactions and motor responses) accompanying the intrusions are the same as those experienced at the time (‘original’ emotions)” (Michael et al., 2005, p. 614). Whilst a high degree of nowness is commonly associated with dissociative flashbacks, it is noteworthy that a sense of nowness can also occur with briefer IMs which do not involve a complete loss of present-moment awareness (Hackmann et al., 2004, cited in Michael et al., 2005). In any case, the degree of IM-related nowness has important clinical implications; not only is it a common feature of intrusive phenomena in PTSD
(Ehlers, Hackmann, & Michael, 2004; Hackmann et al., 2004), it has been found to predict PTSD severity and poor treatment response to imaginal exposure (Michael et al., 2005; Speckens, Ehlers, Hackmann, & Clark, 2006).

Also in line with theoretical predictions, numerous studies have provided evidence of the easy triggering of IMs in PTSD by a broad range of internal and external stimuli (Ehlers & Steil, 1995; Foa, Stekeete, & Rothbaum, 1989; Michael et al., 2005; van der Kolk & Fisler, 1995). Moreover, the clinical significance of this feature has been demonstrated by Michael and colleagues (2005) who found that the ease and persistence of IM triggering, along with the distress caused by the intrusions and their lack of context predicted PTSD severity after six months, regardless of initial diagnostic status. Interestingly, evidence suggests that IM triggers may be temporally associated cues (e.g. similar internal or external states or situations) involving the moments just before the trauma happened or when the situation was becoming more dangerous, explaining the sense of current threat and distress that typically accompanies traumatic IMs (Ehlers et al., 2002; Hackmann et al., 2004). This “warning signal hypothesis” argues that intrusive trauma memories may serve to provide information about imminent threats, thereby reducing the risk of future harm (Kranks et al., 2009).

However, this contrasts with Holmes and colleagues’ (2005) findings that 77% of intrusions reflected the worst moments or “hotspots” of the traumatic event. Despite disparities in the reported timing of intrusive content in PTSD (which may be due to methodological differences, Brewin et al., 2010), both studies concur that PTSD IMs contain cognitive themes of physical and psychological threats to the self, are rich in
sensory-perceptual detail and are accompanied by a high degree of distress, as predicted by dominant models of PTSD.

In summary, IMs in PTSD may be described on the basis of a wide range of subjective features. However, Ehlers and Clark’s (2000) and Brewin and colleagues’ (1996; 2010) models of PTSD predict specific IM or flashback qualities which arise from abnormalities in the peritraumatic processing and encoding of the event in the context of heightened fear and physiological arousal. These models have generated much research and a reasonable body of evidence supports the underlying mechanisms of IMs in PTSD as well as the key intrusive qualities thought to arise from these processes. Of particular interest to the current research is the empirical evidence which suggests, consistent with recent updates to dual representation theory, that flashbacks represent a form of intrusive re-experiencing unique to PTSD (Bryant et al., 2011).

**Intrusive Memories in Depression**

Since the mid-1990s, research interest in IMs in depression has grown, although theoretical frameworks which account for the presence of IMs and their role in the maintenance of the disorder are lacking (Williams & Moulds, 2010). Based on a review of the intrusive memory literature, Williams and Moulds (2010) propose a tentative model for the maintenance of IMs in depression which asserts that maladaptive appraisals can interact with beliefs about the need to control intrusions which triggers distress. This distress prompts employment of various avoidance strategies (e.g. suppression, retrieval of images from an observer perspective, analytical rumination and attempts to disengage emotionally) which prevents emotional processing, thereby
perpetuating the depressive episode. However, the model does not address the role of memory processing and encoding or how IMs in depression develop in the first place.

As such, it may be useful to consider to what extent existing models of IMs in PTSD also apply to depression. For example, DRT (Brewin, Dalgleish et al., 1996; Brewin et al., 2010) and Ehlers and Clark’s (2000) model might suggest that the same shift from conceptual to perceptual processing also gives rise to IMs in depression. If re-experiencing phenomena represent a truly “overlapping” feature of PTSD and depression, a high degree of similarity across IM qualities and related experiences would be expected. In particular, if IMs in depression and PTSD are similarly rich in sensory detail, lacking in temporal context and accompanied by the same level of nowness and physical sensations as outlined by the aforementioned models of PTSD, this would strengthen the argument that IMs in depression are generated by similar encoding processes or by the same sensory-based memory system and may warrant similar clinical interventions. If not, this would reinforce the theory that there is something unique about IM experiencing in PTSD. For example, the distressing quality of IMs in depression may be due more to the negative cognitive schema they activate and strengthen, namely, top-down processes, compared to the distress caused by flashbacks and other uncontextualised, sensory memories of terrifying experiences triggered by bottom-up processes, which may be more typical of IMs in PTSD. Consistent with this view would be past research which has found increased negative thinking (in particular, global negative self-evaluation and generalised hopelessness) from higher level cognitive processes, to predict depression severity (Dent & Teasdale, 1988).
In any case, several studies have attempted to describe the nature and role of IMs in depression and have concluded that whilst they are not a universal feature of this disorder (e.g. Brewin, Hunter et al., 1996; Patel et al., 2007) they resemble PTSD intrusions in various ways. However, most of the studies to date have examined a wide range of IM qualities, some of which may be universal (that is, independent of psychopathology) features of IMs, rather than focussing on theory-driven qualities for a more targeted comparison of PTSD and depression. Furthermore, as reviewed below, while such research has advanced understanding of IM phenomena generally, a number of methodological issues remain to be addressed.

In one of the first studies to target IMs in depression, Kuyken and Brewin (1994) examined the links between intrusions, avoidance and depression severity among a clinical sample of depressed, adult women with a history of childhood sexual or physical abuse. They found that most of the women reported “high levels of disturbing intrusive memories and high levels of avoidance” (Kuyken & Brewin, 1994, p. 525), comparable to those reported by PTSD populations, as indexed by the Impact of Events Scale (IES, Horowitz, Wilner, & Alvarez, 1979). In addition, higher levels of intrusive experiences and avoidance were correlated with more severe depressive symptoms and to more severe abuse. Kuyken and Brewin (1994) conclude that depression may involve an exacerbation of IMs and avoidance.

Brewin, Hunter, Carroll and Tata (1996) aimed to replicate and extend these findings with a mixed sex sample of depressed patients and examined a wider range of IMs concerning a variety of events. They found that spontaneous IMs were reported by 87% (n = 27) of their sample and were most commonly related to events of illness and
death. While greater levels of depression were associated with more intrusion and avoidance of memories concerning child abuse, there was no evidence that depression severity was related to IMs of other categories of past events.

Although these early studies provide some initial insights into the features of IMs in depression, the lack of a control or PTSD group limits the utility of the findings for comparative purposes. In response, Spencely and Jerrom (1997) tested currently depressed, recovered depressed and never-depressed controls and found significantly higher levels of intrusions and avoidance of traumatic childhood events in the depressed group. In addition, the recovered depressed group reported fewer IMs than the currently depressed group suggesting that depressed mood may exacerbate involuntary recall of trauma memories.

However, Spencely and Jerrom’s (1997) study did not appear to exclude participants with PTSD symptoms, hence the depressed group IMs may have been influenced by comorbid PTSD. Likewise, Kuyken and Brewin’s (1994) sample was comprised exclusively of women with a history of sexual and/or physical abuse, which themselves, are highly traumatic events and which put these women at a high risk of having PTSD. As neither Kuyken and Brewin (1994) nor Brewin, Hunter and colleagues (1996) appeared to directly assess participants for PTSD at the time of their studies it is possible that sub-clinical or undiagnosed PTSD may have confounded the results.

More recent studies have attempted to address these methodological concerns. For example, Newby and Moulds (2011) compared the IM experiences of currently depressed, recovered depressed and never depressed university students who were also
screened for posttraumatic stress symptoms. The Memory Experiences Questionnaire (Sutin & Robins, 2007) and Intrusive Memory Interview (Hackmann et al., 2004) were used to assess participants' subjective experiences of IMs which had occurred the week prior to the interview. Newby and Moulds (2011) found that the majority of (96%, n = 24, of currently depressed, 80%, n = 24, of recovered depressed and 73.3%, n = 22, of never depressed) participants had experienced a negative IM, with 70% of the total sample reporting an IM of an interpersonal event. The groups did not differ on the primary modality (visual images, thought or visual images and other elements) of the IMs and for all groups most of the IMs were described as having a sensory, mainly visual, quality. Higher ratings of IM vividness and distress were obtained for the depressed compared to the never-depressed group, although the recovered and depressed groups did not differ, while currently depressed participants reported greater interference with daily activities than recovered depressed. Notably, no between-group differences were found on ratings of IM-related nowness, autonoetic awareness, lack of context, observer perspective or uncontrollability. In terms of intrusion-related emotions, the depressed group endorsed more sadness and helplessness than the recovered group but no other differences were detected. Furthermore, no overall group differences were found for MEQ ratings of vividness, coherence, accessibility, sensory details, visual or time perspective. Finally, groups did not differ on levels of intrusion as measured by the IES-R although levels of avoidance were higher for the depressed than never-depressed group.

Newby and Moulds (2011) conclude that while between-group differences were found for IM-related sadness and helplessness, distress, interference and vividness, “the
phenomenological experience of the intrusive memories was strikingly similar across groups” (p. 240). Furthermore, the lack of difference on ratings of sensory qualities, autonoetic awareness, nowness and lack of context imply “basic qualities of intrusive memories” (Newby & Moulds, 2011, p. 240) for these groups, rather than specific features of the IMs found in depression.

**Overlapping Features of Intrusive Memories in PTSD and Depression**

Attempts have also been made to directly compare IM phenomena in PTSD and depression. However, these studies also exhibit similar methodological limitations and appear to base their claims of overlap on the quantity of similar, predominantly self-report findings, rather than focussing on selected theory-driven qualities associated with persistent PTSD.

In one of the first comparative studies, Reynolds and Brewin (1998) recruited a clinical sample of depressed participants without PTSD, participants with PTSD with or without comorbid depression and a sample of non-clinical controls to explore differences in intrusive cognitions, coping strategies and emotional responses. Although the groups did not differ on the intrusion and avoidance subscales of the IES-R the PTSD group returned significantly higher ratings of frequency, intrusiveness and unacceptability of their most prominent IM compared with the depressed group. Furthermore, while the clinical groups diverged from the control groups on most domains there were no differences between depressed and PTSD groups in terms of coping strategies (suppression and distraction) or on self-ratings of emotional responses (anxiety, depression, distress and guilt) to intrusions. However, Reynolds and Brewin (1998) also reported that at the time of the research interview the most prominent or
frequent intrusive cognition for the PTSD group was more likely to be a personal memory, such as an image of an event from a particular time and place, compared to an evaluative cognition, defined as “cognitions concerning blame or responsibility, or concerning the impact of the event and its consequences for the future” (p. 141) for the depressed group. This is in line with the predictions of Ehlers and Clark (2000) and Brewin and colleagues (1996; 2010) that IMs in PTSD consist of strong sensory-perceptual representations due to threat-induced alterations in peritraumatic processing and encoding, which may not be the case for depression.

In a subsequent study which focussed on intrusive images only, Reynolds and Brewin (1999) recruited treatment-seeking participants with 1) depression and 2) PTSD or comorbid PTSD and depression. Using a semi-structured interview, Reynolds and Brewin (1999) obtained qualitative and quantitative data on negative intrusive images (defined as visual images of a specific scene that had actually taken place) which had occurred in the past week. Participants reported on the emotions, length, frequency, vividness, distress, physical sensations, degree of reliving and “out-of-body” experiences associated with the memories. Intrusive images were found to be more common among PTSD patients, with approximately 98% \( (n = 42) \) reporting an IM in the past week compared with 73% \( (n = 45) \) of depressed patients. In addition, the frequency, amount of intrusion and out-of-body experiences associated with the most prominent IM was greater for the PTSD compared with the depressed group. The PTSD group also mentioned helplessness more often than the depressed group but were otherwise similar on emotional content of IMs. Finally, no differences were found for ratings of vividness, length of IMs, distress, reliving or physical sensations, leading
Reynolds and Brewin (1999) to conclude that “the presence of intrusive memories does not distinguish PTSD from major depression as clearly as might be inferred from diagnostic checklists” (p. 212).

As other researchers have noted however (Patel et al., 2007), the measures used in Reynolds and Brewin’s (1999) study may have been insufficiently sensitive to detect potential differences in the qualitative and quantitative features of the IMs across groups. To address this, Patel and colleagues (2007) conducted an interview-based study of 39 depressed patients. Participants were asked to report on the experiential qualities of spontaneous autobiographical memories of past events that repeatedly came to mind over the past week using 100-point rating scales. In line with past studies, Patel and colleagues (2007) found that almost half (44%, n = 17) of their sample of depressed patients reported IMs. Sadness and anger were the two main IM-related emotions and levels of vividness were lower compared with other ordinary autobiographical memories, while ratings of nowness, interference in daily life and uncontrollability associated with the intrusions fell in the “moderate range”. Based on their findings, Patel and colleagues (2007) claim a high degree of overlap in the IMs in depression and PTSD. However, the lack of a control or comparative PTSD group renders these findings descriptive at best.

Other studies have used theoretical models of IMs in PTSD to guide their research. Recruiting a sample of 250 undergraduate psychology students, Williams and Moulds (2007b) used a diary method and the Intrusive Memory Interview adapted from previous research (Hackmann et al., 2004) to examine the frequency, content, distress, sensory modalities, emotional response and sense of nowness associated with intrusive
memory images in depression. Williams and Moulds (2007b) found that IMs in depression involved mainly visual, emotive and auditory elements and to a lesser extent, kinetic and olfactory memories, and the degree of IM-related nowness predicted severity of self-reported distress and depression. While the predictive quality of IM related nowness and depression severity is interesting, as with Patel and colleagues (2007) and other studies, the lack of a PTSD group weakens the conclusions that can be made regarding the transdiagnostic overlap in PTSD and depression intrusions.

A more complete understanding of intrusive phenomena in depression may be achieved by clarifying the differences between IM phenomena across as well as within the disorders. For example, a depressed cohort with a history of trauma may experience IMs that are qualitatively more similar to IMs in PTSD than a depressed cohort without a history of trauma. A recent study investigated IM differences between depressed cohorts by focusing on the qualities, triggers of and responses to, intrusive images across three groups; patients with PTSD, and depressed patients with and without trauma (Birrer et al., 2007). The authors found that “consistent with the literature, the intrusive images of PTSD patients had a more ‘here-and-now-quality’ and were perceived more visually compared to those of both depressed groups” (Birrer et al., 2007, p. 2053). Although self-report ratings revealed a high degree of similarity in the qualities of intrusive images across the groups, the heightened sense of nowness and sensory quality of the PTSD IMs is consistent with theoretical models of PTSD and could reflect between-group discrepancies in event processing and memory encoding which should not be overlooked.
Finally, in one of the more convincing studies of IM differences in PTSD and depression to date, Bryant and colleagues (2011) compared IM experiences in a range of post-trauma psychological disorders (including major depressive disorder, panic disorder, agoraphobia, specific phobia, social phobia, generalised anxiety disorder, substance-use disorder) and PTSD. While all groups reported some form of re-experiencing (including IMs, nightmares or distress in response to reminders of the event), flashback experiences were unique to the PTSD group. During IMs other than flashbacks, some sense of present moment awareness is maintained whereas during dissociative flashbacks, the individual becomes “immersed” in the trauma memory and temporal context is lost (Bryant et al., 2011). This is consistent with cognitive models and clinical observations which suggest that full-blown dissociative states are unique to PTSD and may give rise to PTSD-specific memory deficits (Brewin et al., 2010; Ehlers & Clark, 2000; van der Kolk & Fisler, 1995).

In summary, emergent findings suggest that IMs are a cognitive feature of both PTSD and depression which exhibit some degree of subjective overlap but diverge on other key features. Despite this, many theorists have been quick to emphasise the similarities in IM phenomena across PTSD and depression, whilst neglecting to provide a satisfactory account of the differences that persist. Such disparities include intrusion-related feelings of helplessness, nowness, out-of-body experiences, lack of context, sensory details and physical sensations, all of which appear to be more intense in PTSD and are predicted by dominant theoretical models of the disorder. Notably, these qualities correspond with flashback-type experiences; a form of IM which may be unique to PTSD. In DRT parlance, flashbacks represent an extreme form of SAM/S-rep.
encoding coupled with minimal contextual processing which occurs under conditions of extreme threat and arousal. As past studies have neglected to consider, a more meaningful comparative analysis of IMs in PTSD and depression may therefore be derived from focussing on these particular theory-driven IM qualities, rather than considering the overall number of common intrusive features.

In addition, much of the comparative research to date has been limited by a heavy reliance on retrospective self-report measures, thereby increasing monomethod bias, as well as potential confounds such as comorbid PTSD or a lack of control or comparative PTSD groups. Self-report measures are limited in that they may be subject to a range of reporting biases (see Spector, 1994, for a review) and as Brewin and colleagues (2010) have noted, the self-report measures which have typically been used in IM research have not been suitably validated. Furthermore, theorists have argued that a comprehensive understanding of emotion requires consideration of behavioural and physiological changes, as well as self-report data and “assessments that leave out one or more of these three models of emotional expression can be highly misleading” (Orr & Roth, 2000, p. 226). Although studies of IMs in PTSD have attempted some degree of method diversification in recognition of this issue, research into the qualitative nature of IMs in depression remains in its infancy. Clearly, more research is required to address these methodological concerns and to strengthen the existing evidence and understanding of IM phenomena across PTSD and depression.

As reviewed above, cognitive models which explain IMs in depression have yet to be developed. While this dissertation does not seek to test any theoretical models directly, it does attempt to strengthen understanding of some of the basic similarities
and differences between the experiential features of intrusions in depression and PTSD, and to consider the findings in light of such models. For instance, certain differences in the subjective experience of IMs are consistent with the view that IM phenomena in PTSD are the product of a sensory rather than a verbal/contextual memory system, the latter of which may be more implicated in depression. If so, this may have clinical implications considering that exposure therapy, a gold-standard therapeutic technique for treating PTSD (Rauch, Eftekhari, & Ruzek, 2012; Rothbaum, Meadows, Resick, & Foy, 2000) has been recently trialled for depression based on self-report studies which claim “few qualitative differences” between IM experiences in PTSD and depression (Kandris & Moulds, 2008). While such studies propose that imaginal exposure may be useful in treating cases of depression with a triggering event, caution is warranted over its use at this stage as little is known about the clinical considerations, including possible contraindications, for this technique across the variety of depressive presentations. Furthermore, imaginal exposure has been criticised by some researchers for only reducing fear whilst other negative emotions and cognitions (e.g. feelings of guilt, shame or disrupted self-image) remain unaddressed (Arntz, Tiesema, & Kindt, 2007). Such concerns are particularly relevant when considering the appropriateness of imaginal exposure for the treatment of depression, for which affective states other than fear, are likely to dominate. In addition, high levels of depression among PTSD patients have been found to interfere with effective engagement in exposure therapy (Scott and Stradling, 1997 cited in Reynolds and Brewin, 1999), reinforcing the need for further research prior to the application of such treatments for depression.
Aims and Hypotheses

To the best of our knowledge, this is the first study to triangulate self-report, narrative and physiological approaches in a comparative investigation of IMs in depression and PTSD. In so doing, this research aims to contribute to a more complete and coherent understanding of IM phenomena and its role in psychopathology and may guide future research on potential exposure-based treatments for depression.

In light of the literature to date, the hypotheses for Study 1 are, firstly, that the IMs in all groups will be accompanied by a range of emotional experiences. However, the IMs in PTSD are expected to be more sensory (particularly visual) and possibly more vivid in nature, and will be associated with a greater sense of nowness, distress and physical sensations than the IMs of the other groups, consistent with enhanced sensory-perceptual processing during the memory encoding phase. Secondly, the narrative data are expected to complement the self-report findings such that the intrusive segments of the PTSD narratives will contain more sensory and primary emotion content (that is, references to fear and helplessness) and switches to present tense, and reduced temporal context as indexed by fewer temporal markers, compared to the ordinary memory segments and the intrusive segments of the other groups. A similar pattern is also expected for within-group comparisons of the intrusive versus ordinary memory segments of the PTSD narratives. Namely, the IM segments are expected to contain significantly more sensory and primary emotion content, more switches to present tense and reduced temporal markers, than the corresponding non-intrusive, or ordinary, memory segments. Finally, an exploratory analysis will be conducted to examine whether depressed group memories contain more self-devaluative
statements, consistent with the involvement of negative schema and maladaptive thinking styles in triggering event remembering and distress.

With regards to Study 2, it is hypothesised that changes in physiological reactivity to script-driven imagery will be significantly greater for PTSD trauma narratives than depressed or control group “trigger/target” narratives, consistent with a more intense “reliving” of the original fear and arousal and the involvement of more sensory-perceptual processes in the encoding of PTSD memories. Due to a lack of prior research, psychophysiological responding to script types within groups will be examined in an exploratory fashion while follow-up self-report ratings of the IMs experienced during the script-driven imagery task are expected to mirror the results of Study 1. The findings of the current research will then be reviewed in conjunction with the literature to consider whether potential discrepancies in the IM features of PTSD and depression may reflect important differences in the underlying information processing and/or encoding processes responsible for the intrusive experiences across the two disorders.
CHAPTER 3: STUDY 1

Method

Participants

Participants ($N = 90$) were recruited from community, clinical and university populations by way of posters, a media release, advertisement in local newspapers, community magazines and web notices. Participants received course credit or $AUD10 for their time. Due to the nature of the study, only native English speakers were recruited to control for language-based differences of expression. Other exclusion criteria included a psychotic episode or administration of electroconvulsive therapy (ECT) in the previous six months, a history of mania, current drug or alcohol problems, organic brain disease or heart condition, cognitive impairment or comorbid obsessive compulsive disorder (OCD). Group membership was determined via responses on the Center for Epidemiologic Studies Depression Scale, (CES-D), Posttraumatic Stress Disorder Scale (PDS) and administration of the Major Depressive Episode (MDE) section of the Structured Clinical Interview for DSM-IV-TR for Axis I Disorders (SCID-I). Participants who scored above a cut-off score of 16 on the CES-D and were experiencing a current MDE as determined by the SCID-I were included in the depressed group. Participants were included in the PTSD group if responses on the PDS suggested criteria were met for a PTSD diagnosis. Participants were included in the control group if they did not meet criteria for an MDE based on the SCID-I interview or PTSD criteria based on the PDS. Note that participants who endorsed a history of traumatic events on the PDS were retained in the depressed and control
groups, provided symptoms did not suggest current comorbid PTSD. Similarly, to ensure sufficient eligibility and a more representative sample, PTSD participants with comorbid depression were retained in the PTSD group in line with past research (Reynolds & Brewin, 1998, 1999).

Several unsuitable participants were excluded from the study; two participants were removed because they endorsed exclusion criteria (organic brain disease/heart condition, comorbid OCD, history of mania, current alcohol and drug problems and diagnosed cognitive impairment). One participant was removed for unreliable data due to non-adherence with narrative instructions, reported concentration difficulties and inability to complete the questionnaires. This resulted in a final sample of 87 participants; with 30 in the control, 29 in the depressed and 28 in the PTSD groups. The study was approved by the Australian National University's (ANU) Human Research Ethics Committee (see Appendix A for notification of ethics approval).

Measures

Self-report measures were administered for screening purposes and to identify levels of emotional distress, posttraumatic stress symptoms, peritraumatic dissociative experiences, intrusive, avoidance and hyperarousal symptoms and memory characteristics. Narrative measures were applied to investigate between and within-group differences in ordinary and intrusive memory content.

Center for Epidemiologic Studies Depression Scale, (CES-D). The CES-D (Radloff, 1977) is a 20-item self-report measure, widely used for depression screening purposes (Santor & Coyne, 1997). Respondents are asked to read each statement and to indicate on a 4-point scale, (from 1 = Rarely or none of the time [<1 day] through to 4 =
Most or all of the time [5-7 days]) which item best reflects how they have felt or behaved over the last week. Higher scores are indicative of greater emotional distress. A cut-off score of 16 was taken to indicate possible clinically-significant symptoms (Boyd, Weissman, Thompson, & Myers, 1982). The CES-D has good internal consistency (cronbach’s alpha = .84) for general populations (Corcoran & Fisher, 1987, cited in Santor & Coyne, 1997) and correlates strongly ($r = .86$) with the Beck Depression Inventory (Santor, Zuroff, Ramsay, Cervantes, & Palacios, 1995).

**Structured Clinical Interview for DSM-IV-TR for Axis I Disorders (SCID-I).** The SCID-I (First, Gibbon, Spitzer, & Williams, 2007) is a widely-used, empirically-sound research and clinical tool (Segal, Hersen & Van Hasselt, 1994, cited in First, Gibbon, Spitzer, & Williams, November 2002 Revision; Zanarini & Frankenburg, 2001). The MDE section of the SCID-I was used to follow-up high CES-D scores and was administered by a suitably trained doctoral-level psychologist (L.P.). Due to resource and time constraints, inter-rater reliability estimates were not obtained in this study. Difficult differential diagnoses, however, were discussed with a supervising senior clinical psychologist (R.O’K.). Past studies have used the SCID-I for similar participant identification purposes (e.g. Patel et al., 2007; Williams & Moulds, 2007b, 2007c).

**Posttraumatic Stress Disorder Scale (PDS).** The PDS (Foa, Cashman, Jaycox, & Perry, 1997) is a 49-item self-report measure of posttraumatic stress which yields a possible Posttraumatic Stress Disorder (PTSD) diagnosis based on DSM-IV-TR criteria (American Psychiatric Association, 2000) as well as a measure of symptom severity
Severity scores are calculated by summing the 17 symptom items, producing a score from 0 (no rating) to 51 (severe).

The PDS possesses sound psychometric properties, including high diagnostic agreement with the Structured Clinical Interview for the DSM-IV and good sensitivity and specificity (Foa et al., 1997). The PDS has high test-retest reliability and internal consistency scores of .92 for Total Symptom Severity, and .78, .84 and .84 for the Re-experiencing, Avoidance and Arousal domains respectively (Foa et al., 1997).

**Intrusive Memory Questionnaire (IMQ).** The IMQ (provided at Appendix B) was adapted from the Intrusive Memory Interview used in previous studies (Hackmann et al., 2004; Newby & Moulds, 2011; Patel et al., 2007; Williams & Moulds, 2007b). Unlike previous studies which have typically enquired about general/overall IM experiences retrospectively, the IMQ in the current study asked participants to report on the only or, if they experienced more than one, the most distressing ("primary") IM experienced during the narrative task.

Prior to completing the IMQ, IMs were defined verbally for participants in the following way: “Intrusive or flashback memories are a type of memory that you experience as markedly different from those memories of the event that you can retrieve at will. The difference might be a marked sense of a reliving of the negative experience. Some report complete reliving, whereas others report more momentary or partial reliving of perhaps just one aspect of the original experience. For some, intrusive memories take them by surprise or swamp their mind. Finally some report a sense of time-distortion and, for example, react to the memory as thought it was an event that was happening in the present (adapted from Hellawell & Brewin, 2002). For
example, sometimes we deliberately remember things that have happened to us. So, if I asked you what you had for dinner last night, you would try to recall what you ate; we will call these deliberate memories. Sometimes we remember things without trying to – memories just pop into our mind spontaneously or when we do not want them to. For example, if you are studying, and you are really hungry, an image of what you had for dinner last night might pop into your mind. Or for example, if you had an argument with a friend a while ago and you recalled memories about this argument (recalling what occurred, remembering what was said etc) when you were not deliberately thinking about the argument; we call these sorts of memories spontaneous or intrusive memories. Memories are therefore different to general thoughts or worries about things (adapted from IMI instructions used in Williams & Moulds, 2007b).

IMQ items were designed to provide an index of the subjective experience of the nature and quality of the intrusive memories. Information regarding the intrusion frequency, content, level and nature of associated distress, sensory modalities, sense ofnowness and emotional responses (sadness, guilt, shame, anger, fear, helplessness), associated daily impairment and time since event, was collected. Following previous studies, participants responded on likert scales or ratings anchored on a 0 (not at all) to 100 (very much) scale (Patel et al., 2007; Williams & Moulds, 2007b).

Peritraumatic Dissociative Experiences Questionnaire (PDEQ). The PDEQ is a 10-item self-report measure designed to assess dissociative experiences at the time of a specific traumatic event. PDEQ scores are associated with measures of traumatic stress, general dissociative tendencies and level of stress exposure, but not with measures of general psychopathology (see Marmar, Weiss, & Metzler, 1997 for a
review). Respondents indicate how they felt during and immediately after their index event by circling a response on a 5-point scale from not at all true through to extremely true (Marmar et al., 1997). The PDEQ score represents the mean score across all 10 items, with scores ranging from 0 to 5. Marmar and colleagues (1996) suggests that PDEQ scores of 1.5 or above may reflect clinically-meaningful peritraumatic dissociation. The PDEQ is considered to have good internal consistency (Cronbach’s alpha .80, Tampke & Irwin, 1999) and good convergent and discriminative validity (Marmar et al., 1997; Shalev et al., 1996).

Impact of Event Scale-Revised (IES-R). The IES-R is a widely used 22-item self-report measure designed to assess responses to traumatic events in the domains of hyperarousal, intrusion and avoidance (Creamer, Bell, & Failla, 2003; Weiss & Marmar, 1997). Respondents are presented with a list of difficulties “people sometimes have after stressful life events” and are asked to rate how distressed or bothered they were by each difficulty over the past seven days. Domain scores range from 0 to 4, and are produced by calculating the mean item response for the relevant subscale. Analyses of the basic psychometric properties of the IES-R have returned high internal consistency values for the subscales including Intrusion alpha from .79 to .91, Avoidance alpha from .84 to .86 and Hyperarousal alpha from .79 to .90 (Weiss & Marmar, 1997). Test-retest coefficients range from .57 to .94 (Intrusion), .51 to .89 (Avoidance), and .59 to .92 (Hyperarousal), with higher values likely due to shorter intervals between testing and/or where the index event had occurred more recently (Weiss & Marmar, 1997).
Narrative measures. Participants were asked to write about past negative life events (see Procedure section for more details), thereby creating narrative scripts which were subsequently coded and analysed on a range of domains. Based on previously established methods (Hellawell & Brewin, 2004), flashback and intrusive versus ordinary memory sections for the target narratives were identified and the length of each intrusive/ordinary narrative segment expressed as the total number of words written during each type of memory. It should be noted that Hellawell and Brewin’s (2004) study targeted flashbacks as a distinct form of intrusive remembering, while the current study involved a more inclusive investigation of IM phenomena (i.e. flashbacks as well as other forms of intrusive remembering) generally.

Adapting Hellawell and Brewin’s (2004) coding method, IM sections were scored on the domains listed below. Hesitations and dysfluencies were excluded from the word count and scores were converted into a percentage of total words written during the IM section in order to control for differences in narrative length. A similar procedure was applied for the ordinary recall sections. Due to resource constraints, inter-rater reliabilities were not obtained for this study.

1. Sensory content. Scores were based on total sensory words. This included references to, or qualifications of, one of the five senses: Visual, Auditory, Olfactory, Taste and Proprioceptive words (Hellawell & Brewin, 2004).

2. Emotion content. Emotion content was calculated by the total number of words that referred to or qualified emotions. Following Hellawell and Brewin (2004), emotion words were divided into two categories: Primary emotions, which included fear, helplessness, horror, and secondary emotions which included
anger, guilt, fear for the future, sadness and other non-primary negative emotions.

3. Temporal markers. Scores were based on the total number of words that provided temporal context and cohesiveness, including words such as “then”, “after”, “before”, “Monday”, “24 January 1997” (O'Kearney, Speyer, & Kenardy, 2007).

4. Switches to present tense. Scores were based on the total number of present tense verbs except when participants: (i) described a timeless procedure in the present tense; (ii) offered a general explanation or narrator comment; (iii) reported a fact; or (iv) used a present tense verb within a verbatim quote (Hellawell & Brewin, 2004).

5. Self-devaluative statements. Self-devaluative statements were investigated because they have been identified as possible maintaining cognitive processes in depression (Kleim, Ehlers, & Glucksman, 2012, January 23; Teasdale & Cox, 2001). Scores were based on the number of self-devaluations in each narrative section. Self-devaluative statements in this study were taken as references to 14 adjectives identified by Teasdale and Cox (2001) which are related to negative mood “but also imply a globally negative view of self” (p. 1313), namely, abandoned, a failure, inadequate, incompetent, a loser, a mess, pathetic, rejected, stupid, unacceptable, unlovable, unwanted, useless, and worthless. In addition, statements that made direct reference to a negative view of self (e.g. “I [hate] you”, directed at self) were coded. Examples of self-devaluative
statements coded in this study included “I realised just how [worthless] I am”, “I was [stupid] and [pathetic]”.

**Procedure**

**Screening phase.** After obtaining informed consent (see Appendices C and D for Information Sheet and Statement of Informed Consent for Screening Phase and Study 1), an initial online or pen and paper screening phase was used to collect demographic information including age, gender, number of years of education, recent depressive (CES-D) and posttraumatic stress symptoms (PDS) and to assess for exclusion criteria. Suitable participants were invited back to complete Study 1.

**Narrative task and measures.** Participants’ written informed consent was obtained after which the MDE section of the SCID-I was administered, followed by the narrative task. Participants were asked to identify and write a detailed narrative of two (Target and Other) discrete (i.e. lasting several minutes to several hours rather than spanning days/weeks/months) negative life events. Target events were defined as a major negative life event for the control group, a trigger event associated with the onset of depressive symptoms for the depressed group, and for the PTSD group, the main trauma event reported in the PDS. Participants were also asked to identify another negative event which occurred “around the same time as, but was not linked with” their target events. The narrative of the Other event was used for Study 2. Based on the procedure of Hellawell and Brewin (2004), participants were asked to write about these events in as much detail as possible, including the lead up to the events, what happened, what they saw, felt and thought as well as any bodily sensations they had experienced. Participants were given 15 minutes to write per narrative and the order in which they
wrote about the Target or Other event was randomised but counterbalanced across the
groups. Upon conclusion of each narrative, participants rated the level of distress
associated with the event memory (from 0, not at all, to 100, severely distressing) and
the degree of clarity or vividness of the event memory (from 0, hazy, to 100, most clear
and vivid memory). Participants then completed the IMQ about their target event. If
participants had experienced any IMs of the target event during the narrative task they
were instructed to highlight the sections which had been written during the IMs. If
participants had more than one IM they were also asked to circle the segment which
corresponded with their most distressing IM. In this way, intrusive and ordinary
memory segments of the narrative were identified for coding and analyses (Hellawell &
Brewin, 2004). Following completion of Study 1 participants were debriefed and
compensated for their time (see Appendix E for Debrief Sheet).

Data Analysis

One-way between groups analysis of variance (ANOVAs) were conducted to
examine demographic and self-report data across groups. Planned or post-hoc analyses
were conducted according to hypotheses and where assumptions of homogeneity of
variance were not met, results were confirmed using robust Welch’s F tests. Due to
differences in sample sizes across groups, post-hoc comparisons were conducted using
Tukey-Kramer tests or, in the case of unequal population variances estimates, the
Games-Howell procedure (Field, 2009). To examine categorical data across groups,
Chi-square tests were used and calculated with exact methods if assumptions were not
met (Field, 2009). Following Hellawell and Brewin (2004), where between-group
narrative data violated assumptions of normality, Kruskal-Wallis non-parametric
analysis of variance of ranks was used followed by Mann-Whitney $U$-tests with exact tests for paired comparisons (Field, 2009). Finally, analyses of within-group narrative type differences were conducted using Wilcoxon sign-ranked exact tests. Data were analysed using SPSS version 18.0 (SPSS Inc., 2009).

Results

Demographic and General Clinical Characteristics of the Total Sample

Table 3.1 presents the demographic and clinical characteristics of participants broken down by group. Eighty-seven participants (50 female; 57.5%) with a mean age of 35.67 years ($SD = 16.42$) took part in the study. There was no difference between groups on gender, age, years of education or time since the nominated target event. Games-Howell post-hoc tests confirmed significantly higher CES-D and PDS scores among the depressed (mean difference = 19.35 s; 95% CI = 12.89, 25.81; $p = .00$; mean difference = 15.44 s; 95% CI = 8.67, 22.20; $p = .00$) and PTSD (mean difference = 17.55 s; 95% CI = 11.29, 23.81; $p = .00$; mean difference = 22.28s; 95% CI = 16.01, 28.54; $p = .00$) groups compared with controls. No differences were detected between the PTSD and depressed groups on either of these measures ($p > .05$), although it should be noted that 46% ($n = 13$) of PTSD group participants also met criteria for comorbid depression based on the MDE section of the SCID. Clinical groups were also examined for current use of psychotropic medication. Among the depressed group, 11 (38%) participants were taking medication at the time of the study compared to six (21%)
participants in the PTSD group. Chi-square tests revealed no association between groups and current use of medication $\chi^2(1) = 1.85, p = .17$. 
Table 3.1

Demographic and Clinical Characteristics across Groups

<table>
<thead>
<tr>
<th></th>
<th>Control (n = 30)</th>
<th>Depressed (n = 29)</th>
<th>PTSD (n = 28)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (n, % female)</td>
<td>17 (57%)</td>
<td>18 (62%)</td>
<td>15 (54%)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>36 (15.97)</td>
<td>38 (17.43)</td>
<td>33 (15.90)</td>
</tr>
<tr>
<td>Education (years)</td>
<td>15.98 (3.45)</td>
<td>16.86 (9.44)</td>
<td>14.15 (2.40)</td>
</tr>
<tr>
<td>Time since target event (days)</td>
<td>4099 (4263.86)</td>
<td>2519 (2689.16)</td>
<td>4556 (5297.63)</td>
</tr>
<tr>
<td>CES-D</td>
<td>10.17 (7.64)</td>
<td>29.52 (12.25)</td>
<td>27.71 (11.53)</td>
</tr>
<tr>
<td>PDS</td>
<td>6.05 (5.64)</td>
<td>21.48 (12.97)</td>
<td>28.32 (12.04)</td>
</tr>
</tbody>
</table>

Note. CES-D = Center for Epidemiologic Studies Depression Scale, PDS = Post-traumatic Diagnostic Scale. Except where noted, values refer to mean and (standard deviation) scores.
Self-Reported Characteristics of Event Remembering and Recent Intrusive Memory Experiences

Table 3.2 provides details of the frequency of the Target event type for each group as well as the mean (standard deviation) of the rating of overall memory quality (clarity/vividness and distress), presence of Target IMs in the past week and general level of IM interference with daily living.

Deaths, illnesses and injuries of others were the most frequently endorsed target event type for the control group, while more than half of the depressed sample nominated negative interpersonal events and relationship breakdowns, and for the PTSD group, instances of assault or abuse involving the self were most common. Across the groups, nine participants described “other” target events which included moving to a new school (n = 1), poor academic performance (n = 3), abortion (n = 1), home break-in (n = 1), negative world event (n = 1), financial loss (n = 1) and a terrorist attack (n = 1). Of the PTSD group, 11% (n = 3) were mild, 14% (n = 4) moderate, 50% (n = 14) moderate-severe, and 25% (n = 7) were severe cases according to PDS cut-off scores.

Games-Howell post-hoc tests confirmed significantly higher scores on IES-R total among the depressed (mean difference = 19.35 s; 95% CI = 12.89, 25.81; p = .000) and PTSD (mean difference = 17.55 s; 95% CI = 11.29, 23.81; p = .000) groups compared with controls. In addition, IES-R Intrusion, Avoidance and Hyperarousal subscale scores were significantly higher for the depressed groups compared with the controls (mean difference = 1.10 s; 95% CI = .48, 1.72; p = .000; mean difference = .93 s; 95% CI = .39, 1.47; p = .000; mean difference = 1.21 s; 95% CI = .55, 1.87; p = .000, respectively). The PTSD group also returned significantly higher scores on these measures than controls (mean difference = 1.59...
s; 95% CI = 1.03, 2.15; p = .000; mean difference = 1.55 s; 95% CI = .99, 2.12; p = .000; mean difference = 1.76 s; 95% CI = 1.15, 2.38; p = .000, respectively). The PTSD and depressed groups did not differ on any of these measures (p > .05).

In terms of peritraumatic dissociative experiences as indexed by the PDEQ, post-hoc Tukey-Kramer tests revealed no difference between the depressed and control groups (mean difference = .04 ns; 95% CI = -.55, .63; p = .99). However PTSD group scores on the PDEQ were significantly greater than both depressed (mean difference = .83 s; 95% CI = .22, 1.43; p = .004) and control groups (mean difference = .86 s; 95% CI = .27, 1.46; p = .002).

One-way ANOVAs revealed that the groups did not differ on self-reported clarity/vividness of the target event memory overall. However a significant main effect was detected for the level of distress associated with the Target memory. Tukey-Kramer post-hoc tests revealed that the clinical groups did not differ (mean difference = 1.78 ns; 95% CI = -9.64, 28.20; p = .93) while both depressed and PTSD groups reported greater distress compared with controls (mean difference = 15.10 s; 95% CI = 3.87, 26.32; p = .005; mean difference = 16.88 s; 95% CI = 5.55, 28.20; p = .002, respectively). In terms of general IM experiences, more PTSD participants experienced an IM of their Target event in the week prior to testing compared with depressed ($\chi^2(1, n = 57) = 5.62, p = .018$) and control ($\chi^2(1, n = 58) = 17.68, p = .000$) participants. Likewise, more depressed than control participants reported an IM of their Target event in the last week ($\chi^2(1, n = 59) = 4.00, p = .045$). Finally, Games-Howell post-hoc tests confirmed that both the depressed and PTSD groups reported significantly greater levels of interference with daily activities due to IMs of their Target events compared with controls (mean difference = 26.19 s; 95% CI = 10.66, 41.72; p = .001; mean difference = 44.86 s; 95% CI = 30.99, 58.72;
While greater levels of interference with daily activities due to IMs of their Target event were reported by PTSD compared with depressed participants, this difference did not reach significance (mean difference = 18.67 ns; 95% CI = -.66, 38.00; \( p = .061 \)).
Table 3.2

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control (n = 30)</th>
<th>Depressed (n = 29)</th>
<th>PTSD (n = 28)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target event type:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative interpersonal event</td>
<td>23% (n = 7)</td>
<td>52% (n = 15)</td>
<td>0%</td>
</tr>
<tr>
<td>Death/illness/injury involving other</td>
<td>47% (n = 14)</td>
<td>17% (n = 5)</td>
<td>25% (n = 7)</td>
</tr>
<tr>
<td>Illness/injury involving self</td>
<td>10% (n = 3)</td>
<td>7% (n = 2)</td>
<td>7% (n = 2)</td>
</tr>
<tr>
<td>Assault/abuse involving self</td>
<td>7% (n = 2)</td>
<td>3% (n = 1)</td>
<td>36% (n = 10)</td>
</tr>
<tr>
<td>Motor vehicle/other accident</td>
<td>0%</td>
<td>7% (n = 2)</td>
<td>14% (n = 4)</td>
</tr>
<tr>
<td>Natural disaster</td>
<td>0%</td>
<td>0%</td>
<td>4% (n = 1)</td>
</tr>
<tr>
<td>War/combat</td>
<td>0%</td>
<td>0%</td>
<td>7% (n = 2)</td>
</tr>
<tr>
<td>Torture</td>
<td>0%</td>
<td>0%</td>
<td>4% (n = 1)</td>
</tr>
<tr>
<td>Other</td>
<td>13% (n = 4)</td>
<td>14% (n = 4)</td>
<td>4% (n = 1)</td>
</tr>
<tr>
<td><strong>IES-R Total (target event)</strong></td>
<td>9.57 (11.14)</td>
<td>33.43 (24.14)</td>
<td>44.60 (19.74)</td>
</tr>
<tr>
<td>Intrusion</td>
<td>.52 (.62)</td>
<td>1.62 (1.20)</td>
<td>2.11 (1.05)</td>
</tr>
<tr>
<td>Avoidance</td>
<td>.48 (.64)</td>
<td>1.41 (1.02)</td>
<td>2.03 (1.05)</td>
</tr>
<tr>
<td>Hyperarousal</td>
<td>.27 (.42)</td>
<td>1.48 (1.39)</td>
<td>2.03 (1.23)</td>
</tr>
<tr>
<td>PDEQ (target event)</td>
<td>2.47 (.95)</td>
<td>2.50 (.97)</td>
<td>3.33 (.93)</td>
</tr>
<tr>
<td><strong>Overall clarity/vividness of event memory</strong></td>
<td>79.67 (18.10)</td>
<td>79.93 (22.93)</td>
<td>80.46 (25.40)</td>
</tr>
<tr>
<td>(mean rating 0-100)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Overall distress rating for event memory</strong></td>
<td>67.77 (23.52)</td>
<td>82.86 (12.62)</td>
<td>84.64 (15.98)</td>
</tr>
<tr>
<td>(mean rating 0-100)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>IM of target event in past week (yes)</strong></td>
<td>23% (n = 7)</td>
<td>48% (n = 14)</td>
<td>79% (n = 22)</td>
</tr>
<tr>
<td><strong>Degree of IM interference with daily activities (mean rating 0-100)</strong></td>
<td>5.47 (10.85)</td>
<td>31.66 (32.42)</td>
<td>50.32 (28.07)</td>
</tr>
</tbody>
</table>

Note. IES-R = Impact of Event Scale-Revised, PDEQ = Peritraumatic Dissociative Experiences Questionnaire. Except where noted, values refer to mean and (standard deviation) scores.
Summary of findings. In summary, significant group differences were found for the overall memory and recent IM experiences of the Target events across groups. Namely, clinical groups endorsed higher rates of Target-memory related distress than controls. In addition, more PTSD than depressed and more depressed than controls reported IMs of their Target events in the week prior to testing. Finally, IMs of the Target event were rated as causing significantly more interference with daily activities for the clinical groups than the controls, while a non-significant trend was noted for higher interference ratings among the PTSD compared to depressed group.

Demographic and General Clinical Characteristics for Participants Who Reported an Intrusive Memory during the Writing Task

All subsequent analyses involve only those participants (80%, n = 70 of the total sample) who reported an IM of their Target event during the narrative memory (writing) task. Table 3.3 presents the demographic and clinical characteristics for these participants, broken down by group. As with the total sample, the groups did not differ in terms of gender, age, years of education or time since the Target event. Games-Howell post-hoc tests confirmed significantly higher CES-D and PDS scores among the depressed (mean difference = 16.91 s; 95% CI = 9.09, 24.72; p = .00; mean difference = 13.85 s; 95% CI = 5.83, 21.86; p = .00) and PTSD groups (mean difference = 14.92 s; 95% CI = 8.34, 21.51; p = .00; mean difference = 20.26 s; 95% CI = 13.84, 26.68; p = .00) compared with controls. No differences were detected between the PTSD and depressed groups on either of these measures (p > .05).
Table 3.3

Demographic and Clinical Characteristics for Participants Reporting an Intrusive Memory across Groups

<table>
<thead>
<tr>
<th></th>
<th>Control $(n = 19)$</th>
<th>Depressed $(n = 23)$</th>
<th>PTSD $(n = 28)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender $(n, %$ female)</td>
<td>10 (53%)</td>
<td>15 (65%)</td>
<td>15 (54%)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>34.21 (15.94)</td>
<td>34.74 (16.49)</td>
<td>32.61 (15.90)</td>
</tr>
<tr>
<td>Education (years)</td>
<td>15.74 (2.98)</td>
<td>17.78 (10.15)</td>
<td>14.15 (2.40)</td>
</tr>
<tr>
<td>Time since target event (days)</td>
<td>4646 (4797.96)</td>
<td>2301 (2530.95)</td>
<td>4556 (5297.63)</td>
</tr>
<tr>
<td>CES-D</td>
<td>12.79 (7.07)</td>
<td>29.70 (13.18)</td>
<td>27.71 (11.53)</td>
</tr>
<tr>
<td>PDS</td>
<td>8.06 (5.34)</td>
<td>21.91 (13.83)</td>
<td>28.32 (12.04)</td>
</tr>
</tbody>
</table>

Note. CES-D = Center for Epidemiologic Studies Depression Scale, PDS = Post-traumatic Diagnostic Scale. Except where noted, values refer to mean and (standard deviation) scores.
Self-Reported Characteristics of Intrusive Memories for Participants Who Experienced an Intrusive Memory during the Writing Task

Table 3.4 presents the self-reported characteristics of IMs that occurred during the narrative memory task. All 28 PTSD participants experienced an IM of their event compared with 79% ($n = 23$) of the depressed group and 63% ($n = 19$) of the control group. Of the participants who reported an IM, 89% ($n = 25$) of the PTSD group, 78% ($n = 18$) of the depressed group and 68% ($n = 13$) of the control group had more than one IM. Across groups, 94% ($n = 66$) of participants confirmed that the IMs which occurred during the narrative task were similar to IMs they had experienced previously. The pattern of Target event types across groups resembled that of the full sample with the most common event type being a death, illness or injury of others for the control group (36%, $n = 4$), a negative interpersonal event for the depressed group (43%, $n = 6$) and assault or abuse of the self and death, illness or injury of others being equally nominated for the PTSD group (32%, $n = 7$ in each category).

**Modality, duration and frequency of primary IM.** Participants were also asked to report on their primary IM and the principal modality (mainly a thought, mainly a feeling/emotion or mainly a sensory/perceptual experience) in which that memory was experienced. For most PTSD participants, their primary IM was experienced more as a sensory/perceptual memory, while emotions/feelings dominated for the control and depressed groups. Whilst these differences were in the expected direction, the results were non-significant perhaps because of the small samples involved. Participants were also asked to nominate how long their primary IM usually lasted. Due to small cell sizes, the categories of up to an hour and more were collapsed for analyses, however no significant differences were detected.
Finally, participants nominated how frequently they experienced their primary IM from the narrative task. Given a zero cell count for frequently occurring IMs within the control group, the categories occasionally and frequently were collapsed across groups for analyses. Fisher's exact tests revealed no significant difference between the clinical groups ($\chi^2(1, n = 51) = 1.64, p = .264$) nor between depressed and control groups ($\chi^2(1, n = 42) = 4.40, p = .075$) on this domain. The PTSD group did, however, report significantly greater IM frequency when directly compared with controls ($\chi^2(1, n = 47) = 10.41, p = .002$).
Table 3.4

General Characteristics of the Primary Intrusive Memory for Participants Reporting Intrusive Memories during the Writing Task (n in parentheses)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control (n = 19)</th>
<th>Depressed (n = 23)</th>
<th>PTSD (n = 28)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM whilst writing (yes)</td>
<td>63% (19)</td>
<td>79% (23)</td>
<td>100% (28)</td>
</tr>
<tr>
<td>If yes, IMs similar to spontaneous IMs (yes)</td>
<td>95% (18)</td>
<td>91% (21)</td>
<td>96% (27)</td>
</tr>
<tr>
<td>IM modality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thought</td>
<td>29% (5)</td>
<td>9% (2)</td>
<td>11% (3)</td>
</tr>
<tr>
<td>Feeling/emotion</td>
<td>41% (7)</td>
<td>44% (10)</td>
<td>25% (7)</td>
</tr>
<tr>
<td>Sensory/perceptual</td>
<td>29% (5)</td>
<td>48% (11)</td>
<td>64% (18)</td>
</tr>
<tr>
<td>Typical duration of primary IM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seconds</td>
<td>74% (14)</td>
<td>44% (10)</td>
<td>41% (11)</td>
</tr>
<tr>
<td>Minutes</td>
<td>21% (4)</td>
<td>39% (9)</td>
<td>41% (11)</td>
</tr>
<tr>
<td>Up to an hour or more</td>
<td>5% (1)</td>
<td>17% (4)</td>
<td>18% (5)</td>
</tr>
<tr>
<td>Frequency of primary IM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rarely</td>
<td>90% (17)</td>
<td>61% (14)</td>
<td>43% (12)</td>
</tr>
<tr>
<td>Occasionally</td>
<td>11% (2)</td>
<td>22% (5)</td>
<td>32% (9)</td>
</tr>
<tr>
<td>Frequently</td>
<td>0% (0)</td>
<td>17% (4)</td>
<td>25% (7)</td>
</tr>
</tbody>
</table>

Fisher's exact test
\[ \chi^2(2, N = 68) = 6.98, p = .13 \]

Fisher's exact test
\[ \chi^2(2, N = 69) = 5.51, p = .24 \]

Fisher's exact test
\[ \chi^2(2, N = 70) = 10.77, p = .004 \]
Following the narrative task participants were also asked to rate (on a scale of 0 to 100) their primary IM on a range of experiential domains. Figures 3.1 and 3.2 present the mean ratings (with standard error bars) of IM qualities across groups. Kolmogorov-Smirnov tests revealed non-normally distributed data for some of the variables, particularly amongst the depressed and PTSD groups. Log and square root transformations were attempted but did not improve normality for most variables. Due to the relatively small sample sizes, other transformations were considered unlikely to produce improved normality across most of the variables hence untransformed data were retained for analyses. Following previous studies, multiple one-way ANOVAs (e.g. Newby & Moulds, 2011) with Bonferroni-corrected planned contrasts were conducted to examine differences between 1) the control and depressed groups, and 2) the depressed and PTSD groups.

**Emotive quality of primary IM.** As displayed in Figure 3.1, no significant differences were found between control and depressed groups or depressed and PTSD groups on the emotional quality (self-ratings of anger, fear, guilt, helplessness, sadness and shame) of the primary IM \( (p > .005) \). However, non-significant trends included higher ratings of IM-related anger within the depressed \( (M = 45.22, SD = 35.44) \) compared to control groups \( (M = 21.39, SD = 31.89; t(66) = -2.26, p = .03) \) and higher ratings of IM-related sadness in the depressed \( (M = 60.79, SD = 31.46) \) compared with the PTSD group \( (M = 56.71, SD = 38.52; t(67) = 1.72, p = .09) \). Higher ratings of IM-related fear were also reported by the PTSD \( (M = 65.82, SD = 37.96) \) compared to the depressed group \( (M = 50.78, SD = 40.25; t(66) = -1.34, p = .19) \) however this difference did not reach significance.
Vividness, nowness, physical sensations and distress associated with primary IM. As displayed in Figure 3.2, no differences were detected on vividness ratings between the control \( (M = 77.89, SD = 24.51) \) and depressed \( (M = 86.30, SD = 17.20; t(67) = -1.44, p = .16) \) groups or between the depressed and PTSD groups \( (M = 89.46, SD = 15.48; t(67) = -.60, p = .55) \). Similarly, ratings of nowness did not differ between control \( (M = 33.47, SD = 33.92) \) and depressed \( (M = 39.26, SD = 35.24; t(67) = -.55, p = .58) \) or depressed and PTSD groups \( (M = 44.75, SD = 32.40; t(67) = -.58, p = .57) \). In terms of IM-related physical sensations, the control \( (M = 45.42, SD = 37.88) \) and depressed groups \( (M = 37.39, SD = 32.68; t(35.85) = .73, p = .47) \) did not differ however more physical sensations were reported by the PTSD \( (M = 71.32, SD = 21.81) \) compared with the depressed group \( (t(37) = -4.26, p < .000, 1\text{-tailed}) \). A similar pattern of results was detected for IM-related distress whereby the control \( (M = 46.47, SD = 29.70) \) and depressed \( (M = 50.65, SD = 29.44) \) groups did not differ \( (t(67) = -.51, p = .61) \), yet more distress was reported by the PTSD \( (M = 72.96, SD = 21.55) \) compared with the depressed group \( (t(67) = -2.98, p = .002, 1\text{-tailed}) \).
Figure 3.1. Emotions associated with primary intrusive memory experienced during the narrative task. Figure represents mean ratings (0-100) and error bars represent standard errors (SEM). No significant differences detected, $p > .005$.

Figure 3.2. Additional self-rated characteristics of primary intrusive memory experienced during the narrative task. Figure represents mean ratings (0-100) and error bars represent standard errors (SEM). * = PTSD > Depressed (1-tailed test).
Summary of self-report findings. For participants who experienced an IM during the narrative task, no significant group differences were found for the principal modality (mainly a thought, mainly a feeling/emotion or mainly a sensory/perceptual experience) in which the primary IM was experienced. Similarly, groups did not differ on the typical length of their primary IMs. However, the PTSD group reported that their primary IMs occurred with greater frequency compared to the control group, while no other group differences were detected. Planned comparisons of the control versus depressed, and depressed versus PTSD groups, revealed non-significant trends for higher ratings of IM-related anger within the depressed compared to control group and higher ratings of IM-related sadness in the depressed compared with the PTSD group. Higher ratings of IM-related fear were also reported by the PTSD compared to the depressed group but this difference did not reach significance, and the emotional quality of the primary IMs was otherwise similar across groups. Finally, the groups did not differ on ratings of IM-related vividness and nowness, however the PTSD group endorsed higher ratings of IM-related physical sensations and distress than the depressed group, while the depressed and control groups did not differ.

Measures of Memory Quality Coded from the Narrative Memories

During the Target narrative task participants in the control, depressed and PTSD groups wrote an average of 326 (SD = 99.88), 301 (SD = 103.83), and 383 (SD = 143.04) words respectively. They were asked to identify intrusive (IM) sections of their narrative memory by highlighting them. For those participants who experienced an IM while writing about their Target event, the mean number of words identified as IM was 76 (SD = 67.31), 50 (SD = 43.17) and 81 (SD = 67.69) for control, depressed and PTSD groups respectively. In the same order, the mean
number of words written during the other parts of the narrative memory (ordinary memory) was 264 (SD = 97.39), 276 (SD = 92.92), and 310 (SD = 126.44). IM segments comprised an average of 22.18% (SD = 18.84), 15.54% (SD = 12.51) and 20.56% (SD = 13.38) of total words of the Target narratives for the control, depressed and PTSD groups respectively. These differences were not significant (F(2, 65) = 1.19, p = .31). It should be noted that two participants (one control, one PTSD) failed to highlight their IM segments hence narrative data are reported for a sample size of n = 18 for the controls, n = 23 for depressed and n = 27 for PTSD groups.

**Between-group differences in narrative memory quality for intrusive memory sections.** For descriptive purposes, Figure 3.3 presents the mean percentage of IM narrative content (with standard error bars) across groups. It should be noted that nil or minimal switches to present tense occurred for any of the groups’ intrusive or ordinary memory segments. Also, given the low counts, olfactory and taste references were collapsed into a single category for analyses. Due to non-normal data, Kruskal-Wallis non-parametric analysis of variance of ranks were conducted which revealed overall group differences on the proportion of visual (H(2) = 16.09, p = .000) and total sensory words (H(2) = 19.99, p = .000) used in the IM segments, while a non-significant trend for proprioceptive words was noted (H(2) = 6.96, p = .031). Mann-Whitney U tests were conducted to follow-up these findings. A Bonferroni correction was applied so all effects are reported at a .005 level of significance. The intrusive segments of the PTSD narratives contained a higher proportion of sensory content overall (Mdn = 7.94, U = 120, p = .000, r = -.54, 1-tailed) compared with the depressed group (Mdn = .19). Examination of the specific sensory qualities of the memories revealed that the intrusive segments of
the PTSD narratives contained a higher proportion of visual references ($Mdn = 3.23$, $U = 145.5, p = .000, r = -0.53, 1$-tailed) than the corresponding intrusive segments from the depressed group narratives ($Mdn = .36$). Similarly, the PTSD intrusive segments contained a significantly higher proportion of total sensory references ($Mdn = 7.94$) compared with the intrusive segments of the control narratives ($Mdn = 1.08$, $U = 94, p = .000, r = -.54, 1$-tailed). While differences approached but did not reach significance for a greater proportion of visual ($U = 160, p = .010, r = -.34, 1$-tailed) content in the PTSD intrusive segments ($Mdn = 3.23$) compared with controls ($Mdn = .00$). Depressed and control groups did not differ on any of these IM features ($p > .005$).
Figure 3.3. Between-group differences in intrusive memory content for Target event narrative. Figure represents mean percentage and error bars represent standard errors (SEM).
Between-group differences in narrative memory quality for ordinary memory sections. Figure 3.4 presents the mean percentage of selected ordinary memory content (with standard error bars) across groups for illustrative purposes only. As above, Kruskal-Wallis tests were performed on the ordinary memory segments of the target narrative. Between-group differences in the ordinary memory segments were detected for proprioceptive \( (H(2) = 11.71, p = .003) \), total sensory words \( (H(2) = 13.80, p = .001) \) and self-devaluative statements \( (H(2) = 27.5, p = .000) \).

Follow-up Mann-Whitney \( U \) tests were then conducted. Directional hypotheses were not made about differences in ordinary memory segments between groups, hence 2-tailed tests were used throughout. A Bonferroni correction was applied once more so all effects are reported at a .005 level of significance.

Regarding sensory content, the PTSD ordinary memory sections contained a higher proportion of total sensory references overall \( (Mdn = 1.40, U = 147.5, p = .001, r = -.45) \) compared with the depressed group \( (Mdn = .00) \). While PTSD segments also contained more proprioceptive \( (Mdn = .70, U = 178.5, p = .006, r = -.39) \) content than the depressed group \( (Mdn < .00 \text{ for all three measures}) \), due to the corrected alpha level, this effect fell just short of significance. No other between-group differences in ordinary memory sensory content were detected \( (p > .005) \). Finally, the depressed group’s ordinary memory segments contained more self-devaluative content \( (Mdn = .30) \) than both PTSD \( (Mdn = .00, U = 135, p = .000, r = -.63) \) and control \( (Mdn = .00, U = 117, p = .002, r = -.46) \) groups, while the control and PTSD groups did not differ on this measure \( (U = 229.5, p = .165, r = -.25) \).
Figure 3.4. Between-group differences in ordinary memory content for Target event narrative. Figure represents mean percentage and error bars represent standard errors (SEM).
Within-group differences in narrative memory quality for IM and ordinary memory sections. Figures 3.5, 3.6 and 3.7 display the mean percentage counts of the different content variables for intrusive and ordinary memory segments across control, depressed and PTSD groups respectively. Due to non-normal distributions, within-group differences between the two types of memory were investigated using Wilcoxon matched-pairs signed rank exact tests with Bonferroni corrections for each group.

Within the control group narratives, significantly fewer temporal markers were detected in the IM ($Mdn = .00$) compared with ordinary ($Mdn = 3.65$) memory segments ($z = -2.70, p = .003, r = -.44, 1$-tailed), however no other differences were detected ($p > .005, 1$-tailed). Interestingly, no significant differences were detected on any of the narrative measures for the depressed group ($p > .005, 1$-tailed) although trends were noted for a greater proportion of total sensory ($Mdn = .00$) and proprioceptive words ($Mdn = .00$) in the IM segments compared with the ordinary memory segments ($Mdn = .19, z = -1.82, p = .036, r = -.27, 1$-tailed; $Mdn = .00, z = -1.87, p = .034, r = -.28, 1$-tailed, respectively).

Within the PTSD group, IM segments contained a greater percentage of total sensory content ($Mdn = 1.08$) than the ordinary memory segments ($Mdn = .68, z = -4.30, p = .000, r = -.59, 1$-tailed). Specifically, IM segments contained significantly more visual ($Mdn = 3.23, z = -3.17, p = .000, r = -.43, 1$-tailed) and proprioceptive ($Mdn = 3.33, z = -3.37, p = .000, r = -.46, 1$-tailed) references compared with ordinary memory segments ($Mdn = .28, and .70$ respectively). Compared to ordinary memory segments ($Mdn = .00$), intrusive segments also contained a greater proportion of auditory references ($Mdn = .00, z = .03, p = .028, r = -.26, 1$-tailed), however this difference fell short of significance. Finally, the IM
segments of the PTSD group contained significantly fewer temporal markers ($Mdn = 2.13$) than ordinary memory segments ($Mdn = 3.14$, $z = -2.67$, $p = .003$, $r = -.36$, 1-tailed). No other significant differences were detected ($p > .005$).

![Graph showing memory content differences](image)

**Figure 3.5.** Control group: Memory content differences in intrusive and ordinary segments for Target event narrative. Figure represents mean percentage and error bars represent standard errors (SEM).
Figure 3.6. Depressed group: Memory content differences in intrusive and ordinary segments for Target event narrative. Figure represents mean percentage and error bars represent standard errors (SEM).

Figure 3.7. PTSD group: Memory content differences in intrusive and ordinary segments for Target event narrative. Figure represents mean percentage and error bars represent standard errors (SEM).
Summary of narrative data findings.

**Between-group analyses.** Between-group analyses of IM narrative content revealed a significantly higher proportion of total sensory content among the PTSD compared with both the depressed and control groups. This was mostly due to a higher proportion of visual references in the PTSD intrusive segments. Depressed and control group IM segments did not differ on any of the IM features. Between-group differences in the narrative memory quality for ordinary memory segments were also found for total sensory words with the PTSD ordinary memory sections containing a higher proportion of sensory references compared with the depressed group only. In addition, the depressed group’s ordinary memory segments contained more self-devaluative content than both PTSD and control groups, while the control and PTSD groups did not differ on this measure.

**Within-group analyses.** Within-group differences in narrative memory quality for IM and ordinary memory sections were also investigated. For the control group, intrusive and ordinary memory segments differed only on the proportion of temporal markers, with fewer detected in the IM compared with ordinary memory segments. No significant differences were detected on any of the narrative measures for the depressed group, although trends were noted for a greater proportion of total sensory and proprioceptive words in the IM segments. Within the PTSD group, IM segments contained a greater percentage of total sensory content; specifically, more visual and proprioceptive references were noted in the intrusive than ordinary memory segments. Finally, the IM segments of the PTSD group also contained significantly fewer temporal markers than ordinary memory segments. No other within-group differences were detected.
Discussion

Past studies have argued that IMs represent overlapping features of both depression and PTSD which derive from the same underlying processes and systems in memory (Reynolds & Brewin, 1999). Yet most of the research to date has relied heavily on retrospective, subjective self-report methods, or has been conducted with non-clinical samples or clinical samples without an adequate control group, weakening the conclusions that may be drawn from such studies. Study 1 sought to address these issues by replicating and extending previous findings regarding the phenomenology of IMs across depressed, PTSD and control groups by combining traditional self-report methods with more objective narrative measures adapted from PTSD research. Analyses focussed on theoretically-driven features which were expected to distinguish IMs in PTSD. These included heightened primary emotion responses (such as fear), vividness, sensory details, accompanying physical sensations, distress, degree of nowness and a lack of temporal context, all of which are predicted to occur when sensory or data-driven processing and encoding dominate in the absence of conceptual processing during PTSD index events (Brewin, Dalglish et al., 1996; Brewin et al., 2010; Ehlers & Clark, 2000). Self-devaluative statements were investigated in an exploratory fashion. In so doing, Study 1 considered whether the IMs in depression and PTSD are likely to arise from common processes in memory or whether, as some authors have suggested (Bryant et al., 2011), qualitative differences in re-experiencing phenomena exist.

General Clinical Characteristics

Inspection of the Target event type across groups found that deaths/illnesses of others were most common for the control group, negative interpersonal events
(including relationship breakdowns) were most common for the depressed group, and instances of assault or abuse concerning the self were most common for the PTSD group. This pattern of event-types persisted for the subgroups of participants who reported an IM during the narrative task, supporting past observations that IMs may occur in response to a wide variety of negative life events beyond Criterion A traumas (e.g. Birrer et al., 2007; Brewin, Hunter et al., 1996; Day et al., 2004).

However IMs were more easily triggered during the narrative task for the PTSD compared to the depressed and control groups, which may have clinical implications considering that the ease and persistence with which IMs are triggered predicts symptom severity over and above initial diagnostic status (Michael et al., 2005). Interestingly, the depressed and PTSD groups reported more IM-related interference with daily activities than the control group, but did not differ from each other on this measure. Furthermore, consistent with past studies (Kuyken & Brewin, 1994) scores of intrusion, avoidance and hyperarousal as indexed by the IES-R in relation to the Target events did not differ between the depressed and PTSD groups, although both were greater than controls. Although the nature of the IM-related interference across groups deserves further exploration, taken together these findings suggest that IMs represent clinically-significant symptoms for both PTSD and depression.

Evidence of Data-Driven Processing Dominance in PTSD Intrusive Memories

Physical sensations and sensory-perceptual detail. With regards to IM-related physical sensations, PTSD self-report ratings exceeded those of the depressed group, while control and depressed groups did not differ. This is in contrast to Reynolds and Brewin’s (1999) study which found no difference in ratings of IM-related physical sensations between depression and PTSD participants, and
may have reflected the more sensitive rating scale used in the current study. Although the modality of the primary IM did not differ significantly between groups, results were in the expected direction with almost two-thirds of PTSD participants nominating their primary IM as a predominantly sensory-perceptual experience, compared with just under half of the depressed and one third of the control groups. This pattern of self-report findings corresponded with the narrative data which also detected a significantly higher proportion of total sensory, mainly visual, content in the IM segments of PTSD narratives compared with the IM segments of the depressed and control groups narratives, which did not differ. Furthermore, within-group comparisons of the intrusive versus ordinary memory segments also revealed that the IM segments of the PTSD narratives contained a greater proportion of sensory, particularly visual and proprioceptive content. In contrast, intrusive and ordinary memory segments could not be distinguished in this way for either the depressed or the control groups.

By combining self-report and narrative data, the current findings provide unique and compelling evidence that IMs in PTSD are characterised by a particular sensory-perceptual quality, consistent with enhanced data-driven or sensory memory processing at encoding. In contrast, evidence for an underlying shift toward data-driven/sensory-perceptual processing in the IMs of depression was not found. Not only did the IM segments of the depressed and control groups contain less sensory-perceptual content overall than the PTSD IM segments, the intrusive and ordinary memory segments within both groups failed to differ on these measures.

Temporal context. As outlined in theoretical models of PTSD, high levels of fear and arousal trigger event processing and encoding differences including a lack of conceptual, or higher-level cognitive processing. As such, resultant
memories are predicted to be rich in sensory-perceptual detail but lacking in contextualising information which contributes to the strong perceptual priming effect and reliving quality typical of PTSD IMs.

In a novel application of narrative measures, Study 1 examined whether temporal markers (an index of temporal context and cohesiveness) differed between groups and across memory (i.e. ordinary versus intrusive) type. While between-group differences were not detected, consistent with predictions the intrusive segments of the PTSD group narratives contained fewer temporal markers than the ordinary memory segments. In contrast, no such difference was detected within the depressed group, indicating that both memory types were equally grounded in temporal context. In fact, the depressed group intrusions did not differ from ordinary memory segments on any of the narrative measures used in Study 1, suggesting that the IMs in depression are unlikely to derive from a separate memory system or extreme shifts in memory processing as proposed by theoretical models of PTSD (Brewin, Dalgleish et al., 1996; Brewin et al., 2010; Ehlers & Clark, 2000).

Unexpectedly, the IM segments of the control group narratives also contained fewer temporal markers than the ordinary memory segments. Temporal context was specifically tested in the current study because of theoretical predictions outlined in dominant models of PTSD (Brewin, Dalgleish et al., 1996; Ehlers & Clark, 2000). However it is possible that the IM segments in the control group narratives may have exhibited other forms of context and cohesion, for example, via the use of causal connectors or evaluative content which help to establish spatiotemporal and causal context (O'Kearney et al., 2007), yet these were not examined in the current study. An alternative explanation for these findings is that reduced temporal context represents a universal feature of intrusive remembering.
Indeed, while conservative tests found a non-significant within-group difference for the depressed narratives, the same pattern of fewer temporal markers in the intrusive memory segments was observed.

**Reliving quality.** Contrary to hypotheses, no significant group differences were found for self-reported ratings of IM-related nowness which is in contrast with past studies (e.g. Birrer et al., 2007). This finding is surprising considering that narrative data suggested a lack of temporal context in the PTSD IMs and that according to Ehlers and Clark (2000), the lack of such contextualising information is expected to enhance the sense of nowness and current threat associated with the intrusions. However, this result could reflect a sampling issue considering Study 1 consisted of small, mixed community and clinical samples with varying degrees of severity. The mean PDS score for the current PTSD sample \((M = 28.32, SD = 12.04)\) was somewhat similar to the mean PDS score of PTSD groups reported previously \((M = 31, SD = 6.3, Birrer et al., 2007)\). Yet it may be that the re-experiencing or nowness quality of IMs increases with more severe PTSD and/or more flashback-type experiences, and that this effect may have been detected if participants had been limited to treatment-seeking individuals or participants with at least moderate symptom severity (minimum score of 15 on the PDS) as per studies which have reported this difference (Birrer et al., 2007).

A further issue pertains to the reliance on self-report ratings as an indication of the nowness or reliving quality of IM phenomena. As Brewin and colleagues (2010) point out, little is known about the validity and reliability of such self-report items, their ability to accurately assess and distinguish between idiosyncratic IM experiences or the factors that influence such self-reports.
The corresponding narrative data also revealed no switches to present tense, one indicator of dissociative reliving, or any differences in the use of primary versus secondary emotions within the PTSD group. Such results are in contrast with Hellawell and Brewin’s (2004) findings and likely stem from methodological differences and variations in the PTSD samples tested. Specifically, Hellawell and Brewin’s (2004) study targeted flashbacks as distinct from other forms of intrusive, as well as ordinary, remembering. Furthermore, their sample consisted of a subset of treatment-seeking PTSD patients known to experience regular dissociative flashbacks, which was not the case with the current study. As discussed, flashbacks may represent a particularly intense or distinct form of IM unique to PTSD, however the degree to which they manifest as a prominent symptom varies across individuals (Lanius et al., 2010; Wolf et al., 2012). Future studies comparing the IM experiences of PTSD subgroups consisting of high and low dissociators, or with high and low frequency of flashbacks, may therefore be warranted to determine whether such differences in the experiential quality of IMs bear out across these samples.

**Vividness, IM-related emotions and peritraumatic dissociation.** Self-report ratings of the degree of vividness and emotions associated with the primary IMs were relatively similar for PTSD compared with depressed and depressed compared with controls suggesting that IMs may be universally experienced as highly emotional and vivid (Birrer et al., 2007). However, inspection of the pattern of ratings revealed that the PTSD group’s two main IM-related emotions were helplessness and fear, compared with sadness and helplessness for the depressed and control groups. Furthermore, compared to depressed and control participants, the PTSD group also reported significantly higher levels of peritraumatic dissociation.
during their Target events, as indexed by the PDEQ. In line with these findings, extreme helplessness (along with fear, horror, panic and elevated arousal) has been identified both as a trigger for dissociation during trauma (Putnam, 1985, cited in Reynolds & Brewin, 1999; Marmar et al., 1997), and as the most commonly reported IM-related emotion in PTSD (Reynolds & Brewin, 1999). It has been suggested that peritraumatic dissociation disrupts the encoding and emotional processing of traumatic information leading to fragmented, uncontextualised memories, thereby mediating PTSD onset (Ehlers & Clark, 2000; Foa & Hearst-Ikeda, 1996). However, considering the problems inherent in the long-term retrospective reporting of acute trauma reactions (see Bryant, 2007, for a review), the PDEQ scores of the current study should be interpreted with caution.

**IM-related distress.** Regarding the overall experience of recalling their trigger events, depressed and PTSD participants reported a similar level of associated distress and memory vividness. However, ratings of IM-related distress were significantly higher for the PTSD compared to depressed group, while depressed and control IM-distress did not differ, highlighting the clinical significance of idiosyncratic appraisals of IMs in PTSD as outlined by Ehlers and Clark (2000). It could be speculated that IM differences in the reliving quality (Steil & Ehlers, in preparation, cited in Ehlers & Steil, 1995), lack of context and heightened sensory-perceptual content associated with memory processing abnormalities enhance subjective distress in PTSD compared with depression. In any case, high levels of IM-related distress are problematic in that they may exacerbate symptoms directly whilst encouraging the use of maladaptive coping strategies such as cognitive avoidance, with implications for prognosis and treatment in PTSD (Cruwys & O'Kearney, 2008; Ehlers & Steil, 1995).
The above findings contradict Birrer and colleagues (2007) who reported no difference in IM-related distress between depressed and PTSD groups. However, this discrepancy could reflect the different methodologies used: for example in the current study, participants were asked to identify a triggering event and to report on the qualities of their IMs of this event almost immediately after they had been experienced during a narrative task, while in Birrer et al.'s (2007) study, respondents reported generally and retrospectively on their “most vivid unwanted memories”. It is acknowledged that the degree to which a depressive episode may be linked to a precipitating event varies across individuals and may play a greater role in certain subtypes (e.g. first episodes) of depression, which this study did not attempt to identify. Despite this, all depressed participants in the current study were able to identify a triggering event connected to the onset of their depressive symptoms. Furthermore, unlike the current study (which confirmed no group differences in the time since Target events), the time elapsed since the IM-related events was not reported by Birrer and colleagues (2007). As such, different temporally-mediated effects such as recency effects, decay, distortion or amplification of memories (see van Giezen, Arensman, Spinhoven, & Wolters, 2005, for a review) may have influenced Birrer and colleagues' (2007) results.

**Self-devalutative statements.** Although the IM segments did not differ on this measure it is noteworthy that the ordinary memory segments of the depressed group contained significantly more self-devalutative statements indicative of higher-level cognitive appraisals than the corresponding memory segments of the other groups. At the time of the narrative task participants were instructed to write about their Target event in as much detail as possible, including what happened, what they saw, felt and thought at the time. As such, the higher proportion of self-devalutative
statements in the ordinary memory segments of the depressed group narrative could suggest that pre-existing negative schemas about the self were activated at the time of the negative life event, and/or by the act of (involuntarily or voluntarily) recalling the Target event during the narrative task.

Either way, this result is consistent with Beck’s (1976, 1987) cognitive theory of depression which proposes that negative life events and/or IMs are likely to activate depressogenic cognitive schema in vulnerable individuals. This triggers negative thoughts or intrusions which exacerbate both the distress associated with the memory itself and levels of dysphoria generally. Given the cross-sectional nature of the current study, causal conclusions about the role of self-devaluative statements in depression cannot be drawn. However, a prospective study by Dent and Teasdale (1988) found that more globally self-devaluative thinking and generalised hopelessness was related to slower recovery from depression, underscoring the clinical significance of particular patterns of negative thinking in this disorder.

Theoretical and Clinical Implications

 Taken together, the current findings are mostly consistent with a theorised shift towards sensory processing dominance in the absence of contextual/conceptual processing and encoding during PTSD index events but not in depression. This results in intrusive trauma memories in PTSD which are rich in sensory detail, poorly contextualised and prone to frequent, automatic retrieval (Brewin, Dalgleish et al., 1996; Brewin et al., 2010; Ehlers & Clark, 2000). In contrast, the overall lack of difference both between and within the depressed and control groups’ intrusive versus ordinary memory segments suggests that such processing and encoding abnormalities are less likely to underlie the IMs of these groups. Instead, the IMs
which occur in non-PTSD disorders such as depression may be better accounted for by general models of autobiographical memory (e.g. Conway & Pleydell-Pearce, 2000) whereby trigger events of unusual or negative experiences are not easily integrated into the broader autobiographical memory base and remain prone to intrusion (Bryant et al., 2011). Alternatively, IMs in depression may simply derive from the activation of salient and related negative self-schemas and/or mood-congruent retrieval biases which are known to occur with dysphoria (Blaney, 1986; Gotlib & Joorman, 2010). In either case, the current findings complement previous studies which have distinguished between IMs as a transdiagnostic feature of several psychological disorders and SAM/S-rep-based flashbacks, which may represent a form of intrusive re-experiencing unique to PTSD (Bryant et al., 2011).

Despite the methodological weaknesses of the IM research and the lack of differentiation between flashbacks and other forms of IMs to date, exposure therapy has been suggested as a treatment option for depression on the basis that IMs represent an overlapping feature of depression and PTSD (Kandris & Moulds, 2008). However, the DRT account of exposure therapy for PTSD proposes that SAMs/S-reps require sustained attention and processing to facilitate their transformation into the VAM/Contextual memory system (Brewin et al., 2010) and that activation of the fear network is required to overcome avoidance strategies and to extinguish fear conditioning (Ehlers & Clark, 2000), which is unlikely to apply directly to depression.

Indeed, these findings raise several clinical questions relevant to the application of traditionally trauma-based therapies to the treatment of depression. For instance, by what mechanisms would such therapies exert clinical change in depression and how might they differ in PTSD? Furthermore, while research has
demonstrated that “some patient variables may make either exposure or cognitive restructuring less appropriate for the treatment of PTSD” (Zayfert & DeViva, 2010, p. 152), the contraindications of using exposure therapies with depressed patients remain unknown. These and other clinical considerations of the current findings are covered in more detail in the General Discussion.

Summary

In summary, although the self-report and narrative data revealed some degree of overlap in the experiential features of IM phenomena in depression and PTSD, several key differences persisted. Specifically, the IMs in PTSD were distinguished by enhanced sensory perceptual detail, accompanying physical sensations and a lack of temporal context and were rated as subjectively more distressing than the IMs of the depressed and control groups, which did not differ. In contrast, the IM segments in depression failed to differ from ordinary memory segments on any of the narrative measures designed to index dual-route processing mechanisms (Brewin, Dalgleish et al., 1996; Hellawell & Brewin, 2004). Finally, while differences in IM-related emotions fell short of statistical significance, the PTSD group identified the primary emotions of helplessness and fear (Hellawell & Brewin, 2004) as their dominant IM-related emotions, while the depressed and control groups gave the highest ratings for sadness and helplessness.

Although results were in the expected direction, self-ratings of IM-related nowness did not vary significantly between PTSD and depressed groups and switches to present tense failed to differentiate the PTSD IM segments within or between groups. As discussed, this may have been due to the small, heterogeneous samples used and possibly, insufficient severity within the PTSD group.
While not all of the expected differences in IMs were found, the results of Study 1 are still consistent with the Ehlers and Clark (2000) and DRT (Brewin, Dalgleish et al., 1996; Brewin et al., 2010) accounts of PTSD, and suggest stronger SAM or sensory-based IMs in PTSD compared with IMs in depression. Although further research is needed, such differences in the phenomenology, and possibly aetiology, of certain forms of intrusive remembering (i.e. flashbacks) in PTSD compared with depression are likely to have clinical implications for the application of IM-focussed interventions such as exposure therapy, to the treatment of depression.

Limitations of Study 1

The current findings need to be considered in light of several limitations. One clear limitation is the lack of a matched trauma-exposed, non-PTSD control group which would help determine to what extent particular IM qualities (e.g. sensory-perceptual content) may be due to the trigger event type or a consequence of unique processing differences in PTSD.

Secondly, as mentioned above, the study did not identify clinical subgroups (such as high/low dissociators or those who experience flashbacks in the PTSD group, depressed participants with or without a history of trauma or first-episode versus recurrent episodes of depression), which may have had an impact on the findings.

Thirdly, the method for this study diverged somewhat from past studies in that it identified IMs to specific trigger events, as opposed to asking about the qualities of recently-experienced IMs (e.g. Patel et al., 2007; Reynolds & Brewin, 1999), reducing comparability with past results. Despite this, the narrative task appeared to elicit IMs at a rate comparable to the “recent report” studies (e.g.
Reynolds & Brewin, 1999), and a strength of this study was that participants reported on near-time IMs, reducing retrospective memory bias. Although we cannot be certain that the IMs experienced by participants during the study replicate those that occur naturally, past research comparing laboratory and naturalistic intrusions found no differences in IM phenomenology across these conditions (Schlagman & Kavilashvili, 2008). Furthermore, confidence in the ecological validity of the current findings is enhanced by the fact that the large majority of participants confirmed that the IMs which occurred during the narrative task resembled those that they had experienced previously.

A fourth limitation of Study 1 relates to the use of relatively small, mixed clinical and community samples. Although the sample sizes were comparable to other published studies in this field, (e.g. Birrer et al., 2007; Newby & Moulds, 2011) the heterogeneous samples would have reduced statistical power to detect certain effects. Also, while control group participants did not meet criteria for a major depressive episode or PTSD, we cannot rule out the influence of other possible subsyndromal or full-blown psychopathologies. Similarly, beyond the self-reported exclusion criteria, the depressed and PTSD groups were not assessed for other comorbid disorders which may have had a bearing on the results. Hence a replication and extension of this study with “purer” clinical and non-clinical samples would be desirable.

Finally, we acknowledge that due to resource constraints, the narrative data was not blind-coded and inter-rater reliability data is not available. However, narrative coding was based on actual counts of strictly defined words following past research (Hellawell & Brewin, 2002) to minimise potential coding biases.
Although the self-report measures for Study 1 were adapted from previous studies in the field, concerns over the lack of validity and reliability data for these measures (Brewin et al., 2010) combined with the inherent limitations of self-report, retrospective data, warrant more multimethod research in this area. The inclusion of narrative data goes some way to addressing this gap in the literature. More objective measures would serve to strengthen conclusions regarding the comparative nature of IMs in depression and PTSD. For example, as discussed previously, discrepancies between the current study and past findings of self-reported IM-related physical sensations may have been due to variations in self-report rating systems. Alternatively, mixed findings could reflect alterations in bodily awareness which have been implicated in depression (Dunn, Dalgleigh, Ogilvie, & Lawrence, 2007), calling into question the accuracy of self-reported physiological states. As such, Study 2 was designed to overcome such limitations and complement the results of Study 1 by considering the impact of arousal on memory encoding and retrieval via an assessment of physiological responsivity to a script-driven imagery task.
CHAPTER 4: STUDY 2

Method

Participants

Seventy-eight participants aged between 18 and 65 years who had completed Study 1 continued on to complete Study 2. Participants in Study 2 received either $AUD10 or research participation credit for their time. As detailed in Study 1, participants were divided into control, depressed and PTSD groups based on their responses to the CES-D, MDE section of the SCID-I and PDS, and the same exclusion criteria applied. Six participants were excluded due to computer problems during the data collection phase resulting in a final data set of 72 participants (24 in each group). The study was approved by the ANU’s Human Research Ethics Committee (see Appendix A for notification of ethics approval).

Script-Driven Imagery Task

Psychophysiological reactivity was investigated using a script-driven imagery task derived from previously published studies (for details see Orr, Pitman, Lasko, & Herz, 1993; Pitman et al., 1987). As outlined in Study 1, participants had previously written two narratives based on past personal experiences. Participants meeting criteria for a major depressive episode wrote about a negative life event that may have triggered their depressive episode. Participants in the PTSD group wrote about the traumatic event which they had identified on the PDS as “bothering them the most”. Finally, participants in the control group wrote about a “major negative life event”. These events are referred to collectively as the Target events. In
addition, all participants also wrote about an unrelated negative life event (referred to as the Other event) which occurred around the same time as their Target event.

These personal event narratives were used to create individualised scripts in the present tense for each participant. A recording of each script was made in a neutral female voice by the experimenter (L.P.), using an Olympus WS-110 digital voice recorder. Following Lindauer and colleagues (2006), a standard Neutral script about brushing teeth was also created (see Appendix F). All Target, Other and Neutral scripts were 60 seconds in duration. Participants listened to these scripts whilst psychophysiological measures of heart rate (HR) and electrodermal activity in the form of skin conductance (SC) responses were recorded as recommended by Larkin (2006) (see Procedure for further details).

Materials

**Apparatus.** Three computers were required for this study. The first, a DELL Optiplex 755 computer with an Intel Core 2 Duo E8400 processor running at 3.00GHz, hosted Inquisit software (Millisecond Software, version 2.0.61004.6, 2008). This computer was used for programming and presenting the script stimuli. Two additional DELL Optiplex 755 computers with Intel Core 2 Duo E6850 processors running at 3.00GHz, hosted LabVIEW and AcqKnowledge® 4.0 software respectively. The LabVIEW program interfaced with the Inquisit computer via a National Instruments PCI 6221 data acquisition card. LabVIEW was used for identifying and triggering test phases based on predefined psychophysiological criteria (see procedure section for details).

HR and SC were measured using a BIOPAC MP150 data acquisition system running AcqKnowledge® 4.0 software (Biopac Systems Inc.) attached to galvanic skin response GSR-100C and electrocardiogram ECG-100C amplifiers. The GSR
amplifier was set to direct current with a gain sensitivity of 5 µohm/V, and a low-pass filter set at 10-Hz. The ECG amplifier gain was set at 500, the R-wave detector was switched on, and the low and high pass filters were set at 35Hz and 0.05Hz respectively.

To monitor HR, two disposable, pre-gelled silver-silver chloride (Ag-AgCl, 7% chloride) electrodes suitable for short-term recordings were attached to the inside of each wrist. A third electrode attached to the inside of the right ankle served as a ground. The electrodes used were 35mm in diameter with a circular contact area of 10mm in diameter (Biopac product type EL503). SC was measured by attaching two disposable, pre-gelled silver-silver chloride (Ag-AgCl, 0.5% chloride) electrodes (Biopac product type EL507) to the volar surfaces of the distal phalanges of the second and third fingers of the nondominant hand. Both HR and SC were acquired continuously, at a rate of 1000 samples per second and recorded at 500 Hz. HR was obtained by the detection of cardiac R-waves with the stored interbeat intervals converted to second-by-second beats per minute (bpm) values.

**Non-physiological measures.** In addition to the CES-D, PDS, IES-R and PDEQ administered and described in Study 1, data was obtained from the State-Trait Anxiety Inventory (STAI) and a shortened version of the IMQ.

**State-Trait Anxiety Inventory (STAI).** The STAI comprises two self report measures aimed at assessing levels of state and trait anxiety (Spielberger, 1983). The State-Anxiety scale (STAI-S Form Y-1) and Trait-Anxiety scale (STAI-T Form Y-2) include twenty statements each. Respondents are asked to read each statement and to circle the appropriate response on a four point scale from 1 (*not at all*) to 4 (*very much so*) to indicate how they feel “right now” (STAI-S) and how they “generally” feel (STAI-T). Total Trait or State Anxiety scores can range from 20 to
80, with higher scores indicating a greater tendency for anxiety. The State scale is intended to provide an indication of the level of transitory anxiety experienced by an individual at a given moment in time. In contrast, scores on the Trait scale are less affected by transitory stress and therefore are a more stable assessment of anxiety (Spielberger, 1983). Both T- and S-anxiety scales has been widely used for assessing clinical anxiety across a range of medical and psychiatric patients (Spielberger, 1983). Normative data is available for working adults, college students, high school students and military recruits. Spielberger (1983) reported adequate test-retest reliability ($r = .73$ to $0.86$) and high internal consistency (median alpha of .90) for the T-anxiety scale. Test-retest reliability for the S-anxiety scale may be relatively low (median $r$ of .33), however this is expected and desirable given that the scale is intended to “reflect the influence of unique situational factors at the time of testing” (Spielberger, Reheiser, Owen, & Sydeman, 2004, p. 427). In contrast, internal consistency of the S-anxiety scale was found to be high, with a median alpha of .93 (Spielberger, 1983).

**Intrusive Memory Questionnaire (IMQ).** A shortened version of the IMQ described in Study 1 was adapted for use in Study 2. Modifications of the IMQ for Study 2 were required to avoid duplication of questions pertaining to general intrusive memory experiences. Participants indexed their responses to any IMs experienced during the Script or Imagery phases of the script-driven imagery task (see Procedure section for further details). Information regarding the overall memory experience as well as the vividness, degree of physical sensations, sense of nowness and emotional responses (sadness, guilt, shame, anger, fear, helplessness) was collected. As per Study 1, self-report ratings were obtained using a 100-point scale (Patel et al., 2007; Williams & Moulds, 2007b).
Procedure

Participants for Study 2 were invited to attend a separate one hour testing session, within one week of completing Study 1. Participants were requested to refrain from consuming any stimulants (e.g. nicotine, caffeine), alcohol or non-prescribed medication for at least 12 hours prior to the study. All testing sessions were scheduled in the morning (commencing at 8:00am and ending by midday), to minimise possible effects of diurnal variations in physiology (Adan & Sanchez-Turet, 1996).

Upon arrival, participants provided written informed consent (see Appendix G for Information Sheet and Statement of Informed Consent) and the STAI-S and STAI-T was administered. The skin surfaces at the electrode sites were wiped down using water and cotton pads and dried, and the electrodes were attached as detailed above. Participants were shown to a quiet, softly-lit adjoining room for testing. They were seated in a comfortable chair, facing a computer monitor within easy reach of the computer keyboard. The ECG and GSR leads were attached to the electrodes and secured with tape to reduce the risk of excessive movement of sensors, consistent with Biopac recommendations.

Participants were informed that during the experiment, all instructions and scripts would be heard through their headphones. Participants were instructed to close their eyes or fix their gaze on a spot on the wall or floor and to remain as still as possible for the duration of the testing period. The procedure for this study was adapted from the standard script-driven imagery procedure (e.g. Pitman et al., 1987). Participants first heard a three-minute relaxation exercise followed by a silent baseline period of seven minutes, followed by the first script phase. All participants received the Neutral script phase first, followed by either the Target or Other script.
phases; the presentation of which were counterbalanced across participants in each test group to control for possible ordering effects.

Each script presentation (Neutral, Target, Other) consisted of four sequential 60 second periods: baseline, script, imagery and recovery. During each baseline period, participants’ HR and SC data was obtained in the absence of any experimental stimuli. Participants were instructed to listen carefully to the script and to imagine the event as vividly as possible (Script phase). The Script phase was followed by a silent 60 second imagery period during which participants imagined the event again from beginning to end (Imagery phase). Participants were then asked to stop imagining the event and to relax until they heard the next instruction (Recovery phase). The subsequent script presentation phase commenced after 60 seconds had elapsed or once HR had returned to within 5% of its value during the preceding baseline period, whichever was longer. For all participants, HR returned to this criterion level within or very soon after the 60 second recovery period. HR and SC were collected continuously over the entire testing period.

Upon conclusion of the psychophysiological phase (approximately 30 minutes in duration), the leads and electrodes were removed and participants were shown back into the main testing room and asked to complete the IMQ. Participants were subsequently debriefed about the study (see Appendix H for Debrief Sheet) and compensated for their time.

**Data Reduction and Analysis**

Based on previously established methods (Brunet et al., 2008; Pitman et al., 1987), the mean of both physiologic variables was calculated for all script types (Neutral, Target, Other) and phases (Baseline, Script, Imagery, Recovery) for each
participant. HR and SC response scores were calculated by subtracting the mean value of the preceding baseline in preparation for analyses.

SC and HR were analysed separately for a number of reasons. Firstly, SC is considered to be a clearer indicator of autonomic nervous system (ANS) functioning which is mediated by the sympathetic nervous system (SNS) without the influence of the parasympathetic nervous system (PNS) (Larkin, 2006). HR on the other hand, is a more complex measure of ANS activity determined by the combined effects of the PNS and SNS (Larkin, 2006). As such, an increase in HR may reflect an increase in SNS, a withdrawal of the PNS and/or a combination of both (Appelhans & Luecken, 2006). Since psychophysiological studies have found increased HR to be "the most consistent finding in the PTSD literature so far" (Lindauer et al., 2006, p. 39) and it is generally recommended that analyses include multiple psychophysiological measures (Larkin, 2006), both HR and SC were examined here.

Clinical, demographic and self-report data were examined using one-way between groups analysis of variance (ANOVAs) and where assumptions of homogeneity of variance were not met, results were confirmed using robust Welch's $F$ tests (Field, 2009). Psychophysiological responsivity was examined using mixed between- and within-groups analysis of covariance (ANCOVAs) with script order entered as the covariate. Greenhouse-Geisser corrections were applied where data violated assumptions of sphericity. Planned or post-hoc follow-up tests (Tukey-HSD, Tukey-Kramer for unequal sample sizes or Games-Howell in the case of unequal population variances) tests were conducted according to hypotheses (Field, 2009). In examining categorical data across groups, Chi-square tests were used and calculated with exact methods if assumptions were not met (Field, 2009). Data were analysed using SPSS version 18.0 (SPSS Inc., 2009).
Results

Demographic and General Clinical Characteristics

Seventy-two participants (40 female; 55.56%) with a mean age of 35.57 years \( (SD = 16.51) \) took part in Study 2. Table 4.1 presents the demographic and clinical characteristics of the participants broken down by group. No group differences were detected for gender, age, years of education or time since the Target or Other event, although there was a non-significant trend for fewer years of education in the PTSD group. It should be noted that 42\% \( (n = 10) \) of PTSD group participants also met criteria for comorbid depression based on the MDE section of the SCID. Clinical groups were also examined for current use of psychotropic medication. Among the depressed group, nine (31\%) participants were taking medication at the time of the study compared to six (25\%) participants in the PTSD group. Chi-square tests revealed no association between groups and current use of medication \( \chi^2(1) = .87, p = .35 \).

Games-Howell post-hoc tests confirmed significantly higher CES-D and PDS scores among the depressed (mean difference = 18.00 s; 95\% CI = 10.36, 25.64; \( p = .000 \); mean difference = 15.14 s; 95\% CI = 7.40, 22.87; \( p = .000 \)) and PTSD (mean difference = 15.71 s; 95\% CI = 8.77, 22.65; \( p = .000 \); mean difference = 19.56 s; 95\% CI = 12.89, 26.22; \( p = .000 \)) groups compared with controls. No differences were detected between the PTSD and depressed groups on either of these measures \( (p > .05) \).

Overall group differences were also detected on total State and Trait anxiety scores as indexed by the STAI. Games-Howell post-hoc tests confirmed that the clinical groups did not differ on State anxiety scores \( (\text{mean difference} = 6.46 \text{ ns}; \)
95% CI = -.46, 13.38; \( p = .07 \), however both depressed and PTSD groups endorsed higher levels of State anxiety compared with the controls (mean difference = 12.13 s; 95% CI = 6.13, 18.12; \( p = .000 \) and mean difference = 5.67 s; 95% CI = .84, 10.50; \( p = .018 \), respectively). In terms of Trait anxiety, Tukey-HSD post-hoc tests confirmed that both depressed and PTSD groups returned higher scores than the controls (mean difference = 22.79 s; 95% CI = 15.46, 30.13; \( p = .000 \) and mean difference = 14.21 ns; 95% CI = 6.87, 21.54; \( p = .000 \), respectively) while the depressed group reported greater levels of Trait anxiety than the PTSD group (mean difference = 8.58 ns; 95% CI = .34, 16.83; \( p = .040 \)).
Table 4.1

Demographic and Clinical Characteristics for All Participants

<table>
<thead>
<tr>
<th></th>
<th>Control (n = 24)</th>
<th>Depressed (n = 24)</th>
<th>PTSD (n = 24)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (n, % female)</td>
<td>12 (50%)</td>
<td>16 (67%)</td>
<td>12 (50%)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>36 (15.73)</td>
<td>40 (16.98)</td>
<td>32 (16.49)</td>
</tr>
<tr>
<td>Education (years)</td>
<td>16.15 (3.57)</td>
<td>18.04 (9.80)</td>
<td>13.21 (5.02)</td>
</tr>
<tr>
<td>Time since target event (days)</td>
<td>3631 (4088.05)</td>
<td>2687 (2846.67)</td>
<td>3681 (4489.73)</td>
</tr>
<tr>
<td>Time since other event (days)</td>
<td>3521 (4312.37)</td>
<td>2672 (4006.89)</td>
<td>3569 (4471.32)</td>
</tr>
<tr>
<td>CES-D</td>
<td>10.83 (8.05)</td>
<td>28.83 (13.06)</td>
<td>26.54 (11.43)</td>
</tr>
<tr>
<td>PDS</td>
<td>6.78 (5.83)</td>
<td>21.91 (13.56)</td>
<td>26.33 (11.54)</td>
</tr>
<tr>
<td>STAI-State t-score</td>
<td>44.46 (4.49)</td>
<td>56.58 (11.05)</td>
<td>50.13 (8.55)</td>
</tr>
<tr>
<td>STAI-Trait t-score</td>
<td>49.88 (7.74)</td>
<td>72.67 (12.69)</td>
<td>64.08 (10.80)</td>
</tr>
</tbody>
</table>

Note. CES-D = Center for Epidemiologic Studies Depression Scale, PDS = Post-traumatic Diagnostic Scale, STAI = State-Trait Anxiety Inventory for Adults. Except where noted, values refer to mean and (standard deviation) scores.
Event type and self-reported peritraumatic dissociation, intrusive, avoidance and hyperarousal symptoms. Table 4.2 provides details of the frequency of the target event type for each group. Deaths, illnesses and injuries of others were the most frequently endorsed target event type for the control group, while just under half of the depressed sample nominated negative interpersonal events and relationship breakdowns, and for the PTSD group, instances of assault or abuse involving the self and death/illness/injury involving others were the most common. Across the groups, eight participants described other target events which included moving to a new school \((n = 1)\), poor academic performance \((n = 3)\), abortion \((n = 1)\), home break-in \((n = 1)\), negative world event \((n = 1)\) and financial loss \((n = 1)\).

Groups differed on total IES scores, as well as the Intrusion, Avoidance and Hyperarousal subscales. Games-Howell post-hoc tests confirmed significantly higher scores on IES-R total among the depressed \((\text{mean difference} = 25.65\; s; 95\% \text{ CI} = 11.67, 39.62; p = .000)\) and PTSD \((\text{mean difference} = 34.58\; s; 95\% \text{ CI} = 22.35, 46.80; p = .000)\) groups compared with controls. In addition, IES-R Intrusion, Avoidance and Hyperarousal subscale scores were significantly higher for the depressed groups compared with the controls \((\text{mean difference} = 1.23\; s; 95\% \text{ CI} = .53, 1.94; p = .000; \text{mean difference} = .97\; s; 95\% \text{ CI} = .37, 1.58; p = .001; \text{mean difference} = 1.26\; s; 95\% \text{ CI} = .50, 2.01; p = .001, \text{respectively})\). In the same order, the PTSD group also returned significantly higher scores on these measures than controls \((\text{mean difference} = 1.53\; s; 95\% \text{ CI} = .91, 2.14; p = .000; \text{mean difference} = 1.61\; s; 95\% \text{ CI} = .99, 2.23; p = .000; \text{mean difference} = 1.59\; s; 95\% \text{ CI} = .91, 2.26; p = .000, \text{respectively})\). The PTSD and depressed groups did not differ on these measures \((p > .05)\)
In terms of peritraumatic dissociative experiences as indexed by the PDEQ, post-hoc Tukey-Kramer tests revealed no difference between the depressed and control groups (mean difference = .16 ns; 95% CI = -.47, .79; \( p = .82 \)). However PTSD group scores on the PDEQ were significantly greater than both depressed (mean difference = .83 s; 95% CI = .20, 1.46; \( p = .006 \)) and control groups (mean difference = .99 s; 95% CI = .36, 1.62; \( p = .001 \)).
Table 4.2

Target Event Type, Peritraumatic Dissociation and Intrusion, Avoidance and Hyperarousal Symptoms for Control, Depressed and PTSD Groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control (n = 24)</th>
<th>Depressed (n = 24)</th>
<th>PTSD (n = 24)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target event type:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative interpersonal event</td>
<td>21% (n = 5)</td>
<td>42% (n = 10)</td>
<td>0%</td>
</tr>
<tr>
<td>Death/illness/injury involving other</td>
<td>42% (n = 10)</td>
<td>21% (n = 5)</td>
<td>29% (n = 7)</td>
</tr>
<tr>
<td>Illness/injury involving self</td>
<td>13% (n = 3)</td>
<td>8% (n = 2)</td>
<td>8% (n = 2)</td>
</tr>
<tr>
<td>Assault/abuse involving self</td>
<td>8% (n = 2)</td>
<td>4% (n = 1)</td>
<td>29% (n = 7)</td>
</tr>
<tr>
<td>Motor vehicle/other accident</td>
<td>0%</td>
<td>8% (n = 2)</td>
<td>17% (n = 4)</td>
</tr>
<tr>
<td>Natural disaster</td>
<td>0%</td>
<td>0%</td>
<td>4% (n = 1)</td>
</tr>
<tr>
<td>War/combat</td>
<td>0%</td>
<td>0%</td>
<td>8% (n = 2)</td>
</tr>
<tr>
<td>Torture</td>
<td>0%</td>
<td>0%</td>
<td>4% (n = 1)</td>
</tr>
<tr>
<td>Other</td>
<td>17% (n = 4)</td>
<td>17% (n = 4)</td>
<td>0%</td>
</tr>
<tr>
<td>IES-R Total (target event)</td>
<td>8.83 (11.02)</td>
<td>34.48 (24.96)</td>
<td>43.41 (20.78)</td>
</tr>
<tr>
<td>Intrusion</td>
<td>.46 (.57)</td>
<td>1.70 (1.25)</td>
<td>1.99 (1.07)</td>
</tr>
<tr>
<td>Avoidance</td>
<td>.44 (.59)</td>
<td>1.42 (1.06)</td>
<td>2.05 (1.10)</td>
</tr>
<tr>
<td>Hyperarousal</td>
<td>.26 (.43)</td>
<td>1.52 (1.43)</td>
<td>1.85 (1.24)</td>
</tr>
<tr>
<td>PDEQ (target event)</td>
<td>2.42 (.82)</td>
<td>2.58 (1.02)</td>
<td>3.41 (.89)</td>
</tr>
</tbody>
</table>

Note. IES-R = Impact of Event Scale-Revised, PDEQ = Peritraumatic Dissociative Experiences Questionnaire. Except where noted, values refer to mean and (standard deviation) scores.
Psychophysiological Responsivity to Script-Driven Imagery

Prior to analyses, the psychophysiological data were examined for multivariate outliers however none were detected. Group data was also examined for univariate outliers, and extreme outliers (>±2 standard deviations from mean) were transformed by replacing the score with the mean ± 2 standard deviations (Field, 2009). Despite these adjustments, Kolmogorov-Smirnov tests revealed non-normally distributed data for some of the variables. Log and square root transformations were attempted but minimal, if any, improvements to normality were observed. Due to the relatively small sample sizes and nature of the data, other transformations were considered unlikely to produce improved normality across most of the variables hence untransformed data were retained for analyses.

As displayed in Table 4.3, control, depressed and PTSD groups did not differ on mean baseline HR or SC measures, suggesting that prior to the script-driven imagery task the groups were experiencing similar levels of physiological arousal.

Table 4.3

<table>
<thead>
<tr>
<th></th>
<th>Control (n = 24)</th>
<th>Depressed (n = 24)</th>
<th>PTSD (n = 24)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR (bpm)</td>
<td>70.90 (8.23)</td>
<td>76.22 (11.43)</td>
<td>74.66 (12.80)</td>
</tr>
<tr>
<td>SC (µohms)</td>
<td>7.07 (4.71)</td>
<td>4.83 (3.50)</td>
<td>7.10 (5.08)</td>
</tr>
</tbody>
</table>

Note. HR = heart rate (bpm, beats per minute), SC = skin conductance. Values refer to mean and (standard deviation) scores.

Script order effects. While the presentation of Target and Other narratives was counterbalanced within groups, one-way group ANOVAs were conducted to determine whether script order had an impact on HR or SC responsivity. Some order effects were detected at different test phases for the depressed and PTSD
groups \((p < .05)\). Specifically, for the depressed group, participants who received the Target script first exhibited a larger SC response during the Target script phase than depressed participants who received the Target script second. For the PTSD group, SC responses during the Other script phase were different, with those receiving the Other script first returning a larger response on this phase than participants who received the Other script second. No group script ordering effects for HR were detected. As such, HR and SC responsivity was examined using mixed 3 x (3), Group by Script Type analyses of covariance (ANCOVAs), with script order entered as a covariate.

**Heart rate and skin conductance responsivity to script phases.** Figures 4.1 and 4.2 display the covariate-adjusted means and standard errors for HR and SC responses to Script phases, broken down by Group. A significant main effect was detected for Narrative Type on HR responsivity \((F(1.77, 1894.00) = 8.65, p = .001, \text{partial } \eta^2 = .11)\). All follow-up comparisons with Bonferroni adjustments were significant such that collapsed across groups, HR responses were significantly greater for the Target compared to Neutral narrative HR (mean difference = 5.30 s; 95% CI = 3.64, 6.97; \(p = .000\)) and Target compared to the Other narrative (mean difference = 3.22 s; 95% CI = 1.57, 4.87; \(p = .000\)). The Other narrative also elicited greater HR responses than the Neutral narrative (mean difference = 2.08 s; 95% CI = .86, 3.30; \(p = .000\)).

A significant Group effect was also found for HR responsivity \((F(2, 68) = 7.33, p = .001, \text{partial } \eta^2 = .18)\). Bonferroni-adjusted comparisons found that collapsed across narrative types, there was no significant difference in HR responses between the control and depressed groups (mean difference = .66 ns; 95% CI = -1.83, 3.14; \(p = 1.00\)). However the PTSD group’s HR responses were significantly
greater than both control (mean difference = 2.99 s; 95% CI = .50, 5.48; \( p = .013 \)) and depressed participants (mean difference = 3.65 s; 95% CI = 1.16, 6.14; \( p = .002 \)).

More importantly, there was a significant Group by Script Type interaction \((F(3.54, 490.85) = 8.81, p = .000, partial \eta^2 = .21)\) for HR responsivity. To break down this interaction, one-way Group with Script Order ANCOVAs for each Narrative Type were conducted, followed by Bonferroni-adjusted pairwise comparisons. The groups did not differ in HR responsivity during the Neutral Script \((F(2, 68) = .69, p = .51, partial \eta^2 = .02)\). However, there was a significant Group effect for the Target Script \((F(2, 68) = 10.51, p = .000, partial \eta^2 = .24)\) with the PTSD group showing higher HR responsiveness compared to control (mean difference = 6.68 s; 95% CI = 2.23, 11.13; \( p = .001 \)) and depressed participants (mean difference = 7.63 s; 95% CI = 3.18, 12.08; \( p = .000 \)), while control and depressed participants did not differ (mean difference = .95 ns; 95% CI= -3.49, 5.39; \( p = 1.00 \)). There was also a significant Group effect for the Other Script \((F(2, 68) = 5.61, p = .006, partial \eta^2 = .14)\), with the PTSD group’s HR response significantly greater than that recorded for the control (mean difference = 3.25 s; 95% CI = .29, 6.21; \( p = .027 \)) and depressed groups (mean difference = 3.71 s; 95% CI = .75, 6.67; \( p = .009 \)). No significant difference was detected between the control and depressed groups (mean difference = .46 ns; 95% CI = -2.49, 3.41; \( p = 1.00 \)) on this measure.

Within-groups pairwise comparisons with Bonferroni adjustments confirmed that participants in each group responded with higher HR to the Target Script compared to the other scripts. The control group’s HR response was greater for the Target Script compared with the Neutral (mean difference = 2.90 ns; 95% CI = .60,
5.19; \( p = .01 \) and Other Script (mean difference = .2.33 ns; 95% CI = -.07, 4.73; \( p = .06 \)) while Neutral and Other Scripts did not differ (mean difference = -.57 ns; 95% CI = -1.81, .67; \( p = .75 \)). Similarly for the depressed group, HR responses were greater for the Target compared to Neutral (mean difference = 2.50 s; 95% CI = .01, 5.00; \( p = .049 \)) and Other Scripts (mean difference = 1.84 s; 95% CI = .51, 3.17; \( p = .005 \)), while Neutral and Other Scripts did not differ (mean difference = -.66 ns; 95% CI = -2.78, 1.45; \( p = 1.00 \)). Finally, for the PTSD group, HR responses were greater for the Target compared to the Neutral (mean difference = .10.51 s; 95% CI = 6.36, 14.65; \( p = .000 \)) and Other Scripts (mean difference = 5.50 s; 95% CI = .96, 10.04; \( p = .014 \)), while responses to the Other Script also exceeded that of the Neutral Script (mean difference = 5.01 s; 95% CI = 1.95, 8.06; \( p = .001 \)).

In terms of SC responsivity, a significant main effect was detected for Narrative Type (\( F(1.49, 101.03) = 12.72, p = .000, partial \eta^2 = .16 \)). Bonferroni-adjusted pairwise comparisons confirmed that SC responsivity was greater for Target compared to Neutral (mean difference = 1.01 s; 95% CI = .34, 1.68; \( p = .001 \)) and Other Scripts (mean difference = .91 s; 95% CI = .35, 1.48; \( p = .001 \)). Neutral and Other Scripts did not differ (mean difference = -.10 ns; 95% CI = -.47, .28; \( p = 1.00 \)). The main effect of Group for SC was not significant (\( F(2, 68) = 1.36, p = .26, partial \eta^2 = .04 \)). However, a significant interaction effect for Group by Narrative Type on SC responsivity was detected (\( F(2.97, 101.03) = 3.58, p = .017, partial \eta^2 = .10 \)). As above, one-way Group ANCOVAs were conducted to examine group differences across script phases. There were no Group differences in SC responses to the Neutral (\( F(2, 68) = 2.12, p = .13, partial \eta^2 = .06 \)) or Other (\( F(2, 68) = .74, p = .48, partial \eta^2 = .02 \)) Scripts. Groups also did not differ in SC responsivity to the
Target Script \( F(2, 68) = 2.91, p = .06, \text{partial } \eta^2 = .08 \), however there was a trend for greater responses to the Target Script among the PTSD group.

Within-groups pairwise comparisons with Bonferroni adjustments for Narrative Type revealed that neither the control nor depressed group’s SC responses differed between Script Types \((p > .05)\). However for the PTSD group, SC responses were greater for the Target compared to both Neutral (mean difference = 2.04 s; 95% CI = .58, 3.50; \( p = .004 \)) and Other (mean difference = 1.31 s; 95% CI = .08, 2.55; \( p = .03 \)) Scripts, with a non-significant trend for a greater response to the Other compared with the Neutral Script (mean difference = .73 ns; 95% CI = -.06, 1.51; \( p = .08 \)).
Figure 4.1. Covariate (script-order) adjusted mean heart rate responses (beats per minute) to Neutral, Target and Other Script and Imagery phases for control, depressed and PTSD groups. Error bars represent standard errors (SEM). * = PTSD > Control; PTSD > Depressed; ** = PTSD > Control.
Figure 4.2. Covariate (script-order) adjusted mean skin conductance responses (µohms) to Neutral, Target and Other Script and Imagery phases for control, depressed and PTSD groups. Error bars represent standard errors (SEM). * = PTSD > Depressed.
Heart rate and skin conductance responsivity to imagery phases.

Figures 4.1 and 4.2 also display the covariate-adjusted means and standard errors for HR and SC responses to Imagery phases, broken down by group. For HR responsivity, the main effect for Imagery Type was not significant \( F(1.65, 1933.83) = 1.04, p = .35, \text{ partial } \eta^2 = .02 \). Between-groups effects were also non-significant; although the PTSD group exhibited greater HR responsivity than the control and depressed groups, this difference failed to reach significance \( F(2, 68) = 2.87, p = .06, \text{ partial } \eta^2 = .08 \). However, there was a significant interaction effect for Group and Imagery Type \( F(3.31, 1933.83) = 3.02, p = .028, \text{ partial } \eta^2 = .08 \). As above, one-way Group ANCOVAs for each Imagery Type were conducted, followed by Bonferroni-adjusted pairwise comparisons. The Groups did not differ in HR responsivity during the Neutral Imagery phase \( F(2, 68) = 1.75, p = .18, \text{ partial } \eta^2 = .05 \) while non-significant trends for higher response scores in the PTSD group were detected for Target \( F(2, 68) = 3.10, p = .05, \text{ partial } \eta^2 = .08 \) and Other Imagery phases \( F(2, 68) = 2.99, p = .06, \text{ partial } \eta^2 = .08 \). Within-groups pairwise comparisons with Bonferroni adjustments for Imagery Type revealed that neither the control nor depressed group’s HR responses differed between phases \( p > .05 \), although there was a trend for a greater response to Target compared to Neutral Imagery for depressed participants \( \text{mean difference} = 2.17 \text{ ns; 95\% CI} = -.04, 4.40; p = .06 \). For the PTSD group however, greater HR responses were recorded for the Target compared to Neutral Imagery \( \text{mean difference} = 5.89 \text{ s; 95\% CI} = 1.56, 10.21; p = .006 \), and for the Other compared with the Neutral Imagery \( \text{mean difference} = 3.10 \text{ s; 95\% CI} = .99, 5.21; p = .003 \). There was no difference between the Target and Other Imagery phases \( \text{mean difference} = 2.78 \text{ ns; 95\% CI} = -1.82, 7.39; p = .40 \).
In terms of SC responsivity, a significant main effect was detected for Imagery Type ($F(1.49, 101.03) = 12.72, p = .000, \text{partial } \eta^2 = .16$). Follow-up comparisons revealed that SC responsivity was significantly greater for the Target compared to both Neutral (mean difference = 1.01 s; 95% CI = .34, 1.68; $p = .001$) and Other (mean difference = .91 s; 95% CI = .35, 1.48; $p = .001$) Imagery phases. However, there was no difference between Neutral and Other imagery phases (mean difference = -.10 ns; 95% CI = -.47, .28; $p = 1.00$). The main effect for Group was non-significant ($F(2, 68) = 1.36, p = .26, \text{partial } \eta^2 = .04$). However, there was a significant interaction effect across group and imagery type ($F(2.97, 101.03) = 3.58, p = .02, \text{partial } \eta^2 = .10$). To break down this interaction, one-way Group ANCOVAs for each Narrative Type were conducted. There were no Group differences in SC responses to the Neutral ($F(2, 68) = 2.09, p = .13, \text{partial } \eta^2 = .06$) or Other ($F(2, 68) = .29, p = .75, \text{partial } \eta^2 = .01$) Imagery phases. However, Groups did differ on SC responsivity to the Target Imagery phase ($F(2, 68) = 3.78, p = .03, \text{partial } \eta^2 = .10$). Bonferroni-adjusted pairwise comparisons revealed that the PTSD group exhibited higher SC responses to the Target Imagery phase than the depressed group (mean difference = 1.55 s; 95% CI = .16, 2.93; $p = .023$). No other comparisons were significant ($p > .05$).

Within groups pairwise comparisons with Bonferroni adjustments for Imagery Type revealed that the control group exhibited a greater SC response to the Target compared with Other Imagery (mean difference = 1.08 s; 95% CI = .06, 2.11; $p = .036$), while there was no difference between Neutral and Target (mean difference = -.65 ns; 95% CI = -2.03, .73; $p = .70$) or Neutral and Other Imagery phases (mean difference = .43 ns; 95% CI = -.39, 1.25; $p = .56$). For the depressed
group, there were no differences in SC responses between any of the Imagery Types ($p > .05$). Finally, for the PTSD group, SC responses were greater for the Target Imagery compared to Neutral Imagery (mean difference = 1.93 s; 95% CI = .40, 3.47; $p = .011$) and Other Imagery (mean difference = 1.44 s; 95% CI = .14, 2.74; $p = .027$) phases. There was no difference in SC response between the Neutral and Other Imagery phases (mean difference = -.50 ns; 95% CI = -1.35, .36; $p = .45$).

Summary of findings for the full sample. For all groups, HR responses were greatest for the Target, Other and Neutral Scripts, in that order. Groups did not differ in HR responsivity during the Neutral Script, however the Target Script elicited greater arousal among PTSD compared to control and depressed participants, while control and depressed participants did not differ. There was also a significant Group effect for the Other Script with the PTSD group’s mean HR response exceeding that of control and depressed participants. Within all three groups, higher HR responses were recorded for the Target compared to the Other scripts, however the PTSD group also demonstrated greater responsivity to the Other compared to the Neutral Script.

In terms of SC, Group main effects were not significant however responses to the Target exceeded those of the Neutral and Other Scripts, which did not differ. A non-significant trend was detected for greater responses to the Target Script in the PTSD compared to the depressed and control groups. Within groups, only PTSD participants exhibited hyperresponsivity to the Target script.

Imagery phase data was also examined; trends were detected for higher Target and Other Imagery responses among the PTSD compared to the depressed and control groups. Within-groups pairwise comparisons revealed no differences in HR responses across Imagery phases for either the control or depressed group. For
the PTSD group, HR responses to the Target and Other Imagery phases were similarly elevated and both exceeded HR responses to the Neutral Imagery phase.

Finally, in terms of SC responsivity, there was a significant interaction effect for Group and Imagery Type; groups did not differ in SC responses to the Neutral or Other Imagery phases however PTSD participants exhibited a larger SC response to the Target Imagery phase than the depressed group. No other effects were significant. Within-group comparisons for Imagery Type found that PTSD participants had a greater SC response to the Target than Neutral and Other Imagery phases. The control group also had a greater response to their Target compared with Other Imagery phase while the depressed group showed no differences in SC responses to any of the Imagery Types.

**Data for Participants Who Reported an Intrusive Memory during the Script-Driven Imagery Task**

Of the 72 participants who participated in the study, 65% (n = 47) reported experiencing an IM during the script-driven imagery task. This represented 46% (n = 11) of the control group, 58% (n = 14) of the depressed group, and 92% (n = 22) of the PTSD group. The following analyses involve only those participants who reported an IM during the task.

**Demographic and General Clinical Characteristics.** The demographic and clinical characteristics of the IM cohort resembled that of the full sample (see Appendix I for a summary table). Namely, no group differences for gender, age, years of education or time since the Target or Other event were detected and the same pattern was observed for scores on the CES-D, PDS, IES-R, PDEQ and STAI. Likewise, the pattern of target event types across groups did not change substantially from the total sample; for the control group, the most common target event remained
death/illness/injury involving other (36%, \( n = 4 \)), for depressed participants, a negative interpersonal event was most frequently endorsed (43%, \( n = 6 \)) and for the PTSD group, death/illness/injury involving other and assault/abuse involving self were equally common (32%, \( n = 7 \) in each category).

**Psychophysiological Responsivity to Script-Driven Imagery.** Control, depressed and PTSD participants who reported an IM during the script-driven imagery task did not differ on mean baseline HR or SC measures (see Table 4.4) suggesting similar levels of physiological arousal prior to the task.

<table>
<thead>
<tr>
<th>Table 4.4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean Baseline Psychophysiological Measures for Participants who reported Intrusive Memories During the Script-Driven Imagery Task</strong></td>
</tr>
<tr>
<td>Control (( n = 11 ))</td>
</tr>
<tr>
<td>HR (bpm)</td>
</tr>
<tr>
<td>SC (µohms)</td>
</tr>
</tbody>
</table>

*Note. HR = heart rate (bpm, beats per minute), SC = skin conductance. Values refer to mean and (standard deviation) scores.*

**Heart rate and skin conductance responsivity to script phases.** As with the full sample, mixed between and within ANCOVAs were conducted to examine group differences with script order entered as a covariate. Figures 4.3 and 4.4 display the covariate-adjusted means and standard errors for HR and SC responses to script and imagery phases for participants who reported an IM, broken down by group. The pattern of results for the IM-reporting subset paralleled those of the full sample, with some loss of interaction and simple effects likely due to reduced power with smaller sample sizes. Specifically, a significant main effect was detected for Script Type on HR responsivity (\( F(2,86) = 4.73, p = .011, partial \eta^2 = .10 \)). All follow-up comparisons were significant; HR responses were significantly greater for
the Target compared to Neutral (mean difference = 5.43 s; 95% CI = 3.15, 7.72; \( p = .000 \)) and Other (mean difference = 3.23 s; 95% CI = .86, 5.69; \( p = .005 \)) Scripts, and the Other Script also elicited greater HR responses than the Neutral Script (mean difference = 2.16 s; 95% CI = .41, 3.91; \( p = .01 \)). As with the full sample, a significant Group effect was also found for HR responsivity (\( F(2, 43) = 7.43, p = .002, partial \eta^2 = .26 \)). There was no significant difference in HR responses between the control and depressed groups (mean difference = .88 ns; 95% CI = -2.17, 3.94; \( p = .56 \)). However the PTSD group’s HR responses were significantly greater than both controls (mean difference = 3.71 s; 95% CI = .29, 7.14; \( p = .03 \)) and depressed participants (mean difference = 4.60 s; 95% CI = 1.36, 7.83; \( p = .003 \)).

A significant Group and Script Type interaction for HR responsivity was detected (\( F(4, 86) = 6.78, p = .000, partial \eta^2 = .24 \)). As above, one-way Group ANCOVAs for each Script Type were conducted, followed by Bonferroni-adjusted pairwise comparisons. Groups did not differ in HR responsivity during the neutral script (\( F(2, 43) = .52, p = .60, partial \eta^2 = .02 \)). However, Group HR responses to the Target Script were significantly different (\( F(2, 43) = 9.23, p = .000, partial \eta^2 = .30 \)) with the PTSD group showing higher HR responsivity compared to control (mean difference = 8.16 s; 95% CI = 1.96, 14.36; \( p = .006 \)) and depressed participants (mean difference = 8.59 s; 95% CI = 3.00, 14.71; \( p = .001 \)), while control and depressed participants did not differ (mean difference = .70 ns; 95% CI = -6.13, 7.52; \( p = 1.00 \)). There was also a significant Group effect for the Other Script (\( F(2, 43) = 5.35, p = .008, partial \eta^2 = .20 \)) with the PTSD group’s HR response significantly greater than that of the depressed group (mean difference = 4.65 s; 95% CI = .76, 8.55; \( p = .014 \)). There was a non-significant trend in the same direction between the PTSD and the control groups (mean difference = 3.88 ns; 95%
CI = -.25, 8.00; \( p = .07 \)). Likewise, no difference was detected between the control and depressed groups on this measure (mean difference = .78 ns; 95% CI = -3.77, 5.32; \( p = 1.00 \)). Within-groups comparisons found nil significant differences in HR responsivity between the Script Types for the control group (\( p > .05 \)). For the depressed group, responses were greater for the Target compared to Other Script (mean difference = 2.41 s; 95% CI = .52, 4.30; \( p = .012 \)) but no other comparisons were significant (\( p > .05 \)). For the PTSD group, HR responses were greater for the Target compared to the Neutral (mean difference = 11.36 s; 95% CI = 7.12, 15.60; \( p = .000 \)) and Other Scripts (mean difference = 5.84 s; 95% CI = .89, 10.79; \( p = .018 \)), and Other Script responses also exceeded those of the Neutral Script (mean difference = 5.52 ns; 95% CI = 2.32, 8.73; \( p = .001 \)).

In terms of SC responsivity, a significant main effect was detected for Script Type (\( F(1.55, 66.59) = 8.07, p = .002, \text{partial } \eta^2 = .16 \)). Although SC responsivity was greater for Target than Neutral Scripts, this difference fell short of significance (mean difference = .80 ns; 95% CI = -.05, 1.64; \( p = .07 \)). However, SC responsivity was significantly greater for Target compared to Other Scripts (mean difference = .75 s; 95% CI = .06, 1.44; \( p = .03 \)), while no difference was found for Neutral and Other Scripts (mean difference = -.05 ns; 95% CI = -.56, .46; \( p = 1.00 \)).

No main group effect for SC responsivity across Script Types was detected (\( F(2, 43) = .65, p = .53, \text{partial } \eta^2 = .03 \)). However, there was a significant Group and Script Type interaction (\( F(3.10, 66.59) = 3.82, p = .013, \text{partial } \eta^2 = .15 \)) for SC responsivity. To break down this interaction, one-way Group ANCOVAs for each Script Type were conducted, followed by Bonferroni-adjusted pairwise comparisons. The Groups did not differ in SC responsivity for any of the Script
Types ($p > .05$), although there was a trend for greater responsivity in the PTSD group during the Target Script ($F(2, 43) = 3.12, p = .054$, partial $\eta^2 = .13$).

Within-groups pairwise comparisons found no differences in control group SC responsivity ($p > .05$). However for the depressed group, SC responses to the Neutral Script were greater than for the Other Script (mean difference = .50 s; 95% CI = .12, .88; $p = .01$), while remaining comparisons were non-significant ($p > .05$). For the PTSD group, SC responses to the Target Script were greater than both the Neutral (mean difference = 2.13 s; 95% CI = .53, 3.72; $p = .007$) and Other Scripts (mean difference = 1.34 s; 95% CI = .03, 2.73; $p = .045$), which in turn did not differ (mean difference = -.75 s; 95% CI = -1.61, .11; $p = .10$).
Figure 4.3. Covariate (script-order) adjusted mean heart rate responses (beats per minute) to Neutral, Target and Other Script and Imagery phases for participants who reported an intrusive memory during the script-driven imagery task, across control, depressed and PTSD groups. Error bars represent standard errors (SEM). * = PTSD > Control; PTSD > Depressed; ** = PTSD > Depressed.
Figure 4.4. Covariate (script-order) adjusted mean skin conductance response (µohms) to Neutral, Target and Other Script and Imagery phases for participants who reported an intrusive memory during the script-driven imagery task, across control, depressed and PTSD groups. Error bars represent standard errors (SEM). Significant (group x script) and (group x imagery) interactions were detected however simple effects did not reach significance ($p > .05$).
Heart rate and skin conductance responsivity to imagery phases. Figures 4.3 and 4.4 also display the covariate-adjusted means and standard errors for HR and SC responses to Imagery phases, broken down by group. Examining HR responsivity first, main effects for Imagery Type ($F(1.53, 65.75) = .68, p = .47, \text{partial } \eta^2 = .02$), Group ($F(2, 43) = 2.05, p = .14, \text{partial } \eta^2 = .09$) and the Imagery by Group interaction ($F(3.06, 65.75) = 1.99, p = .12, \text{partial } \eta^2 = .09$) were not significant. In terms of SC responsivity, a significant main effect was detected for narrative type ($F(1.64, 70.42) = 9.12, p = .001, \text{partial } \eta^2 = .18$). Follow-up comparisons revealed that SC responsivity was significantly greater for the Target compared to Neutral Imagery (mean difference $= .87$ s; 95% CI = -.02, 1.71; $p = .04$) and Other Imagery phases (mean difference $= .80$ s; 95% CI = -.07, 1.52; $p = .03$) while SC responses did not differ for Neutral compared with Other narratives (mean difference $= -.07$ ns; 95% CI = -.62, .47; $p = 1.00$). The main effect for Group was non-significant ($F(2, 43) = .70, p = .50, \text{partial } \eta^2 = .03$) however there was a significant interaction effect across Group and Script Type ($F(3.28, 70.42) = 3.55, p = .02, \text{partial } \eta^2 = .14$). To break down this interaction, one-way Group ANCOVAs for each Imagery Type were conducted, followed by Bonferroni-adjusted pairwise comparisons. The Groups did not differ on SC responsivity for any of the Imagery phases ($p > .05$) although for the Target Imagery, a non-significant trend for higher response scores in the PTSD group was detected ($F(2, 43) = 3.12, p = .054, \text{partial } \eta^2 = .13$). Within-groups pairwise comparisons with Bonferroni adjustments for Imagery Type revealed that, as with the full sample, neither the control nor depressed group's HR responses differed between phases ($p > .05$). For the PTSD group however, greater SC responses were recorded for the Target compared
to both Neutral (mean difference = 2.15 s; 95% CI = .52, 3.78; \( p = .008 \)) and Other Imagery phases (mean difference = 1.55 s; 95% CI = .13, 2.96; \( p = .03 \)). There was no difference between the Neutral and Other phases (mean difference = -.60 ns; 95% CI = -1.52, .31; \( p = .30 \)).

**Self-Reported Characteristics of Intrusive Memories Experienced during the Script-Driven Imagery Task**

Following the script-driven imagery task, participants completed a shortened version of the IMQ adapted from Study 1. Collapsed across groups, participants who reported an IM during the script-driven imagery task rated their overall memory of the event as more distressing than those participants who did not experience an IM during the task (\( M = 77.74, SD = 17.67 \) and \( M = 45.40, SD = 26.81 \) respectively; \( F(1, 70) = 37.81, p = .000 \)). While in the same order, ratings of the vividness of the memory did not differ (\( M = 83.40, SD = 16.83 \) and \( M = 72.20, SD = 24.11 \) respectively; Welch's \( F(1, 36.76) = 4.29, p = .05 \)).

Participants who reported IMs during the script-driven imagery task then provided ratings of these IMs on a range of experiential domains. Kolmogorov-Smirnov tests revealed non-normally distributed data for some of the variables. Square root transformations were attempted but did not improve normality for most variables. Due to the relatively small sample sizes, other transformations were considered unlikely to produce improved normality across most of the variables hence untransformed data were retained for analyses. Planned contrasts were conducted which compared the control and depressed groups, and the depressed and PTSD groups. A Bonferroni correction was applied so all effects are reported at a .006 level of significance.
Emotive quality of IMs experienced during the script-driven imagery task.

Mean ratings (with standard error bars) of the emotional quality (self-ratings of anger, fear, guilt, helplessness, sadness and shame) of the script-driven IMs are displayed in Figure 4.5. A significant effect was found for greater levels of IM-related anger within the depressed ($M = 39.64, SD = 37.39$) compared to control group ($M = 4.09, SD = 9.17$; $t(14.95) = -3.43, p = .004$) while the depressed and PTSD ($M = 42.05, SD = 39.24$) groups did not differ ($t(28.84) = -.18, p = .86$). No other contrasts were significant ($p > .006$).

Vividness, nowness and physical sensations associated with IMs experienced during the script-driven imagery task. Participants provided ratings of the vividness and degree of nowness which accompanied their IMs during the script-driven imagery task. Mean ratings (with standard error bars) are displayed in Figure 4.6. No differences were detected on vividness ratings between the control ($M = 58.00, SD = 31.15$) and depressed ($M = 80.00, SD = 10.95$; $t(4.83) = -1.50, p = .20$) groups or between the depressed and PTSD groups ($M = 77.50, SD = 16.17$; $t(14.18) = .39, p = .71$). Similarly, ratings of nowness did not differ between control ($M = 38.18, SD = 32.43$) and depressed ($M = 56.36, SD = 27.85$; $t(44) = -1.67, p = .10$) or depressed and PTSD groups ($M = 71.91, SD = 23.26; t(44) = -1.69, p = .10$). In terms of IM-related physical sensations, the control ($M = 59.55, SD = 28.59$) and depressed groups ($M = 57.50, SD = 29.40; t(44) = .21, p = .84$) did not differ, however PTSD participants reported higher ratings of IM-related physical sensations ($M = 79.77, SD = 17.96$) than the depressed group ($t(44) = -2.67, p = .005$, 1-tailed).
Figure 4.5. Emotions associated with intrusive memories experienced during the script-driven imagery task. Figure represents mean ratings (0-100) and error bars represent standard errors (SEM). * = Depressed > Control.

Figure 4.6. Additional self-rated characteristics of intrusive memories experienced during the script-driven imagery task. Figure represents mean ratings (0-100) and error bars represent standard errors (SEM). * = PTSD > Depressed (1-tailed test).
Associations between characteristics of script-driven imagery IMs, depression and PTSD severity. Following Williams and Moulds (2007b), Pearson’s r correlations were conducted to explore within-group relationships between depression and PTSD severity and the self-reported characteristics of vividness, nowness and physical sensations of the IMs induced during the script-driven imagery task. Bonferroni corrections were applied so results are reported at the .01 level of significance. The depressed group’s dysphoria scores as indexed by the CES-D were positively correlated with intrusion vividness \(r = .73, p = .003\) but not to physical sensations \(r = .33, p = .25\) or nowness \(r = .26, p = .37\). PTSD group symptom severity as indexed by the PDS was correlated with intrusion nowness \(r = .54, p = .009\) and physical sensations \(r = .61, p = .003\), but not with vividness \(r = .24, p = .29\).

Summary of findings for participants who reported an IM during the script-driven imagery task. The pattern of results for the IM-reporting subset paralleled those of the full sample above, with some loss of interaction and simple effects likely due to reduced power with smaller sample sizes. The main effect for Script Type was significant, with greater HR responses recorded for the Target compared to Other Script, which exceeded those for the Neutral Script. A significant Group effect was also found for HR responsivity. This was due to greater HR responses among the PTSD group across all Script Types compared with control and depressed groups, while control and depressed groups did not differ. An interaction effect was detected whereby Groups did not differ on the Neutral Script however the mean HR response to the Target Script was significantly greater for PTSD compared to control.
and depressed groups, which did not differ. Finally, the PTSD group's HR response to the Other Script was also significantly greater than that of the depressed group. Within-groups comparisons found no significant differences in HR responsivity between the Script Types for the control group, while for the depressed group, responses were greater for the Target compared to Other Script only. For the PTSD group, mean HR responses to the Target Script exceeded that of the Other Script which was in turn greater than responses to the Neutral Script.

In terms of SC responsivity, a significant main effect was detected for Script Type which reflected greater responses for Target compared to Other Scripts. No main Group effect across Script Types was detected yet there was a significant interaction. However follow-up tests revealed a trend only for greater responsivity in the PTSD group during the Target Script. Within-groups pairwise comparisons found few differences for the depressed or control groups, yet for the PTSD group, SC responses to the Target Script were greater than responses to both the Neutral and Other Scripts.

For the Imagery phases, no significant Group, Imagery Type or interaction effects for HR responsivity were found. In terms of SC, the Target Imagery phase triggered greater responses than Neutral and Other Imagery phases, which in turn, did not differ. No main effect for Group was detected. A Group by Script Type interaction revealed one non-significant trend for higher responses to the Target Imagery phase for the PTSD group. Within-group comparisons of SC responses across Imagery phases revealed no effects for either the control or depressed group. However for the PTSD group, SC responses to Target Imagery exceeded both Neutral and Other Imagery responses.
For self-report data collapsed across groups, participants who reported an IM during the script-driven imagery task experienced the overall memory of their target event as significantly more distressing but equally vivid as participants who did not experience an IM during the task. For participants who reported IMs during the script-driven imagery task, depressed group IMs were accompanied by significantly higher levels of anger compared to the control group, while the depressed and PTSD groups did not differ. The PTSD group also reported significantly higher levels of IM-related physical sensations than the depressed group, while the depressed and control participants did not differ. The remaining comparisons detected no differences between control and depressed groups, and depressed and PTSD groups, on ratings of IM vividness or degree of nowness. However, within the depressed group, significant positive correlations were found for IM vividness and depression severity, while for PTSD participants, higher ratings of IM-related nowness and physical sensations, but not vividness, were associated with more severe PTSD symptoms.
Discussion

Study 2 aimed to build upon the findings of Study 1 by providing an objective examination of physiological responsivity to trigger event recall.

**Psychophysiological Findings**

Overall, the Script phase change scores were more revealing than the Imagery phase changes scores, though the pattern of responses was similar. While the groups showed similar levels of physiological arousal at baseline and similar responsivity to the Neutral Script, between-groups analyses of HR data for the full sample revealed greater responsivity to Target Scripts in the PTSD group. While SC data followed the same pattern, the between-group differences fell short of significance. However, an examination of within-group SC responses across narrative types revealed that the PTSD group alone, exhibited consistent hyperresponsivity to the Target Script.

Analyses were also conducted only on the subset of participants who reported the occurrence of IMs during the script-driven imagery task. These findings mirrored those of the full sample, with some loss of effects likely due to the smaller sample sizes involved. It should be noted that the PTSD group’s HR responses to the Other Script were also significantly greater than the depressed and control group responses which could suggest a general level of hyperresponsivity within the PTSD group. However, this effect may have reflected a methodological issue, namely, participants were asked to report on “another negative event which occurred around the same time as the Target event, but was not linked with it”, leaving open the possibility that the PTSD group’s Other negative event may also have been traumatic in nature, in which case IMs and
hyperarousal would be expected. Indeed, previous studies which have adopted the script-driven imagery paradigm and compared responding to other non-traumatic stressful events did not find elevated responding to the non-trauma event in the PTSD group (Lindauer et al., 2006). Furthermore, studies which have compared the psychophysiological responsivity of PTSD, trauma-exposed control and normal control participants on a range of arousing stimuli have also found the physiological differences in PTSD to be trauma-specific (Casada, Amdur, Larsen, & Libezon, 1998).

**Self-Report Findings**

Collapsed across groups, participants who reported an IM during the task rated their overall experience of recalling the event as more distressing than those who did not. Although causal conclusions cannot be drawn, this finding suggests a relationship between the occurrence of IMs and the level of subjective distress experienced when recalling a negative life event. On the other hand, no such difference was detected for ratings of IM vividness which suggests that vividness is likely to be a universal feature of emotional memories and IMs generally (Birrer et al., 2007; Talarico, LaBar, & Rubin, 2004).

Self-report ratings were consistent with psychophysiological findings such that the PTSD group endorsed higher levels of IM-related physical sensations than the control and depressed cohorts. Like Study 1, this finding was in contrast with Reynolds and Brewin (1999) who found no difference in self-reported IM-related physical sensations in depressed and PTSD participants. This discrepancy could have been due to the more sensitive self-report measures used in the current study. In any case, considering that depressed patients may have difficulties with accurate reporting of
physiological states (Dunn et al., 2007), the combined self-report and physiological data enhance confidence in the current findings.

**Evidence of Data-Driven Processing Dominance in PTSD Intrusive Memories**

Overall, the script-driven imagery results of Study 2 were as expected and in line with past studies, with the PTSD group demonstrating significantly greater physiological (particularly HR) responses to reminders of their trigger events than depressed or control groups, consistent with suggestions of a distinct reliving quality to PTSD intrusions (Lindauer et al., 2006; Pitman et al., 1990; Pitman et al., 1987). Such results may be explained by influential models of PTSD (Brewin, Dalgleish et al., 1996; Brewin et al., 2010; Ehlers & Clark, 2000) which propose that high levels of emotional and physiological arousal during an event may trigger a shift towards data-driven or perceptual processing and encoding, resulting in memories for the event which are rich in sensory-perceptual detail but poorly contextualised. The lack of contextualisation or elaboration within the autobiographical memory base renders these memories partly or completely unavailable to conscious recall. Such memories enter consciousness via the automatic triggering by perceptual cues or other reminders of the event and are accompanied by a re-experiencing of the emotional and physical sensations from the time of the original event, including a sense of current threat and heightened physiological arousal.

There are several theoretical and clinical implications of elevated physiological responding whilst recalling trigger events in PTSD. As discussed previously, high levels of emotional and physiological arousal at the time of encoding may have a detrimental effect on memory processing, encoding and subsequent recall performance.
(Cavenett & Nixon, 2006; Deffenbacher, 1983, cited in Christianson, 1992). However heightened physiological arousal at recall also interferes with memory retrieval and may have consequences for treatment (Kenny, 2006). These clinical considerations are reviewed in more detail in the General Discussion.

Despite endorsing comparably intense IM-related emotions as the PTSD group and higher levels of IM-related anger and State anxiety (as indexed by the STAI) than controls just prior to the script-driven imagery task, the depressed group’s physiologic responsivity to their Target scripts was significantly lower than the PTSD group’s and did not differ from controls. Considering the evidence for some degree of specificity in autonomic responding to emotions (see reviews by Cacioppo, Berntson, Larsen, Poehlmann, & Ito, 2000; Kreibig, 2010; Stemmler, 2004), the divergent responses to the script-driven imagery task in the current study could suggest some important differences in the remembering experiences of trigger events in PTSD and depression. In DRT terms it might be argued that the IMs in depression do not arise from the same shift in perceptual processing, are therefore better contextualised and not accompanied by the degree of reliving or flashback quality that occurs in PTSD. This corresponds with recent findings which suggest that while IMs may be a transdiagnostic feature of several disorders including major depression, flashbacks are a qualitatively different form of IM which may be unique to PTSD (Bryant et al., 2011). The main difference between flashbacks and other IMs is that while IMs may be accompanied by varying degrees of subjective nowness (Hackmann et al., 2004, cited in Michael et al., 2005), flashbacks represent an “immersion in the trauma memory” (Bryant et al., 2011, p. 845) characterised by a complete loss of present moment awareness or temporal context.
However, most studies which have compared IM qualities across PTSD and depression have not distinguished between IMs and specific flashback phenomena which may explain some of the mixed findings in the literature to date.

Indeed in the current study, strong associations were found between PTSD group ratings of IM-related nowness and physical sensations and PTSD severity, while weaker associations were detected between vividness and severity. In contrast, levels of dysphoria in the depressed group were strongly associated with IM vividness. This provides some support for the clinical significance of IM-related reliving/nowness and physical sensations in PTSD, and is consistent with cognitive theories which identify re-experiencing as a core feature of PTSD resulting from abnormalities in the processing, encoding and integration of trauma memories (Brewin, Dalgleish et al., 1996; Brewin et al., 2010; Ehlers & Clark, 2000).

In contrast, no such relationship was found between nowness, physical sensations and dysphoria in the depressed group, although the association between dysphoria and the vividness of IMs in depression remains to be explained. While causal conclusions cannot be drawn, it might be speculated that highly vivid IMs are more effective at cueing negative cognitive schema and appraisals which enhance low mood. Alternatively, depressed mood may enhance the subjective vividness of IMs in depression, similar to the way in which it has been shown to enhance recall of negative events and negative thinking biases (Teasdale, 1983). In summary, the pattern of associations between IM qualities and symptomatology across PTSD and depressed groups appears to be consistent with dominant cognitive models of PTSD and schema-based models of depression respectively.
Although the current study did not examine the severity of triggering events across groups, past research which included judged event severity found no connection between severity ratings and physiologic responses suggesting that "physiologic hyperreactivity derives not from severe experiences per se but rather from the disorder that may develop secondary to them" (Pitman et al., 1987, p. 974). Furthermore, research comparing PTSD and trauma-exposed, non-PTSD control subjects also found significantly greater HR responsivity to trauma scripts in the PTSD group, despite equivalent ratings of emotional responses. This suggests that hyperresponsivity is not due simply to the "traumatic" nature of the trigger event (Carson et al., 2000; Lindauer et al., 2006), but is likely to result from interacting situational and individual factors such as a tendency to dissociate or engage in experiential avoidance or data-driven processing during stressful events (Halligan et al., 2002; Kumpula, Orcutt, Bardeen, & Varkovitzky, 2011).

Returning to the current findings, it is possible that the observed lack of physiologic responding in the depressed group reflects some other ANS dysfunction. For example, more specialised psychophysiological research has identified abnormalities in heart-rate variability (HRV) in depression (for example, Park, Kim, & Ahn, 2008; Thayer, Smith, Rossy, Sollers, & Friedman, 1998; Yeragani et al., 1991). HRV represents the continuous interaction between the sympathetic and parasympathetic branches of the ANS in response to environmental changes. As such, HRV is considered to reflect one's autonomic flexibility or "capacity for regulated emotional responding" (Appelhans & Luecken, 2006, p. 230). In this way, suppressed HRV has been identified as a possible cause of a variety of mood and anxiety disorders.
In addition, electrodermal hypoactivity has been observed to occur with depression (e.g., Iacano, 1984, cited in Larkin, 2006) although it remains unclear whether hypoactivity represents a general feature of depression or of certain subtypes only (i.e., those presenting with psychotic, endogenous or psychomotor retardation symptoms) (see Dawson, Schell, & Filion, 2000, for a review). Since the current study did not attempt to distinguish between depressive subgroups it is possible that divergent ANS abnormalities may have masked physiological responses among certain participants. As such, further research is warranted to examine whether, and to what extent, physiological profiles in response to script-driven imagery tasks vary across subgroups of depressed patients.

Particular cognitive processing styles common in depression may also have had a suppressive effect on psychophysiological responding during the script-driven imagery task. For example, rumination has been shown to inhibit physiologic arousal in PTSD participants during the voluntary recall of traumatic events (Halligan, Michael, Wilhelm, Clark, & Ehlers, 2006). Possible inhibitory effects of rumination on the physiological responsivity to Trigger events in depression are worthy of further investigation as they may interfere with the emotional processing considered by theorists to be a key therapeutic goal of exposure therapy for depression (Hayes et al., 2007).

Summary

In summary, Study 2 aimed to strengthen the data on the similarities and differences of trigger event remembering and IM qualities within depression and PTSD. This study found that while the IMs of trigger events in depression and PTSD were
rated as similarly vivid and accompanied by a sense of nowness, ratings of nowness and physical sensations were positively associated with traumatic stress symptom severity in the PTSD group, but no such relationship was detected with levels of dysphoria in the depressed group. Furthermore, the degree of self-reported physical sensations and level of physiological arousal while recalling trigger events was greater for the PTSD group, which may have implications for treatment. For example, heightened physiological arousal during event recall in PTSD encourages the use of cognitive (e.g. thought suppression) or behavioural avoidance, which interferes with recovery and may perpetuate the disorder. Reducing physiological arousal and the use of associated avoidance strategies are therefore key targets for trauma-focussed therapy, which may not be applicable to depression.

Limitations of Study 2

The results of Study 2 need to be considered in light of several limitations. Firstly, as with Study 1, full diagnostic interviews were not conducted hence it is possible that comorbid disorders other than PTSD and depression may have influenced results, while the relatively small and heterogeneous samples may have reduced statistical power to detect certain effects.

Secondly, clinical subgroups which may have exhibited different physiological profiles during script-driven imagery (e.g. dissociative subtypes in PTSD, depressed participants with and without a history of trauma) were not identified in the current study.

Thirdly, it is acknowledged that no information on smoking habits, weight or similar variables which might have affected physiological responding during the
experiment was collected. However, the current research was intended only as an initial, exploratory study of script-driven imagery effects across control, depressed and PTSD groups and the results should be considered in this light.

Finally, further psychophysiological studies are required to unpack the similarities and differences of voluntary and involuntary recall of triggering events, including the role of HRV on script-driven imagery responding which was not examined here.

**Conclusion**

Notwithstanding the aforementioned limitations, the current findings highlight several differences between the voluntary and involuntary recall experiences of PTSD and depression, most notably, the dramatically heightened physiologic responses to trigger event recall among PTSD participants. Such findings may support the hypothesis that IMs in PTSD are characterised by relatively stronger sensory-perceptual and weaker contextual representations in memory, compared with the IMs in depression. While not directly tested in the current study, this pattern of results is also in line with suggestions that flashbacks arise from a separate sensory memory system due to PTSD-specific encoding conditions. Future studies which directly compare flashback with other IM phenomena, both within and between PTSD and other disorders, would help to clarify both the defining qualities and mechanisms underlying such reliving experiences in PTSD. Finally, from a clinical perspective, the lack of physiological responsivity to script-driven imagery of Trigger events in the depressed group and the possibility of ANS dysfunctions among certain subgroups, suggests the need for ongoing research and careful consideration of the method, goals and possible
contraindications of applying novel approaches, such as exposure-based interventions, to the treatment of depression.
CHAPTER 5: GENERAL DISCUSSION

The studies reported here compared the quality of IMs across PTSD, depressed and non-clinical groups. Together, Studies 1 and 2 addressed some of the limitations of previous research by adopting a multimethod approach which included self-report, narrative and physiological measures. Self-report and narrative methods examined theoretically-driven qualities including IM vividness, emotional and sensory content, accompanying physical sensations, degree of nowness and temporal context. In addition, groups were compared on the basis of their physiological reactivity during trigger event recall using heart rate and skin conductance responses to a script-driven imagery task. In so doing, this dissertation considered whether the IMs in depression and PTSD are likely to arise from common processes in memory or whether qualitative differences in re-experiencing phenomena exist (Bryant et al., 2011). This final chapter reviews the main findings, discusses the theoretical and clinical implications and limitations of the current studies, and considers directions for future research.

Main Findings and Theoretical Implications

Drawing from dominant theoretical models of PTSD (Brewin, Dalgleish et al., 1996; Brewin et al., 2010; Ehlers & Clark, 2000) it was predicted that the IMs in PTSD would differ from the IMs in depression in several ways. Specifically, the IMs in PTSD were expected to be more sensory (particularly visual) and possibly more vivid in nature, and associated with a greater sense of nowness, distress and physical sensations than the IMs in depression. The narrative data was expected to complement and strengthen the self-report data such that the IM segments of the PTSD narratives would
contain more sensory and primary emotion content (that is, references to fear and helplessness), switches to present tense, and reduced temporal context as indexed by fewer temporal markers, compared to non-intrusive memory segments, as well as the intrusive segments of the other groups.

Several findings from Study 1 were consistent with these predictions. Firstly, while the difference fell short of significance, more PTSD than depressed or control group participants described their primary IM as predominantly sensory-perceptual in nature. Similarly, the narrative data revealed a significantly higher proportion of sensory (mainly visual) content in the IM segments of PTSD narratives compared with the IM segments of the depressed and control group narratives, which failed to differ. As expected, the IM segments of the PTSD Target event narratives also contained significantly more sensory content than the non-intrusive or ordinary segments, although there were no differences in the sensory quality of intrusive and ordinary segments for depressed or control participants. Taken together, the combined group and narrative segment results indicate that IMs in PTSD are characteristically sensory-perceptual and may be distinguished from the IMs in depression and non-disordered controls by their stronger sensory-perceptual quality.

While the groups in the current research did not differ on ratings of IM-related nowness and PTSD IM narrative segments did not contain more switches to present tense as had been expected, Study 2 found that ratings of IM-related nowness and physical sensations were strongly positively correlated with PTSD symptom severity. In contrast, no such relationship was found between nowness, physical sensations and severity of dysphoria in the depressed group. In addition, the PTSD group endorsed
significantly higher ratings of IM-related physical sensations and distress than the depressed group, while the depressed and control groups did not differ on any of these measures. Finally, the IM segments of the PTSD narratives also contained fewer temporal markers than the ordinary memory segments suggesting a relative lack of temporal context during intrusive remembering for this group as predicted. However, no such difference was found for the depressed group, suggesting that both IM and ordinary memory segments were equally grounded in temporal context. Taken together, these findings provide support for the clinical significance of IM-related reliving/nowness and physical sensations in PTSD compared to depression, consistent with the view that IM re-experiencing in PTSD may result from abnormalities in the processing, encoding and integration of trauma memories.

Although conservative tests of significance revealed no difference between groups on ratings of IM-related emotions, results were in the expected direction with higher levels of fear for the PTSD than depressed group, while depressed group ratings of sadness were higher than those of the PTSD group. In addition, helplessness was the most prominent IM-related emotion for the PTSD group in both studies. This supports previous findings which have linked IMs in PTSD with danger-relevant emotions such as fear, helplessness and horror (Hagenaars, Brewin, Van Minnen, Holmes, & Hoogduin, 2010; Hellawell & Brewin, 2004).

It should also be noted that potential group differences in IM-related emotions may have been obscured by the current study’s definition of IMs which included both intrusive thoughts and intrusive images. Indeed, an analogue study published after the commencement of this dissertation found that different peritraumatic emotions are
related to subsequently different intrusive phenomena. Specifically, peritraumatic anxiety and horror were associated with a higher frequency of subsequent intrusive images but not intrusive thoughts, while results for peritraumatic anger and sadness were inconclusive (Hagenaars et al., 2010). This lends further support to aetiological accounts of IMs in PTSD, which highlight the role of threat and arousal-based changes in memory processing and the subsequent development of IMs of a highly sensory (predominantly visual) and distressing quality (Brewin, Dalgleish et al., 1996; Brewin et al., 2010; Ehlers & Clark, 2000). Although the current study did not investigate whether the IM-related emotions reported here matched participants’ peritraumatic emotional experiences, theoretical models of PTSD predict that this would be the case. In contrast, the extent to which this might apply to depression is unclear, necessitating further research in this field.

Analyses of the intrusive and ordinary memory segments within the depressed group revealed no differences on any of the narrative measures used in Study 1. This suggests that the IMs in depression may be less well accounted for by a shift in memory processing, and may be less likely to arise from a separate sensory-based memory system, as outlined by theoretical models of PTSD (Brewin, Dalgleish et al., 1996; Brewin et al., 2010; Ehlers & Clark, 2000). It might therefore be speculated that the IMs in depression derive more frequently from the verbal memory system, and/or consist of sensory-based memories with stronger and more numerous links to related contextual representations, than is typically the case for PTSD. Indeed, Hagenaars and colleagues (2010) found that intrusive thoughts and images develop under different circumstances and arise from two independent - although not necessarily competing -
memory systems, consistent with the DRT approach. More specifically, Brewin’s DRT model (Brewin, Dalgleish et al., 1996; Brewin et al., 2010) suggests that IMs can arise exclusively from a sensory-based memory system in the form of dissociative flashbacks, which are experienced as highly sensory and distressing memories devoid of present moment awareness. While other forms of IMs occur with a range of disorders, the conditions which give rise to flashback phenomena (namely, encoding under extreme threat or arousal and in the absence of accompanying contextual representations) may be unique to PTSD (Brewin et al., 2010); yet few studies have acknowledged this distinction. Similarly, studies have varied in their definition of IMs, with some focussing just on intrusive images (e.g. Reynolds & Brewin, 1999), while others have examined intrusive thoughts and images (e.g. Reynolds & Brewin, 1998), and yet others have failed to distinguish IMs from ruminative processes (e.g. Holman & Silver, 1998).

It was also interesting to note that the ordinary memory segments of depressed group narratives contained significantly more self-devaluative content than the PTSD and non-clinical groups. This may reflect the activation of prominent negative cognitive schema whilst voluntarily or involuntarily recalling a trigger event. While past studies have found higher levels of self-devaluative thinking to be associated with the maintenance of depression (Dent & Teasdale, 1988), the connection between IMs and self-devaluative statements in depression remains to be tested. It may be that self-devaluative thinking increases dysphoria which in turn increases intrusions, as suggested to be the case for rumination and intrusions (Newby & Moulds, 2012). In any case, further research is required to clarify the role of these interacting cognitive
phenomena in depression and how to best target therapy to maximise therapeutic change.

**A unique role of physiological arousal in PTSD?** Study 2 also provided a novel examination of the physiological arousal which accompanies recall of triggering or major negative life events across depressed, PTSD and non-clinical control groups. Although the clinical groups did not differ on self-report ratings of the overall level of distress associated with remembering the event, and although similar emotional responses to the IMs were recorded for both clinical groups, the PTSD group exhibited significantly greater physiological responsivity than the depressed group, while the depressed group did not differ from controls.

The divergent physiological responding of the PTSD and depressed groups may reflect differences in the quality of the underlying emotional experiences both at the time of the trauma and at the time of retrieval (see reviews by Cacioppo et al., 2000; Kreibig, 2010; Stemmler, 2004). Furthermore, given the link between imagery and increased emotional responding (Holmes, Geddes, Colom, & Goodwin, 2008; Holmes & Mathews, 2005), the sensory/visual nature of PTSD IMs may have contributed to the group's enhanced physiological reactivity observed during script-driven imagery tasks, though this hypothesis remains to be tested. In any case, such findings highlight the role of physiological arousal and connected symptoms of reliving and avoidance in PTSD as possible aetiological and maintaining factors in the disorder which may not apply in the same way to depression.

While the relationship between arousal and memory quality is complex (see Christianson, 1992, for a review), various studies have provided evidence of the
detrimental effects of high levels of emotional and physiological arousal on memory processing, encoding and subsequent recall performance (Cavenett & Nixon, 2006; Deffenbacher, 1983, cited in Christianson, 1992). Less well studied are the effects of heightened physiological arousal at recall, yet preliminary research suggests that it also interferes with memory retrieval and may have consequences for treatment (Kenny, 2006). For example, in the case of PTSD, the physiological arousal and unpleasant emotions which accompany voluntary or involuntary memories of traumatic events may activate cognitive suppression and other avoidance strategies aimed at lowering distress in the short-term. However, avoidant coping mechanisms ultimately perpetuate and exacerbate IMs and posttraumatic stress symptoms by interfering with the emotional processing and integration of IMs considered necessary for recovery by cognitive models of PTSD (Brewin, Dalgleish et al., 1996; Cruwys & O'Kearney, 2008; Ehlers & Clark, 2000). As such, a major focus of interventions such as exposure therapy for PTSD is to extinguish conditioned fear responses and to reduce physiological arousal and avoidance in response to trauma memories. How this applies to depression, given the lack of physiological reactivity to target event memories is unclear but it suggests that a different therapeutic emphasis may be warranted. Indeed, as discussed below, the current findings present several clinical implications with regards to IM symptoms and the adaptation of trauma-focussed interventions to the treatment of depression.

Clinical Implications

Taken together, Studies 1 and 2 concord with past findings (e.g. Brewin, Hunter et al., 1996) that IMs are a relatively common feature of depression which may cause subjectively similar levels of interference with daily functioning as the IMs in PTSD.
However, in the current study, depressed group ratings of IM-related distress were significantly lower than those of the PTSD group and not significantly different to the distress ratings of the non-clinical group. Likewise, the depressed group exhibited significantly lower physiological reactivity, whilst recalling their target events, than the PTSD group, and differed little from the non-clinical group on these measures.

These, and the other discrepancies in IM phenomenology between depression and PTSD identified here, suggest that careful consideration of clinical models and approaches are required prior to the application of trauma-focused interventions to the treatment of depression. For example, a certain level of physiological arousal during imaginal exposure for anxiety is both expected and desirable, as it indicates activation of the fear network, emotional engagement with exposure stimuli, and predicts a better response to treatment (Jaycox, Foa, & Morral, 1998; Kozak, Foa, & Steketee, 1988; Orr & Roth, 2000). However as the current findings suggest, if IMs in depression are already somewhat contextualised, if fear/anxiety is not the dominant emotional response and if IMs trigger depressogenic schema and self-devaluative thoughts (and vice versa), then adjunct or alternative interventions to exposure may be more appropriate. Indeed, evidence from PTSD research which may be applicable to depression suggests that cognitive restructuring is likely to be preferable to exposure therapy in the presence of prominent secondary emotions such as guilt or sadness related to shame or loss of self-worth (Zayfert & DeViva, 2010). Furthermore, according to Orr and Roth (2000), event memories which are accompanied by distressing emotional reactions in the absence of excessive physiological arousal (as observed for the depressed group in the Study 2), “might indicate that emotional resolution has occurred within the physiological, but not
the cognitive, mode of expression” (p. 235) warranting cognitive over exposure-based approaches to therapy.

Although recent studies have provided preliminary evidence of the efficacy of exposure-based therapies for depression (Hayes et al., 2007; Kandris & Moulds, 2008), proponents acknowledge that exposure therapy for depression “is not a pure exposure therapy, and the content and specific intervention strategies differ somewhat from exposure for specific anxiety disorders” (Hayes et al., 2007, p. 411). Furthermore, as with PTSD (Zayfert & DeViva, 2010), exposure therapy is unlikely to be suitable for all cases of depression and exposure-based therapies for depression cannot be justified by the presence of IMs alone. Further research on exposure-based therapies for depression is therefore required on a number of fronts: to identify the underlying mechanisms of change and in so doing, to strengthen the treatment rationale for this approach, to elucidate the clinical factors (e.g. subtypes and/or contraindications) for consideration when selecting exposure over other evidence-based therapies, and to further establish treatment efficacy.

Alternatively, imagery rescripting which has been used to treat negative mental imagery in a range of disorders (e.g. Arntz et al., 2007; Wild, Hackmann, & Clark, 2008), has also been suggested as a novel treatment for depression that may serve to reduce the distressing quality of IMs (Brewin et al., 2009; Wheatley & Hackmann, 2011). Rather than focusing on habituation or the extinction of memory-fear associations (the traditional treatment rationale for imaginal exposure) or on directly changing the negative beliefs associated with the original event and subsequent IMs (cognitive restructuring), imagery rescripting attempts to “construct a new
representation of the original memory that challenges its original meaning, and will hopefully be preferentially recalled over the toxic one” (Wheatley & Hackmann, 2011, p. 445). Cognitive therapy serves a somewhat similar purpose to imagery rescripting in that it attempts to overcome negative thinking by creating more balanced thoughts and beliefs to replace negatively-biased cognitions. However, techniques which directly target distressing images have been proposed on the basis that images trigger stronger emotional responses than verbal thoughts alone and may amplify psychopathological emotions (Holmes et al., 2008; Holmes & Mathews, 2005). As such, for cases with prominent distressing intrusive imagery, rescripted imagery rather than modified cognitions may be more likely to produce adaptive emotional responses. While further research is required, the connection between imagery and emotions, and preliminary findings suggesting that the IMs of both childhood and adult life events in depression respond well to imagery rescripting (Wheatley et al., 2009, cited in Wheatley & Hackmann, 2011), both underscore this approach as a potential treatment avenue for certain cases of depression.

Limitations of the Current Study and Directions for Future Research

Many of the limitations of Study 1 and 2 have been reviewed in detail previously. One of the more significant limitations of the current study was the use of mixed treatment and non-treatment seeking samples and the wide range of symptom severity within the clinical groups. As discussed, a lack of severity within the PTSD group may have obscured group differences on measures such as IM-related nowness and other features consistent with dissociative flashbacks in PTSD for example. Furthermore, while an individual’s response to a stressful event is multiply-determined,
the heterogeneous nature of the current samples is acknowledged considering that post-trauma symptomatology may be impacted by event type and intensity (Briere & Scott, 2006).

It is also acknowledged that the current research included PTSD participants with comorbid depression, consistent with past studies (e.g. Reynolds & Brewin, 1998; Reynolds & Brewin, 1999). While comparisons between the PTSD and depressed group may therefore have been impacted by comorbidity, as Reynolds and Brewin (1999) point out “whereas depressed patients frequently do not meet diagnostic criteria for PTSD, the degree of comorbidity for depression in PTSD patients means that it would be neither practicable nor representative to obtain a sample of PTSD patients who are uniformly nondepressed” (p. 204)\(^1\). Furthermore, the current study included both depressed and non-disordered control groups. This permitted conclusions to be drawn not just with respect to PTSD and depressed group discrepancies, but also with respect to how depressed and non-disordered control groups differed across IM features.

As discussed, the study did not identify other clinical subgroups which may have impacted the study outcomes, for example high/low dissociators or those who experience flashbacks in the PTSD group, depressed participants with or without a history of trauma, or first-episode versus recurrent episodes of depression. Indeed future studies may wish to directly compare “flashback” with other IM phenomena, both within and between PTSD and other disorders, in order to elucidate the defining features and mechanisms of this potentially unique reliving experience in PTSD. In

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1 Visual inspection of the mean scores across Studies 1 and 2 suggest that the PTSD participants with and without depression returned a similar pattern of results on most of the variables of interest when compared to the depressed group (see Appendix J).
light of calls for transdiagnostic approaches to psychopathology (Harvey et al., 2004), such research would provide much-needed clarification of this complex range of phenomena, leading to more elaborated and informed theoretical models, improved diagnostic criteria and targeted interventions.

Finally, although few between group differences were found for self-reported IM-related emotions, a limitation of self-report ratings is that they provide no information about the quality of the emotions of interest. For example, in enquiring about the levels of IM-related fear, the current study did not differentiate between fear of current threat and fear for the future, which may have better distinguished the clinical groups. Likewise, participants may have reported on feelings of “helplessness” related to higher level cognitive appraisals of one’s self-efficacy or self-esteem (which may be particularly relevant to depression) or on a sense of “helplessness” related to lower-level “freezing” or dissociative responses.

Such issues highlight the limitations of self-report assessments and query whether the measures used in much of the IM research to date have been sufficiently sensitive to detect nuanced differences in IM phenomenology. As Brewin and colleagues (2010) note, little is known about the internal and external conditions that may affect intrusion reports or about “how accurately these interview questions assess and discriminate the different dimensions of experience” (p. 212). Hence further research is required to address these measurement concerns and to strengthen confidence in this complex field of enquiry.
Concluding Comments

Autobiographical and IM phenomena have long been recognised as traditionally difficult areas to research. Yet by combining established experimental techniques in an innovative way, the current findings provide compelling evidence for key phenomenological differences in the IMs of PTSD compared to depression.

Specifically, IMs in PTSD were found to be more sensory-perceptual in nature, accompanied by more physical sensations and rated as more distressing than the IMs in depression. The IMs in PTSD were also characterised by a lack of temporal context compared to ordinary memory segments, a difference which was not observed for the depressed group. Furthermore, ratings of IM nowness and physical sensations were associated with post-traumatic stress symptom severity in the PTSD group, but not to levels of dysphoria in the depressed group. Self-reported helplessness and fear may have been more prominent with PTSD group IMs, however these findings did not reach statistical significance. Physiological responses whilst listening to and imagining the Target event during a script-driven imagery task were also significantly greater for the PTSD than depressed participants, while depressed and control participants did not differ. Despite some variations in frequency and levels of IM-related interference and emotions, the overall quality of depressed group IMs was strikingly similar to that reported by the non-clinical group.

As outlined by dominant theoretical models of PTSD, such differences may be due to shifts in processing and encoding during PTSD index events which are triggered by extreme levels of fear and arousal, and possibly influenced by pre-existing vulnerabilities such as trait-like tendencies for data-driven processing during stressful
events (Halligan et al., 2002). In some cases, IMs in PTSD may occur as dissociative flashbacks, which may be a qualitatively different form of IM phenomena unique to PTSD (Bryant et al., 2011).

In contrast, the IMs of trigger events in depression demonstrated many similarities with the IMs of the non-clinical group, consistent with the notion that IMs in depression, whilst distressing, may be better contextualised in the memory system and may reflect more top-down, schema-level processes, compared with IMs in PTSD. Interestingly, the non-intrusive segments of target event narratives for the depressed group also contained more self-devaluative statements compared to corresponding memory segments for the PTSD and control groups. Whilst definitive conclusions about the relationship between IMs and self-devaluative statements cannot be drawn here, such findings reinforce the role of schema-level processes in dysphoria.

In summary, given the presence of IM phenomena in depression and the amplification effects of negative imagery on psychopathological emotions (Holmes et al., 2008; Holmes & Mathews, 2005), the development of IM-focussed therapies for depression are of theoretical and clinical interest. Although interventions such as imaginal exposure and imagery rescripting may hold therapeutic promise for certain subtypes of depression, research in this area remains in its infancy. Indeed, this dissertation has highlighted important discrepancies in the IM phenomenology across these disorders, warranting caution over the direct application of trauma-based therapies for depression. Clearly, given the limitations of IM research to date, ongoing efforts are required to clarify the mechanisms which give rise to and maintain IMs in PTSD and depression, in addition to the role of IMs in perpetuating psychopathology. As
demonstrated here, multimethod approaches are underutilised in IM research, yet they may enable more robust conclusions to be drawn about the phenomenological overlap of IM experiences across disorders, and may contribute to the development of more appropriate, targeted and effective treatments over the long-term.
REFERENCES


APPENDIX A: STATEMENTS OF ANU HUMAN RESEARCH ETHICS COMMITTEE APPROVAL

Subject: Human Ethics Protocol 2008/519
To: lian.parry@anu.edu.au
Cc: richard.okearney@anu.edu.au, human.ethics.officer@anu.edu.au
Date: 02/04/09 10:53 AM
From: aries@anu.edu.au

THIS IS A SYSTEM-GENERATED E-MAIL. PLEASE DO NOT REPLY. SEE BELOW FOR E-MAIL CONTACT DETAILS.

Dear Ms Lian Parry,

Protocol: 2008/519
Intrusive memories in posttraumatic stress disorder and depression: A comparative analysis of cognitive, physiological and experiential features

I am pleased to advise you that your Human Ethics protocol received approval by the Chair of the HREC on 03/02/2009.

For your information:

1. Under the NHMRC/AVCC National Statement on Ethical Conduct in Human Research we are required to follow up research that we have approved. Once a year (or sooner for short projects) we shall request a brief report on any ethical issues which may have arisen during your research or whether it proceeded according to the plan outlined in the above protocol.

2. Please notify the committee of any changes to your protocol in the course of your research, and when you complete or cease working on the project.

3. Please notify the Committee immediately if any unforeseen events occur that might affect continued ethical acceptability of the research work.

4. The validity of the current approval is five years' maximum from the date shown approved. For longer projects you are required to seek renewed approval from the Committee.

All the best with your research,

Yolanda Shave
Ethics Manager
Office of Research Integrity
Research Office
Chancellor Building 10B
The Australian National University
Canberra, ACT 0200
E:human.ethics.officer@anu.edu.au or yolanda.shave@anu.edu.au
T: (02) 6125 7945
F: (02) 6125 4807
CRICOS Provider Code: 00120C
Dear Ms Lian Parry,

Protocol: 2008/519
Intrusive memories in post traumatic stress disorder and depression: A comparative analysis of cognitive, physiological and experiential features

I am pleased to advise the Chair of the Human Research Ethics Committee has approved the variation you submitted on 18/12/2009.

Please note: the Chair has advised the following:

"Variation approved. Request approval for new recruitment options when these are needed in 2010."

You may now commence your research as per your modified protocol.

All the best with your research,

Kim

Ms Kim Tiffen
Human Ethics Manager/ rDNA Committee Secretary
Office of Research Integrity
Research Office
Level 3
Innovations Building 124
Eggleston Road
The Australian National University
ACTON ACT 0200
T: +61 2 6125 3427
F: +61 2 6125 4807
Kim.Tiffen@anu.edu.au or human.ethics.officer@anu.edu.au

CRISCOS Provider Code: 00120C
Intrusive Memory Questionnaire

This questionnaire asks about the intrusive memories you may have experienced in relation to the traumatic event you have just written about.

Please read the instructions carefully and either circle your response or provide a rating (from 0 to 100) as required.

Intrusive memories may occur in the form of images of the event or a re-experiencing of the feelings, thoughts or sensations that you had at the time of the event.

For the purposes of this study, such experiences do not count as intrusive memories if they relate to a different event or if they are of something that you imagine did, or could have, happened.

Remember, intrusive memories refer to specific events or incidents that have actually happened to you and which pop into your mind without you trying to remember them.

If you have any questions, please ask the researcher.

Please turn over the page to start ......
Please read through the following questions about your intrusive memories and answer as accurately as possible.

PART A: Experiences of intrusive memories

1) Generally, to what degree do intrusive memories of the event you just wrote about interfere with your daily activities from 0 (Not at all) to 100 (Severely) (Give a rating):

Rating

Interference with daily activities

2) Did you experience any intrusive memories of this event in the past week? Please circle:

Yes / No

3) Did you experience any intrusive memories while you were writing about this event? Please circle:

Yes / No

If you circled “No” for Question 3, end here.

If you circled “Yes”, please highlight the segment(s) of the narrative where you experienced the intrusive memory or memories, then continue with the questionnaire.
4) Were the intrusive memories you experienced today similar to intrusive memories you may have experienced before? Please circle:

Yes / No

5) While writing about the event, did you experience more than one intrusive memory? Please circle:

Yes / No

6) If "yes", were these the same (i.e. repeating) or different intrusive memories? Please circle:

Same / Different

If you experienced (and therefore highlighted), more than one intrusive memory, identify which one distresses you the most by circling the corresponding segment in your narrative, then continue with the questionnaire.
PART B: The only/most distressing intrusive memory

If you experienced only one intrusive memory while writing about the event, answer the following questions with respect to that intrusive memory.

If you experienced more than one intrusive memory while writing about the event, please answer the following questions about the intrusive memory you identified as the most distressing.

1) a. While writing about the event, was your most distressing intrusive memory experienced predominantly as a thought, feeling (e.g. fear, sadness) or sensory experience (e.g. sight/sound/taste/smell/touch)? (Circle one below)

1) Thought
2) Feeling
3) Sensory experience

b. If you circled “sensory experience” please rate to what degree the intrusive memories involved the following sensory qualities, from 0 (not at all) to 100 (very much so) (Give a rating for each option):

| My most distressing intrusive memory involved... | Rating (0-100): |
|-----------------------------------------------|-----------------
| Visual scenes                                 |                 |
| Sounds                                        |                 |
| Taste/smell sensations                        |                 |
| Other bodily sensations                       |                 |
2) To what degree did the following emotions accompany your most distressing intrusive memory of this event, on a scale from 0 (Not at all) to 100 (Very much so) (Give a rating for each emotion):

<table>
<thead>
<tr>
<th>Emotion</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anger</td>
<td></td>
</tr>
<tr>
<td>Fear</td>
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<tr>
<td>Guilt</td>
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<tr>
<td>Helplessness</td>
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<tr>
<td>Sadness</td>
<td></td>
</tr>
<tr>
<td>Shame</td>
<td></td>
</tr>
<tr>
<td>If other, please specify:</td>
<td></td>
</tr>
</tbody>
</table>

3) How clear and vivid was your most distressing intrusive memory, from 0 (hazy) to 100 (most clear and vivid memory)? (Give a rating):

How clear and vivid was this intrusive memory | Rating

4) To what degree did strong physical sensations accompany your most distressing intrusive memory (e.g. heart racing, sweating, trembling, nausea, headaches, chills/flushes, butterflies in stomach, etc) from 0 (not at all) to 100 (very much so) (Give a rating):

<table>
<thead>
<tr>
<th>Presence of physical sensations</th>
<th>Rating</th>
</tr>
</thead>
</table>
5) During your most distressing intrusive memory, to what degree did it feel as if the event was happening in the here and now (that is, a sense of reliving the event) versus experiencing the memory as having happened in the past? Please rate the sense of “nowness” from 0 (not at all) to 100 (very much so) (Give a rating):

<table>
<thead>
<tr>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sense of “nowness”</td>
</tr>
</tbody>
</table>

6) a. How distressing was this intrusive memory of the event, from 0 (Not at all) to 100 (Severely) (Give a rating):

<table>
<thead>
<tr>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of distress</td>
</tr>
</tbody>
</table>

b. Which emotion best characterises this distress? Circle one:

1) Anger
2) Fear
3) Guilt
4) Helplessness
5) Sadness
6) Shame
7) Other
   Specify: _____________________________
7) How long does this intrusive memory of this event typically last? *Circle one:*

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Seconds</td>
</tr>
<tr>
<td>2</td>
<td>Minutes</td>
</tr>
<tr>
<td>3</td>
<td>Up to an hour</td>
</tr>
<tr>
<td>4</td>
<td>Several hours</td>
</tr>
<tr>
<td>5</td>
<td>Constantly preoccupied</td>
</tr>
</tbody>
</table>

8) How frequently do you experience this intrusive memory? *Circle one:*

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>1</td>
<td>Rarely - Once a week or less</td>
</tr>
<tr>
<td>2</td>
<td>Occasionally - Several times a week</td>
</tr>
<tr>
<td>3</td>
<td>Frequently - Several times a day</td>
</tr>
</tbody>
</table>
PART C: Experience of the other intrusive memories

Did you experience more than one intrusive memory while writing about the event?  
*Please circle:*  
Yes / No

*If you circled “No”, end here*

*If you circled “Yes”, please answer the following questions with respect to how you generally experienced these other intrusive memories:*

9) a. While writing about the event, were your other intrusive memories experienced predominantly as thoughts, feelings (e.g. fear, sadness) or sensory experiences (e.g. sight/sound/taste/smell/touch)? *(Circle one below)*

1) Thoughts  
2) Feelings  
3) Sensory experiences

b. If you circled “sensory experiences” please rate to what degree the intrusive memories involved the following sensory qualities, from 0 *(not at all)* to 100 *(very much so)* *(Give a rating for each option):*

<table>
<thead>
<tr>
<th>Generally, my other intrusive memories involved...</th>
<th>Rating (0-100):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual scenes</td>
<td></td>
</tr>
<tr>
<td>Sounds</td>
<td></td>
</tr>
<tr>
<td>Taste/smell sensations</td>
<td></td>
</tr>
<tr>
<td>Other bodily sensations</td>
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</tr>
</tbody>
</table>
10) Generally, to what degree did the following emotions accompany your other intrusive memories of this event on a scale from 0 (*Not at all*) to 100 (*Very much so*) (Give a rating for each emotion):

<table>
<thead>
<tr>
<th>Emotion</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anger</td>
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<td>Fear</td>
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<td>Guilt</td>
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<td>Helplessness</td>
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<tr>
<td>Sadness</td>
<td></td>
</tr>
<tr>
<td>Shame</td>
<td></td>
</tr>
<tr>
<td>If other, please specify:</td>
<td></td>
</tr>
</tbody>
</table>

11) How clear and vivid were these other intrusive memories, from 0 (*hazy*) to 100 (*most clear and vivid memory*)? (Give a rating):

<table>
<thead>
<tr>
<th>How clear and vivid were these other intrusive memories</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

12) To what degree did *strong physical sensations* accompany these other intrusive memories (e.g. heart racing, sweating, trembling, nausea, headaches, chills/flushes, butterflies in stomach, etc) from 0 (*not at all*) to 100 (*very much so*) (Give a rating):

<table>
<thead>
<tr>
<th>Presence of physical sensations</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
13) During the other intrusive memories, to what degree did it feel as if the event was happening in the here and now (that is, a sense of reliving the event) versus experiencing the memory as having happened in the past? Please rate the sense of “nowness” from 0 (not at all) to 100 (very much so) (Give a rating):

    Rating
    Sense of “nowness” [rating]

14) a. How distressing were these other intrusive memories of the event from 0 (Not at all) to 100 (Severely) (Give a rating):

    Rating
    Level of distress [rating]

b. Which emotion best characterises this distress? Circle one:

1) Anger
2) Fear
3) Guilt
4) Helplessness
5) Sadness
6) Shame
7) Other
   Specify: _____________________________
15) How long do these intrusive memories of this event typically last? *Circle one:*

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Seconds</td>
</tr>
<tr>
<td>2</td>
<td>Minutes</td>
</tr>
<tr>
<td>3</td>
<td>Up to an hour</td>
</tr>
<tr>
<td>4</td>
<td>Several hours</td>
</tr>
<tr>
<td>5</td>
<td>Constantly preoccupied</td>
</tr>
</tbody>
</table>

16) How frequently do you experience these intrusive memories? *Circle one:*

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rarely - Once a week or less</td>
</tr>
<tr>
<td>2</td>
<td>Occasionally - Several times a week</td>
</tr>
<tr>
<td>3</td>
<td>Frequently - Several times a day</td>
</tr>
</tbody>
</table>

**THE END. Thank you for completing this questionnaire.**
APPENDIX C: EXAMPLE OF INFORMATION SHEET AND STATEMENT OF INFORMED CONSENT FOR SCREENING PHASE

INFORMATION STATEMENT

STUDY TITLE: “Memory for distressing events – Stage 1”

DESCRIPTION OF STUDY

The objective of this study is to explore individual differences in how people respond to stressful events that they experience. The procedure entails providing some demographic and background data and filling out two questionnaires which relate to recent mood and traumatic/distressing events from your past.

These tasks do involve thinking about distressing experiences, and may have a negative impact on your mood. The underlying theory and methods of this project are based on a history of published work in this area.

The present research will take approximately 20-30 minutes of your time.

As a participant in this study you may be invited to participate in another study looking at memories of traumatic/distressing and everyday experiences. After that invitation, and if you accept or decline that invitation, all information you provide for this research will be stored independently of any information that can identify you. As such, your data will remain completely anonymous.

Data from each participant will be kept and stored securely by the principal researcher; all material will be treated in a strictly confidential manner as far as the law allows. Data from this study may be used in student theses, presented at professional conferences, and/or published in professional journals. However, no participant will be identifiable in these presentation formats.

The principal researcher for this study is Ms. Lian Parry, Department of Psychology, The Australian National University (Lian.Parry@anu.edu.au - (02) 6125 4100)
This supervisor for this study is A/Prof Richard O'Kearney, Department of Psychology, The Australian National University (Richard.OKearney@anu.edu.au - (02) 6125 8158)

Your participation in this study is completely voluntary – all participants are free to withdraw from participation in this project at any time without penalty.

If you have any questions about his project, please contact Ms. Lian Parry at the ANU Department of Psychology (Email: Lian.Parry@anu.edu.au or Phone: (02) 6125 4100).
If you have any concerns about the way the research was conducted, please contact the Secretary, Human Research Ethics Committee, Research Office, Chancery 10B, The Australian National University, ACT 0200 (Phone: (02) 6125 7945 or Email: Human.Ethics.Officer@anu.edu.au)

If you would like to talk about anything that may come up for you while completing this study, you may wish to contact:
Lifeline (24-hour telephone counselling): 13 11 14
For referral to a private psychologist, you may wish to speak to your GP.
STATEMENT OF INFORMED CONSENT

STUDY TITLE: "Memory for distressing events – Stage 1"

DESCRIPTION OF STUDY

The objective of this study is to explore individual differences in how people respond to stressful events that they experience. The procedure entails providing some demographic and background data and filling out two questionnaires which relate to recent mood and traumatic/distressing events from your past.

These tasks do involve thinking about distressing experiences, and may result in you experiencing negative emotions/sad mood. The underlying theory and methods of this project are based on a history of published work in this area.

The present research will approximately take approximately 20-30 minutes of your time.

As a participant in this study you may be invited to participate in future studies looking at memories of traumatic/distressing and everyday experiences. You will then be able to give informed consent to participate, independently of the present study. After that invitation, and if you accept or decline that invitation, all information you provide for this research will be stored independently of any information that can identify you. As such, your data will remain completely anonymous.

Data from each participant will be kept and stored securely by the principal researcher; all material will be treated in a strictly confidential manner as far as the law allows. Data from this study may be used in student theses, presented at professional conferences, and/or published in professional journals. However, no participants will be identifiable in these presentations formats.

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If you would like to talk about anything that may come up for you while completing this study, you may wish to contact:
Lifeline (24-hour telephone counselling): 13 11 14
For referral to a private psychologist, you may wish to speak to your GP.
1. I ................................................. (please print full name) hereby consent to take part in the research project entitled “Memory for distressing events – Stage 1”. I have read the information sheet for this study and understand its contents.

2. I understand that my participation is completely voluntary, and that I may withdraw from the study at any time without penalty.

3. The objectives and procedure of the project have been explained to me and I understand them.

4. I understand that if I agree to participate in the research project I will be asked to provide some demographic and background data and fill out two questionnaires which relate to recent mood and traumatic/distressing events from my past. This will take approximately 20-30 minutes.

5. I understand that the study requires me to think about distressing events from my past which may have a negative effect on my mood.

6. I understand that I can contact the aforementioned counselling service(s) or speak to my GP about referral to a private psychologist if I would like to talk about anything that may come up for me while or after completing this study.

7. I understand that I may be invited to participate in a future study, and therefore give permission to be contacted by the researcher at a later date. I will then be able to give informed consent to participate, independently of the present study.

8. I have been advised that the results of the project may be published but that my personal details will remain confidential as far as the law allows.

9. I voluntarily consent to participate, but I understand that I may withdraw from the study at any time, without penalty.

Name of Participant (print full name): ............................................................. .

Signed ........................................................ Date ..................................

Contact phone number(s): (Mobile) .................................................................
(AH) .............................................................. (BH) .................................................................

Email: ............................................................................................................

Name of Researcher: LIAN PARRY

Signed ........................................................ Date ........................................
APPENDIX D: EXAMPLE OF INFORMATION SHEET AND STATEMENT OF INFORMED CONSENT FOR STUDY 1 (NARRATIVE PHASE)

INFORMATION STATEMENT

STUDY TITLE: “Memory for distressing events – Stage 2, Part 1”

DESCRIPTION OF STUDY

The objective of this study is to explore individual differences in how people respond to stressful events that they experience. The procedure entails answering some interview questions about your recent mood, past negative life events and how these have impacted you. You will then be asked to write about distressing events from your past and to complete some questionnaires about your memories of these events, their recent impact on you and your current mood.

These tasks do involve thinking and writing about distressing experiences, and may have a negative impact on your mood. The underlying theory and methods of this project are based on a history of published work in this area.

The present research will take approximately 60 - 90 minutes of your time.

As a participant in this study you may be invited back to complete Stage 2, Part 2 of this study looking at physiological responses to reminders of these events. You will then be able to give informed consent to participate, independently of the present study.

Data from each participant will be kept and stored securely by the principal researcher; all material will be treated in a strictly confidential manner as far as the law allows. Data from this study may be used in student theses, presented at professional conferences, and/or published in professional journals. However, no participant will be identifiable in these presentation formats.

The principal researcher for this study is Ms. Lian Parry, Department of Psychology, The Australian National University (Lian.Parry@anu.edu.au - (02) 6125 4100)

This supervisor for this study is A/Prof Richard O'Kearney, Department of Psychology, The Australian National University (Richard.OKearney@anu.edu.au - (02) 6125 8158)

Your participation in this study is completely voluntary – all participants are free to withdraw from participation in this project at any time without penalty.

If you have any questions about this project, please contact Ms. Lian Parry at the ANU Department of Psychology (Email: Lian.Parry@anu.edu.au or Phone: (02) 6125 4100).

If you have any concerns about the way the research was conducted, please contact the Secretary, Human Research Ethics Committee, Research Office, Chancellry 10B, The Australian National University, ACT 0200 (Phone: (02) 6125 7945 or Email: Human.Ethics.Officer@anu.edu.au)

If you would like to talk about anything that may come up for you while completing this study, you may wish to contact:
Lifeline (24-hour telephone counselling): 13 11 14
For referral to a private psychologist, you may wish to speak to your GP.
STATEMENT OF INFORMED CONSENT

STUDY TITLE: "Memory for distressing events – Stage 2, Part 1"

DESCRIPTION OF STUDY

The objective of this study is to explore individual differences in how people respond to stressful events that they experience. The procedure entails answering some interview questions about your recent mood, past negative life events and how these have impacted you. You will then be asked to write about distressing events from your past and to complete some questionnaires about your memories of these events, their recent impact on you and your current mood.

These tasks do involve thinking and writing about distressing experiences, and may have a negative impact on your mood. The underlying theory and methods of this project are based on a history of published work in this area.

The present research will take approximately 60 - 90 minutes of your time.

As a participant in this study you may be invited back to complete Stage 2, Part 2 of this study looking at physiological responses to reminders of these events. You will then be able to give informed consent to participate, independently of the present study.

Data from each participant will be kept and stored securely by the principal researcher; all material will be treated in a strictly confidential manner as far as the law allows. Data from this study may be used in student theses, presented at professional conferences, and/or published in professional journals. However, no participant will be identifiable in these presentation formats.

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This supervisor for this study is A/Prof Richard O’Kearney, Department of Psychology, The Australian National University (Richard.OKearney@anu.edu.au - (02) 6125 8158)

Your participation in this study is completely voluntary – all participants are free to withdraw from participation in this project at any time without penalty.

If you have any questions about this project, please contact Ms. Lian Parry at the ANU Department of Psychology (Email: Lian.Parry@anu.edu.au or Phone: (02) 6125 4100).

If you have any concerns about the way the research was conducted, please contact the Secretary, Human Research Ethics Committee, Research Office, Chancelry 10B, The Australian National University, ACT 0200 (Phone: (02) 6125 7945 or Email: Human.Ethics.Office@anu.edu.au)

If you would like to talk about anything that may come up for you while completing this study, you may wish to contact:

Lifeline (24-hour telephone counselling): 13 11 14

For referral to a private psychologist, you may wish to speak to your GP.
1. I ................................................. (please print full name) hereby consent to take part in the research project entitled "Memory for distressing events – Stage 2, Part 1". I have read the information sheet for this study and understand its contents.

2. The objectives and procedure of the project have been explained to me and I understand them.

3. I understand that if I agree to participate in the research project I will be interviewed about my recent mood, past negative life events and how these have impacted me. I will also be asked to write about distressing events from my past and complete some questionnaires about my memories of these events, their recent impact on me and my current mood. This will take approximately 60 - 90 minutes.

4. I understand that the study requires me to think and write about distressing events from my past which may have a negative effect on my mood.

5. I understand that I can contact the aforementioned counselling service(s) or speak to my GP about referral to a private psychologist if I would like to talk about anything that may come up for me while or after completing this study.

6. I understand that I may be invited to participate in Part 2 of this study and therefore give permission to be contacted by the researcher at a later date. I will then be able to give informed consent to participate, independently of the present study.

7. I have been advised that the results of the project may be published but that my personal details will remain confidential as far as the law allows.

8. I voluntarily consent to participate, but I understand that I may withdraw from the study at any time, without penalty.

Name of Participant (print full name): ........................................................... 

Signed ........................................................ Date ........................................

Name of Researcher: LIAN PARRY

Signed ........................................................ Date ........................................
Thank you for completing “Memory for distressing events – Stage 2, Part 1”.

The aim of this study was to investigate the differences in the way individuals with and without depressive feelings remember distressing events in their lives, and more specifically, their experiences of “intrusive memories”.

Intrusive memories are a type of memory that we experience as markedly different from memories that we can retrieve at will. Intrusive memories are memories of specific incidents or events which happened to us, that we witnessed or experienced, which seem to “pop” into our minds without us deliberately trying to remember them.

Past research suggests that many people report intrusive memories. However for some people, intrusive memories of highly distressing or traumatic events and the way they respond to these memories, may perpetuate and/or exacerbate certain psychological disorders.

Using self-report and narrative measures, the current study aims to detect and describe any differences that might exist between “normal” and “intrusive” memory segments across people with and without depressive feelings.

The study hopes to further inform our knowledge of intrusive memory experiences, and in so doing, contribute to the development of more effective psychological treatments in the long-term.
APPENDIX F: STANDARD NEUTRAL EVENT SCRIPT

Standard neutral event script administered to all participants during the script-driven imagery task, Study 2.

It is morning and you’re at home. You walk into the bathroom to brush your teeth. You pick up your toothbrush and squeeze out some toothpaste.

You start to brush your teeth.

You notice the familiar, fresh, minty taste and the sensation of the bristles on your teeth and gums. You continue to brush your teeth for a few minutes....

When you are done you reach for the tap and turn it on; you can see and hear the water as it flows into the sink.

You rinse out your mouth and rinse off your toothbrush, then you turn off the tap. The water stops.

You put away your toothbrush and leave the bathroom.
APPENDIX G: EXAMPLE OF INFORMATION SHEET AND STATEMENT OF INFORMED CONSENT FOR STUDY 2 (PSYCHOPHYSIOLOGICAL PHASE)

INFORMATION STATEMENT

STUDY TITLE: "Memory for distressing events – Stage 2, Part 2"

DESCRIPTION OF STUDY

The objective of this study is to explore individual differences in how people respond to stressful events that they experience. The procedure entails completing some questionnaires and listening to 1) a neutral event script and 2) scripts of the distressing events you wrote about in "Memory for distressing events – Stage 2, Part 1", while physiological measures (heart rate and skin conductance) are recorded.

These tasks do involve thinking about and imagining distressing experiences, and may have a negative impact on your mood. The underlying theory and methods of this project are based on a history of published work in this area.

The present research will take approximately 60 minutes of your time.

Data from each participant will be kept and stored securely by the principal researcher; all material will be treated in a strictly confidential manner as far as the law allows. Data from this study may be used in student theses, presented at professional conferences, and/or published in professional journals. However, no participants will be identifiable in these presentations formats.

The principal researcher for this study is Ms. Lian Parry, Department of Psychology, The Australian National University (Lian.Parry@anu.edu.au - (02) 6125 4100)
This supervisor for this study is A/Prof Richard O'Kearney, Department of Psychology, The Australian National University (Richard.Okearney@anu.edu.au - (02) 6125 8158)

Your participation in this study is completely voluntary – all participants are free to withdraw from participation in this project at any time without penalty.

If you have any questions about this project, please contact Ms. Lian Parry at the ANU Department of Psychology (Email: Lian.Parry@anu.edu.au or Phone: (02) 6125 4100).
If you have any concerns about the way the research was conducted, please contact the Secretary, Human Research Ethics Committee, Research Office, Chancellry 10B, The Australian National University, ACT 0200 (Phone: (02) 6125 7945 or Email: Human.Ethics.Officer@anu.edu.au)

If you would like to talk about anything that may come up for you while completing this study, you may wish to contact:
Lifeline (24-hour telephone counselling): 13 11 14
For referral to a private psychologist, you may wish to speak to your GP.
STATEMENT OF INFORMED CONSENT

STUDY TITLE: "Memory for distressing events – Stage 2, Part 2"

DESCRIPTION OF STUDY

The objective of this study is to explore individual differences in how people respond to stressful events that they experience. The procedure entails completing some questionnaires and listening to 1) a neutral event script and 2) scripts of the distressing events you wrote about in "Memory for distressing events – Stage 2, Part 1", while physiological measures (heart rate and skin conductance) are recorded.

These tasks do involve thinking about and imagining distressing experiences, and may have a negative impact on your mood. The underlying theory and methods of this project are based on a history of published work in this area.

The present research will take approximately 60 minutes of your time.

Data from each participant will be kept and stored securely by the principal researcher; all material will be treated in a strictly confidential manner as far as the law allows. Data from this study may be used in student theses, presented at professional conferences, and/or published in professional journals. However, no participants will be identifiable in these presentations formats.

The principal researcher for this study is Ms. Lian Parry, Department of Psychology, The Australian National University (Lian.Parry@anu.edu.au - (02) 6125 4100)
This supervisor for this study is A/Prof Richard O’Kearney, Department of Psychology, The Australian National University (Richard.OKearney@anu.edu.au - (02) 6125 8158)

Your participation in this study is completely voluntary – all participants are free to withdraw from participation in this project at any time without penalty.

If you have any questions about this project, please contact Ms. Lian Parry at the ANU Department of Psychology (Email: Lian.Parry@anu.edu.au or Phone: (02) 6125 4100).
If you have any concerns about the way the research was conducted, please contact the Secretary, Human Research Ethics Committee, Research Office, Chancellery 10B, The Australian National University, ACT 0200
(Phone: (02) 6125 7945 or Email: Human.Ethics.Officer@anu.edu.au)

If you would like to talk about anything that may come up for you while completing this study, you may wish to contact:

Lifeline (24-hour telephone counselling): 13 11 14
For referral to a private psychologist, you may wish to speak to your GP.
1. I _____________________________(please print full name) hereby consent to take part in the research project entitled “Memory for distressing events – Stage 2, Part 2”. I have read the information sheet for this study and understand its contents.

2. The objectives and procedure of the project have been explained to me and I understand them.

3. I understand that if I agree to participate in the research project I will be asked to listen to 1) a neutral event script and 2) scripts of the distressing events I wrote about in “Memory for distressing events – Stage 2, Part 1”, while physiological measures (heart rate and skin conductance) are recorded. I will also be asked to complete some questionnaires. This will take approximately 60 minutes.

4. I understand that the study requires me to think about and imagine distressing events from my past which may have a negative effect on my mood.

5. I understand that I can contact the aforementioned counselling service(s) or speak to my GP about referral to a private psychologist if I would like to talk about anything that may come up for me while or after completing this study.

6. I have been advised that the results of the project may be published but that my personal details will remain confidential as far as the law allows.

7. I voluntarily consent to participate, but I understand that I may withdraw from the study at any time, without penalty.

---

Future studies: I may be interested in participating in possible future treatment studies and consent to being contacted by the researcher at a later date (please circle): Yes / No

If Yes:

Contact number: __________________________

Email: __________________________

Name of Participant (print full name): __________________________

Signed __________________________ Date __________________________

Name of Researcher: LIAN PARRY

Signed __________________________ Date __________________________
Thank you for completing "Memory for distressing events – Stage 2, Part 2".

The aim of this study was to investigate the differences in the way individuals with and without depressive feelings remember and respond to distressing events in their lives, and more specifically, their experiences of "intrusive memories".

Intrusive memories are a type of memory that we experience as markedly different from memories that we can retrieve at will. Intrusive memories are memories of specific incidents or events which happened to us, that we witnessed or experienced, which seem to "pop" into our minds without us deliberately trying to remember them.

Past research suggests that many people report intrusive memories. However for some people, intrusive memories of highly distressing or traumatic events and the way they respond to these memories, can perpetuate and exacerbate certain psychological disorders.

This part of the study builds on Part 1 (which used self-report and narrative measures) by examining psychophysiological responses to intrusive memories. Psychophysiological measures (in this case, heart rate and skin conductance) provide a more objective way to examine differences that might exist between "normal" and "intrusive" memory segments across people with and without depressive feelings.

Overall, this study aims to further inform our knowledge of intrusive memory experiences, and in so doing, contribute to the development of more effective psychological treatments in the long-term.
**APPENDIX I: DEMOGRAPHIC AND CLINICAL CHARACTERISTICS FOR PARTICIPANTS REPORTING INTRUSIVE MEMORIES DURING SCRIPT-DRIVEN IMAGERY TASK**

Table 1.1

Demographic and clinical characteristics for participants reporting intrusive memories during the script-driven imagery task

<table>
<thead>
<tr>
<th></th>
<th>Control (n = 11)</th>
<th>Depressed (n = 14)</th>
<th>PTSD (n = 22)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (n, % female)</td>
<td>6 (54.5%)</td>
<td>10 (71.4%)</td>
<td>12 (54.5%)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>35.73 (15.47)</td>
<td>39.21 (18.51)</td>
<td>29.55 (15.42)</td>
</tr>
<tr>
<td>Education (years)</td>
<td>15.64 (3.04)</td>
<td>19.43 (12.61)</td>
<td>13.00 (5.18)</td>
</tr>
<tr>
<td>Time since target event</td>
<td>5021.91 (4882.64)</td>
<td>2145.79 (2917.29)</td>
<td>3036.59 (3857.10)</td>
</tr>
<tr>
<td>Time since other event</td>
<td>4383.09 (4956.74)</td>
<td>2680.86 (4888.85)</td>
<td>2914.68 (3811.91)</td>
</tr>
<tr>
<td>CES-D</td>
<td>12.00 (8.78)</td>
<td>27.79 (14.04)</td>
<td>27.23 (11.01)</td>
</tr>
<tr>
<td>PDS</td>
<td>7.00 (5.03)</td>
<td>24.15 (14.49)</td>
<td>27.00 (11.44)</td>
</tr>
<tr>
<td>STAI-State t-score</td>
<td>45.45 (3.01)</td>
<td>57.64 (11.16)</td>
<td>50.68 (8.28)</td>
</tr>
<tr>
<td>STAI-Trait t-score</td>
<td>51.00 (7.51)</td>
<td>74.57 (13.72)</td>
<td>64.86 (10.14)</td>
</tr>
<tr>
<td>IES-R Total (target event)</td>
<td>10.18 (10.96)</td>
<td>38.23 (26.28)</td>
<td>44.85 (20.80)</td>
</tr>
<tr>
<td>Intrusion</td>
<td>.59 (.71)</td>
<td>1.84 (1.28)</td>
<td>2.01 (1.11)</td>
</tr>
<tr>
<td>Avoidance</td>
<td>.45 (.45)</td>
<td>1.65 (1.11)</td>
<td>2.16 (1.08)</td>
</tr>
<tr>
<td>Hyperarousal</td>
<td>.30 (.42)</td>
<td>1.56 (1.51)</td>
<td>1.90 (1.24)</td>
</tr>
<tr>
<td>PDEQ (target event)</td>
<td>2.73 (.98)</td>
<td>2.93 (.95)</td>
<td>3.55 (.78)</td>
</tr>
</tbody>
</table>

*Note.* CES-D = Center for Epidemiologic Studies Depression Scale, PDS = Post-traumatic Diagnostic Scale, STAI = State-Trait Anxiety Inventory for Adults. Except where noted, values refer to mean and (standard deviation) scores.
APPENDIX J: DESCRIPTIVES OF MAIN VARIABLES OF INTEREST (STUDIES 1 AND 2) FOR DEPRESSED AND PTSD SUBGROUPS WITH AND WITHOUT DEPRESSION

Figure J.1. Emotions associated with primary intrusive memory experienced during the narrative task across depressed group and PTSD with and without depression subgroups. Figure represents mean ratings (0-100) and error bars represent standard errors (SEM).

Figure J.2. Additional self-rated characteristics of primary intrusive memory experienced during the narrative task across depressed group and PTSD with and without depression subgroups. Figure represents mean ratings (0-100) and error bars represent standard errors (SEM).
Figure J.3. Between-group differences in intrusive memory content for Target event narrative across depressed group and PTSD with and without depression subgroups. Figure represents mean percentage and error bars represent standard errors (SEM).

Figure J.4. Between-group differences in ordinary memory content for Target event narrative across depressed group and PTSD with and without depression subgroups. Figure represents mean percentage and error bars represent standard errors (SEM).
Figure J.5. Mean heart rate responses (beats per minute) to Neutral, Target and Other Script and Imagery phases for participants who reported an intrusive memory during the script-driven imagery task, across depressed group and PTSD with and without depression subgroups. Error bars represent standard errors (SEM).

Figure J.6. Mean skin conductance responses (µohms) to Neutral, Target and Other Script and Imagery phases for participants who reported an intrusive memory during the script-driven imagery task, across depressed group and PTSD with and without depression subgroups. Error bars represent standard errors (SEM).